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Highlights in this issue:

- UK house prices showed unprecedented growth between 1997 and 2007
- Fundamental demand factors offer partial explanation
- Supply weakness and backward-looking price expectations facilitated boom, which now looks unsustainable

UK house prices tripled between 1998 and 2007...

...but prices started falling in late 2007.

The UK Housing Market: Anatomy of a house price boom

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Summary

Record growth in UK house prices since 1997 is partly explained by rising average incomes and falls in mortgage interest rates. Non-price loosening of mortgage credit conditions appears to have further contributed to rapid lending growth, partly in the sub-prime market segment. Despite strong population growth and even faster household formation rates since the mid-1990s, increases in housing supply managed to keep pace with greater demand for housing units until 2000, with structural supply weaknesses - in particular related to the UK planning system - becoming more apparent thereafter. Current government targets for increased long-term housing supply appear challenging, necessary though they are. A downward adjustment of house prices may continue, as in late 2008 house prices are still above levels that could be judged consistent with housing market equilibrium, however defined.

1. Introduction

Since the late-1990s the United Kingdom has - once again - witnessed very strong annual real house price increases, placing UK property prices amongst the fastest-growing among European countries over the past decade (Chart 1).¹ Average nominal house prices tripled between 1998 and 2007. Compared to the UK's previous housing market booms of the late 1970s and late 1980s, which were marked by rapid cumulative price increases and, in the latter case, succeeded by a sharp and prolonged house price deflation lasting until the mid-1990s, the UK's latest episode of price rises has surpassed its historic precedents in both its duration and scale.

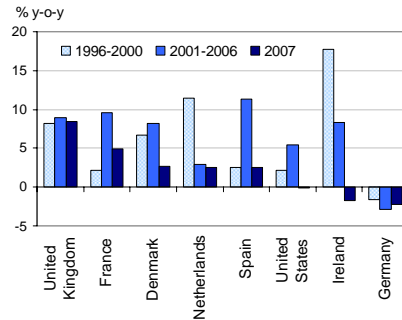
More recently, the protracted crisis in global credit markets originating in the US sub-prime mortgage market in 2007 has taken its toll on the previously buoyant UK housing market. As at the end of the third quarter of 2008, average house prices have fallen by around 10% compared to their peak in the third quarter of 2007, and the number of property transactions fell sharply during the first half of 2008. Against the above background, understanding the remarkable surge in UK house prices is not only interesting in its own right, but it may also yield useful insights into other policy-relevant issues such as housing affordability, the adequacy of the housing stock, household borrowing, and macroeconomic activity. This *Country Focus* therefore attempts to highlight the most important drivers of UK housing market activity since the mid-1990s. It will be followed by further analysis which will build on the conclusions of the paper at hand in examining the economic significance of the

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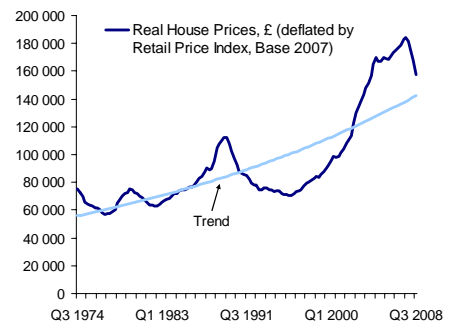
UK housing market as well as the ramifications of a significant downward adjustment of property prices from an economic policy perspective.

Chart 1. Real annual house price growth in UK versus benchmark countries, %



Source: OECD economic outlook database No. 83

Chart 2. Real average house prices in the UK (£, 2007 Prices)



Source: Nationwide Building Society; UK Office of National Statistics (ONS)

2. Increased demand for housing

At its most basic level, analysis of the path of UK house prices must begin with a distinction between housing demand and supply, and factors determining changes in demand and supply. One of the conventional theoretical frameworks for modelling house prices is an inverted demand function approach, whereby house prices are expressed as a function of the physical housing stock, real income and other demand shifters.² Shifting factors include population growth and other demographic changes, the availability of credit, interest rates, and expected or lagged appreciation. Housing supply is commonly assumed fixed in the short term, which entails that demand changes determine house prices in the short term. The following section examines the evolution of the above demand-shifting factors in the UK in turn.

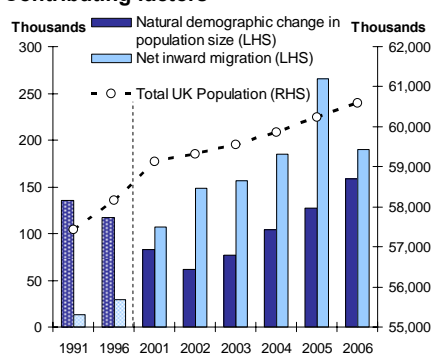
Household formation driven in part by faster population growth

The main source of increased *quantity* demand for housing, i.e. the need for additional housing units, are changes in the total number of households, and this will under plausible assumptions tend to bid up house prices.³ Growth in the number of households can be either due to changes in the size of the adult population, resulting from a combination of birth and mortality rate changes and net inward migration, or result from changes in the overall propensity to form a household. For a given population size, this propensity is determined principally by demographic factors such as population aging (older persons show a greater tendency to live in a one-person household) and changes in couples' cohabitation, marriage and separation rates.⁴ Population growth in the UK notably accelerated between 1996 and 2006 compared to the preceding ten years, with a distinct shift in the relative drivers of population growth. While net inward migration accounted for 60% of UK population growth between 1996 and 2006, it only contributed 15% to population growth between 1986 and 1996 (Chart 3).

Falling average household size projected to continue

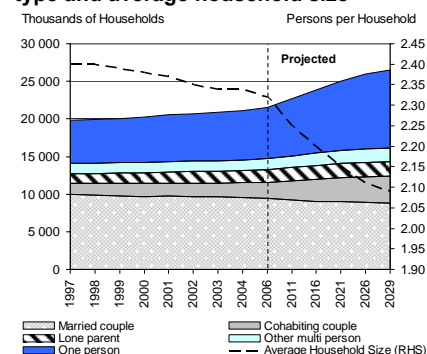
Between 1996 and 2006, 1.8m net additional households were formed in England, while the population in England increased by around 2.2m people, implying a fall in average household size (Chart 4).⁵ Approximately half of the increase in the number of households between 1991 and 2001 can be attributed to growth in the adult population, while demographic changes in sex and age structure account for a further third (Holmans, 2006). A clear long-term trend is that of falling average household size since the early 1970s, including the doubling of the share of one-person households between 1970 and 2006. The comparatively fast growth in the number of households since the early 1990s is expected to continue, with a projected net formation of 4.5 million additional households until 2026, equivalent to 223,000 additional households a year (Chart 4). This growth is driven in broadly equal proportions by the effects of greater longevity, continued net inward migration, increased separation rates of couples as well as a higher propensity for individuals to form households.⁶ It should be borne in mind however that these considerations so far apply to the demographically-driven increase in demand for housing per se, be it rented or owner-occupied.

Chart 3. UK annual population growth: Contributing factors



Source: ONS

Chart 4. Total households in England by type and average household size



Source: UK Department of Communities and Local Governments (DCLG), ONS; Data not available on a UK basis

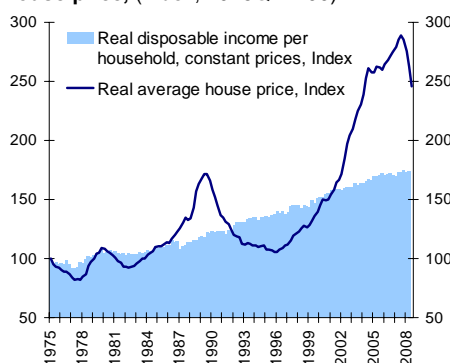
High income elasticity entails disproportionate house price response

Given the marked increase in *quantity* demand for housing since the late 1980s, a key determinant of ability-to-pay for housing is household income. While real income per household increased by 27% between 1995 and 2007, real house prices increased by 168% over the same period (Chart 5). This contributed to rapidly deteriorating affordability of owner-occupied housing (see section 4). Previous econometric studies of UK house price determinants confirm a significant link between household income and house prices. Hunt (2005) notes that the UK's housing demand elasticity with respect to income is high in an international comparison, with UK estimates close to 1, compared to international average of around 0.5.⁷ Most estimates of the own-price elasticity of housing demand are in the region of -0.5. These two elasticity estimates imply an income elasticity of house prices of between 1.5 and 2, meaning that a 1% increase in income may increase house prices by between 1.5% and 2%.⁸ But given that real house prices increased by six times as much between 1995 and 2007 as real income per household did, income growth alone is clearly insufficient to explain the observed house price growth since the mid-90s. Taking population and income growth together, Cameron *et al.* (2006) found that these factors almost entirely accounted for house price increases between 1998 and 2003, but, as Chart 5 shows, at that point much of the house price boom was yet to come.

Interest rates fell sharply until 2004, alleviating debt service costs

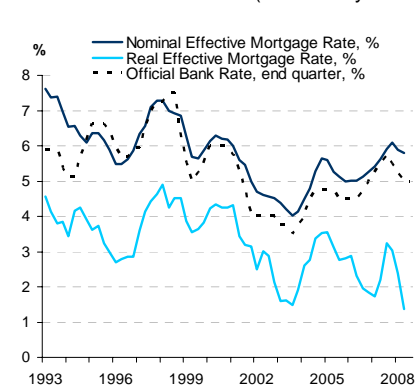
Interest rates not only influence the debt service cost of financing a house purchase, they also change the discount factor for appraising the return on capital, and therefore they should be negatively correlated with house prices. In the UK effective mortgage rates (averaged over all existing mortgages) trended downwards significantly between the late 1990s and 2004, the period where house prices increased at their fastest (Chart 6). The same downward trend is evident for quoted mortgage rates, which apply to new borrowers. As a result of relatively stable inflation rates throughout this period the paths of nominal and real interest rates moved in lockstep, so that both the nominal and real burden of mortgage borrowing fell in parallel, lowering the cost of debt-financed home-ownership for a given levels of income and house prices.

Chart 5. Real disposable annual income per UK household and real UK average house price, (Index, 1975Q1=100)



Source: Nationwide; ONS; DCLG

Chart 6. Official and mortgage interest rates: nominal and real (deflated by RPIX)



Source: Council of Mortgage Lenders (CML), ONS

Since 2007, increasing inflation has contributed to pushing real mortgage rates to a very low level, while nominal mortgage rates did not change much since the onset of the credit crunch. From a theoretical point of view only real interest rates should be relevant in determining investment and borrowing decisions, as they determine the true cost of borrowing. Econometric studies tend to find real interest rates to be significant in determining house price movements, although typically only the spot rate is included in the estimated equations, which ignores the role of interest rate expectations.⁹ The Miles Review (2004) showed that homebuyers tend to be overoptimistic regarding the future path of interest rates, which would go some way in supporting a greater-than-estimated role of interest rate falls since 1998 in driving housing demand and, consequently, house price inflation.

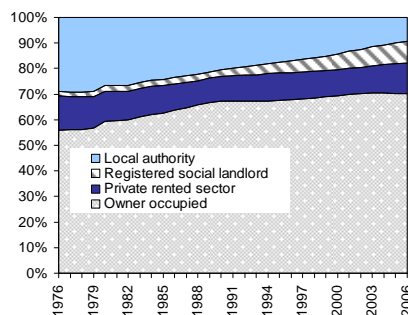
Credit market liberalisation boosted lending and relaxed lending standards

The significant credit market liberalisation that took place in the UK from 1980 onwards is another often highlighted structural factor that has shifted upward the demand for housing (Muellbauer and Murphy (2008), Aron and Muellbauer (2006), Cameron *et al.* (2006) and Barker (2004)). Financial deregulation combined with innovation in securitisation and new mortgage instruments allowed for a mitigation of credit risk for lenders and resulted in both increased credit supply and a more dynamic and competitive mortgage market. Greater credit availability allowed borrowers to keep pace with - but at the same time fuelled - a rapidly appreciating housing market. Goodhart *et al.* (2004) argue that financial sector liberalisation has tended to engender procyclical lending behaviour by banks, thereby fuelling house price growth in an upswing. One clear indication of the increase in credit availability is the increase in median lending multiples from 2.3 times income to 3.2 times income between 1996 and 2007. A rise in 'sub-prime' type mortgage lending is also notable in recent years, including lending based on self-certified income statements, and lending with very high loan-to-value ratios (in excess of 100%). Muellbauer and Murphy (2008) use a credit conditions index covering both mortgage and consumer credit data to show a sharp relaxation in credit conditions from 1995 onwards up until the onset of the credit crunch. More generally, tenure choice is importantly determined by borrowing constraints, so that households with access to sufficient credit are able to buy a home, while credit-constrained households are left with no alternative to renting or social housing, at least until they have raised a sufficiently large deposit.¹⁰

A "cultural" preference for homeownership expressed as a high willingness to buy...

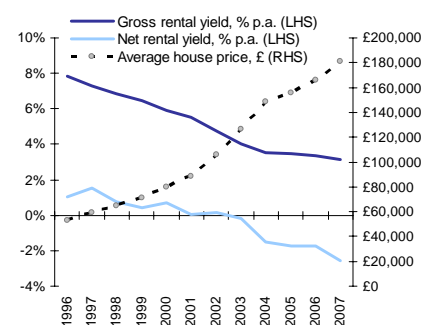
The latter argument suggests a preference amongst UK households for owner-occupation as opposed to renting in the private or social housing market. Barker (2004) and Hunt (2005) confirm this view, which is often expressed as a general wish by households to purchase a house early in life in order to benefit from capital gains and to avoid renting, which is often viewed as "paying off someone else's mortgage".¹¹ Furthermore, and irrespective of UK households' *willingness* to buy, the introduction of various government programmes such as the right to buy one's socially rented property from local authorities in the 1980s and the shared ownership schemes in the 1990s are likely to have increased households' *ability* to buy their own home. Since the 1970s the owner-occupancy rate thus increased substantially to reach 70% in 2006, largely at the expense of social housing (Chart 7). This compares with an average owner-occupancy rate in the EU15 of 62% in 2004.¹²

Chart 7: Dwelling stock by tenure *



Source: DCLG; * Data for England only

Chart 8: Buy-to-Let yields and average house prices



Source: CML; Nationwide; Authors' calculations

...that was reinforced by expectations of continued capital gains

As pointed out by the Royal Institute of Chartered Surveyors (2008), the UK has arguably the most liberalised private renting sector in Europe, which speaks against high homeownership rates being caused in the long run by insufficient renting opportunities. Instead, it appears more plausible that the UK's preference for

homeownership is linked to high historic house price growth and to buyers' expectations of further house price appreciation in the future. Several studies point to house price expectations and market psychology as playing an important role in determining house prices to the extent that house purchases are being driven – at least in part - by an investment motive.¹³ Although future house price expectations per se are hard to capture in econometric housing market models, as they are not directly observed, proxies such as lagged house price appreciation are often found to be significant explanatory variables.¹⁴ In as far as this provides evidence of homebuyers forming house price expectations in a backward-looking way, this raises the possibility of house prices overshooting their equilibrium level and quasi-speculative bubbles occurring (see section 4).

Renting – cheap, but no (perfect) substitute?

As noted above, the acceleration in household formation offers a partial explanation of rapid house price increases since the 1990s. However, as Girouard *et al.* (2006) note, increased demand for housing should have bid up rents as well, as renting should be a close substitute for owner-occupancy. Rental costs may also be viewed as the true cost of housing space, which would rise in the face of demand growing faster than supply. However, rental price inflation has notably remained very stable, with annual rent increases as measured by the HICP component for actual rents averaging 3% between 1997 and 2007, with a standard deviation of around half a percentage point. This arguably constitutes further evidence of a strong homeownership preference, which would weaken the degree of substitutability between rented and owner-occupied housing.

Buy-to-let yields contributed further to the house price increases

While the UK's private rental sector is relatively small (Chart 7), it has witnessed an important change since 1996, when so-called buy-to-let mortgage products (BTL) were introduced, motivated in part by a government objective to increase the size of the UK's private rental sector.¹⁵ BTL lending agreements have since skyrocketed, with the share of outstanding BTL mortgages in the total rising from 0.4% in 1998 to 10% in 2007. BTL deals typically offered landlords a positive net rental yield up until 2003, when sharp rises in house prices began to depress gross yields and significantly raised debt service costs, thus driving down net yields (Chart 8). Overall, BTL activity can be expected to have added upward pressure on house prices, since BTL buyers compete in the market for house purchases (which determines house prices) in order to expand the supply of properties available for rental.¹⁶ Research by the UK government's National Housing Policy Advisory Unit (2008a) suggests that BTL-linked housing demand is likely to have cumulatively accounted for an increase of 20 percentage points of the overall 150% increase of in real houses price between 1995 and mid-2007. There is however no evidence of widespread speculative behaviour amongst BTL landlords, as the majority of BTL purchases appear motivated by a steady flow of rental income, rather than future capital gains (Rhodes and Bevan (2003)).

Stamp duty and taxes do not appear to have played a role in changing demand for housing

Finally, transaction costs and taxation of housing may in principle influence demand for housing in general, and for owner-occupation in particular, given the higher cost of purchasing a property as opposed to renting it. In the UK transaction costs mainly take the form of stamp duty, a tax of between 1% and 4%, levied at rising rates on the entire sale value of the house and paid by the buyer. Stamp duty rates have steadily increased since 1997, when additional, higher stamp duty brackets were reintroduced following their abolition in 1984. Although the stamp duty-free threshold was doubled in 2005, this saved a buyer a maximum of £1200 (€1760), which is unlikely to have significantly affected the willingness to pay for a given property, although it may have increased the level of transactions. Overall, the rise in the average stamp duty burden since 1997 is at odds with the observed surge in house prices. Equally, tax changes in relation to owner-occupied housing since the mid-1990s have led to a gradual phasing out of tax relief for mortgage interest payments, which was removed altogether in April 2000. Although no detailed studies on the impact of the tax and stamp duty changes since the 1990s on housing demand seem to be available, the thrust of property taxation changes makes them unlikely to have contributed to the UK house price boom to any significant extent.

3. Unresponsive housing supply

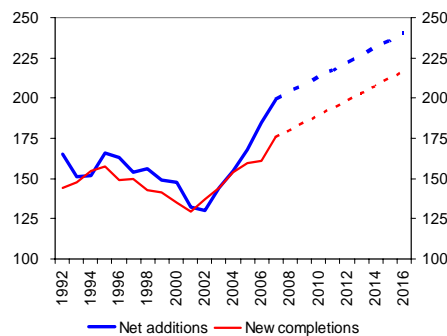
In the preceding analysis we have implicitly assumed, in keeping with many available studies on the subject of UK house price, that the housing supply is fixed in the short term. Although useful for comparative statics analysis, this is clearly an unsatisfactory simplification in a longer term perspective. Over the last 15 years, the

net increase in the number of dwellings in England averaged around 150,000 per year, with a notable rise in net additions between 2005 and 2007 (Chart 9). Most housing supply growth is due to the completion of new dwellings, which represents the gross increase in housing supply, but demolitions and conversions of existing buildings into housing units may drive a wedge between completions and net additions to the housing stock.

Increasingly tight housing market as household formation outstripped net housing additions

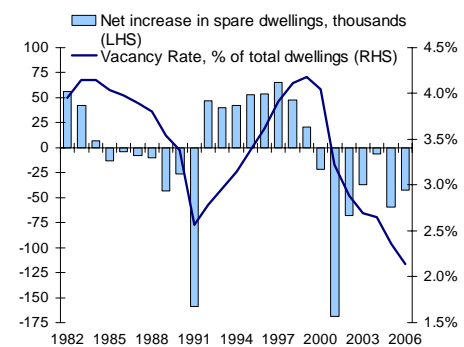
To the extent that the decrease in *spare* dwellings, calculated as the difference between the increase in the number of households in a given year and net additions of dwellings, captures changes in the tightness of the overall market for housing (rented and owner-occupied), it goes some way in illustrating *quantity* demand pressures for housing arising from population growth and demographic changes. Somewhat surprisingly, the pickup of house prices in the late 1990s was preceded by many years of increasing slackness in the housing stock, whereas the record house price growth in 2002-3 followed a sharp reduction in spare dwellings, which is consistent with increasing tightness of the housing stock having fuelled prices (Chart 10). Although positive, the correlation between changes in spare housing capacity and house prices is nonetheless statistically weak ($\rho=0.28$, house price growth lagged one year).

Chart 9. Net addition to the housing stock, new completions and the government's housing target for 2016 (England only)



Source: DCLG

Chart 10. Change in spare housing capacity and vacancy rate (England only)



Source: ONS, DCLG, Nationwide; Authors' calculations

Note: positive bar = net increase in spare dwellings

Since 2000 net housing additions have not kept up with net household formation, thus adding supply pressures to a housing market characterised by rising demand. This shortfall is surprising given increasing profitability of new housing construction due to surging house prices, particularly as construction costs declined markedly from 1999 to 2006. The feeble supply response has also been relatively poor when compared with other European countries (Chart 11). The number of completed UK dwellings per 1000 inhabitants has been falling since the 1980's to 3.2 in 2004. By comparison, the ratio was 19 in Spain, 6 in France and 4 in the Netherlands. Similarly, the share of vacant dwellings to the total dwelling stock has been well below the EU average (around 3% in the England and 10% in EU25).¹⁷

Unresponsiveness of housing supply has added to the long-term upward trend in house prices

Meen (2005) finds that the own-price elasticity of new housing supply has been around zero since the 1990s, confirming the poor correlation between house price growth and new completions. In international comparisons of price elasticities, the UK shows very small own-price elasticities of new housing construction (Chart 11), which is consistent with the econometric studies finding that, at least in the short-to-medium term, house prices are almost entirely determined by demand.¹⁸ Constraints on the supply of new housing however have further contributed to, or at least enabled, the *long-term* upward trend in house prices in the UK, which indicates a persistent mismatch of supply and demand for housing.¹⁹ As many commentators have noted, structural impediments to improving housing supply seem to exist in the UK.²⁰

UK planning system restricts land use

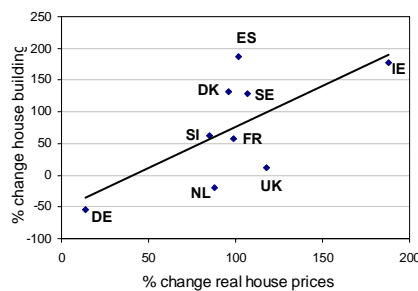
Constraints on housing supply increases are often attributed to the UK planning system, including the restrictions on land supply. The UK's current land planning system has its origins in the Town and Country Planning Act of 1947, which set in law the requirement for each planned development (residential or other) to receive approval from local authorities, who grant this on the basis of consistency with local development plans. The Barker Reviews (2004, 2006) pointed to this planning system, in particular the development control process, as being complex, unpredictable and slow, and to the burdensome requirements of planning

regulations hindering new house building. According to the Barker Review, the inefficient land use is partly related to the fact that low-productivity agricultural land with a potential for development is classified as part of the "green belt", i.e. areas of land surrounding urban areas that are designated to remain undeveloped. Furthermore, the lack of funding for supporting infrastructure and weak financial incentives facing local planning authorities to release land are factors preventing or delaying development. There are some indications that planning constraints became more binding over the course of the latest house price boom, as 25 per cent of applications for planning permissions for major housing developments were refused in 2002, compared to an average of 15 per cent in 1996-99.

A significant challenge for the UK government to increase housing delivery

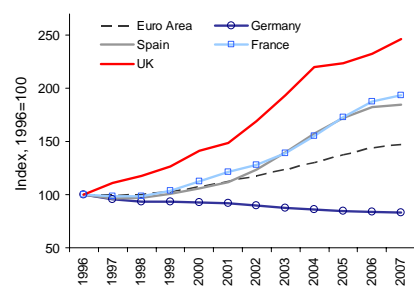
In its 2007 Housing Green Paper the UK government set a target of two million additional homes to be provided in England by 2016 and three million by 2020, and a 50% increase in social housing supply by 2010/2011. The first target implies that net housing supply additions would have to increase over time towards 240,000 a year by 2016. Such rates are almost 40% higher than the already strong completion rates in 2007, which implies a significant challenge to increase housing delivery in the UK. Furthermore, even if these targets were met they would not be sufficient to improve housing supply relative to the number of households, as the latest demographic projections imply that by 2016 the number of households in England will have increased by 2.3 million, rising to around 3.2 million by 2020. Correspondingly, the National Housing and Planning Advice Unit (2008b) estimates an average annual new build requirement of up to 277,000 until 2026 if affordability is to be prevented from worsening.

Chart 11. The responsiveness of housing supply to house price rises, 1996-2006



Source: RICS, European Housing Review 2008

Chart 12. House price to rent ratios in major EU countries



Source: Authors' calculations using Reuters EcoWin data (national sources)
Note: higher index = house prices relatively higher

4. Equilibrium considerations

Two approaches to estimating housing market equilibrium: ratios and models

Having examined specific potential drivers of house price growth in relative isolation in the preceding sections, we now move towards integrating these in an overall identification of housing market equilibrium and, consequently, the possible degree of overvaluation of current UK house prices. The academic literature broadly distinguishes two approaches to determining house prices in equilibrium, of which the first one is based on calculating ratios of house prices to pertinent denominators such as average earnings, rents, or mortgage service costs. While computationally more convenient, these ratios do not offer some of the analytical advantages of a model-based approach. We examine empirical results based on both approaches in turn.

House prices have become "unaffordable"

The ratio of UK house prices to average earnings has shown a substantial increase since 1996, when the average property cost around three times an average annual salary. By mid-2007, this ratio had increased to around 6 times earnings as house price growth rapidly outpaced earnings growth. Relative to a long-term average of around 3.5, housing affordability (as measured by the ratio) thus deteriorated sharply until mid-2007 as a result of steep house price appreciation. Whilst this indicates that the ability to pay for one's own house has certainly not kept up with actual prices, it does not settle whether changes in the willingness to pay, or indeed any other factors such as lower mortgage interest costs, can account for the observed increase in house prices. Therefore, equating equilibrium house values with that house price level that maintains the ratio of house price to earnings at its long-run level is a simple, but arguably too simple, estimate of an equilibrium price. As a starting point, this 'affordability' approach would imply that average house

prices were overvalued at their peak in Q3 2007 by close to 100%, but in light of the results below we disregard this result.

Prices overvalued compared to rents

A preferable ratio-based approach is based on a postulated equilibrium relationship between house prices and rents. Starting from the premise that, in equilibrium, the cost of renting a property should be equal to the cost of owning it and therefore to the real user cost of housing, this method embodies an asset-pricing approach.²¹ It should be noted that in the long-run the actual ratio between house prices and rents need not be stationary. The user cost of housing, which typically is presented as a function of interest rates, depreciation, taxes, and expected appreciation, may all affect the implicit rental cost of owning a house, and can therefore change the equilibrium ratio between house prices and actual rents. By contrast, demand-shifting factors such as population or income growth should be reflected in rising rents *and* house prices if rents accurately reflect the true cost of space, in which case excess demand for housing services need not significantly affect the price-to-rent ratio.²² Chart 12 shows the evolution of house price-to-rent ratios in selected euro area economies, which overall show an upward drift, but not as strong as in the UK. Using a user cost approach, Girouard *et al.* (2006) find that UK house prices were overvalued by 25-30% in 2005. Hunt (2005) compares price-to-rent ratios to their long-run average and finds them overvalued by nearly 30% in 2004. Using a similar approach, White *et al.* (2007) suggest an overvaluation of around 50% by early 2007. In our own calculations, we find that, at their peak in Q3 2007, house prices were around 35% higher than even an extrapolation of the (upward) trend between house prices and rents would suggest.²³ Considering that house prices have fallen by around 10% between mid-2007 and Q3 2008, this would still suggest an overvaluation of around 20% at the end of the third quarter of 2008.

Econometric estimates confirm some degree of overvaluation

By contrast, studies using econometric models have tended to reach slightly more mixed conclusions regarding the degree of overvaluation of UK house prices. Using a model-based approach, the IMF (2008) finds that the portion of the rise in house prices between 1997 and 2007 that cannot be attributed to demand fundamentals was estimated at around 30% in 2007. Barrell *et al.* (2004) estimate that in the first quarter of 2004, UK house prices were already 30% above their equilibrium value. A further finding of the Barrell *et al.* study is that a 10% initial deviation above equilibrium prices leads to an overvaluation of nearly 30% one year later, followed by a gradual correction to below equilibrium prices four years after the initial shock. Using data up to 2003, Cameron *et al.* (2006) find no evidence of overvaluation, and that but demand changes related to income and population growth had accounted for most of the upward drift. Revisiting this study, Muellbauer and Murphy (2008:12) suggest that by mid-2007 UK house prices looked "slightly overvalued".



Conclusion

UK house prices have shown strong growth in nominal and real terms since 1997, especially when compared to previous house price cycles. A key explanation for the recent appreciation lies in the evolution of fundamental demand factors, most prominently the rise in average household incomes and, in the years up to 2004, the fall in average mortgage interest rates. This boosted both the ability to pay for housing as well as households' capacity to service a larger mortgage for a given income. Relaxation of mortgage lending constraints and a preference bias towards homeownership also appear to have supported house price demand, but rising demand for owner-occupied housing further appears to include a significant quasi-speculative element, fuelled by expectations of previous capital gains continuing in the future. While population growth and other demographic factors also contributed to growing demand for housing services since the mid-1990s, this was met by commensurate aggregate increases in the stock of housing until 2000. Thereafter, the UK's weak supply response became more apparent as household formation accelerated. This relative supply weakness is also evident in international comparisons and is mainly related to the nature of the UK planning system, which has recently attracted domestic policy attention. Finally, these supply and demand factors appear to have made house prices overshoot their equilibrium level by between 20% and 40% in mid-2007, depending on the methodology invoked. In light of falling house prices and a sharp fall in property transactions since, a potentially protracted correction towards equilibrium may be underway.



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¹ See Malzubris, J. (2008) for a study on the Irish housing boom.

² See for example Muellbauer and Murphy (2008).

³ This paper implicitly treats housing demand as the outcome of a discrete choice-type consumer decision. As such, it is primarily concerned with households' decision of whether or not to buy one single home, and at what price. Second homes, which account for only 1% of the UK housing stock, are ignored.

⁴ This framework follows Holmans (2006).

⁵ Household projections and housing supply statistics are only readily available for England, and therefore this paper is on occasion forced to deviate from its focus on the UK as a whole.

⁶ See Holmans (2006).

⁷ Meen and Andrew (2008) assume an income elasticity of housing demand of unity, although Meen and Andrew (1998) estimate income elasticity at 1.27 and Meen (1996) cites estimates ranging from 1.7 to 3. Given that most other estimates confirm an elasticity of at least unity, housing would appear to be a (borderline) superior good in the UK.

⁸ These estimates square with Cameron *et al.* (2006) and Barrell *et al.* (2004). In a standard model set-up with a given income elasticity α of housing demand and an own-price elasticity β of housing demand, the elasticity θ of house prices with respect to income is $\theta = (\alpha/\beta)$. If this income elasticity θ is greater than 1, house prices may increase relative to incomes even if housing supply growth fully matches growth in the number of households (Meen and Andrew, 2008).

⁹ Farlow (2004a) finds no evidence that, in the long-run, nominal interest rates determine house prices. One IMF report (2003) finds some support for a negative relation between nominal rates and house prices in the short term. Muellbauer and Murphy (1997) found that including the nominal interest rate does nothing to improve their model's empirical fit. However, Barrell *et al.* (2004) find that lagged changes in the short-term nominal interest rate have significantly negative effects on house prices because they cause liquidity constraints.

¹⁰ See e.g. Meen and Andrew (2008). The typical challenge for prospective UK homebuyers of keeping up with rising house prices in their saving and borrowing efforts is well captured in the metaphor of "catching a rung on the housing ladder".

¹¹ Farlow (2004a) sums up the typical "buyer's fallacy" in relation to the above phrase, which ignores not only the interest cost incurred in securing the claim on potential capital gains, but also the risks related to interest rate changes and overall property market performance.

¹² Source: Housing Statistics in the European Union 2005/6, Ministry of Infrastructure of the Italian Republic.

¹³ Miles and Pilonca (2008) interpret the residual of their fundamentals-based decomposition of house price determinants as a "capital gains effect", i.e. the expected appreciation of future house prices, which they estimate to account for a third of the rise in house prices between 1996 and 2006. Schiller (2007) cites survey evidence confirming that house price expectations appear to be formed adaptively. Farlow (2004b) offers a number of psychological explanations of adaptive expectation formation, while Springings *et al.* (2006) highlight the role of popular media, in particular UK television programmes, in supporting extrapolative expectation formation regarding house prices.

¹⁴ See e.g. Muellbauer and Murphy (2008) and Barrell *et al.* (2004).

¹⁵ BTL mortgages allow prospective landlords to purchase additional properties with typically modest deposits (from 20% upwards), based on evidence that the resulting rental income will adequately cover interest payments, and principal repayments if applicable. Farlow (2004a) characterises the BTL market as predominantly in the South of England, financed mainly by interest-only loans with typically a high degree of leverage.

¹⁶ BTL activity may also help explain why rental price growth remained subdued and stable since the mid-1990s, as BTL-related expansion of the rental sector more than outweighed reductions in the non-BTL rental sector (see NHPAU 2008).

¹⁷ Source: Housing Statistics in the European Union 2005/6, Ministry of Infrastructure of the Italian Republic.

¹⁸ Swank *et al.* (2002), Farlow (2004a), Barrell *et al.* (2004).

¹⁹ See e.g. Barker (2008) and Muellbauer *et al.* (2008). There are indications that suggest that mismatches also exist in terms of housing type, location, and size. Springings *et al.* (2006) and Power and Houghton (2007) for example point to an oversupply in the Midlands and the North of England and a supply shortage emerging in the South.

²⁰ See for example Muellbauer and Murphy (2008).

²¹ See for instance Sampson (1995) and Girouard *et al.* (2006).

²² Muellbauer and Murphy (2008) argue that due to the small size of the UK rental sector and high price stickiness of rents, demand shocks may shift the price-to-rent ratio.

²³ Calculations based on ONS rental cost data and Nationwide house price figures using an exponential trend. Assuming an upward trend in the equilibrium price-to-rent ratio may not be justified for the period 2003-2008, as mortgage interest rates in fact rose in this period, which *ceteris paribus* would lower the equilibrium price-to-rent ratio, thereby making our assumption of an upward trending equilibrium ratio in recent years conservative in the extent of overvaluation. This argument follows from the decomposition of user cost employed in Girouard *et al.* (2006), where in equilibrium the ratio of house prices P to rents R is given by $\frac{P}{R} = \frac{1}{i^a + \tau + f + \pi}$, where i^a is after-tax nominal interest, τ is the property tax rate of owner-occupied housing, f is the recurrent holding cost of depreciation, maintenance and risk premium, and π is the expected capital gains.

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