When is a Housing Market Overheated Enough to Threaten Stability?

John Muellbauer*

1. Introduction

In many economies, housing prices are subject to boom-bust cycles and in some cases these cycles are linked to severe economic and financial instability. Overheating can have both a price and a quantity dimension, but it is likely that they are linked by common drivers. It is helpful to make the distinction between housing prices overshooting due to extrapolative expectations and 'frenzy', given fundamentals, and shifts in possibly fragile fundamentals. The contribution of careful econometric modelling to estimating the effects of the former is demonstrated: central banks or other policymakers should institute quarterly surveys of housing price expectations of potential housing market participants to help assess the first type of overshooting.

Assessing the fragility or otherwise of the economic fundamentals is more complex. Credit supply conditions in the mortgage market are the 'elephant in the room'. Without taking a measure of credit conditions into account, one simply cannot understand the behaviour of housing prices, household debt and consumption in countries such as Australia, the United Kingdom, the United States, South Africa or France, or understand the vulnerability of some economies to high levels of household debt. Other financial and economic indicators of vulnerability are discussed, including high bank leverage ratios, high ratios of loans to deposits, and high debt, deficit and current account to GDP ratios. Models of early warning of financial and economic crises estimated on large country panels need to be quite complex, for example, including some important interaction effects since shock transmission is very institution-dependent.

The outline of this paper is as follows. Section 2 questions the 'one size fits all' approach to explaining housing prices and their wider consequences by examining differences in recent housing price cycles across countries. This exercise illustrates the importance of country-specific institutional factors, as well as different types of economic shocks in determining a country's housing price dynamics. Differences in the feedback mechanisms between housing prices and the real economy are also important. Section 3 introduces the connection between housing and economic and financial stability. Feedback loops operate via construction and its impact on income, employment and housing prices, via consumption, and via the financial system, all of which proved important in the banking crises and GDP declines suffered by the United States, Ireland and Spain in recent years. Section 4 discusses problems with modelling housing prices,

* This paper draws on the author's research with a number of colleagues including Janine Aron, Valerie Chauvin, John Duca, Keiko Murata, Anthony Murphy and David Williams. Research support from the Open Society Foundation, The Oxford Martin School and the European Central Bank, via the Wim Duisenberg Fellowship, is gratefully acknowledged. Comments from Janine Aron, John Duca and Andrea Fracasso are much appreciated but the author takes responsibility for interpretations made in this paper.

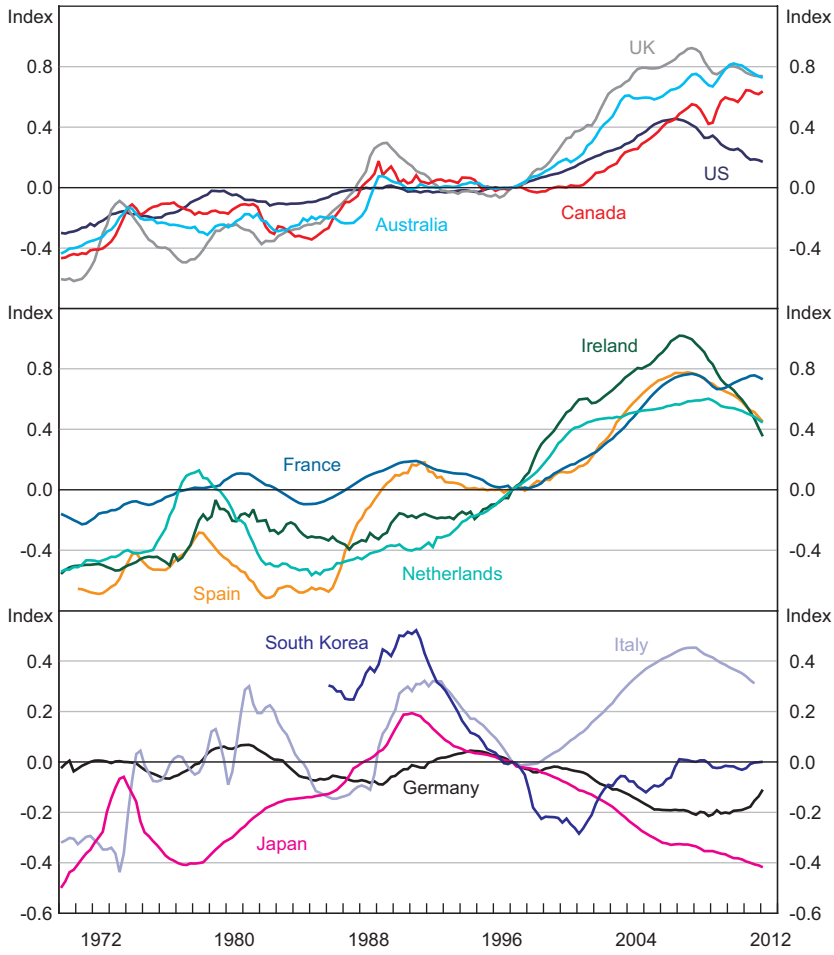
compares alternative approaches and discusses the measurement of user cost, emphasising the treatment of expectations of capital appreciation and of the risk premium. I contrast overvaluation arising from extrapolative expectations and 'frenzy', conditional on economic fundamentals, from overvaluation due to unsound fundamentals such as unsustainable levels of income, or interest rates, or the architecture of credit. Since overheating in housing markets can involve quantities as well as prices, and they are likely to be linked by common drivers as recently demonstrated in the United States, Ireland and Spain, Section 5 turns to possible drivers of construction booms and busts. As we shall see, econometric research on these questions still has far to go.

Since consumption typically accounts for around 60 to 70 per cent of GDP in developed economies, it is important to quantify/gauge the linkages between consumption and housing, which vary with the nature of credit market architecture across economies and over time. The multi-equation approach pioneered by my colleagues and myself that treats credit supply conditions as a latent variable provides sophisticated answers and is outlined in Section 6. I also suggest some simple single equation tests that indicate whether housing has important effects on consumption and whether shifts in credit availability have had important effects on the relationships between consumption, income and wealth portfolios. Feedbacks via the financial system are discussed in Section 7. Most obviously they occur when mortgages to households and loans to developers go bad, or when regulation fails to prevent unsustainable credit practices from spawning real and financial bubbles. Since mortgage data tend to be far more systematic than data on commercial real estate debt, I focus more attention on residential mortgages. Section 8 draws some conclusions.

2. Explaining Housing Prices – One Size Does Not Fit All

In the decade 1997 to 2007, the rise in real housing prices was unprecedented in many countries, though absent in a few, notably Japan and Germany. The three panels of Figure 1 illustrate this with real housing price data from the Organisation for Economic Co-operation and Development (OECD). The top panel includes four Anglo-Saxon economies: the United States, the United Kingdom, Canada and Australia. These are all economies with liberal credit markets and independent monetary policies. The United Kingdom shows the highest appreciation in real housing prices since 1970, followed by Australia, Canada and the United States, though from 1970 to 2005, appreciation was similar in the United States and Canada. The US pattern is smoother than those of the other economies, reflecting averaging over heterogeneous regional markets, a generally more elastic housing supply, and the nature of the Federal Housing Finance Agency (FHFA) data used. Of these four economies, the United States has experienced the greatest fall in real housing prices since 2006, while housing prices in Australia and Canada rose to new highs after the global financial crisis.

Figure 1: Real Housing Prices
Log price indices, base = March quarter 1997

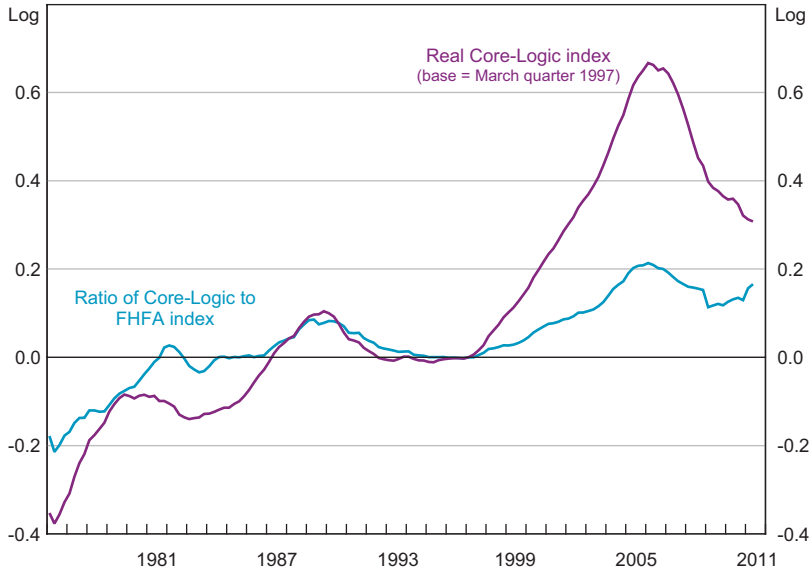


Source: OECD

Figure 2 shows an alternative US housing price index, the Core-Logic index, which is based on prices for a wider range of homes financed with prime and non-prime mortgages, and its log ratio to the FHFA index, which tracks home sales financed with prime, conforming mortgages.[1] The Core-Logic index shows greater appreciation during the subprime boom and rises more sharply during the 1980s. It also declines more in the early 1990s and after 2006. Indeed, the similarity of the United States with other Anglo-Saxon economies is greater for the Core-Logic index than for the FHFA index.

1 This version of the Core-Logic index excludes 'distressed' sales stemming from actual or imminent foreclosures.

Figure 2: United States – Real Housing Prices



Source: OECD

The middle panel of Figure 1 illustrates housing prices for a group of euro area economies – France, Spain, the Netherlands and Ireland – where mortgage credit appears to have been relatively freely available over the decade before the global financial crisis. Spain and Ireland experienced a similar rise in real housing prices from 1970 to 2007, and all four economies went through large appreciations from the late 1990s to 2007.[2] The largest subsequent declines occurred in Ireland followed by Spain. A remarkable fact is that from 1997 to the end of 2007 Spain and France had almost the same rise in real housing prices. Yet Spain's housing and mortgage markets and wider economy are now in deep crisis while France's are not.

The bottom panel of Figure 1 covers Germany, Italy, Japan and Korea where mortgage credit availability has long been restricted with little evidence of major shifts in the past decade.[3] Japan experienced a great rise in real housing prices (actually housing land prices) in the 1980s but real housing prices have been in almost continuous decline since their 1991 peak.

The differences between the economies illustrated in Figure 1 are so extreme as to call into question the 'one size fits all' tendency of conventional modern macroeconomics. Clearly, institutional differences, as well as different types of economic shocks, matter greatly.

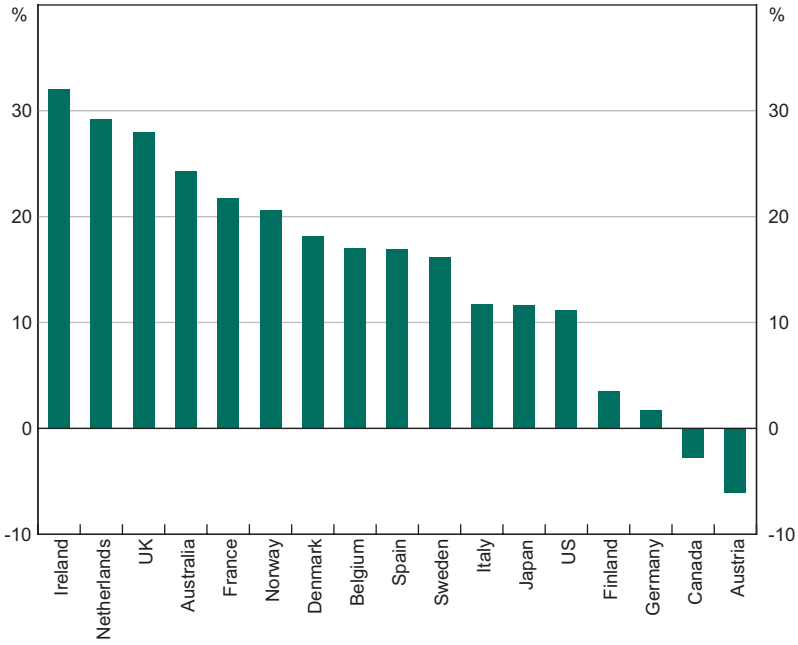
Over the years, the IMF has regularly pointed to risks posed by housing price bubbles and developed a methodology for judging the degree of overvaluation. For example, the analysis subtitled, 'Assessing Overvaluation in House Prices', was published shortly after housing prices peaked in many countries and before the most severe stage of the global financial crisis (Cardarelli,

2 The housing price index for Spain, which begins in 1987, is linked to a housing price index for Madrid for earlier years. This undoubtedly results in an upward bias of the pre-1987 rise in real housing prices reported for Spain.

3 In Korea, the experience of the 1980s housing price boom and later bust led the authorities to take systemic action to forestall repeated occurrences (Igan and Kang 2011).

Igan and Rebucci 2008, pp 113–114). For each country, housing price growth is modelled as a function of the lagged ratio of housing prices to per capita personal disposable income (PDI), growth in per capita PDI, short-term interest rates, long-term interest rates, credit growth, and changes in equity prices and the working-age population. The unexplained increase in housing prices from 1997 to 2007 defines the 'housing price gap', a measure of overvaluation (Figure 3).

Figure 3: IMF Housing Price Gaps Estimated in Early 2008



Source: Cardarelli *et al* (2008)

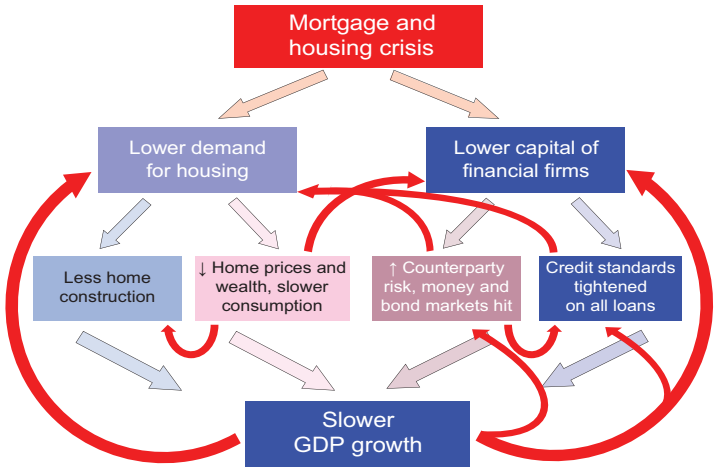
The relationship between these estimated gaps and subsequent falls in real housing prices is poor, apart from Ireland. The United States, ranked 13th, has experienced a sharper fall in real housing prices than all the countries ranked as higher risks, except for Ireland and Spain. Australia, France, Norway, Belgium, Sweden and Finland had all experienced *rises* in real housing prices by the third or fourth quarter of 2010 relative to the first quarter of 2008 despite their supposed overvaluations, though prices in Australia have slipped a little since then.

Cardarelli *et al* (2008) lacks a clear theoretical foundation. The omission of the supply side is a fundamental problem – making no distinction, for example, between Ireland and the United States, where there were large expansions of housing supply, and the United Kingdom where there was not. The imposition of a long-run income elasticity of 1 for housing prices without any justification is another serious problem. Permanent shifts in credit conditions and shifts in the age structure of the working-age population play no role in the analysis, the former being a particularly crucial omission. Further, no distinction is drawn between temporary overshooting conditional upon fundamentals and the fragility of the fundamentals themselves. Finally, no account is taken of feedback loops between the housing market and the wider economy. These issues will be addressed in the course of the paper.

3. Housing and Financial Stability

Figure 4 presents some of the mechanisms and feedbacks which operated in this crisis in the United States. Starting from left to right, it illustrates the linkages via construction, which fell by about 3.5 percentage points of GDP after three years (see Duca, Muellbauer and Murphy (2010)). Second, it illustrates the linkages via consumption, as collateral values dropped and credit contracted. The third and fourth channels track the negative feedback loops via credit markets and the banking sector more generally, through credit contraction triggered by rising bad loans, risks of bank insolvencies and higher risk spreads. In turn, the decline in economic activity feeds back negatively on home values, amplifying the initial shocks.

Figure 4: The Financial Accelerator Operating in the US Subprime Crisis



Source: Figure designed by John Duca and taken from Duca and Muellbauer (2012)

This second channel played a central role in the US crisis. Indeed, in the Great Recession, the saving rate rose by 4 percentage points, as consumption fell by 4 per cent more than income, in sharp contrast to a rather flatter saving rate in prior US recessions. Consumption also plays a key role in upswings of the business cycle, where negative feedbacks become positive feedbacks. As suggested by the contrast between Spain and France discussed below, recognising differences between countries in whether this channel is operative can substantially improve our understanding of whether a housing price boom is likely to be followed by an economic and financial crisis.

Countries where this channel is absent almost certainly include Germany, Italy, France, Japan and China. In China, there may, however, be another channel with consequences for GDP, which operates via the budget constraint of local governments. According to a 2012 report from the British Consul General in Chongqing, the China Real Estate Information Centre reported that city

income for the first 11 months of 2011 from land transfer fees was down in 50 out of 66 cities studied (UK Trade & Investment 2012). Seventeen cities had a drop in income from land transfers totalling CNY500 billion (approximately £50 billion). Provincial governments also receive tax revenues from real estate and construction companies and some collateralise their debt (or that of the local government financial vehicles) with land under the assumption of increasing prices. As a result, a decline in land prices and revenues can have consequences for health and other local expenditures, and for the quality of local government debt, currently thought to be around 25 per cent of GDP.[4]

The fallout in the United States on credit availability after the financial crisis, despite strenuous policy efforts to soften the impact, is well known (see, for example, Duca *et al* (2010)). Mortgage delinquency and the proportion of mortgages entering foreclosure proceedings reached unprecedented levels in 2009–2010. The average loan-to-value (LTV) ratio for first-time home buyers as recorded in the American Housing Survey in 2009 fell to 1990s levels (Duca, Muellbauer and Murphy 2012b). The net percentage of domestic respondents tightening standards for residential mortgage loans in the Federal Reserve Board's Senior Loan Officer survey reached unprecedented heights in 2008–2009 (Federal Reserve 2012). All of these factors negatively affected the real economy.

4. What Can be Learned from Housing Price Models?

There are two basic theories of housing price determination. The first is based on supply and demand functions, and a price adjustment process which brings supply and demand into balance. The second is based on finance and assumes that arbitrage brings housing prices and rents into an equilibrium relationship, again after a price adjustment process. In both approaches, interest rates as well as shifts in access to credit for households, provide an important link between the macroeconomy and housing prices.

4.1 The supply and demand approach

In this approach, the supply – the stock of housing – is given in the short run. Then housing prices are determined by the inverted demand curve, that is, by the stock of housing and the factors driving demand. Let the log of housing demand, h, be given by:

$$\ln h = -\alpha \ln hp + \beta \ln y + z \tag{1}$$

where hp is the real housing price, y is real income and z represents other demand shifters. The own-price elasticity of demand is $-\alpha$, and the income elasticity is β. Solving for housing prices, hp, yields:

$$\ln hp = \left(\beta \ln y - \ln h + z\right) / \alpha \tag{2}$$

Note that forecast simulations of housing prices for this model would need a residential investment equation as well as assumptions on income, interest rates and credit availability. An advantage of the inverted demand function approach (i.e. expressing price as a function of quantity and the other factors shifting demand) is that it is well grounded theoretically, unlike many 'ad hoc'

4 See Renaud (2012) for an excellent account of the risks for the Chinese economy of real estate developments of the last decade.

approaches. In addition, we have strong priors regarding the values of the key long-run elasticities, corresponding to the 'central estimates' set out in Meen (2001). For example, many estimates of the income elasticity of demand suggest that β is in the region of 1, in which case the income and housing-stock terms in the above equation simplify to log income per property, i.e. ln*y* – ln*h*. But the elasticity of housing prices with respect to income, given the stock, is β/α, which is typically substantially above 1 since the own-price elasticity, α, is below 1.

The demand shifters included in *z* cover a range of other drivers. Since housing is a durable good, intertemporal considerations imply that expected or 'permanent' income and 'user cost' should be important drivers. The user cost takes into account that durable goods deteriorate, but may appreciate in price and incur an interest cost of financing as well as tax. The usual approximation is that the real user cost, *uc*, is:

$$uc = hp\left(r + \delta + t - \Delta hp^{e} / hp\right) = hp\left(uch\right), \tag{3}$$

where *r* is the real after-tax interest rate of borrowing, δ is the deterioration rate plus transaction costs and a risk premium, *t* is the property tax rate, and $\Delta hp^{e}/hp$ is the expected real rate of capital appreciation. Before discussing user cost further, I consider the other basis for modelling housing prices.

4.2 The rent-arbitrage approach

Housing prices have also been modelled using the rent-arbitrage approach, particularly in the United States, where rental markets are well-developed and rents are generally market determined, in contrast to the more heavily regulated rental markets of some European countries. This approach is grounded in finance and assumes that, in the absence of substantial frictions and credit restrictions, arbitrage between owner-occupied and rental housing markets equates the rent-to-price ratio for housing with the real user cost of capital term *uch* defined in Equation (3) as the cost of mortgage finance, $(r+\delta+t)$, minus expected appreciation, $\Delta hp^{e}/hp$:

$$rent / hp = uch. \tag{4}$$

A similar result also obtains when agency costs make renting housing services more expensive than owning a home. Inverting and taking logs of Equation (4), implies:

$$\ln\left(hp / rent\right) = -\ln\left(uch\right) \tag{5}$$

where the elasticity of the price-to-rent ratio with respect to the user cost term equals –1.

However, Kim (2008) shows that in an equilibrium model, when rental agency costs are accompanied by binding, maximum LTV ratios on marginal home buyers, the equilibrium log price-to-rent ratio is more complicated:

$$\ln\left(hp / rent\right) = f\left(\ln\left(uch\right), \max LTV\right). \tag{6}$$

In this case, the size of the negative real user cost elasticity can be smaller than 1, in line with empirical results (see Duca, Muellbauer and Murphy (2011) for evidence and discussion). Kim's result is close in spirit to Meen (1990) who considers the result of relaxing mortgage credit constraints. He shows that when there is a binding credit constraint, the user cost term in the

optimal housing price-to-rent ratio includes the shadow price of the credit constraint (such as a maximum LTV bound), which will be related to the pervasiveness of such constraints.

Note that forecast simulations for housing prices from a model of this kind require an equation for rents and assumptions on the path of the LTV ratio ceiling. Duca, Muellbauer and Murphy (2009) suggest that US rents adjust relatively slowly to their long-run determinants, which are the general price level, the level of housing prices, the nominal mortgage rate and user cost.

4.3 User cost and expectations

Both the inverse demand and the arbitrage approaches depend heavily on the user cost concept. An important practical issue for the modeller is measuring expected housing price appreciation. One might have thought that regularly monitoring household expectations of housing prices would be a high priority for central banks and other policymakers. However, actual surveys of housing price expectations are unfortunately sparse and intermittent, which is likely to be a consequence of the 'pretence of knowledge syndrome' (Hayek 1974; Caballero 2010) that has long plagued conventional macroeconomics. Bracke (2010) analyses some of the sparse survey information for the United States and United Kingdom and finds strong evidence that expectations of future appreciation are linked with past observed appreciation and cannot be reduced to a combination of other macroeconomic predictions. He also finds a high dispersion of responses across households. He interprets these findings in a sticky information or epidemic framework of spreading information. Hamilton and Schwab (1985), Case and Shiller (1989, 1990), Poterba (1991) and Meese and Wallace (1994) find housing price changes are positively correlated and that past information on housing fundamentals forecasts future excess returns. Capozza and Seguin (1996) and Clayton (1997) also find evidence against rational housing price expectations.

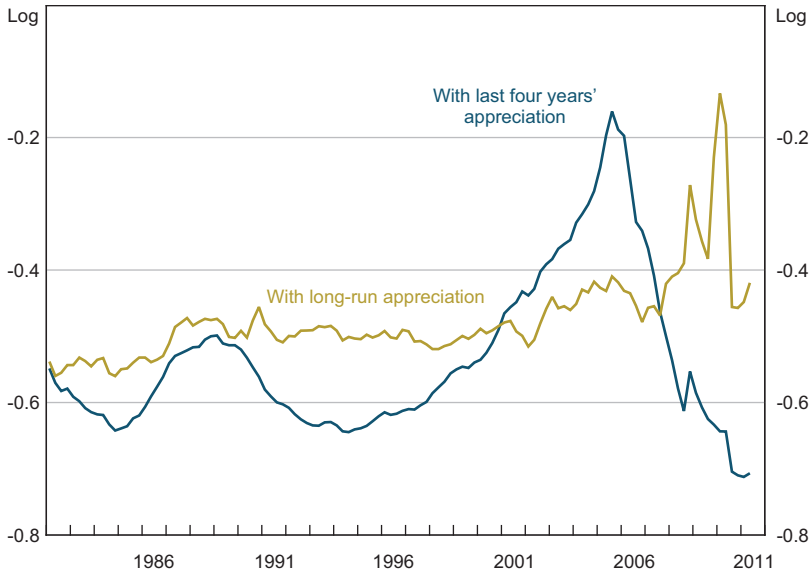
In our research on aggregate US housing prices (Duca *et al* 2011, 2012a, 2012b), we find evidence that a user cost calculation that uses the average rate of appreciation over the previous four years to proxy for expectations produces the best fit for both the inverse demand and the rent arbitrage approaches. In econometric work on housing prices in Norway using the inverse demand approach, Anundsen finds that the four-year average rate of appreciation in an expression for user cost also gives the best fit.[5] Cameron, Muellbauer and Murphy (2006) estimate a UK regional housing price model and test for an asymmetry between appreciation and depreciation phases and also find a four-year memory of depreciation produces the best fit. In current research on France, Chauvin and Muellbauer (2012) find that an average of one- and four-year lagged appreciation gives the best-fitting user cost measure. While there is probably not a universal law of precisely how housing price expectations are formed, there is at least a hint from this set of evidence that econometric modellers should treat the lagged four-year rate of appreciation as an important candidate for measuring user cost. This horizon is close to the five-year window used by Himmelberg, Mayer and Sinai (2005).

A four-year memory has important implications for the overshooting of housing prices: it implies that a series of positive shocks such as the subprime mortgage boom and the fall in interest rates experienced in the United States, which cause housing prices to appreciate, will cause further appreciation over a considerable period even if the fundamentals do not change further

5 Personal communication with André Anundsen, 30 June 2012.

or mean-revert. An estimate of the importance of this phenomenon can be derived from Duca *et al* (2012a, 2012b), who study the FHFA housing price index for the United States. Figure 5 plots the log user cost term scaled by its estimated coefficient in the long-run solution for real housing prices against an alternative which uses the average historical appreciation from 1982 to 2011. The difference of around 35 per cent averaged over the four quarters from 2005:Q2 to 2006:Q1 is a measure of the degree of overshooting due to extrapolative expectations.[6] Our model suggests that this was a very important component of the overshooting in US housing prices. Of course, given sluggish adjustment, housing prices never got to the peak implied by this long-run solution: the equilibrium correction towards the other fundamentals was already offsetting the pull from extrapolative expectations and, before long, other fundamentals turned sour. Mortgage interest rates drifted up from their lows in 2005 and, in 2007, LTV ratios started to fall.

Figure 5: United States – Contribution of the User Cost Term to Estimated Housing Prices



Notes: Long-run log real FHFA housing prices; for more details see Duca *et al* (2012b)
Source: author's calculations

Thus, there was an important role for extrapolative expectations in the overshooting of housing prices in the United States. This is consistent with the snapshot surveys by Case and Shiller in 2003 which suggested that many households had absurdly positive expectations of appreciation. Shiller (2007) emphasises the psychological element in expectations. But since we can account for the other drivers and quantify the adjustment process, we can understand the series of positive economic shocks that ultimately drove expectations. This is extremely helpful in quantifying the degree of overvaluation and the time path for likely corrections.

6 It seems likely that adding a time-varying risk premium to user cost (see below) would bring down the estimated peak effect in 2005, but would not greatly alter the overall conclusions.

A sceptic might argue that dynamics estimated from modelling aggregate housing price indices could be distorted because of aggregation bias. In other words, different regions might exhibit different dynamics, and none might be like the aggregate. One test of our model is the predictions it generates. In Duca *et al* (2009) the time path of future housing prices was simulated using the rent-arbitrage approach. It correctly forecast that there would be a second leg to housing price declines after the tax credit for first-time home buyers was withdrawn in June 2010. It also forecast that 2012 would see the bottom of nominal housing prices and obtained the same result with the inverse demand approach in Duca *et al* (2012a, 2012b). At the time of writing, the Case-Shiller 20-city home price index had risen significantly by September from its low reached in February 2012. The FHFA housing price index lags several months behind the Case-Shiller index so our forecast made in December 2009 for lows in the second half of 2012 is plausibly on track. A range of other housing market indicators are also improving, lending credibility to our conclusion.[7]

Other approaches to modelling expectations of capital appreciation are also possible. One might, for example, model future housing price appreciation in a semi-rational model using data that households would have some knowledge of, such as lagged housing price changes, income, mortgage interest rates and growth of mortgage debt, as a simple proxy for changes in credit availability. The fitted value could then serve as a proxy for expected appreciation. But over what horizon is future appreciation likely to be relevant? Obviously, one quarter ahead, given transaction costs and delays, is not a plausible horizon. One year ahead is more plausible but also seems arbitrary. If some average with declining weights of future appreciations is to be taken, what weights should be used? These are relevant research questions.

There is evidence that non-linear 'frenzy' effects can operate in countries with volatile housing prices. Hendry (1984) first used the cubic of recent appreciation to model this phenomenon. Muellbauer and Murphy (1997) find supporting evidence for the United Kingdom and Muellbauer and Williams (2011) do so for Australia. One interpretation is that if housing price rises exceed thresholds given by transaction costs and costs of finance, the potential speculative gains become so attractive that the number of bidders in the housing market rises sharply, resulting in an acceleration of housing prices. This can be an overshooting mechanism additional to the one discussed above. The cubic has the property that 'frenzy' can also operate on the downside so that the fear of capital losses might also raise transaction volumes leading to sharp price declines. An alternative interpretation is that in periods of falling prices, defaults rise, leading to a rise in the proportion of auction sales, and so more rapid price movements.

The user cost approach itself suggests an intrinsic source of non-linearity in housing price dynamics. Equations (5) and (6) suggest that the log of the user cost term *uch* is the right functional form for explaining log housing prices. The log function has the property that *log x* tends to minus infinity as *x* tends to zero. The log function therefore amplifies the effect of user cost as it becomes small – which can happen in housing price booms as Figure 5 amply illustrates.

The user cost, neglecting the risk premium, can take on negative values if rates of capital appreciation in housing price booms exceed interest and other costs of owning a home. Since the log of a negative number cannot be defined, this is a problem. We can write:

7 Pessimists who point to the continued high levels of stocks of housing in foreclosure tend to forget that housing prices reflect both the owner-occupied and rental markets, and vacancies in the latter are at decade lows.

$$uch_t = r_t + \delta_t + t_t - E_t \Delta \log hp \tag{7}$$

where $E_t \Delta \log hp$ is the expected annualised rate of change of real housing prices over the relevant horizon. While this term can be large enough to make the expression in Equation (7) negative, this may not be a problem if expectations, averaged over households, have the form:

$$E_t \Delta \log hp = \lambda const + (1-\lambda) av \Delta \log hp \tag{8}$$

where λ is positive and less than one, and $av\Delta \log hp$ is the relevant annualised historical rate of appreciation. The specification in Equation (8) clearly reduces fluctuations in the implied expected housing price appreciation.

Another possibility is to assume that annualised transaction costs and the risk premium are always large enough to make the expression in Equation (7) positive. Some transaction costs are monetary and there is considerable variation across countries in the size of such costs. But since there are typically costs of moving, costs of fine-tuning the decorative state of one's new dwelling, as well as non-monetary costs associated with disruptions of social networks and learning about new environments, it may be reasonable to suppose that these costs are always large enough.

However, it also seems likely that the risk premium is time-varying and could increase with recently experienced volatility and with the extent to which prices deviate from perceived economic fundamentals. One might have thought that such a specification would pose challenging problems of non-linear estimation and identification. However, for French housing price data, it is possible to go quite far. In particular, a simple version of *uch* is defined as:

$$uch_t = 0.12 + 0.85 mr/100 - \Delta_4 \log pc_t - 0.5\left(\Delta_4 lhp_t + \Delta_{16} lhp_t / 4\right) \tag{9}$$

which assumes that total annualised transaction costs of all kinds plus a constant risk premium is 12 per cent and that the appropriate average rate of tax relief on mortgage interest is 15 per cent, giving an after-tax mortgage interest rate of $0.85mr/100$, where mr is the nominal percentage rate of interest on mortgages. Then the annual inflation rate is subtracted to obtain the real after-tax interest rate where pc_t is the consumer price index. Finally, we subtract the annual rate of increase of real housing prices averaged over the last four quarters and the last sixteen quarters, respectively. The user cost term *uch* is positive throughout the sample. A plot of log *uch* – with the last four years' appreciation and without a risk premium – scaled to measure its long-run impact on log real housing prices is shown in Figure 6. The user cost term makes the largest contribution to long-run housing prices in 2005:Q3.

These data can be used to test a linear versus a log-linear specification. For data from 1980:Q4 to 2003:Q4, linearity is strongly rejected against log linearity. For the full sample to 2011:Q1, linearity is marginally preferred. However, by raising the composite transaction cost/risk premium term from 0.12 to 0.20, log linearity again does better for the full sample. This finding and the shift in parameter estimates are consistent with the hypothesis of a time-varying risk premium. Such a risk premium can be modelled in terms of a measure of housing price volatility, *hpvol*, defined as a moving average of the absolute deviation of changes in log real housing prices, *lhp*, from their mean, *m*, as follows:

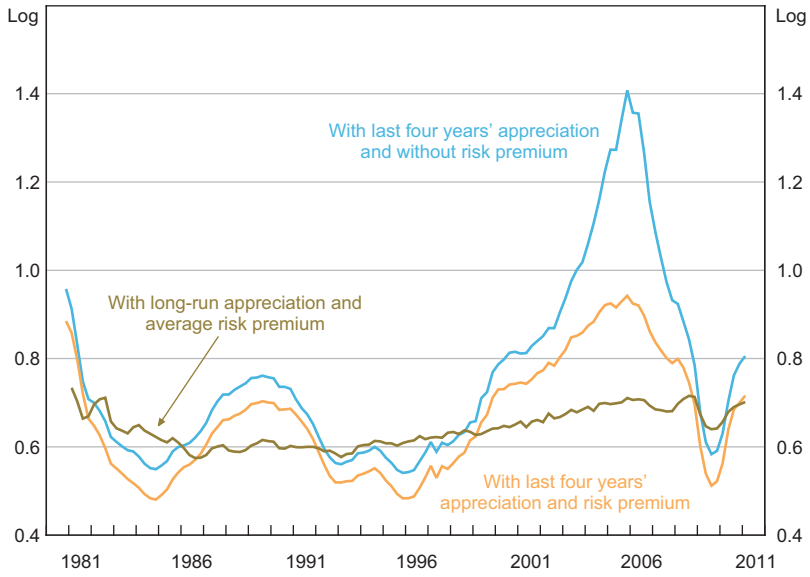
$$\begin{aligned} hpvol_t = {} & abs\left(\Delta_4 lhp_t - m\right) + 0.7\, abs\left(\Delta_4 lhp_{t-4} - m\right) + 0.7^2\, abs\left(\Delta_4 lhp_{t-8} - m\right) \\ & + 0.7^3\, abs\left(\Delta_4 lhp_{t-12} - m\right) / \left(1 + 0.7 + 0.7^2 + 0.7^3\right) \end{aligned} \tag{10}$$

Adding this measure of the risk premium to the previous user cost term with a coefficient β to be estimated results in:

$$\log uch2_t = \log\left(\beta hpvol_{t-1} + uch_t\right) \tag{11}$$

For French data, the estimate of β is highly significant at 0.63 (t = 5.1). Parameter stability and fit both improve with this risk adjustment of the user cost term. Figure 6 compares the time profile of the log user cost term with last four years' appreciation and without risk adjustment to the log user cost term with last four years' appreciation and with risk adjustment. Measured in terms of the long-run impact on the log of the French real housing price index, Figure 6 makes clear that risk adjustment substantially lowers the peak impact of the log user cost term relative to values over the rest of the period.[8]

Figure 6: France – Contribution of the User Cost Term to Estimated Housing Prices



Note: Long-run log real housing prices
Sources: Banque de France; Institut National de la Statistique et des Études Économiques (INSEE); OECD; author's calculations

As was done earlier for the United States, it is possible to estimate the impact of extrapolative expectations of housing price appreciation for France. This is shown in Figure 6 which also plots the long-run impact of the log user cost term with long-run appreciation and the historical mean risk premium on the log of real housing prices. At the peak in 2005, the difference between this series and the series with the last four years' appreciation and last quarter's risk premium is around 0.22, representing 'overvaluation' due to extrapolative expectations of around 25 per cent in the

8 For simplicity, the coefficient of –0.37 (t = –4.5) estimated for the log risk-adjusted user cost term has been applied to both measures. Omitting the time-varying risk adjustment results in a substantially smaller coefficient (in absolute value) on log user cost even if a small constant is added to user cost to prevent it falling into a negative range.

level of real housing prices. While this is a substantial amount, it is a lower figure than the US estimate reported above, in part probably because that estimate does not take into account a time-varying risk premium. However, the main reason is likely to be that the positive shocks from financial innovation in the United States during the 2000s were a lot stronger, so that US housing prices deviated more from sustainable long-run fundamentals than was the case in France.

4.4 Overshooting due to the decline of fragile fundamentals

Overshooting due to extrapolative expectations, given economic fundamentals, is one aspect of overvaluation. Another, sometimes even more important reason for overshooting, is if the 'fundamentals', which include income, credit supply, interest rates and the housing stock, themselves overshoot. There are many examples of this. First, consider Finland. After the credit liberalisation of the 1980s (without a reduction in the generous tax relief on mortgage interest), Finland experienced a huge housing price and consumption boom, and faced a large reduction in exports in the early 1990s when the former Soviet Union collapsed. At the same time, German unification led to a rise in interest rates. The subsequent decline in income, employment and credit came on top of a housing market which would have been overvalued even if fundamentals had held constant. In the resulting crisis, GDP fell by 14 per cent and unemployment rose from 3 per cent to almost 20 per cent.

The United Kingdom too experienced a decade of credit liberalisation in the 1980s, a boom in credit, consumption, housing prices and an increase in the balance of payments deficit. Muellbauer and Murphy (1990) argued:

> … our empirical evidence on the determination of housing prices suggests an important extrapolative component in expectations, giving rise to bouts of speculative frenzy. With the sharp rise in house prices, residential property became more than half of personal sector wealth. Financial liberalization allowed households to cash it in as consumer expenditure financed by borrowing.
>
> In our view, in contrast to that of at least one of our discussants, liberalization of housing finance had important effects on personal wealth, consumption and hence the trade deficit. (pp 349–350)

The discussion by Mervyn King (1990) summarised our policy recommendation for the demand side as follows:

> First, they would increase capital-adequacy requirements on mortgage loans on the balance sheet of firms in the financial-services industry. Second, they would introduce a national tax on residential property and restrict the scope of mortgage interest relief. Both their diagnosis and proposed cure raise the question of how far developments in the housing market can be blamed for the recent emergence of large balance of payments deficits. (p 383)

He then dismissed both the diagnosis and cure, arguing that the more likely explanation for the boom in credit, housing prices and consumption was that income growth expectations had become more optimistic.

Soon after this 1989 debate (published 1990), domestic inflation rose sharply. The United Kingdom had entered the Exchange Rate Mechanism (ERM) with an overvalued exchange rate. Base rates were raised from 7.5 per cent in 1988 to 15 per cent in 1989 in an attempt to curtail domestic inflation and curb balance of payments deficits. Housing prices fell from 1991 to 1995 and mortgage arrears and foreclosures rose to all-time records in 1991:Q2. In 1992, the Bank of England

launched a (secret) lifeboat of liquidity to support the financial system and, given the pressure of high interest rates within the ERM and a severe domestic recession, the United Kingdom was forced to exit the ERM in September 1992.

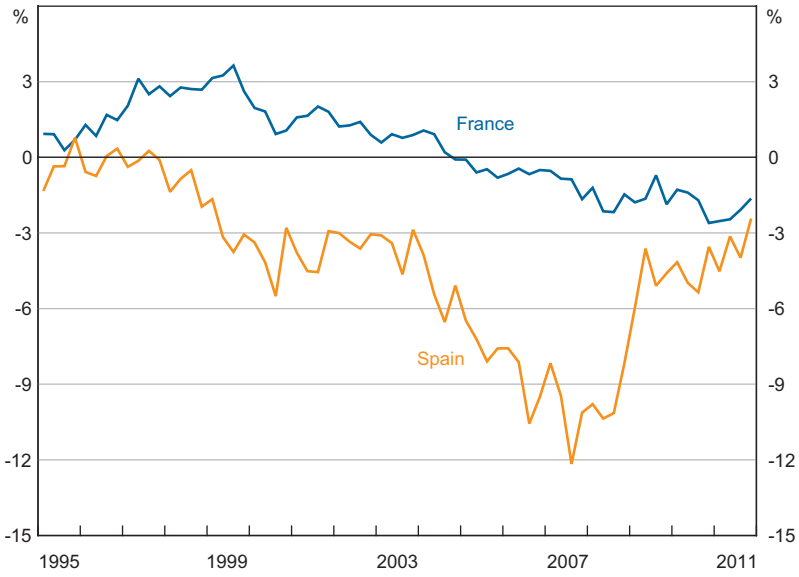
In the more recent UK crisis, what proved most unsustainable were the extreme levels of leverage of the banking system, the maturity mismatch implied by short-term money market financing of longer-term mortgages and the structural deficits run by the government. The exchange rate too was overvalued, given the crowding out of capacity in the non-financial sector of the economy by the long boom in the financial sector, which now faced an unprecedented contraction.

Duca *et al* (2011) show for US housing prices, based on the rent-arbitrage approach, the most obvious fundamental shift was the decline in the LTV ratio for first-time home buyers to levels last experienced in the 1990s. In the inverse-demand approach, the property building boom in 2002–2006 also plays a role, since the housing stock had risen significantly relative to income and population by 2007, adding to downward pressure on prices.

The contrast between Spain and France is also instructive. Chauvin and Muellbauer (2012) suggest that the housing collateral effect on consumption is absent in France, but micro-evidence from Bover (2005) suggests that it is positive in Spain. Spain almost certainly experienced a rather greater expansion of credit availability than France but its effect on real housing prices was offset by a far greater construction boom. Lending to companies, many in the construction business, was certainly part of this expansion in Spain and part of the problem Spanish banks currently face.[9] Spain also experienced very high levels of immigration, which added both to labour working in construction and to demand for housing. In terms of economic fundamentals, Spain's international competitiveness measured in relative unit labour costs declined more than France's. Together, these effects largely account for the far greater ballooning of Spain's balance of payments deficit shown in Figure 7, which contrasts the current account-to-GDP ratios of the two countries since 1995. In Spain the current account balance reached –10 per cent of GDP in 2008 while France's never fell below –2.5 per cent in 2008.

9 Paralleling recent problems in Spain, US bank failures during the recent crisis were largely due to bank lending to construction and land development companies.

Figure 7: Current Account Balance
Per cent of GDP

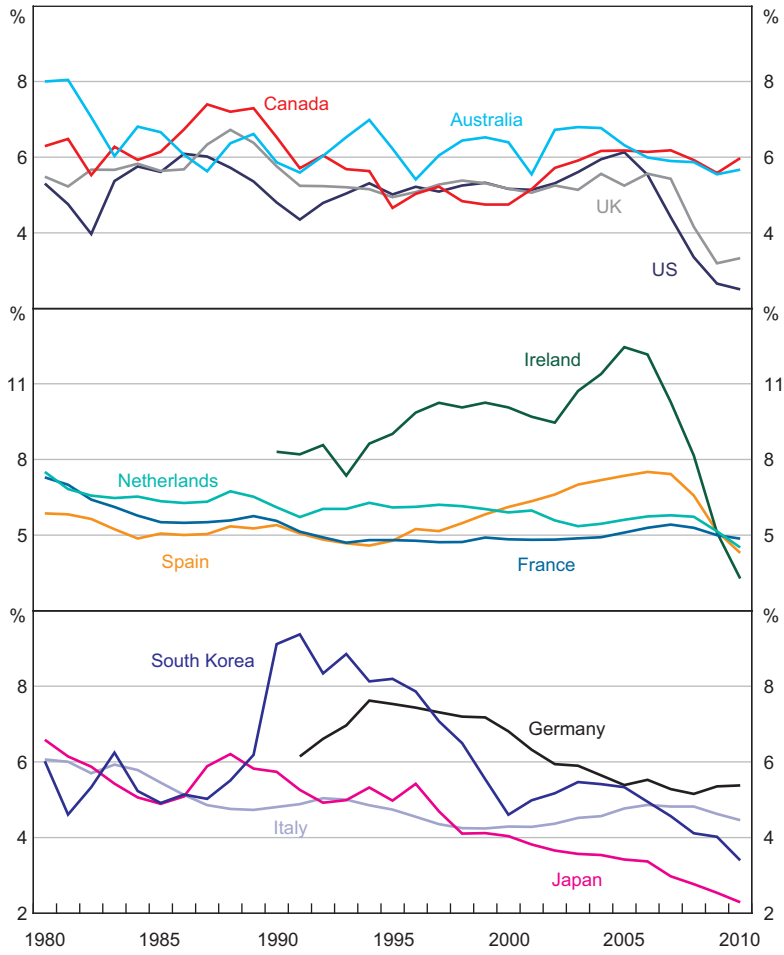


Source: OCED

5. Modelling Residential Construction: What Scope for Overshooting?

The three panels of Figure 8 show the ratio of residential housing investment to GDP for the same three sets of countries examined in Section 2. The top panel of Figure 8 most strikingly contrasts the collapse of housing building in the United States and the United Kingdom since 2006 and 2007 with the steady performance in Australia and Canada. In the United States the peak-to-trough decline accounts for around 3.5 per cent of GDP. In the United Kingdom, the peak-to-trough decline was around 2 per cent of GDP and in 2009–2010, construction volumes fell from low levels to even lower levels, such that the United Kingdom built fewer homes in 2010 than in any year since 1923. The boom in 2002–2006 in the United States contrasts with 15 years of little fluctuation in the United Kingdom.

Figure 8: Residential Housing Investment
Per cent of GDP



Source: OECD (2011)

The middle panel of Figure 8 suggests that the collapse of housing construction in Ireland was around 9 per cent of GDP and around 3.5 per cent in Spain, while France and the Netherlands had far more modest declines. The building boom in Ireland and Spain seems to have begun in the mid 1990s but the OECD data indicate a more extreme boom in Ireland. The impact of excess supply, as well as of the credit crunch, is the most plausible explanation for the fall in housing prices in Ireland displayed in the middle panel of Figure 1.

The bottom panel of Figure 8 sheds light on the fall in real housing prices experienced by Germany after the late 1990s and by Korea in the 1990s: the expansion of the housing stock due to high levels of investment seems to have been part of the explanation in each case.

But what determines residential investment? The determinants of the supply of housing are extraordinarily complex. The literature on the econometrics of new housing construction is

correspondingly diverse and contradictory. DiPasquale (1999) explains some of the reasons why we appear to know so little about housing supply. Housing supply comes from new buildings as well as conversions and rehabilitation of the existing stock. Data on expenditure on improvements suggest that it has become a substantial fraction of total gross investment in housing. But the behaviour of builders and owners is likely to differ, and among owners, owner-occupiers may behave differently from landlords. New construction can be for owner-occupation, the private rental sector or for the social rental sector, each with different drivers. Housing is heterogeneous and the available data on numbers of units usually ignore this heterogeneity by type and location.

Government intervention in some countries had or has been on a massive scale. For example, as a matter of policy, the construction of social housing in the United Kingdom (and, for that matter, in many other countries, such as the Netherlands) has declined sharply since the 1970s. The incidence of rent controls has varied greatly. The literature on private residential construction has converged to some extent in recent years in agreeing on the importance of land supply and, hence, zoning and planning restrictions, and other interventions, such as the taxation of developers (see Muellbauer and Murphy (2008) for further references and Quigley (2007) for a review of the US literature).

Wide disagreements on details remain. Estimates for housing supply elasticities differ greatly, even when they are meant to refer to the same country and time period, sometimes even within the same study. Mayer and Somerville (2000) argue that residential construction responds not to the level of real housing prices, but to their rate of appreciation, and that this could be part of the reason for the great instability of estimates of the supply elasticity. Stripped to the essentials they advance two main arguments. The first is that residential construction is a stationary series while real housing prices are non-stationary, so that a cointegrated relationship cannot exist explaining the former by the latter. The second is that housing values are basically land values plus the value of the bricks, mortar, etc, erected by builders on the land. The structures are reproducible and their supply price is given by costs little affected by demand in the long run. Land, however, is non-reproducible. Builders effectively onsell the same land they acquired earlier so that their profit consists of the normal mark-up on construction costs plus the capital gain on land. Capital gains in land are approximately capital gains in housing minus the rise in other construction costs. Hence, expected capital gains in land (or housing) will be important drivers of residential construction volumes. To be more precise, because builders also need to take the cost of capital into account, a user cost concept analogous to that which influences household demand for housing should help explain variations in residential investment.

The relevant interest rate will be the rate at which builders can borrow, which will be correlated with, but not identical to, mortgage interest rates. Furthermore, access to borrowing by large and small construction companies may sometimes move differently from access to mortgages by households. It is also possible that builders may have better-informed expectations with regard to capital gains than households. Nevertheless, it is likely that an extrapolative element governs these expectations too. Hence it is likely that similar factors, namely extrapolative expectations of capital gains, low interest rates and easier access to borrowing, explain both the overshooting of residential construction volumes in housing booms and the overshooting of housing prices in, for example, Ireland, Spain and the United States. User cost, together with an ageing population,

could also help explain the declining levels of residential construction in Japan, illustrated in the bottom panel of Figure 8.

Most housing economists, if asked before 2005, would have argued that economies where the supply responsiveness of housing is relatively high, as in Ireland, Spain and the United States, should experience *lower* housing price volatility than economies where housing supply is unresponsive as in the United Kingdom. The evidence that has since become available strongly contradicts this hypothesis. The explanation lies partly in the lags in the response of the stock of housing, which may continue to rise when housing prices have already started to fall, and partly in the common drivers of overshooting noted above – clearly if supply overshoots, then the subsequent fall in home prices needed to restore equilibrium will be greater. The argument here is similar to that of the classic 'hog cycle'.[10] The common drivers of overshooting would include the greater relaxation of credit conditions and poorer lending standards, and hence greater reversal in prices after 2007, in at least Ireland, Spain and the United States. Another reason for greater volatility in countries with high supply elasticities lies in the macroeconomic feedback on unemployment and incomes, which occurs when residential construction volumes collapse.

6. How Can We Tell if the Consumption Channel Operates?

There has been much disagreement among economists on whether variations in housing wealth matter for consumption. The pre-crisis view of Mervyn King and the Bank of England, that housing price fluctuations reflect shifts in income expectations and play no causal role for consumption, has long been popular.[11] In a number of papers I have explained that classical theory, in which credit constraints and buffer stock saving play no role, suggests that there could be a small positive housing wealth effect on non-housing consumption but that the housing wealth effect was likely to be negative on the standard national accounts' concept of consumption, which includes imputed rent from housing.[12]

Moving beyond classical theory to take credit constraints into account, the conclusions are quite different: a liberal credit market tends to result in a positive effect of housing prices on consumption because collateral constraints on owners are relaxed and there is less need for the young to save for a housing deposit even at higher prices. However, in the long run, the accumulation of higher debt will eventually reduce consumption. With an illiberal credit market, the collateral effect is weak, while the need of the young to save for a housing deposit increases with higher housing prices. In the latter case, higher housing prices reduce consumer spending, as seems to have been the case in Italy and Japan. Institutional differences between countries therefore matter greatly, and so does properly controlling for changing credit conditions in econometric work.

With proper controls for shifting access to credit, income growth expectations, interest rates and the change in the unemployment rate, empirical estimates of the shifting marginal propensity to

10 Here pig farmers respond to high prices by breeding more pigs in year t, but because pigs take two years to reach maturity, supply in year $t + 2$ then overshoots and excess supply reduces prices at $t + 2$ which then reduces the supply of pigs at $t + 4$, causing prices to rise once more.

11 Attanasio and Weber (1994) and Attanasio *et al* (2009) are among the adherents, but Attanasio, Leicester and Wakefield (2011) represents a pronounced shift away from this position. In the latter paper, the authors set up a micro-simulation with a realistic representation of credit constraints in the UK mortgage market and simulate the implications for consumption of housing price shocks with these frictions.

12 See Muellbauer and Lattimore (1995) and Muellbauer (2007); the argument is easiest to follow in Aron *et al* (2012).

consume out of housing wealth tend to be lower but more accurately determined than estimates widely found in the literature, such as Case, Quigley and Shiller (2005).

To meet the King/Bank of England view with evidence, it is necessary to have a quantitative measure of shifts in credit conditions as well as of consumers' permanent income. In the Latent Interactive Variable Equation System (LIVES) approach, an index of credit conditions can be extracted from a system of equations that typically includes consumption and other credit-related variables such as mortgage debt, housing prices, home equity withdrawal, mortgage refinancing rates and potentially other components of household flow-of-funds data.[13] Such a system is also a major step towards developing a general equilibrium analysis in which household portfolios, on the basis of which consumers make consumption decisions, are endogenised. It is a key component of modelling efforts to understand the links between finance and the real economy.

A starting point for understanding consumption is the canonical form of the life-cycle/permanent income consumption function. Following Aron *et al* (2012), the best log-linear approximation to this is:

$$\ln c_t = \alpha_0 + \ln y_t + \gamma A_{t-1} / y_t + \ln\left(y_t^p / y_t\right) \tag{12}$$

where c is real per capita consumption, y is real per capita non-property income, the p-superscript denotes the permanent version of this income concept, and A is real per capita net worth. γ is a close approximation to the marginal propensity to consume (MPC) out of net worth. Note the coefficients of unity on the log income terms in the canonical model.

The following is a generalisation, with partial adjustment, of the canonical permanent income model of consumption in Equation (12):

$$\ln c_t \approx \lambda\left(\alpha_0 + \alpha_1 r_t + \alpha_2 \theta_t + \ln y_t + \alpha_3 E_t \ln\left(y_t^p / y_t\right) + \gamma A_{t-1} / y_t - \ln c_{t-1}\right) + \varepsilon_t \tag{13}$$

where λ measures the speed of adjustment. This version relaxes the constraint on the coefficient for permanent income (since not all consumers may be so forward looking) and allows the real interest rate r and income uncertainty θ (typically proxied by changes in the unemployment rate) to affect consumption.

There are two reasons why this specification is not general enough. First, the net-worth constraint that all assets are equally spendable should be regarded as absurd by any banker. Obviously liquid assets should be more spendable than illiquid assets and economic theory implies that housing and financial assets are not equivalent. It follows that net worth should be disaggregated into at least three components: Aron *et al* (2012) find that net liquid assets (defined as liquid assets minus debt), illiquid financial assets, and housing assets are the minimal set for useful empirical work. Second, credit market liberalisation shifts some of the key parameters. Most importantly, it is likely that credit market liberalisation will raise the average consumption to income ratio, given

13 Our initial attempt to measure shifts in mortgage credit conditions in Muellbauer and Murphy (1993) estimated an equation for the LTV ratio for first-time buyers to 1979 and took the forecast errors after 1979 as the indicator of shifts in mortgage credit availability. This proved to be highly significant as a measure of the rise in the marginal propensity to consume out of illiquid assets (including housing) in the UK consumption function. The method was later extended to a system of regional LTV ratio data, which allowed this residual to be extracted as a common factor. Fernandez-Corugedo and Muellbauer (2006) extended this model further to a 10-equation system including proportions of LTV and loan-to-income ratios exceeding traditional thresholds. In Aron and Muellbauer (forthcoming), the LIVES method was applied to a 2-equation system of consumption and debt.

household portfolios and, if access to home equity loans increases, the marginal propensity to consume out of housing wealth should also rise.

A typical symptom of omitting important shifts in credit conditions when estimating extended versions of Equation (13) with wealth split into its main components is that the coefficients on these wealth components are unstable over time and the speed of adjustment is typically low and/or unstable. For quarterly data, any speed of adjustment below about 0.2 is generally a symptom of misspecification. For US quarterly data from 1966 to 2011, one can find a great variety of adjustment speeds for 25-year sub-periods ranging from less than 0.1 to 0.35, and hugely unstable coefficients on net worth components, ranging from sometimes negative for liquid assets to sometimes positive for debt, and similarly for housing wealth.

The Bank of England investigated the housing wealth to consumption linkage in Benito *et al* (2006). In a consumption equation estimated for 80 quarters in a rolling window from 1998:Q1 to 2006:Q1, they report a significant decline in the relationship. Few details of the model are available except that it was in an equilibrium correction form with a long-run solution linking consumption with income and net financial wealth, and that only the change in housing wealth, and not the level, was allowed to influence the change in log consumption. No information is given on whether the controls include the change in the unemployment rate or interest rates, or the size of estimated adjustment speeds. Omission of such controls and of indicators of the radical credit market liberalisation that began at the end of 1979 would undoubtedly affect the empirical estimates. Muellbauer (2007) and Aron *et al* (2012) report that the coefficient on the level of housing wealth-to-income ratio interacted with the credit conditions index of Fernandez-Corugedo and Muellbauer (2006) is highly significant (*t*-ratio around 6) and stable.[14] Since the credit conditions index rose from the mid 1990s into the 2000s, this indicates that, in the relevant period, housing wealth actually had a rising influence on consumption, the opposite of the Bank of England conclusion.

Estimates from research for the United Kingdom, the United States, Australia, South Africa and France all point to: quarterly adjustment speeds between 0.3 and 0.4; increases in the ratio of consumption to income with more liberal credit market conditions; the MPC for net liquid assets between around 10 and 16 per cent; MPCs for illiquid financial assets between around 2 and 4 per cent; and highly variable MPCs out of housing wealth ranging from slightly negative to around 5 per cent.[15] For these countries, credit market liberalisation had an important impact on consumption. Once this impact is controlled for, the remaining parameters are stable and well determined, while tests confirm both cointegration and that consumption is the main variable adjusting to the cointegration vector.[16] The combination of wealth and credit effects, in

14 Incidentally, to obtain approval for Fernandez-Corugedo and Muellbauer (2006) to appear as a Bank of England working paper we had to remove three passages. The first suggested that the level of UK household debt might pose a threat to future financial stability. The second referred to academic research on herd behaviour by banks. The third argued that there were sometimes delays in the reporting of bad loans on bank balance sheets.

15 See Muellbauer and Williams (2011); Aron *et al* (2012); Chauvin and Muellbauer (2012); Duca *et al* (2012b); and Aron and Muellbauer (forthcoming). Japan is the only country where there appears to have been no break in consumption behaviour emanating from credit market liberalisation.

16 This is exactly the opposite conclusion from that reached in the influential work of Lettau and Ludvigson (2001, 2004, 2011) which claims that assets, and not consumption, do the adjusting to a cointegration vector defined on consumption, income and net worth. Their work implicitly assumes that the vast changes in US credit market architecture since the 1950s had no impact on the relationships between consumption, income and household portfolios.

conjunction with accounting for how financial innovation has shifted key financial real linkages, is necessary to understand the behaviour of consumption in these economies.

7. Non-linearities from the Bad-loans Feedback Loop: Understanding Payment Delinquencies and Foreclosures

The banking channel is the third of the major macroeconomic channels involving the housing market. This can be illustrated by comparing the differing experiences of the United States, Spain, Ireland and the United Kingdom since the financial crisis began in 2007.

Banks in Ireland were caught both by contagion from the United States and by a double domestic lending problem: reliance on funding from short-term money markets which seized up in August 2007, and overextension and poor quality of lending both to property developers and households (Kelly 2009). The overwhelming bad-loan problem led to a massive bank bailout by the government, and a credit crunch with sharply tighter loan conditions. The guarantee hastily given to the Irish banks by the Irish Government and the collapse of tax revenue contributed to a more than doubling in two years of the government debt-to-GDP ratio and to a sovereign debt crisis in 2010–2011.

Irish banks were also hit by contagion from the United Kingdom, although UK banks were far less exposed to UK mortgage markets and UK property developers. Indeed, by 2010, bad domestic mortgage loans accounted for only a small part of the bad-loan book of UK banks. Bad loans that financed highly leveraged takeovers and risky commercial and unsecured borrowers impaired the balance sheets of domestic UK banks far more. Without unprecedented monetary policy actions, including dramatic reductions in the policy rate and 'quantitative easing', there would have been far more severe problems in the UK mortgage market.

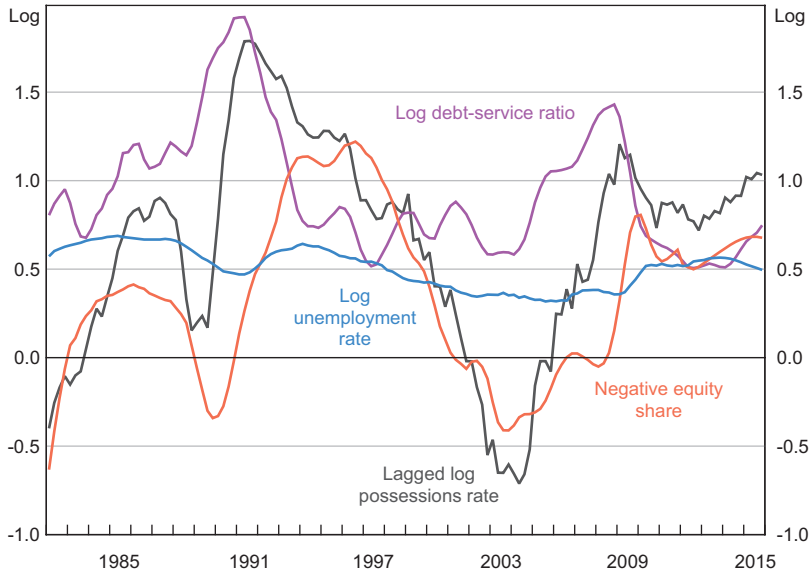
As is well-known, the subprime crisis in the United States triggered major falls in US housing prices, a surge in mortgage defaults and a wider banking and credit market crisis, which spread to other overleveraged banks and financial institutions globally. There is a large literature on US mortgage foreclosures since a number of micro datasets are in the public domain. Variants of 'double trigger' models where negative equity and cash flow problems are both causes of foreclosure are now generally accepted (see Bhutta, Dokko and Shan (2010), *inter alia*). The 'ruthless default' alternative based on options theory under which rational households simply default if negative equity goes beyond a threshold even if they can still service their mortgage has been found empirically defective.

In the United Kingdom, mortgage loans are full recourse and defaulting borrowers can be pursued for up to seven years for the shortfall between the loan and what the lender receives from the sale of the foreclosed property. This makes it more likely that foreclosure (mortgage possession or repossession) involves both a weak debt/equity position and a cash flow problem with debt service. Moreover, because most mortgages are made at adjustable interest rates, shocks to the debt-service ratio from variations in interest rates can be an important cause of both foreclosure and payment delinquencies (mortgage arrears), in addition to negative net equity and income loss, for example, due to unemployment. The United Kingdom, like most countries, has no micro-data in the public domain on representative samples of foreclosures. But it does have aggregate time series data going back to the early 1980s. Aron and Muellbauer (2010) analyse and estimate the

effects on UK arrears and possessions of lower loan quality in the late 1980s and the 2005–2007 period, the subsequent tightening of access to refinancing possibilities, and government policies. These policies included increasing forbearance on lenders through the enforcement of a code of practice, and increasing the generosity of income support for those with payment difficulties. The UK Government also took other policy measures to support those at risk of defaulting.

Figure 9 shows the estimated long-run contributions to the log of the possessions or foreclosure rate in the UK from the debt-service ratio (the mortgage interest rate multiplied by average mortgage debt and divided by income), the proportion of mortgages in negative equity, and the unemployment rate.[17] The outcomes from 2010 onwards are based on an assumed economic scenario in which interest rates start a return to more normal levels only at the end of 2013. Figure 9 shows the contribution of higher interest rates in 1989–1992 in driving up foreclosures through the debt-service ratio, the contribution of dramatically lower rates over 2008–2010 in preventing a larger rise in foreclosures, and the effects of simulated interest rate normalisation. Increases in the proportion of home owners with negative equity explain why foreclosures did not fall more rapidly in the mid 1990s and accounted for much of the rise in the foreclosure rate from 2004 to 2010.

Figure 9: United Kingdom – Long-run Contribution of Key Explanatory Variables to Estimated Possessions Rate



Source: author's calculations

This research also suggests that the policy of increasing lender forbearance on delinquent borrowers reduced the foreclosure rate by about 12 per cent from where it would otherwise have been both in the mid 1990s and since late 2008. Models of mortgage arrears (payment delinquencies) give

17 The proportion in negative equity is based on a theoretical relationship between the mean and the tail of the distribution of log debt/equity ratios, calibrated to a few survey-based estimates of the proportion in negative equity.

a somewhat larger relative weight to the debt-service ratio and the unemployment rate, but the negative equity share remains highly significant. Complete identification of the effects of previous weak lending standards and of policy responses is not possible, though sign restrictions in the 3-equation system of foreclosures and two measures of arrears are helpful. This aggregative approach would be more accurate if data were available on foreclosures and arrears rates by vintage of issue. Then vintage effects associated with the quality of lending at the time of origination could be identified and provide early warning of stresses to come.

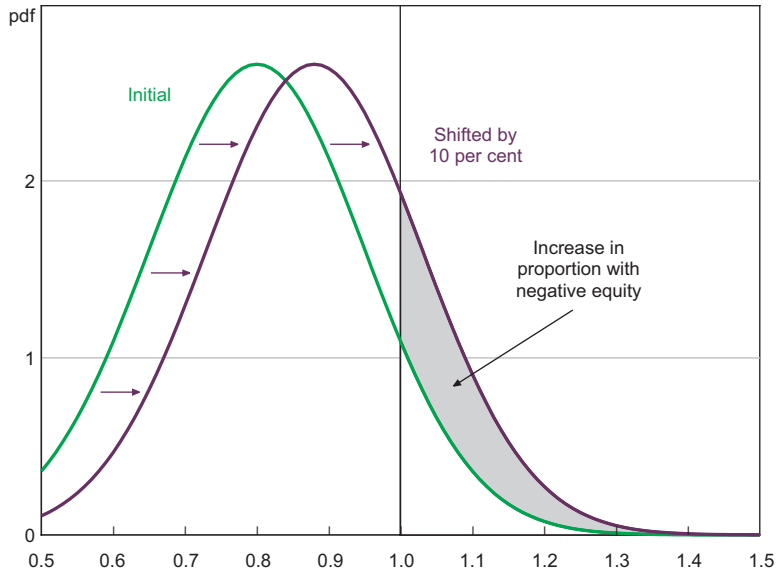
The survey on mortgages published quarterly since 2005 by the UK's Financial Services Authority (FSA) is also very useful. This reports key characteristics of distributions of LTV and loan-to-income ratios and other mortgage descriptors such as interest rates and the terms of rate adjustments, loan duration, whether securitised or not, low documentation or not, owner-occupier or landlord. Unfortunately, the new survey data cannot be matched well with previous survey data, precluding continuity with pre-2005 history. Nevertheless, the pioneering efforts of the FSA deserve to be copied by all mortgage market regulators and will be very useful in future.

Models of mortgage arrears and foreclosures can be linked to the bad-loan books of mortgage lenders and used for stress testing the stability of the financial sector of the economy under different scenarios. The models should contain an important non-linearity or amplification in the transmission of shocks via the housing market to the financial sector, and so the economy, reflecting the non-linear link between housing prices and the incidence of negative equity. In the distribution of the debt-to-equity ratio, the area under the distribution for values greater than one is the fraction of mortgages with negative equity (with home equity less than debt). If average housing prices fall by 10 per cent, say, this distribution shifts to the right, and this area would increase by much more than 10 per cent (Figure 10). Thus, beginning in 'normal' times, even a large rise in housing prices has little effect in reducing an already low level of foreclosures. But a moderate fall in housing prices moderately raises the level of foreclosures, while a large fall in prices leads to disproportionately large increases in foreclosures. This is an important asymmetry which helps account for the fact that business cycle contractions are often far sharper than business cycle expansions.

Bad loans, which could arise from corporate lending to construction companies or from household mortgages coupled with poor general business conditions, affect bank profits given the structure of trading income and expenses. The pricing structure of each bank's balance sheet, especially the mismatch between assets and liabilities, influences each bank's vulnerability to shocks to interest rates, spreads and default probabilities. This influences the ratings banks receive from ratings agencies, which can affect funding costs and liquidity and possibly even induce bank failure. Banks may engage in fire sales to boost liquidity. Interactions between banks with network externalities (where counterparty risk constrains behaviour) generate the possibility of further losses which, in turn, reduces funding liquidity and thereby increases the possibility of bank failure. Survivors bear credit losses which impair their balance sheets and assumptions need to be made about the portfolio/risk strategies pursued by the survivors. At the end of each period, balance sheets, and loan and trading books are set for the beginning of the next period. Bank lending also feeds into

the macroeconomic picture for the beginning of the next period, when new macro or financial shocks arrive.[18]

Figure 10: Distribution of Debt-to-equity Ratios



Note: Not the true distribution; for illustrative purposes only

This gives a good flavour of the kinds of realistic feedbacks and shock amplification which arose in the global financial crisis and which potentially could arise again. It also highlights the risks associated with higher interest rates in the aftermath of the financial crisis and the role played by housing and mortgage markets in transmitting and amplifying such risks.

8. Policy Conclusions

For assessing whether a housing market is overheated enough to threaten financial and economic stability, policymakers should avoid relying on analysis from a 'sausage machine' approach to large multi-country datasets which skate over data quality, a proper treatment of the supply side and of credit markets, and institutional variation across countries and over time. That said, there is much to be learned from comparative cross-country analysis of historical experience. My bias is that careful econometric modelling of individual country datasets, in a comparative perspective, can make a huge contribution.

Overheating can have both a price and a quantity dimension, but it is likely that they are linked by common drivers. However, much depends on the land use planning regime which profoundly affects the supply response: there is at least one country, the United Kingdom, where private sector housing construction appears not to respond to price signals, whether housing prices or user cost.

18 A model for risk assessment which broadly shares these features, RAMSI, has been designed at the Bank of England: see Aikman *et al* (2009).

It is helpful to make the distinction between overshooting of housing prices due to extrapolative expectations and 'frenzy', given fundamentals, and shifts in possibly fragile fundamentals. The contribution of careful econometric modelling to estimating the effects of the former has been demonstrated and evidence provided that this type of overshooting was important in 2005 in the United States and to a lesser extent in France. However, it is high time that central banks and other policymakers conduct regular quarterly surveys of the housing price expectations of potential housing market participants to help assess the first type of overshooting.

Assessing the fragility and evolution of the economic fundamentals is a more complex task. Our experience has been that credit supply conditions in the mortgage market are the 'elephant in the room'. Without taking them into account, one simply cannot understand the behaviour of housing prices, household debt and consumption in countries such as Australia, the United Kingdom, the United States, South Africa or France. Although central bank surveys of mortgage market conditions have been run by the US Federal Reserve since 1990 (with improvements since 2007),[19] the European Central Bank (ECB) since 2002, and by the Bank of England since 2007, precise interpretation of the results is difficult until a long track record is available. In part, this is because the survey responses tend to be affected by other economic conditions, as well as by longer-term shifts in credit supply.

The systems approach my co-authors and I have pioneered to measure a credit conditions index is extremely helpful. But the results need careful interpretation. For example, Muellbauer and Williams (2011) estimate a credit conditions index for Australia, which shows a fairly spectacular rise in the 1980s, from the late 1990s to 2007, and on estimates up to 2008, a modest decline. From circumstantial evidence on financial regulation in Australia, the relatively modest leverage and continued profitability of its banking system, as well as skilful counter-cyclical policies of its central bank, one would conclude that these credit fundamentals are more robust in Australia than in the United States, Ireland, the United Kingdom and Spain. Australia's dependence on exporting to China and more generally its reliance on a permanent improvement in its international terms of trade does point to a potential vulnerability in other economic fundamentals. If these fundamentals turned negative, the high levels of household debt in Australia could seriously constrain growth even though the appropriate exchange rate adjustment could very likely be managed without a rise in interest rates, and fiscal policy would also be available, given low levels of government debt.

The vulnerability of consumption to high levels of household debt has been hidden by analysis that relies on aggregate net worth in modelling consumption rather than on a more accurate but simple three-component disaggregation of wealth as has been revealed by Aron *et al* (2012). With estimates in different countries of the MPC out of liquid assets minus debt of between 0.10 and 0.16, it is clear that credit market liberalisation – which boosts consumption and debt – can leave households vulnerable to a credit crunch and asset price declines, as demonstrated by the long and painful process of household deleveraging in the United Kingdom, the United States, Ireland and Spain. Assessing the fragility or otherwise of credit conditions is critical for accurately judging the fragility of economic fundamentals in economies with high levels of household debt

19 The mortgage module was added in 1990 to a survey which began in 1966. Non-prime loans were distinguished from 2007.

relative to income. In turn, since credit conditions themselves depend on the bad-loan book of the banking sector, they depend on multiple financial and economic influences.

The size of the housing collateral effect on consumption is another aspect of this potential fragility since the absence of such an effect, for example, in France or Japan, means that part of the potentially amplifying feedback loop is missing, implying less economic instability. In the United Kingdom, the United States, Australia and South Africa, this feedback loop is powerful. Distinguishing between economies where most mortgage debt is at fixed rates, as in the United States or France, and where most mortgage debt is on floating rates, as in the United Kingdom, is also useful since interest rate risk can be important in the latter. However, one should avoid overgeneralising. For example, in the United Kingdom the rise in interest rates in 1988–1991 was a powerful crisis trigger, but the ability of the Bank of England to cut rates rapidly in 2008–2009 and the large impact of these cuts on cash flows of indebted households, greatly softened the impact of the recent financial crisis. In this respect, monetary policy in the United Kingdom in 2008–2009 was more powerful than in the United States.

Since housing supply is crucial for understanding long-run developments in housing prices, it is important to include it among economic fundamentals. Fortunately, this is easy since the capital stock evolves fairly slowly even with high rates of investment. However, residential investment is potentially highly volatile as the staggering chart for Ireland in the middle panel of Figure 8 demonstrates. The implications for employment and income and further negative feedbacks of a 9 percentage point fall in residential construction as a share of GDP in Ireland have been all too obvious. Falls in population growth in economies with high levels of international migration, as in Ireland and Spain, can also contribute to housing market declines when economic conditions worsen.

Among financial indicators, the bank leverage ratio and the ratio of loans to domestic deposits are likely to be important. The first is a clear indicator of the stability of the banking system and extreme levels of the second typically indicate potential maturity mismatches between loans and sources of funding. In Ireland and the United Kingdom, the resort to short-maturity money market borrowing was a crucial source of vulnerability when these markets dried up in 2007, though in Australia, where lending practices were far more cautious and banks remained profitable, it was not. The level and nature of securitisation of loans through asset-backed securities can also be a source of vulnerability as the US subprime crisis amply illustrates. There are well-regulated, low risk and transparent versions of this form of finance such as securitising *prime* mortgages, but also unstable forms, such as special investment vehicles that funded subprime mortgages, junk bonds, and even private equity investments with short-term debt. So it is not securitisation in general, but the form it takes that can reduce financial and macroeconomic stability.

Clearly, the quality of financial regulation and the general policy stance of the central bank is another important factor in judging the fragility of the fundamentals. In Australia, the Reserve Bank has long had a pragmatically cautious respect for the risks posed by credit and housing price booms, and has been decisive in raising rates to head off incipient booms; the Australian Prudential Regulation Authority has always been tough on bank supervision. Before 2007, the Bank of England's views were quite different, as the discussion of the article by Benito *et al* (2006) and footnote 14 reveals. In 2006, the financial stability division of the Bank of England had little

influence on the Bank's policies and the Bank only introduced its survey of credit conditions in 2007. Lack of appreciation of the power of the financial accelerator by the Bank of England's leadership, combined with the light-touch regulation pursued by the government in the game of competitive advantage with New York and other financial centres left the United Kingdom ill-prepared when the global financial crisis arrived.

The history of financial and exchange rate crises suggests that foreign currency-denominated loans can be a serious source of instability if the exchange rate is on a potentially movable peg. The lessons of the Asian economic crisis of 1997–1998 in this respect seem not to have been learned in countries such as Latvia and Hungary, now suffering the consequences of high levels of such loans.

In the more standard real economy sphere, useful signals are the ratios of public and private sector debt and current accounts to GDP, which tend to be good indicators of whether a country is living beyond its means and also may be indicative of a potentially overvalued exchange rate. Spain, Ireland, the United Kingdom and the United States are all cases in point. However, overly simplistic interpretations need to be avoided. Australia has run current account deficits continuously for decades partly because of the flow of foreign investment to its resources sector. As the inter-temporal balance of payments theory in Muellbauer and Murphy (1990) implies, it can be rational to run sustained deficits if future productivity growth will be higher or if the economy has the capacity to generate higher income, for example, from the exploitation of natural resources.

The role of taxation should also not be ignored. I have long advocated using national property taxes linked to recent market valuations as an automatic stabiliser in economies where housing and mortgage markets play an important role as shock transmitters and amplifiers (Muellbauer 2005). Such a system raises the tax burden in housing price booms and lowers it when housing prices fall. It worked well for many years in Denmark until the automatic link with market values was abandoned for short-term political gain in 2001. The politics of property are very sensitive, and wealthy elites have a powerful influence. Even now, UK politicians seem unwilling to reform a regressive property tax system linked to 1991 valuations, in which zero marginal tax rates apply to properties above approximately £1.5m in current price terms. In Australia, where the tax system has long favoured buy-to-let investors, it can be argued that tax reform could do more to discourage high levels of gearing and risk taking in this sector.

This list of potential influences and this brief discussion of their complexities suggests that models of early warning of financial and economic crises estimated on large country panels would need to be quite complex. For example, such models should include some important interaction effects based on detailed institutional understandings of each economy. Obvious dummies for interaction effects would include whether home equity loans are common as a simple proxy for the consumption-housing channel, typical LTV ratios for first-time home buyers, and whether mortgage rates are floating or are fixed. This is a very active research area, with recent examples including the IMF's *Global Financial Stability Reports* and the report of the ECB's team examining macro-financial linkages (Hubrich *et al* 2011).

As is now widely accepted, in addition to the standard stabilisation tools, instruments of macroprudential policy are needed and are under active discussion. One of these, very closely connected with mortgage markets is the maximum permissible LTV ratio, which appears to have

been rather effective in Hong Kong (Wong *et al* 2011) and other economies. The Bank of England seems to regard this as politically too sensitive to be regulated by the Bank (Tucker 2012), but this is all the more reason why such regulation should not be left to politicians. Cyclical variation in capital requirements to tighten standards in booms are clearly beneficial.

As far as lending to the corporate sector is concerned, history suggests that at least a tripartite sectoral division of such requirements is needed for the financial sector, the real estate-connected corporate sector and the rest of the corporate sector. There seems no sensible alternative for managing the commercial real estate sector since activity is so very heterogeneous and measurement so difficult that no standard model such as loan-to-cash flow or loan-to-value is likely to work. As well as focusing on risks posed by overvalued housing prices, this paper has also highlighted the importance of building booms fuelled by excess corporate borrowing in causing financial and macroeconomic instability. It is important therefore for complementary macroprudential policies to be imposed both on lending to households and to corporates in real estate development.

References

Aikman D, P Alessandri, B Eklund, P Gai, S Kapadia, E Martin, N Mora, G Sterne and M Willison (2009), 'Funding Liquidity Risk in a Quantitative Model of Systemic Stability', Bank of England Working Paper No 372.

Aron J, JV Duca, J Muellbauer, K Murata and A Murphy (2012), 'Credit, Housing Collateral, and Consumption: Evidence from Japan, the U.K., and the U.S.', *The Review of Income and Wealth*, 58(3), pp 397–423.

Aron J and J Muellbauer (2010), 'Modelling and Forecasting UK Mortgage Arrears and Possessions', Centre for Economic Policy Research Discussion Paper No 7986. 2012 update available at <http://www.communities.gov.uk/publications/housing/forecastmortgagearrears>.

Aron J and J Muellbauer (forthcoming), 'Wealth, Credit Conditions and Consumption: Evidence from South Africa', *Review of Income and Wealth*.

Attanasio OP, L Blow, R Hamilton and A Leicester (2009), 'Booms and Busts: Consumption, House Prices and Expectations', *Economica*, 76(301), pp 20–50.

Attanasio OP, A Leicester and M Wakefield (2011), 'Do House Prices Drive Consumption Growth? The Coincident Cycles of House Prices and Consumption in the UK', *Journal of the European Economic Association*, 9(3), pp 399–435.

Attanasio OP and G Weber (1994), 'The UK Consumption Boom of the Late 1980s: Aggregate Implications of Microeconomic Evidence', *The Economic Journal*, 104(427), pp 1269–1302.

Benito A, J Thompson, M Waldron and R Wood (2006), 'House Prices and Consumer Spending', Bank of England *Quarterly Bulletin*, 46(2) Summer, pp 142–154.

Bhutta N, J Dokko and H Shan (2010), 'The Depth of Negative Equity and Mortgage Default Decisions', Board of Governors of the Federal Reserve System Finance and Economics Discussion Series No 2010–35.

Bover O (2005), 'Wealth Effects on Consumption: Microeconometric Estimates from the Spanish Survey of Household Finances', Banco de España Documentos de Trabajo No 0522.

Bracke P (2010), 'Great Expectations: An Analysis of House Price Predictions', Paper presented at Second Annual Conference of the Spatial Economics Research Centre, London School of Economics, London, 6–7 May.

Caballero RJ (2010), 'Macroeconomics after the Crisis: Time to Deal With the Pretense-Of-Knowledge Syndrome', *The Journal of Economic Perspectives*, 24(4), pp 85–102.

Cameron G, J Muellbauer and A Murphy (2006), 'Was There a British House Price Bubble? Evidence from a Regional Panel', Centre for Economic Policy Research Discussion Paper No 5619.

Capozza DR and PJ Seguin (1996), 'Expectations, Efficiency, and Euphoria in the Housing Market', *Regional Science & Urban Economics*, 26(3–4), pp 369–386.

Cardarelli R, D Igan and A Rebucci (2008), 'The Changing Housing Cycle and the Implications for Monetary Policy', *World Economic Outlook – Housing and the Business Cycle*, World Economic and Financial Surveys, IMF, Washington DC, pp 103–132.

Case KE, JM Quigley and RJ. Shiller (2005), 'Comparing Wealth Effects: The Stock Market versus the Housing Market', *Advances in Macroeconomics*, 5(1), Article 1.

Case KE and RJ Shiller (1989), 'The Efficiency of the Market for Single-Family Homes', *The American Economic Review*, 79(1), pp 125–137.

Case KE and RJ Shiller (1990), 'Forecasting Prices and Excess Returns in the Housing Market', *Real Estate Economics*, 18(3), pp 253–273.

Case KE and RJ Shiller (2003), 'Is There a Bubble in the Housing Market?', *Brookings Papers on Economic Activity*, 2, pp 299–342.

Chauvin V and J Muellbauer (2012), 'Consumption, Household Portfolios and the Housing Market in France: A Flow of Funds Approach', research in progress.

Clayton J (1997), 'Are Housing Price Cycles Driven by Irrational Expectations?', *The Journal of Real Estate Finance and Economics*, 14(3), pp 341–363.

DiPasquale D (1999), 'Why Don't We Know More About Housing Supply?', *The Journal of Real Estate Finance and Economics*, 18(1), pp 9–23.

Duca JV and J Muellbauer (2012), 'Tobin LIVES: Integrating Evolving Credit Market Architecture into Flow of Funds Based Macro-Models', University of Oxford Department of Economics Discussion Paper Series No 622.

Duca JV, J Muellbauer and A Murphy (2009), 'House Prices and Credit Constraints: Making Sense of the U.S. Experience', Paper presented at the Allied Social Science Associations 2010 Annual Convention, Atlanta, 3–5 January 2010. Available at <http://www.aeaweb.org/aea/conference/program/retrieve.php?pdfid=446>.

Duca JV, J Muellbauer and A Murphy (2010), 'Housing Markets and the Financial Crisis of 2007–2009: Lessons for the Future', *Journal of Financial Stability*, 6(4) Special Issue: Bank of Finland and SUERF Council of Management 'Housing Markets-A Shelter from the Storm or Cause of the Storm?', pp 203–217.

Duca JV, J Muellbauer and A Murphy (2011), 'House Prices and Credit Constraints: Making Sense of the US Experience', *The Economic Journal*, 121(552), pp 533–551.

Duca JV, J Muellbauer and A Murphy (2012a), 'Credit Standards and the Bubble in US House Prices: New Econometric Evidence', in *Property Markets and Financial Stability*, Proceedings of a Joint Workshop Organised by the BIS and the Monetary Authority of Singapore in Singapore on 5 September 2011, BIS Paper No 64, Bank of International Settlements, Basel, pp 83–89.

Duca JV, J Muellbauer, and A Murphy (2012b), 'Shifting Credit Standards and the Boom and Bust in U.S. House Prices: Time Series Evidence from the Past Three Decades', Federal Reserve Bank of Dallas, unpublished manuscript.

Federal Reserve (Board of Governors of the Federal Reserve System) (2012), 'The April 2012 Senior Loan Officer Opinion Survey on Bank Lending Practices', p 10. Available at <http://www.federalreserve.gov/boarddocs/snloansurvey/201205/fullreport.pdf>.

Fernandez-Corugedo E and J Muellbauer (2006), 'Consumer Credit Conditions in the United Kingdom', Bank of England Working Paper No 314.

Hamilton BW and RM Schwab (1985), 'Expected Appreciation in Urban Housing Markets', *Journal of Urban Economics*, 18(1), pp 103–118.

Hayek FA (1974), 'The Pretence of Knowledge', Prize Lecture to the Memory of Alfred Nobel, Stockholm, 11 December. Available at <http://www.nobelprize.org/nobel_prizes/economics/laureates/1974/hayek-lecture.html>.

Hendry DF (1984), 'Econometric Modelling of House Prices in the United Kingdom', in DF Hendry and KF Wallis (eds), *Econometrics and Quantitative Economics*, Basil Blackwell, Oxford, pp 211–252.

Himmelberg C, C Mayer, and T Sinai (2005), 'Assessing High House Prices: Bubbles, Fundamentals and Misperceptions', *The Journal of Economic Perspectives*, 19(4), pp 67–92.

Hubrich K, A D'Agostino, M Červená, M Ciccarelli, P Guarda, M Haavio, P Jeanfils, C Mendicino, E Ortega, MT Valderrama and MV Endrész (2011), 'Heterogeneity and Nonlinearities in the Transmission of Financial Shocks', Presented at the European Central Bank Conference 'A Flow-Of-Funds Perspective on the Financial Crisis: Lessons for Macro-Financial Analysis', Frankfurt, 29 November.

Igan D and H Kang (2011), 'Do Loan-To-Value and Debt-To-Income Limits Work? Evidence from Korea', IMF Working Paper No WP/11/297.

Kelly M (2009), 'The Irish Credit Bubble', University College Dublin Centre for Economic Research Working Paper No WP09/32.

Kim Y (2008), 'Rent-Price Ratios and the Earnings Yield on Housing', University of Southern California, unpublished manuscript.

King M (1990), 'Discussion on "Is the UK's Balance of Payments Sustainable?"', *Economic Policy: A European Forum*, 5(2), pp 383–387.

Lettau M and SC Ludvigson (2001), 'Consumption, Aggregate Wealth, and Expected Stock Returns', *The Journal of Finance*, 56(3), pp 815–849.

Lettau M and SC Ludvigson (2004), 'Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption', *The American Economic Review*, 94(1), pp 276–299.

Lettau M and SC Ludvigson (2011), 'Shocks and Crashes', NBER Working Paper No 16996.

Mayer CJ and CT Somerville (2000), 'Residential Construction: Using the Urban Growth Model to Estimate Housing Supply', *Journal of Urban Economics*, 48(1), pp 85–109.

Meen GP (1990), 'The Removal of Mortgage Market Constraints and the Implications for Econometric Modelling of UK House Prices', *Oxford Bulletin of Economics and Statistics*, 52(1), pp 1–23.

Meen GP (2001), *Modelling Spatial Housing Markets: Theory, Analysis and Policy*, Advances in Urban and Regional Economics, Volume 2, Kluwer Academic Publishers, Boston.

Meese R and N Wallace (1994), 'Testing the Present Value Relation for Housing Prices: Should I Leave My House in San Francisco?', *Journal of Urban Economics*, 35(3), pp 245–266.

Muellbauer J (2005), 'Property Taxation and the Economy after the Barker Review', *The Economic Journal*, 115(502), pp C99–C117.

Muellbauer J (2007), 'Housing, Credit and Consumer Expenditure', in *Housing, Housing Finance, and Monetary Policy*, A Symposium sponsored by the Federal Reserve Bank of Kansas City, Kansas City, pp 267–334.

Muellbauer J and R Lattimore (1995), 'The Consumption Function: A Theoretical and Empirical Overview', in MH Pesaran and M Wickens (eds), *Handbook of Applied Econometrics: Macroeconomics*, Blackwell Handbooks in Economics, Blackwell, Oxford, pp 221–311.

Muellbauer J and A Murphy (1990), 'Is the UK's Balance of Payments Sustainable?', *Economic Policy: A European Forum*, 5(2), pp 348–395.

Muellbauer J and A Murphy (1993), 'Income Expectations, Wealth and Demography in the Aggregate UK Consumption Function', Presented at HM Treasury Academic Panel, June.

Muellbauer J and A Murphy (1997), 'Booms and Busts in the UK Housing Market', *The Economic Journal*, 107(445), pp 1701–1727.

Muellbauer J and A Murphy (2008), 'Housing Markets and the Economy: The Assessment', *Oxford Review of Economic Policy*, 24(1), pp 1–33.

Muellbauer J and DM Williams (2011), 'Credit Conditions and the Real Economy: The Elephant in the Room', Centre for Economic Policy Research Discussion Paper No 8386.

OECD (Organisation for Economic Co-operation and Development) (2011), *OECD Economic Outlook*, 2011/1, OECD Publishing, Paris.

Poterba JM (1991), 'House Price Dynamics: The Role of Tax Policy and Demography', *Brookings Papers on Economic Activity*, 2, pp 143–183.

Quigley JM (2007), 'Regulation and Property Values in the United States: The High Cost of Monopoly', in GK Ingram and Y-H Hong (eds), *Land Policies and Their Outcomes*, Lincoln Institute of Land Policy, Cambridge, pp 46–65.

Renaud B (2012), 'How Vulnerable is China to a Housing Bust after a Unique Decade?', Korea Development Institute, Comparative Project on 'Housing and Macroeconomic Stability in East Asia', June.

Shiller RJ (2007), 'Understanding Recent Trends in House Prices and Homeownership', in *Housing, Housing Finance, and Monetary Policy*, A Symposium sponsored by the Federal Reserve Bank of Kansas City, Kansas City, pp 89–123.

Tucker P (2012), 'The Good Things in Life Require Stability', Article published by *Financial Times*, 4 April. Available at <http://www.bankofengland.co.uk/publications/Documents/speeches/2012/speech578.pdf>.

UK Trade & Investment (2012), 'China: Falling Land Prices put Local Government Finances under Pressure – February 2012', Foreign and Commonwealth Office Political and Economic Updates, 1 February. Available at <http://www.ukti.gov.uk/export/countries/asiapacific/fareast/china/premiumcontent/253320.html>.

Wong E, T Fong, K-F Li and H Choi (2011), 'Loan-To-Value Ratio as a Macro-Prudential Tool – Hong Kong's Experience and Cross-Country Evidence', Hong Kong Monetary Authority Working Paper 01/2011.