Asset prices, financial stability and monetary policy*

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The theoretical and empirical literatures on monetary policy and real estate prices are rapidly evolving. There is considerable debate about whether monetary policy should play a role in forestalling dangerous real estate bubbles that have the potential to trigger financial crises. This paper provides a selective survey of this literature. The focus is on research that incorporates financial frictions and asset price bubbles that have the potential to create the discontinuous collapses that have been witnessed periodically. The possible role of macroprudential regulation in controlling real estate prices is also discussed. Our conclusion is that monetary policy and macroprudential regulation both need to be used to guard against real estate bubbles.

Paper presented at November 12, 2010 Swedish Riksbank Workshop on Housing Markets, Monetary Policy and Financial Stability.

* Franklin Allen, University of Pennsylvania and Kenneth Rogoff, Harvard University. We are grateful to Frank Smets and Marie Hoerova for helpful suggestions on the literature. We also thank our discussants Luci Ellis and Jean-Charles Rochet, other participants at the November 12 Workshop, and members of the Commission of Inquiry into the risks in the Swedish Housing Market for many helpful comments. Sevinc Cukurova and Balint Horvath provided excellent research assistance.

1. Introduction

This paper gives a selective review of the literature on monetary policy and real estate prices, including both empirical and theoretical contributions.[1] The literature is rapidly evolving and there is considerable debate, particularly about whether monetary policy should play a role in forestalling dangerous real estate bubbles, even if the monetary authorities can recognize them. There is no question that too much of the academic literature on central monetary policy is built on models with perfect financial markets, which essentially assume away any debt catastrophes associated with real estate crashes. The small literature that does incorporate financial frictions mainly does so in a way that creates second-order distortions, but does not yield the kind of catastrophic discontinuous collapses that have been witnessed periodically in practice.

This paper surveys recent research that attempts to incorporate financial frictions and bubbles, and to allow for a possible role for monetary policy in exacerbating leverage cycles. We discuss this literature in sections 3-6 of the paper. Section 7 discusses the view that properly tuned macroprudential regulation policy can relieve monetary policy of any need to focus on real estate prices except as a helpful indicator in predicting near and medium-term inflation and unemployment. Our read of the literature is that it is probably dangerous to adopt any extreme position. Even if macroprudential regulation is the first line of defense, it can be subject to political pressures that leave significant vulnerabilities if monetary policy is not vigilant. Fundamentally, because of the central bank's role as lender of last resort, macroprudential policy and monetary policy have to be inter-linked.

In section 2 of the paper, we give an introduction to some related empirical literature, underscoring both the importance of being alert to real estate bubbles, while at the same time showing how difficult they can be to quantify in practice.

2. Evidence on real estate prices and financial crises

The empirical literature on house price bubbles and monetary policy, while limited, still presents a strong case for continuing attempts by central banks to monitor major upward spikes in house prices as an important part of any approach to risk management. As Reinhart and Rogoff (2009) argue, credit-boom-fueled housing price spirals are particularly pernicious. In economies where a significant portion of consumers are credit constrained, a sharp rise in housing prices can have effects on consumption far in excess in of the usual relatively small wealth effects. At the same time, the financial liberalizations undertaken by many countries in the 1980s

1 We focus particularly on real estate cycles as leverage tends to be very high in this sector and, for many consumers it is both their main asset and their main liability. Equity price bubbles can in principle present similar issues where debt finance is important. Our theoretical analysis takes both kinds of cycles into account.

and 1990s have led to greatly expanded loan to value ratios in the housing market, thereby raising the financial system's vulnerability to a housing price collapse. Similar arguments can be made concerning commercial real estate.

There is, however, enormous debate surrounding how reliably central banks can identify housing price bubbles in the data. The nearly decade long global housing price boom that occurred in the run-up to the 2007 financial crisis is illustrative of the issues. In the September 2004 *World Economic Outlook* [2], IMF economists identified a number of global factors that contributed to the boom, including per capita income growth, interest rates and bank credit.

For 18 industrialized countries, covering the period 1971-2003, they report the regression below.[3]

Table 1. A cross country analysis of housing price growth, 1971-2003

EXPLANATORY VARIABLES	DEPENDENT VARIABLE (REAL HOUSE PRICE GROWTH)	
Lagged real house price growth	0.521	(0.030)
Lagged house affordability ratio	-0.144	(0.021)
Real per capita disposable income growth	0.530	(0.119)
Short term interest rate	-0.507	(0.109)
Real credit growth	0.109	(0.036)
Lagged real stock price growth	0.033	(0.009)
Population growth	1.754	(0.623)
Bank crisis	-2.426	(0.952)

Note. Standard deviations in parentheses. Number of observations: 524.

Looking at deviations from the overall cross-country regression line, the IMF researchers argue that, on average, the model is able to explain most of the increase in housing prices internationally over the sample period, 1971-2003. However, they identified four countries: Australia, Ireland, Spain and the United Kingdom, as having price increases ten to twenty percent above the level that could be explained by fundamentals. United States housing price increases, through 2003, had a deviation of a less than ten percent from the regression line

In general, a major problem in looking for housing price bubbles is that it can be hard to assess the risk of long-term structural shifts in key underlying macroeconomic parameters. For example, many analysts have pointed to the apparent trend decline in global long-term real interest rates as justifying a worldwide increase in housing prices. This point was emphasized in the IMF's April 2008 World Economic Outlook, which identified declining real interest rates as a major driver of global house price increases during the 2000s. Of course, not only did interest rates decline in the financial center countries, but they declined

2 See *IMF World Economic Outlook*, September 2004, Ch. 2, "The Global House Boom", Marco Terrones (lead author).

3 IMF WEO, September 2004, Table B2.1.

disproportionately more in periphery countries, particularly in the Eurozone, possibly in ways that were partly transitory, As has become all too painfully evident in the Eurozone periphery countries, there is always a risk that over the long run, real interest rates trends will reverse, creating problems in regions where housing purchases are heavily leveraged.

Macroeconomic volatility is another fundamental determinant of asset prices that is dangerous to extrapolate. Using relatively standard consumption capital asset pricing models, Lettau and Ludvigson (2007) showed that one could rationalize a significant share of the trend rise in risky asset prices thanks to the long period of the Great Moderation, where macroeconomic volatility fell significantly. Post 2008, of course, it is far from clear how much of this trend fall in volatility is actually permanent versus temporary.

Finally, whereas the global financial crisis revealed the malign side of financial deepening, it is also the case the financial development helped make housing a more liquid asset for many consumers, particularly in countries where it is possible to add second mortgages or refinance as housing prices rise. Rising liquidity also, in principle, can contribute to a rise in housing prices.

Indeed, after the global financial crisis and the subsequent collapse of housing prices in many countries, especially the United States, many of the above rationales for higher housing prices seem now to ring hollow. Certainly the argument that all real asset prices should be higher because of the Great Moderation (decline in macroeconomic volatility) now seems far less convincing as macroeconomic volatility has spiked. The argument that houses are worth more because they have become more liquid clearly rested far too much on pro-cyclical factors that have gone into reverse as housing prices have fallen. But other core rationales for high housing prices still stand. Whereas global risk premia have risen after the financial crisis, global real interest rates have remained at very low levels. Population growth continues to drive housing prices in many countries, particularly where, due to geography and regulation, supply remains scarce. The contrast between the United Kingdom and the United States is a good case in point. Whereas housing prices in the United States have fallen over 35% in real terms (by the Case Shiller index), they fell only 15% in the UK, and have since risen back roughly 10%. In contrast to the US, where millions of new homes are built each year in normal times, zoning restrictions have kept UK residential investment relatively small.

Just as housing prices depend on a variety of complex fundamentals, leverage is also a function of fundamentals. In the UK, if home prices remain firm and real interest rates remain low, one might expect a lower pace of deleveraging than in the United States. In countries such as Canada and Sweden, where the financial system was more resilient during the crisis, leverage and house prices are rising and now stand above pre-crisis levels.

One useful way to analyze housing price trends is to look at cross country analysis, using new data bases on housing prices (e.g., such as those presented by Reinhart and Rogoff, 2009.) It is particularly helpful to take out global factors, so as to be able to focus on idiosyncratic country trends. Even so, there are limitations. The IMF 2004 paper was prescient in calling the housing bubbles in Spain and Ireland. But in Australia, another country labeled by the IMF report as significantly overvalued at the end of 2003, trend housing prices have continued to rise sharply. Indeed, in the Economist (October 23, 2010) index of housing prices, Australia is listed as the most overvalued housing price market in the sample based on price to rent ratios (63%). (Sweden, too, is listed as very richly valued (42%).)

It certainly appears to be the case that the transmission mechanism for monetary policy has changed over time, particularly for countries such as the United States with very deep and sophisticated mortgage markets. As Leamer (2007) notes, traditionally, residential real estate investment cycles have played a surprisingly significant role in major monetary cycles, despite the fact that on average, residential real estate (and associated industries such as home furnishings) are usually at most 5 or 6 percent of GDP in normal times. But as financial liberalization has proceeded, housing price fluctuations have become increasingly important in the transmission from housing to the real economy. As the IMF *World Economic Outlook* (April 2008) argues, the effect of monetary policy on housing prices has become increasingly important relative to the effect on housing investment. As we will later discuss, recent theoretical advances also suggest that monetary policy can exacerbate bubbles in a leverage cycle.

Despite all the uncertainties, one strong argument for taking account of housing prices in monetary policy is seen in the literature on the aftermath of financial crisis. Large and very long-lasting housing price collapses are the norm. Table 2 is taken from Reinhart and Rogoff (2009), chapter 13.

Table 2 (from Reinhart and Rogoff, 2009). Real housing price cycles and banking crises

COUNTRY	CRISIS DATE	PEAK	TROUGH	DURATION OF DOWNTURN	MAGNITUDE OF DECLINE (IN PERCENT)
Advanced economies: The big 5					
Finland	1991	1989:Q2	1995:Q4	6 years	–50.4
Japan	1992	1991:Q1	Ongoing	Ongoing	–40.2
Norway	1987	1987:Q2	1993:Q1	5 years	–41.5
Spain	1977	1978	1982	4 years	–33.3
Sweden	1991	1990:Q2	1994:Q4	4 years	–31.7
Asian crisis: The big 6					
Hong Kong	1997	1997:Q2	2003:Q2	6 years	–58.9
Indonesia	1997	1994:Q1	1999:Q1	5 years	–49.9
Malaysia	1997	1996	1999	3 years	–19.0
Philippines	1997	1997:Q1	2004:Q3	7 years	–53.0
South Korea	1997		2001:Q2	4 years	–20.4
Thailand	1997	1995:Q3	1999:Q4	4 years	–19.9
Other emerging					
Argentina	2001	1999	2003	4 years	–25.5
Colombia	1998	1997:Q1	2003:Q2	6 years	–51.2
Historical episodes					
Norway	1898	1899	1905	6 years	–25.5
US	1929	1925	1932	7 years	–12.6

Sources: Bank of International Settlements and the individual country sources described in the Data Appendix in Reinhart and Rogoff (2009).

As the table illustrates, the average fall in housing prices after a financial crisis is very substantial (36%) whereas the duration of the fall (from peak to trough) lasts an average of five years, even excluding Japan.

The table contains only two pre-World War II housing price collapses, as long-dated time series on housing prices are scarce. However, other measures of housing market collapse indicate a similar pattern. Table 3 (taken from Reinhart and Rogoff, chapter 16) illustrates the depth and breadth of the housing price declines that occurred around the Great Depression.

Table 3. Indices of total building activity in selected countries in the Great Depression of the 1930s (from Reinhart and Rogoff, 2009, Chapter 16)

(1929 = 100)

COUNTRY	INDICATOR	1932
South Africa	Buildings completed (value)	100
Argentina	Permits (area)	42
Australia	Permits (value)	23
Belgium	Permits (number)	93
Canada	Permits (value)	17
Chile	Permits (area)	56
Colombia	Buildings completed (area)	84
Czechoslovakia	Buildings completed (number)	88
Finland	Buildings completed (cubic space)	38
France	Permits (number)	81
Germany	Buildings completed (rooms)	36
Hungary	Buildings completed (number)	97
Netherlands	Buildings completed (dwellings)	87
New Zealand	Buildings completed (value)	22
Sweden	Buildings completed (rooms)	119
United Kingdom	Permits (value)	91
Unites States	Permits (value)	18
Average		64
Memorandum item:		
United States September 2005 peak = 100	Permits (number)	25[1]

[1] Through February 2009.

Source: Carmen M Reinhart and Kenneth Rogoff, *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press 2009.

If one invokes the "Greenspan principle" that monetary policy should not try to lean against the wind in asset price bubbles, but only clean up "the mess" afterwards, then it must certainly be acknowledged that the "mess" after banking crises can be quite large.

3. The traditional view on monetary policy and real estate prices

Having provided a cursory view of the empirical literature, we now discuss the literature on the theory of monetary policy and real estate prices, also discussing further empirical work where particularly relevant.

In recent years the conventional view in the macroeconomics literature has been that the best way to conduct monetary policy is for central banks to adopt inflation targeting. Giavazzi and Mishkin (2006) give an excellent account of this.[4] Before the consensus on the desirability of inflation targeting developed, there was a widespread belief that there was a trade-off between unemployment and inflation. As the Phillips Curve illustrated, by lowering interest rates it was possible

4 This section draws on their account of inflation targeting.

to stimulate the economy and lower unemployment but at the expense of higher inflation.

Phelps (1967) and Friedman (1968) argued instead that there was a natural rate of unemployment that the economy reverted to in the long run no matter what the rate of inflation. Lucas (1972, 1973, 1976) and Sargent and Wallace (1975) ushered in the rational expectations revolution by showing that there was no long run trade-off, only a short term one. Once it became accepted that monetary policy cannot affect the unemployment rate in the long run, the next step was to realize that monetary policy should be focused on controlling inflation. After the high inflation era of the 1970s and 1980s the inefficiencies of inflation were well appreciated and this led to the desire to lower inflation rates substantially.

Kydland and Prescott (1977), Calvo (1978), and Barro and Gordon (1983) pointed out that because there is a short term tradeoff between unemployment and inflation there is a time-inconsistency problem. Governments tend to have a short term orientation because of the election cycle. As a result there is always the temptation to cut interest rates to boost the economy before an election even though there is no long run gain and in the short run there is the cost of increased inflation. Rogoff (1985) proposed, as an institutional solution to the time consistency problem, creating an independent central bank that places a significant weight on an inflation target.

These contributions provide the intellectual foundations of inflation targeting or more broadly, the establishment of an independent central bank with a conservative attitude towards inflation. As many central bank designers recognized, achieving inflation and macroeconomic stability involves a number of supporting measures, beyond establishing an independent central bank with a high weight on maintaining inflation stability. The first is establishing fiscal stability. If governments run large fiscal deficits and build up significant amounts of debt, there will be a temptation to undermine the independence of the central bank, and there is pressure to inflate away the value of this debt. If, on the contrary, governments are fiscally responsible, price stability is feasible.

The second necessary condition for a stable inflation regime to be viable is financial stability. Poor regulation and supervision of financial institutions may lead to large losses in the financial sector. This could, for example, prevent the raising of interest rates to fight inflation if the banks and other institutions were in a bad situation. Financial regulation has been mostly based on a microprudential approach. In most countries throughout most of history, banks have been regulated largely on an individual basis. The idea was that if individual banks are limited in the risks they take, there cannot be a problem in the financial system. Unfortunately, the recurrent occurrence of systemic financial crises has shown that this approach is

not correct. For financial stability to be achieved, macroprudential policies need to be designed based on systemic risks.

The third necessary measure is to determine the mandate of the central bank. Mandates may differ depending on whether they are required to just fight inflation like the European Central Bank or whether in addition they are required to maintain full employment like the Federal Reserve. In practice, the different mandates of central banks often imply greater differences in communication strategies than actual interest rate policy. In the run-up to the financial crisis, inflation targeting was a mandate that many central banks gravitated towards, albeit with widely differing interpretations encompassing a very broad range of institutions and policies. The appeal of inflation targeting as a communication device was appealing to central bankers especially because it underscores their desire for independence from fiscal policy, as well as from election cycles.

In order for inflation targeting to be implemented, in any form, a target consumer price inflation rate is chosen. This can be done by the central bank itself or by the government. The target inflation rate acts as a nominal anchor for the economy and the independent central bank has to ensure that this target is implemented. It does this by making medium term forecasts. This used to be done assuming a constant rate but the Riksbank and a number of other central banks now project a path of policy rates going forward. If inflation looks to be too high, the central bank will raise interest rates, while if it is set too low it will cut rates.

In practice many factors are taken into account in the process of setting interest rates particularly if the central bank has a dual mandate that is concerned with the level of economic activity as well as inflation. The policy response depends on the type of shock that has hit the economy and normally on how the policy maker weighs stabilizing inflation and output. One of the main issues to have arisen with inflation targeting is the extent to which asset price inflation and in particular real estate prices should be taken into account in setting interest rates. It has been widely argued that central banks should only take asset prices into account to the extent they affect consumer price inflation and economic activity (see, e.g., Giavazzi and Mishkin, 2006). The idea is that asset prices are useful for providing information and may play a role in the transmission mechanism. However, they should not be targeted. In some countries such as Sweden and Australia real estate prices are discussed and taken into account from a financial stability perspective. This is discussed further below.

A standard tool of inflation targeting central banks is Dynamic Stochastic General Equilibrium Models (DSGE). These usually do not include a banking sector, nor indeed any kind of friction in financial markets. (In the abstract world of much modern macroeconomic theory, banks are simply a device for dealing with transactions frictions and agency problems, which are simply assumed away for

analytical convenience and computational tractability.) The underlying assumption is presumably that problems in the banking sector are taken care of by regulation and systemic risk has been eliminated. To the extent there is a financial sector, it consists of bond and stock markets that are important determinants of wealth. Where a more complex financial sector has been included in such models, as in Bernanke, Gertler and Gilchrist (1999), they typically involve a distortion based on a wedge in a first order condition that leads to inefficiency rather than a discontinuous event such as a real estate bubble that causes a crisis.

4. Problems with the traditional view and new approaches

The framework described above has turned out to be inadequate to say the least. Prudential regulation has failed to maintain financial stability largely because it has not properly recognized the problem of systemic risk for banks. In practice systemic risk arises from a number of sources including common exposure to asset price bubbles, particularly real estate bubbles, liquidity provision and mispricing of assets, multiple equilibria and panics, contagion, fiscal deficits and sovereign default, and currency mismatches in the banking system. Here we focus on real estate bubbles as the cause of systemic risk since this is arguably the most important source of systemic risk.

As already mentioned above, Reinhart and Rogoff (2009) provide evidence that collapses in real estate prices, either residential or commercial or both, are one of the major causes of financial crises. In many cases these collapses occur after bubbles in real estate prices that often appear to be associated with loose monetary policy and excessive availability of credit. When the bubbles burst, the financial sector and the real economy are adversely affected.

The current crisis provides a good example of this. Allen and Carletti (2009) argue that the main cause of the crisis was that there was a bubble in real estate in the U.S. but also in a number of other countries such as Spain and Ireland. When the bubble burst in the U.S., many financial institutions experienced severe problems because of the collapse in the securitized mortgage market. Problems then spread to the real economy. Figure 1 shows the movement in real property prices in Ireland, Spain, Sweden and the U.S. It can be seen that in Ireland, Spain and the U.S. prices rose significantly and then dropped. It is interesting to note that prices have fallen much more in Ireland than in Spain or the U.S. This is why the Irish banking system has been so badly affected and why they have already required a bail out from the European Financial Stability Fund. In Spain prices have not fallen very far yet and this is one of the reasons their banking system has fared better than in Ireland (though the story is far from over yet). The figures for the U.S. are for the country as a whole. One of the important factors is that the real estate bubbles in the U.S. were regional in nature. They were focused in areas such as Las Vegas, Miami, and

Los Angeles. Many parts of the U.S. did not suffer from very large movements. Interestingly Sweden has had a very large run-up and now has real prices that are higher relative to their 1996 level than the peak that occurred in Spain.

It is wrong to say that economists missed this problem entirely. We have already discussed warnings in the IMF World Economic Outlook (September 2004) which echoed earlier warnings in the April 2003 World Economic Outlook, warnings that were repeated albeit in the run-up to the crisis. But as we will discuss below, during a bubble, there are very strong political pressures on regulators to ignore such problems, a classic symptom of the "This Time is Different" syndrome.

In fact, it can be argued that the real estate bubble in these countries was the result of loose monetary policy and global imbalances that led to excessive credit availability. These are problems that might have been addressed to help mitigate the crisis, had they been more broadly recognized and understood. Central banks, in particular the Federal Reserve in the U.S., set very low interest rates during the period 2003-2004 to avoid a recession after the bursting of the tech bubble in 2000 and the 9/11 terrorist attacks in 2001 at a time when house prices were already rising quite fast. As argued by Taylor (2008) and illustrated in Figure 2, these levels of interest rates were much lower than in previous U.S. recessions relative to the economic indicators at the time captured by the "Taylor rule". In such an environment of low interest rates, people in the U.S. started to borrow and buy houses to benefit from their growing prices. Unlike stock prices where returns are serially uncorrelated, in fact returns on housing are positively serially correlated as found by Case and Shiller (1989), Englund, Quigley and Redfearn (1998), and Glaeser and Gyourko (2007). If this correlation is due to economic factors such as market microstructure effects rather than measurement problems, this means that by lowering interest rates significantly below the current rate of house price appreciation, the Fed effectively created a profitable opportunity to buy property. Other public policies such as the tax deductibility of interest on mortgages contributed further to the advantages of buying property and the housing boom.

The issue of how much monetary policy contributed to the real estate and leverage bubble is controversial, with some observers pointing to the fact that the central bank was largely successful in achieving its inflation mandate. One narrow answer to this point is to follow the rationale of some central banks for taking into account housing prices, namely that the central bank should have a longer horizon than just a couple of years, since it is by nature extremely difficult to call the timing of financial market crashes.[5]

5 Reinhart and Rogoff (2011) discuss a range of models suggesting that countries vulnerability to financial crises can be assessed quantitatively but that the exact timing depends on factors such as confidence which can be extremely fragile.

Figure 1 illustrates the run-ups in property prices in Spain and Ireland we have already discussed. According to Taylor (2008) and as shown in Figure 2, these countries also had loose monetary policies relative to the Taylor rule. Spain, which had one of the largest deviations from the rule, also had the biggest housing boom as measured by the change in housing investment as a share of GDP. Other countries in the Eurozone such as Germany did not have a housing boom. Their inflation rates and other economic indicators were such that for them the European Central Bank's interest rates did not correspond to a loose monetary policy. Sweden did not deviate nearly as much as Spain and Ireland from the Taylor rule. The rise in prices there may therefore reflect changes in fundamentals rather than being a bubble.

There is considerable debate about whether the Taylor rule provides a firm indication of the "correct" level of interest rates. Furthermore, it is difficult to use monetary policy to lean against asset price bubbles in individual countries in a single currency area such as the Eurozone. Bernanke (2010) has argued that the Taylor rule is sensitive to the choice of inflation measure and to whether actual or forecasted inflation and output gaps are used. Once changes in these measures are introduced, it is no longer clear whether interest rates were unusually low given the state of the economy or whether house prices were unusually high given interest rates and the state of the economy. Bernanke (2010) concludes that Taylor`s claim is not persuasive enough. He suggests that what seems to have played a crucial role in setting the stage for the crisis is financial innovation in the form of mortgage contracts and securitization. Rather than interest rates being set too low, the implications of financial innovation for monetary policy transmission were not understood by monetary policy makers. This failure together with weak financial regulation and supervision set the stage for the crisis.

However, on the other side of this debate there is a considerable amount of evidence accumulating that low interest rates increase risk-taking by banks both in terms of real estate and other loans. This is the so-called risk-taking channel of monetary policy. Maddaloni and Peydró (2010) consider the impact of low interest rates and securitization on bank lending standards and risk-taking using data from the Euro area and the U.S. They find evidence that low short term (policy) interest rates result in a softening of lending standards and increase in bank risk-taking. This effect is magnified when supervision standards for bank capital are weak, interest rates are held low for an extended period, and the more securitization there is in an economy. Their results are more in line with Taylor's view that loose monetary policy is an important cause of the crisis.

Jiménez, Ongena, Peydró, and Saurina (2010) consider the impact of short term interest rates on banks' risk taking. They use a unique data set from Spain on all loans since 1984 as well as all loan applications since 2002 up until the beginning of

2009 that can be matched with relevant bank and firm information. They find that loose monetary policy in terms of low short term interest rates leads banks to take greater risks when granting loans, particularly banks with lower capital. Low long term rates have much smaller effects. Ioannidou, Ongena and Peydró (2009) study data from the credit register in Bolivia and find similar results.[6]

As Allen and Gale (2000, 2007) have argued, asset price bubbles are also caused by growth in credit. During the recent crisis, credit expanded rapidly in the countries with a loose monetary policy due to the presence of global imbalances. Several Asian countries started accumulating large amounts of reserves in the late 1990s and these grew to high levels. Figure 3 illustrates that this acquisition of reserves was an Asian phenomenon. In Latin America and Central and Eastern European countries reserves did not increase significantly. There are a number of reasons behind this accumulation. Allen and Carletti (2010) argue that the Asian countries affected by the crisis of 1997 started accumulating reserves in response to the tough conditions that the International Monetary Fund imposed on them in exchange for financial assistance. The motivations for the reserve accumulation of China, which is the largest holder, are probably more complex than this. Beside the precautionary reason, China started accumulating reserves to avoid allowing its currency to strengthen and damage its exports as well as to increase its political power.
The accumulated reserves were mostly invested internationally. Much of it was invested in U.S. dollars in debt securities such as Treasuries, and Fannie and Freddie mortgage-backed securities. The large supply of debt in the U.S. helped to drive down lending standards to ensure that there was enough demand for debt from house buyers and other borrowers. However, funds did not only flow to the U.S. Spain and Ireland (among others such as Portugal and Greece) also ran large current account deficits as shown in Figure 4. Interestingly Sweden has not run a large deficit as the figure shows. This also suggests that price rises in Sweden might not have been driven to quite the same extent as in the United States by low interest rates and abundant credit. Nevertheless, the authorities still need to be alert to high private leverage even if Sweden overall is a net creditor to the rest of the world.

The burst of a real estate bubble has a clear effect on the stability of the financial sector as documented in Reinhart and Rogoff (2009). In the current crisis, for example, the sudden drop in securitized asset prices starting in the summer of 2007, triggered by the fall in real estate prices and the large volatility that followed, worsened the balance sheets of financial institutions significantly and froze several financial markets including the normally stable interbank market.

6 There is now a large literature with similar results using a variety of data sets on the importance of the risk-taking channel. See, e.g., Gambacorta (2009), Altunbas, Gambacorta and Marques-Ibanez (2010), Bekaert, Hoerova and Lo Duca (2010), and Delis and Kouretas (2010).

The financial crisis then spread to the real sector. The burst of a bubble can, however, also create direct damaging effects on the real economy. In Spain during the current crisis, for example, the bursting of the property bubble led to a doubling of unemployment in the country to around 20 percent. However, the financial sector was not affected as much as one might infer, at least initially, thanks to strict financial regulation and the use of some macroprudential instruments such as countercyclical loan loss ratios. (Whether Spain's better macroprudential regulation will prove enough in the face of other structural weaknesses remains an open question as the European debt crisis unfolds.) The fact that the burst of a bubble can affect both the financial and the real sector significantly underlines the importance of preventing bubbles.

While most of the macroeconomic literature has argued that central banks should not target real estate and other asset prices, there are a number of papers that stress the importance of asset prices. Kiyotaki and Moore (1997) emphasize problems when asset prices collapse through collateral and other effects. Borio and Lowe (2002) and Borio, English and Filardo (2003) argue the question is not so much about pricking asset price bubbles, but whether central banks should lean against the buildup of financial imbalances which may later unwind at a much larger cost. Bordo and Jeanne (2002a, b) propose a model to investigate the optimal response of monetary policy to asset price booms when this risks leading to large collapses in lending and economic activity. They argue that taking preemptive action using monetary policy to prevent large run ups in asset prices can be desirable if significant falls in asset prices can have serious effects on real output. None of these papers model asset price bubbles or the possible role of interest rates in causing them.

Very few central banks have taken the approach of targeting real estate prices. Cecchetti (2005) and Cagliarini, Kent and Stevens (2010) give the examples of Australia and Sweden. In Australia in 2003 an increase in interest rates that was partially justified to the public by developments in the housing markets led to a softening of the real estate market and a fall in nominal house prices in a number of areas of the country.

Sweden's central bank, the Riksbank, has for some time considered property prices when making interest rate decisions. Ingves (2007, pp. 433-434) explains the rationale for this in the following way.

> "Let me say at the outset what I and other members of the Executive Board have said on many occasions – Sveriges Riksbank does not have a target either for the level of house prices or for house price inflation, or for any other asset price for that matter. However, when we observe long periods of high growth rates in asset prices and debt, growth rates that appear to be unsustainable in the long

run, our view is that it is not reasonable to completely ignore that there may be risks associated with this, even though it is difficult to give consideration to these risks in any simple manner in our regular forecasting process. What this view has meant in practice is fairly marginal changes in the timing of our interest rate changes, and substantial public oral and written focus on the issue."

Ingves gives the example of February 23, 2006 when the Executive Board of the Riksbank voted to raise the interest rate by 0.25% because of house price increases.

The current practice of the Riksbank is well illustrated by the Executive Board minutes for their October 2010 meeting. There was an extensive discussion of the potential danger from a future drop in housing prices and the likelihood of this occurring. On the one hand, there was a considerable expansion in households' mortgage debt and housing prices might continue to rise as a result. On the other hand, marginal mortgage holders who have new loans and the highest levels of indebtedness were not perceived as particularly vulnerable as they could pass extreme stress tests. In the end there was a divergence of opinions but interest rates were increased with the fears about the housing market going forward playing some part in the decision.

5. Theories of real estate bubbles

One interpretation of the Riksbank's policy is that if there is evidence of a growing bubble in real estate central banks may want to take actions to try and cool such bubbles. In order to understand why this kind of response makes sense and what other policies should be used to combat bubbles in real estate prices and prevent financial crises it is necessary to have a theory of bubbles. What is missing from the Taylor (2008) explanation and much of the other macroeconomics literature on this topic is a theory of why low interest rates and credit expansion lead to real estate bubbles.

Standard neoclassical theory and the efficient markets hypothesis suggest that bubbles cannot occur. In practice, one important factor in the development of bubbles appears to be the amount of liquidity provided by the central bank as money or credit. Kindleberger (1978; p. 54) emphasizes the role of this factor in his history of bubbles: "Speculative manias gather speed through expansion of money and credit or perhaps, in some cases, get started because of an initial expansion of money and credit."

The sequence of events in the current crisis is, in fact, often observed. Kaminsky and Reinhart (1999) study a wide range of crises in 20 countries including 5 industrial and 15 emerging ones. A common precursor to most of the crises considered is financial liberalization and significant credit expansion. These are followed by an average rise in the price of stocks of about 40 percent per year

above that occurring in normal times. The prices of real estate and other assets also increase significantly. At some point the bubble bursts and the stock and real estate markets collapse. In many cases banks and other intermediaries were overexposed to the equity and real estate markets and about a year later on average a banking crisis ensues. This is often accompanied by an exchange rate crisis as governments choose between lowering interest rates to ease the banking crisis or raising interest rates to defend the currency. Finally, a significant fall in output occurs and the recession lasts for an average of about a year and a half.

Arguably the most important reform to prevent future crises is to design policies that ensure that asset price bubbles are minimized. In order to do this we need tractable models of bubbles that can be used as a basis for policy analysis. Developing such theories has so far proved a difficult task.

Much of the early theoretical literature was concerned with showing that bubbles do not arise in standard models. Tirole (1982) argued that with finite horizons or a finite number of agents, bubbles in which asset prices deviate from fundamentals are not consistent with rational behavior. Santos and Woodford (1997) have argued that the conditions under which bubbles arise in standard general equilibrium frameworks are very special.

Building on the overlapping generations model of Samuelson (1958), Tirole (1985) showed that bubbles could exist in infinite horizon models in which all agents are rational. A large literature based on developments of this model has developed. Recent contributions include Caballero and Krishnamurthy (2006), and Farhi and Tirole (2010). An important issue with these models is the extent to which the OLG framework is consistent with the kind of bubbles in real estate and stock markets that are documented in Kaminsky and Reinhart (1999), Reinhart and Rogoff (2009) and elsewhere where bank credit appears to play an important role and the bubbles grow very quickly before bursting.

A second branch of the bubbles literature builds on asymmetric information models where everybody rationally believes that they may be able to sell the asset at a higher price even though it is above its fundamental. Allen, Morris and Postlewaite (1993) developed a discrete-time, finite-horizon model where the absence of common knowledge led to bubbles in asset prices. However, the model is not very robust. Conlon (2004) and Dobles-Madrid (2010) develop more appealing versions of this kind of model that are more robust.[7]

A third branch develops agency theories of bubbles. Allen and Gorton (1993) constructed a model with continuous time and a finite horizon in which an agency problem between investors and portfolio managers could produce bubbles even though all participants were rational. Allen and Gale (2000) develop a model with

7 See also Diamond and Rajan (2009).

an agency problem in discrete time where bubbles arise as a result of an expansion in credit. Barlevy (2009) extends this kind of model to allow for more general debt contracts and dynamic considerations. Allen and Gale (2003, 2004, 2007) and Adrian and Shin (2008) explicitly focus on the relationship between lending and asset price bubbles.

The difficulty in reconciling bubbles with rational behavior resulted in many authors such as De Long, Shleifer, Summers, and Waldmann (1990) developing asset pricing models based on irrational behavior. Herring and Wachter (1999) provide a behavioral theory based on "disaster myopia". Recent contributions in this strand of the literature, which involve slight deviations from rationality and provide appealing models of bubbles, include Abreu and Brunnermeier (2003) and Scheinkman and Xiong (2003).

Given the evidence in Maddaloni and Peydró (2010) and the other papers mentioned above that low interest rates lead to increased risk taking, perhaps the most promising theory of bubbles to analyze monetary policy is agency theories. Allen and Gale (2000, 2003, 2007) show how a risk shifting problem in the banking system can lead to asset bubbles. The model is particularly applicable to real estate. Credit expansion interacts with risk shifting in two ways. By encouraging investors to fund risky investments at the current date, credit expansion has a contemporaneous effect on asset prices. However, the anticipation of future credit expansion can also increase the current price of assets and it turns out that this may have a greater effect on the likelihood of an eventual crisis. The first version of the model shows how asset prices are related to the amount of credit and how uncertainty about asset payoffs can lead to bubbles in an intermediated financial system because of risk shifting. In this version default and the resulting crisis is caused by low payoffs to risky assets. In the second version of the model, a dynamic model is developed where it is expectations about the future level of credit that are important in determining asset prices. Here default and crisis result from the actions of the central bank rather than the outcome of any exogenous uncertainty about real economic variables. The third version of the model shows how anticipated credit expansion can lead to financial fragility, in the sense that a crisis occurs unless the realized credit expansion is quite large. In other words a financial contraction is not needed to burst the bubble.

In practice the real estate market in many countries operates without bubbles for long periods of time. The Allen and Gale model does not incorporate an explanation of this but rather focuses on how a bubble can arise. An important extension is to understand why there appear to be two regimes, one where fundamentals drive real estate prices and one where there is a bubble. For example, suppose that in normal times those investing with borrowed money will receive a steady stream of income from investing in safe investments. If they invest in a risky asset to shift risk and the

investment does not turn out well they will be unlikely to be able to borrow going forward. There is therefore an important issue as to whether a short run gain from taking a risk is worth it given the alternative of an ongoing safe stream of income. Only when circumstances are right will it be worthwhile to engage in the risky investment that drives the bubble. One of the important inputs into this trade-off is likely to be interest rates that are perceived to be temporarily low. Thus by creating a very favorable environment for real estate investment it is possible to depart from normal times and set off a bubble.

Another factor that seems important in setting off real estate bubbles in the kind of model outlined is the availability of credit. This is where global imbalances and the large current account deficits of countries such as the U.S., Spain and Ireland seem to have played an important role in the setting off and continuation of the bubble.

The other important feature that needs to be incorporated in such a model is the positive serial correlation of real estate returns found by Case and Shiller (1989), Englund, Quigley and Redfearn (1998) and Glaeser and Gyourko (2007). This empirical observation is important as it shows that if real estate prices are currently rising, then it is likely this will continue. For example, Glaeser and Gyourko (2007) find that a $1 increase in one year will on average be followed by a $0.71 increase the following year. Thus once a real estate bubble has started it is likely that it will persist for some time. This positive serial correlation of returns is currently not well understood. One possibility is that the search nature of the market microstructure means that idiosyncratic and aggregate shocks are difficult to disentangle and this results in the correlation. Another possibility is that the data is inadequate. Much more research needs to be done on this topic.

The kind of theory of real estate bubbles sketched above can provide a justification for the type of policy outlined by Ingves (2007). By avoiding low interest rates it may be possible to prevent the start of a bubble and by maintaining interest rates at relatively high levels and restricting credit it may be possible to cool them off and prevent real estate prices going to very high levels. This will also reduce the severity of any subsequent collapse and possible crisis that will follow. The other thing that this type of theory suggests is that discretionary macroprudential policies that make it more expensive to trade real estate may have an important role to play in preventing or dampening bubbles and subsequent financial crises. We turn to a discussion of these two kinds of policy next.

6. What should be the role of monetary policy in preventing real estate bubbles?

How should a central bank with a policy of flexible inflation targeting give consideration to house prices and credit growth? The current state of the literature precludes any simple answer to this question.

Many major financial crises result from the bursting of real estate bubbles. These financial crises can be very costly. As a result it is important that central banks try to predict and prevent bubbles. However, separating out bubbles from rises in prices due to changed fundamentals and determining when they are going to burst is difficult.

In an important early paper, Borio and Lowe (2002) argue that while it is difficult to predict asset price bubbles and in particular property bubbles, it is not impossible. They provide evidence that rapid credit growth combined with large increases in real estate prices can lead to financial instability. In low inflation environments they suggest that inflationary pressures can first appear in asset prices rather than in the prices of goods and services. They argue that in such cases it may be appropriate to use monetary policy to prick asset bubbles and to preserve financial and monetary stability.

Bubbles, in particular real estate bubbles, seem to be related to loose monetary policy and excessive credit supply. As argued in the previous section one way to prevent them is then through interest rate policy. In particular, very low interest rates at a time when property prices are static or increasing should be avoided. Once they have started increasing, an important question is whether interest rates should be raised to prick them. It may be possible and desirable to do this in economies with a high degree of homogeneity as in small countries like Sweden or possibly medium sized countries like the U.K.

The problem is more complicated in heterogeneous economies like the U.S., the Eurozone, and China. Different regions within these economies differ in terms of economic fundamentals and the rate of property price increases. Using interest rates to prick bubbles will not be so desirable because this will adversely affect the areas that do not have bubbles. The recent events in the Eurozone constitute a clear example. The interest rate policy followed by the European Central Bank was correct for countries like Germany where there was no bubble but it was inappropriate for Spain and Ireland, where it arguably contributed to the creation of the property bubbles. A tighter policy may have been effective for preventing the bubble in these countries but at the cost of a recession or at least slower growth in some of the other countries.

Even in small homogeneous countries, using interest rates to prick real estate bubbles may be difficult for political reasons. In particular when such policies are first introduced, it may be difficult to explain why it is worth causing a recession to

burst a property bubble. The recent crisis and its effects on the real economy may have made such arguments much easier to make, however.

Assenmacher-Wesche and Gerlach (2008, 2010) have argued that it is extremely costly in terms of reductions in GDP to use monetary policy to deal with real estate bubbles. They use a vector autoregression methodology to study the relationships between inflation, economic activity, credit, monetary policy and property and equity prices in 17 OECD countries using quarterly data from 1986-2006. Among other things they find that to offset a 15 percent rise in residential property prices the central bank might have to depress real GDP by 5 percent. This suggests that monetary policy should not be used to prick real estate bubbles as it is simply too costly.

They do not use a theory of bubbles in their analysis. An important issue is that much of the time, as discussed above, real estate markets do not have bubbles. For example, it seems that in the U.S. property prices were determined by fundamentals from the 1930's through to the 1990's. There were no sudden run-ups and collapses in prices. This suggests that there are important threshold effects. Much of the time when prices are driven by fundamentals large rises in interest rates will be required to reduce property prices even a few percent as their results suggest. However, in bubble times this may not be the case. The rise in Japanese interest rates at the beginning of 1990 that pricked the Japanese stock and real estate bubbles took many years to have its full effect but this has been dramatic. Much careful empirical work based on theories of bubbles is needed to understand how effective monetary policy can be in controlling property bubbles.

In summary, while raising interest rates to dampen or prick real estate bubbles may have a role to play in some small countries such as Sweden, in large countries like the U.S. or monetary areas such as the Eurozone it is likely to be costly to do this. In both cases, however, macroprudential policies are likely to be needed to try to control property bubbles. We turn to these next.

7. Macroprudential policies to prevent real estate bubbles

The previous sections have highlighted systemic risk arising from bubbles in real estate prices. This section discusses the macroprudential regulatory measures and the policies that might be put in place to deal with this source of systemic risk. What is most important is that the new macroprudential regulation deals with systemic risk and no longer only with the risk of failure of single financial institutions. The current crisis has clearly shown that the microprudential approach to financial regulation is not sufficient to prevent systemic crises.

What exactly is meant by the term macroprudential regulation? Christensson, Spong and Wilkinson (2010) provide a nice summary. They identify three policy steps associated with macroprudential regulation and supervision:

1. Countercyclical regulatory policy
2. Control of contagion risk
3. Discretionary policies

The first involves increasing financial institutions' capital reserves when the economy is growing and financial institutions are not under stress. The second requires stronger supervision of systemically important firms, counterparty risk and financial infrastructure. The final one involves timely interventions by regulators and supervisors to deal with growing imbalances and risk exposures. In particular, it is necessary to intervene to cool down real estate and other asset price bubbles. It is this kind of macroprudential intervention that we will focus on in the discussion below. Countercyclical capital ratios and control of contagion risk are key policies but our interest here is in real estate bubbles and crises.

Before considering the details of discretionary macroprudential policy, an important issue is how likely it is that such interventions will actually be deployed. Christensson et al. (2010) provide some interesting insights into this question. They point out that the Financial Stability Reports (FSRs) that are currently produced by about 50 central banks involve an attempt to undertake many of the steps that will be necessary in undertaking discretionary macroprudential regulation. In particular the financial stability reports attempt to identify and track the key economic and financial risks that are likely to lead to a financial crisis. Christensson et al. (2010) consider the FSRs of the Netherlands, Norway, Spain, Sweden, and the U.K. over the period preceding and during the crisis. The authors find that these FSRs were successful in identifying many of the risks and unsustainable trends that led to the financial crisis. However, many were regarded as low probability events not worthy of action and several factors that were not important in the crisis were also identified. The authors' conclusion is that it is unrealistic to expect macroprudential regulation and supervision to reliably prevent a financial crisis. Nevertheless these kinds of intervention may be able to contribute positively to the prevention and ability to manage a crisis.

Whether or not interest rates can be used, it may often be desirable to use other forms of discretionary macroprudential regulation to prevent bubbles. Some possible macroprudential policies to prevent or dampen real estate bubbles include the following.

i. Mandatory reductions in loan to value ratios.
ii. Increases in taxes on real estate transfers.
iii. Increases in annual real estate taxes.
iv. Elimination of tax deductibility of interest.
v. Direct restrictions on real estate lending.

The first measure would involve limits on loan-to-value ratios that would be lowered as property prices increase at a faster pace. This can be effective for residential property but may be difficult to enforce for commercial property. The reason is that firms may be able to use pyramids of companies that effectively increase leverage. The second measure is to have property transfer taxes that are greater the higher is the rate of property price increases. The third is a shift towards higher annual real estate taxes as the bubble grows to make owning real estate less attractive. For those countries that have tax deductibility of mortgage interest, eliminating it may help reduce property prices. Finally, perhaps the most direct measure is to impose restrictions on real estate lending in regions where property prices are booming.

There is some evidence that as a result of its stimulus policies China is experiencing real estate bubbles in a number of major cities such as Beijing, Shanghai and Shenzhen. The government has tried a number of these macroprudential policies to cool these real estate markets. However, it seems that their success has so far been limited.

As discussed in the previous section, one of the major causes of bubbles is excessive credit. During the recent crisis it has been suggested that excessive credit emerged because of large global imbalances. To prevent bubbles in the future, it is important to solve this problem. While it is individually advantageous for countries to self-insure by accumulating reserves, this is an inefficient mechanism from a global perspective.

As argued above, the accumulation of reserves by the Asian countries was at least partly a response to the policies that the IMF imposed on a number of countries during the Asian crisis in the late 1990s. Part of the problem was the fact that East Asian countries were not well represented in the senior staff of the IMF. It is therefore important to reform the governance structure of the IMF and of the other international organizations to ensure that the Asian countries receive equal treatment when they need financial help. This would reduce the need of these countries to accumulate reserves as a self insurance mechanism.

To reduce the large accumulation of reserves by China, other measures are necessary, however. For example, senior Chinese officials have proposed having a global currency to replace the dollar. This has the advantage that reserves can be created initially without large transfers of resources and the attendant risk of a crisis. All countries could be allocated enough reserves in the event of a crisis so that they could survive shocks. The problem is that an international institution like the IMF would need to implement the currency. There would then again be the issue of whether all countries, and in particular the Asian ones, are properly represented in the governance process of this institution.

A more likely medium term scenario is that the Chinese Rmb becomes fully convertible and joins the U.S. dollar and the euro as the third major

reserve currency. With three reserve currencies there would be more scope for diversification of risks and China itself would have little need of reserves. This is perhaps one of the most practical solutions to the global imbalances problem. The Chinese have already taken some steps in this direction. They have started to allow the settlement of trade in Rmb. They have also allowed the issue of Rmb bonds by Western companies such as McDonalds in Hong Kong. Of course, the most important aspect of being a reserve currency is full convertibility of the Rmb. That is still some way off and this is the sense in which this solution to the global imbalances problem is a medium term one.

Another important issue is whether countries should pursue policies to limit capital inflows. As has been argued already, countries like Spain and Ireland have run large current account deficits in the years preceding the crisis. These seem to have contributed to the emergence of bubbles in those countries. Going forward, it is important for countries to control their current account deficits if capital inflows are being invested in real estate and driving up prices.

8. Concluding remarks

We have suggested that the empirical evidence in Reinhart and Rogoff (2009) and elsewhere suggests there is a strong relationship between run ups in property prices, which then collapse, and the occurrence of financial crises. Since such crises have large effects on real output and inflation this suggests that real estate prices should be taken account of when conducting monetary policy, particularly in small homogeneous countries like Sweden. The traditional approach to inflation targeting, where asset prices only play a limited role in the determination of monetary policy, needs to be adapted. The models on which policies are based should incorporate a financial sector where property price bubbles can arise and lead to a financial crisis. Unfortunately, much research remains to be done to develop such models.

In the absence of such models, thorough discussion of the influences of monetary policy on the housing sector of the type currently undertaken by the Executive Board of the Riksbank seem a very sensible input to the setting of interest rates. The problems involved in detecting real estate bubbles and the uncertain effects of interest rates on them mean that monetary policy alone is unlikely to deal with the problem. Macroprudential policies are likely to be needed to buttress the effects of monetary policy. Controlling bubbles is a difficult task that needs as many tools as possible.

References

Abreu, D. and M. Brunnermeier (2003). "Bubbles and Crashes," *Econometrica* 71, 173-204.

Adrian, T. and H. Shin (2008). "Financial Intermediaries, Financial Stability and Monetary Policy," 2008 Jackson Hole Conference Proceedings, Federal Reserve Bank of Kansas City, 287-334.

Allen, F. and E. Carletti (2010). "An Overview of the Crisis: Causes, Consequences and Solutions," *International Review of Finance* 10, 1-27.

Allen, F. and D. Gale (2000). "Bubbles and Crises," *Economic Journal* 110, 236-255.

Allen, F. and D. Gale (2003). "Asset Price Bubbles and Stock Market Interlinkages" in *Asset Price Bubbles: The Implications for Monetary, Regulatory, and International Policies* edited by William C. Hunter, George G. Kaufman, and Michael Pomerleano, Cambridge: MIT Press, 323-336.

Allen, F. and D. Gale (2004). "Asset Price Bubbles and Monetary Policy" in *Global Governance and Financial Crises*, edited by M. Desai and Y. Said, New York and London: Routledge, Chapter 3, 19-42.

Allen, F. and D. Gale (2007). *Understanding Financial Crises*, Clarendon Lecture Series in Finance, Oxford: Oxford University Press.

Allen, F. and G. Gorton (1993). "Churning Bubbles," *Review of Economic Studies* 60, 813-836.

Allen, F., S. Morris, and A. Postlewaite (1993). "Finite Bubbles with Short Sale Constraints and Asymmetric Information," *Journal of Economic Theory* 61, 206-229.

Altunbas, Y., L. Gambacorta and D. Marques-Ibanez (2010). "Does Monetary Policy Affect Bank Risk-Taking?", BIS Working Papers No 298.

Assenmacher-Wesche, K. and S. Gerlach (2008). "Monetary Policy, Asset Prices and Macroeconomic Conditions: A Panel-VAR Study," working paper, Institute for Monetary and Financial Stability, University of Frankfurt.

Assenmacher-Wesche, K. and S. Gerlach (2010). "Financial Structure and the Impact of Monetary Policy on Property Prices," working paper, Institute for Monetary and Financial Stability, University of Frankfurt.

Barlevy, G. (2009). "A Leverage-based Model of Speculative Bubbles," working paper, Federal Reserve Bank of Chicago.

Barro, R., and D. Gordon (1983). "A Positive Theory of Monetary Policy in a Natural Rate Model," *Journal of Political Economy* 91, 589-610.

Bekaert, G., M. Hoerova and M. Lo Duca (2010). "Risk, Uncertainty and Monetary Policy," NBER Working Paper Series No 16397.

Bernanke, B. (2010). "Monetary Policy and the Housing Bubble," Speech to the Annual Meeting of the American Economic Association, Atlanta, Georgia, http://www.federalreserve.gov/newsevents/speech/bernanke20100103a.htm.

Bernanke, B., M. Gertler, and S. Gilchrist (1999). "The Financial Accelerator in a Quantitative Business Cycle Framework," *Handbook of Macroeconomics*, 1341-1393.

Bordo, M., and O. Jeanne (2002a). "Monetary Policy and Asset Prices: Does "Benign Neglect" Make Sense?", *International Finance* 5, 139-164.

Bordo, M, and O. Jeanne (2002b). "Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy," NBER Working Paper 8966. National Bureau of Economic Research, Cambridge.

Borio, C., B. English, and A. Filardo (2003). "A Tale of Two Perspectives: Old or New Challenges for Monetary Policy?", BIS Working Paper 127. Bank for International Settlements, Basel.

Borio, C. and P. Lowe (2002). "Asset Prices, Financial and Monetary Stability: Exploring the Nexus," BIS Working Paper 114, Basel, Switzerland.

Caballero, R., and A. Krishnamurthy (2006). "Bubbles and Capital Flow Volatility: Causes and Risk Management," *Journal of Monetary Economics* 53, 35-53.

Cagliarini, A., C. Kent, and G. Stevens (2010). "Fifty Years of Monetary Policy: What Have we Learned?", working paper, Reserve Bank of Australia.

Calvo, G. (1978). "On the Time Consistency of Optimal Policy in the Monetary Economy," *Econometrica* 46, 1411-1428.

Case, K. and R. Shiller (1989). "The Efficiency of the Market for Single-Family Homes," *American Economic Review* 79, 125-137.

Cecchetti, S. (2005). "The Brave New World of Central Banking: The Policy Challenges Posed by Asset Price Booms and Busts," Czech National Bank, Working Paper Series No. 14.

Christensson, J., K. Spong and J. Wilkinson (2010). "What Can Financial Stability Reports Tell Us About Macroprudential Supervision?", working paper, Federal Reserve Bank of Kansas City.

Conlon, J. (2004). "Simple Finite Horizon Bubbles Robust to Higher Order Knowledge," *Econometrica* 72, 927-36.

Delis, M. D. and G. Kouretas (2010). "Interest Rates and Bank Risk-Taking," Munich Personal RePEc Archive, MPRA Working Paper No. 20132.

De Long, B., A. Shleifer, L. Summers, and R. Waldmann, (1990). "Positive Feedback Investment Strategies and Destabilizing Rational Speculation," *Journal of Finance* 45, 379-395.

Diamond, D. and R. Rajan (2009). "Illiquidity and Interest Rate Policy," working paper, University of Chicago, July.

Dobles-Madrid, A. (2010). "A Robust Model of Bubbles with Multidimensional Uncertainty," working paper, Michigan State University.

Englund, P., J. Quigley and C. Redfearn (1998). "Improved Price Indexes for Real Estate: Measuring the Course of Swedish Housing Prices," *Journal of Urban Economics* 44, 171-196.

Farhi, E. and J. Tirole (2010). "Bubbly Liquidity," working paper, Harvard University.

Friedman, M. (1968). "The Role of Monetary Policy," *American Economic Review* 58, 1-17.

Gambacorta, L. (2009). "Monetary Policy and the Risk-Taking Channel," *BIS Quarterly Review*, December 2009.

Giavazzi, F. and F. Mishkin (2006). "An Evaluation of Swedish Monetary Policy 1995-2005," Reports from the Riksdag 2006/07:RFR 1, Committee on Finance.

Glaeser, E. and J. Gyourko (2007). "Housing Dynamics," working paper, Wharton School, University of Pennsylvania.

Herring, R. and S. Wachter (1999), Real Estate Booms and Banking Busts: An International Perspective, Wharton Financial Institutions Center Working Paper 99-27, University of Pennsylvania.

Ioannidou, V., S. Ongena, and J. Peydró (2009). "Monetary Policy, Risk-Taking and Pricing: Evidence from a Quasi-Natural Experiment," European Banking Center Discussion Paper No. 2009-04S. SSRN: http://ssrn.com/abstract=1406423.

Ingves, S. (2007). "Housing and Monetary Policy: A View from an Inflation-Targeting Central Bank," 2007 Federal Reserve Bank of Kansas City Conference Volume on *Housing, Housing Finance, and Monetary Policy*, 433-443.

Jiménez, G., S. Ongena, J. Peydró, and J. Saurina (2010). "Hazardous Times for Monetary Policy: What do 23 Million Loans Say About the Impact of Monetary Policy on Credit Risk-Taking?" CentER Discussion Paper Series No. 2007-75. SSRN: http://ssrn.com/abstract=1018960.

Kaminsky, G. and C. Reinhart (1999). "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems," *American Economic Review* 89, 473-500.

Kindleberger, C. (1978). Manias, Panics, and Crashes: A History of Financial Crises, New York, NY: Basic Books.

Kiyotaki, N. and J. Moore (1997). "Credit Chains," *Journal of Political Economy* 99, 220-264.

Kydland, F., and E. Prescott (1977). "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* 85, 473-492.

Leamer, E. (2007). "Housing *is* the Business Cycle," 2007 Federal Reserve Bank of Kansas City Conference Volume on *Housing, Housing Finance, and Monetary Policy*, 149-232.

Lettau, M. and S. Ludvigson (2007). "The Declining Equity Premium: What Role Does Macroeconomic Risk Play?", *Review of Financial Studies* 21, 1653-1687.

Lucas, R., Jr. (1972). "Expectations and the Neutrality of Money," *Journal of Economic Theory* 4, 103-124.

Lucas, R., Jr. (1973). "Some International Evidence on Output-Inflation Tradeoffs," *American Economic Review* 63, 326-334.

Lucas, R., Jr. (1976). "Econometric Policy Evaluation: A Critique," in *The Phillips Curve and Labor Markets*, K. Brunner and A. Meltzer, eds. *Carnegie-Rochester Conference Series on Public Policy* 1, 19-46.

Maddaloni, A. and J. Peydró (2010). "Bank Risk-Taking, Securitization, Supervision and Low Interest Rates: Evidence from the Euro Area and the U.S. Lending Standards," European Central Bank Working Paper 1248, *Review of Financial Studies*, forthcoming.

Phelps, Edmund (1967), "Phillips Curves, Expectations and Optimal Unemployment Over Time," *Economica*, 34 (August): 254-281.

Reinhart, C., and K. Rogoff (2009). *This Time is Different: Eight Centuries of Financial Folly*, Oxford and Princeton: Princeton University Press.

Reinhart, C. and K. Rogoff (2011). "From Financial Crash to Sovereign Debt Crisis," forthcoming, *American Economic Review* 101.

Rogoff, K. (1985). "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics* 100, 1169-1189.

Samuelson, P. (1958). "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money," *Journal of Political Economy* 66, 467-482.

Santos, M. and M. Woodford (1997). "Rational Asset Pricing Bubbles," *Econometrica* 65, 19–57.

Sargent, T. and N. Wallace (1975). "Rational Expectations, the Optimal Monetary Instrument and the Optimal Money Supply Rule," *Journal of Political Economy* 83, 241-254.

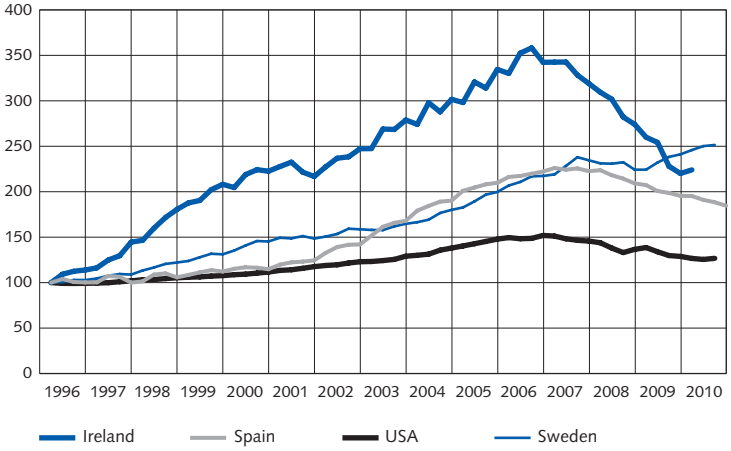
Scheinkman, J., and W. Xiong (2003). "Overconfidence and Speculative Bubbles," *Journal of Political Economy* 111, 1183-1220.

Taylor, J. (2008). "The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong," working paper, Stanford University.

Tirole, J. (1982). "On the Possibility of Speculation under Rational Expectations," *Econometrica* 50, 1163-1181.

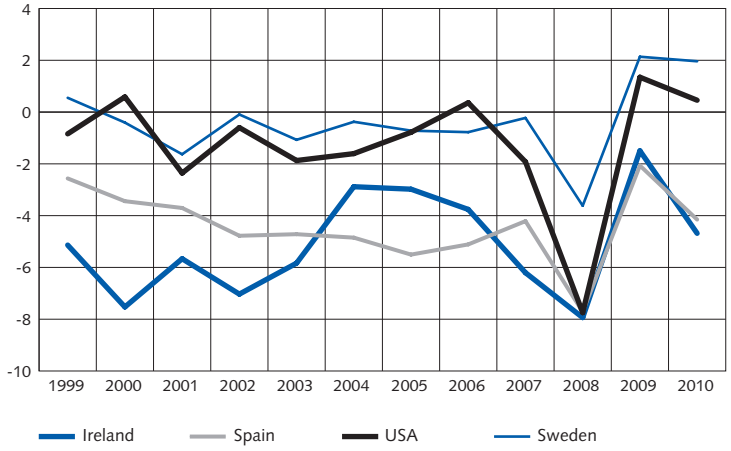
Tirole, J. (1985). "Asset Bubbles and Overlapping Generations," *Econometrica* 53, 1499-1528.

Figure 1. Housing prices in Ireland, Spain, Sweden and the U.S.
Index 1996 Q1 = 100



Sources: Irish Dep. of the Environment, Banco de España, FHFA, Statistics Sweden, OECD.

Figure 2. Deviations from the Taylor Rule in Ireland, Spain, Sweden, and the U.S.
Per cent

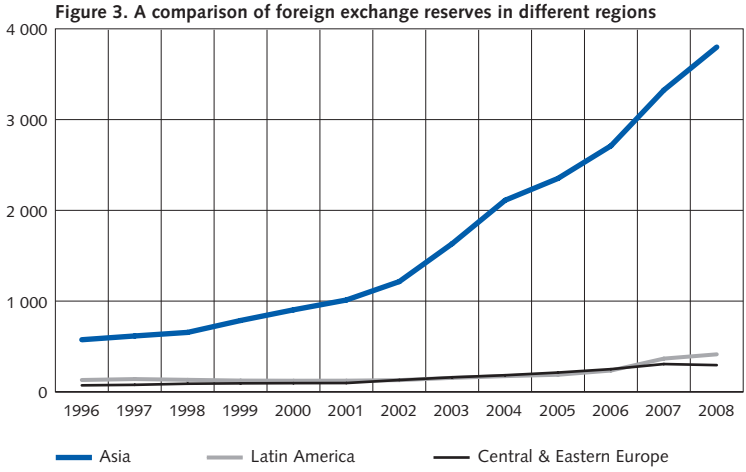


Source: Data on inflation and output gap from the IMF World Economic Outlook Database and calculated the implied interest rate according to the formula

$TR_t = CPI_t + (\text{average IR over the sample period}) + 0.5*(CPI_t - 2\%) + 0.5*\text{output gap}_t$,

where TR_t is the implied interest rate in period t, CPI_t is the consumer price index and IR is the central bank's official interest rate.

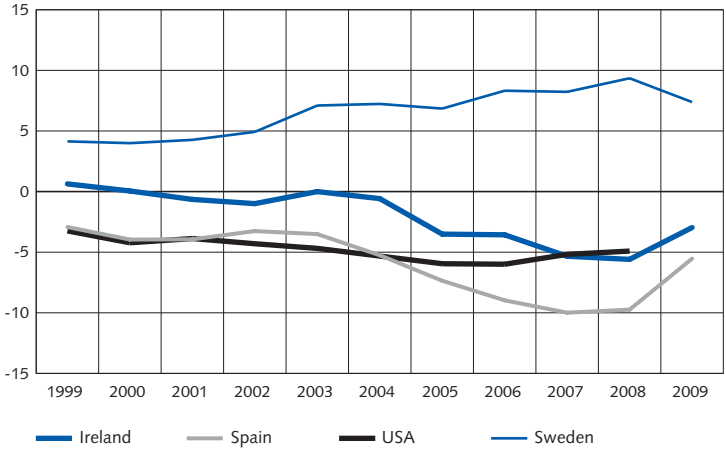
Figure 3. A comparison of foreign exchange reserves in different regions



Note: Asia is the six East Asian countries China, Hong Kong, Japan, Singapore, South Korea, Taiwan – province of China.

Source: IMF website.

Figure 4. Current account deficits as a % of GDP in Ireland, Spain, Sweden and the U.S.



Source: Eurostat.

Housing market dynamics and macroprudential tools

Davis, E.P., Fic, T.M. and Karim, D*

Against the background of the subprime crisis, where housing was implicated in the financial crisis in countries such as the US, as well as the ongoing discussions regarding Basel III, we survey the literature on housing market dynamics with a view to finding possible links to banking crises as well as potential macroprudential tools for dampening disruptive tendencies. We then go on to estimate house price equations and evaluate NiGEM macromodel simulations for Sweden with the same aim. Light is cast on the appropriateness of macroprudential intervention in housing, possible instruments to employ, and the interrelation of macroprudential with monetary policies.

Keywords: Macroprudential policy, bank regulation, house prices, housing markets

JEL classification: C52, E58, G21

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1 Introduction

The issue of housing bubbles, banking crises and monetary policy has returned to the fore with the subprime crisis. It is clear that the collapse of house prices in the US was a trigger for the crises, operating domestically via losses on banks' balance sheets and globally via securitised housing loans. This episode has led to a renewed debate on bank regulation, and notably on macroprudential policy. It is widely agreed that capital levels of banks have to rise, and also that it would be appropriate for some countercyclical element to be introduced into bank regulation, in order to offset the natural procyclicality that has been seen in this and many previous boom-bust cycles. However, the Basel proposals are for the most part based on counter cyclical tools with an economy wide effect based on capital or provisioning on the whole of banks' balance sheets. There remains a tradition, which has been continued in some Eastern European and Far Eastern countries, of applying countercyclical tools to the housing or commercial property markets alone, notably via controls on loan-to-value ratios. This raises the question of whether such tools could be appropriate for advanced OECD counties such as Sweden, what their incidence would be and how they would relate to monetary policy.

In order to address this overall issue, we provide an overview of work on the housing market, particularly as it links to monetary policy and financial stability. We also survey existing use of macroprudential policies in the housing market and related empirical work, and undertake estimation of house price equations with a view to seeing what evidence they provide on possible impacts of such policies. Finally we undertake extensive simulations of the NiGEM model for Sweden in order to assess the macroeconomic impact of such policies and their relationship to monetary policies.

Accordingly, the paper is structured as follows. In Section 2 we provide a survey covering the relationship of house prices to financial instability, macroprudential surveillance and monetary policy. In Section 3 we look at macroprudential tools applicable to the housing market, notably loan to value (LTV) ratios but also debt service/income caps, capital weights on housing lending, dynamic provisioning and sectoral exposure limits. We note that current Basel proposals (higher overall capital and procyclical capital weights) do not bear specifically on the housing market. Section 4 completes the survey sections by giving an overview of econometric work on house prices which is essential to evaluating policy proposals.

Section 5 shows estimation of house price equations for Sweden and within a panel of OECD countries, based on the approach of authors such as Muellbauer and Murphy (1997 and later). Variables assessed include demographics, income, the housing stock, interest rates, and lagged house price rises. We consider whether credit enters these models and what other significant variables could be affected

by macroprudential policies. Finally in Section 6 we consider the interaction of macroprudential policies and monetary policy. Apart from surveying the few papers which look explicitly at the impact of macroprudential policies on the economy as a whole, this section is focused on NiGEM simulations comparing macroprudential policies and monetary policy for Sweden with a newly estimated house price equation from the current exercise.

Throughout, we seek to keep in mind the overall aims of the project, for example to describe which macroprudential instruments - new, applied or proposed internationally - may be better suited than the repo rate to counteract excessive risk taking, increased indebtedness among households or extreme deviations of house prices from a long-term trend; to examine which macroprudential tools could be applied in Sweden and under what circumstances such tools should be used, and to assess how monetary policy tools can be coordinated with the macroprudential tools.

2 House prices, banking crises and monetary policy

2.1 INTRODUCTION

The connection between asset prices and banking crises was established in the seminal work of Kaminsky and Reinhart (1999), as well as Borio and Lowe (2002). Since then, specific linkages between house price dynamics and banking crises have been discussed inter alia by Reinhart and Rogoff (2008) and empirically quantified by Barrell et al. (2010a). In the wake of the sub-prime crisis, policy makers such as Turner (2009) have increasingly turned their attention to the role of housing markets.

From an early stage in the development of macroprudential surveillance, there have been recommendations to focus on housing (BIS, 2000). Such recommendations include the monitoring of house prices down to a regional level due to the high concentration of banks' asset portfolios in this market (IMF, 2000) and their exposure to boom and bust cycles.

There is an ongoing debate as to whether house price bubbles should be targeted by monetary policy given, their connection with financial instability. Again this reflects the increasing recognition that house price behaviour is ignored at the policy maker's peril, (although central banks often consider house prices as inappropriate targets except to the extent that they influence consumer prices in the relatively short run).

Meanwhile the subprime crisis has entailed a new focus on the possible use of tools for macroprudential policy to directly affect housing markets. These include loan-to-value ratios, loan to income limits and sectoral exposure limits for banks. These have been applied in countries such as Hong Kong (CGFS 2010) posing the

question whether they might be appropriate for advanced OECD countries as well.

In the light of these developments, a need to be able to explain house price behaviour has become crucial for regulators so as to be able to mitigate the social costs of crises. Moreover given the changing nature of financial intermediation within increasingly competitive banking systems and structural shifts in demographics, migration and building regulations, the modelling of house prices is important in its own right. One important conclusion is that more resources must be devoted to collecting and disseminating data on house prices and related variables such as LTVs since accurate house price modelling and assessment of related risks requires such information.

This section is structured as follows: in section 2.2 we explore the linkages between house prices and financial instability which justifies the recommendations of section 2.3 where the monitoring of house prices as part of macroprudential surveillance is discussed. Section 2.4 summarises the debate on whether central banks should pursue the twin objectives of price stability and financial stability in which case they may be required to respond to house price bubbles. Section 2.5 reviews the linkages between house prices and consumption since these are important channels by which regulatory changes to house prices could impact on aggregate demand. Thereafter in Section 3 we look at experience in using macroprudential policies in the housing market, and in Section 4 we focus on house price estimation both in the long-term and short-term. In this context, the user cost of housing which is central to house price estimation is discussed at length. A selection of alternative estimators in the literature is also briefly reviewed.

2.2 HOUSE PRICES AND FINANCIAL INSTABILITY

Much of the seminal work on banking crisis determination such as Demirguc-Kunt and Detragiache (1998, 2005) simply does not assess the link from banking crises to housing markets owing to a lack of house price data for most emerging market countries. Nevertheless, a connection between asset prices in a broad sense and banking (and currency) crises was established empirically by Kaminsky and Reinhart (1999) although they focused mainly on equity prices. Using a dataset containing 76 currency crises and 26 banking crises between the 1970s and 1995, they identified abnormal behaviour in stock market returns in the run up to banking crises. Their results showed that equity returns prior to banking crises were driven by possible asset price bubbles; returns 9 months prior to banking crises were 40% higher than their "tranquil period" levels.[1] The authors note that these results

1 In contrast, currency crises were preceded (by about 18 months) by returns that were 40% below those observed during non-crisis periods; the authors attributed this to a downturn in the economic cycle. The results suggested that asset returns had already fallen below their cyclical peaks when currency crises materialised.

accord with Gorton (1988) and Calomiris and Gorton (1991) who view the bursting of an asset price bubble as a stylistic occurrence associated with banking crises: depositors who observe increases in firm failures in periods preceding the crisis form conditional expectations of impending recession and change their perceptions of the riskiness of their bank deposits accordingly.

Borio and Lowe (2002) and subsequent work by the BIS has also linked banking crises to asset prices, although their main focus has been on role of credit gaps (i.e. gaps between the credit/GDP ratio and its long-run trend as shown by a Hodrick-Prescott filter). Their asset price variable, which they consider helpful in prediction albeit poorer than the loan variable has tended to be a similar "gap" based on the average of equity, housing and commercial property prices. Their methodology, like that of Kaminsky and Reinhart (1999) has been the "signal extraction" approach.

More recently Reinhart and Reinhart (2008) have examined the link between capital inflows and banking crises by focusing on the behaviour of asset prices in emerging markets. They argue, along the lines Calvo et al. (2003), that to a large extent, capital inflow surges that precede crises are driven by foreign demand for a country's equity and housing as investment vehicles. Like Kaminsky and Reinhart (1999), the results of Reinhart and Reinhart (ibid) suggest that asset market collapses precede crises.

Reinhart and Rogoff (2008) extend the Reinhart and Reinhart (2008) analysis in the context of residential property prices. They examine 16 countries that experienced a banking crisis according to the dating proposed by Reinhart and Reinhart (ibid). Their data also reveals significant increases in property prices in the run-up to the sub-prime episode, with this trend being particularly marked in the US.

The above findings are corroborated by description in the Turner Review (2009) which suggests that in the context of the sub-prime crisis, historically low interest rates fuelled credit expansion and consequent property price booms in the US and UK. In the UK the housing boom was exacerbated by rising demand for housing coupled with inadequate physical supply and between 1997-2007 total mortgage debt relative to GDP rose from 50% to 80%. Lending decisions were driven by the perception that high LTVs were defendable because continued house price appreciation would erode borrowers' debt burdens. In the US, lending patterns were similar but driven also by the need to direct credit to previously excluded social classes.

Against the background of suggestions regarding the predictive power of property prices for banking crisis occurrence as described above, Barrell et al. (2010a), published in the Journal of Banking and Finance have recently tested the usefulness of property prices as a leading indicator of banking crises in a multi-variate context. Using the logit approach common in the Early Warning System

literature (see Demirguc-Kunt and Detragiache, 1998, 2005) they tested the predictive power of previously unused variables such as bank capital adequacy, liquidity and residential property price growth against more commonly utilised determinants in the literature. Based on a sample of 14 OECD economies covering the years 1980-2007, which included 14 systemic and non-systemic banking crises, they concluded that bank capital adequacy, broad liquidity and residential property price growth are the most important determinants of crises in the OECD.

Moreover, Barrell et al. (ibid) were able to quantify the marginal impact of house price fluctuations on the probability of banking crisis materialisation. For a given level of bank balance sheet health, a one percentage point rise in real house price growth was sufficient to raise the probability of a crisis by at least 0.07% (US) and by as much as 0.74% (France).

They note that their results accord with those of Borio and Drehmann (2009) and Borio et al. (2010) who utilised a signal extraction methodology to establish that property prices are leading indicators of banking crises. Whereas the Borio et al. (ibid) did not subject their model to extensive robustness tests, Barrell et al. (ibid) used a series of robustness tests, including out-of-sample crisis prediction, to show that house price dynamics have a major role in the generation of financial instability. The social and public policy implication of this result, in the context of the earlier literature, is that house prices should be subject to monitoring as part of macroprudential surveillance, and possibly to control via macroprudential regulation.

Note however that predictive power over banking crises does not necessarily entail causality, if for example it is commercial property losses, correlated with house prices, that tend to bring down banking sectors. Rising commercial property prices drive credit availability and fixed investment in the upturn (the financial accelerator) and then when prices fall commercial property companies are most likely to default. In contrast, in most OECD countries, housing lending is recourse based, in other words there is a lien of the lender on household income to make up for any shortfall in the case of repossession. This may limit the impact of "negative equity" on defaults except in countries such as the US where lending is non-recourse and handing in the keys to the house covers the borrower's liability. On the other hand, there may be important wealth effects on consumption (Davis 2010) which mean falling house prices drive defaults across the economy more widely.

2.3 MONITORING HOUSE PRICE BUBBLES AS PART OF MACROPRUDENTIAL SURVEILLANCE

Macroprudential surveillance (MPS) can be defined as policy that focuses on the financial system as a whole, and also treats aggregate risk as endogenous with regard to the collective behaviour of institutions. It aims to limit system-wide distress so as to avoid output costs associated with financial instability (Borio 2009;

Davis and Karim, 2009). To this end, variables that are systematically correlated with crises are monitored on a rolling basis by policy makers with the idea that aberrance in their behaviour can trigger policy intervention to mitigate potential financial instability. In other words, there may be transmission of macroprudential surveillance into macroprudential regulation, whereby outcomes of surveillance are institutionalised as part of the regulator's strategy for ensuring financial system soundness.

The definition above allows for a wide variety of surveillance techniques to become part of the arsenal against banking crises; both qualitative and quantitative aspects of the financial system should be monitored so that tools such as early warning systems form one component of the surveillance regime. Surveillance can also be distinguished at a micro bank level or at a systemic level. Regarding the former, Davis (1999) suggests monitoring of variables relating to bank balance sheet health as well as measures of their income and expenditures. In contrast systemic risk should be monitored by tracking aggregate variables such as non-financial and financial sector debt, leverage and asset prices.

Given the discussion in the preceding section it is therefore surprising that the monitoring of house price trends and bubbles has not formed an explicit component of surveillance strategies to date in all countries. On the other hand, it could be argued that regulation is backward looking in that MPS needs are updated in the wake of crises as new information on the causes of crises emerges. This may explain why there is an increasing recognition that house price monitoring should form part of the MPS toolkit.

According to Whyte (2010), the emergence of property price bubbles before the sub-prime crisis occurred in countries such as Spain and the US which had distinct regulatory frameworks. This suggests property price evaluation may be a missing component in the MPS frameworks of many OECD economies. IMF (2000) noted that real estate prices should be monitored at a sectoral level because banks often concentrate their portfolios with loans against properties the prices of which display boom and bust cyclicality. A recent example of this in the UK was lending for "buy-to-let". In this context the authors also recommend monitoring of household indebtedness since a large fraction of this is related to mortgage obligations. However there is recognition that this enhanced monitoring system is subject to data availability which is currently limited and that more resources are required to collect and disseminate data such as residential property prices and loan to value ratios.

One point to note regarding MPS and house prices is the difficulty associated with measuring house price bubbles. As will be discussed in section 4, the estimation of the determinants of house prices has broadly followed two paths: the asset pricing approach and the cointegrating approach. The former methodology

essentially uses a time series of house prices to determine whether prices are over or undervalued but the lack of a structural model implies the degree of price misalignments is a rough guide only. The cointegrating approach assumes house prices are driven by fundamental factors but there is limited consistency in the literature on the exact nature of these determinants; different authors use different specifications based on their theoretical motivations and data availability (see Section 4). This heterogeneity in estimation means the detection of house price bubbles is operationally difficult. On the other hand if standard "bubble" estimation tools are employed such as comparison with long term trends using Hodrick-Prescott filters, the bubble estimate becomes subject to the same criticisms as output gap measures or even measures of credit gaps. Hence although the monitoring of house price bubbles may be an important principle of MPS, in practice policymakers may need to form a consensus on acceptable bubble estimators and use a high degree of judgement.

The lack of adequate historic data on house prices may explain to some extent why new regulatory proposals (e.g. BIS 2010) advocate countercyclical provisioning against credit in aggregate, since authors such as Borio and Drehmann (2009) and Drehmann et al. (2010) contend that credit cycles may cause property price cycles,[2] although they also maintain that credit is a better direct indicator of banking crises than asset prices. The suggestion that credit has a primary role in the transmission mechanism of banking crises may stem from the observation that rapid credit growth precedes banking crises during a phase when collateral values are high and credit risk is improperly processed. It also may relate to developments in both house prices and commercial property prices.

Although empirically many studies appear to find credit growth to be a leading banking crisis indicator (Demirguc-Kunt and Detragiache, 1998, 2005; Borio, Furfine and Lowe, 2001), Barrell et al. (2010b) shows that there is no conclusive empirical evidence that credit Granger causes property prices in OECD countries since 1980. In this sense although credit growth is an important MPS variable in its own right, it cannot be a substitute for property price monitoring.

Furthermore, Barrell et al. (2010b) show that a logit model using house prices, capital adequacy, liquidity and the current account (i.e. slightly extending their earlier work) could have predicted the subprime crisis in the UK, US, Belgium and France using an estimate for up to 1997 only. They contend that the recursive forecasts their model provides should be a key input to macroprudential surveillance as well as giving important evidence for macroprudential regulation.

2 Evidence in Barrell et al (2011) suggests this is not the case in most OECD countries, rather, it is property prices that drive credit. Davis and Zhu (2010) found a similar result for commercial property prices.

There remain some difficulties with using house prices for surveillance. With respect to house price cycles, there is little consensus on definitive estimators that can be used to identify trend levels and deviations from trend (this is discussed in more detail below). However the same estimation problem applies to credit analysis where the cyclical components are often computed with a degree of subjectivity. Given that similar limitations apply to the estimation of credit and house price cycles, there is little reason to exclude house price monitoring from the next generation of MPS frameworks. Moreover if property prices are not subjected to robust monitoring in future, it is possible that signs of financial instability will be missed and that societies will re-incur the costs of banking crises. In recognition of such costs, a debate has formed on the merits of including asset prices, including house prices, in monetary policy rules. We turn to this issue next.

2.4 ASSET PRICE BUBBLES AND MONETARY POLICY

Given the empirical connection between house prices and banking crises and the recognition that housing market developments should feed in to MPS, a natural question arises as to whether house price developments should also be the target of monetary policy, given that interest rates can influence house prices via a number of channels (see discussion of Mishkin (2007) below and Section 4)

Disysatat (2010) highlights the two crucial alternatives available to policy makers in this respect: one in which the central banks only responds to asset price misalignments if they alter the path of central bank targets (inflation and the output gap). The other alternative is that in recognition of the social costs of asset price corrections, central banks should counteract the accumulation of asset price imbalances irrespective of whether they are likely to impact on the short-term paths of inflation and output. This second approach has been used to justify why central banks should "lean against the wind" of asset price bubbles, whereas according the first view, policy makers would deal with the aftermath of such bubbles in the wake of asset price corrections (leaning versus cleaning).

The debate does not question the inflation targeting role of central banks but is concerned with more subtle aspects of stability such as the timing of interventions against asset prices and the relative weights given by policy makers to information contained in asset prices versus their targets. Fawley and Juvenal (2010) summarise the divergent views on this; Bernanke and Gertler (2001) suggest monetary policy should restrict itself to targeting inflation whereas Cecchetti et al. (2002) believe asset price bubbles should be mitigated by central banks. In other words, the latter suggest central banks should be concerned with the "twin objectives" of monetary and financial stability.

Bernanke and Gertler (ibid) cite an earlier contribution (Bernanke and Gertler, 1999) in which they establish that the medium term inflation target announced

by the central bank should be the primary anchor for monetary policy. Inasmuch as the inflation forecast already imbibes the forward looking expectations of asset prices, including house prices, central banks should not respond to asset price developments beyond this.

The empirical simulations of Bernanke and Gertler (1999) appear to validate this stance; they used a Taylor rule in which the change in the interest rate is dictated by a coefficient of 2 on the expected inflation rate. They found that this aggressive reaction function was sufficient for the stabilisation of output and inflation in situations where asset price bubbles emerged and then collapsed. On the premise that such a Taylor rule is adopted, the authors could not establish any additional benefits when central banks responded to asset price deviations. Moreover they argue that if central banks attempt to stabilise asset prices there may be detrimental effects on market expectations which are not always predictable and could modify monetary policy transmission adversely.

In line with the above, Bohl et al. (2004) suggest unpredictability could arise due to problems with estimating house price bubbles. They estimate Taylor rules for Germany, France and Italy and find that the addition of asset prices to the reaction function produces interest rate volatility along the lines of the results for Bernanke and Gertler (1999). However their GMM results which rely on asset prices as instruments generate Taylor rules which fit the actual data well, suggesting that although the central banks in practice did not respond to asset prices directly they did respond implicitly as asset market developments affected expectations of the inflation and output gaps.

Fawley and Juvenal (2010) also note the problems with Taylor rules and house price bubbles. The latter are by definition episodes when house prices respond to irrational exuberance and thus it could be argued are unpredictable. In this case forward-looking rules could not accommodate bubbles effectively and even if a bubble is identified, the impact of an interest rate rise would not be predictable and would most likely generate interest rate volatility. Furthermore if linkages between interest rates and asset prices are weak, central banks would have a limited capacity to deflate housing market bubbles.

On the other hand Mishkin (2007) recognises the economic impact of housing market fluctuations can be severe and thus may warrant interventions by central banks. In other words, a financial crisis is itself a major disinflationary shock, the impact of which is appropriately allowed for. The recent experience of the US housing market where post-2006 contractions in residential investment reduced GDP growth by 1% over the preceding four quarters exemplifies the detrimental impacts of substantial property price corrections. He lists 6 transmission mechanisms whereby interest rate changes impact on house prices and consumption which are discussed further in Section 4: (1) the user cost of capital (2) expectations

of house price movements (3) housing supply (4) wealth effects (5) credit effects on consumption and (6) credit effects on housing demand.

Whilst there is considerable uncertainty on the exact structure of these transmission mechanisms, Mishkin (ibid) indicates the relationships cannot be ignored by those setting monetary policy and that following rules based systems that do not recognise these linkages is inappropriate: if central banks aim to manage aggregate demand to stabilise inflation and unemployment, they cannot ignore housing market developments.

According to the preceding view, a Taylor rule based system where interest rates respond to house price appreciation only once it is realised, may not set the path of interest rates optimally. This is because optimality would require the interest rate to accommodate expected house price changes. Empirical simulations verify this: the model which incorporates future price changes results in more aggressive and rapid interest changes than the Taylor rule model. Moreover there is a considerable lag before changes in house prices feed through to changes in households' consumption which means central banks should have sufficient time to respond to price fluctuations. On the other hand in his 2007 paper Mishkin does not advocate "leaning" per se (although he has tended towards it in more recent work).

Cecchetti et al. (2002) strongly support the view that central banks should explicitly respond to asset price misalignments. They do however make the distinction between reaction and targeting: whilst they argue that central banks could improve macroeconomic stability by responding to misalignments not contained in the inflation forecast, they do not advocate asset prices as actual targets. In line with the argument of Poole (1970) who suggested that by "leaning against the wind" of money market changes central banks could stabilise the macroeconomy, Cecchetti et al. (ibid) believe a similar approach should be used against asset price misalignments, provided that the source of this aberrance can be attributed to supply and demand for the asset itself.

In other words, they do not propose that central banks should respond to all asset price misalignments but only after an analysis of asset price behaviour suggests some corrective action would be prudent. In this sense, the authors' arguments complement the arguments put forward in the preceding sections on macroprudential surveillance and the empirically established connection between financial instability and house prices. Wadhwani (2008) suggests that the Swedish authorities "leaned into the wind" in the 2000s in the manner that Cecchetti et al (2002) recommended, and this may account for lesser difficulties there than elsewhere.

Disyatat (2010) adds to the debate by constructing a model using standard transmission mechanisms with the focus on the operational aspects of central banks' remits. In other words, explicit Taylor rules are not derived since as the

author points out, these reduced form rules prevent flexibility in the central bank's response. Instead, the author uses a non-restrictive approach whereby the central bank is assumed to face an economy characterised by three equations describing the evolution of inflation, output and asset prices. These then give rise to the optimal policy response; the author shows that to the extent that asset prices impact on inputs to the central banker's loss function (output gap and inflation), asset price misalignments require some intervention.

An important issue in this context is that the above choice whether or not to respond to housing market developments is only feasible for countries whose monetary policymakers are able to respond. This rules out those who have a currency board, fixed exchange rate or monetary union. It is particularly in the latter context that interest has arisen in specific macroprudential instruments to control the housing market, as discussed in Section 3 below. First we briefly consider the relation of house prices to consumption in the context of monetary and financial stability.

2.5 HOUSE PRICES, CONSUMPTION AND POLICY CONCERNS

There are divergent views on the extent to which house price changes eventually impact on consumption. These issues are important from the perspective of regulators since depending on the exact transmission mechanisms, house price changes and associated financial crises may have different impacts on aggregate demand via consumption, while falling consumption may itself aggravate crises via bankruptcies of firms involved in producing consumer goods and services, as well as unemployment.

As noted above, Mishkin (2007) lists six transmission channels by which monetary policy decision can impact on house prices: via (1) the user cost of capital (2) expectations of house price movements (3) housing supply (4) wealth effects (5) credit effects on consumption and (6) credit effects on housing demand. While the first three channels reflect the direct impact of interest rate changes, the last three channels are indirect.

The impact of interest rate changes on the user cost of housing is apparent from the user cost functions described below which are also discussed in the context of the role of expectations of house price appreciation and impacts on supply. In Mishkin (ibid), wealth effects according to life-cycle theories of consumption, should arise because households disregard the source of increased wealth (whether from appreciation of financial or real assets) and increase consumption according to their marginal propensity to consume.

However there is the alternative view that wealth changes from different sources will have different impacts on consumption because of the demographic distribution of these assets: financial assets (such as stocks) are more likely to be held by the

rich and old whose marginal consumption propensities are lower and so stock price appreciation will have a smaller impact on consumption than house price appreciation. Also the relatively lower volatility of house prices compared with stock prices could mean that house price appreciation is viewed as being more permanent and therefore leads to larger changes in consumption behaviour.

On the other hand it is possible that house price increases could lead to lower current consumption because the price appreciation is associated with a higher user cost of housing in which case non-residential consumption suffers; those wishing to purchase housing will now have to save more and consume less. Moreover a rise in stock prices is a stronger signal of increased future productivity than house price appreciation because the latter could arise from supply side constraints and not because future economic prospects have improved. In this case, stock price appreciation could lead to higher consumption especially since older generations, according to life cycle theories, have higher propensities to consume and tend to hold more stocks than younger households.

Muellbauer and Murphy (2008) argue there should be no wealth effect per se from house price appreciation based on estimations in Muellbauer and Murphy (1989) and Aron et al. (2007). Instead there is a collateral effect when house prices rise whereby positive equity is translated into higher household borrowing. This, they argue is important in explaining the empirical reality of higher consumption following house price appreciation which is contrary to predictions based on the life cycle hypothesis. In their view the latter suggests that when house prices rise, consumption should fall due to higher downpayment requirements on house purchases.

Thus the credit channel is an important reason as to why increased house prices may lead to higher consumption. In poorly developed credit markets such as Italy, Muellbauer and Murphy (ibid) argue that households cannot translate positive equity into loans and consequently house price appreciation is associated with lower consumption. Conversely in deep mortgage markets such as the UK and US, greater competitiveness in the lending markets means borrowers benefit from higher loan to value ratios and thus need to save less to finance new house purchases. Moreover, existing homeowners can release equity easily due to the depth of credit markets. In combination these effects lead to an increase in consumption when house prices rise.

Buiter (2010) elaborates further on the wealth effect debate. He argues that housing assets are no different from any other durable asset, whereby self-sufficiency means price effects have no impact. In other words, if the owner does not plan to sell or buy a property and has the desired lifetime level of housing services, then they are indifferent to price changes since wealth and the cost of the stream of services change by the same amount. In reality agents are often not self

sufficient and are affected by price changes in different ways; if prices fall, owners are worse off to the extent that the fundamental value of the house is less than the discounted value of the housing services they wish to consume in their lifetime; those who are outside the market at present will in contrast be advantaged by house price declines as they can buy housing services more cheaply.

Buiter (ibid) argues that representative agent models cannot distinguish between the two ownership categories described above and therefore contends that there is no net housing wealth effect. If however, a heterogeneous agent model is used then the differential impacts of house price changes on non-owners, landlords and owner-occupiers can be established; the aggregate consumption change then arises from the redistributive effects between agents who have different marginal propensities to consume (Woodford 2010). The implication of the heterogeneity in housing consumption is important for regulatory purposes. If, in aggregate house price changes do alter consumption, and thus aggregate demand, there may be a case for policy makers to avoid large swings in house prices especially as these may generate financial instability both directly (via mortgage defaults) and indirectly (via the impact of lower consumption on producers' solvency and unemployment).

Finally, Davis (2010) surveys empirical work on consumption and house prices and concludes that the empirical evidence for tangible wealth effects as well as financial wealth is well supported. This underlines the importance for all countries to ensure that there is adequate, accurate and timely data on the complete balance sheet of the household sector. He notes that arguments for different long-run housing wealth effects across countries are arguably stronger than those for net financial wealth, given the wide differences in housing finance systems. On the other hand, there remains some evidence, notably at the micro level, that the housing wealth effect is actually an income-expectations effect.

Note again that this effect on consumption is quite distinct from the possible losses that mortgage lenders may make as a consequence of homeowners defaulting on their loans. It may nevertheless be an indirect cause of financial instability, since falls in consumption may give rise to general recession leading to widespread job losses and business failures. Accordingly, it could justify monetary policy concerns over house prices as well as macroprudential regulation which addresses housing valuation concerns. It is to use of such macroprudential policies that we now turn.

3 International experiences of macroprudential policies related to housing

3.1 OVERVIEW

Whereas macroprudential surveillance focused on house prices as a key indicator is common across many countries, attempts to regulate house purchase lending are less widespread. It is also contrary to the thrust of Basel discussions which is focused on general macroprudential instruments, notably capital or provisions held by institutions (either in time series or cross section) rather than sectors they lend to. Under it, national regulators have scope to set an additional capital buffer of 2.5 percentage points for banks, which rises when times are good and falls when they are bad. And the suggestion in Basel Committee (2010) is that such buffers should be calibrated to credit "gaps"[3]. The Basel approach builds on the historically less interventionist approach of regulators and central banks in OECD countries, who have until recently taken the view that interest rates and individual bank capital regulation are all that is needed for both monetary and financial stability to be maintained.

That said, there has been quite extensive use of housing market related macroprudential regulation by non-OECD countries and some lower income OECD countries. As outlined in this section, methods that have been applied include limits on loan to value (LTV) ratios, debt service/income caps, dynamic provisioning related to housing lending and sectoral exposure limits. And in the light of the sub-prime crisis there is increased interest in what can be called specific macroprudential instruments, see in particular CGFS (2010), also Harding (2010).

3.2 LTV LIMITS

According to CGFS (2010), the most widely used specific instruments have been those limiting credit supply to sectors such as housing or commercial property seen as vulnerable to excessive credit growth. The most common approach is the control of LTV ratios. This has been used in particular in Asian countries such as Hong Kong, Korea, Malaysia, Singapore and India, China, Thailand, Bulgaria, Romania and Croatia have also imposed such limits (Borio and Shim 2007). These limits tend to start from a typical "normal" level in the economy from a microprudential point of view such as 80%. Then they would impose a tightening beyond that of 10 or 20 percentage points.

3 Like the output gap, the credit gap measure is the distance between credit levels at time t and the long-run trend as (usually) measured by a Hodrick-Prescott filter.

Most recently the Swedish Financial Regulatory Authority capped the mortgage LTV at 85%, while Hungary, Finland and Norway have also declared that LTV policies will be introduced. Whilst the motivations for such caps are diverse (in the case of Sweden consumer protection is a large consideration, elsewhere it is often financial stability) it is likely these measures will be beneficial for systemic stability, although it is too early to evaluate the exact effectiveness of these policies.

Such limits have historically tended to be chosen in economies that had a heavy exposure to financial cycles both in terms of the macroeconomy and the financial sector. They would also have housing markets that responded strongly to credit availability, having incipient excess demand. Often fixed or managed exchange rates limit the use of monetary policy for stabilisation purposes in these countries (which makes it a paradox that they have not to date been considered in euro area countries). LTVs might be complemented by other policies which seek to ensure prudent lending such as limits on loan to income and loan concentration, on the grounds that a single policy could not address all the elements of risk in a transaction. The intended use of LTVs was to enhance financial sector resilience and leaning against build-ups of risk both at micro and macro levels, although as noted they can also be motivated by consumer protection. According to central banks and regulators which use them, LTVs are seen to directly influence credit growth and also provide a clear signal of concerns by the authorities to institutions and the public.

The level of the cap needs to take into account expected volatility and overvaluation of house prices as well as political economy considerations (that it is difficult to impose very low caps) and the tolerable level of loss given default. A risk with an LTV cap is to make the maximum level also a minimum and thus raise the LTVs on new lending. Judgement is the main basis for adjustment in LTV caps, although one country does calibrate it to quantitative indicators such as growth in home sales, real estate investment and house prices. Further information needs are for surveys which show the extremes of the distribution, and the riskier products (e.g. subprime) and new distribution channels that may be missed by conventional statistics.

On the other hand, there is a risk that LTV limits are circumvented by strategies such as offshore borrowing, unsecured borrowing, financial engineering, falsification of asset valuation or other borrowing from outside the regulated financial system. Scope for cross border lending is a particular challenge in small open economies. Such problems could however be avoided by simply making the portion of loans above a regulatory limit non-enforceable in the case of default (Weale 2009) – a policy that has not been tried to our knowledge at present. Institutions would then have a strong incentive to hold to the LTV limit, and check consumers against credit registers.

In addition, it should be noted that LTV limits are not strictly countercylical since the ratio depends on an endogenous variable (house prices). Some would argue that limits on debt servicing ratios would more sensitively address the issue of households' burden of debt and hence likelihood of default.

Measuring the success of LTV policies could be done by assessing the growth rate of credit, assuming the objective is mainly to lean against the financial cycle. It is not however easy to distinguish from the effects of monetary policy, confidence and income growth expectations in driving borrowing. There appears to be less evidence that LTVs are effective in promoting lending in a downturn than restraining it in the upturn. If the aim is to increase resilience, then total housing equity (and especially of recent loans) as well as banking sector capital adequacy would be relevant and LTVs may be helpful in providing buffers. CGFS (2010) seems to suggest that the success in this latter aim has been greater than in restraining credit expansion. There is also little evidence at present that LTV limits can restrict house price growth per se.

Hong Kong has no scope for raising interest rates due to the fixed rate vis a vis the US dollar. Accordingly, macroprudential instruments were seen as essential to prevent banking crises following property bubbles when the US interest rate was "too high" for domestic conditions in Hong Kong. There were successive decreases in the maximum loan to value ratio in the 1990-1997 period, from 80-90% to 60%. Although the Asian crisis came after the last tightening, with a marked fall in the price of housing, the banks remained solvent given the low LTVs on their loans. This limit was complemented by a maximum limit of 40% of assets to be held in the form of mortgage loans over 1994-1988.

Wong and Hui (2010) comment that although property prices dropped remarkably by more than 40% right after the Asian financial crisis, the subsequent delinquency ratio for mortgages in Hong Kong never exceeded 1.43%. They also suggest that a policy of mortgage insurance may need to be instituted to prevent excessive liquidity constraints on households and that that an effective operation of loan-to-value policy may require some discretion to adjust the maximum loan-to-value ratio.

Gerlach and Peng (2005) showed that the limits on LTVs had a detectable effect on the impact of house prices on borrowing in Hong Kong, with a 10% rise in house prices having only a 1.5% effect on lending compared to 4% before the measures. In earlier work (Gerlach and Peng 2002) they showed that there is both short-term and long-term causality running from property prices to lending but not the opposite, suggesting that the LTV limits did not restrain property prices per se.

The potential benefit of LTV caps is visible in countries such as the US where by some estimates 25% of loans currently suffer from negative equity, with a strong incentive to default. Meanwhile the structural features of the financial markets

may also limit lending via LTVs, for example in Germany via Pfandbriefe which can only be used to securitise if they have LTVs of less than 80%. Fiscal policy may also impact on the housing market via LTVs.

Wong and Hui (2010) also look more deeply into the effectiveness of LTV limits in a panel of countries. They find that economies with LTV policy are estimated to have a lower sensitivity of mortgage delinquency ratios to property prices than those without LTV policy, taking into account other determinants of default (property prices, GDP growth, mortgage debt/GDP and interest rates). On the other hand, their model can be criticised from a robustness point of view, notably because omitted variation in regulations could underlie the results.

3.3 OTHER SECTOR-SPECIFIC MACROPRUDENTIAL REGULATIONS

LTV limits are not the only form of regulation of the terms of credit that can be applied to the housing market. Debt service/income caps have also been tried in Hong Kong, Malaysia and Korea. For example in 2006 the Korean authorities imposed a debt repayment to income limit of 40% in specific areas where the price of luxury apartments had risen sharply. China imposed a wider limit in 2004 of 50% on loan interest/household income ratios, and Greece a 40% limit in 2005. In Malaysia in 1995 the monthly repayment for credit cards was raised from 10% to 15% of balances. In Thailand in 2005 credit card lines were limited to no more than 5 times monthly income. Such limits require there to be sufficient information exchange between banks and/or the existence of a central credit register.

Dynamic provisioning as applied in Spain since 2000 is applied to overall credit expansion rather than that in the housing market, but would naturally bear on housing credit when this is a large proportion of total credit, as has been the case in Spain in recent years. Banks set aside provisions during times when credit expansion is particularly rapid, which anticipates the losses to be realised when there is a downturn. The provisions are higher on riskier forms of loan. So for example at the end of 2007 the total accumulated provisions (close to 75 percent were general provisions) covered 1.3 percent of the total consolidated assets of Spanish deposit institutions, at a time that capital and reserves represented 5.8 percent of those assets (Saurina 2009).

The experience to date of this policy is that it has been more successful in the protection of the institutions than in limiting credit growth or the asset bubble, although the difficulties of the Cajas or savings banks shows that even this effectiveness is limited. We note that the parameters of dynamic provisioning could be adjusted to penalise certain types of loan since they fall into 6 different risk buckets, but the Spanish have not chosen to do this to date.

Some countries have explicitly varied capital weights to allow for concerns regarding the housing market. This enables banks to choose whether or not to lend

to the sector judged to be growing too rapidly in the light of the amended cost of lending. They could react by absorbing the cost, raising more capital, and raising the cost of lending to the sector. At a macroeconomic level, it could be seen as widening the spread of mortgage loans over the deposit rate in the housing market, as the deposit margin can also be adjusted when capital requirements are raised (see Barrell et al 2009).

As noted by McCauley (2009) varying capital weights was an instrument used by the Indian central bank in late 2004, raising Basel 1 weights on mortgages and other household credit given rapid growth. The capital weight on mortgages was raised from 50% to 75% and that on consumer loans from 100% to 125% while commercial property lending had its weight raised from 100% to 150%. The consequence was a considerable fall in the growth rate of these loans, absolutely and relative to the total. Mortgage loan growth for example fell from around 70% in the year to March 2004 to 50% up to March 2005 and just over 40% in the year ending March 2006. Estonia imposed similar general increases in the risk weights on housing loans to residents in 2006.

Such limits can be conditional on LTVs as cited by McCauley (2009), in that the Reserve Bank of Australia permitted the 50% weight on mortgages to be applied only to loans with an LTV of below 70%, while Borio and Shim (2007) cite a rise in the Irish risk weight for the portion of mortgages over 80% LTV from 50% to 100%; Norway and Portugal imposed similar limits in the 1990s, and Bulgaria in 2004.

Implicit taxation of credit growth was applied widely in the pre-liberalisation policies in countries such as the UK and France, where rapid growth in lending attracted higher reserve requirements on the funding side. In Finland in the late 1980s there was a threshold set on loan growth with lending above that level attracting higher reserve requirements. This was considered successful in restraining lending growth relative to that in Sweden (Berg 1993), although it did not prevent the occurrence of a banking crisis in Finland. Bulgaria imposed similar limits in 2005. Latvia raised general reserve requirements in 2004 to restrain lending growth. The policy of penalising growth of banks balance sheets of over 20% set in Croatia in 2003-2006 was also applied to general credit growth. Such policies could also be applied to the housing market. But banks with access to securities borrowing or foreign bank credit could avoid such restrictions.

Sectoral exposure limits were applied in Ireland in the late 1990s, which meant that only up to 200% of own-funds could be lent to a given industrial sector, while only up to 250% could be lent to two sectors, which shared the economic risks of an asymmetric shock, such as property and construction. But these evidently did not prevent sufficiently large exposures to lead to the current economic and financial difficulties that the country is facing. In Romania in 2005, foreign currency lending was set to be no more than 300% of own-funds.

Borio and Shim (2007) sought to evaluate the impact of macroprudential policies such as those summarised in this section on credit and asset price growth. They found that there was rapid growth in both these variables at the time the measures were introduced. They found that there were reductions in both credit growth (of 4-6 percent) and house price growth (3-5 percent) after the measures, although that is not always easy to divide the impact of such measures from that of monetary policy or economic growth.

Barrell et al. (2010b) looked at how house prices should impact on macro-prudential regulation generally. Against the background of their logit model predicting banking crises cited in Section 2, as well as arguments that credit growth should guide countercyclical provisioning, they suggest that the appropriate adjustment for procyclicality requires the country to calculate the trade-off between house prices, current account balances and regulatory variables over time. Since there is nonlinearity in a logit equation, there is not a simple rule that can be derived. Undertaking a scenario with 5 pp higher house prices, they showed that the regulatory adjustment is greater, as would be expected, with higher lagged house price growth, but the relationship is not one-to-one – it depends also on the other regulatory and non regulatory variables in the model. A given growth rate of house prices is more threatening to financial stability when there is also low capital and liquidity as well as a current account deficit.

Whatever the context, it is clear that the correct modelling of house prices is crucial and is likely to receive increasing attention in the wake of the sub-prime crisis and policy developments; it is this issue we turn to in the next section. The determinants of house prices may either capture directly the impact of policy, or identify key driving variables which would otherwise bias the results of estimation – and which may in any case be indirectly affected by policy in a macroeconomic context.

4 Extant work on estimation of house price equations

House price estimation typically uses a first stage model which links house prices to a set of "fundamental" determinants. These in turn represent the factors that drive the supply of and demand for housing (Gattini and Hiebert (2010), Muellbauer and Murphy (2006, 2008), Capozza et al. (2002)). The justification of this approach is that house prices and fundamentals are cointegrated; this model then determines the long-run price of housing. Such fundamentals may include long run settings of policy variables.

The dynamics estimated in the second stage recognise that actual house prices deviate from their fundamental values in the short-run and attempt to accommodate these deviations through an error correction framework. This allows the examination of a host of factors that drive house price dynamics: bubbles,

spatial and temporal effects and behavioural and informational drivers of house prices as well as short run variations in policy variables.

There has however been criticism of the cointegrating approach. Gallin (2006) notes that while there may be theoretical justification for a cointegrating relationship based on supply and demand, the same model explains why a cointegrating relationship may be absent: there is no reason to assume supply and demand elasticises are stable over time[4]. In other words, a test of cointegration implicitly tests the stability of these elasticities; however given the research time that has been devoted to their temporal and spatial variations, it may be that a cointegrating framework has been accepted too readily in the literature. Nevertheless, this methodology remains the dominant modelling technique[5] in the housing market literature and so we devote the rest of this section to discussing it in more detail.

4.1 THE SUPPLY AND DEMAND FRAMEWORK

According to Gallin (2006), house prices are cointegrated with their fundamental determinants if a long-run relationship exists and if this relationship can be characterised by supply and demand equations according to:

$$Q_d = D\left(Y, N, W, UC, \theta_d\right) \tag{1}$$

where Y = income
N = population
W = wealth
UC = user cost of housing
θ_d = other factors that shift demand

where both income and wealth are potentially influenced by monetary or fiscal policies.

We will discuss the user cost of housing in more detail later, but briefly in this context, the user cost of capital itself depends on the price of housing and other variables according to:

$$UC = P\ \left(1 - T_y\right)\left(m + T_p\right) + \delta - cg \tag{2}$$

4 E.g. due to regulatory changes in planning permission (affecting supply) or demographic changes (affecting demand).

5 Other approaches include the VECM [Gattini and Hiebert (2010)] and spatio-temporal impulse responses to gage the degree to which shocks diffuse over time and space [Holly, Pesaran and Yamagata (2010)].

where P = house price
m = mortgage rate
T_y = income tax rate
T_p = property tax rate
δ = depreciation rate
cg = capital gains

where fiscal policy may affect taxes and also monetary policy may affect the mortgage rate. We note that macroprudential policies may also affect the user cost via mortgage rates, for example if there are higher capital charges on mortgage lending. However, a low LTV limit may not affect the interest rate directly but rather may affect the "shadow price of housing" as demand for housing falls at a given mortgage rate owing to the need for more saving in order to pay a deposit.

The main influences on the supply of housing can be summarised as:

$$Q_s = S\left(P, C, \theta_s\right) \tag{3}$$

where P = house price
C = real cost of building
θ_s = other factors which shift supply

where monetary policy can affect the real cost of building via the interest cost of financing construction, while regulations affecting land use may also have an important influence on supply overall. Re-writing equation (2) as

$$\mathrm{UC} = \mathrm{P} \bullet \mathrm{A} \tag{4}$$

means house prices are determined by the following set of "fundamentals":

$$P = f\left[Y, N, W, C, A, \theta_D, \theta_S\right] \tag{5}$$

In many studies, an explicit supply equation is not defined, rather, determinants of supply enter indirectly through the demand framework, e.g. Muellbauer and Murphy (2008) where the existing stock of housing impacts on house prices through the income per household variable.

In Cameron et al. (2006), θ_s is partially defined by an explicit equation describing the change in the stock of housing over time. This equation augments the supply and demand equations.

In Hott and Monin (2008), housing supply is modelled in the manner of McCarthy and Peach (2004) where housing supply (S_t) is a function of the

depreciated existing housing stock (δS_{t-1}) and any new builds that occurred over the period (B_{t-1}) as in equation (6). Housing supply is deliberately not related to house prices so that construction costs can be treated as an exogenous variable[6] although the authors recognise that alternative specifications are possible where construction costs positively affect house prices and the level of construction is endogenously determined.

$$S_t = \delta S_{t-1} + B_{t-1} = \delta^t S_0 + \sum_{i=1}^{t} \delta^{i-1} B_{t-1} \qquad (6)$$

In Muellbauer and Murphy (2008) and Cameron et al. (2006) the demand equation is inverted to model house price as a function of its determinants. This is akin to equation (5) and is formally derived from their demand curve specification as follows:

$$\ln \frac{hs}{pop} = \alpha \ln \frac{y}{pop} - \beta \ln r_h + \ln d \qquad (7)$$

where hs = housing stock
pop = population
y = real income
r_h = real rental cost of housing
d = demography

The final inverted demand curve is obtained by replacing the real rental cost (which is unobserved) in equation (7) with the real user cost of housing since the two are equal in equilibrium. The equation is then inverted to yield:

$$\ln(hp) = \frac{\alpha}{\beta} \ln \frac{y}{pop} - \frac{1}{\beta} \ln \frac{hs}{pop} - \ln(UC_h) + \frac{1}{\beta} \ln(d) \qquad (8)$$

where UC_h[7] is the real user cost of housing.

In practice, a restriction[8] is imposed by the authors to obtain the final estimated equation:

$$\ln(hp) = \beta_0 + \theta(\ln(y) - \ln(hs)) - \beta_1 (UC_h) + \beta_2 \ln(d) + u \qquad (9)$$

where $\theta = \frac{\alpha}{\beta}$ and u is the error term.

6 This is so the authors can make use of data on construction costs.
7 Note the term UC_h is explicitly defined in terms of constituent parameters by Cameron et al. (2006) and Muellbauer and Murphy (2008) but because other authors present alternative definitions we discuss the user cost variable later on.
8 $\alpha = 1$.

Moreover equation (9) is modified to accommodate dynamic effects during the modelling process including lagged house price effects, lags of other explanatory variables and an error correction term.

4.2 THE LONG-RUN RELATIONSHIP

Following a log-linear transformation of all the variables, a cointegrating relationship would be identified with whichever fundamentals possess a unit root. The long run relationship is expressed by Capozza et al. (2002) as:

$$P_t^* = p\left(X_t\right) \qquad (10)$$

where P^* is the log of real fundamental house price and X_t is the vector of exogenous determinants.

The actual members of the exogenous vector vary according to studies. For example, in Capozza et al. (2002) the set of long-run determinants includes population levels, real median income levels[9], the long-run (5 year) population growth rate[10], real construction costs and the user cost of housing. However in Muellbauer and Murphy (2008) and Cameron et al. (2006) the vector of long-run drivers contains real disposable (non-property) income, the sum of mortgage rates and stamp duty rates, the national credit conditions index and a term which interacts the mortgage rate with the credit conditions index. The latter may be a means of capturing the impact of credit rationing that may be induced by macroprudential policies as well as providing a better understanding of the impact of financial instability on housing markets.

4.3 THEORETICAL BASIS FOR THE EXPLANATORY VARIABLES

Here we briefly outline the theoretical justification for the inclusion of the aforementioned variables in the long-run relationship. Those already aware of the underlying issues could move on to Section 4.4.

Population levels:

Population enters house price models via the housing demand equation where a rising number of households increases the price via excess demand (Meen, 2002; Poterba; 1984). In Cameron et al. (2006) population enters indirectly through the demographic effect in the dynamic equation. Specifically, the change in the proportion of 20-39 year olds in the working age population is expected to be

9 Both the population level and the real median income levels are included together because this also accounts for the size of the region (cross-section).

10 This acts as a proxy for the expected growth premium.

positively correlated with house prices: as this proportion increases, the demand from first time buyers will also increase and with the assumption that supply constraints owing to land use regulation restrict new builds, house prices rise[11].

Capozza et al. (2002), who include this variable, are motivated by the differences in serial correlation and mean reversion that manifest between house price series belonging to different regions (cross-sections). One explanation for such differences arises from buyers' inability to determine the "true" value of a property; products are extremely heterogeneous and so agents typically rely on the informational content of previous transactions in the market to impute their true price. However if transaction volumes are low or if they are spatially and temporally distant, the information embedded in these sales is weak and agents are unable to set their reservation price easily (Quan and Quigley, 1991). In such cases, house price deviations from their fundamental levels are likely to persist for longer (lower mean reversion and higher serial correlation).

Thus Capozza et al. (2002) focus on the informational costs of house purchases and argue that these costs fall on average as the volume of transactions increases. Hence their rationale for the inclusion of population levels: by proxying the number of transactions, the population level captures the demand for housing and correspondingly the informational costs of house purchases.

We note that the impact of population or the size of the young cohort will be dependent on the scope of credit rationing in the mortgage market. To the extent that first time buyers are rationed, this may limit the effect of this variable, at least in the short run. This comment also applies to a number of the other variables discussed below.

Real personal disposable income levels

The relevance of income to house prices is apparent in Poterba (1984) where a simple separation of US states is made on the basis of volatility in house prices (high versus low). The house price to annual per capita income ratios are then computed for both groups. This reveals the effect of income on house prices: the least volatile house price regions have very stable price to income ratios as compared against the volatile regions. In other words, per capita income is likely to explain a substantial amount of long-term house prices but is less involved in generating short-run deviations.

The intuition behind the role of income and house prices is straightforward: it is the income of a household that determines the affordability of a potential

11 This demographic justification is also used by authors relying on alternative estimators such as Tsatsaronis and Zhu (2004), who use a VAR approach on a 17 industrialised country panel, suggest a broader measure of demographic effects: relative size of younger to older generations. However this ratio is excluded from their final model on the basis that its time series dynamics are captured by other variables included in their parsimonious model.

house purchase. This income effect is formalised in Hott and Monnin (2008) who maximise a representative utility function subject to an income constraint both of which underpin the demand equation for housing. In conjunction with supply, the equilibrium (or fundamental house price) is then directly dependant on aggregate income. However, via this framework it is also possible to justify the use of per capita income as in the case of Case and Shiller (2003) or even real GDP as in the case of Collyns and Senhadji (2002) who argue that this captures aggregate income and population trends.

Miles and Pillonca (2008) examine house price behaviour in fourteen OECD economies over 10 years (1996-2006) and attempt to quantify the main drivers of house price changes. On average, approximately 45% of the change in house prices are due to increases in real GDP per capita[12] and for countries such as Ireland and Greece, the income contribution is as high as 108 and 81 percent respectively. The major stimulus from rising real incomes to property prices may also help explain the generation of house price bubbles if, for example, future expected income rises are capitalised early on into house prices.

Real construction costs

Real construction costs are important determinants of house prices in that they underpin the supply function and thus help determine the price elasticity of supply. This in turn is a major determinant of the long-run price level (OECD (2010)). However, as discussed below, there is disagreement on the extent to which housing construction responds to current house price. In addition, non-priced factors such as regulation may explain why house prices deviate in the short-run from their long-run fundamental levels.

Real construction costs contribute to the marginal cost of housing production alongside land costs and normal profits to the builder (OECD 2010). Poterba (1984) assumes the housing construction industry is perfectly competitive and supply responds to the real cost of housing. However, Poterba (ibid) notes, according to Muth (1960) and Foley and Sidrauski (1971), there are divergent views on the stability of supply elasticities: the former assumes that long-run supply is perfectly elastic with respect to price in which case, in the long-run, the only determinant of house prices is real construction costs; the existing level of housing stock does not influence price. However in the Foley and Sidrauski (1971) model, the trade-off between the production of houses and other goods is not constant and so if the availability of individual inputs (such as skilled labour or timber) is restricted, the opportunity cost of building new houses increases and therefore so does the price of new builds.

12 Excludes Italy which has an anomalously low income effect.

Muellbauer and Murphy (2008) also note the divergent views on house price supply responsiveness and in particular discuss arguments by Mayer and Somerville (2000) who believe that house builders do not respond to the current price level but to the appreciation rate. They draw their conclusion for two reasons, firstly, house prices are a composite of their marginal costs of inputs which are mostly reproducible (e.g. bricks and cement). In this case, in the long-run, the price of housing depends on these factors and not on demand (similar to the Muth (1960) argument presented above). Moreover, since land (which is a factor input) is not reproducible, land appreciation will constitute much of the capital gain on dwelling (alongside limited appreciation of other reproducible inputs) so that residential construction predominantly depends on the price acceleration of land. The second reason is empirical: in reality the time series of housing construction is stationary whereas house price levels are not. In this sense the authors argue that there can be no long-run cointegrating relationship whereby new housing construction is explained by existing house price levels.

4.4 THE USER COST OF HOUSING

This variable is fundamental to most house price models in the literature in that it reflects the cost of home ownership. Meen (2002) defines the user cost as being equivalent to the marginal rate of substitution between housing services and an alternative composite bundle of goods. In this sense it can also be interpreted as the downward sloping demand curve for housing (van den Noord, 2005). More generally the OECD (2005) defines user cost as the expected cost of owning a house.

Whatever the interpretation of user cost, it is important to highlight that it is not directly observed; consumers do not explicitly encounter this variable when making allocative decisions. Hence Capozza et al. (2002) note that the user cost is a derived variable although we point out that the actual derivation of the time series uses a set of determinants which varies in the literature due to data availability or motivation of study. However according to Poterba (1984, 1992), McCarthy and Peach (2004) and Himmelberg et al. (2005) there are seven factors that should be included: (i) mortgage rates (ii) depreciation (iii) maintenance and repairs (iv) property taxes (v) risk premia (vi) capital gains and (vii) tax deductibility (on mortgage interest where applicable). We briefly describe the rationale for the inclusion of each of these variables before presenting a selection of user cost equations from the literature (which do not always include all seven factors):

(i) Mortgage rates:

These are included in user costs because they represent the opportunity cost of funds for the buyer. This rationale also partly explains why some authors choose to use the yield on government securities instead of the mortgage rate: in theory the opportunity cost is the interest that could be earned on an alternative investment which could be equally proxied by government yields or mortgage rates provided the spread between them remains constant. In reality, factors such as credit market conditions are associated with changing spreads and so the distinction between mortgage rates and treasury yields may be important. For example, the OECD (2010) points out that increased competition amongst lenders and a change in their risk-assessment behaviour led to a recent decline in spreads in the OECD up to 2007. Moreover in some countries banks have actively cross-subsidised products in order to offer better mortgage rates.

Poterba (1984) notes that as the cost of home financing diverges from the cost of borrowing the opportunity cost of housing equity changes and the user cost equation should be adjusted to include the loan to value ratio. This is because the latter essentially captures the risk borne by the homebuyer who is paying for a property that should be priced according to fundamentals, including the borrowing rate, but paying for the finance at the mortgage rate. The higher the loan to value ratio, the greater the user cost. On the other hand, as pointed out above, limits in loan to value ratios may also impact on the overall cost of owning a house, at least in the short run.

Poterba (ibid) makes a distinction between short term and long-term mortgage rates. When long-term rates increase, the future expected user cost increases and although there is no impact on user costs today, there will be an impact on current house prices since buyers assimilate the signal of higher future borrowing costs and reduce demand thereby reducing house prices. Hence Poterba (ibid) suggests that studies such as Hendershott (1980) which use long-term mortgage rates may have incorrectly measured the user cost. Gallin (2006) who constructs a composite mortgage rate which consists of the 30 year fixed rate and the one year variable rate on 30 year loans, both weighted by the proportion lent out in each category, may mitigate the short-term versus long-term issue to an extent. There are of course important cross country differences in mortgage markets that mean that either long or short rates may predominate.

OECD (2010) also makes a distinction between real and nominal interest rate effects. Whilst most studies use the real interest rate burden, there is a nominal effect that they may be ignoring. This arises because changes to nominal rates affect the repayment profile for the borrower; for most mortgage contracts, a rise in the nominal mortgage rate will mean repayments become front loaded so that

so that debt servicing burdens are greater towards the start of the mortgage term. This means households are less able to borrow during the earlier years whereas if mortgage rates fall in nominal terms, households' budget constraints become more relaxed due to the ability to borrow and so demand for housing increases (Muellbauer and Murphy, 2008; Kearl, 1979). This may explain the divergences in the choice of mortgage rates in the literature: for example, Hendershott (1996) uses the T-Bill rate in real terms whereas Malpezzi (1999) uses the national mortgage rate in nominal terms. The short versus long rate distinction is also important when estimating house prices from the asset price perspective; this will be discussed later in the section on asset models of house prices.

Another important issue regarding interest rates is their role as a monetary instrument for the prevention of financial instability. Box 1 presents a selection of five user cost equations from the literature. In some cases the mortgage rate is used whilst in others the short term interest rate enters the user cost. From the financial stability perspective, monetary policymakers aiming to mitigate housing bubbles can effectively alter the short term rate with the view that this will be transmitted to mortgage rates and affect the user cost of housing accordingly.

However, as described above there will be a divergence in the estimated user costs based on short term rates versus mortgage rates if, for example, banks do not pass on base rate cuts to customers. In such cases the interest rate loses its potency and the user cost will not reflect the regulator's goal as has been observed recently where banks have not fully passed on interest rate cuts to customers. And where long rates determine the cost of mortgages, there is also the term structure relationship to bear in mind, whereby monetary policy changes may not affect the risk free long term rate if future short rate expectations are offsetting.

We noted above that the user cost is also related to the loan to value ratio. It can be argued that the LTV would be a better macroprudential instrument than the mortgage rate or short term rate because it would enable the specific manipulation of house prices without affecting the wider real economy unduly. During boom periods in property markets, regulators could dampen excess demand for housing by requiring mortgage lenders to impose lower loan to value ratios on marginal loans and conversely banks could respond to lower housing demand by raising the loan to value ratio.

(ii) Depreciation and (iii) maintenance and repairs:

OECD (2004) defines this as the recurrent costs associated with owning a home, arising from depreciation, maintenance and repairs. For their estimation on OECD data the authors assume a constant parameter value of 4%.

Although lack of data may necessitate the assumption of time invariant depreciation, Poterba's (1984) analysis shows this may be too much of a generalisation since apart from any other reason, depreciation costs should increase in line with population and real income per capita growth in order to ensure the ratio of housing stock to income remains is maintained across the economy.

(iii) Property related taxes

Van den Noord (2005) focuses on the Euro area to examine the impact of property tax regimes on the cyclical volatility of house prices, since different tax regimes across member states will lead to different house price dynamics. Tax breaks to promote home ownership such as relief on interest payments cause the long-run level of house prices to increase. However tax subsidies are also likely to generate higher house price volatility through indirect means by amplifying housing market shocks such as changes in income, demography and building regulations.

Since income tax acts as an automatic stabiliser, property tax regimes may counteract this stabilisation effect. Van den Noord (ibid) notes that different tax regimes in monetary union members could thus generate different degrees of house price volatility and may explain why different union members display different growth rates and inflation rates.

Poterba (1984) notes that an increase in inflation which generates rises in nominal interest rates will both increase homeowners' mortgage repayment burdens and nominal capital gains. However in real terms, the user cost of homeownership decreases due to tax regimes which allow mortgage interest payments to be tax exempt. Under such frameworks home owners enjoy capital gains fully but only repay a fraction of the higher mortgage repayments and thus gain overall. Such considerations underpin the inclusion of property related taxes in the user cost equation.

This section on taxes is relevant since it shows that monetary or macroprudential policies are not the only way to limit house price bubbles. On the other hand it can be argued that given the long term nature of house purchase decisions, an appropriate fiscal framework may be best set for the long term rather than varied frequently, The role of changing property taxes in the US Savings and Loans crisis and the Swedish banking crisis are relevant in this regard.

(iv) Expected house price appreciation

In theory the expected user cost for potential investors should be influenced by their views on expected house price appreciation which thus influences the demand for housing. The OECD (2010) discusses two reasons as to why anticipated price movements may influence prices today: (1) speculative pressures (2) affordability.

Speculative buyers aim to benefit from expected house price appreciation when expected risk adjusted returns on homeownership exceed returns on other assets. However, agents that are not motivated by investment returns will also increase their demand for housing if they believe that future house price appreciation could price them out of the owner occupier market.

In the UK at least, affordability considerations are substantial for prospective buyers. The BSA (2007) which examined respondents' reasons for house purchases found that 28% of existing first time buyers and 68% of consumers considering purchasing first time viewed being priced out of the market as the main consequence of expected house price appreciation.

On the other hand, Miles and Pillonca (2008) are amongst those who suggest that house price expectations are backward looking; investors use the historic long-term house price growth rate alongside recent movements in house prices to form their expectations of future price movements. According to Shiller (2007) such psychological factors explain why fundamentals such as rents or construction costs alone are unable to explain house price movements. In reality, housing markets are not efficient; prices show momentum between successive periods as a manifestation of a behavioural feedback mechanism where repeated price appreciation serves to reinforce investors' beliefs that such trends will continue into the future.

Empirically, this momentum, which is likely to generate higher serial correlation and slow mean reversion, is modelled by Capozza et al (2002). They cite Case and Shiller (1988, 1989) and Shiller (1990) who suggest serial correlation in house prices arises from backward looking expectations.

Case and Shiller (1988) surveyed buyers in a control market and a "boom" market and found that boom market buyers believed expected house price appreciation would be higher than in the control market where prices had not risen by much in the past. Accordingly, behavioural reasons may explain why serial correlation is stronger in buoyant markets than in situations where the housing market is exposed to lower income growth.

Capozza et al. (ibid) accommodate such effects by augmenting the long-run relationship with dynamic serial correlation and mean reversion terms which are allowed to vary spatially and temporally. This allows differences in behavioural responses to house prices across regions and through the economic cycle to be captured. The mean reversion term accounts for the impact of psychological factors on the long-run price level.

Whether anticipated house price movements are modelled explicitly or as part of the user cost equation, most investigators rely on survey data for house price expectations or proxy this with the current inflation rate. Although the latter approach is common, Capozza et al. (ibid) note that it does not accommodate

regional variation in expected house price appreciation which would impact on user costs accordingly.

The role of serial correlation in house price movements and underlying expectational shifts helps to explain why housing booms are hard to stop once underway. The UK experience of raising interest rates in the late 1980s is relevant in this regard. It is only when a major shock to confidence occurs that the bubble ceases to exist, and at that point a major collapse is likely, threatening financial stability. The underlying lesson may be that monetary or macroprudential polices are best deployed early on in the housing cycle, before there are entrenched speculative elements. Later on such policies risk to be ineffective, although arguably an effective LTV policy may be more effective than interest rates in this regard.

(v) Risk premium

Although Poterba (1984) does not incorporate investors' risk preferences in the derivation of user cost, he does recognise that a complete model of asset market equilibrium would include the impact of risk tolerance on investors' demand for housing as an asset.

In Hott and Monin (2008) investors' risk premia are assumed to be constant and are thus combined with maintenance costs and property taxes as an aggregated user cost input. However Sinai and Souleles (2005) suggest that risk premia can vary and can take both positive and negative values. Risk arises from the decision to own and occupy versus the renting of housing services; whereas capital gains or losses arising from ownership only materialise at the point of sale, changes in rental charges can occur in each period. The differential in risk declines as the time horizon of agents is extended so that if occupation of a given property occurs for long enough the risk premium can become negative.

Having discussed the components of user cost and their theoretical underpinnings, in the box below we present a selection of user cost equations in the literature which vary according to the motivation of the study.

We next turn to describing some short run specifications in brief. These recognise that house prices deviate from their long-run fundamental values and attempt to specify an empirical relationship to track these short-term dynamics.

Box 1. User cost (UC) equations in the literature

Poterba (1984):

UC = [after tax depreciation + maintenance + (1 – property tax rate)(mortgage rate + opportunity cost of housing equity) – inflation rate]

Capozza et al. (2002):

UC = (mortgage rate + property tax rate)(1 – income tax rate) – inflation rate

Gallin (2006):

UC = price[(mortgage rate + property tax rate)(1 – income tax) + maintenance and depreciation – expected capital gains]

Meen (2002):

UC = price[(market interest rate + depreciation rate – inflation rate – expected house price appreciation)(1 – income tax rate)]

OECD (2005):

UC = (mortgage rate adjusted for tax relief + property tax rate + maintenance and depreciation and risk premium – expected capital gains)

4.5 SHORT-RUN DYNAMICS:

Cutler et al. (1991) provide a rationale for the inclusion of dynamic terms in house price models. They examine a host of asset types, including real estate, and find that asset price behaviour typically displays 3 characteristics:

1. positive serial correlation in the short-term
2. negative serial correlation in the long-term
3. the deviations of asset prices from their long-run fundamental values contain predictive information

They suggest these characteristics arise due to speculative motives of market participants and in combination they justify the inclusion of dynamic terms alongside fundamental house price determinants; the informational content of such dynamic terms will have predictive value. Cecchetti et al (2002) specifically delve into the properties of serial correlation and mean reversion terms of house prices. Whilst Cutler et al. (ibid) generalised the dynamic terms into descriptors of asset prices in general, Cecchetti et al. (ibid) put forward specific theoretical reasons as to why these terms should manifest in house price series. Informational reasons, transaction costs and supply side factors can all be used to explain serial correlation and mean reversion and since these factors are likely to differ across regions and time, it is also likely that the serial correlation and mean reversion terms will differ across cross sections.

To test the above proposition, Cecchetti et al. (ibid) augment the long-run relationship (equation 10) with dynamic terms according to:

$$P_t = \alpha \quad P_{t-1} + \beta (P_t^* - P_{t-1}) + \gamma \quad P_t^* \qquad (11)$$

where

α is the serial correlation coefficient

β is the mean reversion coefficient and $0 < \beta < 1$

γ is the immediate partial adjustment to the fundamental value

In general as α increases, the amplitude and persistence of the cycle will increase whilst as β increases the frequency and the amplitude of the cycle will increase.

The estimators in the literature do not always take the exact specification highlighted above. For example, Terrones and Otrok (2004) take a dynamic panel approach based on the GMM estimator which also contains the lagged dependant variable. Like Cecchetti et al. (ibid) they point out that if the autocorrelation coefficient (α) exceeds a value of one, house price growth will be explosive.

While authors such as Gallin (2006) focus on the long-run behaviour of house prices, others specify dynamics by using autoregressive distributed lag models in error correction form (Meen, 2002). Several non-structural specifications have also been used in the literature such as the VAR (Hott and Monin, 2008; Sutton, 2002) and the SVAR (Tsatsaronis and Zhu, 2004) since such studies focus on the interdependencies of house prices and their determinants such as term spreads, house price inflation, GDP growth and the growth rate of private sector credit.

4.6 THE ASSET PRICING APPROACH: NO ARBITRAGE EQUILIBRIUM

In this section we briefly outline an alternative house price modelling approach which has been used in the literature. Poterba (1984) proposed the no arbitrage approach to house price valuation which requires that the one period return from owning a house must equate to the return that could be obtained by holding an alternative asset[13].

In an extension to this approach housing service users can be thought of as investors who face a choice between renting and owning a property. In this case they will equate the marginal value of renting a house to the cost of owning a house which is the user cost of housing. Van den Noord (2005) represents this equilibrium as:

$$R(H) = UC \bullet P_H \qquad (12)$$

where $R(H)$ is the marginal value of rental services per period on an owned and occupied property, UC is the user cost of housing[14] and P_H is the price of owner occupied housing.

A similar approach has been used by OECD (2005) where equation 12 is re-expressed in terms of the price to rent ratio in order to determine the degree of overvaluation of OECD house prices:

$$\frac{P_H}{R(H)} = \frac{1}{UC} \qquad (13)$$

Equation 13 translates house price valuation to asset market models where $\frac{P_H}{R(H)}$ is analogous to the price-to-dividend ratio. If the price to rent ratio is high, investors will gain by renting housing services and the subsequent drop in demand for owner occupancy will restore the equilibrium relationship.

However there are problems associated with this interpretation of equation 13. Firstly the OECD (ibid) results suggest the price to rent ratio is non-stationary.

13 Poterba (1984) interprets this as the short-term interest rate. He also assumes risk does not feature in the investor's decision.

14 Van den Noord (2005) defines this explicitly.

Secondly, the user cost of housing is itself not static and may be subject to shifts in institutional factors such as mortgage market innovations which alter the cost of mortgage finance. Moreover, expectations of future house price appreciation are driven to an extent by behavioural factors and thus extremely hard to model (Miles and Pillonca, 2010). As discussed in the sections above, backward looking expectations which give rise to serial correlation in house prices will impact on the user cost accordingly.

Despite the caveats mentioned above, the asset model approach can be used to indicate general under or overvaluation of house prices. In theory, it can also be used to assess housing market efficiency (Meen, 2002) since the no arbitrage condition should ensure that equation 13 holds. However the existence of serial correlation in house prices suggests the market is inefficient since persistent excess returns become possible. One potential explanation for the inefficiency may be the presence of search and transaction costs which restrict buyers to specific geographical regions. This in turn means transaction volumes are lower than they would be in a more efficient market and so buyers have restricted access to information that could be used to compute fair house price valuations (Capozza et al., 2002). Another problem may be the planning regulations which restrict housing supply. Consequently, buyers have limited scope to exploit arbitrage opportunities and in this sense the asset pricing approach may be flawed.

4.7 KEY FACTORS OMITTED FROM MOST EXTANT STUDIES

Institutional factors relating to mortgage markets are typically not taken into account in house price estimates. In fact, many mortgage market innovations that have altered the terms and availability of credit have emerged in OECD financial markets over the past 30 years (OECD, 2005). This financial deregulation has not only increased competition, it has also led to the creation of new products such as buy-to-let mortgages, interest only loans and offset mortgages which allow borrowers to offset their savings against the mortgage balance.

As a result of such innovations, the availability of mortgage credit has risen dramatically in Europe and the US. Miles and Pillonca (2008) note that although the mortgage debt to GDP ratio varies across Europe (exceeding 70% in countries like the UK and Denmark), the stock of mortgage debt has risen in all cases. Consequently house buyers have seen a relaxation in their borrowing constraints and this has fed back positively to house prices.

Nevertheless, as this section has shown, few house price models have taken these fundamental changes into account. One possible way of doing so are to restrict the sample so that it only contains post liberalisation observations. However, this has the problem that there is likely to be a long period of adjustment of balance sheets to liberalisation that may well distort estimates. Furthermore, the period may

be too short to adequately capture long run relationships in the housing market. An alternative is to include a pre liberalisation period in the sample and allow coefficients to vary by use of leveraged dummies. We employ both approaches in our estimation below.

Mortgage spreads (loan less deposit rates) are also typically not included in house price equations, whereas these could be relevant to the impact of capital requirements on interest rates, as in Barrell et al (2009) and have important consequences for household incomes as well as for house price dynamics. We include such a term in our quarterly equation for Sweden below. Equally, despite recognition that housing is part of the asset portfolio of the household sector, most studies do not take the logical step of including household gross financial wealth, as a substitute asset, a rise in whose value would lead naturally to rising demand for housing for portfolio balance reasons.

An additional question raised by financial liberalisation is whether the stock of mortgages is appropriately included in house price equations. This was traditionally the case in pre liberalisation estimates in countries such as the UK (e.g. Hendry 1984) but was judged by authors such as Muellbauer and Murphy (1997) to be inappropriate in a post liberalisation sample, since the stock of lending is endogenous to the determination of house prices (this is consistent with the Granger causality results from Barrell et al (2011) cited above). On the other hand, if there remains a degree of rationing for some participants in the housing market, then the mortgage stock could have a role to play, and all the more if macroprudential policies have an effect of reintroducing forms of credit rationing. And indeed along these lines Miles and Pillonca (2008) do argue that the existing mortgage stock should also be included. We test this also in our work below.

Muellbauer and Murphy (2008) note that deregulation of mortgage markets has implications for monetary policy transmission and business cycles and that these changes are exerted via the interaction of house prices, housing finance and the real economy. Mortgage credit availability drives house prices and thus influences consumption and the supply of new housing stock. Moreover, if the housing wealth effect is negligible then the credit channel becomes crucial for explaining why consumption rises in response to house price appreciation: deregulation of mortgage markets means more homeowners can withdraw equity against a rise in their property values.

In recognition of the above, Muellbauer and Murphy (ibid) include a credit conditions index which they introduce both alone and as an interaction term with the mortgage rate. The credit conditions index is constructed using 10 consumer credit and mortgage market indicators as described in Fernandez-Corugedo and Muellbauer (2006). It is included so as to capture shifts in the credit supply function faced by households in the post-1980s era. The authors note that by omitting this

variable, previous house price models in the literature (which typically utilise pre-1980s data) suffer from omitted variable bias.

Unemployment may impact on house prices via demand and also if it entails widespread defaults and consequent "fire sales" but is typically not included in house price equations. Similar comments apply to banking crises per se, which give rise to uncertainty and credit rationing that other variables may not adequately capture. Certain supply aspects of housing are also typically omitted. Many studies do not even include housing investment or the value of the housing stock as an influence on house prices. But beyond this there is the influence of planning regulations in restricting supply, nationally and/or in local areas subject to high demand. And there is the potential influence of a regulated rental market for housing.

5 Estimation of house price equations for an OECD panel and for Sweden

5.1 SPECIFICATION AND DATA

In the light of the above literature survey and limited experience of macroprudential tool as applied to housing markets, we sought first to estimate panel equations for house prices in OECD countries, with a view to assessing how macroprudential tools could usefully operate, as well as whether suitable international rules could be devised. Given the extensive availability of cross-country data from the NiGEM database,[15] we have scope to investigate the common patterns of property price movements, while at the same time controlling for heterogeneity across countries or at different stages of real estate cycles. This in turn casts light on the relevance of earlier work cited in Section 4. The panel specifications (with details below) are the appropriate tool for this purpose. Moreover, from an econometric perspective, a panel approach gives more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency (Baltagi, 2005, p. 5).

A first table shows the data sample we are able to use, which for most countries is back to the 1970s. We hence include periods when there has been liberalisation as well as structural regulation in the housing market. This can be justified by the need for cointegration equations to have as long a data period as possible. But it will also be of interest if we can capture the differences in behaviour between liberalised and non-liberalised periods, since the introduction of macroprudential instruments will lead to a reintroduction of some form of credit rationing as was typical of the pre-liberalisation period. Note that we use annual data for the cross country panel

15 Note that the population data in NiGEM are interpolated annual data from the UN Demographic database (in our case we use the original annual data).

work, We contend that annual data ensures that dynamics can be simple and comparable, while it facilitates a focus on the long-run properties of the data.

Table 2 shows the standard panel unit root tests for the main variables. They use the Im-Pesaran-Shin approach to calculation. It can be seen that the bulk of the variables, being trended, are I(1), at least at the 1% level thus justifying an error correction model based approach to estimation. The dependent variable hence must be changes in real residential property prices. Accordingly, changes in real house prices were regressed on contemporaneous changes in explanatory variables, and lagged dependent and explanatory variables (both in levels) as well. This error-correction specification is able to deal with non-stationarity in the data (as mentioned above), and at the same time offers further tests of the theory by distinguishing short- and long-run influences on residential property prices. The significance of the coefficients for lagged non-stationary variables (in levels) and their magnitude reveal the long-term relationship among those variables.

Our modelling started from the work cited above with a basic equation where we include real house prices, real personal disposable income and the long term real interest rate (proxying the user cost). We use this as a foundation for applying further tests of extra variables that could be added.

As a first step, we start with the pooled regression that treats all countries as equally important, while the country fixed effects take account of heterogeneity. This regression is able to give us a preliminary view of whether the theoretical hypotheses set out above are validated by the data. Meantime, the result also serves as a benchmark for the follow-up discussion on distincative characteristics of real estate cycles for different markets of interest. We then proceed with a number of sub-sample panel regressions, in which each panel only consists of a particular group of countries (with similar market arrangements).

Hence, we first estimate for all 18 OECD countries but also for two divisions of that group. The first is between the large and small countries, with the large countries being the G-7 and the small countries the remainder. Then we have the division between the Anglo Saxon and bank-dominated countries, where the former are the UK, US, Ireland, Australia and Canada and the latter are the remainder. These breakdown analyses offer deeper insights by allowing for richer heterogeneity, e.g. distinctive economic determinants in each sub-sample (compared to the pooled regression). The combination of the pooled regression and the sub-sample panel regressions reveal elements of both commonality and uniqueness in residential property cycles in those 17 countries.

To confirm the existence of the long-term relationship, we also implement the panel cointegration test proposed by Kao (1999) among those variables with significant lagged level terms in a simple levels equation (i.e. the first step of an Engle and Granger (1987) two-step estimation).

5.2 RESULTS FOR THE FULL PANEL SAMPLE

Table 3 shows the basic results for the full sample from 1970-2009, with real long rates and real personal disposable income entering the equation. It can be seen from the Kao tests that the long run of all the equations cointegrate except for the G-7. This may link to the group being relatively small and non-homogeneous given the inclusion of both bank and market dominated countries. As regards the results, in the short run we find a strong income effect with an elasticity of 0.8 for all countries, larger in the G-7 and Anglo Saxon countries and lower in the small and bank dominated ones. The short run real rate effect is negative as expected, and significant for all countries, small countries and the Anglo Saxon ones, with a similar coefficient magnitude. A 1 percentage point rise in long real rates leads to a 0.5% fall in house prices in the short run.

A very consistent effect is the short run serial correlation term, which is highly significant, and around 0.5 in each case. In other words, a rise of 10% in house prices one year gives rise to a 5% rise next year independent of the other coefficients in the equation.

Turning to the long run results, we have a highly significant error correction term in each case of around 0.08, which means a slow adjustment to the long run fundamentals, around 12 years in fact. Their significance is supportive of cointegration (see Pesaran and Shin, 1995) as is confirmed by the Kao tests for most of the equations. Then the long run income elasticity is somewhat below the theoretical level of one, around 0.7-0.8 in most cases. The long run interest rate effect is significant except for the G-7, with a long run elasticity of around 4, i.e. the long run impact of a one percentage point rise in long real rates is to reduce the level of real house prices by 4%. These contrast to some degree with the results of Terrones and Otrok (2004) with a similar panel, who found an income elasticity of 1.1 and an interest rate elasticity of –1.0. Country studies cited in OECD (2005) are much closer to ours, however.

We undertook F-tests on the pooling assumptions in the groupings and found that for both categories, the divisions were preferred to the "all" sample. This was more the case for the G7/small breakdown than for the Anglo-Saxon/banking split. (In the former pooling was rejected at 99% whereas for the latter it was only rejected at 95%). Accordingly, we consider closely the G7 and small country results, with particular focus on the latter as being relevant for Sweden.

Table 4 shows the variants on these basic results, which we consider highly satisfactory in general terms. We first sought to include a cubes lag in house price growth. This was suggested originally by Hendry (1984) as a proxy for "frenzy" when a large rise in house prices gives rise to a further boost, suggestive of bubble formation. The expected coefficient is positive. In fact we find only a significant negative coefficient for all countries, the G7 and for the bank dominated ones. This

implies rather a form of mean reversion in growth. It may be that using annual data gives rise to periods too long for "frenzies" to be detectable, whereas a shorter quarterly frequency might have captured it.

The second variant has the log stock of real mortgage debt included. We note in this context that there is a theoretical argument, which has been borne out by much empirical work, that mortgage debt should not be causal for house prices in a liberalised financial system. This is because it accommodates to house prices, when it is freely available. Such a surmise was partly confirmed, for example, by Granger causality tests in Barrell et al (2010b) between personal debt and house prices, which showed causality from credit to property prices only in Belgium, Canada and Finland from a group of 14 OECD countries, although some causality was also found for Sweden in the pre-1995 period. At least, we considered it essential to instrument the difference of credit, so that results were not affected by simultaneity with house prices. The instruments were the lagged difference of house prices, income and interest rates.

The results were that there was indeed a significant impact of credit on house prices in a number of subgroups, albeit generally only in the short term, with a quite consistent elasticity of around 0.15. Comparison with Davis and Zhu (2010)'s estimates for commercial property prices with similar panels showed a much higher coefficient of around 0.8. In commercial property the incidence of rationing is likely to be much greater. There is only a long run effect in the small countries, with a long run elasticity of around 0.4.

An objection to such results is that the sample, typically from 1970-2009, includes periods of both financial repression and financial liberalisation. We used dates from OECD (2000) to fix the time of financial liberalisation, As in Barrell and Davis (2007), we then defined dummies distributed from 1.0 prior to liberalisation to 0.0 five years after, with the transition being in the form of an ogive imposed to conserve degrees of freedom. The coefficients on the differences in debt and lagged debt were then leveraged by these dummies to give scope for the parameter to change gradually with liberalisation. Our result for the G7 we consider unsatisfactory due to outliers and should be disregarded. However, the result for the small countries is of interest, suggesting as it does that the short run elasticity for debt changed from 0.44 before liberalisation to 0.09 thereafter. This is in line with the hypothesis of a fall in the impact of mortgage lending with liberalisation, while leaving an ongoing small positive effect. The small countries of course include Sweden. The results for all countries, the Anglo Saxon and bank dominated are unchanged by the dummy, however.

The implication of this result for the mortgage stock is that a macroprudential policy that affects the mortgage stock will have an additional effect on house prices over and above the interest rate/user cost change that may underlie it. Hence the

effect of macroprudential policy will be greater than if the mortgage stock variable had been absent.

The third variant was using a demographic variable, namely the proportion of 20-39s in the population. In Cameron et al (2004), as cited on Section 4, this is considered to be the prime age group for property purchase. However, it is acknowledged that this may not hold in countries such as Germany where renting is more common at this age, and house purchase may be delayed till later in the life cycle. Possibly consistent with this, we only obtain a significant result for the "Anglo Saxon" countries where owner occupation is high and also mortgages are freely available for most of the sample. There is a short run elasticity of 1 between the size of this age group and the house price, and in the long run the effect is around 1 also.

We then sought in two ways to allow for supply in the equation, firstly by including a flow variable which is the ratio of housing investment to GDP, then by adding a stock variable, the ratio of the estimated housing stock to GDP. The latter is estimated on the basis of a perpetual inventory model with a deprecation rate based on a life of 75 years, and the initial year's investment/GDP ratio. Hence it may well be inaccurate. That said, there is evidence of supply effects for the small countries, and to some extent in the Anglo Saxon ones, but not elsewhere. The effect in the small countries is as would be expected, with a rise in the supply leading to lower house prices. On the other hand, the Anglo Saxon result is a positive one, suggesting that housing investment tends to accompany booms in house prices.

We tried two dummy variables directly in the equations. First we assessed whether financial liberalisation has had a direct effect on house price growth, with systematically lower growth before liberalisation. Then, we tested whether banking crises had a marked effect, over and above any effect from the changes in income and interest rates. As can be seen in Table 4, the liberalisation dummy (as defined above) had no significant impact, while banking crises (with periods defined as in Caprio and Klingebiel (2003)) were highly significant and negative in all cases. We can hypothesise that crises impact via uncertainty and credit rationing effects that the existing variables are unable to capture. For the most part, the crisis variable complements but does not supersede the other variables in the equation. Crisis impacts are worse in small countries than the G-7, and in bank dominated countries than in market based. In the latter, there are in most cases alternative sources of finance to banks (e.g. securitisation – except in the latest episode) which may mitigate the impact of bank failures on the housing market. There have tended to be a greater proportion of systemic crises in the smaller than the larger countries also.

Does unemployment impact on house prices, via greater uncertainty and incidence of default? Table 4 shows that this is the case in most of the country groups for the difference of unemployment, but not the levels. A 1% rise in the rate

of unemployment reduces house prices by around 1% in the first year. It is notable that the largest effect is in the Anglo Saxon countries where unemployment is typically more volatile and protections against default less.

Finally in this section we tested for an effect of gross financial wealth on house prices. The idea is a portfolio balance one, whereby high financial wealth might lead to shifts in allocation to real assets, thus boosting house prices. The empirical results suggest that this is an effect worth considering, with significant results for the difference in all countries, the small and bank dominated ones. A 1% rise in real financial wealth boosts house prices by around 0.1-0.15%. There is also a significant long run effect in the G7 countries only, where the elasticity is around 0.7. A counter argument to including wealth is that the relevant information should be captured by income and interest rates.

5.3 RESULTS FOR THE POST LIBERALISATION PERIOD

A feature of the above results is that we have included both periods of financial liberalisation as well as non liberalisation. Accordingly, we may be vulnerable to shifts in coefficients within the sample. On the other hand, we do benefit from a long data period which includes several cycles and hence should well capture the long run properties of the data. Accordingly, we retain the above as our main set of results, but test in two ways for possible biases. First, we shortened the sample for each country to begin with financial liberalisation. Second, we sought in the manner of Barrell and Davis (2007) to do generalised leveraging of coefficients, to see whether the partial results for debt cited above generalise to some of the other terms. We comment on these results relatively briefly, to mainly highlight contrasts with the main results in Tables 3 and 4.

For the liberalisation period, the methodology was to multiply the dependent variable by a dummy which is 1 for all periods after liberalisation. This reduces the sample from 618 to 413 in the all countries case, for example. The most noteworthy feature is that we "lose" the long run income effect in this shorter period, and it becomes insignificant. This may be due to the protracted adjustment period after financial liberalisation, although a further experiment with an even shorter period 5 years after liberalisation also produces counter intuitive results (a negative income effect for "all countries" for example). We consider this result to mean this is an unsatisfactory result overall. Nevertheless, some differences with the full panel remain noteworthy. As shown in Table 5, the short run income effect is lower and the interest rate effect is consistently higher. There is more serial correlation in house prices when the later period is considered alone. And the adjustment to the long run equilibrium is generally slower. This suggests a more volatile period when house prices can deviate further from equilibrium and fundamentals, albeit strongly driven by real long term interest rates.

As regards the variants (Table 6), we do not find a significant cubic term in the later period. On the other hand, the debt effect remains in the short run in all cases, with a comparable coefficient to the full period, and a negative long run effect in the Anglo Saxon countries, perhaps caused by the recent falls in prices in 2007-2009. Demography continues to be significant for the Anglo Saxon countries too. We find long run effects for the housing stock in the G7 and Anglo Saxon countries which are negative in line with theory, but no investment effects. Crises remain powerful determinants of house prices. Most of these of course occurred after liberalisation in any case. We now find a long run as well as a short run effect of unemployment in all countries and the bank dominated ones. And wealth is a consistent determinant of house prices in the short run across the country groups.

5.4 APPLYING LEVERAGED COEFFICIENTS FOR THE PRE LIBERALISATION PERIOD

Although the above-cited results from Tables 5 and 6 add to knowledge, they remain unsatisfactory due to the long run income effect being zero. We accordingly go on to comment on the full sample regressions with the pre-liberalisation dummies (i.e. set at unity for unliberalised phasing to zero five years after liberalisation). So for example in Table 7, the variables labelled X*Lib show the absolute difference in the coefficient before liberalisation compared with after it. If all of these coefficients are insignificant, the equation is stable between the two regimes. If on the other hand there are some significant coefficients, it is indicative of structural change.

A first point to note from Table 7 is that the unleveraged coefficients are comparable to the basic estimates in Table 3 over the same time period, which is a favourable sign. As in Table 3, all of the coefficients are significant except for the long run effect of the long rate for the G7. As regards the leveraged coefficients, we can see that the short run is much more affected than the long run. We have evidence of a much lesser response to income growth since liberalisation for example (positive leveraged dummies are significant for all groups except the small and bank dominated). The short run interest rate effect was absent before liberalisation for the Anglo Saxon and G7 groups. And the serial correlation "bubble building" effect is much greater in the G7, Anglo Saxon and All countries groups since liberalisation (and also at 90% for the bank dominated countries). Equally, the adjustment coefficient suggests that there was slower adjustment to the long run before liberalisation, apparently in contrast to the differences between Tables 3 and 5. There are in contrast no significant coefficients for the long run, except that prior to liberalisation the small countries have a smaller long run interest rate coefficient. The income term is totally unchanged.

Looking at Table 8 where we leverage the variants, there are no significant effects or differences for the cube term. Results for debt are comparable to those

in Table 4, except that of course we are also permitting other terms to vary as well. The key result is again that for the small countries, where the debt effect in the short run was much greater before than after liberalisation. There is some evidence for a demographic effect in the G7 as well as the Anglo Saxon countries in the post liberalisation period, while supply effects only appear now in the G7. There is a positive crisis effect in the Anglo Saxon countries, which we attribute to a single observation – virtually all OECD crises were after liberalisation. As regards unemployment, it appears to have impacted on house prices mainly before liberalisation in the G7 and Anglo Saxon countries, whereas for the smaller countries (and all countries) it is consistent across the sample. Finally, the financial wealth effect is apparent across the whole sample in first difference form only. Noteworthy patterns from Table 8 are again that there are virtually no changes to the long run specifications, only some amendments to the short run results.

Reflecting on the impact of macroprudential instruments, it seems likely that LTV limits could be incorporated as feeding through the discount factor, as they require further saving to take on the mortgage (the interest rate term) also affecting the volume of credit (the stock of mortgages would decelerate). Capital ratio increases could similarly be an interest rate effect although perhaps a better index would be the spread between deposit and loan rates – a form of risk premium.

5.5 QUARTERLY ESTIMATES FOR SWEDEN

Against the background of the panel estimation, we estimated an equation for Sweden using quarterly data from 1970-2009 as a basis for the model simulations.[16] We include the key variables which are significant in the small countries panel, but also can include the spread between the deposit and lending rate, unlike in the cross country panel data where this variable is not available for most countries over a sufficiently long sample period. As noted, this variable can capture the impact of higher capital requirements for mortgage lending, affecting as it does the deposit rate and also the lending rate.

Four versions are shown in Table 9. The first has long run income homogeneity not imposed, the second has that restriction and the third includes estimates for the additional variable bank spreads between household loan and household deposit rates. The fourth imposes the same coefficient on spreads and long rates, as is required in the NiGEM model as discussed below.

As can be seen in Table 9, the equations are all well behaved statistically, with no autocorrelation or non-normality despite the differing regimes during estimation. There is however some evidence of heteroskedasticity, which may relate to the greater volatility of house prices in the more recent period. The only

16 Source: BIS; quarterly data before 1986 were annual data interpolated.

difference between pre and post liberalisation coefficients that was significant was the difference of income term, which is much larger prior to liberalisation. Other significant short run terms are on wealth and liabilities, there is also a large serial correlation term (lagged difference of house prices) of around 0.5. There is no short run interest rate effect. The freely estimated long run income elasticity is around 1.6, while there is also a significant long run interest rate and spread effect. The freely estimated spread effect is larger than the interest rate effect.

It is the final column equation that is incorporated in our NiGEM simulations. It allows macroprudential policy to operate in three ways, via the long term real interest rate, via the spread (which affects household incomes as well as the cost of credit) and via the mortgage stock. On the other hand we note that this specification is not very "dynamic" in the sense that although there is a major serial correlation coefficient, the shocks feed through slowly given the low income-difference term as well as the slow adjustment to the long run.

6 Interactions of macroprudential policies with monetary policy, and simulations with the NiGEM model

In a final section of our work, we first review overall comments and the limited amount of technical work on macroprudential and monetary policies. We then go on to carry out simulations on the Swedish component of the NiGEM model using the final equation in Table 9, comparing the effect of housing market related macroprudential policy with that of monetary policy and more general macroprudential instruments. We consider the impacts on house prices, real activity and also credit formation of the various shocks that can be imposed.

6.1 OVERALL COMMENTS

Looking first at the interaction of macroprudential with monetary policy, Barrell et al (2010a and b) cited above have shown that the overall country adjustment in prudential policy to reduce crisis probabilities depends partly on macroeconomic volatility. So one argument one can make is that if monetary policy can reduce house price bubbles and imbalances in the current account, it impacts on macroprudential adjustment.

On the other hand, extant comments suggest it is more doubtful that macroprudential regulation will significantly affect the macro economy and hence the demands on monetary policy. This is based not only on NIESR calculations but also the Basel calculations that were made in FSB (2010). According to simulations with macroeconomic models in various countries, 1% more capital and liquidity seems to take around 0.1% off GDP which is not huge and only 0.03% if all countries moved together. So in other words, the effect of regulatory tightening on

the macro economy are small so long as the tightening is gradual, which is a point relevant to monetary policy.

As the BIS point out in their recent Annual Report (2010), there are some benefits to monetary policy of a more active macroprudential policy. Less financial crises imply less economic fluctuation. If crisis risk can be reduced, interest rates are less likely to become ineffective due to financial distress, and also there will be less need to cut interest rates for financial stability in the downturn with possible inflation risks. Conflict between monetary and macroprudential policy is possible mainly well in advance of a crisis, since inflation may be subdued but there may be pressures on asset markets. Then one might wish to pursue a tight macroprudential policy and an easy monetary policy. Once inflationary pressures also emerge both macroprudential and monetary policies should be tightened, but this may be too late to prevent a crisis. After a crisis, both policies should be loosened, although as noted there may be inflation risk from holding monetary policy too loose for too long.

6.2 EXTANT TECHNICAL WORK

We note there are rather few papers that have sought to look at monetary and macroprudential policy together. These are typically in stylised calibrated models rather than estimated ones. And a comment from one such paper is relevant "within a standard macroeconomic framework, it is very difficult to derive a satisfactory way of modelling macroprudential objectives" (Angelini et al 2010).

For example in Kannan et al (2009) they use the standard New Keynesian model as for example in Gali (2009) and add, first, a choice on the part of households how much to invest in housing as well as how much to consume, second, a distinction between borrowers and lenders, and third, the lending rate is modelled as a mark-up over the policy rate dependent on LTV ratios, the mark-up over funding rates, and in some simulations a macroprudential instrument. So for example a rise in house prices leads to a fall in LTVs and hence in mortgage rates even if the policy rate does not change. Market competition can also affect the mark-up. Hence, there can be endogenous house price and investment booms.

The general results are that strong monetary reactions to such financial accelerator effects that drive credit and asset price growth can improve macro-economic stability compared with a simple Taylor rule, while a macroprudential tool against credit cycles, applied in a discretionary manner, could also stabilise the economy. Such rules would entail additional capital or provisioning when credit grows in excess of a certain rate. They note however that because it is not always straightforward to identify the cause of house price movements, a rigid rule could increase macroeconomic instability. In particular, whereas a relaxation in lending standards (financial shock) can be well catered for by rules, this is not the case for

an increase in productivity (real shock). In the latter case resisting rises in credit would be inappropriate and cause undershooting of inflation targets.

Angelini et al (2010), use a similar dynamic general equilibrium model of the Euro Area to address the issue of appropriate macroprudential tools and rules and their interaction with monetary policy. Their extensions of the DSGE model are for a banking sector with capital, loans to households and firms and deposits from households. Interest rates are sticky owing to banks' market power. There are risk sensitive capital requirements generating procyclicality and heterogeneous creditworthiness of agents. The macroprudential policies are capital requirements and loan to value ratios, where the latter gives rise to credit rationing for households given the value of the housing stock. The former affects both firms and households, by contrast.

They find that macroeconomic volatility can be reduced by active management of macroprudential instruments in cooperation with monetary policy but the benefits are not large. When there is a technology shock, macroprudential policy should focus on output and not loans or equity prices, for the capital based rule, but loans is preferred in the case of the LTV. When there is a credit crunch shock, that destroys bank capital, both policies should focus on loan growth. Overall, the capital policy is more effective at reducing volatility of output growth, and LTV at reducing variance of the loan/GDP ratio, suggesting there is in their model a trade-off of stabilising economic activity and financial stability.

As regards the coordination issue, both policies operate partly by affecting the interest rate on loans. In a cooperative game between policymakers output variability is reduced. But if there is a non-cooperative Nash equilibrium, then substantial coordination problems emerge. In other words, there is a risk of coordination failure if suitable coordinating mechanisms are not devised.

Finally Angeloni and Faia (2009), give a DSGE model with a competitive banking sector and the possibility of bank runs, where the monetary policy is allowed to react to asset prices and leverage as well as inflation and output, and capital requirements can be pro or anti cyclical. There is a need for mildly counter cyclical capital requirements and a monetary policy that reacts to asset prices or leverage as well as inflation.

As noted by Angelini et al (2010) a difficulty of all these is that systemic risk cannot readily be modelled, although stabilising the loans/GDP ratio and GDP growth around their steady state values could be justified by definitions of macroprudential aims such as those of the Bank of England "the stable provision of financial intermediation services to the wider economy, avoiding the boom and bust cycle in the provision of credit". Of course, systemic risk will heighten economic volatility, and the loans/GDP ratio may be one factor underlying systemic risk (although we argue in Section 2 that it is not the most important one).

6.3 NIGEM SIMULATIONS

We turn now to simulations using the NiGEM sub-model for Sweden. The NiGEM model is presented in Appendix 1. In sum, it contains elements of demand, including consumption, and a supply side with a production function that is driven by technology and the user cost of capital which is the main determinant of the development of the economy in the longer term. Financial markets are forward looking, as are factor markets. i.e. incorporating rational expectations. All of these may be affected by financial regulation. When banks increase the spread between borrowing and lending rates for individuals it changes their incomes, and can also change their decision making on the timing of consumption, with the possibility of inducing sharp short term reductions. The volumes of deposits and lending that result are demand determined. Changing the spread between borrowing and lending rates for firms may change the user cost of capital and hence the equilibrium level of output and capital in the economy in a sustained way.

We contend that NiGEM offers the advantage of being a description of the economy and not a theoretical abstract as is true of DSGE models, which may not well describe the economy. The latter is a weakness of models such as Meh and Moran (2008) which seek to identify some potential influence of banks on the economy. The rational expectations features of NiGEM increase realism further and reduce the impact of the Lucas critique. As regards the modelling of banking sectors' influence in terms of spreads between borrowing and lending rates, in a global macromodel this was pioneered by NIESR in its work on the impact of capital adequacy regulation (Barrell et al 2009), where other influences on spreads besides capital include measures of borrower risk. Goodhart (2010) has argued that determining spreads is precisely the way that banks should be incorporated in macro models, and not either ignored or set out in terms of the "money multiplier", see also Woodford (2010). Operating via spreads' impact on investment, the stock of capital and hence, via the production function, output, NiGEM offers a highly realistic and plausible view of the economy and banks' role therein.[17]

We undertook a number of modifications of the existing Swedish NIGEM model, with first an inclusion of housing wealth in the consumption function. Second, we allowed the increase in household liabilities to be driven by housing wealth (previously it had been driven by income). And third, we included the house price equation set out in column 4 of Table 9, which incorporates an income, wealth and mortgage stock effect as well as an effect of long real rates and the household sector lending spread (the previous equation had included only the interest rate terms). Hence the effect of banks on the economy via lending spreads is broadened

17 We note that the Meh and Moran (2008) paper cited above, bank lending does not operate via spreads explicitly but rather in a form of quantity rationing of credit, where it is only after the investment that returns to banks are made explicit.

from fixed investment, the stock of capital and consumption to also include house prices. The new equations are shown in Appendix 2.

As regards the simulations, we describe seven differing ones. First there is a 0.5 percentage point rise in technical progress, which boosts long term growth. There is a fiscal tightening, which is equivalent to 1% of GDP off government consumption, with the target for the government deficit raised by 1% so tax adjustment is mitigated. There is a fiscal easing which is 1% of GDP on government consumption There is a 3 percentage point rise in the intervention rate for 2 years, showing the impact of tighter monetary policy. We then have three macroprudential simulations. One is for a 3 percentage point rise in the bank spread for mortgages only (LENDW) (showing the effect of higher countercyclical capital requirements on mortgages), for 2 years. We then do this for all bank lending so it also affects the spread for the corporate sector (IPREM). And finally we seek to proxy a fall in regulated LTVs by simply shocking the implicit user cost of housing by 3 percentage points for 2 years. The main difference between LENDW and user cost is simply the effects of LENDW on personal income which is absent for the user cost shock. Then we present the results in a series of tables. Our main focus is on the monetary and macroprudential simulations, the others are there mainly for comparison purposes and to validate the properties of the model.

Table 10 shows the impact of the simulations on GDP. It can be seen that all sectors capital adequacy has a similar effect to monetary policy. This is largely due to the impact of the IPREM variable on investment, because the corresponding fall in GDP where only the spread for the housing market is widened is much less, around 0.2% off GDP after 2 years compared to 1.1% for monetary policy and 1.4% for economy wide capital adequacy. Even more subdued is the response of output to the LTV proxy, which by construction does not affect personal income and hence consumption directly, but only affects consumption via the value of housing wealth. Note that we do not build in a possible response of saving to a lower LTV, as people save more to buy a house.

As regards inflation, (Table 11) monetary policy is more effective than macroprudential policies, although there is some effect of the latter also on inflation from the all sectors capital adequacy simulation. We show house prices as a deviation in terms of levels from base in Table 12 . The macroprudential policies are more effective at reducing house prices than monetary policy of the same magnitude (3 pcp for two years). This no doubt relates partly to the term structure effect of the short intervention rate being less than one to one on the long real rate that enters house price determination. The greatest effect is from the all sectors capital adequacy simulation which affects house prices via personal disposable income as well as directly. The other macroprudential policies are quite comparable however.

Table 13 looks at changes in the stock of personal debt. This is driven largely by housing wealth, as shown in Appendix 2 so falls in line with house prices. Again the impact is much greater for macroprudential than monetary policies, calibrated in the manner we have chosen. Table 14 shows housing wealth moving in line with house prices. This variable enters the determination of consumption as does personal disposable income (Table 15) which falls considerably more in the monetary policy than in the macroprudential simulations, although "other personal income" declines in the case of widening spreads in the lending market from LENDW. Note that there is by construction virtually no change to PDI for the case of LTV limits, and we consider this to be realistic.

We finally construct two key macroprudential indicators, namely debt/housing and debt/personal disposable income and consider how many percentage points the ratios change. In the case of housing market gearing (Table 16) monetary policy raises gearing in each case since it affects housing wealth proportionately more than it does debt. In contrast, the macroprudential policies start to reduce the ratio, in the case of an LTV policy in the third year and for the two capital adequacy policies slightly later on. The debt/income ratio (Table 17) is also raised by monetary policy for the first three years, before declining thereafter. The LTV policy, which reduces debt while leaving income unchanged, unambiguously reduces the ratio. For the capital adequacy simulations the effect is again delayed till after the policy is taken off, although there are marked reductions in years 3 to 5 in each case.

Summarising briefly, we need to caution the reader that model simulations can only be imperfectly calibrated. It would be hard to devise a policy that makes an exact change in the spread via capital adequacy equivalent to 3 percentage points, for example. Nevertheless, we contend that the results are of interest in showing that monetary policy is superior in addressing inflation and for the most part output. That said, a rise in capital requirements which gives rise to 3 pcp wider spreads for households and corporations has a major effect on GDP, indeed greater than a 3 pcp rise in intervention rates for the same period. It appears to generate more volatility in GDP for a given macroprudential effect than do the housing market related tools.

In terms of housing market variables, the macroprudential policies seem to be more effective, although monetary tightening also has a major effect on house prices and correspondingly on housing wealth. The restraint of debt by the macroprudential policies is much more effective, operating as it does largely via house prices and housing wealth. We see that an LTV policy can restrain house prices while not impacting on personal income in the same way as capital adequacy based policies. It is correspondingly better at reducing debt/wealth and debt/income ratios, at least in the first two years of the simulation. We should note that

the model excludes confidence effects that could differ between these policies, as well as any adjustment to the saving/consumption balance due to LTV restrictions.

Against the background of these results, as well as the theoretical work summarised in Section 6.2, we suggest that the housing market linked macroprudential tools could be a useful complement for monetary policy even in a country like Sweden where there is no constraint on use of monetary policy for domestic stabilisation – and all the more for countries such as those in the Euro zone with a fixed exchange rate.

Conclusion

Against the background of the subprime crisis, where housing was implicated in the financial crisis in countries such as the US, as well as the ongoing discussions regarding Basel III, there has been renewed interest in both macroprudential regulation in general and countercyclical and macroprudential regulation focused on the housing sector in particular. However, although a number of "building blocks" exist, the literature on macroprudential policy in respect of housing is quite thin. There are some descriptions of national experience and some tentative econometrics on the success of such policies, as well as theoretical papers but little beyond that.

We have sought to contribute to reflection in this area by taking a wide point of view and surveying the literature on housing market dynamics with a view to finding possible links to financial instability as well as potential macroprudential tools for dampening disruptive tendencies. We then went on to estimate house price equations and evaluate NiGEM model simulations for Sweden with the same aim.

Summarising our work, we note a number of empirical papers which suggest a link from house prices to banking crises. Notably, we highlight Barrell et al (2010a and b) which show that house prices are a key indicator of banking crises. On the other hand, we also note that housing losses have not tended historically to lead to bank collapses, except in the US where housing loans are non-recourse. It is rather commercial property which is the biggest risk to banks, and the predictive power of house prices might be seen as partly linked to the close relation of the various real estate prices. However, house prices may also influence banking crises via the wealth effect of housing on consumption, falls in which may drive defaults for producers of consumer goods and services, and for the unemployed.

Such results underpin the growing consensus that housing markets in general and house prices in particular need to be monitored in macroprudential surveillance. Monetary policy can influence house prices via a number of channels, including the user cost of capital, expectations of house price movements, housing supply, wealth effects (although the size of the housing wealth effect is disputed), credit effects on consumption and credit effects on housing demand. Hence, there is an ongoing debate as to whether monetary policy should respond to house prices directly,

particularly if there is evidence of deviations from their fundamental determinants. The debate can be summarised by two points of view, whether policy should "lean" against house prices generating potential risk independently of forecasts of inflation and the output gap, or whether it should concentrate on the latter and "clean up" if there is a crisis following a house price collapse.

Notably in countries where monetary policy is taken up with other objectives (e.g. with a fixed exchange rate) there has been ongoing development of policies to influence housing markets via banking regulations, notably limits of allowable loan to value ratios, and variable capital requirements on bank lending for house purchase. These complement the Basel rules which focus on capital regulations across the whole of banks' balance sheets. However, the effectiveness of housing market specific macroprudential regulations is not fully empirically proven beyond their impact on lending, perhaps partly due to the short periods over which they have been introduced in most countries. There are nevertheless some tentative results suggesting that default rates and house prices are affected by such policies.

Policy can only operate effectively on housing in a context where the determinants of house prices are well understood. In the literature, house prices are typically estimated in a cointegrating framework where long and short run influence arise from personal income and a user cost variable (where the latter may incorporate not only interest rates but also taxes and expected house price appreciation). Population and construction costs may also enter. Serial correlation in the short run is a feature of many house price equations. On the other hand, most empirical studies omit some influences that might be expected to impact on house prices. These include financial liberalisation, banking crises, the mortgage stock (especially before liberalisation), unemployment, regulations on housing supply, the housing stock or the flow of investment , financial wealth as a portfolio balance effect, and interest rate spreads on mortgage lending.

In our empirical work, we capture not only the conventional effects but also a number of those typically omitted from existing work, such as banking crises, unemployment, gross financial wealth and the mortgage stock. We find that there are regime shift changes between pre and post liberalisation periods, with a lesser impact of the mortgage stock and a smaller short term income effect after liberalisation. However, long run determinants of house prices are consistent between the two periods, for the most part. Some variables that could be helpful in estimation of the effect of macroprudential policies are absent for most countries, notably a marginal LTV ratio and data on spreads between lending and borrowing rates. The latter was helpfully available for Sweden however. Indeed, estimation of an equation for Sweden includes a significant mortgage spread.

In our estimation we have shown that a number of potential macroprudential effects can be captured in freely estimated house price equations. Notably, we can

have effects arising via the user cost, which can proxy LTV limits, spreads, which can proxy for changing capital ratios, as well as a mortgage stock effect.

As noted the mortgage stock effects were stronger in the period before financial liberalisation, which raises the issue of what "regime" tough macroprudential policy will bring the housing market to. Will it lead to renewed rationing and a return to the past, or will it rather be consistent with a free market in house prices and housing finance? In our view the types of policy under consideration are unlikely to be so draconian as to return the housing market to a 1970s style rationing.

Finally, there is evidence from our NiGEM simulations that macroprudential policies can have a distinctive impact on the economy, focused on the housing market, which could helpfully complement monetary policy at most points in the cycle. These results are in turn broadly consistent with the small volume of work assessing theoretically how macroprudential policies may affect the economy. A generalised rise in capital adequacy is shown to have a quite marked impact in GDP, mainly via investment rather than consumption, however. A more focused capital adequacy rise for mortgage lending only or an LTV policy appear to have scope to reduce house prices with less effect on the rest of the economy than other options, although it may of course be more subject than capital adequacy based policies to disintermediation. Capital adequacy for mortgage lending affects GDP more than the LTV policy since it impacts more on personal income and hence consumption. Monetary policy does of course also affect housing market variables but also has a greater effect on the wider economy, as do generalised rises in capital ratios affecting all lending.

Overall, we suggest that the housing market specific macroprudential tools could be a useful complement for monetary policy even in a country like Sweden where there is no constraint on use of monetary policy for domestic stabilisation – and they could be particularly helpful for countries such as those in the Euro zone with a fixed exchange rate.

References

Angelini P, Neri S and Panetta F (2010), "Grafting macroprudential policies in a macroeconomic framework; choice of optimal instruments and interaction with monetary policy" paper presented at a conference on "Procyclicality and Financial Regulation", Tilburg, 11-12 March 2010

Angeloni I and Faia E (2009), "A tale of two policies, prudential regulation and monetary policy with fragile banks", Kiel Working Papers 1569, Kiel Institute for the World Economy.

Aron, J., Muellbauer, J. and Murphy, A. (2007). "Housing Wealth, Credit Conditions and UK Consumption". Discussion Paper, Centre for Economic Policy Research, London.

Baltagi, B.H., (2005), "Econometric Analysis of Panel Data". John Wiley, London.

Barrell R, Davis E P, Fic T., Holland D., Kirby S., and Liadze I (2009) "Optimal regulation of bank capital and liquidity: how to calibrate new international standards" FSA Occasional Paper no. 38, October

Barrell, R., Davis, P., Karim, D., Liadze, I., (2010a). "Bank regulation, property prices and early warning systems for banking crises in OECD countries". Journal of Banking and Finance vol. 34 pp 2255–2264.

Barrell, R., Davis, E.P., Karim, D., Liadze, I., (2010b). "Calibrating macroprudential policy", NIESR Discussion Paper no. 354.

Basel Committee (2010), "Countercyclical capital buffer proposal - consultative document", BIS, Basel, July 2010

Berg S A (1993), "The Banking Crisis in the Scandinavian countries", in "FIDICIA, an appraisal", FRB Chicago Banking Conference Proceedings, 441-9.

Bernanke, B. S. and Gertler, M. (1999), "Monetary Policy and Asset Price Volatility," Federal Reserve Bank of Kansas City Economic Review, 84, 17-51.

Bernanke, B.S. and Gertler, M. (2001), "Should Central Banks Respond to Movements in Asset Prices?", American Economic Review, 91, 253-257.

Bohl, M. T., Siklos, P., L. and Werner, T. (2004). "Asset Prices in Taylor Rules: Specification, Estimation, and Policy Implications for the ECB," Discussion Paper Series 1: Economic Studies 2004,22, Deutsche Bundesbank, Research Centre.

Borio, C. (2009), "The macroprudential approach to regulation and supervision, What? How Why?" presentation to the Banque de France and Toulouse School of Economics Conference on "the future of financial regulation", 28 January 2009

Borio C, Drehmann M, Gambacorta L, Jimenez G and Trucharte C (2010), "Countercyclical capital buffers; exploring options", BIS Working Paper no. 317.

Borio, C and Lowe, P (2002). "Assessing the Risk of Banking Crisis", BIS Quarterly Review, December 2002.

Borio C., and Drehmann M., (2009). "Assessing the risk of banking crises – revisited". BIS Quarterly Review, March.

Borio, C and I Shim (2007): "What can (macro-)prudential policy do to support monetary policy?", BIS Working Papers, no 242, December.

Borio, C, C Furfine and P Lowe (2001), "Procyclicality of the financial system and financial stability: issues and policy options", in "Marrying the macro- and micro-prudential dimensions of financial stability", BIS Papers, no. 1, March, pp 1-57.

Buiter, W. (2010). "Housing Wealth Isn't Wealth". Economics Discussion Papers 2009-56, Kiel Institute for the World Economy

Calomaris, C, W. and Gorton, G, (1991). "The Origins of Banking Panics: Models, Facts and Bank Regulation", in R. Glenn Hubbard, ed., Financial Markets and Financial Crises. University of Chicago Press.

Calvo, Guillermo, Izquierdo, A. Alejandro and Talvi, E. (2003). "Sudden Stops, the Real Exchange Rate and Fiscal Sustainability: Argentina's Lessons". NBER Working Paper.

Cameron, Gavin, Muellbauer, John and Murphy, Anthony (2006). "Was There a British House Price Bubble? Evidence from a Regional Panel," CEPR Discussion Papers 5619.

Capozza, D.R., Hendershott, P.H., Mack, C. and Mayer, C.J., (2002). "Determinants of Real House Price Dynamics", NBER Working Paper, 9262.

Caprio, G., and Klingebiel, D., (2003), "Episodes of systemic and borderline financial crises". World Bank Research Dataset.

Case, K. E. and Shiller, R. J. (2003). "Is There a Bubble in the Housing Market?" Brookings Papers on Economic Activity, 2, pp 299 – 362.

Cecchetti, S.G., Genberg, H. and Wadhwani, S. (2002), 'Asset prices in a flexible inflation targeting framework', in Hunter, W.C., Kaufman, G.G. and Pomerleano, M. (eds), Asset Price Bubbles: The Implications for Monetary, Regulatory and International Policies, MIT Press, pp. 427-44.

CGFS (2010), "Macroprudential instruments and frameworks: report published by the Committee on the Global Financial System" 21 May 2010, Basel

Collyns, C. and Senhadji, A. (2002). Lending Booms, Real Estate Bubbles and the Asian Crisis. IMF Working Paper, W/P/ 02/20.

Davis, E. P. (1999). "Financial Data Needs for Macroprudential Surveillance – What are the Key Indicators of Risks to Domestic Financial Stability?" Centre for Central Banking Studies, Bank of England, number 2, October.

Davis E P (2010), "New International Evidence on Asset-Price Effects on Investment, and a Survey for Consumption", forthcoming, OECD Economic Studies

Davis, E. P. and Karim, D. (2010). "Macroprudential Regulation: The Missing Policy Pillar". National Institute Economic Review, Vol. 211, No 1, pp 67-80.

Davis E P and Zhu H (2010), "Bank lending and commercial property cycles, some cross country evidence" forthcoming, Journal of International Money and Finance

Demirguc-Kunt, A. and Detragiache, E. (1998). "The Determinants of Banking Crises in Developed and Developing Countries". IMF Staff Paper, Vol. 45, No. 1, International Monetary Fund, Washington.

Demirgüç-Kunt, A and Detragiache, E (2005). "Cross-Country Empirical Studies of Systemic Bank Distress: A Survey." IMF Working Papers 05/96, International Monetary Fund.

Disyatat, P. (2010). "Inflation Targeting, Asset Prices and Financial Imbalances: Contextualising the Debate". Journal of Financial Stability, Vol. 6, pp 145 – 155.

Engle, R.F., Granger, C.W.J., (1987), "Co-integration and error correction: representation, estimation and testing", Econometrica 55, 251–276

Fawley, B. and Juvenal L. (2010). "Monetary Policy and Asset Prices". Economic Synopses, Reserve Bank of St. Louis.

Fernandez-Corugedo, E. and Muellbauer, J. (2006). "Consumer credit conditions in the United Kingdom," Bank of England working papers 314.

Financial Stability Board (2010), "An assessment of the long-term economic impact of stronger capital and liquidity requirements", Basel, August 2010

FSA (2009). "The Turner Review: A Regulatory Response to the Global Banking Crisis". Financial Services Authority, March 2009.

Gali J (2009), "Monetary policy, inflation and the business cycle", Princeton University Press

Gallin, J (2006). ''The Long-Run Relationship between House Prices and Income: Evidence from Local Housing Markets ,'' Real Estate Economics, Vol. 34 (Fall 2006), pp. 417-438

Gattini, L and Hiebert, P (2010). "Forecasting and Assessing Euro Area House Prices Through the Lens of Key Fundamentals", ECB Working Paper Series, No 1429/ October 2010.

Gerlach, S. and W. Peng (2005): "Bank lending and property prices in Hong Kong.", Journal of Banking and Finance, 29, 461-481.

Goodhart C A E (2010), "Money, credit and bank behaviour: need for a new approach" National Institute Economic Review, 214

Gorton, G. (1988). "Banking Panics and Business Cycles". Oxford Economic Papers, Vol. 40, Issue 4., pp. 751 – 81.

Harding R (2010) "Alternative tools: Macroprudential line joins armoury to avert new crisis", Financial Times, October 7th

Hendershott, P. (1980). "Real User Costs and the Demand for Single-Family Housing". Brookings Papers on Economic Activity, Vol. 2.

Hendry, D.F., (1984), "Econometric modelling of house prices in the United Kingdom" In: Hendry, D.F., Wallis, K.F. (Eds.), Econometrics and Quantitative Economics. Basil Blackwell, Oxford, pp. 135–172.

Himmelberg, C. Mayer, C. and Sinai, T. (2005). "Assessing High House Prices: Bubbles, Fundamentals and Misperceptions". Journal of Economic Perspectives, Vol. 19, pp 67 – 92.

Holly, S., Pesaran, H. M. and Yamagata, T. (2010). "Spatial and Temporal Diffusion of House Prices in the UK", forthcoming in Journal of Urban Economics.

Hott, C and Monnin, P (2008). "Fundamental Real Estate Prices: An Empirical Estimation with International Data". The Journal of Real Estate Finance and Economics, Issue 4, Vol. 36, pp 427-450.

IMF (2000). "Macroprudential Indicators of Financial System Soundness". Occasional Paper 192, April 2000.

Kaminsky, G. and Reinhart, C. (1999). "The Twin Crises: The Causes of Banking and Balance of Payment Problems". American Economic Review, Vol. 89, No 3, pp 473-500.

Kannan P, Rabanal P and Scott A (2009), "Monetary and macroprudential policy rules in a model with house price booms", IMF Working Paper No 09/251

Kao, C., (1999), "Spurious regression and residual-based tests for cointegration in panel data", Journal of Econometrics 90, 1–44.

McCarthy, J. and Peach, R. W. (2004). "Are Home Prices the Next Bubble?". Federal Reserve Bank of New York Economic Policy Review, December.

McCauley R (2009), "Macroprudential tools in emerging markets", Paper written for Central Bank of Nigeria's 50th Anniversary International Conference on "Central banking, financial system stability and growth", session on "Rethinking regulation for financial system stability and growth", Abuja, 4-9 May 2009

Meen, Geoffrey (2002). "The Time Series Behaviour of House Prices: A Transatlantic Divide?". Journal of Housing Economics, Vol. 11, pp 1 – 23.

Meh C and Moran K (2008), "The role of bank capital in the propagation of shocks" Bank of Canada working paper No 2008-36

Miles, D and Pillonca, V (2008). "Financial innovation and European housing and mortgage markets," Oxford Review of Economic Policy, Oxford University Press, vol. 24(1), pages 145-175.

Mishkin,F. S. (2007). "Housing and the Monetary Transmission Mechanism," Proceedings, Federal Reserve Bank of Kansas City, pages 359-413.

Muellbauer, J and Murphy, A, (1997), "Booms and Busts in the UK Housing Market," Economic Journal, Royal Economic Society, vol. 107(445), pages 1701-27

Muellbauer J., and Murphy, A. (1989). 'Why Has Personal Saving Collapsed?". Credit Suisse First Boston Research.

Muellbauer J., and Murphy, A. (2008). 'Housing Markets and the Economy: The Assessment'. Oxford Review of Economic Policy, Vol. 24, No 1, pp 1-33.

OECD (2000), "OECD Economic Outlook". Organisation for Economic Cooperation and Development, Paris

OECD (2005), "Recent house price developments, the role of fundamentals", OECD Economic Outlook 78, 123-154

OECD (2010). "Resolving and Avoiding Unsustainable Imbalances in the Euro Area". Economics Department Working Paper No. 827.

Pesaran, M.H., Shin, Y., (1995) "An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis", University of Cambridge. DAE Working Paper 9514.

Poole, W. (1972). "Housing Finance Under Inflationary Conditions" in Ways to Moderate Fluctuations in Housing Construction, Federal Reserve Staff Study (Washington: Board of Governors of the Federal Reserve System).

Poterba, J. M. (1984). "Tax Subsidies to Owner-Occupied Housing: An Asset Market Approach". Quarterly Journal of Economics, Vol. 99, pp 729 – 752.

Quan, D C., and Quigley, J (1991). "Price Formation and the Appraisal Function in Real Estate Markets". The Journal of Real Estate Finance and Economics, Vol. 4, pp 127 – 146.

Reinhart, C M. and Rogoff, K S. (2008). "Is the 2007 US Sub-prime Financial Crisis So Different? An International Historical Comparison." American Economic Review, Vol. 98, No 2, pp 339-44

Reinhart, C. and Reinhart, V. (2008). "Capital Flow Bonanzas: An Encompassing View of the Past and Present". CEPR Discussion Papers, No. 6996.

Saurina J (2009), "Dynamic provisioning, the experience of Spain", Crisis Response Note No 7, World Bank, Washington DC

Shiller, R (1990). "Market Volatility and Investor Behavior." American Economic Review, Vol. 80, pp. 58-62.

Shiller, R (2007). "Understanding Recent Trends in House Prices and Home Ownership," NBER Working Papers 13553, National Bureau of Economic Research, Inc.

Terrones M and Otrok C (2004), "The global house price boom", IMF World Economic Outlook, September

van den Noord, P (2005). "Tax Incentives and House Price Volatility in the Euro Area: Theory and Evidence," Economie Internationale, CEPII research center, issue 1Q, pages 29-45.

Wadhwani, S (2008). "Should Monetary Policy Respond to Asset Price Bubbles? Revisiting the Debate." FMG Special Papers sp180, London School of Economics.

Whyte, P (2010). "How to Restore Financial Stability". Centre for European Reform, January 2010.

Wong E and Hui C-H (2010) "Loan-To-Value Ratio As A Macroprudential Tool – Hong Kong Experiences", mimeo, Research Department, Hong Kong Monetary Authority

Woodford M (2010), "Financial intermediation and macroeconomic analysis", Journal of Economic Perspectives, 24/4, 21–44

Table 1. Data sample

	AU	BG	CN	DK	FN	FR	GE	GR	IR
House prices (PH)	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009	1994-2009	1970-2009
Intervention rate (INT)	1968-2009	1961-2009	1961-2009	1976-2009	1970-2009	1965-2009	1961-2009	1961-2009	1971-2009
Consumers expenditure deflator (CED)	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009
Real personal disposable income (RPDI)	1961-2009	1970-2009	1961-2009	1971-2009	1963-2009	1961-2009	1961-2009	1977-2009	1961-2009
Real long term interest rate (LRR)	1970-2009	1962-2009	1962-2009	1962-2009	1972-2009	1966-2009	1962-2009	1962-2009	1971-2009
Personal debt (LIABS)	1977-2009	1961-2009	1961-2008	1961-2009	1979-2009	1971-2009	1971-2009	1984-2009	1961-2008
Personal net financial wealth (NW)	1970-2009	1961-2009	1961-2008	1961-2009	1979-2009	1970-2009	1971-2009	1964-2009	1975-2008
Unemployment rate (U)	1970-2009	1965-2009	1965-2009	1970-2009	1970-2009	1968-2009	1965-2009	1961-2009	1961-2009
Housing investment (IH)	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1970-2009	1970-2009	1970-2009
Gross domestic product (GDP)	1961-2009	1961-2009	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009	1970-2009
Housing stock estimate (RHS)	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1970-2009	1970-2007	1970-2008
Total population (POP)	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009
20-39 age group (2039)	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010

Note. Country codes are Australia AU, Belgium BG, Canada CN, Denmark DK, Finland FN, France FR, Germany GE, Greece GR, Ireland IR, Italy IT, Japan JP, Netherlands NL, Austria OE, Portugal PT, Sweden SD, Spain SP, the United Kingdom UK and the United States US.

Table 1. Data sample continued

	IT	JP	NL	OE	PT	SD	SP	UK	US
House prices (PH)	1970-2006	1961-2009	1970-2009	1970-2009	1988-2009	1970-2009	1971-2009	1964-2009	1970-2009
Intervention rate (INT)	1961-2009	1961-2009	1962-2009	1961-2009	1972-2009	1963-2009	1977-2009	1961-2009	1971-2009
Consumers expenditure deflator (CED)	1961-2009	1965-2009	1961-2009	1970-2009	1970-2009	1961-2009	1961-2009	1961-2009	1961-2009
Real personal disposable income (RPDI)	1965-2009	1970-2009	1970-2009	1970-2009	1970-2009	1961-2009	1964-2009	1961-2009	1961-2009
Real long term interest rate (LRR)	1962-2009	1967-2009	1962-2009	1971-2009	1971-2009	1962-2009	1980-2009	1962-2009	1962-2009
Personal debt (LIABS)	1972-2009	1971-2009	1961-2008	1970-2009	1961-2008	1961-2009	1961-2009	1963-2009	1961-2009
Personal net financial wealth (NW)	1972-2009	1971-2008	1961-2009	1970-2009	1980-2008	1961-2009	1970-2009	1963-2009	1961-2009
Unemployment rate (U)	1978-2009	1961-2009	1965-2009	1961-2009	1961-2009	1975-2009	1965-2009	1971-2009	1961-2009
Housing investment (IH)	1981-2009	1965-2009	1961-2009	1970-2009	n/a	1961-2009	1961-2009	1986-2009	1961-2009
Gross domestic product (GDP)	1970-2009	1965-2009	1970-2009	1970-2009	1961-2009	1961-2009	1964-2009	1961-2009	1961-2009
Housing stock estimate (RHS)	1981-2009	1965-2009	1961-2009	1970-2009	n/a	1961-2009	1961-2009	1986-2009	1961-2009
Total population (POP)	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1961-2009	1971-2009	1961-2009
20-39 age group (2039)	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010	1961-2010

Note. Country codes are Australia AU, Belgium BG, Canada CN, Denmark DK, Finland FN, France FR, Germany GE, Greece GR, Ireland IR, Italy IT, Japan JP, Netherlands NL, Austria OE, Portugal PT, Sweden SD, Spain SP, the United Kingdom UK and the United States US.

Table 2. Panel unit root tests

	LEVEL	DIFFERENCE
Log real house prices	-2.1 (0.02)	-10.3 (0.00)
Log RPDI	-1.6 (0.06)	-13.6 (0.00)
Real long rate	-2.2 (0.01)	-16.9 (0.00)
Log real liabilities	6.6 (1.0)	-11.7 (0.00)
Log real gross financial wealth	0.5 (0.67)	-15.0 (0.00)
Unemployment rate	-2.3 (0.01)	-10.7 (0.00)
Log housing investment/GDP	-0.8 (0.21)	-15.7 (0.00)
Log real housing stock	-1.7 (0.04)	-3.1 (0.00)
Log 20-39 as a share of population	-5.8 (0.00)	-6.4 (0.00)

Table 3. Panel results – all observations – basic equation

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
C	**-0.423**	**-0.42**	**-0.67**	**-0.414**	**-0.559**
	(4.8)	**(3.5)**	**(4.4)**	**(3.2)**	**(4.1)**
DLRPDI	**0.81**	**1.0**	**0.644**	**1.16**	**0.683**
	(8.5)	**(6.1)**	**(5.2)**	**(6.8)**	**(5.2)**
DLRR	**-0.0047**	-0.0035	**-0.0058**	**-0.0046**	-0.0044
	(2.3)	(1.4)	**(1.9)**	**(2.2)**	(1.4)
DLRPH (-1)	**0.534**	**0.511**	**0.547**	**0.432**	**0.577**
	(13.5)	**(7.4)**	**(11.5)**	**(6.6)**	**(12.0)**
LRPH (-1)	**-0.07**	**-0.07**	**-0.088**	**-0.074**	**-0.075**
	(7.1)	**(4.3)**	**(6.4)**	**(4.0)**	**(6.8)**
LRPDI (-1)	**0.048**	**0.048**	**0.079**	**0.04**	**0.068**
	(4.8)	**(3.5)**	**(4.4)**	**(3.0)**	**(4.1)**
LRR (-1)	**-0.0025**	-0.0016	**-0.0036**	**-0.0026**	**-0.0027**
	(3.5)	(1.5)	**(3.5)**	**(2.5)**	**(2.8)**
Countries	18	7	11	5	13
Obs	618	268	350	185	433
Adjusted R2	0.53	0.53	0.528	0.555	0.523
SE of regression	0.05	0.048	0.051	0.043	0.053
Durbin Watson	1.79	1.71	1.84	1.82	1.82
Kao	-4.6	0.17	-4.3	-1.3	-3.94
	(0.00)***	(0.43)	(0.00)***	(0.09)*	(0.00)***

Note. Countries included in "All" are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Austria, Portugal, Sweden, Spain, the UK and US; "G7" are the UK, US, Germany, Japan, Canada, Italy and France; "Small countries" are Australia, Belgium, Denmark, Finland, Greece, Ireland, Netherlands, Austria, Portugal, Sweden, Spain; "Anglo Saxon" are the UK, US, Ireland, Australia and Canada; Bank-dominated are Belgium, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Austria, Portugal, Sweden, Spain. In table 3-9, figures in bold are statistically significant.

Table 4. Panel results – all observations – variants

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
Cubic (-1)	**-4.9**	**-9.88**	-1.05	-6.44	**-4.9**
	(2.9)	**(4.4)**	(0.6)	(1.3)	**(3.9)**
Debt (diff)	**0.122**	0.15	**0.15**	**0.14**	**0.13**
	(6.0)	(0.9)	**(4.0)**	**(3.8)**	**(5.2)**
Debt (-1)	-0.001	0.025	**-0.047**	-0.025	-0.0028
	(0.1)	(1.3)	**(3.5)**	(1,1)	(0.2)
Debt (diff)	**0.152**	**3.9**	**0.086**	**0.16**	**0.144**
	(5.1)	**(3.1)**	**(2.5)**	**(2.8)**	**(4.6)**
Debt (diff*unlib)	-0.066	**-3.8**	**0.35**	-0.08	-0.034
	(1.3)	**(2.9)**	**(4.4)**	(0.8)	(4.6)
Debt (-1)	-0.0043	0.02	**-0,047**	-0.023	-0.004
	(0.3)	(0.6)	**(3.5)**	(0.9)	(0.3)
Debt (-1) *unlib	0.0005	0.0009	0.0002	-0.0022	0.0017
	(0.6)	(0.6)	(0.2)	(1.1)	(1.5)
Demog (diff)	0.064	0.16	-0.07	**1.0**	-0.317
	(0.3)	(0.5)	(0.2)	**(2.6)**	(1.0)
Demog (-1)	0.028	0.012	0.011	**0.127**	0.011
	(0.9)	(0.2)	(0.3)	**(2.4)**	(0.3)
Investment/GDP (-1)	-0.019	-0.014	**-0.029**	**0.049**	-0.017
	(1.7)	(0.9)	**(2.0)**	**(2.0)**	(1.2)
Housing stock (-1)	0.0009	0.008	**-0.065**	-0.024	-0.0018
	(0.1)	(0.2)	**(1.9)**	(0.8)	(0.1)
Finlib	-0.005	0.0016	0.007	-0.004	0.007
	(0.1)	(0.2)	(0.6)	(0.3)	(0.9)
Crises	**-0.027**	**-0.021**	**-0.033**	**-0.019**	**-0.4**
	(4.5)	**(3.1)**	**(2.8)**	**(2.4)**	**(5.1)**
Unempl (diff)	**-0.0093**	**-0.0096**	**-0.0097**	**-0.015**	-0.0057
	(3.8)	**(2.6)**	**(2.8)**	**(4.3)**	(1.6)
Unempl (-1)	0.00085	0.001	0.0005	-0.0024	0.0008
	(0.9)	(0.6)	(0.4)	(1.3)	(0.6)
Finwealth (diff)	**0.11**	0.079	**0.138**	0.064	**0.153**
	(2.9)	(1.6)	**(3.6)**	(1.4)	**(4.1)**
Finwealth (-1)	0.015	**0.043**	-0.0011	0.031	0.004
	(1.3)	**(2.1)**	(0.1)	(1.2)	(0.3)

Note. (1) Debt growth is instrumented by a constant and lagged growth in RPDI. House prices and real long rates.
(2) For country groupings see footnote to Table 3.

Table 5. Panel results – liberalised – basic equation

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
C	0.029 (0.15)	0.025 (0.1)	-0.135 (0.4)	-0.088 (0.3)	0.097 (0.3)
DLRPDI	**0.567** **(5.0)**	**0.799** **(4.3)**	**0.408** **(2.8)**	**0.883** **(4.8)**	**0.386** **(2.7)**
DLRR	**-0.009** **(4.1)**	**-0.008** **(2.2)**	**-0.012** **(3.5)**	**-0.0089** **(3.3)**	**-0.0088** **(2.4)**
DLRPH (-1)	**0.617** **(13.4)**	**0.646** **(9.9)**	**0.593** **(8.9)**	**0.537** **(7.6)**	**0.642** **(10.7)**
LRPH (-1)	**-0.06** **(5.7)**	**-0.059** **(3.4)**	**-0.069** **(4.3)**	**-0.067** **(3.0)**	**-0.059** **(4.7)**
LRPDI (-1)	-0.002 (0.1)	-0.002 (0.1)	0.018 (0.5)	0.0086 (0.3)	-0.01 (0.2)
LRR (-1)	**-0.006** **(4.0)**	**-0.0058** **(2.2)**	**-0.007** **(3.4)**	**-0.0056** **(2.0)**	**-0.0069** **(3.3)**
Countries	18	7	11	5	13
Obs	413	188	225	133	280
Adjusted R2	0.599	0.625	0.554	0.571	0.605
SE of regression	0.043	0.038	0.047	0.041	0.0448
Durbin Watson	1.76	1.63	1.89	1,83	1.72
Kao	-4.03 (0.00)	-1.97 (0.02)	-2.83 (0.00)	-2.72 (0.00)	-.2.55 (0.00)

Note. For country groupings see footnote to Table 3.

Table 6. Panel results – liberalised – variants

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
Cubic (-1)	-3.27 (1.4)	-4.4 (1.5)	-0.85 (0.3)	-7.1 (1.4)	-3.43 (1.2)
Debt (diff)	**0.19** **(7.9)**	**0.22** **(5.0)**	**0.18** **(4.6)**	**0.19** **(4.3)**	**0.19** **(6.0)**
Debt (-1)	-0.023 (1.7)	-0.053 (1.8)	-0.003 (0.2)	**-0.075** **(2.4)**	-0.017 (1.0)
Demog (diff)	0.07 (0.2)	0.45 (1.1)	-0.506 (1.0)	1.0 (1.8)	0.117 (0.3)
Demog (-1)	0.005 (0.1)	0.044 (0.7)	0.001 (0.1)	**0.21** **(2.4)**	-0.056 (1.0)
Investment/GDP (-1)	0.0007 (0.1)	0.019 (1.0)	-0.014 (0.8)	0.023 (0.8)	0.002 (0.1)
Housing stock (-1)	-0.047 (1.5)	**-0.16** **(3.4)**	0.033 (0.6)	**-0.107** **(2.3)**	-0.005 (0.1)
Crises	**-0.024** **(3.8)**	**-0.019** **(2.7)**	**-0.032** **(2.6)**	**-0.017** **(2.2)**	**-0.036** **(3.9)**
Unempl (diff)	**-0.012** **(4.3)**	**-0.0099** **(2.2)**	**-0.015** **(3.7)**	**-0.014** **(3.2)**	**-0.01** **(2.9)**
Unempl (-1)	**-0.003** **(2.0)**	-0.002 (0.9)	-0.003 (1.6)	-0.0025 (0.9)	**-0.003** **(2.0)**
Finwealth (diff)	**0.114** **(2.9)**	**0.166** **(2.3)**	**0.165** **(2.8)**	0.122 (1.8)	**0.094** **(1.9)**
Finwealth (-1)	-0.019 (0.9)	-0.034 (1.0)	0.062 (1.7)	0.007 (0.2)	-0.057 (1.8)

Note. For country groupings see footnote to Table 3.

Table 7. Panel results – all observations – with liberalisation dummies

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
C	**-0.529** **(4.1)**	**-0.559** **(2.6)**	**-0.868** **(4.3)**	**-0.541** **(2.4)**	**-0.692** **(3.4)**
DLRPDI	**0.572** **(4.6)**	**0.646** **(3.3)**	**0.457** **(2.5)**	**0.659** **(3.6)**	**0.464** **(2.7)**
DLRR	**-0.0089** **(3.7)**	**-0.008** **(2.5)**	**-0.012** **(3.0)**	**-0.0089** **(3.3)**	**-0.0095** **(2.4)**
DLRPH(-1)	**0.67** **(12.1)**	**0.758** **(9.6)**	**0.54** **(6.2)**	**0.63** **(8.2)**	**0.695** **(8.3)**
LRPH(-1)	**-0.105** **(8.8)**	**-0.106** **(5.2)**	**-0.132** **(7.8)**	**-0.119** **(5.1)**	**-0.101** **(7.6)**
LRPDI(-1)	**0.061** **(4.2)**	**0.062** **(2.6)**	**0.104** **(4.4)**	**0.055** **(2.4)**	**0.085** **(3.5)**
LRR(-1)	**-0.0044** **(3.2)**	-0.002 (0.8)	**-0.009** **(4.6)**	**-0.0037** **(2.0)**	**-0.0058** **(2.7)**
DLRPDI*LIB	**0.483** **(2.2)**	**0.738** **(2.0)**	0.422 (1.5)	**1.0** **(3.3)**	0.444 (1.6)
DLRR*LIB	0.006 (1.6)	**0.009** **(1.9)**	0.007 (1.3)	**0.011** **(2.3)**	0.0063 (1.1)
DLRPH(-1) *LIB(-1)	**-0.238** **(2.9)**	**-0.462** **(3.4)**	-0.026 (0.2)	**-0.395** **(3.0)**	-0.2 (1.8)
LRPH(-1) *LIB(-1)	0.043 (3.9)	0.026 (1.6)	**0.059** **(3.5)**	**0.036** **(2.2)**	**0.034** **(2.1)**
LRPDI(-1) *LIB(-1)	0.00006 (0.1)	-0.0004 (0.3)	-0.0002 (0.2)	-0.0025 (1.4)	0.0006 (0.6)
LRR(-1) *LIB(-1)	0.002 (1.5)	0.00037 (0.1)	**0.006** **(3.0)**	-0.0012 (0.5)	0.0032 (1.5)
Countries	18	7	11	5	13
Obs	618	268	350	185	433
Adjusted R2	0.55	0.57	0.543	0.612	0.536
SE of regression	0.05	0.046	0.05	0.041	0.053
Durbin Watson	1.79	1.69	1.83	1.88	1.82
Kao					

Note. For country groupings see footnote to Table 3.

Table 8. Panel results – all observations – variants with liberalisation dummies

	ALL	G7	SMALL COUNTRIES	ANGLO SAXON	BANK DOMINATED
Cubic (-1)	-6.87	-4.76	-6.8	-9.6	-8.13
	(1.8)	(1.0)	(1.4)	(1.7)	(1.6)
Cubic(-1)*LIB	3.48	-3.78	6.4	8.2	4.2
	(0.8)	(0.7)	(1.2)	(1.0)	(0.7)
Debt (diff)	**0.19**	**3.68**	**0.107**	**0.197**	**0.171**
	(5.9)	**(3.2)**	**(2.9)**	**(3.1)**	**(5.1)**
Debt (-1)	0.001	0.02	-0.034	-0.034	0.005
	(0.1)	(0.7)	(1.8)	(1.3)	(0.3)
Debt (diff)*LIB	**-0.111**	**-3.61**	**0.327**	-0.137	-0.072
	(2.3)	**(3.1)**	**(3.4)**	(1.5)	(1.3)
Debt (-1)*LIB	0.0045	0.007	0.001	-0.003	0.005
	(1.2)	(1.2)	(0.1)	(0.6)	(0.9)
Demog (diff)	0.41	**0.91**	0.17	**0.987**	0.61
	(1.4)	**(2.0)**	(0.3)	**(2.1)**	(1.6)
Demog (-1))	0.023	0.033	0.0037	**0.156**	-0.004
	(0.7)	(0.5)	(0.1)	**(2.1)**	(0.1)
Demog (diff)*LIB	**-1.11**	**-1.69**	-0.54	0.856	-1.95
	(1.8)	**(2.0)**	(0.5)	(0.9)	(2.6)
Demog (-1))*LIB	-0.0083	-0.014	-0.007	-0.006	-0.008
	(1.6)	(1.6)	(0.9)	(0.6)	(1.3)
Investment/GDP (-1)	-0.013	**-0.049**	-0.017	0.038	-0.013
	(1.0)	**(2.2)**	(0.9)	(1.4)	(1.0)
Investment/GDP (-1)*LIB	0.0037	0.01	0.007	-0.0058	0.0037
	(0.6)	(0.9)	(0.8)	(0.5)	(0.6)
Housing stock (-1)	0.02	0.088	-0.008	-0.059	0.024
	(1.1)	(1.8)	(0.2)	(1.2)	(1.1)
Housing stock (-1)*LIB	-0.037	-0.04	-0.024	0.077	-0.037
	(2.4)	(1.7)	(1.2)	(1.2)	(2.4)
Crises	**-0.021**	-0.0128	-0.025	**-0.018**	**-0.034**
	(3.1)	(1.6)	(1.5)	**(2.0)**	**(3.8)**
Crises*LIB	-0.006	0.0016	-0.007	**0.203**	-0.001
	(0.4)	(0.1)	(0.2)	**(2.2)**	(0.1)
Unempl (diff)	**-0.0076**	-0.003	**-0.015**	-0.0088	-0.0062
	(2.5)	(0.7)	**(3.5)**	(1.7)	(1.5)
Unempl(-1)	0.001	0.0026	-0.0003	0.0002	0.001
	(0.9)	(1.5)	(0.2)	(0.1)	(0.8)
Unempl (diff)*LIB	-0.0063	**-0.021**	0.0076	**-0.0148**	0.0019
	(1.1)	**(2.5)**	(1.0)	**(2.2)**	(0.2)
Unempl(-1)*LIB	-0.0009	0.0001	-0.0004	**-0.006**	0.0007
	(0.7)	(0.1)	(0.2)	**(2.2)**	(0.4)
Finwealth (diff)	**0.164**	**0.135**	**0.193**	**0.141**	**0.157**
	(3.8)	**(2.0)**	**(3.6)**	**(1.9)**	**(3.0)**
Finwealth (-1)	0.008	0.032	0.02	0.004	-0.007
	(0.6)	(1.6)	(0.7)	(0.2)	(0.4)
Finwealth (diff)*LIB	-0.092	-0.068	-0.069	-0.138	-0.0132
	(1.6)	(0.9)	(0.9)	(1.6)	(0.2)
Finwealth (-1)*LIB	0.004	0.013	-0.0059	-0.009	0.015
	(0.7)	(1.4)	(0.5)	(1.1)	(1.4)

Note. For country groupings see footnote to Table 3.

Table 9. Results for Sweden quarterly data 1970Q3-2009Q4

	NO RPDI HOMOGENEITY	RPDI HOMOGENEITY	RPDI HOMOGENEITY AND LENDW	RPDI AND LENDW HOMOGENEITY
C	**-0.404** **(3.3)**	**-0.233** **(2.6)**	**0.084** **(0.9)**	**-0.31** **(2.3)**
DLRPDI	**0.695** **(5.0)**	**0.653** **(4.7)**	**0.657** **(4.8)**	**0.609** **(4.3)**
DLRR				
DLRPH(-1)	**0.489** **(8.3)**	**0.521** **(9.1)**	**0.489** **(8.5)**	**0.56** **(10.2)**
LRPH(-1)	**-0.024** **(2.5)**	**-0.026** **(2.7)**	**-0.024** **(2.6)**	**-0.0224** **(2.3)**
LRPDI(-1)	**0.039** **(3.4)**	**0.026** **(fixed)**	**0.024** **(fixed)**	**-0.0224** **(fixed)**
LRR(-1)	-0.098 (1.8)	-0.101 (1,8)	**-0.11** **(2.1)**	**-0.00635** **(1.9)**
DLRPDI*LIB	**-0.667** **(4.2)**	**-0.618** **(3.9)**	**-0.629** **(4.0)**	**-0.572** **(3.5)**
DLRGW	**0.061** **(1.9)**	0.059 (1.8)	0.061 (1.9)	0.062 (2.0)
CRISES	**-0.011** **(2.2)**	**-0.0098** **(2.0)**		
DLRLIABS	**0.063** **(2.1)**	**0.072** **(2.4)**	**0.07** **(2.4)**	**0.0828** **(2.8)**
SPREAD (-1)			**-0.268** **(3.1)**	**-0.00635** **(Fixed)**
R2	0.61	0.61	0.62	0.594
SE	0.014	0.014	0.014	0.014
DW	1.96	1,99	1.97	2.0
LM (4)	4.1	4.6	4.2	3.3
NORM (2)	3.0	1.0	4.6	2.5
HET (1)	4.4*	6.9*	5.2*	5.9*

Note. In last column the real rate and spread are defined as log (real rate/100 + spread/100).

Table 10. Change in GDP

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.34	0.66	0.93	1.15	1.34
Government consumption	-0.22	-0.15	-0.12	-0.11	-0.11
Government consumption	0.24	0.17	0.13	0.10	0.07
Monetary policy tightening	-0.9	-1.14	-0.79	-0.53	-0.33
Housing sector LTV proxy	-0.01	-0.04	-0.05	-0.04	-0.02
Housing sector capital adequacy	-0.05	-0.16	-0.15	-0.12	-0.10
All sectors capital adequacy	-0.72	-1.35	-1.13	-0.90	-0.75

Note. Tables 10-17 depict differences from simulation base in percentage points.

Table 11. Change in inflation

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.28	0.14	0.20	0.18	0.13
Government consumption	0.15	-0.05	0.02	0.04	0.03
Government consumption	-0.10	0.12	0.07	0.04	0.03
Monetary policy tightening	-0.71	-0.06	-0.22	-0.11	-0.01
Housing sector LTV proxy	-0.02	0.00	-0.01	-0.01	-0.01
Housing sector capital adequacy	0.06	-0.01	-0.06	-0.05	-0.04
All sectors capital adequacy	0.06	-0.06	-0.14	-0.07	-0.13

Table 12. Change in house prices

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.41	0.63	0.95	1.32	1.71
Government consumption	0.36	0.39	0.43	0.50	0.59
Government consumption	-0.31	-0.42	-0.63	-0.92	-1.23
Monetary policy tightening	-1.30	-1.79	-2.36	-2.81	-3.01
Housing sector LTV proxy	-0.83	-2.36	-3.03	-2.73	-2.18
Housing sector capital adequacy	-0.89	-2.75	-3.76	-3.66	-3.13
All sectors capital adequacy	-0.86	-2.74	-3.94	-4.11	-3.91

Table 13. Change in stock of personal debt

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.22	0.37	0.56	0.83	1.15
Government consumption	0.39	0.51	0.51	0.52	0.56
Government consumption	-0.25	-0.16	-0.15	-0.33	-0.63
Monetary policy tightening	-0.43	-0.55	-1.11	-1.91	-2.58
Housing sector LTV proxy	-0.24	-1.54	-3.05	-3.56	-3.29
Housing sector capital adequacy	0.17	-0.94	-3.01	-4.13	-4.21
All sectors capital adequacy	0.19	-0.76	-2.76	-4.05	-4.49

Table 14. Change in housing wealth

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.41	0.63	0.95	1.31	1.69
Government consumption	0.36	0.39	0.44	0.50	0.59
Government consumption	-0.31	-0.42	-0.63	-0.92	-1.23
Monetary policy tightening	-1.30	-1.78	-2.35	-2.80	-3.0
Housing sector LTV proxy	-0.83	-2.36	-3.03	-2.73	-2.18
Housing sector capital adequacy	-0.89	-2.75	-3.76	-3.66	-3.13
All sectors capital adequacy	-0.86	-2.74	-3.93	-4.10	-3.89

Table 15. Change in nominal personal disposable income

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	0.31	0.18	0.18	0.20	0.24
Government consumption	-0.18	0.00	0.02	0.05	0.11
Government consumption	0.31	0.18	0.18	0.20	0.24
Monetary policy tightening	-2.49	-3.32	-2.13	-1.86	-1.58
Housing sector LTV proxy	0.04	0.07	0.12	0.17	0.18
Housing sector capital adequacy	-1.74	-2.05	-0.20	0.15	0.26
All sectors capital adequacy	-1.96	-2.81	-1.34	-1.02	-0.79

Table 16. Change in debt/housing wealth ratio

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	-0.19	-0.26	-0.39	-0.49	-0.54
Government consumption	0.03	0.12	0.07	0.02	-0.02
Government consumption	0.05	0.25	0.48	0.59	0.59
Monetary policy tightening	0.87	1.23	1.24	0.89	0.42
Housing sector LTV proxy	0.59	0.82	-0.02	-0.83	-1.12
Housing sector capital adequacy	1.06	1.81	0.75	-0.47	-1.09
All sectors capital adequacy	1.04	1.97	1.17	0.05	-0.60

Table 17. Change in debt/income ratio

SIMULATION	1 YEAR	2 YEARS	3 YEARS	4 YEARS	5 YEARS
Productivity shock	-0.09	0.19	0.37	0.62	0.91
Government consumption	0.57	0.51	0.49	0.47	0.45
Government consumption	-0.57	-0.34	-0.34	-0.53	-0.88
Monetary policy tightening	2.06	2.77	1.02	-0.05	-1.00
Housing sector LTV proxy	-0.27	-1.60	-3.17	-3.73	-3.48
Housing sector capital adequacy	1.91	1.11	-2.81	-4.28	-4.47
All sectors capital adequacy	2.15	2.04	-1.42	-3.03	-3.70

Appendix 1. The structure and use of the NiGEM model

For a macroeconometric model to be useful for policy analyses, particular attention must be paid to its long-term equilibrium properties. At the same time, we need to ensure that short-term dynamic properties and underlying estimated properties are consistent with data and well-determined. As far as possible, the same long run theoretical structure of NiGEM has been adopted for each of the major industrial countries, except where clear institutional or other factors prevent this. As a result, variations in the properties of each country model reflect genuine differences in data ratios and estimated parameters, rather than different theoretical approaches. The model has been in use at the National Institute since 1987, but it has developed and changed over that time. Some of its development was initially financed by the ESRC, but since 1995 it has been funded by its user community of public sector policy institutions. These currently include the Bank of England, the ECB, the IMF, the Bank of France, the Bank of Italy and the Bundesbank as well as most other central banks in Europe along with research institutes and finance ministries throughout Europe and elsewhere.

Each quarter since 1987 the model group has produced a forecast baseline that has been published in the Institute *Review* and used by the subscribers as a starting point for their own forecasts. The forecast is currently constructed and used out to beyond 2031 each quarter, although the projection beyond 2015 is a stylized use of the long run properties of the model. Since 1998, the model has also been used by the EFN Euroframe group to produce forecasts for the European Commission. Forecasts are produced based on assumptions and they do not always use forward looking behaviour. In policy analyses the model can be switched between forward looking, rational expectations mode and adaptive learning for consumers, firms, labour and financial markets. Policy environments are very flexible, allowing a number of monetary and fiscal policy responses. The model has been extensively used in projects for the European Commission, UK government departments and government bodies throughout the world. It has also contributed to a number of Institute ESRC projects.

Production and price setting

The major country models rely on an underlying constant-returns-to-scale CES production function with labour-augmenting technical progress.

$$Q = \gamma \left[s\left(K\right)^{-\rho} + (1-s)(Le^{\lambda t})^{-\rho} \right]^{-1/\rho} \qquad \text{(A1)}$$

where is Q is real output, K is the total capital stock, L is total hours worked and t is an index of labour-augmenting technical progress. This constitutes the theoretical

background for the specifications of the factor demand equations, forms the basis for unit total costs and provides a measure of capacity utilization, which then feed into the price system. Barrell and Pain (1997) show that the elasticity of substitution is estimated from the labour demand equation, and in general it is around 0.5. Demand for labour and capital are determined by profit maximisation of firms, implying that the long-run labour-output ratio depends on real wage costs and technical progress, while the long-run capital output ratio depends on the real user cost of capital

$$Ln(L) = \sigma \ln\{\beta(1-s)\} - (1-\sigma)\ln(\gamma) + \ln(Q) - (1-\sigma)\lambda t - \sigma \ln(w/p) \quad \text{(A2)}$$

$$Ln(K) = \left[\sigma \ln(\beta s) - (1-\sigma)\ln(\gamma)\right] + \ln(Q) - \sigma \ln(c/p) \quad \text{(A3)}$$

where w/p is the real wage and c/p is the real user cost of capital. The user cost of capital is influenced by corporate taxes and depreciation and is a weighted average of the cost of equity finance and the margin adjusted long real rate, with weights that vary with the size of equity markets as compared to the private sector capital stock. Business investment is determined by the error correction based relationship between actual and equilibrium capital stocks. Government investment depends upon trend output and the real interest rate in the long run. Prices are determined as a constant mark-up over marginal costs in the long term.

Labour market

NiGEM assumes that employers have a right to manage, and hence the bargain in the labour market is over the real wage. Real wages, therefore, depend on the level of trend labour productivity as well as the rate of unemployment. Labour markets embody rational expectations and wage bargainers use model consistent expectations. The dynamics of the wage market depend upon the error correction term in the equation and on the split between lagged inflation and forward inflation as well as on the impact of unemployment on the wage bargain (Anderton and Barrell 1995). There is no explicit equation for sustainable employment in the model, but as the wage and price system is complete, the model delivers equilibrium levels of employment and unemployment. An estimate of the NAIRU can be obtained by substituting the mark-up adjusted unit total cost equation into the wage equation and solving for the unemployment rate. Labour supply is determined by demographics, migration and the participation rate.

Consumption, personal income and wealth

Consumption decisions are presumed to depend on real disposable income and real wealth in the long run, and follow the pattern discussed in Barrell and Davis (2007). Total wealth is composed of both financial wealth and tangible (housing) wealth where the latter data is available.

$$\ln(C) = \alpha + \beta \ln(RPDI) + (1-\beta)\ln(RFN + RTW) \qquad \text{(A4)}$$

where C is real consumption, $RPDI$ is real personal disposable income, RFN is real net financial wealth and RTW is real tangible wealth. The dynamics of adjustment to the long run are largely data based, and differ between countries to take account of differences in the relative importance of types of wealth and of liquidity constraints. As Barrell and Davis (2007) show, changes in financial (dlnNW) and especially housing wealth (dlnHW) will affect consumption, with the impact of changes in housing wealth having five times the impact of changes in financial wealth in the short run. They also show that adjustment to the long run equilibrium shows some inertia as well.

$$\mathrm{dlnC_t} = \lambda(\mathrm{lnC_{t-1}} - \mathrm{lnPI_{t-1}}) + \mathrm{b_1 dlnRPDI_t} + \mathrm{b_2 dlnNW_t} + \mathrm{b_3 dlnHW_t} \qquad \text{(A5)}$$

Al Eyd and Barrell (2005) discuss borrowing constraints, and investigate the role of changes in the number of borrowing constrained households. It is common to associate the severity of borrowing constraints with the coefficient on changes in current income (dlnRPDI) in the equilibrium correction equation for consumption, where d is the change operator and ln is natural log,

Financial markets

We generally assume that exchange rates are forward looking, and 'jump' when there is news. The size of the jump depends on the expected future path of interest rates and risk premia, solving an uncovered interest parity condition, and these, in turn, are determined by policy rules adopted by monetary authorities as discussed in Barrell, Hall and Hurst (2006):

$$RX(t) = RX(t+1)[(1+rh)/(1+ra)](1+rprx) \qquad \text{(A6)}$$

where RX is the exchange rate, rh is the home interest rate set in line with a policy rule, ra is the interest rate abroad and $rprx$ is the risk premium. Nominal short term interest rates are set in relation to a standard forward looking feedback rule. Forward looking long rates are related to expected future short term rates

$$(1+LR_t) = \Pi^{T}_{j=1},\ (1+SR_{t+j})^{1/T} \quad \text{(A7)}$$

We assume that bond and equity markets are also forward looking, and long-term interest rates are a forward convolution of expected short-term interest rates. Forward looking equity prices are determined by the discounted present value of expected profits

Public sector

We model corporate (CTAX) and personal (TAX) direct taxes and indirect taxes (ITAX) on spending, along with government spending on investment and on current consumption, and separately identify transfers and government interest payments. Each source of taxes has an equation applying a tax rate (TAXR) to a tax base (profits, personal incomes or consumption). As a default we have government spending on investment (GI) and consumption (GC) rising in line with trend output in the long run, with delayed adjustment to changes in the trend. They are re-valued in line with the consumers' expenditure deflator (CED). Government interest payments (GIP) are driven by a perpetual inventory of accumulated debts. Transfers (TRAN) to individual are composed of three elements, with those for the inactive of working age and the retired depending upon observed replacement rates. Spending minus receipts give us the budget deficit (BUD), and this flows onto the debt stock.

$$BUD = CED*(GC+GI)+TRAN+GIP-TAX-CTAX-MTAX \quad \text{(A8)}$$

We have to consider how the government deficit (BUD) is financed. We allow either money (M) or bond finance (DEBT).

$$BUD = \Delta M + \Delta DEBT \quad \text{(A9)}$$

rearranging gives:

$$DEBT = DEBT_{t-1} - BUD - \Delta M \quad \text{(A10)}$$

In all policy analyses we use a tax rule to ensure that Governments remain solvent in the long run (Barrell and Sefton 1997),. This ensures that the deficit and debt stock return to sustainable levels after any shock. A debt stock target can also be implemented. The tax rate equation is of the form:

$$TAXR = f(\text{target deficit ratio} - \text{actual deficit ratio}) \quad \text{(A11)}$$

If the Government budget deficit is greater than the target, (e.g. -3% of GDP and target is -1% of GDP) then the income tax rate is increased.

External trade

International linkages come from patterns of trade, the influence of trade prices on domestic price, the impacts of exchange rates and patterns of asset holding and associated income flows. The volumes of exports and imports of goods and services are determined by foreign or domestic demand, respectively, and by competitiveness as measured by relative prices or relative costs. The estimated relationships also include measures to capture globalization and European integration and sector-specific developments. It is assumed that exporters compete against others who export to the same market as well as domestic producers via relative prices; and demand is given by a share of imports in the markets to which the country has previously exported. Imports depend upon import prices relative to domestic prices and on domestic total final expenditure. As exports depend on imports, they will rise together in the model. The overall current balance depends upon the trade balance and net property income form abroad which comprised flows of income on gross foreign assets and outgoings on gross foreign liabilities. Gross National Product (GNP) is gross Domestic Product (GDP) plus net factor income from foreigners.

Appendix 2. New equations for Swedish NiGEM

Addition to credit rate (SDCR)

This allows an extra wedge to be incorporated in the interest rate relevant for house prices to proxy an LTV cap.

```
#  sdcr = sdcr(-1)
```

House prices (SDPH)

As described in the text, real house prices are in an error correction relationship with real personal disposable income, and the long real rate, adjusted for the credit rate as above (sdcr) and the bank spread (sdlendw). There is also a link in the short run to real gross financial wealth and to real household debt.

```
log(sdph)= log(sdced) + log(sdph(-1)/sdced(-1)) -0.3104
+ 0.03*(log(sdrpdi)-log(sdrpdi(-1)))+ 0.5598*(log(sdph(-1)/sdced(-1))
- log(sdph(-2)/sdced(-2))) - 0.0224*(log(sdph(-1)/sdced(-1))-log(sdrpdi(-1)))
- 0.0063*log((sdlrr(-1)/100)+(sdlendw(-1)/100)+sdcr(-1)) +
0.0663*(log((sdnw+sdliabs)/sdced)
- log((sdnw(-1)+sdliabs(-1))/sdced(-1))) + 0.0828*(log(sdliabs/sdced)
- log(sdliabs(-1)/sdced(-1)))
```

Value of personal sector housing stock (SDHW)

This is a technical equation that ensures that housing wealth is adjusted in line with housing investment and house prices.

```
sdhw  = sdhw(-1)*(sdph/sdph(-1))*(1.-.01*0.25)
  + .01*sdph*0.6*(sdih-0.0059*sdy)
```

Private consumption, Mn SEK, 2000 prices (SDC)

The Swedish consumption function in NiGEM is an error correction relationship including real personal disposable income, total wealth (financial plus housing) and the retired share pf the adult population.

```
dsdcrr = dwdcrr*((1.- 0.22145)*(1.-0.037433)*0.00125*sdrr(-1)
            -(1.- 0.22145)*0.00125*sdrr)
log(sdc) = log(sdc(-1)) + 0.0402 + dsdcrr  -  0.074257*(  log(sdc(-1))
 +0.5*sdpopr/(sdpopr+sdpopwa)
 - 0.92266* log(sdrpdi(-1))
- (1.-0.92266)* log((sdnw(-1)+sdhw(-1))/sdced(-1)))
```

```
 +0.03866*log((sdnw/sdced)/(sdnw(-1)/sdced(-1)))
+ 0.10885*log(((sdhw/(0.01*sdced))*100.)/((sdhw(-1)/(0.01*sdced(-1))) *100.))
+sdcliq*log(sdrpdi/sdrpdi(-1))
```

Gross liabilities personal sector, Mn SEK (SDLIABS)

Personal gross liabilities rise in line with personal disposable income and housing wealth.

```
log(sdliabs) = log(sdliabs(-1))
      + 0.1232 - 0.2576*((log(sdliabs(-1))-log((sdpi(-1)-sdtax(-1))))
      - 0.1691*(sdhw(-1)/(sdpi(-1)-sdtax(-1))))
```

Other variable definitions

SDRPDI	Real personal disposable income
SDPI	Personal disposable income
SDTAX	Income tax rate
SDNW	Personal net financial wealth
SDCED	Consumers expenditure deflator
SDY	Real GDP
SDIH	Real housing investment
SDLRR	Real long term interest rate
SDLENDW	Spread between household borrowing and deposit rate
SDPOPR	Retired population
SDPOPWA	Working age population
SDCLIQ	Proportion of population facing liquidity constraints
SDSCRR	Technical variable permitting the effect of indirect taxes on inflation to be removed

Tools and institutions for influencing house prices and household debt

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This chapter discusses alternative tools to the monetary policy rate to prevent developments in house prices and household debt from being a source of macroeconomic shocks. The chapter starts by discussing a number of general considerations relating to the design of the tools. In the light of this a number of tools are then evaluated. For each of them an assessment is made as to how they can counteract shocks and how effective they may be in this respect. We also assess the consequences the tools may have in other relevant respects and the questions that may arise on implementation and application of the tools. Further, we consider how these tools can be coordinated with the monetary policy instruments and their effect on monetary policy and the transmission mechanism. In conclusion, issues concerning the institutional arrangements associated with the tools are discussed.

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Introduction

The ability of households to borrow money for house purchases or for other purposes is a basic prerequisite for a well-functioning economy. At the same time credit provision can entail risks to the economy if it breeds a dynamic in which house prices and debt mutually drive each other up to levels that are unsustainable in the long term. In a situation where the economy is slowing down, house prices can quickly take a downward turn. Falling prices combined with a high level of household debt may in such a situation reinforce the contraction of the economy. One reason for this could be that households are unwilling or unable to sustain the same level of consumption, with a consequent fall in demand in the economy. Another reason is that stability in the financial system may be threatened if the development leads to large losses or funding difficulties for banks and other financial institutions. In both these cases there is a risk that problems will be bigger the more inflated credit volumes and house prices become.

To prevent imbalances in the housing market from resulting in this type of shock there may be reason for authorities to intervene using various types of tools, i.e. regulations, supervision or other policy measures. The monetary policy rate is one such a tool, but as discussed in Chapters III.1 and III.2, its use may be problematic in several respects.

Consequently, this chapter discusses what other tools, apart from the monetary policy rate, can be used to prevent the housing market from being a source of macroeconomic shocks. We also consider how these tools can be coordinated with the monetary policy instruments and their effect on monetary policy and the transmission mechanism. In conclusion, issues concerning the institutional arrangements associated with the tools are discussed.

1. General considerations concerning the design of alternative tools

As a point of departure for the evaluation of individual alternative tools that follows in the next section we first discuss a number of general considerations concerning the design of the tools and the advantages and disadvantages of these considerations. The aim is to produce alternatives to the interest rate weapon that are better suited to the purpose of preventing the housing market from becoming a source of macroeconomic shocks.

1.1 TWO POSSIBLE STRATEGIES FOR COUNTERACTING SHOCKS

There are two strategies that authorities can use to prevent imbalances in the housing market from giving rise to macroeconomic shocks. One is preventive work using tools directed at preventing or moderating excessive hikes in house prices

and debt, i.e. trying to prevent imbalances from arising at all. Another strategy is working with tools that are directed at minimising the shocks that may arise as a consequence of unsustainable price and debt movements, i.e. trying to ensure that the macroeconomic consequences do not become very serious if the economy slows down and imbalances are corrected.[1]

The first case concerns tools to ensure long-term sustainability of credit and price cycles. This can be done either by trying on isolated occasions to dampen excessive rises in prices or credit volumes, or by continuously trying to keep the price and credit cycle stable.

The advantage of this strategy is that imbalances never need to arise or need not be very serious. One condition for the authorities' success is, however, that the tools are really able to counteract imbalances and that this is done without too great a cost to the economy in other respects.

In the second case, the task of the tools is instead to manage the consequences of an unsustainable price and credit cycle. One way may be to ensure *ex ante* that the financial system has sufficient resilience in the form of economic buffers to be able to absorb the losses that may arise as a consequence of mortgage lending. In that way no shocks need ever arise in the economy as a consequence of deterioration in the functioning of the financial system. Correspondingly, the tools can be directed towards strengthening households' resilience, so that they can retain a certain level of consumption even if their income or wealth decrease. Another way can be to use stimulus measures *ex post*, which restore house prices and credit volumes to the trend that is sustainable in the long-term or to take fiscal and monetary policy measures to stimulate general demand in the economy.

The main advantage of this strategy is that it does not require to the same extent that the authorities are able to identify if and when imbalances are being built up. The disadvantage is, however, that it is not directed at dealing with the actual source of the problem, but only its consequences. Remaining passive towards the build-up of an imbalance may be problematical, partly because it can be costly for the Government to take measures afterwards, partly because it is not certain that these measures will have the desired effect. For example, it is conceivable that measures to stimulate household borrowing or consumption will be ineffective in a situation where households, as a reaction to housing market developments, decide to consolidate their own finances by saving and paying off loans.[2]

Making a clear-cut distinction between tools that counteract imbalances and tools that manage their consequences is not, however, very easy. The tools may have both these qualities. A good example of this is the capital requirements

1 See CGFS (2010) for a discussion on the application of these strategies in the framework of financial regulation and supervision.

2 See for example Nyberg (2010) for a discussion that monetary policy in these situations may have considerably less effect than it normally does.

imposed on credit institutions, which partly strengthen banks' resilience to shocks and partly influence household borrowing costs and hence also the development of price and credit cycles. But even if a tool can contribute to fulfilling both strategies, its effectiveness in doing so may vary. An actual example that illustrates this is the dynamic provisioning rules applied in Spain, which functions in a similar way to capital requirements. These rules contributed to strengthening the Spanish banks' resilience in the global financial crisis. On the other hand, the rules do not seem to have had any perceptible dampening effect on the substantial credit expansion that preceded the crisis.[3] This example shows that the risk of excessive increases in price and credit cycles is not automatically eliminated just because it has been ensured that the participants in the financial system have sufficient economic buffers.

1.2 HOW TARGETED SHOULD THE TOOL BE?

The repo rate is a monetary policy tool that affects the entire economy, even if it were to be used to manage development on the housing market. The generality of this tool is one of its greatest drawbacks, so alternative tools should be more targeted towards the market to be corrected in order to prevent or manage imbalances. An open question is, however, the tool's degree of precision.

It may seem obvious that tools should be as precise as possible if the problems are isolated to individual markets, but a tool that is too precisely targeted may have disadvantages. For example, targeted tools can sometimes be circumvented or give rise to the build-up of imbalances in other markets. Such a case would be if the tool limits banks' lending to households and this leads to the banks increasing their lending to other more risky sectors instead. Another risk is that the banks will find alternative ways of lending to households, which in the worst case makes the tool ineffective.[4] However, given that these problems can be avoided, targeted tools are preferable to general tools.

Another consideration is whether the tool should be restricted to trying to influence the market for buying and selling homes or if it should also target those who already own their homes. The repo rate is a tool that reaches everyone who has a mortgage, new as well as existing borrowers. But it is not certain that alternative tools are suitable or even possible to apply to the entire mortgage stock.

1.3 SHOULD THE TOOL BE STATIC OR DYNAMIC?

We noted above that one strategy for the authorities to counteract shocks is to try to ensure that credit and price cycles develop in a sustainable way. To be able to *actively* manage these cycles the authorities must use tools that are **dynamic**,

3 CGFS (2010).
4 See for example Borio (2010) for a more detailed discussion.

i.e. tools that can be varied over time. This is done either to tighten or to stimulate the market, for example by making it more expensive in an expansionary phase for households to borrow money for housing and vice versa in a contractionary phase. The Riksbank's steering of the interest rate is a tool that works dynamically, but its purpose is broader than just influencing conditions in an individual market.

The main advantage of dynamic tools is that they are sensitive to how markets and other factors develop over time and in that way make it possible to actively offset a development that is seen as harmful to the economy. The effectiveness of the tools is, however, dependent on their being based on the "right" indicators, i.e. those that give rise to imbalances, and on it being possible to apply them at the right time.

Static tools, i.e. those that do not change over time, can also to some extent contribute to stabilising price and credit cycles. For example, fixed restrictions on household borrowing may have a price-stabilising effect on the housing market. In the same way stricter capital adequacy rules for banks can help to reduce variations in credit growth. But since the tool is static it cannot actively contribute to eliminating a certain cycle, but only prevent further cyclical effects that would have arisen if it had not been used. The dampening effect also always remains in place, which entails a cost to the economy.

Regarding the second possible strategy the tools can fulfil – minimising the consequences if a price correction in the housing market actually occurs – both dynamic and static tools can be effective. For example, rules that set limits for credit institutions' or households' borrowing contribute to strengthening the resilience of those agents to substantial price corrections. In that way the risk of a price fall leading to financial instability or substantial changes in household consumption also decreases. However, here dynamic tools also have the advantage that they can be changed in response to how the markets and the economy develop, for example by raising requirements for buffers in the banks in good times and reducing them in bad times.

1.4 SHOULD THE USE OF A DYNAMIC TOOL BE AUTOMATIC OR DISCRETIONARY?

Tools that are applied dynamically can either be *discretionary* or *automatic*. Tools are **discretionary** if it is up to a responsible authority to make continuous assessments and on the basis of these assessments decide if measures need to be taken to steer a certain development in a desired direction. The Riksbank's inflation steering using the repo rate is an example of a tool that is based on discretionary assessments. **Automatic** tools are instead based on measures being taken in accordance with one or more pre-determined parameters that do not leave any scope for discretionary decisions by the authorities. A conceivable example of an

automatic tool is a rule that determines how the level of banks' capital requirements is to be adjusted in relation to credit growth in the economy.

Accordingly, automatic tools have the advantage of being predictable. Another advantage is that the automatic functioning removes some of the burden of proof and anguish over the need to make uncomfortable decisions. A disadvantage is, however, that automatic tools reduce precision and can be more indiscriminate than "discretionary" interventions based on assessments of the prevailing situation. Nor is it certain that automatic tools "hit the target", since all types of risks or imbalances are not necessarily seen in the indicators on which the tool is based.

Discretionary tools entail a higher degree of flexibility, since they leave room for authorities to make situation-adapted assessments. A potential problem is, however, that an unsustainable development will not be corrected in time. There is a risk that authorities decide to refrain from acting if the necessity for action is difficult to prove. The fact that discretionary tools are less predictable than automatic tools can also create increased uncertainty on the part of market participants. Such uncertainty can, on the one hand, lead to the tools being unnecessarily restrictive, which may be the case if credit institutions (or households) choose to handle uncertainty about the future regulatory environment by being excessively prudent. On the other hand, uncertainty can reduce the effectiveness of a tool if the market participants have the "wrong" expectations of how the authorities will apply the tool.

One way of dealing with the problems of a fully discretionary application is to make the tool "semi-automatic". The tool can be linked to some type of decision rule, such as the quantified inflation target that currently exists for monetary policy. Also, a formalised decision-making process can be introduced, in which authorities are forced to regularly take a stand on whether measures are necessary and report the reasons for their decision in official publications. In that way the predictability can increase at the same time as the risk of authorities refraining from making uncomfortable decisions is reduced.[5]

1.5 SHOULD THE TOOL BE QUANTITATIVE (ABSOLUTE) OR PRICE-ADJUSTING (INCENTIVE-BASED)?

Further, tools can be quantitative or price-adjusting. Quantitative tools set absolute limits for households or banks and force them to act in a certain way. For example, it may be a matter of introducing rules that set an absolute limit on the percentage of the value of a house that may be mortgaged. Price-adjusting or incentive-based tools instead encourage the agents to restrict their risk taking or otherwise act

5 See for example Bank of England (2009) for a more detailed discussion of considerations of the pros and cons of automatic or discretionary tools ("rules versus discretion").

in a desired way. Instead of setting an absolute limit on households' borrowing, it is conceivable that the authorities would decide to introduce a tax or fee on mortgages.

The repo rate is in this respect price-adjusting, since it raises or lowers households' interest expense. In the academic literature price-adjusting tools are generally preferred to quantitative tools. The main reason is that these tools give the market participants a choice, which also means that the objectives for which the tool is created can be achieved in a more cost-effective way. One problem with price-adjusting tools, however, is that authorities can only influence the outcome but not fully control it. Another problem with price-adjusting tools is that the households that react to price signals are not always the same as those that run the greatest risk of taking on too much debt. A quantitative tool reaches everyone, for better or worse.

2. Alternative tools

Building on these general considerations, in this part we discuss a number of specific tools that could potentially be used to discourage developments in the housing market from being a source of macroeconomic shocks. As has been mentioned earlier, such shocks can be reflected in stability problems in the financial system or through a decline in household demand. For each of the tools we also make an overall assessment of the consequences the tools may have in other relevant respects and issues that may arise when implementing and applying the tools.

There are, of course, several other conceivable tools than those discussed here. The selection is based on the most commonly existing tools internationally and those we have assessed to be most relevant from a Swedish perspective. We have decided to divide these tools into the following categories; tools targeting household debt, tools targeting lending institutions and fiscal tools.

To be able to clearly illustrate the effects of the various tools each section contains a calculation for how the tool affects a stylised household. A comparison is made using the following basic example, which is intended to give a representative picture of a borrowing situation for a normal Swedish household buying a home today. (However, the basic example disregards the maximum loan-to-value ratio that was introduced on 1 October 2010).

BASIC EXAMPLE
A household meeting the following conditions intends to buy a house for SEK 2 million:

- Total disposable annual income of SEK 350 000
- SEK 100 000 available for down-payment
- No existing loans

The household may take out a mortgage of 95 per cent of the house value, 85 per cent of which is a first mortgage loan and 10 per cent a second mortgage loan. The total loan amount is SEK 1 900 000, broken down into a first mortgage of SEK 1 700 000 and a second mortgage of SEK 200 000. They borrow at a variable (3-month) interest rate and for the first year have the following interest and repayment costs (straight amortisation term of 90 and 10 years respectively):

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.6	3 683	1 574
Second mortgage	200 000	10	4.6	767	1 667
Down payment	100 000	5			

The initial monthly expense is about SEK 6 356 per month, after tax relief, of which about SEK 3 115 is interest costs and about SEK 3 241 is amortisations.

2.1 TOOLS TARGETING HOUSEHOLD DEBT

2.1.1 Loan restrictions based on the house value

Internationally the most common method for regulating household debt is to set a limit on the percentage of the house value that may be mortgaged. Such limits exist for example in Canada[6] and Hong-Kong[7]. In Sweden the Financial Supervisory Authority (Finansinspektionen) recently issued a general guideline stating that credit institutions providing credit against residential property as collateral should restrict the loan so that the loan-to-value ratio does not exceed 85 per cent of the market value of the property at the time of granting credit.[8] Lending beyond this limit is not prohibited, but must be granted without using the residential property as collateral. In Norway and Finland the supervisory authorities have recently issued similar guidelines for the banks' lending. In both cases it is stipulated that the loan-to-value ratios may not normally exceed 90 per cent of the market value.

6 Under Canadian law all federally regulated credit institutions must buy loss insurance for mortgages where the loan-to-value ratio exceeds 80 per cent. The borrower may mortgage a maximum of 95 per cent of the property value, i.e. at the time of purchase the borrower must make a down-payment of 5 per cent. You can read more about how the housing market functions in Canada in the Canadian housing observer 2010, Canada Mortgage and Housing Corporation, Ottawa, Ontario, Canada (http://www.cmhc-schl.gc.ca/en/index.cfm).

7 In Hong Kong the limit is between 50 and 60 per cent of the property value. 50 per cent applies to residential property with a value of HK$ 12 million and residential property where the owner does not live in the property personally. You can read more about how the housing market in Hong-Kong functions on the website of The Hong Kong Mortgage Corporation Limited, (http://www.hkmc.com.hk/eng/index.html).

8 Finansinspektionen, FFFS 2010:2.

EXAMPLE: Loan restriction based on the value of the residential property
A rule is introduced that limits the household's loan-to-value ratio to 85 per cent. In other respects the same conditions apply as in the basic example.

A binding limit, i.e. where no borrowing beyond the limit is allowed, means that the household cannot buy a home for SEK 2 million. Instead, they can buy a home for a maximum of SEK 667 000. (The rule requires a 15 per cent down payment, which with the household's SEK 100 000 of own funding enables the purchase of a home worth SEK 667 000. SEK 567 000, or 85 per cent of SEK 667 000, is the maximum loan amount).

A non-binding limit , i.e. where borrowing above the limit is allowed if it does not use the residential property as collateral, makes it possible to buy the desired home. The household's costs will then be as follows:

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.6	3 683	1 574
Unsecured loan	200 000	10	6.5	1 083	1 667
Down payment	100 000	5			

CONSEQUENCES: A binding limit of 85 per cent has a drastic effect on the ability of the household to buy a home. In this example there is a shortfall of just over SEK 1.3 million in financing for the purchase of the desired home. With a non-binding limit the household can buy a home for SEK 2 million. The initial monthly expense, after tax relief, is SEK 6 577. This is an increase of just over SEK 200, compared with the basic example. To the extent the lender requires a faster rate of amortisation of the unsecured loan than 10 years, the differences compared with the basic example will be greater.

Achievement of objectives

A loan-to-value limit may help to reduce the risk of households' over-indebtedness and thereby also to reduce their vulnerability to price falls in the property market. This consumer protection motive underlies the limit recently decided by Finansinspektionen. In other countries the introduction of similar rules was motivated by more macroeconomically related objectives. The limit has been regarded either as a way to promote stability in the financial system or as a complementary tool to monetary policy.

Regardless of the reason for which a limit is applied, it can contribute both to strengthening financial stability and to stabilising the macro economy as a whole.

Firstly, from the financial stability perspective, credit risk in the banks' credit portfolios can decrease if the limits helps to reduce households' financial vulnerability. In that the risks in the financial system decrease, the risk of future macroeconomic shocks arising from stability problems is also reduced.

Secondly, limits on household debt can contribute to more stable price formation in the housing market. Since the rules restrict the capital gearing of households and thereby also the amount of money they can use to purchase homes, price variations on housing may decrease. The lower the loan-to-value limit is set, the greater the price stabilising effect of the limit can be assumed to be. If in addition the limit is applied dynamically, i.e. the limit varies over time, price variations in the housing market can be assumed to stabilise further.

Through the price-stabilising effect of the limit, the risk decreases of house prices becoming a breeding ground for unsustainable credit expansion in which households use the rising values of their homes to take out further mortgages, either for consumption or to buy more or costlier property. If a limit can counteract both excessive price variations in the housing market and an unsustainable build-up of household debt, it will also in this respect contribute to reducing the risk of credit losses in the banking system. With its potentially price-stabilising effect it also helps to stabilise household balance sheets, which from a macroeconomic perspective can be regarded as favourable, since the risk of drastic variations in household consumption can thereby be restricted.

The possibility of dampening excessive credit expansion or hefty swings in house prices using regulation that relates the size of the loan to the underlying asset value should not, however, be exaggerated. Since the limit is set in relation to the value of the property, price developments in the housing market will influence the amounts that households may borrow. If house prices rise, households' credit limits will rise, and vice-versa. The binding restriction will in this case be the value of the asset being mortgaged and not the household payment capacity. Consequently, the credit limit set by the rule will also be affected as prices in the housing market change. For example, a household that is mortgaged up to the limit at the time of purchase can increase its mortgage if the property has subsequently increased in value. (If the limit is 90% then an increase in value of the property of SEK 100 000 will increase the credit limit by SEK 90 000. Alternatively, the same household can sell its home and use the profit as a down-payment when buying a new home. Further capital of SEK 100 000 would make it possible to buy a house that is SEK 1 million more expensive than the household could buy before.) This may fan the flames of a credit expansion and push house prices up further.

Compared with a situation where there are no explicit rules to limit household debt, a loan-to-value limit – as pointed out earlier – could of course help to dampen this type of cyclical variation in credit growth and house prices. The effectiveness of the limit in this respect depends on the level of the limits and if they are allowed to vary over time. Besides this, the method of determining the value of the property is significant. A limit based on the full market value of the house is probably less effective in offsetting cyclical patterns in house prices and credit growth than a limit that is for example based on model-based valuations (on the basis of what is regarded as a long-term sustainable level of house prices.)

But regardless of how the limit is designed as regards levels, valuation etc., it is probable that a static limit is not the most effective instrument to prevent imbalances or drastic price variations in the housing market. This is quite simply because the limit is based on house prices, which in itself may constitute a driving force in building up a debt and price spiral. If the aim of the limit is to manage

price and credit cycles it is important that it can be applied dynamically or is supplemented by other types of tool, such as restrictions on how much households may borrow in relation to their income (see next section).

It can be added here, however, that if the limit is applied dynamically it can in itself give rise to certain inflationary price and credit effects. This could be the case for example if households expect the authorities to tighten limits. Major demand for credit could then temporarily arise when people try to avoid being affected by the expected squeeze. The lending institutions on their part can whip up such a situation by playing on expected credit restraint in their marketing.

Other consequences

A loan-to-value limit puts households that have little capital of their own, such as first-time buyers, at a disadvantage. It should be noted here, however, that this effect can be mitigated if the regulation itself entails a cooling off of housing market prices so that the capital input required is not as great (in kronor) to meet the limit for getting a mortgage.

Implementation issues

If the limit is not binding, in the sense that it entails an absolute ban on borrowing over a given limit, there is a risk that the regulation will not have the effect intended. This is because the effect of the regulation on household debt, house prices and credit growth can be assumed to be small if a large proportion of households decide to take out mortgages in excess of the limit. If such additional borrowing is also at a higher borrowing cost (for example through unsecured loans) a limit may even be counterproductive, because if the credit cost for a given level of debt increases, it also entails greater vulnerability of households to shocks. However, here it must be added that the increased costs entailed by borrowing over the limit give households an incentive not to take on too much debt. It cannot, however, be taken for granted that households will act in accordance with these incentives – either because the price signal is not sufficiently strong or because households simply do not react to the incentives. For these reasons it cannot be assumed that a non-binding limit will have the same effect as a binding limit. Seen in that light, a binding limit may therefore be preferable. Against this it can be said, however, that a binding limit implies a quantitative regulation, which in general is a more costly method of achieving the desired objective. In addition it is doubtful if it is possible to introduce a binding limit that is not easily circumvented. This would in principle require that all lending without collateral is prohibited so as to prevent households from taking out unsecured loans to cover any financing needs beyond the limit.

Even a non-binding limit may be ineffective if households or banks find ways

of circumventing it. For example, a conceivable risk is that household lending moves abroad, either because the borrowers choose to borrow from foreign credit institutions or because the credit institutions themselves start to offer loans from foreign subsidiaries.

Reasonably, a loan-to-value limit can only be applied to new lending. An obvious reason for this is that from a legal point of view it is doubtful, or even impossible, to introduce provisions that retroactively change the terms and conditions of loans already agreed. But even disregarding the legal aspects, it would for several reasons seem to be inappropriate to allow the rule to include existing loans. For example, it would mean that new agreements between the bank and the borrower would have to be signed in cases where the loan-to-value ratio is higher than allowed. In best case this would mean slightly higher borrowing costs for the borrower, since parts of first or second mortgages would have to be replaced by unsecured loans. But it could also mean that a few people would not be allowed to borrow the same amount. If the borrowers have insufficient funds to make up the funding shortfall they would quite simply be forced to sell their homes.

2.1.2 Loan restrictions based on income

A related method for regulating household debt is to set a limit on the debt or borrowing expenses in relation to income. Such limits are applied in several countries, including South Korea, the Netherlands and Hong Kong. In all these cases the limit is formulated so that the household's borrowing expenses (interest and amortisations) do not exceed a certain percentage of the (disposable) income. It is, however, conceivable to design the rules in other ways, for example by stipulating that households' total loan amounts may not exceed a certain percentage of the household's annual (disposable) income.

In Sweden there are no explicit limits to the amount a household may borrow in relation to its income. However, the Swedish regulations stipulate that the lender must carry out a review to establish whether the borrower has the capacity to fulfil his or her obligations under the credit agreement. This includes the lender ensuring that private individuals do not take on too much debt in relation to their income and other economic conditions (payment capacity).

EXAMPLE: Loan restriction based on the value of the residential property
A rule is introduced that limits households' total loans to a maximum of 500 per cent of the household's total annual disposable income. The example assumes that the household has no income from capital or that this may not be included in disposable income. In other respects the same conditions apply as in the basic example.

A binding limit, i.e. in which all loans are included, means that the household can buy a home for a maximum of SEK 1 850 000 (as they have SEK 100 000 in capital and may borrow a maximum of 500 per cent of the disposable income of SEK 350 000, which is SEK 1 750 000).

A non-binding limit, in which only borrowing with the house as collateral is counted in the loan amount, would mean that the household can buy a home for SEK 2 million by taking out an unsecured loan for the borrowing needs in excess of 85 per cent of the house value.

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.6	3 683	1 574
Unsecured loan	200 000	10	6.5	1 083	1 667
Down payment	100 000	5			

CONSEQUENCES: With a binding limit the household cannot buy the desired home costing SEK 2 000 000. The limit implies that the household can buy a home for a maximum of SEK 1 850 000. A non-binding limit would give an initial monthly expense after tax relief of SEK 6 577 instead, i.e. just over SEK 200 more expensive than in the basic example.

Achievement of objectives

A limit based on income has by and large the same qualities as a corresponding limit based on the property value. The limit can help to reduce households' financial vulnerability and thereby also reduce the risks in banks' lending. Potentially it can also help to influence price and credit development, both by having a cooling effect in an expansionary phase and by stabilising development over time.

In the latter respect an income-related limit is probably a more effective instrument than a loan-to-value limit. This is because the parameter that governs household borrowing – income – is more stable over time and varies less than the parameter – price of the property – on which a loan-to-value limit is based. And if the debts are not linked to house prices the problem of price-rises and indebtedness mutually driving each other up in a rising spiral is avoided. In this way the need to apply the limit dynamically is also reduced.

It should, however, be noted that the limit gives different effects depending on whether it is designed as a limit on the *loan amount* or *borrowing expenses* (interest and amortisation). In the former case it is only income that affects the maximum amount a household can borrow. In the latter case interest rate movements and households' amortisation preferences/banks' amortisation requirements are also of significance for the size of the loan.

If the limit is to be used to steer price and credit development it would seem most appropriate to design a limit that is neutral in relation to the interest level in

the economy. Hence, in this respect an amount-based limit is preferable. Such a regulation would mean that changes in the interest rate would not have a direct effect on households' credit limits, which would be the case with a expense-based limit. Another circumstance that favours an amount-based limit is that the loan amount would also be independent of the size of the amortisations. In that way no incentive is created for households to refrain from making amortisations, which must be seen as positive from the financial stability perspective.

Other consequences

An advantage of an income-based limit is that it does not discriminate against households with little capital, such as first-time buyers. On the other hand, the limit may mean that households with low incomes who were previously able to obtain loans no longer can. However, it is difficult to see how this would be a problem, since a basic condition for being able to borrow money at all is that the borrower has sufficient capacity to service the loans. It could possibly be seen as a problem that the limit does not take into account that households with low incomes may have considerable wealth which secures their ability to bear a greater debt than their income justifies. For those households the rule implies that they are forced to invest their wealth in their home against their will.

Implementation issues

An important question that must be decided when introducing an income-based rule is the level at which the limit should be set. There are few examples of countries that apply or have applied a limit that relates the size of households' loans to their disposable incomes. In Sweden this ratio is currently about 170 per cent[9]. Looking only at new lending, however, the ratio is considerably higher. There, over half the households have a debt ratio of over 500 per cent and the ten per cent of households most in debt have a debt ratio of more than 1 000 per cent[10]. A limit of the order of 500 per cent would thus mean a relatively severe constraint on lending and in that way could also help reduce the pressure on house prices.

Another central issue is how the income measurement on which the limit is based should be designed. Households have three types of income – earned income (wages, salaries and other remuneration), transfers (child allowance etc.) and income from capital. Income from capital consists partly of direct return on financial assets, i.e. interest and dividends, and partly of capital gains (realised value changes). A reasonable point of departure is that the limit should be based on the income sources that are stable and provide a reliable flow of income over

9 Sveriges Riksbank, Financial Stability Report 2010:2.
10 Finansinspektionen, "The Swedish Mortgage Market and Bank Lending", February 2010.

time. With the exception of capital gains this can be assumed to apply to all the income types mentioned above. It therefore appears reasonable to formulate an income measurement which includes all types of income except capital gains. Doing this also avoids the problem of borrowers deciding to realise their capital gains to achieve a temporary income effect making it possible to borrow more.

As with a limit based on the value of the property, there is a risk that the desired effects will not materialise if the limit is not binding, i.e. if it allows borrowing above the limit, or if it can be circumvented by households or institutions. A binding rule would in this case mean that no loans over a certain percentage of income would be allowed. Compared with a limit based on the value of the property, a binding rule would be less harmful, since it would not require the same far-reaching restrictions on the type of loan households could obtain. As long as the loans are below the limit, borrowers and banks can themselves decide how the loan terms and conditions should be formulated and the collateral against which the loans can be granted.

For the same reasons as the case of a limit based on the property value, an income-based rule could only reasonably be introduced for new lending.

2.1.3 Amortisation requirements

An alternative to (direct) regulation of the size of household mortgages is to impose amortisation requirements. An amortisation requirement means that households will be forced to pay off all or part of their mortgages within a certain pre-determined period of time.

An amortisation requirement can be formulated in slightly different ways. In its very simplest form it can mean that a maximum period is established for how long the entire loan may run and that amortisations during this period must be made periodically (for example monthly) and of the same amount. Such a straight amortisation requirement over 30 years would mean monthly repayments of just under SEK 2 800 on a loan of SEK 1 million. Provided that the households do not raise further loans the debt stock will decrease successively during the life of the loan.

A conceivable alternative is for the requirements to only cover a certain part of the loan. It may, for example, be a matter of making the amortisations for as long as the borrower's loan-to-value ratio exceeds a certain level. Another alternative is to only establish that the loan must be repaid within a certain period, without stipulating the periodicity of the amortisations. Such a requirement could, however, be circumvented by repaying the entire loan in a lump sum on the end-date of the loan.

There are amortisation requirements in several countries, including Canada and Hong Kong. In Canada all federally regulated credit institutions must take out credit insurance with the Government for mortgages with a higher loan-to-value

ratio than 80 per cent. A requirement for granting such mortgages is that they must be amortised within a maximum of 35 years. This requirement also applies to mortgages that credit institutions voluntarily insure (i.e. loans with a loan-to-value ratio of less than 80 per cent). In Hong Kong the maximum amortisation period is 30 years. Linked to this requirement is also a ban on interest-only periods during the life of the mortgage.

EXAMPLE: Amortisations requirements
An amortisation requirement is introduced stipulating that the first mortgage must be repaid over 30 years (straight repayment). In other respects the same conditions apply as in the basic example.

The household's costs will be:

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.6	3 683	4 722
Second mortgage	200 000	10	4.6	767h	1 667
Down payment	100 000	5			

CONSEQUENCE: The initial monthly expense, after tax relief, is SEK 9 504, which is mainly because the repayment expense increases by just over SEK 3 100 per month compared with the basic example. The substantial increase in the rate of repayment (from 90 years to 30 years) means, however, that the interest costs decrease faster. After the first year the interest cost after tax (given the same interest rate) is down to SEK 2 976 per month (compared with SEK 3 115 initially).

Achievement of objectives

An amortisation requirement gives households reason to restrict their borrowing. The requirement means that the households' immediate mortgage expense will rise, which leaves less room for other expenditure. The limit for how much a household can and may borrow against collateral in the form of residential property is also adjusted downwards, since the households' 'left to live on' estimates are affected negatively by the amortisation expense. In that way an amortisation requirement may be seen as an indirect loan restriction in relation to income (see previous section). An effect of households borrowing less as well as paying off their mortgages is that they reduce their debt and loan-to-value ratios. As the mortgage is paid off, household sensitivity to interest rates also decreases. Taken together, these effects mean that the lending institutions' credit risk decreases, which also reduces vulnerability in the financial system.

In that the requirements affect both borrowing expense and credit limits for households this is also a useful tool to counteract imbalances in price and credit developments, which also benefits financial stability, but potentially also to avoid drastic variations in household consumption. As in the case of the loan restriction based on income, the need for dynamic application of repayment requirements is not as great as with a restriction based on the value of the property. Nevertheless,

there may be reason to adjust the requirements at times of strong fluctuations in the credit cycle, so as to try to prevent shocks in the economy from arising.

Other consequences

Like a loan restriction based on income, an advantage of an amortisation requirement is that it does not affect households with little capital as severely as a restriction related to the value of the home. This is because income, rather than wealth, becomes the crucial factor for the amount that can be borrowed. The group that would "suffer" most from the regulation would be households with relatively low incomes and little capital for a down-payment.

A amortisation requirement means that households can set aside less money for saving in other assets than their home. This means that households' ability to build up an asset portfolio with a balanced composition of different types of real and financial assets is impaired. If all available income after deduction for living and interest costs goes to repay the mortgage the household's assets will consist entirely of the home. This makes them more vulnerable to a fall in house prices than they would have been if they could have saved the funds used for repayment in other types of asset.

Implementation issues[11]

A amortisation requirement that is designed without regard for the borrower's financial position, or the value of the collateral pledged for the loan, risks being unnecessarily restrictive. For example, it is difficult to see any reason for forcing households with low loan-to-value ratios to amortise. Therefore it seems more practical to design a amortisation requirement that targets households with high loan-to-value ratios or high borrowing costs relative to their income. A conceivable alternative is, for example, to prescribe amortisation requirements for loans with a loan-to-value ratio of more than 80 per cent.

While the requirements should not be unnecessarily restrictive, they must be formulated so that they cannot be easily circumvented. If households can, for example, raise new loans to compensate for the amortisations they are forced to make then the requirement is at risk of being ineffective. In the same way the requirement will not fulfil its purpose if it only regulates a final date for when the loan must be repaid. If that were to be the case the requirement could be simply avoided by paying back the entire loan on the maturity date, which can easily be replaced by a new loan. To avoid both these problems the requirements must

11 Finansinspektionen raises the difficulties of implementing a amortisation requirement in its memorandum "Allmänna råd om begränsning av lån mot säkerhet i bostad" (General Guidelines on restricting loans with residential property as collateral).

be designed to require amortisations over the entire life of the loan and that in addition cover all household credit. In practice such a regulation would need to be designed so that no new credit can be granted during the amortisation period, with or without the residential property as collateral. And to introduce a rule that forbids the household to raise any loans at all during the period of repayment seems to be rather a drastic measure. Apart from the fact that curtailment of households' ability to adapt their credit needs over time would probably lead to negative welfare effects, the risk is also great that a black lending market would arise outside the regulated banking sector. In addition, it would also be very difficult, and not least extremely resource-intensive, to monitor compliance with the rule.

Another problem of amortisation requirements is that they can be counterproductive in an economic downturn or crisis. In a situation where households' payment capacity has deteriorated, the amortisation requirement in itself could become a reason for borrowers defaulting on their loans and the loan losses thereby being higher than they would have been if no requirement had existed. In these situations there may be reason to allow exceptions from the amortisation requirement. Regulating when such exceptions may be made is, however, not easy and would also be resource-intensive for the supervisory authority to monitor.

Like previous tools, an amortisation requirement can reasonably only be introduced for new lending. It may, however, be worth pointing out that the economic consequences of an amortisation requirement introduced on existing loans would probably be more severely felt than in the two previous cases. Since a amortisation requirement would entail a relatively large increase in the monthly borrowing expenses it would probably imply a substantial restriction on household consumption. Particularly as this is a cost that households could not have anticipated when they took out their mortgage. If the amortisation requirement is applied dynamically there may, however, be reason to allow any relief on the requirement to also include the existing borrowers on whom the requirement was imposed when they took out a mortgage. This is because in a situation where household finances are strained in an economic downturn, reduced amortisation requirements can contribute to reducing the risk of default among households. By reducing household borrowing expenses, relaxation of the requirements can also provide some stimulus to household consumption.

2.1.4 Risk insurance

One way of handling some of the risks existing in the housing market is to introduce risk-reducing insurance. In several countries there are different insurance solutions that protect the borrower, the lender, or both against price falls or payment difficulties on the part of the borrower. This is often a matter of some form of

arrangement that is over and above the risk management achieved through other solutions, such as for example a loan restriction based on property value.

Various underlying objectives can be differentiated for these insurance schemes:[12]

- *Insurance for social purposes.* These insurance schemes are often arranged by a government agency and generally target certain types of household. For example, these government insurance schemes can target households wishing to buy a home but which for one reason or another find it difficult to obtain a normal mortgage. This may be due to low income, new employment, low equity or a poor credit history. Variants of such insurance schemes can be found for example in Finland, Greece and Hungary, as well as Sweden.[13]
- *Insurance for stability purposes.* These insurance schemes are arranged by both government and private actors internationally and often as a complement to other existing regulation, such as a loan-to-value limit. Most of these insurance schemes aim to transfer part of the credit risk taken on by the lender. In that way these insurance schemes can function as a type of safety valve to enable households that do not fully meet the requirements of the general regulations or the bank's lending practice to obtain mortgages. In Canada such insurance is compulsory if the loan-to-value ratio exceeds a certain limit. In the United Kingdom a lender may require for high loan-to-value ratios that borrowers take out insurance to protect the lender against any losses in connection with forced sales/foreclosure.
- *Insurance for security purposes.* These insurance schemes are often arranged by private actors and aim to allow households the possibility of managing their risks in connection with home ownership. It is often an insurance against price falls, which can for example be a way of eliminating a potential loss if the buyer knows he or she will only be active in the housing market for a certain period.

Loan insurance schemes for stability purposes are of greatest interest as an alternative tool to prevent the housing market from being a source of macroeconomic shocks. Even if these insurance schemes can be designed in different ways, we will only study price-fall insurance in the following.

12 An examination of different international trends in risk insurance has been made by Scanlon and Whitehead (2004).

13 The National Housing Credit Guarantee Board can grant a home purchase guarantee, which is a government guarantee covering interest payments for first-time buyers' home purchases. This guarantee can be seen as insurance for the borrower, who by signing a guarantee with the National Housing Credit Guarantee Board is insured against the risk of losing interest income for a mortgage. This is often also the case internationally. The insurance is mainly for the purpose of protecting the lender against default or suspension of payments by the borrower. In some cases the government guarantees protect the borrower, for example in Belgium (against loss of income) and the Netherlands (against fall in price).

EXAMPLE: Loan insurance against price falls
A rule is introduced stipulating that all loans with a loan-to-value ratios over 80 per cent must be insured against price falls. We look at two cases. In other respects the same conditions apply as in the basic example (the maximum loan-to-value ratio allowed is 95%).

CASE 1. The insurance premium is paid as a lump sum and is 2 per cent of the insured amount (= the entire mortgage).[14] The premium affects how much the household has left for a down-payment. At the same time the insurance means that the entire mortgage amount can be granted as a first mortgage, so the second mortgage loan of the basic example disappears.

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 357 142	95	2.6	2 940	1 257
Down-payment	71 428	5			

The insurance cost is SEK 28 571 for 5 years, which is paid as a lump sum directly from the SEK 100 000 the household has for the down-payment.

CASE 2. The insurance premium is paid monthly and covers only SEK 300 000, i.e. down to a loan-to-value ratio of 80 per cent. The cost is assumed to be 2 per cent of the insurance amount. Also in this case the insurance makes it possible to lend the entire loan amount as a first mortgage.

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 900 000	95	2.6	4 117	1 759
Down-payment	100 000	5			

The insurance cost is about SEK 500/month.

CONSEQUENCES: The consequences are relatively great in Case 1, while they are relatively small in Case 2. In Case 1 the household can only buy a home for SEK 1 428 571, since part of their savings must also cover the insurance cost. This means that they only have just over SEK 70 000 left to use as a down-payment (given that they cannot take out a loan for the premium).[15] In Case 2 the household can buy the same property as in the basic example. The initial monthly expense will be about SEK 5 141 per month after tax relief, given that no stricter amortisation requirements are imposed by the insurance company. Amortising the loan with the insured amount (SEK 300 000) over the insurance period (5 years) would cost SEK 5 000 per month, but a more reasonable assumption is something between this amount and SEK 1 759, i.e. SEK 3 380 per month. The initial monthly expense will then be SEK 6 262 per month, which is about the same expense as in the basic example.

Achievement of objectives

A price-fall insurance requirement for higher loan-to-value ratios contributes to reducing the vulnerability of households and credit institutions to price falls in the property market. If households had such insurance most households forced to sell their homes would be able to pay back their mortgages even if the price fell short of the mortgage amount. This in turn reduces the credit institutions' credit risk.

An insurance requirement may also have an indirect stability-enhancing effect. Insurance companies selling loan insurance will function as a controlling third party to maintain the quality of loan reviews. The issuers of the insurance have

14 We assume in somewhat simplified terms, that the insurance company takes the same premium as the risk premium on the second mortgage compared with the first mortgage, i.e. 2 per cent.
15 If the household can borrow to pay the premium (unsecured loan) the monthly cost will be a couple of hundred kronor more expensive than in Case 2, i.e. almost exactly the same as the basic example.

an incentive to ensure that the loan review is adequate, since they must pay any residual debt if the property is sold at a loss. To insure a borrower the insurer may also impose further requirements that go beyond ordinary regulations and lending practice, for example as regards amortisation or the ability of the borrower to cope with high interest rates. These further requirements in turn strengthen the resilience of both households and credit institutions. If, on the other hand, the insurer does not carry out this controlling function the insurance may have the directly opposite effect. If borrowers do not risk having a residual debt after selling property to the same extent they may take on more risk when borrowing. If the credit institutions do not risk credit losses to the same extent they may be less prudent in their credit reviews.[16]

The strength of the stability enhancing effect also depends on which actors will offer this insurance. A lesson from the crisis is that it is important that the risk that is insured against is really also removed from the credit institutions' balance sheets and is not either too concentrated on one or a few actors that are intimately linked with the credit institutions. If the credit institutions for example have exposures to the actor or actors who insure mortgages not much has been achieved from a stability perspective. It is, therefore, important to have an adequate framework for monitoring systemic risks when there is an insurance solution, not least if the insurers are private actors. One way of reducing such network risks is for the Government to create one such actor, which is common internationally. In that case, however, it is important that the Government is charging premiums that reflect the risk it takes, so that mortgage lending is not subsidised.

If mortgage insurance requirements would have an effect on household debt, and more generally on the price and credit cycle in the housing market, is more difficult to assess. The outcome depends to a great extent on how these insurance schemes are designed and priced, as well as on what further demands the insurance company may impose to insure borrowers.[17] Purely theoretically, however, the effect on price and credit developments should be relatively small as long as the insurance is priced on commercial terms. It is true that the cost of the mortgage itself (the interest), all else being equal, will be lower for an insured borrower than an uninsured borrower. This is because all or part of the lender's credit risk disappears with a price-fall insurance policy. At the same time the risk is transferred to the insurer, who will demand a premium corresponding to what the lender would have taken if the loan had been uninsured. This insurance premium will ultimately

16 For example the insurance schemes can reduce the incentive of credit institutions to obtain and use more qualitative information about the borrower when carrying out a credit review, such as structural use of overdraft facilities and a high percentage of late payments, if the borrower is an existing or former customer.

17 In principle the insurance company could apply its own terms for how much a household may borrow in relation to its income in order to insure the loan.

be paid for by the borrower. Provided that the insurance policy is priced on market terms and paid regularly during the life of the policy the monthly costs of borrowing with or without insurance should be equally great. Thus the effect on credit demand and household debt will also be small. On the other hand, if the insurance cost is taken as a lump sum directly at the time of the mortgage, the household will have a relatively large initial cost, which affects how much the household can spend on a down-payment. If the down-payment amount decreases, the maximum mortgage amount also decreases.[18] There will be an even greater effect if the insurer also imposes stricter amortisation requirements and 'left-to-live-on' estimates to insure the mortgage than the lender would have done.

Other consequences

Regardless of how mortgage insurance schemes will affect the price and credit cycle in the housing market, one consequence of them will be improved consumer protection. But only to the extent that insurance can help households that for one or other reason must sell their home for a lower price than the mortgage amount, for example after a divorce or during a recession. How price-fall insurance will affect households that become insolvent more generally is, on the other hand, an open question. In normal cases credit institutions try to help their customers if they have temporary payment problems, for example by granting a period of grace for amortisation of the mortgage. At present it is in both the borrower's and the credit institutions' interest to have this possibility. But with loan insurance the credit institutions' incentive to use this possibility may potentially decrease when loan losses on forced sales have been substantially reduced. To a certain extent the insurer can require that such solutions must be tried first before a claim on the policy is made, but it is not clear exactly how this would work.

Implementation issues

Introduction of mandatory price-fall insurance is a fairly extensive change in relation to how credit is granted today. Among other things it includes another party in the credit review and the insurance policies may also affect credit institutions' funding. Besides, the supply of these insurance policies is limited in Sweden, at least at present. It will be a political question whether the Government should create such an actor, or if it should rely on private actors being created when regulation is introduced.

A price-fall insurance requirement is also easier to justify if the regulation is introduced together with a loan restriction bases on property value or other similar

18 Given that the loan-to-value ratio of 100 per cent is not allowed (see example). This also assumes that the household cannot borrow to cover the premium.

requirement. This is since it is difficult to justify why households with very low loan-to-value ratios would need to take out insurance. One consequence of only requiring insurance for loan-to-value ratios over a certain level is that it in practice would be equal to having an actual loan-to-value restriction, but where higher loan-to-value ratios are allowed if you take out insurance. In other words, to some extent a loan restriction based on property value will follow automatically if price-fall insurance is required for high loan-to-value ratios.

2.1.5 Fixed rate requirement

The last tool targeting households that we will discuss is a fixed rate requirement. A fixed-rate requirement means that the borrower must borrow at a fixed interest rate for all or part of the mortgage for a predetermined period.

In some countries, such as Denmark and the USA, mortgages are characterised by interest rates being fixed for very long periods. For example, 95 per cent of American borrowers choose to fix their interest rates for 30 years or more. In Sweden, on the other hand, a very large proportion of households have mortgages at variable interest rates or very short fixed interest periods. This is a change that has taken place in a little more than 10 years, from having made up about half of all new mortgages, those with fixed-interest rates of 5 years or more are now just a few per cent. Those who had variable interest rates during this period were able to benefit from the falling trend in interest rates and there is much to indicate that households today attach greater importance to the difference between variable and fixed rates than to other variables, such as income, future interest rates or inflation.[19]

There are two potential problems with this; firstly that households take on an increasing interest rate risk and become more sensitive to interest rate changes, secondly that households tend to borrow heavily when the interest rate is low (see Figure 1).

19 National Housing Credit Guarantee Board (2010).

Figure 1. Credit growth at different interest rates

Source: The Riksbank.

A fixed rate requirement could be designed in various ways as regards the duration of the period rates must be fixed and the share of the loan that must be at a fixed rate. The requirement could be formulated, for example, so that households that mortgage their property over a certain limit (for example 75 per cent) must have fixed rate of the entire mortgage for a period of 10 years.

EXAMPLE: Fixed rate requirement
A fixed rate requirement is introduced stipulating that first mortgages must be at a fixed rate for 10 years. The household's costs will then be:

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	4.5	6 375	1 574
Second mortgage	200 000	15	4.6	767	1 667
Down payment	100 000	5			

CONSEQUENCES: The initial monthly expense, after tax relief, is about SEK 8 240. The household will thus have a higher interest rate cost of about SEK 1 884 per month compared with the basic example. The difference is because a 10-year loan is assumed to have a higher interest rate than a variable interest loan (3 month fixed interest period). If the variable interest rate rises (falls) during the fixed interest period the differences decrease (increase) compared with the basic example.

Achievement of objectives

With fixed interest mortgages households have full control of their borrowing costs and are less sensitive to interest rate changes. A fixed rate requirement would, thus, entail a lower collective interest rate risk for the household sector. It would strengthen households' resilience at interest rate peaks, and mean that fewer would fail to meet their borrowing costs when interest rates are increasing. In that the

short-term interest rate is more volatile than the long-term rates, credit demand can to some extent be levelled out over time.

A fixed rate requirement could also have a certain dampening effect on price and credit development, particularly in periods with historically low interest rate levels and a favourable housing market with a strong price trend. If interest costs are higher, the borrower is given an incentive to avoid high borrowing levels and thus avoid getting into a vulnerable position if something unexpected should happen. A fixed rate requirement could in that way capture some of the borrowers who do not react to housing cost estimates with assumptions of higher interest rates in the future.

Since a fixed rate requirement does not restrict how much households may borrow, nor does it entail the same perceptible effects on household borrowing costs as an amortisation requirement, it is, however, doubtful if the requirement can have any great impact on house prices and credit growth. A fixed rate requirement is therefore primarily to be regarded as a tool to reduce households' vulnerability to interest rate shocks. And as such it is difficult to see any need to apply the requirement dynamically.

Other consequences

For households with large economic margins (high income/large wealth) a fixed rate requirement is not such a good measure, as they will be forced to insure themselves against a risk that they most probably can afford to bear. Another category of borrower who may be negatively affected is people who will borrow or rearrange loans at a relatively high interest rate level. The problem of high interest rates when rearranging a loan could, however, be dealt with by requiring that the interest must be fixed at the same rate for the entire life of the loan. Such a solution assumes, however, that the loan has a fixed amortisation period. For borrowers affected by the requirement, this entails in effect an indirect amortisation requirement.

Another consequence for households is that their borrowing costs will be insensitive to inflation. In periods when inflation and – as a consequence – variable interest rates have risen more than expected, households who fixed their loans earlier will benefit. If, on the other hand, inflation and the variable interest rates are lower than expected, it will instead be a disadvantage to have a fixed rate. In that way households' real borrowing costs may vary much more with fixed rates than with variable rates.

For the banks, a fixed rate requirement would mean a changed interest rate risk. When fixed interest periods on the assets (mortgages) increase, funding must be adapted to retain the same risk level. This can be achieved through longer-term funding or by swapping short-term interest rates to long-term. In both cases the requirement entails a cost to the banks.

Implementation issues

A fixed rate requirement should reasonably be restricted to households that are vulnerable to interest rate shocks. It may therefore be appropriate to link the requirement to the borrower's indebtedness, either in relation to the value of the property or in relation to income.

2.2 TOOLS TARGETING CREDIT INSTITUTIONS' OPERATIONS

An alternative to tools targeting household borrowing is to use tools that instead target the credit institutions' operations. By regulating the economic conditions in these institutions, it is possible to both steer the risk of disruptions in the financial system and to influence the price and supply of credit in the economy and hence also development in the housing market.

2.2.1 Capital requirements

The capital requirements imposed on the credit institutions form a central part of the regulation of the financial system. In Sweden and many other countries these rules are based on internationally agreed standards that stipulate the composition and the minimum level of capital. The amount of capital required is related to the risk in the assets held by the institution, including mortgages. The capital functions as a buffer against losses and by means of the requirements the authorities can regulate the risk of disruptions arising in the financial system. The higher the requirements, the lower the risk of disruptions. In that the capital requirements also affect the institutions' funding costs, adjustments of the requirements can also potentially be used to steer the price and supply of credit in the economy, which in turn has an impact on developments in the housing market. Even if this is not their explicit purpose, the capital requirements can thereby also contribute to steering the price and credit cycle.

Since capital requirements already exist as a tool, the regulatory framework will require amendment to strengthen the ability of the requirements to offset the macroeconomic risks that developments in the housing market may cause. In the light of the lessons learned from the latest financial crisis the international capital requirement standards will be reformed in several important respects. More specifically, the reforms consist of two main parts; a general tightening of existing requirements, where both quality and amount of capital is raised, and the introduction of contracyclical elements into the regulation, for example in the form of obliging banks to hold more capital in periods of strong credit expansion, and vice versa. These reforms do not, however, aim to manage risks arising from the housing market specifically, but are directed at the institutions' operations in general. Nor

are they designed for the direct purpose of counteracting an unsustainable rise in the price and credit cycle, but rather for ensuring stability in the financial system.

To achieve isolated effects in relation to the housing market it is necessary to specifically focus on adjusting capital requirements for mortgages. Since the capital requirements can be calculated in accordance with two different methods, different procedures may be needed for achieving this. For the method in which the institutions calculate the requirements using pre-determined risk weightings (the standardised approach), one alternative is to increase the degree of differentiation in the risk weightings on the basis of how risky the loans are, for example as regards the loan-to-value ratio[20]. Since in this way the borrowing costs increase in proportion to the loan-to-value ratio, households are given the incentive to refrain from excessive indebtedness. For the method in which the institutions calculate the requirements using their own risk models (the internal ratings-based approach) this is not an alternative, since extensive risk differentiation already takes place within the banks' internal models. Here an alternative could instead be to set a floor for how low the risk weightings may be allowed to go. In this way a certain minimum level is ensured for the institutions' capital buffers for mortgage lending. In addition, it may have a certain price effect on housing credit that helps to dampen credit demand. An alternative that is applicable to both models is to raise the capital requirements for mortgages in general. This can lead to higher borrowing costs for housing credit in general, which in that case would probably have a dampening effect on the credit cycle.

EXAMPLE: Tighter capital requirements for mortgage lending
Provided that the stricter capital requirements lead to banks increasing their capital, they will entail increased costs for banks' provision of mortgage lending. Given that these costs will be passed on to customers the lending rates will increase. The extent to which interest rates increase depends on a number of different circumstances, above all the size of the increase in capital requirements and the extent to which costs are passed on to customers. In this example we assume that the lending rate for first mortgages will increase by 0.3 % and that the interest rate for second mortgages will remain unchanged. The same conditions apply as in the basic example.

In this case the household's costs will be:

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.9	4 108	1 574
Second mortgage	200 000	15	4.6	767	1 667
Down payment	100 000	5			

CONSEQUENCES: The household's initial monthly expense, after tax relief, will be SEK 6 654, of which SEK 3 413 in interest costs. Compared with the basic example the household will have a higher interest cost after tax of about SEK 300 per month.

20 This is done to a certain extent already in existing capital adequacy rules.

Achievement of objectives

The credit institutions as a rule hold more capital than the legal requirement. A tightening of capital requirements, generally or specifically for mortgages, would not automatically mean an improvement in the financial system's resilience to shocks. For this to happen the tightening would have to make the institutions increase their capital, either through compulsion or their own choice. In brief, to achieve an actual effect, the formal capital requirement would have to exceed the capital requirements that the institutions (via their financiers) impose on themselves.

As regards the effect on the price and credit cycle, tighter capital requirements for mortgages mean that this category of lending will be more expensive for the banks to provide (assuming they do not have internal capital requirements that exceed the legal requirements). If the banks decide to pass on the increased cost to mortgage customers, interest rates will rise and demand for mortgages will decrease. Tighter requirements can thus be expected to have a dampening effect on the credit cycle and thus also the housing market. The banks could also decide to meet the tighter requirements by reducing their mortgage lending. In that case the credit supply will be negatively affected, which also has a dampening effect.

It should be noted here that the main objective of capital adequacy rules is to strengthen the resilience of the financial system. Even if the requirements can impact price and credit cycles this is not a purpose for which the regulatory framework can be used for. But even if the requirements could also be used for this purpose, there may be circumstances that mean that the effect of tightened requirements on price and credit cycles may not be the one desired. In an expansionary phase characterised by great optimism, household demand for credit may be so strong that the increased borrowing costs (price incentives) entailed by the extended requirements do not have any material effect on lending. It may also be the case that the banks' costs for acquiring capital may be low in an expansionary phase, which may mean that the tightened capital requirements do not lead to any major effect on lending rates.

Changes in capital requirements that only target certain types of lending, in this case mortgage lending, mean that this type of lending will be relatively more expensive for the institutions. A possible consequence of this is that the banks will decide to redistribute their lending to other loan categories, such as unsecured consumer credit or corporate lending. If flows move toward riskier lending, the stability preserving effect an increase in the requirements intends to achieve will be counteracted.

Some alternatives for tightening capital requirements specifically for mortgages have been mentioned above, though a general increase in the requirements, extended differentiation of risk weightings or a floor for risk weightings.

A differentiation on the basis of loan-to-value ratio would make high indebtedness more expensive, which in itself can help to reduce indebtedness and dampen credit and price cycles. However, the fact that capital requirements are dependent on the market value of the properties means that there is a counteracting cyclical effect. If the institutions value their collateral at fair value, rising prices will mean a fall in borrowers' loan to value ratios, which also entails falling capital requirements. In that way capital will be freed up, which the institutions can use to increase their lending. The reverse applies when prices fall. In that way capital requirements help to strengthen rather than dampen credit and price cycles. This effect can be assumed to be greater the more risk differentiated the requirements are.

Introducing a floor for risk weightings in the internal ratings-based approach contributes to ensuring that the banks' capital buffers for mortgage lending are always at a certain minimum level. At the same time, such a floor means a deviation from the principle that capital requirements should be calculated on the basis of historical losses.

Other consequences

Calculation of capital requirements on the basis of historical loss data is a manifestation of one of the most basic principles of capital adequacy rules, which is that capital requirements should reflect as closely as possible the actual risks taken by the institutions. An important reason for this is that the regulatory framework as such should not be a factor for how institutions decide to conduct their lending. Another central reason is that the banks must not be forced to hold more capital than the risks in their operations merit.

If a decision is made to deviate from this principle by introducing capital requirements for mortgages that exceed those indicated by existing risk calculation methods, mortgage lending may decrease (and other types of lending increase). Allowing the regulatory framework to influence credit allocation in this way may, however, be motivated if there is reason to believe that the calculation methods for capital requirements underestimate the actual risks. Another motive could be if the banks' lending creates a negative externality, i.e. that mortgage lending creates risks for the economy that are greater than the risks it entails for the individual bank. Through the capital requirements, but also through other tools discussed, the authorities can try to "price" these externalities so that mortgage lending arrives at a acceptable risk level from an macroeconomic point of view.

An increased differentiation of capital requirements means that households with high loan-to-value ratios will have higher borrowing costs relative to households with lower loan-to-value ratios. In the same way as in the case of a loan restriction related to the value of the property, this can lead to households with insufficient

capital, for example first-time buyers, finding it more difficult to enter the housing market.

Implementation issues

Unlike the previously discussed tools, which reasonably can only be applied to new lending or loans that are rearranged, changed capital requirements will affect the existing mortgage stock. One effect of this difference is that existing owners of residential property are affected in a more immediate way. To the extent the requirements lead to higher lending rates, existing home owners' scope for consumption will decrease, while a loan-to-value limit for example will only have an indirect effect (if it creates prices changes that in turn affect household consumption choices). Changed capital requirements can thus be expected to have a greater influence on demand in the economy than tools that target new lending, since they affect both borrowing costs and asset values for already existing borrowers as well. If the purpose of the tool is to prevent unsustainable development in house prices and borrowing, without at the same time tightening households' "liquidity", tools that target new lending seem to be a more suitable alternative.

The capital requirements are based on internationally agreed standards. Unilateral changes in the Swedish regulatory framework would mean that conditions in the Swedish mortgage market deviated from those prevailing internationally. However, several countries have decided to take this route and apply stricter requirements. In addition, other tools that entail a tightening of mortgage lending would also have an effect on Swedish banks' international competitiveness.

If the capital requirements for mortgage loans are to be applied dynamically, it is important to consider how they should be coordinated with the contra-cyclical capital requirements that will be phased in as of 2016. These will also in fact function so as to enable requirements to vary over time, though not with reference to mortgage lending specifically, but on the basis of the general credit trend in the economy. To avoid two different dynamic capital requirements, a reasonable approach would be to design the contra-cyclical capital requirements so that it is not only possible to activate them when credit expansion in the economy as a whole is high, but also when lending rises sharply in individual sub-markets, such as the mortgage market.

2.2.2 Reserve requirements for mortgage lending

Within the framework of its operations the Riksbank can impose reserve requirements on the banks. These requirements could be used as an instrument to influence the banks' mortgage lending and thus also price and credit growth in the housing market.

A reserve requirement works so that the banks are forced to deposit a certain amount of funds with the Riksbank. The reserve requirement is calculated as a percentage (reserve requirement ratio) of an item (base) in the bank's balance sheet. The Riksbank decides the base on which the requirement is to be calculated, as well as the interest compensation payable on the deposited funds. By introducing a minimum reserve requirement using the banks' mortgage lending as a base, and paying a lower interest rate for this than the interest the banks must pay to acquire these funds, the requirement will in practice function as a tax or fee on mortgage lending. To the extent this cost is added to the banks' lending rates the reserve requirement will have a dampening effect on credit demand.

EXAMPLE: Reserve requirements for mortgage lending
The Riksbank applies a reserve requirement where the base consists of mortgage loans and where the reserve requirement ratio is set at 20 per cent. If the difference between the interest compensation paid by the Riksbank and the bank's borrowing costs is 2 per cent, the bank's costs for mortgage lending will increase by 2*0.2=0.4 per cent. If this cost is added to the lending rate for the mortgage the household's costs will be as follows (we assume that only first mortgages are included in the base for the minimum reserve requirement):

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	3.0	4 250	1 574
Second mortgage	200 000	15	4.6	767	1 667
Down payment	100 000	5			

CONSEQUENCES: The household's initial monthly expense, after tax relief, will be SEK 6 753, of which SEK 3 512 in interest costs. Compared with the basic example the household will have a higher interest cost after tax of about SEK 400 per month.

Achievement of objectives

A reserve requirement that is applied like this is primarily aimed at influencing banks and borrowers in such a way as to reduce lending for housing. The increased costs entailed by the requirement require that the banks raise their lending rates if they want to maintain their profit margins. However, increased lending rates have a dampening effect on household demand for mortgages. If for some reason the banks cannot compensate themselves for the costs through higher lending rates then household demand for credit will not be affected. On the other hand, the banks' propensity to lend money for housing may decrease, which in that case leads to a reduced supply of mortgages. Regardless of whether the increased costs lead to reduced demand or reduced supply, the reserve requirement will have a dampening effect on the price and credit cycle.

Through its effect on the price and credit cycle the reserve requirement reduces the risk of the housing market being a source of shocks in the financial system. However, the requirement does not entail any direct strengthening of the banks'

resilience in the way that tightened capital requirements do, which create greater buffer capital held by the banks.

An attractive quality of a reserve requirement is that it probably gives more accurate price control of loans than increased capital requirements. The effect of capital requirements on mortgage interest rates depends on several different factors over which the authorities have no immediate control. These include the banks' capital costs and internal capital allocation models. The effect of a reserve requirement on mortgage interest rates is, however, probably more direct and controllable, since the cost is depends on factors that the Riksbank itself decides (size of the reserve requirement ratio, interest compensation for the reserves and the borrowing rate for financing the reserve requirement).

A condition for the effectiveness of minimum reserve requirements in restricting a certain category of lending is, however, that the banks decide to pass on the costs to that particular lending category. If the Riksbank decides to introduce a reserve requirement for new mortgage lending and the banks transfer this cost to a wider circle of borrowers, for example also to existing borrowers, the effect will be less on the loan category targeted by the measure, while at the same time an unwanted price effect arises for other loan categories.

Implementation issues

Under the Sveriges Riksbank Act[21] a reserve requirement may only be introduced for monetary policy purposes. Consequently, strictly speaking a reserve requirement cannot be introduced if mortgage lending is only regarded as a risk to the stability of the financial system. At the same time, however, the government bill supporting the Riksbank Act states that there may be situations in which a crisis in the payment system threatens to jeopardise the price stability objective. In such situations, monetary policy tools may be used with a view to avert a crisis. In a wider sense then, it is possible to justify the use of a reserve requirement to manage stability problems, provided that the problems could ultimately threaten price stability. Reserve requirements cannot, however, be used for the isolated purpose of promoting financial stability. In a communication to the Riksdag, the Riksbank has stated that an analysis should be made of whether the Riksbank should be given special tools, such as reserve requirements, that may be used solely for the purposes of stability[22].

The Riksbank itself determines the base for the reserve requirement. Thus there are no legal obstacles to applying the minimum reserve requirement to the existing stock of mortgages as well. As argued in earlier sections, however, tools targeting

21 Sveriges Riksbank Act (1988:1385).
22 2009/10:RB4, Submission on certain areas that require investigation as a result of the financial crisis.

new lending are more efficient if the objective is to affect price and credit growth. Since it is primarily for this purpose that minimum reserve requirements can be used it is therefore also natural to restrict the application to new lending.

One condition that enables minimum reserve requirements to fulfil the purpose of managing mortgage lending is that the lending institutions do not find ways of circumventing the requirements. It is important to ensure that lending is not moved to institutions that are not subject to the requirements or that the institutions choose other forms of lending to avoid the requirements.

2.3 FISCAL TOOLS

Taxes and fees constitute a further category of tools that could be used to affect developments in the housing market. In the very widest sense most fiscal instruments that target households or credit institutions can be significant for the housing market. For example, a change in income tax impacts households' purchasing power and thus also potentially their demand for housing. Here, however, we have decided to restrict the discussion to fiscal instruments that may be assumed to have a more direct impact on the housing market.

In Sweden there are no fiscal tools for the specific purpose of steering price and credit growth in the housing market. Nor does there seem to be any international example of taxes or charges with this express purpose. However, both in Sweden and other countries there are many different rules for taxes and fees that affect the housing market and households' propensity to borrow money for housing.

For Sweden, the housing market includes both transaction taxes in the form of stamp duties and capital gains taxation on the sale of housing, and taxation of housing assets in the form of a municipal real estate charge. One tax rule that is not linked to housing transactions or housing ownership, but nevertheless has great importance for the housing market, is the possibility of households to obtain tax relief on the interest expense for their loans.

A conceivable alternative is to use these rules as a tool to ensure sustainable development of house prices and debt. Another alternative is to develop new tax and fee instruments with the same purpose. These could be for example the introduction of a special tax or fee on household debt, either for all types of debt or specifically for mortgages. With the help of such a tax it would be possible to steer household credit demand. If the tax was also applied dynamically it would be possible to use it as an instrument for active stabilisation of price and credit cycles.

EXAMPLE: Abolished tax relief on interest
Abolition of tax relief on interest means the household must bear the entire interest cost itself. The household's cost will be as follows:

FINANCING	AMOUNT (SEK)	SHARE OF TOTAL (%)	INTEREST RATE (%)	INTEREST COST (SEK/MONTH)	AMORTISATION (SEK/MONTH)
First mortgage	1 700 000	85	2.6	3 683	1 574
Second mortgage	200 000	10	4.6	767	1 667
Down payment	100 000	5			

CONSEQUENCES: Without tax relief the initial monthly expense will be SEK 7 691 per month. The interest cost of SEK 4 450 is SEK 1 335 higher than the basic example in which the tax relief on interest is allowed. The higher the interest rate, the greater the difference the tax relief on interest will make. A three per cent higher interest rate on first and second mortgages gives a monthly cost that is SEK 2 760 higher if the tax relief on interest is not allowed.

Achievement of objectives

All the taxes and fees mentioned could potentially be used both for influencing price formation in the housing market and for dampening households' credit demand and indebtedness. For example, abolition of tax relief on interest would most probably lead to considerable weakening of household credit demand, which would also have a cooling effect on house prices. In a similar way, higher stamp duties and capital gains taxes or increased real estate charges would have a price-dampening effect.

Since the emergence of harmful imbalances in the housing market in most cases is credit-driven, a reasonable point of departure is that the tools should be directed at household debt. Of the rules mentioned above, only tax relief on interest and special taxation of household debt would thus qualify as appropriate tools.

As regards their effects, the differences between these two alternatives are small. Introducing taxation of all household debt would even be an identical measure to reduced or abolished tax relief on interest, which makes it difficult to see the need of introducing such a tool instead of reforming an existing rule. Taxation that only refers to mortgages gives a more targeted effect in the housing market. The problem of such a rule is, however, that it discriminates lending for housing in favour of other types of lending.

Changed tax relief on interest (or a debt tax) is purely a price-adjusting tool. Unlike a binding loan-to-value limit it sets no absolute limits on how much households may borrow, but instead affects credit demand by influencing the cost of the loan. In this respect it works in the same way as capital requirements. An important difference is, however, that changed tax relief rules do not affect credit supply in the same way as capital requirements can, if the banks decide to meet changed requirements by increasing or decreasing their lending volumes. Another difference is that tax relief on interest does not strengthen the banks' resilience in the same direct way as increased capital requirements. Tax relief on interest is then

more to be regarded as a measure to stabilise price and credit cycles rather than a direct way of strengthening stability in the financial system.

In the same way as changed capital requirements, changed tax relief on interest affects the existing stock of mortgages. As discussed in the section on capital requirements, this means that existing home owners are affected in a more immediate way than would be the case with a loan-to-value limit or other tools that reasonably can only target new lending. However, it is probable that these effects will be even greater with changed tax relief on interest, since in the matter of capital requirements it is uncertain to what extent a tightening would really lead to rising lending rates and hence reduced scope for consumption for households. Reduced tax relief on interest would, on the other hand, without doubt lead to increased borrowing costs for households. As was established earlier, it may be redundant to tighten households' "liquidity" in this way if the goal is only to counteract unsustainable development of house prices and debt. For this purpose, tools that target new lending are a more appropriate alternative.

For existing borrowers, changed tax relief on interest means increased interest cost which they could not take into account or predict at the time of taking the loan. For borrowers with small margins this may be particularly problematic, since the conditions for bearing the loan deteriorate if the tax relief decreases.

Other consequences

Even if adjustments to tax relief rules were to be an effective tool to counteract imbalances in the housing market it is important to point out that this, like other already existing taxes and fees, was not created for this particular purpose. Adjusting the rules to make them into a policy instrument for housing market developments risks undermining the primary purpose of the rules and thereby giving rise to unwanted fiscal and macroeconomic effects. In addition, tax relief on interest and capital gains taxation on housing is an important part of the Swedish framework for taxation of capital. Making changes that only refer to individual sectors or classes of assets would cause asymmetries in the tax system which may possibly be regarded as inappropriate.

The alternative, to develop new fiscal tools, would mean refining and increasing clarity regarding the goals of such instruments. This does not mean, however, that conflicts of interest with existing fiscal instruments would be eliminated. If, for example, taxation of household debt was introduced it would be the same thing in principle as reducing or abolishing tax relief on interest. Apart from the fact that this would fully or partly neutralising the intended purpose of tax relief on interest it would also mean – as mentioned above – that asymmetries would arise in the tax system.

Implementation issues

An aspect that must be considered when using fiscal instruments to steer development on the housing market is that only the Riksdag can make decisions on taxes. This means that it is not possible to delegate decision-making powers to an agency that can make the decisions independent of political considerations.

2.4 CONSIDERATIONS IN SUMMARY

The analysis above was made on the basis of which tools, apart from the monetary policy rate, can be used to prevent the housing market from becoming a source of macroeconomic shocks. As described initially, there are two main strategies for preventing such shocks from arising. Either the authorities can try to steer house prices and credit so that imbalances in the housing market never arise, or they can ensure that there is sufficient resilience in the financial system (and households) to prevent such shocks arising if – or when – imbalances are adjusted.

As regards steering price and credit development, most of the tools can be effective - though to a greater or lesser extent. Of the tools that have a price-adjusting effect changed tax relief on interest is probably the most effective. This is because it has a direct effect on household borrowing costs and in addition affects all households with loans, regardless of the size of the loan, wealth or incomes. A reserve requirement based on mortgages can also be expected to have a fairly direct impact on banks' mortgage rates and thus also household borrowing costs. A condition for the reserve requirement to be effective is, however, that the banks decide to pass on the costs of the requirement to the borrower category the requirement refers to.

Provided that they are binding (i.e. function as quantitative restrictions) tools that restrict the size of loans or the amount that must be amortised are expected to have a good ability to influence price and credit growth. The strength of this type of tool is that it can have a stabilising effect over time without necessarily needing to be applied dynamically. If the loan restrictions are not binding (in the sense that households on certain premises can take out mortgages over the limits) they will instead have price-adjusting properties. The effect they then have on price and credit growth will, like other price-adjusting tools, depend on how household borrowing costs are affected. Compared with tax relief on interest and a reserve requirement, however, the loan restriction tools' impact on borrowing costs is more indirect and thus also more difficult for authorities to control with any great precision.

Fixed rate requirements, risk insurance and capital requirements are probably less effective tools if the goal is to control price and credit cycles. Fixed rate requirements can certainly have a dampening effect when introduced, but it is

difficult to see how they could contribute on a more continuous basis to more stable price and credit development. Depending on how they are designed, risk insurance schemes can also have a cooling effect, but since they neither restrict borrowing volumes nor raise costs for borrowing (at least from a theoretical perspective) the effects would probably be limited. That a capital requirement is regarded as a less effective tool is because it is uncertain what impact changed requirements de facto would have on the banks' lending rates, and thus also household credit demand. It can be added here that capital requirements in the present situation cannot – or at least are not intended to – be used for the isolated purpose of influencing house prices or credit stocks (even if they have such an effect indirectly).

A shared feature of capital requirements and tax relief on interest is that they (probably) cannot be restricted to only cover new lending. This is unlike other tools that either can or must be restricted to only cover new loans and loans being rearranged. This speaks in favour of the latter category of tools, since rules that cover the entire loan stock have a tightening effect on all households, which does not appear to be necessary if the intention is to influence prices and credit.

As regards the ability to strengthen the resilience of the financial system, then capital requirements constitute the most direct way of achieving this. In that the banks' economic buffers increase, the risk of macroeconomic shocks arising as a result of stability problems decreases. All the tools that target household debt also contribute to strengthening the financial system's resilience, though in a more indirect way. In that the rules contribute to reducing households' financial vulnerability, credit risks in the banks also decrease. Nor do changed tax relief on interest or reserve requirements have any direct effect on the resilience of the financial system, in the sense that they strengthen the banks' financial buffers. To the extent they contribute to a more stable price and credit development, however, the vulnerability of the financial system and of households will decrease.

As regards implementation of the tools, the difficulties are greatest for amortisation requirements. A repayment requirement would probably require severe restrictions on households' ability to borrow so that the requirement cannot easily be circumvented.

Even as regards the other tools, there are certain central implementation issues to consider. The choice between quantitative or price-adjusting rules is an important such issue. On the one hand, it can be both difficult and costly to introduce absolute restrictions on household debt. This applies above all to a loan restriction based on the value of the residential property, which in principle would require a ban on borrowing without the residential property as collateral. On the other hand, the question is whether rules that do not entail an absolute restriction give sufficient price incentives to influence household debt. If they do not then there is a risk instead of the tool being counterproductive.

Another implementation question concerns whether the tools can and should be applied dynamically. In the matter of price-adjusting tools, such as reserve requirements, dynamic application is more important than for quantitative tools, such as binding limits for household debt. This is because households' reactions to the incentives a price-adjusting tool gives can vary over time. A tool that raises borrowing costs can – depending on how household preferences develop – have a major effect in one period and a minor effect in another period. Since a quantitative tool sets absolute limits on households' actions, shifting preferences are of lesser importance. Stabilising effects on prices and credit can therefore probably be achieved even without applying the tools dynamically. But dynamic application may also be needed for quantitative tools. This mainly applies to the alternative of restricting households' debt in relation to the value of the residential property.

2.5 MONETARY POLICY CONSEQUENCES OF THE TOOLS

In this section we look more closely at how the alternative tools affect monetary policy. By monetary policy we mean changes in the Riksbank's policy rate and interest rate path. We endeavour to answer two questions:

1. How do the tools affect the impact of monetary policy on the real economy and inflation (the transmission mechanism)?
2. How does dynamic use of the tools interact with monetary policy? Will a tightening of the tools strengthen or weaken the effects of a change in the interest rate?

Monetary policy operates through different channels (see for example Hopkins, Lindé and Söderström, 2009). We will focus here on the demand channel, particularly the effects of monetary policy on household demand. The other channels of monetary policy, such as the exchange rate channel or the channel to corporate demand are affected to a small extent by the alternative tools.

The analysis is qualitative. Hence we only try to identify how the tools may conceivably affect the impact of monetary policy. We make no attempt to quantify. Several of the tools operate in different directions, and in that case to be able to say anything about the total effect a quantitative model is required.

2.5.1 Effects on the transmission mechanism

Tools targeting household debt

Several of the tools targeting household debt entail setting a limit for how much households may borrow. Binding rules for how much households may borrow in relation to the value of their residential property or their income are examples of

such direct limits. Repayment requirements also function indirectly as such a limit. In the absence of a limit on how much households may borrow, they can freely change their borrowing and savings when interest rates change to achieve their desired consumption. At first glance, tools that set a limit on how much households may borrow should thus reduce the sensitivity of household consumption to interest rate changes. A reasonable conclusion then would be that monetary policy impact on household consumption will decrease.

But several of the tools targeting household debt imply that the limit for how much households can borrow in kronor will change when interest rates change. For example, the limit in kronor will change if the loan restriction is stated as a percentage of the house price, and the house price changes when there is a change in the interest rate. The effect of the tools on the transmission mechanism will therefore be more complicated, and it is even conceivable that the sensitivity of household consumption to interest rate changes will increase when tools restricting loans are introduced. That is why it is important to differentiate between tools where the loan limit in kronor is affected by the interest rate and tools where the limit in kronor is not affected by the interest rate.

The analysis of the transmission mechanism and tools targeting household debt will be simpler if we first define some simple concepts that describe the effects of an interest rate change on household consumption.[23] As tools targeting household debt in principle only affect households that borrow, we only study the effects of an interest rate change on households that borrow. We differentiate between two effects.

- **The income effect:** When the interest rate is cut, the interest costs fall for a given loan. Households with loans thereby have more over for consumption. The reverse applies when the interest rate goes up.
- **The substitution effect:** When the interest rate is cut, consumption today is cheaper in relation to consumption later. Households tend therefore to consume more now in relation to later. The reverse applies when the interest rate goes up.

To make the analysis as simple as possible we only look at absolute requirements. For example, we will assume that different loan restriction rules are absolute in the sense that it is not possible to borrow in excess of the loan limit. In reality, however, it may be possible to borrow in excess of the loan limit, but at a higher borrowing cost.

23 By "consumption" is meant household demand in a wider sense, including households' real investment demand. "Interest rate" here refers to the real interest rate, since this determines households' demand in real terms.

A **loan restriction based on the value of the residential property** gives lower household indebtedness, provided that the requirement is binding for some households. By "binding" we mean that a household would want to borrow an amount over the limit. With lower indebtedness the income effect of interest rate changes will be weaker for households that have loans, since a smaller mortgage loan amount means that a given change in the repo rate would mean a smaller change in interest costs (interest multiplied by the size of the loan). In isolation this indicates that the effects of an interest rate change will be weaker with a loan restriction than without it.

If house prices are not affected by changes in monetary policy, a loan restriction based on the value of the property would mean that there is a fixed upper limit in kronor for how much a household may borrow. With such a limit parts of the substitution effect are disconnected. Households that already borrow to the upper limit may not borrow more if interest rates fall. For households that borrow less than the limit, the limit may mean that they cannot increase their borrowing as much as they would have wanted when the interest rate was cut (see example 1). However, when the interest rate is increased, the limit has no significance for the substitution effect as the limit only determines the maximum amount that can be borrowed.

EXAMPLE 1. Household whose consumption becomes less sensitive to interest rate cuts under a loan restriction based on the value of the residential property

We assume in this example that house prices are not dependent on the interest rate. Changes in the interest rate will therefore not influence the upper loan limit. We look at a household that owns (or will buy) a residential property for SEK 2 000 000 and has its own capital of SEK 300 000. This means a mortgage loan of SEK 1 700 000. This household has (or will have) a loan-to-value ratio of 85 per cent (17/20). If the interest rate is 5 per cent the household's interest expense will be SEK 85 000 per year (we disregard tax relief). If the interest rate is cut to 4 per cent the annual interest expense falls by SEK 17 000. The household can then increase its borrowing by SEK 425 000, but will have the same annual interest costs as when the interest rate was 5 per cent and the loan was SEK 1 700 000. But with a rule that restricts the mortgage to 85 per cent of the value of the property the household cannot increase its loan (as long as house prices are unchanged). The only effect of the lower interest rate is that the household will have more money left over every month. In that way the household's demand cannot increase as much as if there was no loan restriction.

House prices tend, however, to change with the interest rate, and when house prices change, the limit for how much households can borrow in kronor change.[24] For example, a loan restriction of 85 per cent will mean that a house worth SEK 2 000 000 can be mortgaged for SEK 1 700 000, while the same house can be mortgaged for SEK 1 870 000 if it is worth 10 per cent more (SEK 2 200 000). If the house prices change a lot when the interest rate is changed, the limit in kronor will also change a lot with the interest rate. This may give an extra push to the substitution effect. Example 2

24 According to the model calculations in Chapter II.1 the effects of interest rate changes on house prices may be small.

shows how this can happen. In the example, household consumption becomes more sensitive to cuts in the interest rate if there is a loan restriction based on the value of the residential property than if there is no such restriction.

EXAMPLE 2. Household whose consumption becomes more sensitive to interest rate cuts with a loan restriction based on the value of the residential property

We look here at a household that owns a home and has a mortgage on that property. If there is no loan restriction the household borrows SEK 1 850 000 when the interest rate is 5 per cent, and SEK 1 900 000 when the interest rate is 4 per cent. In that way an interest rate cut from 5 to 4 per cent will lead to an increase in the loan amount of SEK 50 000 in the case without a loan restriction (see the table below). We assume that the entire increase in the loan amount is used for consumption.

Assume now that there is a rule that restricts the loan amount to 85 per cent of the value of the residential property. Assume further that the property is worth SEK 2 000 000 if the interest rate is 5 per cent, and SEK 2 100 000 if the interest rate is 4 per cent.[25] In that way the household can borrow a maximum of SEK 1 700 000 when the interest rate is 5 per cent, and SEK 1 785 000 if the interest rate is 4 per cent. Thus, an interest rate cut from 5 to 4 per cent will lead to an increase in the loan amount of SEK 85 000 in the case with a loan restriction. A cut in the interest rate from 5 to 4 per cent will then have a greater effect on the household's consumption with the loan restriction than without it.

Value of the residential property and mortgage amount with and without a loan restriction[1]

INTEREST	VALUE OF THE RESIDENTIAL PROPERTY	LOAN AMOUNT WITHOUT LOAN RESTRICTION	LOAN AMOUNT WITH LOAN RESTRICTION[1]
4 per cent	2 100 000	1 900 000	1 785 000
5 per cent	2 000 000	1 850 000	1 700 000
Difference	100 000	50 000	85 000

1 Loan restriction in which the loan amount may not exceed 85 per cent of the value of the residential property.

In example 2 we see the effects of a *reduction* in the interest rate. The effects of an *increase* in the interest rate depend on whether the rule only applies to new loans or if it also covers existing loans. If the rule only applies to new loans, the rule has no significance for the effect of an increase in the interest rate for households that already have mortgages. These households can choose freely if they want to retain their loans or reduce them in the same way as if there was no loan restriction.[26] We can thus summarise by saying that if the loan restriction only applies to new loans it will mainly affect the impact of an interest rate cut. If, when there is an interest rate cut, the transmission mechanism becomes stronger or weaker with the loan restriction will depend on the percentage of the population who borrow

25 A five per cent increase in house prices as a consequence of a cut in the repo rate of one percentage point is relatively high, see chapter II.1 "A macroeconomic analysis of house prices" in this report.

26 For households that save up their own capital to buy a home the rule may, however, have significance for the effect of an increase in the interest rate even if it only applies to new loans. When the interest rate goes up, households that save up a cash down-payment do not need to save as much as before, as a higher interest rate means greater interest income and lower house prices and therefore lower cash down-payment requirements for a given residential property. For these households consumption may be more sensitive to a rise in the interest rate if there is a loan restriction for new loans than if there is no such restriction.

and the proportion of them who are subject to the limit.[27] It also depends on how much house prices and hence the limit changes when interest rates are cut.[28] Our assessment is that many households must be subject to the limit and house prices must be very sensitive to interest rates for the transmission mechanism to be stronger with a loan restriction based on the value of the property (for new loans) than without such a restriction.

If the limit is also applied to existing loans, the impact on household consumption of interest rate increases can also be affected; this is because households with existing loans must repay parts of their loans if house prices fall so much that the limit becomes binding. The transmission mechanism could therefore be stronger with a rule that applied to all loans than if no such rule existed. As pointed out earlier it is, however, unrealistic to contemplate a rule that applies to anything other than new loans.

Wallentin and Sellin (2008) make a quantitative analysis of the effects on the transmission mechanism of a loan restriction based on the value of the property. They find that the transmission mechanism becomes stronger when the rule is stricter. We believe, however, that this conclusion is due to two relatively unrealistic assumptions in their analysis: (i) The restriction applies to all loans (new and existing). (ii) 20 per cent of households in the economy borrow to the upper limit. In Sweden this applies approximately to new lending, but for all (existing and new) mortgages the figure is considerably lower. In addition many households do not have any mortgages at all.

Loan restrictions based on household income can be formulated in two ways, either by restricting the loan amount to the income or by restricting the borrowing expenses (interest and repayments) to the income.

When restricting the loan amount the limit for how much households may borrow is not affected by the interest rate. This is because households' incomes are only affected to a small extent by changes in interest rates. That is why the rule functions more as a pure and fixed loan limit in kronor. The income and substitution effect of a change in interest rate will be weaker than if the rule did not exist. The transmission mechanism, and in particular the effect of interest rate cuts, will therefore be weaker with the rule than without it.

27 In reality there will be an upper limit for how much a household may borrow even when the authorities have not set an upper limit. Among other things the banks often require a certain cash down-payment, which in reality means that a limit is set for how much a household may borrow as a percentage of the property value. Requirements imposed by the authorities that reduce this limit will mean, however, that more households encounter a loan restriction.

28 According to the model calculations in the chapter II.1 of this report, a change in the repo rate of one percentage point will give a change in house prices of between 2 and 5 per cent. With such small effects it may be reasonable to assume that the limit for how much households may borrow in kronor will not change very much with the interest rate.

With a rule that is based instead on borrowing expenses (interest rates and repayments) the limit for how much households may borrow will depend very much on the interest rate. If the interest rate is cut, interest expense decreases for a given loan amount, which directly enables an increased mortgage. It can give an extra push to the substitution effect in the same way as for a loan restriction based on the value of the property when the value of the property is very sensitive to changes in the interest rate (example 2). Here too we can summarise by saying that if the loan restriction only applies to new loans it will mainly affect the impact of an interest rate *cut*. If the restriction is also to apply to existing loans the impact on household consumption of interest rate *increases* can also be affected. If when there is an interest rate cut the transmission mechanism becomes stronger or weaker with the loan restriction will depend partly on the percentage of the population who borrow and the proportion of them who are subject to the limit.

An **amortisation requirement** can be compared to a loan restriction based on borrowing expenses. As households must have something left to live on after paying their borrowing expenses, household income minus the left-to-live-on amount will implicitly define an upper limit for borrowing expenses as a percentage of income. The qualitative analysis is therefore similar to that for loan restriction based on a loan restriction in which the borrowing expenses may not exceed a certain percentage of income.

Price-fall insurance schemes, which are the form of **risk insurance** discussed in section 2.1.4, affect the impact of monetary policy on household consumption in different ways, depending on whether the premium must be paid as a lump sum of the cash down-payment or if it is divided into regular payments. If the premium is paid as a lump sum it affects the impact of monetary policy in the same way as a loan restriction based on the value of the property. If the premium is paid regularly, the price-fall insurance can be compared to an amortisation requirement. If a certain premium amount must be paid every month, an interest rate cut means that the monthly expense decreases if the loan amount is unchanged, which increases the possible consumption and loan amounts.

Fixed rate requirements, that is requirements that mortgages are to be taken at a fixed rate of interest, mean that monetary policy cannot affect the cost of mortgages in the same way as if the mortgages were at a variable interest rate. Consequently, such a requirement can lead to monetary policy affecting demand to a lesser extent. If household debt decreases as a result of the fixed rate requirement the income effect of an interest rate change can also be weaker. For more information on the effects of monetary policy when there is a variable or fixed mortgage rate, see Chapter II.2.

Tools targeting credit institutions' operations

In section 2.2.1 **capital requirements for credit institutions** are discussed. To analyse the effect of the capital requirement on the transmission mechanism we assume that the banks' lending rate for mortgages is set in a standardised way as follows:

Mortgage rate = repo rate + "capital requirement add on" + "other add ons"

We assume here that the add ons on top of the repo rate are additive. A higher capital requirement is assumed to make the banks' funding of lending more expensive, which raises the "capital requirement add on". The effect of higher capital requirements will then be, all else being equal, a higher lending rate for mortgage customers. All else being equal, the effect of monetary policy on the lending rate will be exactly the same as without such a requirement. If household debt decreases as a result of the capital requirement the income effect of an interest rate change can, however, be weaker.

As discussed in section 2.2., the **minimum reserve requirement for mortgage lending** in practice can function as a tax or charge on mortgages. If this cost is paid through a supplement on banks' mortgages it can be analysed in the same way as capital requirements for credit institutions (see above).

FISCAL TOOLS

Tax relief on interest

The relevant interest rate for calculating the cost of a mortgage is the real interest rate after tax relief. The current tax relief on interest costs of 30 per cent means that only 70 per cent of the nominal interest costs are paid by the borrower. An increase in the nominal interest rate of 1 percentage point therefore increases the interest paid by the borrower by only 0.7 percentage points.

Abolition of tax relief on interest would instead mean that an interest increase of 1 percentage point would increase the interest paid by the borrower by the same amount. The impact of a given change in the interst rate would therefore be stronger if tax relief on interest was abolished.

2.5.2 The interaction between monetary policy and alternative tools

All the tools described above can potentially be used both contractionary and expansionary. Changes in the interest rate and loan restrictions can thus be complementary. For example the introduction of a loan restriction – or the tightening of an already existing loan restriction – will have a contractionary effect. Another example is changed capital requirements. If the capital requirement is made more stringent, the banks must reduce their lending or increase their capital. In both

cases the increased capital requirements can have a contractionary effect. In the first case because the banks reduce their lending to households. In the second case because the banks will be forced to rise their lending rates as a result of increased capital costs.

The fact that the tools complement monetary policy means that they can help to support current monetary policy. If the tools are introduced or tightened for example in a period where inflationary pressure is expected to increase, the need for monetary policy restraint may decrease. However, potential conflicts of objectives may arise. One example may be a situation in which household borrowing increases substantially but inflation is low. This could motivate stricter requirements through the alternative tools, but a central bank with an inflation target could keep the policy rate unchanged or cut it.

An important difference between monetary policy and the tools described above is, however, how general their effects on the economy are. The alternative tools mainly affect household demand, while monetary policy affects demand throughout the economy.

The interaction between monetary policy and alternative tools is further discussed in the following section, where we analyse the institutional arrangements concerning the tools.

3. Institutional arrangements – who should be responsible for alternative tools?

Up to now we have discussed a number of different tools that can potentially be used to prevent and manage the risks that the housing market may pose for the economy as a whole. In this section a general discussion is pursued concerning which authority is best suited to be responsible for the application of such alternative tools.

To the extent this is a matter of detailed regulation of a tool in legislation, in other words describing in the text of a law when and how the tool is to be used, the institutional arrangements are of less significance. In such a case the tool is implemented and no independent decision-making by individual authorities is necessary. An example of this could be that the rules for tax relief on interest were changed as a one-off measure. If, however, the more detailed formulation and/or application of the tool is delegated to an authority, the issue of responsibility becomes important. This matter is particularly important if the application of the tool is to be discretionary, i.e. if the tool must be adjusted regularly in accordance with the authority's assessment of developments in the housing market.

To determine which authority is best suited to monitor and possibly correct events in the housing market, several aspects must be considered and investigated further. But before we go into this it may be appropriate to first describe what

mandates and tools the Central Bank (the Riksbank) and the Financial Supervisory Authority (Finansinspektionen) have today. At present it is these two authorities that have the more explicit task of monitoring the financial system and preventing financial crises.

3.1 WHAT CAN THE RIKSBANK AND FINANSINSPEKTIONEN DO TODAY?

The Riksbank's mandate is to maintain price stability (monetary policy) and to promote a safe and efficient payment system (financial stability). Most of the tools (for example the repo rate, minimum reserve requirement) that the Riksbank has at its disposal are, however, classified as monetary policy instruments in the Sveriges Riksbank Act and its preparatory work. The Act certainly allows these instruments to be used to avert a financial crisis, provided that this ultimately benefits the price stability objective. This gives the Riksbank a margin for using these tools even for stability purposes. One such tool could be that the Riksbank introduces a minimum reserve requirement for the purpose of dampening credit expansion in the economy and in that way averting a threat to financial stability and ultimately to price stability as well. Apart from these mainly monetary policy tools, the Riksbank has few sharp instruments that can be used to prevent the housing market, or other parts of the economy, from causing financial stability problems or otherwise giving rise to macroeconomic shocks. With the exception of minimum reserve requirements, the Riksbank at present has no possibility of introducing any of the tools discussed in this chapter. Provided that the Riksbank is judged to be the most appropriate authority to have control of such tools, it will therefore be necessary to adapt the Riksbank's mandate and its arsenal of tools.

Finansinspektionen has a different role in financial stability than the Riksbank. The task of the authority is to promote stability and efficiency in the financial system as well as to ensure an effective consumer protection. Unlike the Riksbank, the authority has relatively far-reaching powers to introduce various types of regulation of the agents in the financial system. Within the framework of its remit Finansinspektionen can decide on binding regulations or issue general guidelines (that are not binding) to financial institutions.[29] On the other hand they have no direct mandate to safeguard macroeconomic stability. This means, for example, that Finansinspektionen cannot prescribe rules if it is considered that developments in the housing market only risk leading to a substantial loss of household demand. Under its current mandate, Finansinspektionen must be able to demonstrate reasons of efficiency, stability or consumer protection for taking action. For example, Finansinspektionen adduced consumer protection as the main reason for

29 General guidelines allow a company to behave in another way than is recommended in the guidelines, as long as the company can show that it fulfils the purpose of the regulation.

deciding on a loan-to-value cap of 85 per cent from 1 October 2010. Provided that alternative tools should be possible to use to avert threats to both financial stability and the economy as a whole, and that Finansinspektionen is deemed to be the most appropriate authority to shoulder this task, the authority's current mandate must be extended.

3.2 THE PURPOSE OF THE TOOL IS OF GREAT SIGNIFICANCE FOR DIVISION OF RESPONSIBILITY

The problems the tool is mainly intended to counteract provide some guidance on which authority should be responsible for it. The consequences that imbalances in the housing market can lead to are discussed in several of the chapters in this report. Two types of macroeconomic shock are involved; instability in the financial system and/or loss of demand in the economy due to weakened household consumption. That these shocks can also act together and strengthen each other is an important aspect to consider in discussing the question of responsibility.

If the main purpose of the tool is to ensure stability in the financial system it would be best if it was placed with an authority that currently has a responsibility for financial stability. In Sweden this is a responsibility that is shared between several authorities – the Riksbank, Finansinspektionen, the Ministry of Finance and the Swedish National Debt Office – but where all have responsibility for different sub-areas. The more explicit task of monitoring the financial system and preventing crises lies, however, with the Riksbank and Finansinspektionen.

If the main purpose of the tool is instead to prevent imbalances on the housing market from causing or exacerbating macroeconomic shocks as a result of weakened demand, the tool would best be assigned to an authority that has a broader macroeconomic remit than just responsibility for financial stability. In that case it is a matter of the Riksbank and the Ministry of Finance, with their responsibility for monetary policy and fiscal policy in Sweden.

A pure division of responsibility on the basis of this template is, however, made more difficult by the fact that the economy and the financial system affect each other. For example, a negative shock to the real economy can generate financial instability, which in turn can cause a downturn in the real economy. Nor is there any individual tool that gives an isolated effect in one or other area. This fact is an argument that the responsibility should fall to an authority that has responsibility in both areas.

At the same time, it is important to point out that there may also be other reasons for using the tools discussed in this chapter. Several of the tools actually already exist today or can be introduced within the framework of the authorities', mainly Finansinspektionen's, existing mandate. As in the example of the recently implemented loan-to-value ratio, it may be a matter of applying the tools for

reasons of consumer protection. Another reason for implementing the tools may be to ensure that the economic resilience of each individual lending institution is at an acceptable level, without there necessarily being any immediate threat to financial stability. If it is important that the tools chosen will be possible to use in the future for these purposes as well, regardless of whether there is any threat to macroeconomic or financial stability, this is an argument in favour of the responsibility being given to the authority that already controls several of them. This is because in that way the risk of the same type of tool being used by different authorities for completely or partly different purposes will be avoided.

3.3 MAJOR POINTS OF CONTACT WITH THE DEVELOPMENT OF A MACROPRUDENTIAL FRAMEWORK

The purpose of the new tools also touches on a larger question. In the international debate following in the wake of the crisis, many voices have been raised for a stronger macroprudential framework, i.e. a framework for monitoring and preventing financial systemic risks. The need for such a framework is a consequence of the rules and supervision in many places having been far too focused on the state of health of individual institutions and too little focused on broader development tendencies, such as credit expansion in the economy. A large part of the discussion concerns the need for clear responsibility and access to effective "corrective tools" that make it possible to be better able to influence risk behaviours and increase resilience in the financial system as a whole.

The authorities often mentioned in the international debate as most suitable to be responsible for macroprudential tools at national level are the central banks.[30] The arguments put forward in this literature include the fact that the central banks already have a responsibility for financial stability, that monetary policy and macroprudential tools complement each other[31] and that there are significant similarities of expertise, analysis, institutional capacity and independence that are needed to effectively pursue the policy in both areas.

Within the EU a new structure of supervision and a new body, the European Systemic Risk Board, tasked with responsibility for a more comprehensive oversight of stability at macro level, have recently been created. At national level an important role is envisaged for central banks to identify at an early stage signals of imbalances in the economy, including the need for measures. From the Swedish point of view it is, therefore, important that the roles, tasks and tools of the authorities in these contexts are determined in more detail. This is one of the reasons that the

30 See for example Group of Thirty (2010), HM Treasury (2010), Caruana (2010) and Brunnermeier et al. (2009).

31 The correlation between macroprudential policy and monetary policy is mentioned for example in Angeloni and Faia (2010), Kannan, Rabanal and Scott (2009), and Angelini, Neri and Panetta (2010).

Government in February 2011 decided to appoint a committee to make a review of the Swedish regulatory framework for managing financial crises. The Committee's instructions also include a remit to propose measures to improve the regulatory framework so that future financial crises can be mitigated primarily through preventive measures.[32]

Several of the alternative tools we have dealt with in this chapter are a subset of the tools also being discussed in macroprudential contexts. That the tools are to some extent the same, as is the objective of maintaining financial stability, means that there are efficiency gains from coordinating these two tasks in one authority. This is not least apparent in view of the fact that risks linked to developments in the housing market can constitute a system-wide risk. Hence the issue of responsibility for macroprudential tools has significance for the issue of responsibility for the tools we deal with in this chapter.

A strong argument for coordinating these tools is that it would be unfortunate if two authorities controlled the same type of tool, or tools with similar effects on the housing market, but applied them independently of each other and for purposes that did not quite overlap. At the same time the not quite overlapping purposes of the tools can also be an argument that speaks against a coordination of tasks. The tools that we have discussed in this chapter can have a broader purpose[33] than only financial stability, while macroprudential tools are implemented and used solely to protect the financial system as a whole.

If the decision is made to introduce alternative tools with a different or broader purpose than financial stability, this must be managed in some way. If the tools are to be coordinated by one authority, one solution could be to write into the authority's mandate that one or more of the macroprudential tools may be used for this broader purpose. If the decision is not to coordinate the tools, then it will be important that the authorities have clearly defined roles and areas of responsibility, and that a clear structure for exchange of information and coordination is created to avoid conflicts of interest.

3.4 ANALYTICAL RESOURCES AND INDEPENDENCE

3.4.1 Need for analytical resources

Provided that use of the tool is intended to be discretionary it is important that the authority to which it is assigned has the competence and analytical resources to use it appropriately. The authority must be able to identify, understand and monitor the risks and imbalances that may arise in the housing market, particularly with

32 Committee terms of reference (ToR 2011:6), Översyn av regelverket för hantering av finansiella kriser (Review of the regulatory framework for managing financial crises), Government Offices.

33 The tools may also be aimed at preventing imbalances in the housing market from having negative consequences for the economy, despite the fact that financial stability is not under direct threat.

reference to the connections that exist with the financial system and the economy as a whole. When these risks and imbalances have been identified the authority must also be able to determine how the tool should be best used, which means obtaining knowledge about the timing, intensity and duration of its use.

Hence the need for analysis covers a wide area, even if it can of course vary, depending on the choice of tool. Examples of what may need analysis are: how sensitive to interest rates is household demand for housing? How does the tool affect other household consumption and saving? How may credit institutions act when the tool is applied? For example, to what extent and to which business areas will they pass on their higher costs if the tool is price-adjusting? Good indicators that "measure" imbalances and risk levels will also need to be developed, and various target variables will be needed for the tool, for example debt and house price levels. Analysis will also be needed of how the effects of the tool will be influenced by repo rate and the forecast repo rate path decisions (and vice-versa).

In conclusion, it is important that the authority assigned the tool has adequate analytical resources or at least the means of building up such resources.

3.4.2 Is independence important?

The arguments for having independent central banks as regards monetary policy are relatively strong and now fairly undisputed. It is an open question if similar independence is also important as regards responsibility for new tools targeting the housing market, particularly considering that they may be part of a new framework for monitoring financial systemic risks.

There is some research showing a positive correlation between central banks' independence and financial stability.[34] Various efforts have been made to explain this correlation. One explanation is that political involvement can imply that action is taken too late.[35] This could be because decisions in these cases must go through several political levels or perhaps first be negotiated in coalition governments or parliaments. Another explanation is that it may be politically difficult to "apply the brakes" without complete proof that developments – for example in the housing market – are unsound. Hutchison and McDill (1999) also believe that political involvement can increase the probability of ultimately giving government support to problem banks, which in turn increases the moral hazard problems. Several of these arguments relate to the fact that there would be a time-inconsistency problem in financial stability, which to a great extent is similar to that in monetary policy.[36]

34 See for example Garcia Herrero and Del Rio (2003), Cihák (2007, 2010), and Klomp and de Haan (2009).
35 This explanation is given by Cihák, (2007), for example.
36 Cihák (2007, 2010) has described this time inconsistency problem in financial stability.

The time-inconsistency problem in monetary policy arises because economic policymakers' short term motives may come into conflict with the long-term ambition to keep inflation at a low level. Cihák (2010) has argued that the same type of confidence problem exists in financial stability. Fundamentally it is the Government that has the ultimate responsibility for financial stability and in somewhat simplified terms the Government can either be tough or lenient when risks build up or a crisis develops. If the market participants believe that the Government will be tough (for example use tools early and treat problem institutions firmly) the Government has a short-term incentive to act leniently (for example await developments and give help to problem institutions) when risks start building up or a crisis has developed. This is because the short-term costs of acting leniently are lower than those that follow from acting tough.[37] Rational participants will, however, expect this behaviour and act accordingly (for example by taking greater risks). The consequence will be that economically and financially unsound situations or even crises will arise more often than if the Government was able to commit itself to the strategy of always acting tough. Just as in monetary policy, there would be arguments for the Government needing a mechanism to make credible, i.e. binding, undertakings on how it will act when risks and crises arise. One way of doing this is to delegate the task to an independent authority.

Extending the mandate for independent authorities, however, comes at a cost. This cost is that the elected representatives waive parts of decision-making on supervision and regulation to an authority. If there is a time-inconsistency problem in financial stability and if, in that case, it is sufficiently serious to motivate such a measure, is a difficult question that must be investigated thoroughly, particularly bearing in mind that there may be synergies between monetary policy and macroprudential tools.

3.5 CONCLUDING COMMENTS

As an isolated question the choice of tool – which to a great extent depends on the purpose of introducing alternative tools to the policy rate – and how it is designed is crucial to deciding which authority is best suited to control it. In reality, however, this issue of responsibility must be related to the question of which authority is to be entrusted with the task of monitoring and managing financial systemic risks, and for that purpose is assigned responsibility for various macroprudential tools. It would be appropriate to make this authority responsible for alternative

37 One example is that decisions entailing a tightening of the housing market will be unpopular and need to be implemented when everything still looks good. Political decision-makers have short-term goals – a consequence of a representative democratic system – which do not always go hand in hand with long-term goals such as stability in the real economy and financial stability. There is an obvious risk that non-one wants to do anything about a problem if the risk of its becoming a reality lies far in the future.

tools specifically targeting the housing market, unless there are strong reasons for another arrangement.

If these tools are to be coordinated by one authority, or not, is also intimately associated with the question of responsibility for financial stability. A conclusion in many countries after the financial crisis is that it was a weakness that no single authority had a clear responsibility, authority and power to oversee the system as a whole. Authorities either had a mandate but no tools to manage systemic risks, or they had the tools but no clear mandate to use them for this purpose. If this is the case, then command of new tools should be coordinated with responsibility for more general management of financial systemic risks.

An alternative to collecting all tools in one authority with a clear mandate, thus clarifying responsibility, is instead to link authorities up with each other.[38] This may be a matter of pure merger[39] of authorities to more or less formal cooperation and coordination between authorities.

Learning from the crisis, the United Kingdom will establish a Financial Policy Committee (FPC) within the Bank of England with the express task of being responsible for maintaining financial stability. They will also reshape the supervisory authority into a new authority, the Prudential Regulation Authority (PRA), which will be transferred to and become an operationally independent subsidiary of the Bank of England. This supervisory authority will be in charge of most of the tools targeting the financial sector. To ensure that the FPC can fulfil its mandate, this committee will, most likely, be given control of the macroprudential tools, for example the contracyclical capital buffer, and a mandate to order the PRA to use their tools as needed.[40]

Another conceivable alternative is that the authorities are very loosely linked to each other, and continue to share responsibility for financial stability.[41] But for this to function, the roles and areas of responsibility must be made very clear, so that it is evident who is responsible for what. One example could be that the central bank is given overall responsibility and the mandate to monitor and propose measures to manage financial systemic risks. For this purpose the central bank can also have

38 Another alternative is to create a whole new authority. The greatest drawback of that alternative is that there will be yet another authority working on financial stability and thus lose the potential synergies and efficiency gains that follow from using the existing structure.

39 A pure merger must, however, be weighed against the arguments in favour of a separation of supervision and monetary policy. One such argument is that a conflict of interest may arise between the monetary policy goals and the supervision goals, for example the central bank could be tempted to set interest rates far too low to prevent acute problems for banks. Another argument is that if a bank under the supervision of the central bank should fail, there is a risk that public confidence in the central bank's monetary policy responsibility will also suffer (Ingves and Lind, 2007).

40 For a more detailed description of the reforms in the United Kingdom, see HM Treasury (2010, 2011).

41 In Finland and some other countries banking supervision is carried out by an organisation that is closely linked to the central bank, but not a part of it. In that way it is possible to benefit from the resources of the central bank and make some savings, but nevertheless avoid some of the arguments against placing the supervisory function within the national central bank (Ingves and Lind, 2007).

some new macroprudential tools. The supervisory authority may, however, continue to oversee financial companies and control its toolkit, which contains several tools that are also applicable for systemic risk purposes. For such an arrangement to work the central bank must, where necessary, also be able to use the supervisory authority's tools. One way of managing this is to induce the supervisory authority to relate to the central bank's analysis and policy proposals on a "comply or explain" basis. In other words, if the central bank finds that the conditions in the financial system occasion measures that include application of tools over which the supervisory authority has control, the supervisory authority must either implement the measures or explain why these measures do not need to be taken, or – if other measures are taken – why they were more appropriate.

Saying which institutional arrangement is best suited to Sweden would be to pre-empt the government inquiry. One of the overall purposes of the inquiry is to ensure that the regulatory framework is designed so that different types of financial crisis can primarily be mitigated by means of preventive measures. The committee will analyse the division of responsibility and the interaction between the Riksbank, the Swedish National Debt Office, Finansinspektionen and the Government Offices (mainly the Ministry of Finance) and the possible accountability procedures for the authorities and propose necessary improvements. Regardless of what is found to be appropriate in the end, it is important to have accountability procedures. It is also clear that the authorities' current mandate and division of responsibility will need to be changed.

References

Angeloni, I and E. Faia, (2010), "Capital Regulation and Monetary Policy with Fragile Banks", mimeo. Revised version of "A Tale of Two Policies: Prudential Regulation and Monetary Policy with Fragile Banks", Kiel Working papers 1569.

Angelini, P., S. Neri and F. Panetta, (2010), "Grafting Macroprudential Policies in a Macroeconomic Framework: Choice of Optimal Instruments and Interaction with Monetary Policy", essay presented at the conference Procyclicality and Financial Regulation, Tilburg, 11-12 March.

Bank of England (2009), "The role of macroprudential policy – a discussion paper"

Borio, C. (2010), "Implementing a macroprudential framework: Blending boldness and realism", Keynote address for BIS-HKMA research conference, Hong Kong SAR, July 2010.

Brunnermeier, M., A. Crocket, C. Goodhart, M. Hellwig, A. D. Persaud, and H. Shin (2009), "The Fundamental Principles of Financial Regulation", Geneva Report on the World Economy 11.

Caruana, J. (2010), "The challenge of taking macroprudential decisions: who will press which button(s)?", speech at 13th Annual International Banking Conference Federal Reserve Bank of Chicago, in cooperation with the International Monetary Fund, Chicago, 24 September 2010. Available at www.bis.org/speeches.

Cihák, M. (2007), "Central Bank Independence and Financial Stability", IMF Mimeo.

Cihák, M. (2010), "Price Stability, Financial Stability, and Central Bank Independence", 38th Economics Conference at the Oesterreichische Nationalbank.

CGFS (2010), "Macroprudential instruments and frameworks: report published by the Committee on the Global Financial System.

Committee terms of reference (ToR 2011:6), Review of regulatory framework for managing financial crises, Government Offices.

Finansinspektionen, "The Swedish Mortgage Market and Bank Lending", February 2010.

Finansinspektionen, "Allmänna råd om begränsning av lån mot säkerhet i bostad", memorandum (FI reference number 10-1533), July 2010.

Finansinspektionen, "Allmänna råd om begränsning av lån mot säkerhet i bostad", FFFS 2010:2.

Garcia Herrero, A. and P. Del Rio (2003), "Financial stability and the design of monetary policy", Banco de España Working Paper 0315.

Group of Thirty (2010), "Enhancing Financial Stability and Resilience. Macroprudential Policy, Tools, and Systems for the Future", October 2010.

HM Treasury (2010), "A new approach to financial regulation: judgement, focus and stability", July 2010.

HM Treasury (2011), "A new approach to financial regulation: building a stronger system", February 2011.

Hopkins Elisabeth, Jesper Lindé and Ulf Söderström (2009). "The monetary transmission mechanism,"Sverigens Riksbank Economic Review, no 2, 2009, Sveriges Riksbank

Hutchison, M. and K. McDill (1999), "Are all banking crises alike?", Journal of the Japanese and International Economies, 12 (3), 155-180.

Ingves, I. and G. Lind, "Is there an optimal way to structure supervision?", Sveriges Riksbank Economic Review, no 3, 2007, Sveriges Riksbank, 31-44.

Kannan, P., P. Rabanal and A. Scott, (2009), "Monetary and Macroprudential Policy Rules in a Model with House Price Booms", IMF Working Paper 251.

Klomp, J. and J. de Haan (2009), "Central bank independence and financial instability", Journal of Financial Stability, 5, 321-338.

National Housing Credit Guarantee Board (2010), "Bolån i Sverige – en begränsad marknad", Market report, May 2010.

Scanlon, K. and C. Whitehead (2004), "International trends in housing tenure and mortgage finance", November 2004, The Council of Mortgage Lenders, London.

Sveriges Riksbank Act (1988:1385).

Sveriges Riksbank, Financial Stability Report 2010:2.

Sveriges Riksbank, Submission on certain areas that require investigation as a result of the financial crisis, 2009/10:RB4.

Wallentin, K. and Sellin, P. "Housing collateral and the monetary transmission mechanism," Sveriges Riksbank Working Paper No. 239.