(i) UK house prices: Going through the roof?

1. Introduction

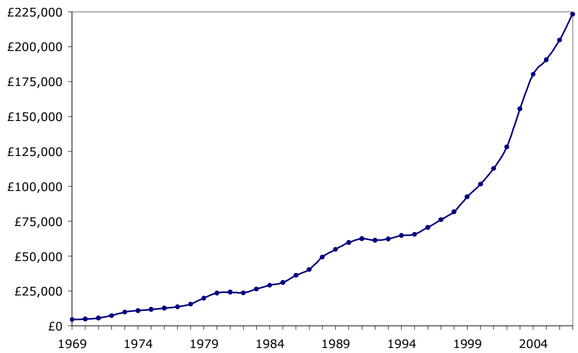
If you pass by a newspaper stand you are very likely to observe a headline about the British housing market. There is little doubt that the British have an appetite for stories about the housing market. Frequently, these headlines concern the *level* of house prices, the *rate* at which they are growing and their *direction* in which they are moving.

This case study focuses on UK house prices since the late 1960s. Such is the volatility of UK house prices, it might be that when you read this case study a more appropriate title could be: 'UK house prices: Is the roof caving in?'

2. Nominal house prices

The Department of Communities and Local Government[1] records the average UK house price in 1969 as **£4,640**. By 2007 this had risen to **£223,405**.

Chart 1: Nominal UK house prices



Source: Department of Communities and Local Government

Chart 1 shows the upward trajectory of house price levels across the entire period. The series is referred to as a nominal or a current price series. Each observation is the house price level observed at the time. No adjustment is made to control for the fact that the prices of many goods and services increases over time. This issue is pursued later in the case study.

To assess the long-run growth of house prices we can calculate an annual compound growth rate. This is the year-on-year rate of growth able to account for the growth in house prices from the first year to the last year. It is calculated by subtracting 1 from the result of taking the nth root of the relative value in the final year, *V*, to that in the first year, *A*, where *n* is the number of years in the period being considered.

(1) $$g = \left(V/A\right)^{1/n} - 1$$

The annual compound growth rate for house prices in the UK from 1969 to 2007 can be calculated by inserting the appropriate values into (1). This shows that house prices grew at an annual rate of **10.73%**.

(2) $$g = \left(£223{,}405/£4{,}640\right)^{1/38} - 1 = 0.10733$$

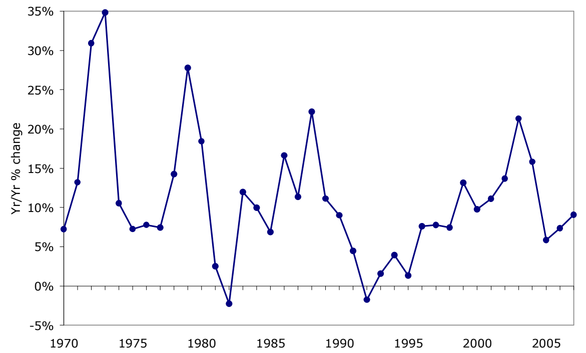
The actual rate of growth observed from year-to-year is very volatile. This rate of growth is better known as the annual rate of house price inflation. It is usually expressed as a percentage. With annual data it is calculated by expressing the change in house price levels between two consecutive years *relative* to the level in the first of the two years.

(3) $$\left(\frac{HP_t - HP_{t-1}}{HP_{t-1}}\right) * 100$$

Chart 2 displays the annual percentage change in house prices between 1970 and 2007. It captures nicely the volatility of house price growth. We can identify several periods of very strong growth, including the early 1970s, with the annual rate of house price inflation reaching 35% in 1973. We can see that house price falls are unusual, but house price deflation was experienced in 1982 and 1992.

[1] The DCLG's homepage is http://www.communities.gov.uk/

Chart 2: Annual house price inflation, %



Sources: Department of Communities and Local Government and author's calculations

3. Real house prices

The price paid for the services of housing increases over time. But, this is true of most goods and services consumed by households. If the rate of change in nominal house prices is equivalent to that in the price of a basket of consumer goods and services then the *relative* price of housing services is unchanged. In this case, the *real* price of housing is constant.

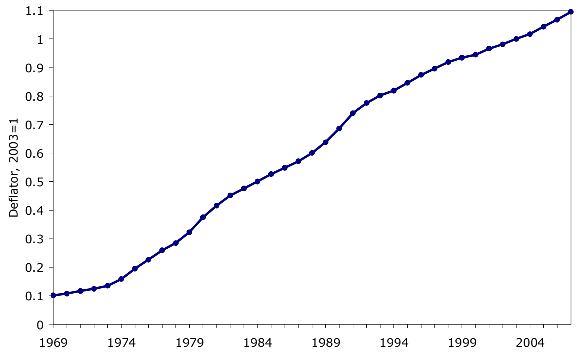
Should the nominal price of housing increase proportionately more than our basket of consumer goods and services, then its real price has risen. If the rate at which house prices increase is less than that of the price of the basket of consumer goods and services, then its real price has fallen.

The *consumer expenditure deflator* is a measure of the price level of the basket of goods and services consumed by the households. This particular price level is a weighted index of the prices of categories of goods and services consumed by households. The weights reflect the proportion of total expenditure accounted for by each category of household consumption.

The consumer expenditure deflator can be derived from the data published by the Office for National Statistics on household expenditure at current prices (nominal expenditure) and household expenditure at constant prices (real expenditure). The latter is derived by applying a method known as chain-linking. Information on prices is used to generate a set of constant price expenditure series for expenditure categories where the rate of change from period to period reflects only changes in *volumes*.

By dividing current price household expenditure by constant price expenditure, we find the implied price index for consumer goods and services.[2]

Chart 3: Consumer expenditure deflator



Source: Table 2.5, Economic and Labour Market Review, Office for National Statistics

Chart 3 shows the consumer price deflator for the UK. It indicates that the aggregate consumer price level rises over time. The deflator in any particular year represents that year's consumer price level as a *proportion* of that in a chosen year. The chosen year is known as the *base year*. The deflator in Chart 1 is calculated using 2003 as the base year.

To illustrate how we interpret the consumer expenditure deflator numbers consider first 1984 when its value is 0.50 (50%). This means that in 1984 the consumer price level is one-half (or 50%) of its 2003 level. If we now consider 1975, we find the price level is one-fifth (20%) of that in 2003 because the deflator's value is 0.20 (20%).

By substituting the deflator values for 1969 and 2007 into (1), we find the

[2] The deflator is typically presented as a *percentage* with a base year value of 100. This is got by multiplying the division of nominal expenditure by real expenditure by 100.

annual compound growth rate of consumer prices between 1969 and 2007 is **6.46%**.

(4) $g = \left(1.0944/0.1014\right)^{1/38} - 1 = 0.0646$

This is less than the 10.73% p.a. growth for house prices.

The consumer expenditure deflator, *D*, is a *price relative*. This is because it reflects the consumer price level in any year *t* relative to that in the base year. We can express the deflator as

(5) $D_t = \dfrac{P_t}{P_{base}}$

We can apply this consumer price relative to nominal house prices. By doing so we can investigate whether the change in consumer prices accounts for the change in house prices. Specifically, we create a house price series where *consumer prices are held constant* at their base year (2003) levels.

To create our real house price series, *RHP*, we divide the nominal house price, *HP*, for each year by its corresponding consumer expenditure deflator value, *D*

(6) $RHP_t = \dfrac{HP_t}{D_t}$

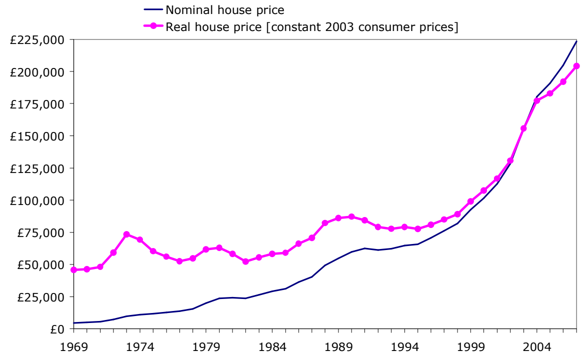
This is equivalent to

(7) $RHP_t = HP_t * \dfrac{P_{base}}{P_t}$

By applying (7) we are scaling *up* nominal house prices in the years *before* 2003 to reflect the proportion by which the level of consumer prices in 2003 is higher. Conversely, we are scaling *down* nominal house prices in the years *after* 2003 to reflect the proportion by which the level of consumer prices is lower in 2003. In 2003 the nominal and real house price values are the same.

Chart 4 plots both nominal and real house prices for the UK since 1969. The real house price series increases over time meaning that the increase in consumer prices is not sufficient to explain the full extent of nominal house price growth. Prior to 2003, the scaling up of nominal house prices does not raise nominal house prices up to their 2003 levels. After 2003, the scaling down of nominal house prices does not decrease nominal house prices to their 2003 level.

Chart 4: Nominal and real house prices



Sources: Department of Communities and Local Government, Economic Trends and author's calculations

Some care is needed when interpreting real house price *levels*. This is because their values change if we adopt an alternative base year when holding consumer prices constant. It is therefore good practice to note the base year when referring to a level of real house prices. For instance, the real house price in 1969 *at constant 2003 consumer prices* is £45,739, while in 2007 it is £204,132.

The *rate of change* in our real house price series is unaffected by changing the base year of the consumer expenditure deflator. This is because we are still eliminating the same annual rate of change in consumer prices.

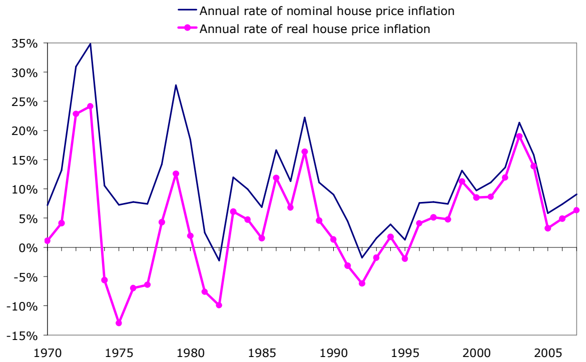
If we substitute the real house price values at constant 2003 consumer prices for 1969 and 2007 into (1) we find that the annual compound growth rate for real house prices is incredibly close to **4%**.

(8) $g = \left(£204{,}132/£45{,}739\right)^{1/38} - 1 = 0.0401$

This would be true regardless of the base year used for fixing consumer prices.

Chart 5 illustrates the volatility of real and nominal house prices. While observing strong periods of real house growth, as we do nominal growth, we now observe significant episodes of real house price *deflation*.

Chart 5: Nominal and real house price inflation rates



Sources: Department of Communities and Local Government and author's calculations

The experience in the mid-1970s is interesting because real house price deflation occurred while actual or nominal house prices were continuing to grow. This occurred because consumer price inflation rates were especially high during this period. The consumer expenditure deflator rose by 23% in 1975 while house prices grew by 7%.

Consider how long it takes for real house prices to double given the long run growth rate of 4% per annum. We need to solve the following expression for *n*, where *RHP* is house price, *g* the annual rate of growth of house prices at constant consumer prices and *n* the number of years.

(9) $RHP(1+g)^n = 2RHP$

If we divide both sides by *RHP*,

(10) $(1+g)^n = 2$

We have a power function, with *(1+g)* the known base and *n* the unknown exponent. Substituting for *g*, the annual rate of real house price growth this becomes,

(11) $(1.04)^n = 2$

Applying logarithms allow us to solve an equation where the exponent is unknown. The logarithm of a number *y* with respect to a base *b* is the exponent to which we have to raise *b* to obtain *y*. Therefore, $\log_b y = x$ means $b^x = y$.

Taking the log of both sides of (11) we get

(12) $\log_b (1.04)^n = \log_b 2$

One rule of logarithms relevant to the LHS of our expression is known as the *power rule*. This allows us to "reclaim the exponent", such that

(13) $\log_b m^n = n \log_b m$

Applying this rule to (12)

(14) $n \log_b (1.04) = \log_b 2$

In solving for *n* we find

(15) $n = \log_b 2 \big/ \log_b 1.04$

Solving (15) is not dependent on the base we choose. On our calculators *log* represents the *common logarithm*. The common logarithm is the logarithm with base 10. In solving (15), we find that with an annual growth rate of 4% per year, the real price of housing in the UK doubles roughly every **18 years**.[3]

Tasks

The following table displays information from the *Department of Communities and Local Government* on the average house price in the nations of the UK in 1969 and 2007.

	England	Wales	Scotland	Northern Ireland
1969	**£4,674**	**£4,168**	**£4,609**	**£3,941**
2007	**£232,054**	**£169,848**	**£158,798**	**£229,701**

The consumer expenditure deflator values for 1969 and 2007 are 0.1014 and 1.0944 respectively. These indicate the consumer price level in 1969 and 2007 relative to that in 2003.

Using this information calculate the annual compound growth rate in nominal and real house prices between 1969 and 2007 in each of the 4 countries.

[3] Using the common logarithm, n approximately equals 0.3010/0.017 = 17.7.