

# FORECASTING UK HOUSE PRICES AND HOME OWNERSHIP

A REPORT FOR THE REDFERN REVIEW INTO THE  
DECLINE OF HOME OWNERSHIP

NOVEMBER 2016

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## November 2016

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# EXECUTIVE SUMMARY

The housing market is at the top of the political agenda. Growing concern has tracked two recent trends: rapidly rising house prices since the late 1990s, and home ownership rates that have dramatically declined since the start of the century. Over the ten years from the end of 1996 to the eve of the financial crisis, house prices rose by 151 percent after adjusting for general inflation, a pace of growth that has recently resumed. Meanwhile, the UK home ownership rate peaked at 69.3 percent in 2002 but has since fallen rapidly to stand at 63.1 percent by early 2014.

In this context, the Redfern Review into the decline of home ownership commissioned this study in order to:

- establish the drivers of these two important trends;
- understand the outlook for home ownership and house prices; and
- shed light on the levers available to policymakers to change the outlook for both house prices and home ownership rates.

In this report we set out a new approach to modelling the macroeconomic drivers of house prices and home ownership based on data from 1992 to 2014. This approach enables us to explore the drivers, outlook and policy options for the housing market in a more comprehensive way than most past studies, which tend to focus only on one aspect, such as house prices.

The modelling results illustrate how sensitive house prices and home ownership rates are to a range of different macroeconomic drivers, including the supply of housing, the cost of capital and people's incomes. The model also allows us to diagnose the underlying causes of recent trends—why have prices risen and why has the home ownership rate dropped? The answers are somewhat surprising in the context of the current public debate around housing, and have important implications for the appropriate policy response.

## 1.1 UNDERSTANDING THE HOUSING MARKET

The housing market is commonly thought of as a market for a single thing—houses—when in fact there are two distinct markets in operation. First, by living in a house one consumes housing 'services'—having a place to live. Second, by owning a house one is seeking housing as an investment. The primary financial benefit of housing as an investment for an owner occupier lies in preventing him or her from having to pay rent.

Two sets of prices govern these markets. Rental prices balance the supply and demand for housing services, while house prices balance the supply and demand for housing as an investment. These markets are separate from one another. It is entirely possible to be in the market for one and not the other. Renting makes it possible to have a place to live without owning a house, or, conversely, to invest in housing but not live in it.

Although they are separate, these markets are closely related to one another. It is the intersection of the two which determines both house prices and home ownership rates. In terms of house prices, rent is of central importance because it affects how appealing owning is compared to renting. House prices,

however, do not have an impact on rent. This relationship is analogous to the one between the price of the widgets sold by a company and the company's share price: the ability to charge higher prices to customers will tend to boost the company's share price, but fluctuations in the share price have no direct impact on the price of the widgets produced.

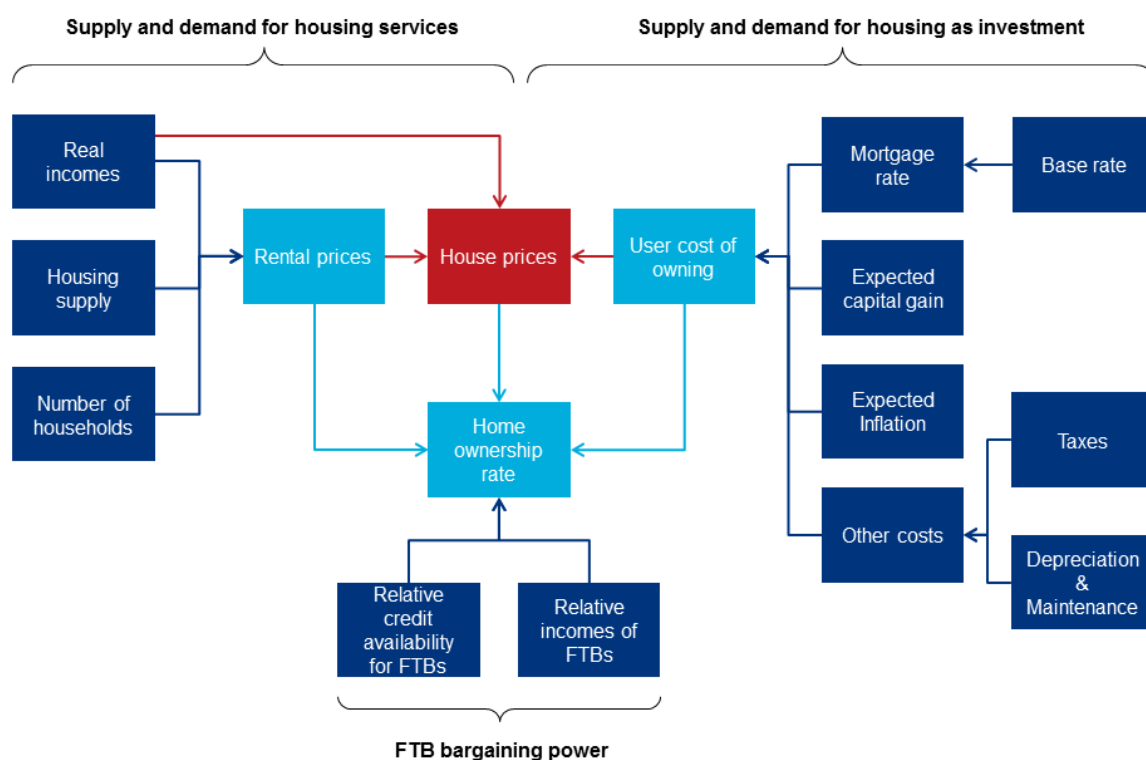
While rent influences house prices, it is not their only driver. A wide range of factors translate the house price into an annual cost facing owners. The so-called 'user cost of capital' is determined most obviously by the mortgage interest rate—if this rises so does the cost of owning a property at any given price level. It is also influenced by the forgone income that could have been earned on equity that is instead tied up in housing had it been invested in some other asset. In addition to these, property taxes, the costs associated with maintaining a property, and expectations of inflation and capital gains, all affect how costly it is to own a house of any given price.

The balance between the cost of renting and the annual effective cost of owning a property is the central determinant of the home ownership rate. If the annual costs associated with ownership begin to exceed rent, more people will choose to rent and vice versa. In normal times, theory suggests that the costs of renting and owning should be equal.

Again, a set of other factors also influences the balance of home ownership. These include the incomes of would-be first-time buyers and the costs of mortgage credit they face relative to those for existing owners who tend to have more equity and can therefore secure lower mortgage rates. The absolute level of house prices also has an impact of the affordability of buying a property: a rise in house prices implies a bigger cash deposit to access better mortgage rates.

Overall the interaction of these forces gives rise to the housing market system depicted in Fig. 1. This informs the basic structure of the three-part model for the housing market that we have developed for this study. It illustrates, how income, for example, affects house prices directly, but also indirectly through their influence on rent, which also has its own impact on house prices. In turn, income affects home ownership through several channels, since the home ownership rate is determined by a combination of house prices and rental prices (as well as other factors where income plays no role).

**Fig. 1. The housing market as a system**



## 1.2 A NEW MODELLING APPROACH

A conventional approach to analysing house prices or rent would involve developing models for estimating each separately. But this approach is flawed for the purposes of this study because of the interdependencies described above and our ultimate focus on home ownership, which is largely a by-product of developments in prices and rent. For example, the degree to which higher income drives house prices directly versus through driving up rents is important in understanding the impact of income on home ownership rates.

For this reason we adopt a Structural Equation Modelling approach, in which three models—describing rent, prices and home ownership—are estimated simultaneously in order to disentangle the direct and indirect effects of different factors.

While policy measures towards the housing market are not directly captured in our framework, the impact of policy enters the system through the macroeconomic variables used. In particular, the Help to Buy schemes that have been implemented since 2013, or the Bank of England’s Funding for Lending scheme are likely to have affected the rate of new housing supply, mortgage availability and, potentially, mortgage rates, all of which appear in our model.

### **1.3 WHAT CAUSED HIGH HOUSE PRICES AND FALLING HOME OWNERSHIP?**

The modelling results allow us to identify the drivers of both rising house prices since the late 1990s and declining home ownership rates since the early years of the century. These conclusions are surprising in the context of the assumptions that often underpin the public debate around housing. They also point the way to what kinds of policies will and will not make a significant difference to prices and ownership rates. First we explore the house price results before turning to home ownership.

#### **Additional supply, or shortfalls in supply, only affect prices if sustained over long periods.**

Our results show that a one percent increase in the number of houses, or a one percent fall in the number of households, would reduce house prices by 1.8%. In the context of a stock of over 28 million dwellings in the UK in 2014, this means that even when new supply outstrips new household formation, its impact on prices is likely to be small unless sustained over a long period.

It is instructive to put this result in the context of recent changes in both supply and house prices. Between 2013 and 2014 270,000 new households are estimated to have formed in the UK, while net new supply was 159,000 in the year to 31 March 2014. The shortfall of around 110,000 dwellings represented 0.4 percent of the UK housing stock. This was an unusually large shortfall by recent standards, since housing supply had grown in line with household formation over the previous ten years. The results suggest that this was responsible for pushing up prices by around 0.7 percent over the year. However, overall, prices rose by 4.6 percent in real terms, indicating that even 2014's unusually large shortfall of supply made only a marginal contribution to price increases.

#### **Rising earnings and falling interest rates, rather than insufficient supply, drove the boom in house prices between 1996 and 2006.**

Applying the results to the house price boom from 1996 Q4 to 2006 Q4 we are able to identify the major drivers over a period when real prices increased by 151 percent in real terms. During this period, new supply slightly outstripped the rate of household formation. Consequently housing supply constraints did not make any material contribution to price growth.

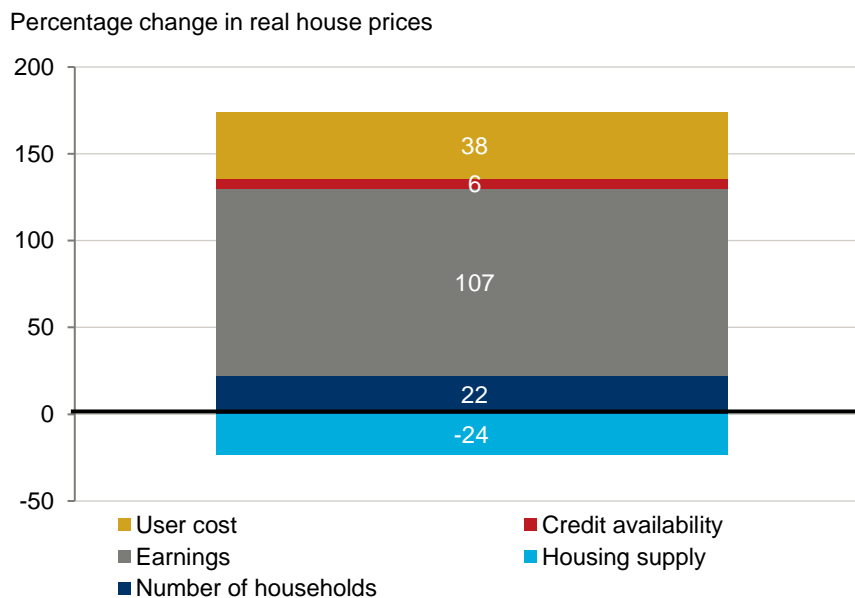
Rather, the main drivers of the boom were growing household earnings, rising employment and falling interest rates. In keeping with other studies, we find that house prices are highly sensitive to household earnings, such that a one percent increase in average real average earnings per household increases prices by 2.2 percent. By contrast, sharp falls in real earnings after the financial crisis drove prices down.

The other driver was mortgage interest rates. Typical mortgage interest rates fell from around 11 percent in 1992 to just over two percent by the end of 2014, sustaining a substantial increase in house prices by lowering the user cost of capital. Putting it all together, Fig. 2 reveals the contributions of various factors to the 151 percent boom in house prices in the ten years from late 1996. The



analysis has important implications for the degree to which additional supply can be expected to temper rapid price growth driven by other factors.

**Fig. 2. Drivers of the house price boom between 1996Q4 and 2006Q4**



Source: Oxford Economics

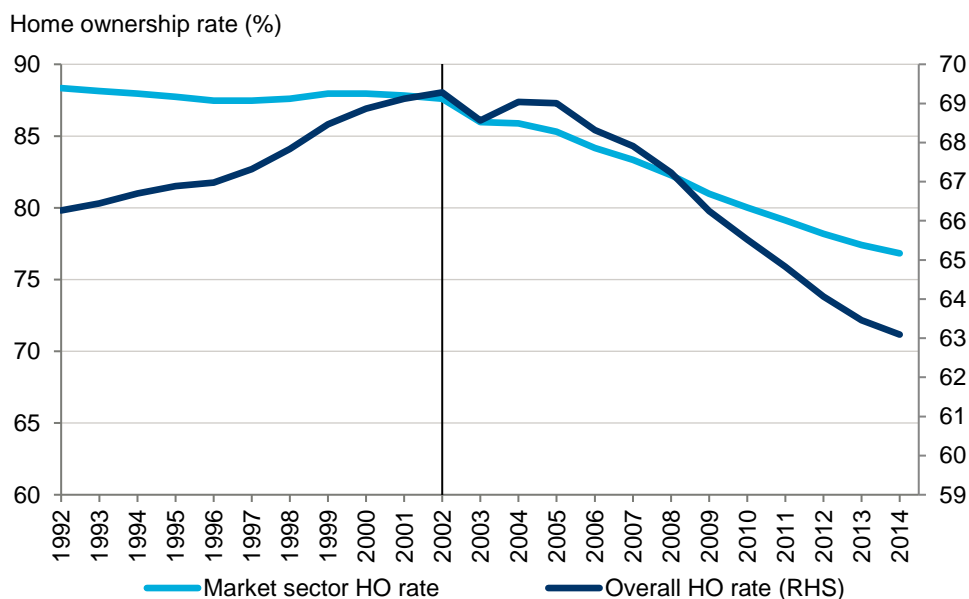
**Home ownership grew strongly up to 2002, almost exclusively due to changes in the social rented sector, such as Right to Buy.**

The home ownership rate grew strongly up to 2002 and has since fallen back rapidly, as shown in Fig. 3. However this overall rate is influenced both by the size of the social rented sector—determined almost exclusively by policy—and by the interactions in the private market that our macroeconomic approach makes a rare attempt to model. Looking at trends in the social rented sector and the market sector separately helps to explain why home ownership rose and then fell.

Setting aside the social rented sector, home ownership rates in the market sector were broadly flat for 20 years from the early 1980s until 2002, at around 87 percent. But from 2002 the ratio began to fall quickly, to stand at less than 77 percent by the end of 2014, as illustrated by the light blue line in Fig. 3.

Major changes occurred in the social rented sector over the period from 1980 to the early 2000s, when little was changing in the market sector. A shrinking social rented sector—in particular due to Right to Buy—was therefore primarily responsible for the rise in overall home ownership rates up to 2002. In England alone around 1.6 million social houses were sold between 1980 and 2002, pushing up the overall home ownership rate over a period of two decades. In part due to policy changes, Right to Buy has withered in importance since its heyday in the 1980s and 1990s, with the sales slowing to a trickle after 2005. Consequently the policy responsible driving up home ownership was coming to an end just as trends in the market sector started to push home ownership down. As a result, the overall home ownership rate fell by 6.2 percentage points between 2002 Q1 and 2014 Q1.

**Fig. 3. Falling home ownership rates in the UK, 1992-2014**



Source: Oxford Economics

**In the market sector alone, the decline in home ownership was driven by the higher cost of credit for first-time buyers, higher house prices and lower relative earnings for younger people.**

Using the model to break down the determinants of the decline, we see that the biggest contribution came from the higher cost of, and restrictions on, mortgage lending for first-time buyers. More specifically the interest rates on high loan-to-value (LTV) mortgages, typically used by first-time buyers, deteriorated quickly in the wake of the financial crisis relative to credit conditions for people borrowing at lower LTV levels. Relatively higher rates and more constrained lending to first-time buyers therefore appears to have cut 3.8 percentage points off the home ownership rate by the end of 2014.

The deterioration in relative credit conditions for first-time buyers occurred after the financial crisis struck in 2008, but home ownership rates had been falling for a number of years before that. The main contributor to the fall prior to the financial crisis was the increase in house prices, which peaked in 2007. Despite prices falling after 2007, they remained 31 percent above their 2002 Q1 level by early 2014. Over the whole period, higher real house prices are estimated to have reduced the private home ownership rate by 2.6 percentage points.

A third driver of the fall has been the decline in the earnings of younger people, aged 28-to-40 relative to people aged 40-plus. In the wake of the financial crisis and recession, younger people's average earnings fell from approximate parity with the over-40s in 2002, to being almost ten percent lower by the start of 2014. This reduced the relative buying power of would-be first-time buyers, pulling down the home ownership rate over the period by around 1.4 percentage points.

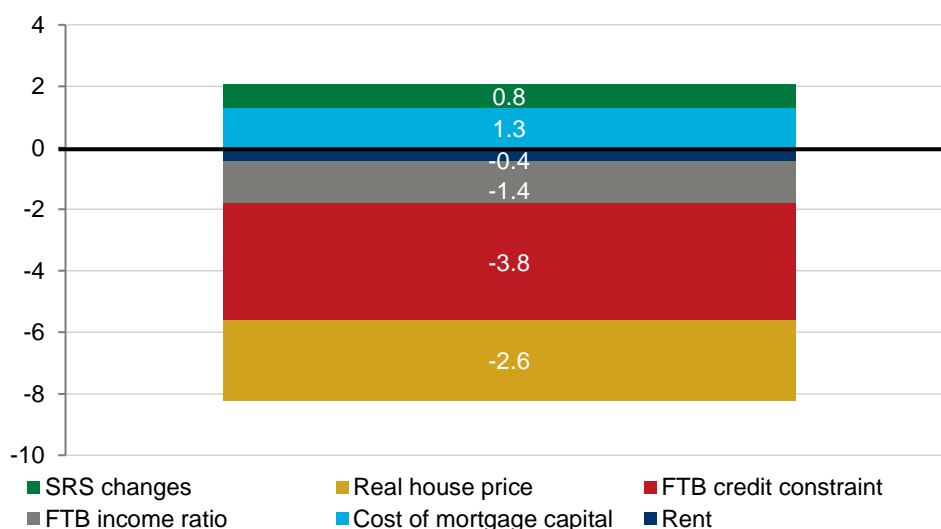
These three factors would have pushed home ownership rates down much further than the observed fall had it not been for two offsetting forces. First, a

drop in the user cost of capital, mainly due to declining mortgage rates, acted to offset roughly half of the impact of rising house prices.

Second, the fall in home ownership the market sector was ameliorated somewhat by changes in the social rented sector over the period. These effects, in particular the impact of Right to Buy, appear to have added just under one percentage point to home ownership over the period between 2002 and 2014. Being similar in 2014 to what it had been in 2002 in real terms, rent made a negligible contribution to the trend.

**Fig. 4. Drivers of the 6.2 percentage point fall in home ownership rates between 2002Q1 and 2014 Q4**

Percentage point change in home ownership rate



Source: Oxford Economics

**The results show that additional housing supply has no clear impact on home ownership rates.**

One conclusion that is notable from the above discussion is the absence of housing supply as a factor in the recent trends in home ownership. The reason for this is that the model results show no statistically significant effect of additional housing supply on home ownership. This initially surprising result makes good sense on closer inspection. Additional supply has its impact on house prices only through its effect on rent. When supply has grown in the past, this has tended to put downward pressure on both rent and prices together, improving the attractiveness of both simultaneously. The result is no change in the home ownership rate because additional supply does not make one tenure more financially attractive than the other.

Consequently, the results suggest that increased housing supply is not a policy that will raise the rate of home ownership. It is worth highlighting that despite the lack of impact on the distribution of tenure, additional supply would cut the cost of housing for both owners and renters alike. Indeed other research has suggested that, while extra supply may not change the home ownership rate, the absolute *number* of home owners could increase if additional supply

stimulates a degree of new household formation by making housing in any tenure cheaper.

#### **1.4 FORECASTS AND POLICY IMPLICATIONS<sup>1</sup>**

The results of our modelling exercise can be used, together with forecasts of the main macroeconomic determinants, to derive forecasts of house prices and home ownership. Many of the determinants, such as earnings, inflation and interest rates, are drawn from Oxford Economics' macroeconomic outlook as at the end of October 2016.

This forecast for the UK economy holds that GDP will grow at 1.8 percent in 2016 and 1.1 percent in 2017. It assumes that the UK is heading for a relatively loose trading relationship with the EU—a 'hard Brexit'. Related to this we anticipate a weaker investment environment and labour market, together with somewhat higher inflation due to the recent depreciation of sterling. Meanwhile, the weakness in sterling is expected to benefit net exports to a degree and expansionary monetary policy is set to provide some stimulus.

In line with this, mortgage interest rates are forecast to remain at historic lows until near to the end of the decade. This macroeconomic outlook affects our house price and home ownership forecasts, mainly by reducing real earnings per household, as inflation reduces purchasing power and sluggish economic growth weighs on earnings and employment. Another channel of impact on the housing market is likelihood that the user cost of capital will fall with interest rates initially, before rates eventually begin to rise around the end of the decade.

Other determinants in our forecast are more difficult to form a view about. In particular, it is too early to say what the impact of Brexit may be on the number of households in the country and the rate of house building. We therefore assume that the housing stock grows at 0.76% per year, its average rate since 1992, and that household numbers grow at the same rate causing housing stock per household to remain constant. There is also no easy way to assess the likely path for first-time buyer earnings and mortgage rates relative to those of older people. Consequently we assume that first-time buyer credit constraints and the first-time buyer income ratio remain constant over the next ten years.

#### **House prices are likely to be pinned down by weak earnings growth and rising interest rates over the next five years.**

Our baseline forecast suggests that real house price increases will tail-off as we head into 2017, and then remain broadly flat until 2021. This is driven by two key trends. Initially, the negative impact of the Brexit vote is expected to subdue economic growth and therefore earnings growth. Real earnings growth then resumes in 2018, but the positive impact of this on house prices is offset by increases in interest rates, which are currently forecast by Oxford Economics to begin around the end of the decade. As a result, real prices are

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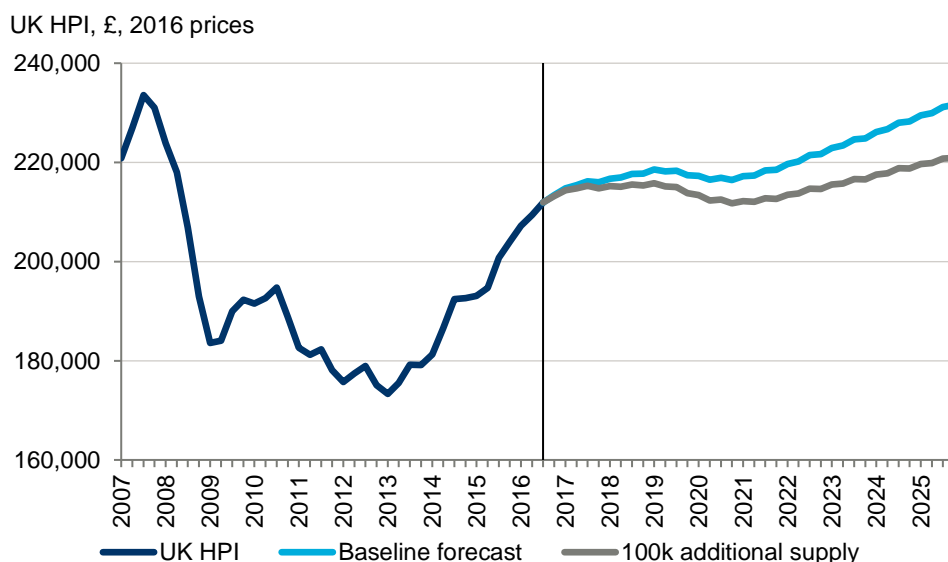
<sup>1</sup> The house price forecast presented here differs from Oxford Economics' house view. This is inevitable given that this study involves the estimation of an entirely new model, which is ultimately focused on analysing home ownership rates.

expected to remain almost static over the next five years, averaging annual growth of around 1.1 percent over the next ten years as a whole. Fig. 5 below illustrates the baseline forecast.

**Additional supply will only reduce prices materially if maintained over the long term.**

How would additional supply alter this picture? Our baseline forecast assumes the steady addition of around 210,000 dwellings each year with a similar number of households being formed. To put downward pressure on prices new supply would need to outstrip underlying household formation. Fig. 5 shows the impact of boosting the annual supply figure by a further 100,000 per year - to around 310,000 per year in total. This helps to keep prices in check, but they end the forecast period only around five percent below the baseline forecast. Consequently we can see that even at historically high rates of building, this has to be sustained each year over a long time if it is to have a substantial impact on prices.

**Fig. 5. House price forecasts 2016-26: baseline and additional supply scenario**



Source: Oxford Economics

**The long fall in home ownership rates may now be at an end, with rates set to stabilise at their current level.**

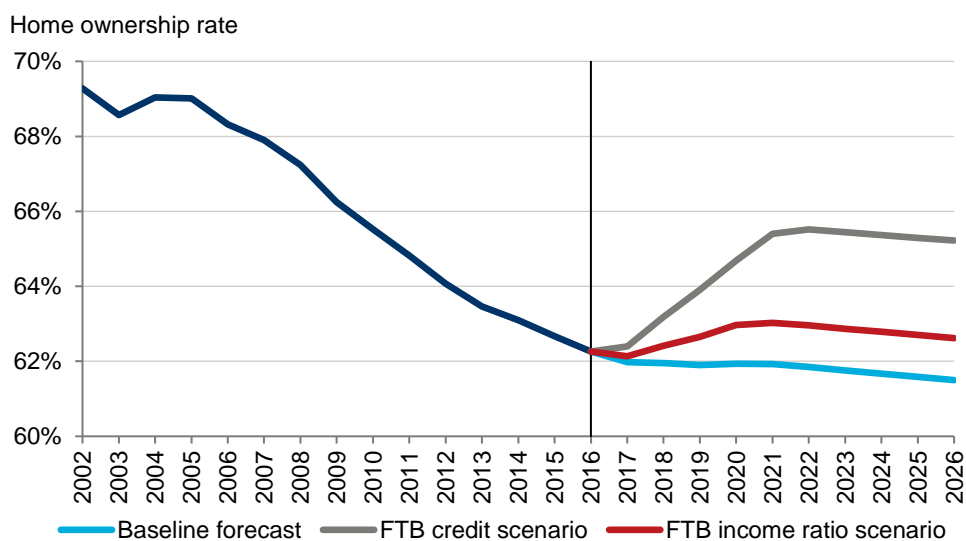
Our house price forecast suggests that real earnings will see limited growth over the next few years, before starting to pick up in late 2018. Thereafter steady earnings growth is likely to affect both prices and rent, leading to stability in the home ownership rate. The model predicts that the home ownership rate will stop falling and stabilise at around 62 percent over the next few years, as shown in the baseline forecast presented in Fig. 6. The forecast assumes that the social housing stock remains at its current proportion of the total.

**A fall in first-time buyer mortgage rates or a rebound in younger people’s earnings are the most likely sources of higher home ownership rates.**

Our model illustrates how sensitive home ownership rates are to a divergence in credit conditions for first-time buyers relative to others. The gap between the mortgage rates available on high versus low LTV borrowing can be taken as a proxy for this. Accordingly, if the gap between 95 percent and 75 percent LTV mortgage rates were to fall from its current level of around three percentage points to one by 2020, home ownership rates would jump considerably, regaining almost four percentage points. The desirability of such a change in credit availability is one that policymakers would need to weigh against financial stability goals. But fiscal policy options could be considered that would have a comparable impact.

Finally, the home ownership rate may also recover somewhat if younger people’s earnings were to recover. Since the financial crisis the relative earnings of people aged 28-to-40 have dropped from parity to almost ten percent below those of the 40-plus group. If this situation were to reverse, our forecast suggests that home ownership would rise by a little over one percent point compared to the baseline. Achieving any such a shift is obviously difficult and represents part of a wider economic policy challenge.

**Fig. 6. Home ownership forecast, 2016-26**



Source: Oxford Economics, DCLG

## 2. INTRODUCTION

Housing is rising up the public policy agenda. This is primarily due to two important dynamics relating to house prices and home ownership.

House prices have recently resumed the rapid pace of growth that characterised them from the late 1990s up to the eve of the financial crisis in 2008. Over the period of the boom, from 1996 Q4 to 2006 Q4 prices rose by 151 percent in real terms. Following a drop in prices in the wake of the crisis, recent rapid growth has seen them recover some of that fall in real terms.

Related to this, home ownership rates in the UK, which peaked at 69.3 in 2002 have since fallen inexorably, and stood at 63.1 percent at the start of 2014, the last point for which we have official UK data. Such a fall is unprecedented, ending an upward trend that had been evident for most of the twentieth century. These trends have important economic and social implications, and are the focus of the Redfern Review into the decline of home ownership.

In this context, this study was commissioned by the Redfern Review in order to:

- establish the drivers of these trends;
- understand the prognosis for home ownership and house prices; and
- identify what would need to happen to change the outlook for both.

The report begins by setting out a new approach to modelling house prices and home ownership, based on data from 1992 to 2014. The results from the modelling illustrate the sensitivity of house prices and home ownership rates to different macroeconomic drivers: the supply of housing, the cost of capital and households' earnings, among other things.

Armed with these results, we go on to identify the factors that have driven some of the big changes that have occurred to house prices and home ownership in recent years, a piece of analysis that has not been undertaken before to our knowledge. This reveals some clear and surprising conclusions. Finally, based on Oxford Economics' forecasts of the macroeconomy, we present ten-year forecasts of each measure, and explore what might happen in a number of scenarios built around different policy responses.

## 3. UNDERSTANDING THE HOUSING MARKET

### 3.1 TWO MARKETS RATHER THAN ONE

The unique nature of housing can create confusion about how rental prices, house prices and home ownership are related to one another. In this section we set out how economists think about the housing market and a stylised version of the interaction of these different concepts.

The housing market is commonly thought of as a market for a single thing, while in fact there are two distinct markets, the intersection of which determines both house prices and home ownership rates. First, by living in a house one consumes housing 'services'—a place to live. Second, by owning a house one is seeking housing as an investment, the primary financial benefit of which lies in preventing the owner occupier from having to pay rent, and insuring him or her against possible future increases in rent. Through the rental market it is possible to consume housing services without owning a house, or to invest in housing without consuming its services.

This is analogous to the way that it is possible to benefit from the services provided by a company without owning shares in it, or own the company without ever using its services. Owner occupiers are, in this way of thinking, a special case of people who both own and consume a property.

Rental prices adjust to match the supply and demand for housing services—places for people to live—in aggregate. Changes in the size of the private rented or owner occupied sectors do not affect this balance, since they do not change the overall number of dwellings or households. For this reason, shifts in the distribution of tenure type do not affect rental prices. For example, if someone buys five houses and rents them back to their former owner occupiers, the private rented sector has grown by five, but the balance of households to dwellings, and therefore rental prices, is unchanged.

House prices play the same role for the supply of housing and demand for it as an investment. This market is separate from the market for housing services. The attractiveness of housing as an investment, and therefore the level of house prices, depends upon the relationship between the costs and benefits of ownership.

The costs of ownership should be thought of as the real annual costs faced by the owner, rather than the house price itself. These include not just the mortgage interest payments that an owner has to make, but foregone income on any equity the owner has in the property, as well as annual property taxes, maintenance and depreciation costs, and any expected capital gain. Taken all together, and adjusted for expected inflation, these costs are referred to as the



*real user cost of capital*.<sup>2</sup> Multiplying the user cost of capital by the house price gives us the annual *user cost of owning*.

The benefits of ownership are the rent that one can receive by owning or, equivalently, the rent that one can avoid having to pay by becoming an owner occupier. This is often referred to as the 'imputed rent' on an owner occupied house.

In terms of these concepts, house prices are determined in a similar way to any other asset whereby, assuming constant levels of rent:<sup>3</sup>

$$\text{House price} = \frac{\text{Rent}}{\text{Real user cost of capital (\%)}} \quad (1)$$

Consequently, when the housing market is in equilibrium the rental yield is equal to the user cost of owning. In other words, the costs of owning a given house will tend to equal the cost of renting it. Where these are out of line with one another, house prices will tend to adjust to bring them back into line.

What does this mean for how prices behave? If mortgage interest rates fall, the user cost will fall, making investment in residential property more attractive for a given level of rent. Greater investment could come either through buy-to-let or more renters moving into owner occupation. This in turn bids up house prices to the point where the user cost of owning is brought back into line with rent.

A similar dynamic would play out if yields on comparable alternative investments were to fall. If real global interest rates fall, as has been seen over the past 20 years, the effect is to lower the user cost of capital—both directly as mortgage rates fall, and indirectly as the opportunity cost of housing equity falls—and therefore boost prices for any given level of rent. Standard asset pricing theory would suggest that at constant rent, if the user cost of capital were to halve this would double house prices.<sup>4</sup>

An important point to note here is that fluctuations in house prices have no impact on rent. This is because house prices are only paid by people who want to invest in housing and it is not necessary to do so in order to have a home. Rather, rent is determined by the number of dwellings, the number of households and income levels—the determinants of the market for housing services.

On the other hand, in keeping with the above equation, changes in rent do drive prices. If rents rise—perhaps because the supply of houses grows more slowly than the number of households—this increases the value of the benefits accruing to the owner of the property, raising the yield relative to alternative investments. This, again, attracts more investment into property until the yield is brought back into line with that available on other comparable investment opportunities, through higher house prices.

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<sup>2</sup> For a more detailed discussion see: C. Himmelberg, C. Mayer and T. Sinai, "Assessing High House Prices: Bubbles, Fundamentals and Misperceptions", *Journal of Economic Perspectives*, 19 (2005): p. 67-92.

<sup>3</sup> M. Gordon, *The Investment, Financing and Valuation of the Corporation* (Homewood, Ill.: Irwin, 1962).

<sup>4</sup> R. Hubbard and C. Mayer, "The Mortgage Market Meltdown and House Prices", *The B.E. Journal of Economic Analysis & Policy*, 9: ISS. 3 (Symposium), Article 8. (2009).

These relationships are analogous to the value of a company and the price of the services it provides. The value of a company's shares is determined by the stream of profits the company generates by selling the widgets it makes. If the yield on alternative investments falls, investors will buy the company's shares, bidding up the share price with no impact on the price of its widgets for customers. On the other hand, if there is a sudden change in demand for the company's output—perhaps because it develops a new and exciting product—its profitability will rise. This temporarily raises the yield on the company's shares, attracting investors and bidding up the share price until the yield is brought back into line with that of risk-equivalent investments.

Finally, this framework allows us to differentiate between the cost of owning a property and the cost of buying one. If house prices increase the cost of buying a house becomes less affordable since buyers need a bigger cash deposit. But if that increase in prices comes as the result of a fall in the user cost of capital, the actual annual costs of owning a house, and therefore the affordability of owning, may be unchanged.

### **3.2 USER COSTS, RENT AND THE CHOICE OF TENURE**

As explained above, the user cost of owning tends to equal rental prices on any given property. But divergence of the user cost from rent can persist for long periods and this has implications for the distribution of home ownership.

If house prices were to rise even though mortgage interest rates and rent were unchanged, the desire to rent would rise as the user cost of owning outstripped rent. Fewer people looking for somewhere simply to live would be inclined to buy and hence home ownership rates would fall.

Similarly if rent were to increase due to rapid growth in the number of households and limited new supply, this would take it above the user cost of owning, causing renters to seek to insulate themselves by becoming owner occupiers, and raising the home ownership rate.

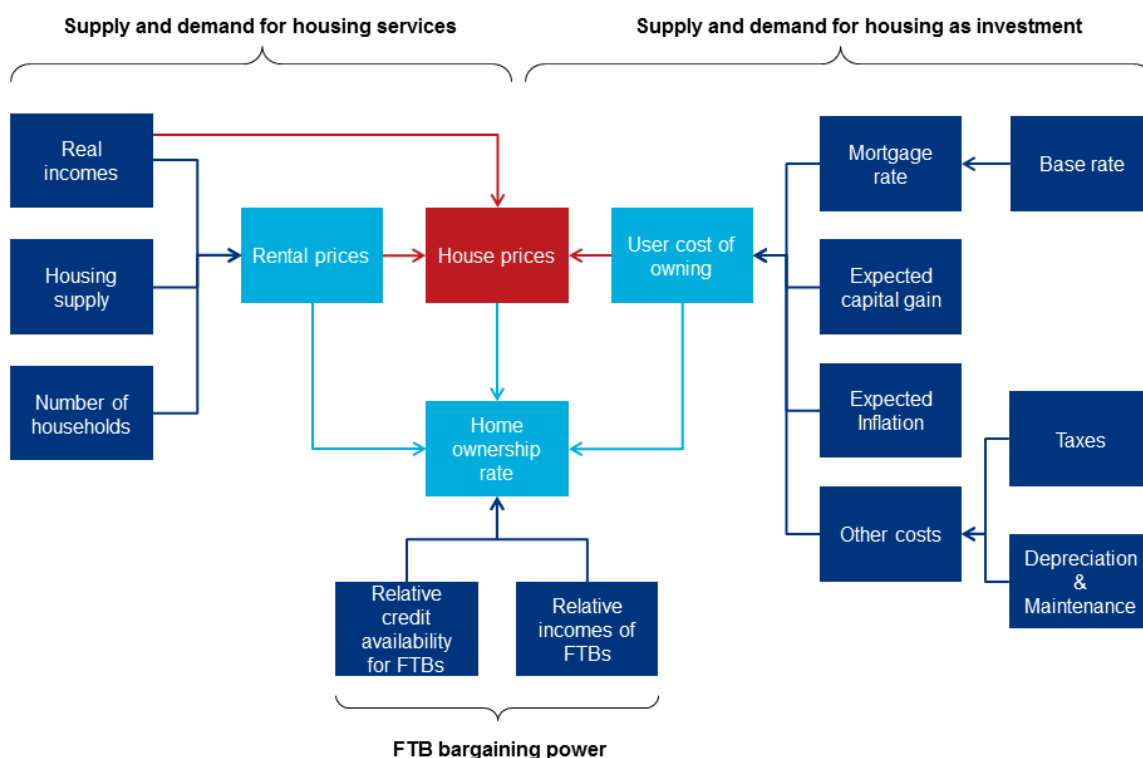
Over time, in either case, prices will tend to adjust to bring the user cost of owning and rental prices back to equality. But temporary divergence can have lasting impacts on the home ownership rate as households respond.

These dynamics are the core element that determine the level of owner occupation. However there is also a bargaining element that determines the distribution of house ownership. If the cost of capital for would-be first time buyers is higher than for existing owners, because mortgage rates available at high loan-to-value (LTV) ratios are higher for example, this puts first-time buyers at a cost disadvantage to would-be buy-to-let investors. All else equal this is likely to reduce the incentive to become an owner occupier. Similarly if the earnings of would-be first-time buyers fall relative to would-be buy-to-let investors, this is liable to reduce home ownership rates.

### **3.3 THE HOUSING MARKET AS A SYSTEM**

Putting these elements together we are able to draw a stylised diagram of the direct and indirect links between drivers of rent, home ownership and house prices. 0 sets out these relationships. A number of implications from this are surprising and hence worth noting.

Fig. 7. The housing market as a system



First, the supply of houses and the number of households only affects house prices through their impact on rental prices. This is because changes in these variables affect the supply and demand of housing services, which are equalised by the level of rent. Rent, in turn, then determines house prices. An implication of this is that rental prices are a better indicator than prices of whether housing supply is keeping pace with the demand for housing services – whether we ‘have enough housing’.

A second important implication is that the impact of additional supply on home ownership rates is theoretically ambiguous. Additional supply tends to reduce rent and therefore to reduce prices. Consequently its impact on ownership rates is uncertain because it reduces the costs of owning and renting simultaneously.

Third, changing household incomes has both an indirect effect on house prices via rent, and a direct effect to the extent that owner occupation is seen as carrying additional housing service benefits. These additional consumption benefits associated specifically with owner occupation could include greater security of tenure, freedom to alter a property, and the insurance value that ownership provides against future increases in rent.<sup>5</sup> The total impact of

<sup>5</sup> Statistical testing on our dataset bears out the idea that income affects prices directly as well as via rent.

income on house prices is therefore composed of these direct and indirect effects.

A further important implication is that drivers of the user cost of owning—house prices, interest rates, taxes and subsidies on ownership, depreciation, expected inflation and expected capital gains—have no impact on rent in the short term and only a very marginal one in the long term.<sup>6</sup> This is because neither changes in house prices nor the user cost of capital alter the balance between the number of households and the number of dwellings in the economy in the short run.<sup>7</sup> So rather than rent adjusting, if the cost of capital were to rise, house prices would tend to fall such that the user cost of owning remained unchanged.

Finally, while the user cost of capital is very obviously a determinant of house prices it also *indirectly* drives home ownership rates. A higher user cost of capital, perhaps due to higher mortgage interest rates, will tend to lower house prices, which in turn boosts home ownership, all else equal.

This chapter has set out a theoretical model of the interaction of rent, house prices and home ownership as related elements of the housing market as a system. This understanding has important implications for any attempt to model the housing market. In the next chapter we set out our modelling approach in light of this.

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<sup>6</sup> We undertook tests for endogeneity in the relationship between rent and prices. The results confirm the theoretical expectation here (see appendix one).

<sup>7</sup> In the long term, if the user cost of owning persists below the rental price, a supply response could alter the balance in dwellings per household, lowering rent. Casual observation of the UK shows that this response is unlikely to be either quick or significant.

## 4. MODELLING APPROACH

This section sets out our approach to modelling house prices and home ownership, in the context of the housing market relationships explained in the previous chapter. We begin by considering how best to model home ownership, as the ultimate goal of this exercise, before discussing the approach to house price and rent modelling.

A conventional approach to exploring these forces would involve distinct models for estimating house prices and home ownership separately. But this approach is flawed for the present purposes because of the interdependencies described above. If house prices rise, the impact on home ownership depends crucially on what caused the rise: if it was something that also drove rent up, the implications for home ownership rates are very different compared to changes that only affect house prices, such as the user cost of capital.

Having explored each element separately, we go on to explain how the models come together into one overarching framework that reflects these complex interactions. We set out why it is necessary to estimate models for rent, prices and home ownership *simultaneously*, in order to identify (in this example) which drivers of price rises have come through the rent channel and which through the cost of capital channel.

### 4.1 APPROACHES TO MODELLING HOME OWNERSHIP

There are two main approaches used to model home ownership in the literature—microeconomic and macroeconomic models. Microeconomic models treat home ownership as being determined by the characteristics of individuals across the population. They estimate the probability that a given individual or household will be a home owner based on their age, marital status, income and other variables, and derive the implications for national home ownership rates by aggregating the probabilities across a nationally representative sample of people.

The microeconomic approach is useful to understand the effect of individual policy interventions such as Help to Buy, since it is possible to simulate what a given policy might do to the probability of owning for a specific type of person. But such models don't consider some of the biggest drivers of house prices and affordability, which are commonly understood to be key influences on home ownership.

Macroeconomic models, on the other hand, take a top-down approach to investigate how macroeconomic parameters like interest rates, housing supply, house prices and income affect home ownership rates. The macroeconomic approach is more useful to understand how housing supply and wider economic conditions affect home ownership. We follow the macroeconomic approach predominantly but borrow some ideas from the microeconomic approach where appropriate.

The theory underpinning our model is based on papers by Haurin *et al.* and King.<sup>8</sup> The framework behind these is that household utility is derived from the consumption of housing services, the consumption of other goods, and leisure. In this world, households maximise their utility by consuming as much of each item as possible given their relative prices, and subject to the budget constraint that total cost is equal to total income. In this context it is easy to see how, if the user cost of owning were to rise above rent, more people would tend to choose to rent in order to maximise their utility by consuming more housing for their money, and vice versa.

On top of these determinants there are a set of so-called 'shifters' that affect people's preferences for ownership, aside from the relative costs of owning and renting. These include unobserved factors such as the feel good factor of owning a property. Shifters can also include observable factors that affect preferences, such as credit availability. The relative price of housing vis-a-vis other goods determines what proportion of total consumption housing makes up, and so the level of utility derived by the households.

As described above, households have the option of consuming housing services via renting or owning. For given levels of the shifters and the price of renting ( $P_R$ ) and owning ( $P_O$ ) a property, households will compare the relative utility derived to decide whether to own or rent. The higher the utility derived from owning ( $U_O$ ) relative to renting ( $U_R$ ), the higher the probability of owning ( $Prob_O$ ) and the lower the probability of renting ( $Prob_R$ ). Thus we have:

$$Prob_O = f(U_O > U_R) \quad (2)$$

$$Prob_R = f(U_O < U_R) \quad (3)$$

The probabilities sum to one and are interdependent, hence they can be expressed in terms of an odds ratio (a ratio of the probabilities). The odds ratio of owning a property can therefore be expressed as a function of the price of owning and renting, and the shifters.

$$\left( \frac{Prob_O}{1 - Prob_O} \right) = f(P_R, P_O, shifters) \quad (4)$$

The cost of renting a property is simply the rent paid. The cost of owning a property, however, includes all the elements of the user cost of ownership described in the last chapter: the mortgage interest rate, the annualised value of taxes and subsidies, depreciation, expected inflation, expected capital gains and of course the house price. The balance between the cost of owning and the cost of renting is a key determinant of the home ownership rate.

In terms of shifters, we include three variables that are particularly influential: relative mortgage constraints, relative earnings, and relative numbers of would-be first-time buyers.

First-time buyers tend to face more constraints in the mortgage market: having lower levels of equity means they pose a greater risk for lenders and hence

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<sup>8</sup> D. Haurin, P. Hendershott and S. Wachter, "Borrowing constraints and the tenure choice of young households", *Journal of Housing Research*, 8 (1997): p. 137–154. M. King, "An Econometric Model of Tenure Choice and Demand for Housing as a Joint Decision", *Journal of Public Economics*, 14 (1980): p. 137-159.

typically face higher costs of borrowing and tighter restrictions on mortgage availability. This puts them at a cost disadvantage compared to existing owners and buy-to-let buyers. This disadvantage has been reinforced since the financial crisis as a result of changing sentiment towards higher-risk lending as well as tighter domestic and international regulatory constraints. First-time buyer credit constraints are therefore included in our model as an important shifter variable that, as we will demonstrate, is a crucial determinant of home ownership.

In a similar vein, trends in the relative incomes of would-be first-time buyers and existing owners can be an important driver of home ownership. Various studies, including by Meen and Bottazzi *et al.* have found that first-time buyers tend to be aged 28-40 years old.<sup>9</sup> Therefore, if there are divergent trends in the earnings growth of young versus older workers, such as those seen since the financial crisis, this is likely to affect the relative purchasing power of would-be first-time buyers. We therefore include a variable to capture these trends.

Finally, having a high proportion of the population within this would-be first-time buyer age group is clearly a factor in home ownership rates. When the proportion of the population above 40 is high, one would expect a higher home ownership rate than when the population is younger since the decision to own is to some degree affected by an individual's life stage.

In this subsection we have set out the determinants of home ownership within our model, and house prices are unsurprisingly an important element. Next we outline our approach to modelling prices themselves.

## 4.2 MODELLING HOUSE PRICES

The theoretical foundation of the house price model broadly follows the structure laid out by Meen and Auterson.<sup>10</sup> As in the home ownership model, households are assumed to derive utility from consuming housing services and other goods (consumables and leisure). As explained above, households maximise their utility by consuming as much of each item as possible given their relative prices and household budget constraints, such that total cost is equal to their total income.

For each household, income is given as current income plus any income generated from financial assets, which implicitly captures the opportunity cost of investing in housing. There are three elements to their costs. First, the net cost of housing includes the cost of owning a property, determined by house prices, mortgage interest rates, annualised taxes and subsidies, depreciation and expected capital gain. Second, the net acquisition of financial assets includes the cost of new investment plus the loss in value of total financial stock

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<sup>9</sup> G. Meen, "A long-run model of housing affordability", *Housing Studies*, 26 (7-8) (2011): p. 1081-1103., R Bottazzi, T Crossley and M Wakefield, "Late starters or excluded generations? A cohort analysis of catch up in homeownership in England," in *IFS Working Paper* ([n.p]: [n.pub.], 2012), W12/1. G. Meen, *Modelling Spatial Housing Markets: Theory, Analysis and Policy* (London: Kluwer Academic Publishers, 2001).

<sup>10</sup> T. Auterson, "Forecasting house prices", *OBR Working paper*, 6 (2014). G. Meen, "A Simple Model of Housing and the Credit Crunch", *University of Reading, Department of Economics mimeo.*, 2009.

as a result of inflation. Finally, consumption includes the cost of goods and services.

Household utility is maximised when the ratio of marginal utility of housing to other goods (consumption and financial assets) is equal to the corresponding cost ratio. The cost ratio is referred to as the shadow price of housing or the real user cost of capital ( $RUCC_t$ ). From the utility maximising process,  $RUCC_t$  can be derived as interest rate payments ( $i_t$ ) plus the other recurring costs ( $\delta$ ) net of any expected capital gain and expected inflation ( $\pi$ ). This can be expressed as:<sup>11</sup>

$$RUCC_t = RHP_t(i_t + \delta - \pi - \text{expected gains}) \quad (5)$$

where  $RHP_t$  represents real house price. It is further assumed that the real rental value per unit of housing ( $RR_t$ ) also clears the market for housing services, and as a result it should be equal to  $RUCC_t$  when the housing market is in equilibrium. Replacing  $RR_t$  in equation (5) and rearranging, we obtain and the following expression for  $RHP_t$ :

$$RHP_t = RR_t / (i_t + \delta - \pi - \text{expected gains}) \quad (6)$$

Some studies replace real rent with its main determinants - real income, housing stock and household numbers - due to the lack of robust data for rent over long time period. However, due to the recent availability of a better ONS rental data series, as well as the fact that real incomes may also have an independent and direct impact on house prices as described in the last chapter, we retain real rent in our approach.

Finally, the availability of mortgage finance is clearly an important determinant of demand for housing as an investment, and one that has fluctuated historically, especially in the run-up to and aftermath of the financial crisis. In line with Meen and Auterson we therefore extend equation (6) to include a similar, albeit different, mortgage constraint variable as an additional determinant of house prices, to obtain the final model that we will seek to estimate.<sup>12</sup>

$$RHP_t = RR_t / (i_t + \delta - \text{expected gains} + \text{mortgage\_constraint}) \quad (7)$$

With the approach to house price modelling explained, it is clear that rent is an important determinant. The final element of the system therefore involves modelling rent.

### 4.3 MODELLING RENTAL PRICES

The literature on modelling rental prices at the macroeconomic level is fairly scant. Most studies that exist have looked at the determinants of rent at a microeconomic level for a given usage type, such as office, retail and residential property. These hedonic-based models tend to focus on the

<sup>11</sup> See Auterson (2014) for a formal derivation of this utility maximising condition.

<sup>12</sup> Ibid. and G. Meen, "The Removal of Mortgage Market Constraints and the Implications for Econometric Modelling of UK House Prices", *Oxford Bulletin of Economics and Statistics*, 52(1) (1990): 1-24.



characteristics of the property, such as size, location and vacancy rate as the main determinants of the rental price. At a macroeconomic level, Swan has argued that household income, housing stock and the number of households are the main determinants of residential rent.<sup>13</sup> This is the approach we adopt here.

An increase in housing stock with a corresponding increase in number of households should not have an effect on rent. As a result, the composite variable of *housing stock per household* is considered to be a better determinant for rental price.

Andrew and Meen point out that there is a potential problem here. Lower housing stock per household is likely to increase rents, but it is also possible that higher rents may deter people from forming new households and hence increase the housing stock per household compared to what the ratio would otherwise have been.<sup>14</sup> This two-way relationship makes intuitive sense: if rent is high, young people, for example, are more likely to live with their parents than if it were cheaper.

It is essential to account for this so-called 'two-way causality' between stock per household and rent in the modelling approach. We deploy appropriate econometric techniques to account for this simultaneity bias as set out in chapter five.

#### **4.4 PUTTING IT ALL TOGETHER: STRUCTURAL EQUATION MODELLING**

The complexities and interactions of the housing market, described above, make modelling home ownership difficult. It requires specific econometric techniques in order to obtain consistent and efficient estimates of the model parameters. In particular, the potential two-way causality between the three main outcome variables—house prices, rent and home ownership—leads to simultaneity bias whereby the error terms of the three equations are correlated. This means that estimating such models individually using a standard regression approach would generate biased estimators with large errors.

Moreover, estimating separate models would not allow us to disentangle direct and indirect influences of variables on home ownership and house prices. Doing so is important for understanding the implications for policy. For example, the degree to which higher incomes drive house prices directly versus through driving up rents is of primary importance to understand the impact of income on home ownership rates. So a different approach is needed to discern the rich interactions at play in the housing market and their policy implications. Following Meen, Painter and Redfearn, and Meen and Andrew, we therefore model the market for housing as a coherent system.<sup>15</sup>

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<sup>13</sup> C. Swan, "A Model of Rental and Owner-Occupied Housing", *Journal of Urban Economics*, 16(2) (1984): p. 297-316.

<sup>14</sup> M. Andrew and G. Meen, "Planning for housing in the post-Barker era: affordability, household formation, and tenure choice", *Oxford Review of Economic Policy*, 24(1) (2008): p. 79-98.

<sup>15</sup> Ibid. G. Meen (2011). G. Painter and C. Redfearn, "The role of interest rates in influencing long-run homeownership rates", *Journal of Real Estate Finance and Economics*, 3 (2002): p. 243-67. M. Andrew and G.

Careful consideration of alternatives has led us to conclude that the Structural Equation Modelling (SEM) approach is best suited for these modelling needs. The SEM, pioneered by Tinbergen, allows the estimation of a system of linear equations that describe a network of relations among variables.<sup>16</sup> SEM can account for correlation between the error terms in each equation, in order to mitigate the simultaneity bias problems highlighted above. While there are other methods that can be used to address this problem, such as two-stage least squares and instrumental variables methods, those alternatives do not facilitate estimation of both the direct and indirect effects that we have identified. The SEM therefore provides a richer explanation of the mechanisms at work in the housing market.<sup>17</sup> In the next chapter we define the model equations used and explain the data sources behind the variables involved.

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Meen, "Planning for housing in the post-Barker era: affordability, household formation, and tenure choice", *Oxford Review of Economic Policy*, 24(1) (2008): p. 79-98.

<sup>16</sup> J. Tinbergen, *Selected Papers* (Amsterdam: North-Holland Publishing Company, 1959).

<sup>17</sup> Vector Autoregressive Models (VAR) are another method commonly used to estimate such a system of equations. A SEM model specification requires researchers to support a hypothesis with theory or research and then to specify the relationships between variables a priori, as we do in chapter two. In contrast, a VAR system has the benefit of relying on no such pre-determined relationships. Rather, the regressors of the equations have to be identical, and the equations describe a system in which each variable is a function of its own lag, and the lag of the other variables in the system. This is a more data-intensive approach requiring a larger number of parameters and a longer time series than SEM to generate sensible estimates. Given that we have data for 92 quarters—from 1992 to 2014 - the SEM is a more viable option.

## 5. MODEL AND DATA

So far we have set out a theoretical framework for how the different elements of the housing market interact, together with a description of the modelling approach in general terms. In this chapter we define the equations included in the model, together with the data sources used, and describe some of the trends in those series over the modelling period from 1992 to 2014.

### 5.1 THE MODEL

As explored in framework set out in chapter three, the housing market is driven by a system of three equations determining rent, house prices and home ownership respectively. Since home ownership is largely determined by prices and rent, while prices are influenced directly by rent, we begin with rent as the first determinant modelled.

#### 5.1.1 Rent model

The real rent model is given as follows:

$$rRent_t = HSHH_t + rEarnings_t \quad (8)$$

where:

- $HSHH_t$  is housing stock per household; and
- $rEarnings_t$  is real earnings per household.

People's decisions to form new households clearly have an impact on levels of rent. But as discussed earlier, it is also likely that rent levels affect the propensity for people to form new households. If higher rent does suppress household formation to a significant degree the above model will over-estimate the sensitivity of rent to housing stock per household due to this two-way causality.

In order to correct for the endogeneity bias, we use a two-stage least squares instrumental variable (IV) approach. In the first stage of the regression, we estimate a proxy for stock per household, which is not contemporaneously affected by rent, using a set of instruments. The instruments used are the lags of housing stock per household and real earnings. A number of tests were performed to assess the validity of the approach. The Durbin-Hu-Hausman test confirmed that housing stock per household is indeed endogenous. Meanwhile, the Sargan-Hansen and Hansen's J tests confirmed the validity of the instruments used to overcome the problem.<sup>18</sup>

In the second stage, we use the instrumented housing stock per household to estimate the rent equation. This two-step estimation ensures that the derived coefficient describing the relationship between rent and housing stock per household only reflects the degree to which household numbers drive rent.

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<sup>18</sup> Results are given in appendix one.

### 5.1.2 House price model

Based on the theoretical model of housing demand and various studies on house price modelling (Meen; Muellbauer and Murphy; Auterson), the basic house price model is given as follows: <sup>19</sup>

$$rHP_t = i2_t + rRent_t + rEarnings_t + Mort\_Gap_t \quad (9)$$

where:

- $rHP_t$  is the real house prices;
- $rRent_t$  is an index of real rent;
- $rEarnings_t$  measures real earnings per household;
- $Mort\_Gap_t$  captures constraints or slack in the mortgage market.
- $i2_t$  is the real user cost of capital, consisting of
  - mortgage interest rate;
  - taxes, subsidies, depreciation and maintenance costs;
  - expected inflation;
  - expected capital gains;

### 5.1.3 Home ownership model

As discussed earlier, the dependent variable in the home ownership model is given as the log of odds of the home ownership rate ( $LO_t$ ) defined as:

$$LO_t = \ln\left(\frac{HO_t}{1-HO_t}\right) \quad (10)$$

The model used to estimate this is given as:

$$LO_t = rHP_t + rRent_t + i2_t + Y\_Rat_t + FTB\_Credit_t \quad (11)$$

where:

- $Y\_Rat_t$  is the ratio of average earnings of 28-to-40 year olds to that of 40-plus year olds; and
- $FTB\_Credit_t$  captures the credit constraint faced by first time buyers, proxied by the spread between 75 percent and 95 percent LTV mortgage interest rates.

## 5.2 DATA SOURCES AND TRENDS

This section describes how each variable used is constructed and highlights the underlying rationale for doing so. The model uses data on a quarterly basis for the years 1992 to 2014 for the UK as a whole, except where indicated otherwise.

**Real rental price** ( $rRent_t$ ) is nominal rent ( $Rent_t$ ) deflated by  $CPI_t$ .  $Rent_t$  is ONS's Index of Private Housing Rental Prices (IPHRP), available from 2005 on

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<sup>19</sup> Ibid. Meen (2009). G. Meen, "Modelling local spatial poverty traps in England", *Housing Studies*, 24 (1) (2009): p. 127-147. J. Muellbauer and A. Murphy, "Housing markets and the economy: the assessment", *Oxford Review of Economic Policy*, 24 (1) (2008): p. 1-33. Ibid. Auterson (2014).

a monthly basis. This series relates to Great Britain, rather than the UK, however we do not think this makes a material difference to the results.

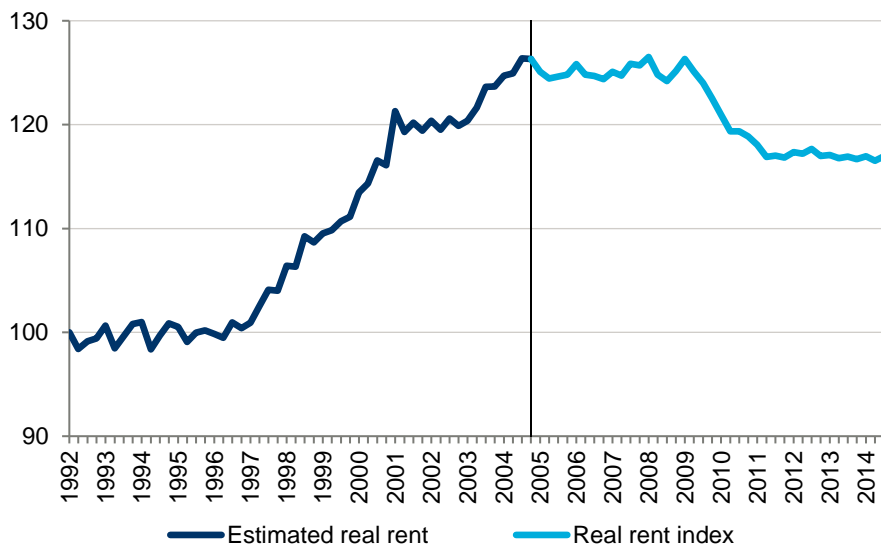
An alternative to IPHRP would be to use the rent component of CPI or RPI. However this involves two problems. First, the rent components of the CPI and RPI indices do not reflect pure household rent and are contaminated by commercial rents. Second, these components (intentionally) reflect the changing composition of the private rented sector. This could be problematic for our purposes since it is important that the index used reflects changes in the rent on a given property. If one were to use these indices, substantial recent changes in the composition of the private rented sector would give an artificial impression of rapidly rising rent on any one property.<sup>20</sup> Since the new IPHRP series deals with both of these shortcomings, we use it here.

IPHRP data prior to 2005 is ‘backcast’ using a dynamic panel data model of nine English regions for the 11 years from 2005 to 2015. Details on how the backcasting was undertaken are given in appendix one.

When compared to the trend in house prices over the observation period, the path of rental prices is striking. As shown in Fig. 8 the profile of real rent is far more muted than that for real house prices. Rents rose by around 25 percent from 1992 to their high point before the financial crisis—a change dwarfed by the boom in house prices, suggesting that the house price surge may have had little to do with shifts in the supply and demand for housing services.

**Fig. 8. Real rent index, 1992-2014**

Index of private housing rental index, constant prices (1992Q1=100)



Source: ONS, Oxford Economics

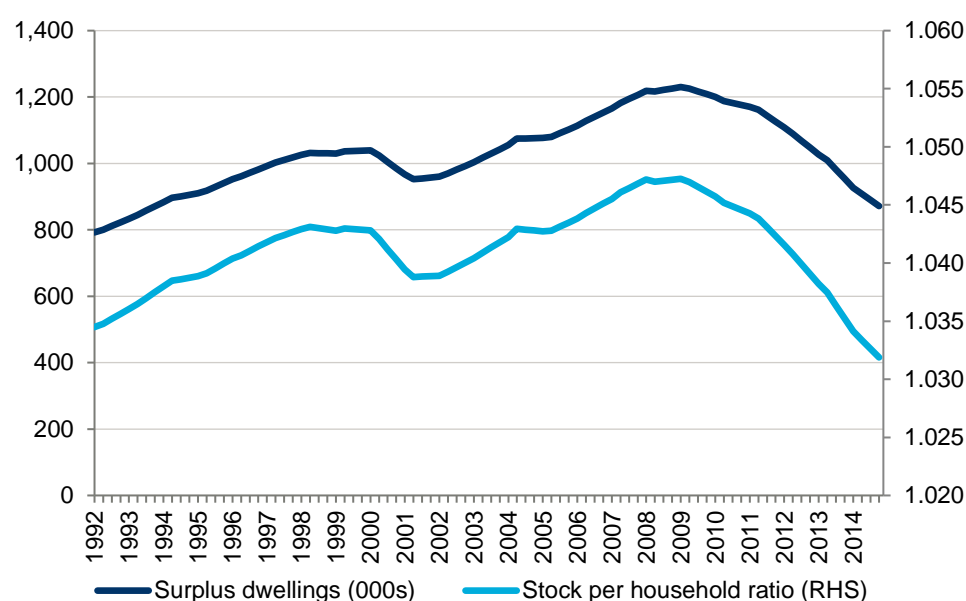
**Housing stock per household ( $HSHH_t$ )** comprises of total dwelling stock ( $HS_t$ ), including owner occupied and rented dwellings, divided by the number of

<sup>20</sup> See, for example, ONS (2015). Rhys Lewis, *Explaining private rental growth* (London: ONS, 2016).

households ( $HH_t$ ).<sup>21</sup> Both sets of statistics are compiled by DCLG on an annual basis, and are interpolated linearly into a quarterly series by Oxford Economics.<sup>22</sup>

Importantly,  $HSHH_t$  trended steadily upwards from the start of the observation period in 1992 until the financial crisis, with the inventory stock of dwellings rising from around three percent to approximately 4.5 percent on the eve of the recession. This represents an increase in ‘surplus’ dwellings from just under 800,000 to more than 1.2 million over a period when house prices more than doubled in real terms. Since the financial crisis however, this picture has reversed, with lower rates of construction mean new dwellings have lagged household formation rates driving the ratio downwards.

**Fig. 9. Surplus housing stock per household, 1992-2014**



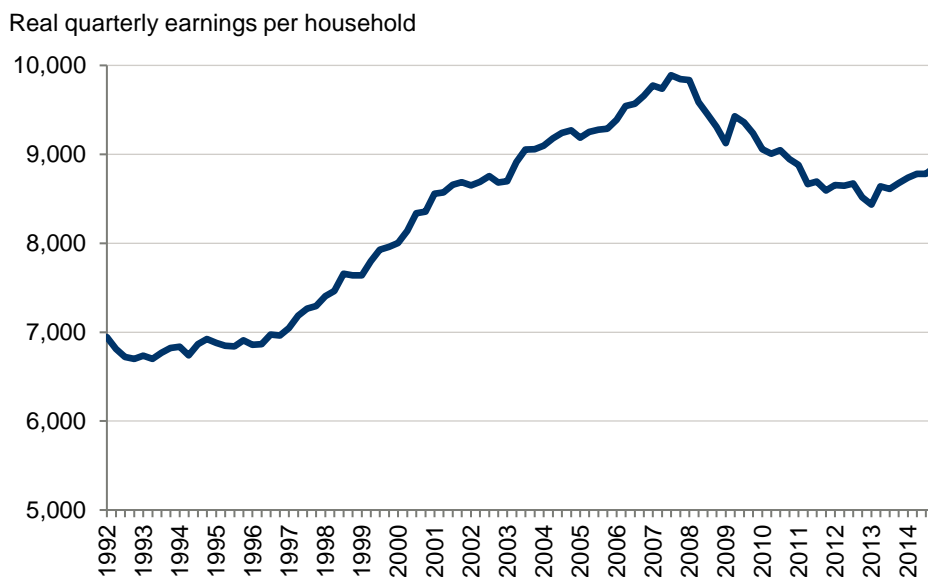
Source: DCLG, Oxford Economics

**Real earnings per household ( $rEarnings_t$ )** is calculated by dividing total compensation to employees (from national accounts statistics published by ONS) by number of households and deflating using CPI. As shown in Fig. 10, there was a fall in real earnings per household after the recession, after a steady increase prior to the recession.

<sup>21</sup> Due to a change in the methodology by DCLG, vacant properties in the rental market are not included in housing stock before 2003. DCLG does not offer any adjustments to the pre-2003 data. The impact of this change on the stock level is relatively small.

<sup>22</sup> The interpolation ensures that the quarters match the data provided by DCLG. In particular, annual housing stock data are given for quarter 1 and data on number of households are given for quarter 2, and the interpolation is constrained to these values.

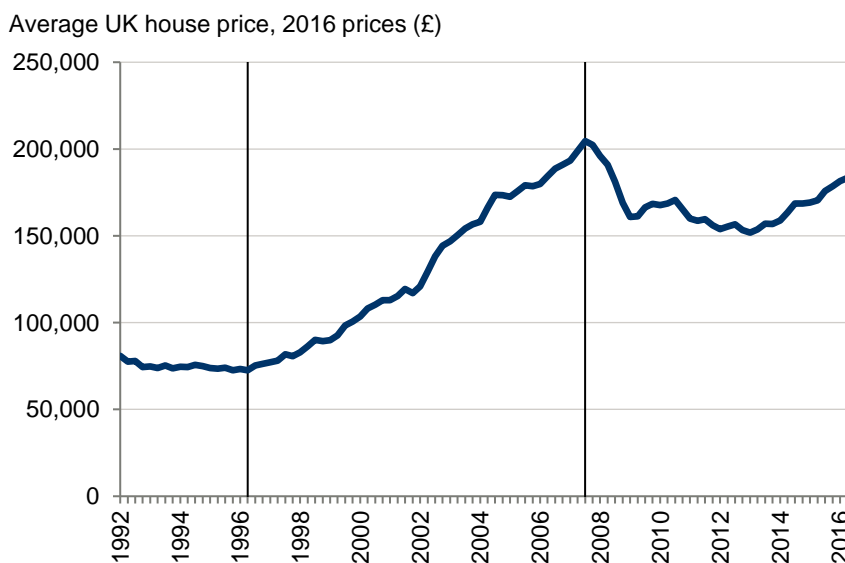
**Fig. 10. Real quarterly earnings per household, 1992-2014**



Source: ONS, DCLG, Oxford Economics  
Computed using total compensation of employees (ONS), number of employees (ONS) and number of households (DCLG)

**Real house prices** ( $rHP_t$ ) are derived from the nominal house price index ( $HP_t$ ) deflated by the consumer price index ( $CPI_t$ ).  $HP_t$  is the new mix-adjusted UK house price index (UKHPI) published by the Land Registry. Fig. 11 shows four clear phases in the path of national house prices over the observation period: a period of stagnant real prices in the first four years from 1992; a boom period from 1996 Q2 to 2007 Q3, during which prices rose by 182 percent in real terms; a 21 percent fall in real prices following the financial crisis, between 2007 Q3 and 2009 Q2; and a period of stagnation from 2009, with prices starting to pick up towards the end of the period, 2014 Q4.

**Fig. 11. Mix-adjusted average UK house price, 1992-2016**



Source: UK HPI

**The real user cost of capital** ( $i2_t$ ) is a key determinant of house prices and home ownership. But estimating its path over time is not straight forward given the range of different components involved. Our construction of  $i2_t$  broadly follows the OBR methodology, as given by Auterson, but our approach differs in some important ways, particularly in the treatment of stamp duty, MIRAS and depreciation.<sup>23</sup> These changes magnify the fall in the user cost of capital over the observation period. We also take a different approach to estimating expected capital gain.

In our calculation,  $i2_t$  consists of a number of ‘tangible’ elements of the cost of capital, and two elements based on people’s expectations about the future. The tangible elements include:

- the cost of mortgage capital (which also acts as a proxy for the opportunity cost of housing equity) ( $i1_t$ );
- the annualised cost of housing taxes such as stamp duty land tax;
- subsidies such as mortgage interest relief at source (MIRAS); and
- the cost of depreciation and maintenance.

These comprise the concrete elements of the nominal user cost of capital. But this cost is qualified by people’s perceptions about the future. If they expect a burst of inflation, or believe that house prices are set to double in value, their overall perceived user cost of capital will be lower. Hence we add two other elements to create the real user cost of capital:

- inflation expectations; and
- expected real capital gain.

The cost of **mortgage capital** ( $i1_t$ ) is given as the mortgage interest rate on loans at 75 percent LTV and is obtained from the Bank of England. Interest rates on mortgages at 75 percent LTV are more representative of the mortgage cost faced by the typical owner and the opportunity cost of housing equity, since they do not entail the risk premium associated with high LTV loans.

The annualised cost of **stamp duty land tax** (SDLT) is calculated using the total annual revenue apportioned over the average length of house ownership as a proportion of the total value of the housing stock. Council tax, as a tax in respect of local services, is levied on occupants rather than owners and should not therefore be thought of as part of the user cost.

The annualised subsidy of **mortgage interest relief at source** (MIRAS) declined rapidly from £6.1 billion per year in 1991-92, when the value of the housing stock stood at around £1.6 trillion, withering to zero by 2000.<sup>24</sup> As with property taxes, appropriate estimation of the impact of the subsidy on the average user cost should consider the aggregate annual subsidy as a proportion of the value of residential property. Taking this approach shows that in 1992 MIRAS represented a subsidy of about 0.3 percent on average.

**Depreciation** should be based on the value of a building excluding the value of the land it is on. Consequently we use the chained volume measure of household sector depreciation of dwelling capital stock as the appropriate

<sup>23</sup> Ibid. Auterson (2014).

<sup>24</sup> C. Davis, *Finance for Housing* (Bristol: Policy Press, 2013), p. 103.



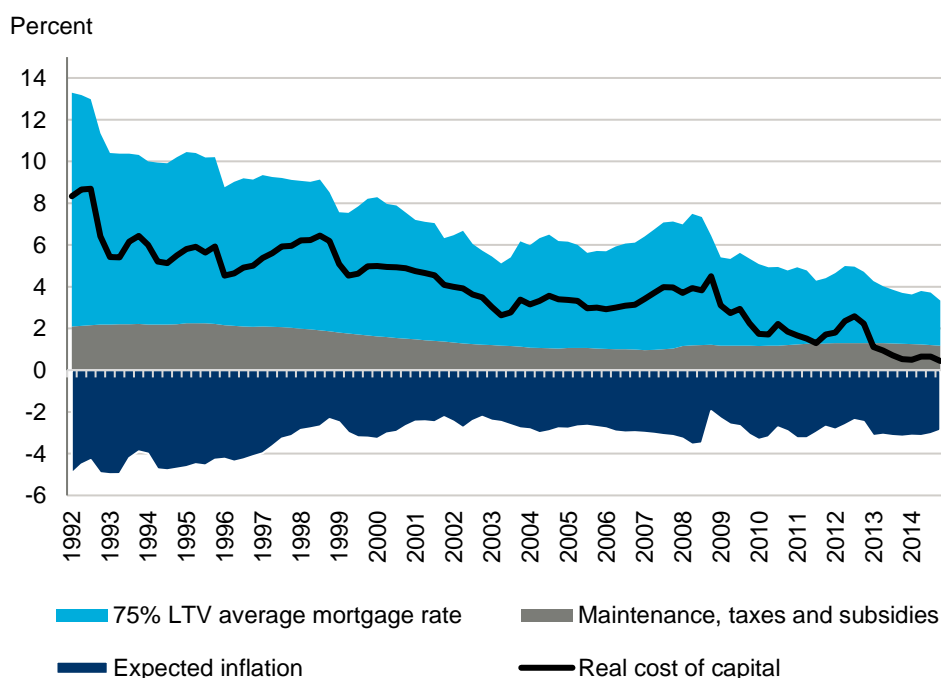
indicator of depreciation and maintenance costs each year. This is then expressed as a proportion of the total value of the residential property stock each year (all in constant prices) to give an average annual depreciation charge.

As described above, each of the above elements of the user cost are in some way tangible or concrete costs faced by owners, since they relate to variables that are known at any point in time. In total these elements have fallen substantially since 1992 as Fig. 12 shows. Falling nominal mortgage rates are the main driving force, dropping to around a fifth of their level at the start of the period. The other components of the user cost of capital have also fallen over the period, exacerbating that drop.

But perceptions of future inflation and expected capital gains also contribute to the real user cost of capital, and these need to be factored into the assessment.

In keeping with other studies, we use the implied ten-year **inflation expectations** from the Bank of England, derived from the difference in yields between index-linked and conventional gilts. Fig. 12 also shows the impact on the tangible elements of the user cost of capital when it is adjusted for expected inflation.

**Fig. 12. Real user cost of capital excluding expectations of capital gain**



Source: Bank of England, HMRC, ONS, Oxford Economics

The **expected capital gain** ( $Exp\_Gain_t$ ) on housing investment is measured as the average annual change in real house prices seen over the past 14 years. This variable captures the degree to which recent momentum in house prices might give owners reason to expect future capital gain, hence effectively reducing the user cost.

Inevitably, determining a plausible basis for how people's expectations about future price rises are formed is fraught with difficulty. Some modellers have used very long-run appreciation rates as a guide. For example Hubbard and Mayer use average real house price appreciation over a 50-year period in their study of the US housing market.<sup>25</sup> Others, such as Muellbauer, have chosen shorter windows of four or five years.<sup>26</sup> We tested variants of the time period used, finding that a window of between 12 and 14 years caused the model to fit the data best.

However in our view it is unlikely that people will necessarily place the same weight on expectations of an uncertain future as they do on the tangible costs associated with changes in their mortgage interest rate. For this reason it seems inappropriate to give a one percentage point change in the expected capital gain the same weight as a one percentage point change in mortgage rates. We therefore ran the model with the concrete and expectations-related terms entering separately and used the resulting coefficients as weights to create a composite estimate of the perceived real user cost of capital. This is similar to the approach taken by Auterson.<sup>27</sup>

**Fig. 13. Real user cost of capital, 1992 to 2014**



Source: Oxford Economics, Bank of England, HMRC, ONS, Land Registry

Overall we can see a steady decline in the perceived real user cost of capital over the period, primarily reflecting the decline in risk-free global interest rates over the same period.

**The mortgage gap** ( $Mort\_Gap_t$ ) is estimated as the difference between the expected level of new mortgage lending ( $ME_t$ ) given the current state of economic fundamentals (interest rates, house prices, earnings), and the

<sup>25</sup> See for example, R. Hubbard and C. Mayer, "The Mortgage Market Meltdown and House Prices", *The B.E. Journal of Economic Analysis & Policy*, 9: ISS. 3 (Symposium), Article 8. (2009).

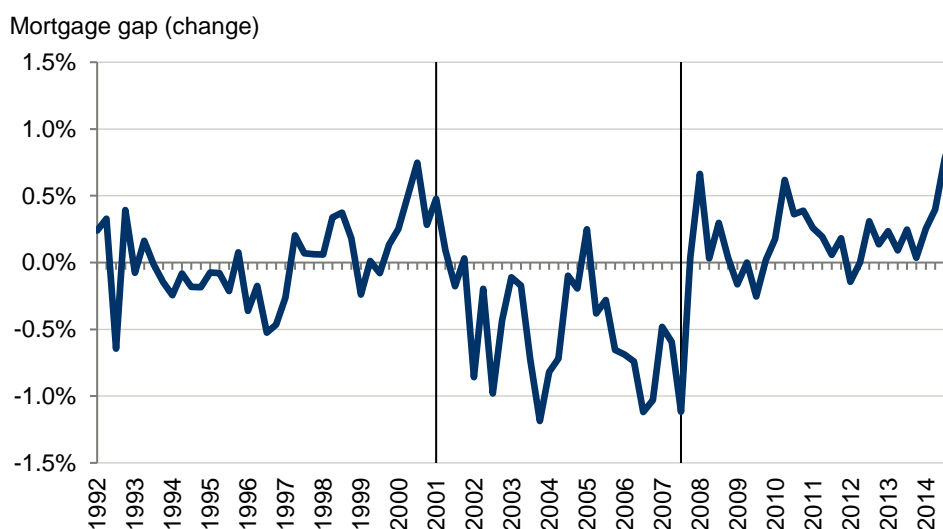
<sup>26</sup> J. Muellbauer, "When is a housing market overheated enough to threaten stability?", *Oxford University Department of Economics*, 623 (2012).

<sup>27</sup> Ibid. Auterson (2014).

observed level ( $MO_t$ ). The gap therefore captures periods when the take-up of credit seems to have been more or less than would be justified by the fundamentals and past experience.

Following Meen and Auterson, we estimate mortgage demand as a function of the cost of mortgage capital ( $i_t$ ), real house prices ( $rHP_t$ ), real earnings ( $rEarnings_t$ ) and the average LTV ratio ( $ltv_t$ ).<sup>28</sup> The model is estimated using an error correction model (ECM), and  $ME_t$  is calculated as the predicted values from the model. More details on the model structure and results are given in the appendix two. Fig. 14 shows the results of this exercise, with the divergence between the actual and expected level of mortgage lending having the expected shape both before and after the financial crisis struck.

**Fig. 14. New mortgage lending relative to expectation, 1992-2014**



Source: Oxford Economics, Bank of England, Land Registry

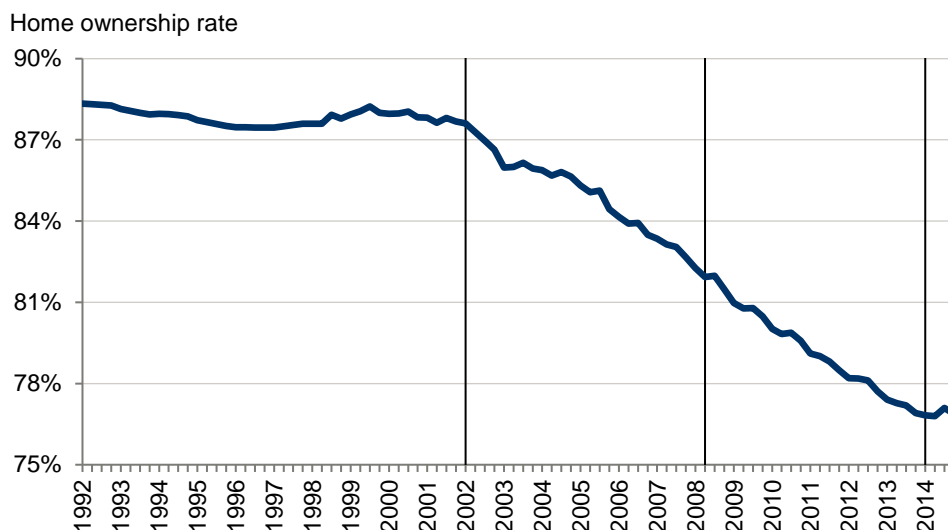
**Home ownership rate ( $HO_t$ )** measures the market sector home ownership rate. In other words it captures the number of owner occupiers divided by the sum of owners occupiers and households in the *private* rented sector. These households account for more than four in five households in the UK today. The remainder is comprised of the social rented sector, which we exclude from the model. Ours is a macroeconomic model, but the determinants of the size of the social rented sector are overwhelmingly policy-related (in particular Right to Buy), which cannot be captured by it. For this reason we model the market sector home ownership rate and use these results to calculate the impact for home ownership overall.

Our model uses annual data on UK dwelling stock by tenure, published by the Department for Communities and Local Government (DCLG). These data are annual and relate to 31 March each year. Since our model is quarterly we interpolate, or estimate, the quarterly changes using data from the quarterly Labour Force Survey (LFS). Fig. 15 below shows the steep decline in private

<sup>28</sup> Ibid. Auterson (2014). G. Meen, "The Removal of Mortgage Market Constraints and the Implications for Econometric Modelling of UK House Prices", *Oxford Bulletin of Economics and Statistics*, 52(1) (1990): 1-24.

sector home ownership in the past 15 years. This has been substantially more dramatic than the overall home ownership rate suggests, and starts slightly earlier than the fall in the overall rate.

**Fig. 15. Declining home ownership rates in the market sector**



Source: DCLG, Oxford Economics

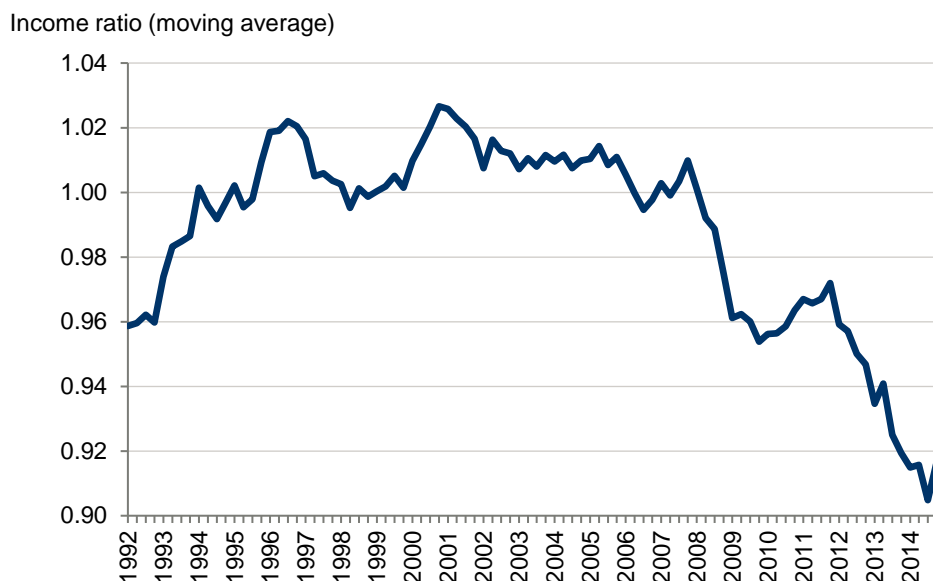
**Income ratio** ( $Y\_Rat_t$ ) measures the earnings of would-be first-time buyers relative to the earnings of older people, who typically already own a property, in order to measure their relative purchasing power. If the earnings of would-be first-time buyers increases by more than that of existing owners (that is,  $Y\_Rat_t$  increases), one would expect first-time buyers to have more purchasing power in the housing market leading to an increase in home ownership, all else equal.

Various studies (Meen; Bottazzi *et al.*) find that first-time buyers are overwhelmingly to be found in the age band between 28 and 40.<sup>29</sup> We therefore proxy the earnings of would-be first-time buyers and existing owners with the average earnings of individuals between 28 and 40, and 40-plus, respectively. Data for earnings by age are compiled from the LFS.

As Fig. 16 shows, this ratio of earnings was fairly constant prior to the financial crisis, hovering at around one (i.e. the average earnings of people in these two groups were very close), but has suffered a sharp fall since then. The earnings of people in the younger age band were almost ten percent lower than their older counterparts by 2014 Q4.

<sup>29</sup>Ibid. G. Meen (2011). R Bottazzi, T Crossley and M Wakefield, "Late starters or excluded generations? A cohort analysis of catch up in homeownership in England," in *IFS Working Paper* ([n.p]: [n.pub.], 2012), W12/1.

**Fig. 16. Average earnings ratio of people aged 28-to-40 versus 40-plus**



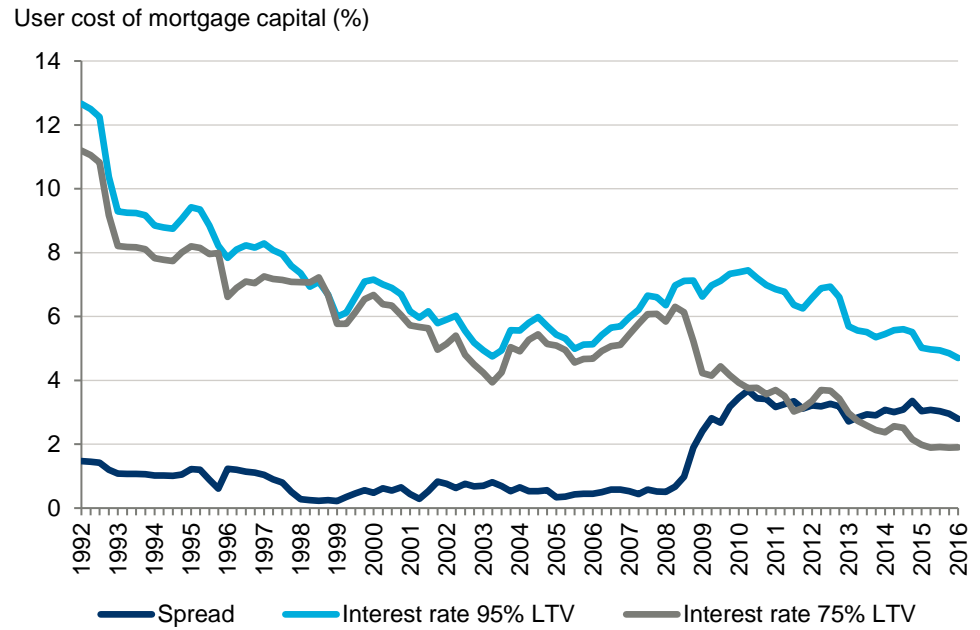
Source: Labour Force Survey

**Credit constraints for first-time buyers** ( $FTB\_Credit_t$ ) captures the ease with which first-time buyers are able to borrow the necessary funds to buy. As can be seen in Fig. 17, the difference in interest rates on first-time buyers' mortgages (proxied by the interest rate on 95 percent LTV mortgages) and other mortgages (proxied by 75 percent LTV mortgages) jumped from an almost negligible level before the financial crisis to a spread of some three percentage points in its wake.  $FTB\_Credit_t$  is measured as the difference between the two interest rates.

This divergence occurred when interest rates on 75 percent LTV mortgages fell with the sharp reductions in the Bank of England base rate in late 2008, while interest rates on high LTV mortgages actually rose. This development left first-time buyers reliant on such products at a substantial disadvantage to other buyers, and their user cost of owning consequently much higher.

The causes of the divergence in borrowing costs include changes in lenders' appetite for risk, as well as numerous recent regulatory reforms, including Basel III and the UK's Mortgage Market Review, which constrained high LTV lending. These changes are likely to have manifested themselves in terms of both higher mortgage interest rates (prices) and volumes of lending to this segment of the market (quantities).  $FTB\_Credit_t$  should therefore be thought of as a proxy for both price and quantity restrictions.

**Fig. 17. Divergent mortgage rates for different levels of equity**



Source: Bank of England, Oxford Economics

In the next section we set out the results of the modelling and explain their meaning.

## 6. MODELLING RESULTS

In this chapter we set out the results of our structural equation model of rent, house prices and home ownership and explain their interpretation. Throughout we describe the outcome of various diagnostic tests on the performance of the model. We also compare the results with those of past studies where comparable analysis has been carried out.

### 6.1 HEADLINE RESULTS

The direct, indirect and total effects estimated by the SEM are given in Fig. 18.<sup>30</sup> The direct effect is estimated directly from the model, while the indirect effect is calculated from the various interactions in the model. For example, housing stock per household ( $HSHH_t$ ) does not affect house prices directly, but has an effect on price indirectly via the rent equation. The indirect effect of  $HSHH_t$  on house prices (-1.78) is calculated as the coefficient of  $HSHH_t$  from the rent equation (-1.73) multiplied by the coefficient of rent in the house price equation (1.03). The total effect of any one variable, such as average earnings per household ( $rEarnings_t$ ), on an outcome variable, such as house prices, is the sum of its direct (1.39) and indirect (0.81) effects.

Below we draw out the results and their interpretation for the rent, house price and home ownership elements of the model in turn.

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<sup>30</sup> Before estimating the system of equations using the SEM, we tested whether the relationships among the variables described by each equation (set out in chapter four, above) are true economic relationships rather than spurious relationships driven by common trends. Fig. 35 in the appendix shows the cointegration test results, which confirm that a valid economic relationship is described by each equation.

**Fig. 18. SEM results**

Rental price model	Direct effects	Indirect effects	Total effects
Real earnings per household	0.784*** (0.002)	-	0.784*** (0.002)
Housing stock per household	-1.727*** (0.452)	-	-1.727*** (0.452)
Recession dummy	-0.033*** (0.003)	-	-0.033*** (0.003)

House price model	Direct effects	Indirect effects	Total effects
Real rental price	1.031*** (0.244)	-	1.031*** (0.244)
User cost of capital	-0.186*** (0.011)	-	-0.186*** (0.011)
Mortgage gap (lag)	-8.742*** (1.901)	-	-8.742*** (1.901)
Real earnings per household	1.389*** (0.123)	0.808*** (0.192)	2.197*** (0.069)
Housing stock per household	-	-1.780** (0.697)	-1.780** (0.697)
Recession dummy	-	-0.034*** (0.008)	-0.034*** (0.008)

Home ownership model	Direct effects	Indirect effects	Total effects
Real house price	-0.838*** (0.122)	-	-0.838*** (0.122)
Real rental price	1.246*** (0.321)	-0.863*** (0.240)	0.382 (0.282)
User cost of capital	-0.084** (0.037)	0.156*** (0.025)	0.072*** (0.021)
Mortgage gap (lag)	-	7.323*** (1.919)	7.323*** (1.919)
Real earnings per household	-	-0.864*** (0.060)	-0.864*** (0.060)
Housing stock per household	-	-0.660 (0.489)	-0.660 (0.489)
Recession dummy	-	-0.013 (0.009)	-0.013 (0.009)
First-time buyer credit	-0.143*** (0.011)	-	-0.142*** (0.011)
First-time buyer income ratio	1.073*** (0.303)	-	1.073*** (0.303)

legend: \* p&lt;0.1; \*\* p&lt;0.05; \*\*\* p&lt;0.01



## 6.2 RENTAL MODEL

As expected, housing stock per household and earnings are the two key determinants of rent. In line with the theoretical description of the housing market set out in chapter three, there are no indirect effects in the rent model: house prices and home ownership rates do not have an impact on rent, therefore their determinants do not have any indirect impact on rent levels either.<sup>31</sup>

The coefficients of the rent model are of similar magnitude to the panel data analysis we used to ‘backcast’ the rent series (see appendix one). As illustrated in Fig. 19, real rent fell sharply after the financial crisis. The decrease in earnings alone is not sufficient to explain the reduction in rent especially given that housing stock also fell during that period. As a result, we include a recession dummy variable to capture the sharp decrease in rent and the variable is statistically significant with a negative sign, reflecting the negative impact of the financial crisis on rent.

The coefficients from the model can be interpreted as follows:

- a one percent increase in real earnings per household raises rent by 0.78 percent; and
- a one percent increase in the number of houses or a one percent fall in the number of households lowers rent by 1.73 percent.

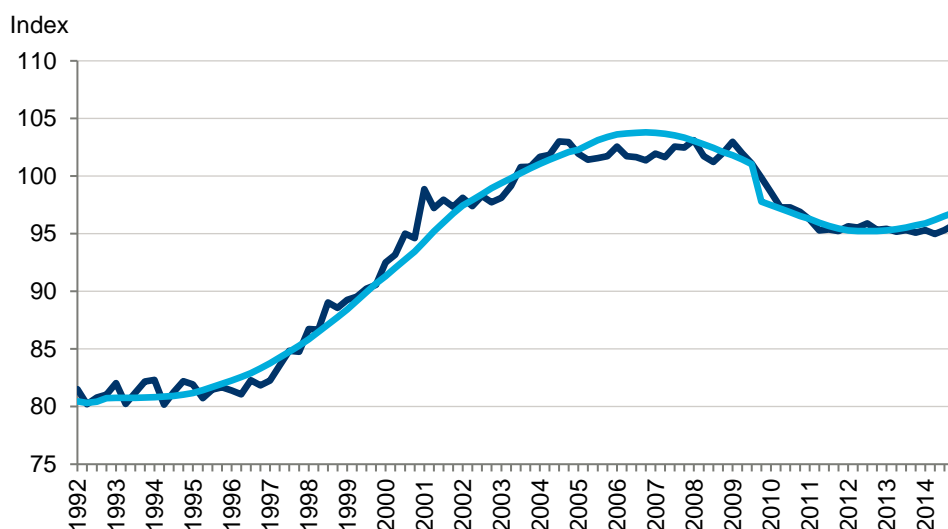
How well does this model reflect the reality of how rent is determined? The model exhibits an R-squared value of 0.98, indicating that 98 percent of the variation in the rental index data is described by our model.<sup>32</sup> This therefore gives confidence that the model fits the data well and offers a good description of the way rent is set according to macroeconomic factors. The plot given in Fig. 19 below offers a graphical illustration of the model’s fit.

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<sup>31</sup> The house price variable was initially statistically significant in the rent model, suggesting a relationship between prices and rent. However, this effect disappeared once we controlled for endogeneity—the possibility that the relationship might be entirely from rent to prices. This implies that the initial effect was a result of pure correlation, and there is no causal effect of house prices on rent.

<sup>32</sup> The SEM does not generate the traditional R-squared, hence this number represents the correlation between the dependent variable and its prediction based on the model.

**Fig. 19. Actual versus predicted rental price**



Source: Oxford Economics, ONS

### 6.3 HOUSE PRICE MODEL

In the house price model all variables bar one have the sign that was intuitively anticipated (positive or negative) and are statistically significant. Earnings, housing stock per household, and the recession dummy all have an indirect effect on house price via rent. Income has both a direct and indirect effect on house prices. Both effects are positive and significant and reinforce each other. On the other hand, stock per household only has an indirect effect on house prices: the direct effect was found to be insignificant. The implication of this is important as it tells us that changes in supply or household numbers only affect house prices to the extent that they affect rent.

Focusing on the total effects, the coefficient for each variable can be interpreted as follows:

- a one percent increase in real rent raises prices by 1.03 percent;
- a one percent increase in housing stock or one percent fall in household numbers lowers prices by 1.78 percent;
- a one percent increase in real earnings per household raises prices by 2.2 percent in total—partly directly and through its effect on rent;
- a one percent increase in the mortgage interest rate lowers prices by 0.19 percent; and
- one percent more mortgage lending than expected increases prices by 0.09 percent.<sup>33</sup>

The key results (income and housing stock elasticities) from the total effect model are in line with previous studies as shown in Fig. 20. The results show that increases in rent tend to raise prices one-for-one. This is as expected since in conventional asset pricing theory we would expect the value of the asset to change one-for-one with changes in the stream of revenue associated with it. The housing supply result shows that a large boost to additional supply is

<sup>33</sup> This captures the flow of lending rather than its stock.

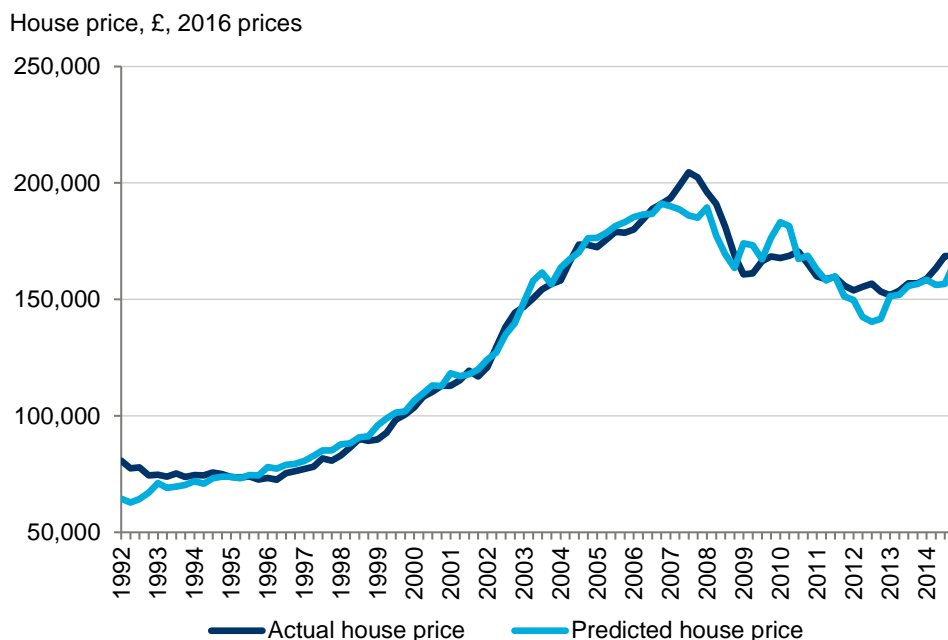
required to have a substantial impact on prices. The results suggest that adding an *extra* 100,000 units to housing supply, in excess of household formation, in any given year would only shave around 0.6 percent off prices. Again, in keeping with past studies, prices appear to be very sensitive to average household earnings.

**Fig. 20. Comparison of results with other studies**

Study	Income elasticity	Supply elasticity	Last data point used
<i>(per household)</i>			
<b>OE Model</b>	<b>2.2</b>	<b>-1.8</b>	<b>2014Q4</b>
OBR model	2.7	-1.1	2013Q4
Meen (2013)	2.8	-1.7	2009Q4
<i>(per capita)</i>			
Mullbauer/Murphy (1997)	2.6	-2.2	1994
Cameron/Muellbauer/Murphy (2006)	1.6	-1.6	2003
<i>(unscaled)</i>			
OBR model, re-estimated without number of households	2.3	-1.2	2013Q4
OECD (2011)	2.9	-2.1	2010Q1
Meen (2009)	2.1	-1.5	2007Q2

Here too, the house price model fits the actual data well, as illustrated by the high R-squared, at 0.98. Fig. 21 below gives a visual representation of how well the model predicts the actual house price data. One area where the model performs less well is at the peak of the 2007 house price boom. Here, the economic fundamentals given in model appear insufficient to predict prices as well as in other years. This may suggest that at the height of such a bubble the model is not fully capturing people's expectations of future capital gain.

**Fig. 21. Actual versus predicted house prices, 1992-2014**



Source: Oxford Economics, Land Registry

#### 6.4 HOME OWNERSHIP MODEL

When interpreting the home ownership model, it is important to note that the dependent variable ( $LO_t$ ) is given as the log of odds of the home ownership rate ( $HO_t$ ), as given by equation (9). The estimated coefficient ( $\beta$ ) therefore shows the marginal effects of a given variable on  $LO_t$ . Following Haurin, Hendershott and Ling, the marginal effect in terms of  $HO_t$  is given as:<sup>34</sup>

$$\text{Marginal effect on } HO_t = \beta \times (1 - \overline{HO}) \quad (11)$$

where  $\overline{HO}$  is the average home ownership rate over the period of the study. Using this formula, the home ownership model can be interpreted as follows:

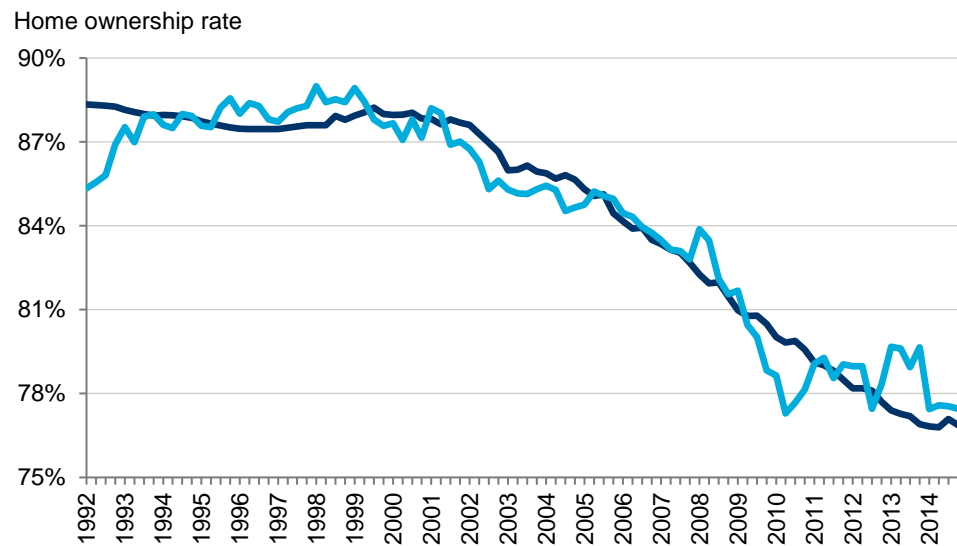
- a ten percent rise in real house prices lowers home ownership by 1.3 percent. This means that if home ownership is at 70 percent a ten percent price rise will lower home ownership by 1.3 percent  $\times$  70 percent = 0.91 percentage points, cutting just under half a percentage point from the home ownership rate;
- a one percent rise in real rent increases home ownership by 0.19 percent;
- a one percentage point rise in gap between first-time buyer and others' mortgage interest rates lowers home ownership by 2.2 percent
- housing stock or household numbers do not have a statistically significant effect on home ownership rates; and
- a ten percent rise in the earnings of those aged 28-to-40 relative to the over-40s raises home ownership by 1.67 percent.

<sup>34</sup> D. Haurin, P. Hendershott and D. Ling, "Homeownership Rates of Married Couples: An Econometric Investigation", *NBER Working Papers*, 2305 (1987).

At least two aspects of these results are striking. First, the model reveals that home ownership rates are sensitive to a divergence in mortgage interest rates for first-time buyers compared to owners with more housing equity. Second, and contrary to common perception, additional housing stock does not appear to improve home ownership rates. The drivers and implications of these results are discussed in more detail in the next section.

Since the home ownership model relies on both the house price and rent models in our system of equations, it inevitably fits the home ownership data slightly less well than do those. Nevertheless, it achieves an R-squared of 0.94 percent indicating that it explains 94 percent of the variation in home ownership rates captured in the data. The plot below shows the model fit graphically.

**Fig. 22. Actual versus predicted market sector home ownership rate, 1992-2014**



Source: Oxford Economics

In chapter seven we move on to draw out the implications of these results for understanding what drove past changes in house prices and home ownership. This points the way to the range of possible policy responses.

## 7. DISCUSSION

The modelling results of the previous chapter tell us about the sensitivity of rent, prices and home ownership rates to changes in their macroeconomic determinants. But these results can also be used to find out which of the determinants was responsible for past changes in house prices and home ownership. That in turn, helps to shed light on the nature of the policy challenge.

The determinants of falling home ownership rates since the early 2000s and rising house prices are of central importance to the Redfern Review. In the public debate these trends are typically attributed to restrictions on housing supply. The model allows us to test that hypothesis, with the results described in this chapter.

The results of the model show the importance of a given variable in explaining each dependent variable over the whole sample period. For instance we saw that the first-time buyer income ratio ( $Y\_Rat_t$ ) has a significant positive effect on the home ownership rate. But while home ownership rates may be sensitive to changes in the income ratio, if there was no change in  $Y\_Rat_t$  over a given period of time then it will not have influenced home ownership rates during that period.

The ‘contribution’ of a given variable in explaining changes in house prices or home ownership is therefore a combination of both the estimated sensitivities and the change in that variable over the period under analysis.

### 7.1 THE HOUSE PRICE BOOM FROM 1996 TO 2006

In the ten years from the fourth quarter of 1996, UK house prices rose by 151 percent in real terms. What does our model say about the causes of this increase? The results show that a one percent increase in the number of dwellings, or a one percent fall in the number of households, would reduce prices by 1.8 percent.

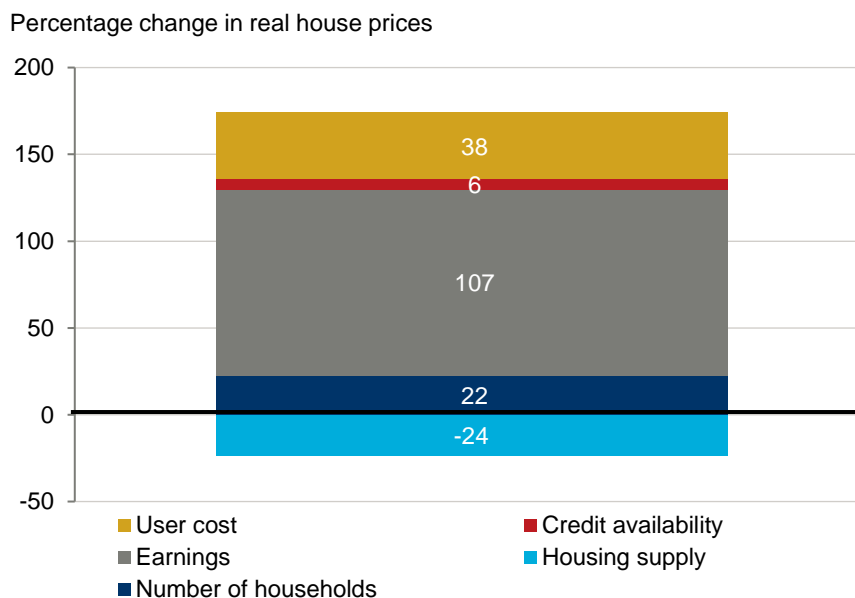
But looking at the housing stock per household (see Fig. 9), we can see that the increase in household numbers over the period was more than offset by increases in the number of dwellings. In this decade 1.83 million new households appeared, while the dwelling stock rose by 1.98 million units. Consequently, despite the sensitivity of prices to changes in ratio of dwellings to households, this variable actually increased slightly, and hence housing supply constraints do not appear to have contributed to price growth over the decade.

Rather, the main driver of the boom during this period was growing household earnings, rising employment and the falling user cost of capital driven primarily by declining interest rates. As Fig. 23 shows, average earnings growth alone (which includes the impact of rising employment rates) was responsible for around 107 percentage points of the 151 percent increase.

The other significant determinant was the user cost of capital, caused mainly by falling mortgage interest rates. Typical rates fell from around 11 percent in 1992 to just over two percent by the end of 2014, sustaining a further increase in

house prices. Meanwhile easier credit availability in the run up to 2007 also boosted prices. Overall the lower user cost and easier credit together contributed some 44 percentage points of the increase. Fig. 23 below sets out the contribution of each determinant of price increases over the period.

**Fig. 23. Drivers of the house price boom between 1996 Q4 and 2006 Q4**



Source: Oxford Economics

Over the period, new supply outstripped the rate of household formation. But since the financial crisis this picture has reversed. The results therefore also have implications for the contribution of supply constraints to house prices in recent years, as price growth has again gathered pace.

For example, between 2013 and 2014 some 270,000 new households are estimated to have formed in the UK, while net new supply was 159,000 in the year to 31 March 2014. The shortfall of new supply in this case was therefore estimated to be around 110,000 dwellings or approximately 0.4 percent of the stock of dwellings in the UK in 2013 (27.9 million). Applying the supply elasticity to this figure suggests that the shortfall was responsible for pushing up prices by around 0.7 percent. In total, real prices rose by 4.6 percent over the year to early 2014, indicating that even the unusually large shortfall of supply in the year to March 2014 was not a particularly large driver of house price inflation.<sup>35</sup> We go on to examine in more detail how increased supply might affect future prices in chapter eight.

## 7.2 FALLING HOME OWNERSHIP SINCE 2002

The home ownership rate in the private housing sector (i.e. excluding the social rented sector) was stable from the early 1980s, but has declined steadily since

<sup>35</sup> The shortfall over the previous five years averaged less than 40,000 per year, contributing around 0.2-0.3 percent to price growth each year.

2002 by around 11 percentage points up to the end of 2014. This has been the cause of the 6.2 percentage point decline in the overall home ownership rate.

Using the model to break down the determinants of the rapid fall in the overall home ownership rate from 2002 Q1 to 2014 Q4, we see that the biggest contribution to the fall came from the higher cost of, and restrictions on, mortgage lending for first-time buyers. More specifically, the interest rates on, and availability of, high LTV mortgages, typically used by first-time buyers, deteriorated quickly in the wake of the financial crisis relative to credit conditions for people borrowing at lower LTV. This is estimated to have cut 3.8 percentage points off the UK home ownership rate by the end of 2014.

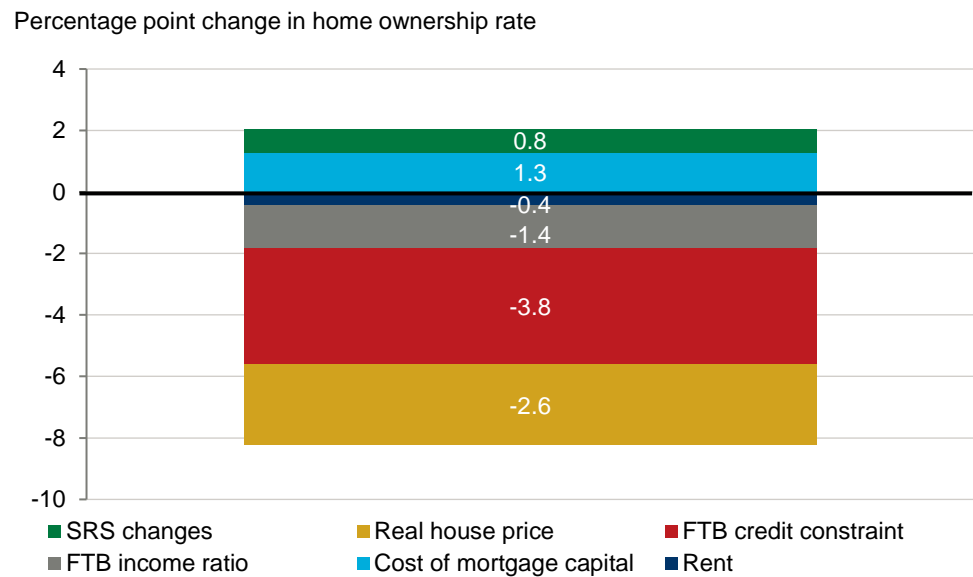
The second biggest contributor to the fall was the increase in house prices. Over the whole period, higher real house prices are estimated to have reduced the home ownership rate by 2.6 percentage points.

A third driver of the fall has been the decline in the earnings of younger people, aged 28-to-40 relative to those of people aged 40-plus. Younger people's average earnings fell from approximate parity with the over-40s to some ten percent below in the wake of the financial crisis and recession. This reduced the relative buying power of would-be first-time buyers, pulling down the home ownership rate over the period by around 1.4 percentage points. Being broadly flat in real terms over the period, rent made a negligible contribution to the trend. The user cost of capital fell over this period, which helped to offset some of the fall driven by other factors.

While the fall in home ownership in the market sector was substantial, it was ameliorated somewhat by changes in the social rented sector. In particular, it is likely that Right to Buy was responsible for offsetting some of the macroeconomic effects. Indeed around 400,000 properties were bought by tenants from the social rented sector over the period. Changes here contributed positively to the home ownership rate up to the end of 2014, to the tune of 0.8 percentage points.

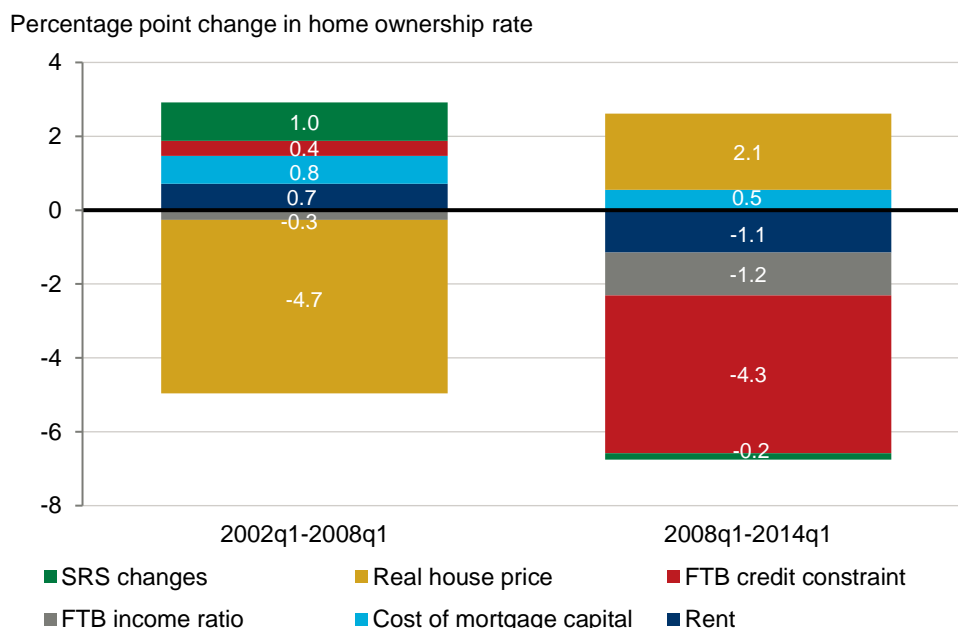


**Fig. 24. Drivers of the fall in overall home ownership rates between 2002 Q1 and 2014 Q1**



Clearly the period since 2002 has been a volatile one in the housing market and the economy more widely, so it is instructive to split the contribution analysis into periods before and after the financial crisis. The home ownership rate declined by 2.0 percentage points up to early 2008 and then by a further 4.1 percentage points up to early 2014. But were the drivers the same in each period? We analyse the factors contributing to this decline over two time periods - up to the start of the 2008 recession (2002 Q1 to 2008 Q1) and from the start of the recession to the start of 2014 (2008 Q1 to 2014 Q1), the last official data point available for the UK as a whole. The results are shown in Fig. 25.

**Fig. 25. Explaining the fall in the market sector home ownership rate, 2002 to 2014**



Source: Oxford Economics

The above breakdown shows a very clear difference in the determinants of falling home ownership in this period. Prior to the financial crisis, rapidly rising house prices had the effect of both reducing the financial attractiveness of owning and pricing would-be buyers out. The result was a 4.7 percentage point fall in the overall home ownership rate, although this was somewhat offset by changes in the social rented sector. Rent rose slightly over the period, encouraging some into home ownership and hence offsetting a small portion of the price rise effect. The declining user cost of capital also cushioned the fall to a degree.

From the eve of the financial crisis, real house prices were already falling and remained below their pre-crisis peak at the end of 2014. Accordingly, very different factors were to blame for the continuing fall in home ownership. Specifically the contribution chart above shows that the rapid increase in cost, and fall in availability, of mortgage credit for high LTV borrowers made a very large contribution to falling home ownership, contributing 4.3 percentage points to the overall fall in home ownership rates.

An important implication of this analysis for policy is therefore that in seeking to reverse the recent trend, interventions that focus on reducing the mortgage market disadvantages faced by first-time buyers may be important.

Finally, it is worth noting that the contribution of housing stock per household on home ownership is negligible. This result is to be expected since both the housing stock and the number of households in the UK grew by very similar amounts over this period. However, the results in Fig. 18 suggest that even if supply had been outstripped by household formation eating into the surplus stock of dwellings, the impact on the home ownership rate is likely to have been negligible.

For policymakers this implies that additional housing stock is unlikely to shift the home ownership rate. This counterintuitive result occurs because of two competing dynamics in the housing market that offset one another. First, greater housing stock would have a downward effect on house prices, which in turn would be expected to boost home ownership, all else equal. But on the other hand, greater housing stock also depresses rent which, in turn, has a negative impact on home ownership. Consequently it is unsurprising to discover that supply has an ambiguous impact on home ownership rates.

While the home ownership rate is unlikely to rise in the face of increases in housing supply, building more homes can stimulate increased household formation.<sup>36</sup> Consequently the number of home owners is likely to rise in response to additional supply, even if the rate itself is unchanged.

In any case, an excessive focus on the distribution of tenure risks obscuring the fact that greater levels of supply unambiguously lower housing costs for both renters and owners—something that is more likely to boost their wellbeing than any specific rate of home ownership.

### 7.3 IS IT CHEAPER TO OWN OR TO RENT?

The modelling exercise above has established the empirical relationship between different macroeconomic factors and home ownership rates. Over the past quarter of a century. It is intuitively unsurprising that higher house prices make owning more difficult, all else equal, and therefore reduce home ownership. But recalling the theory of chapter three, another way to think about this is to compare the user cost of owning with the cost of renting a given property. House prices are only one component of the user cost, hence they can increase substantially without the annual costs faced by owners (or potential owners) changing.

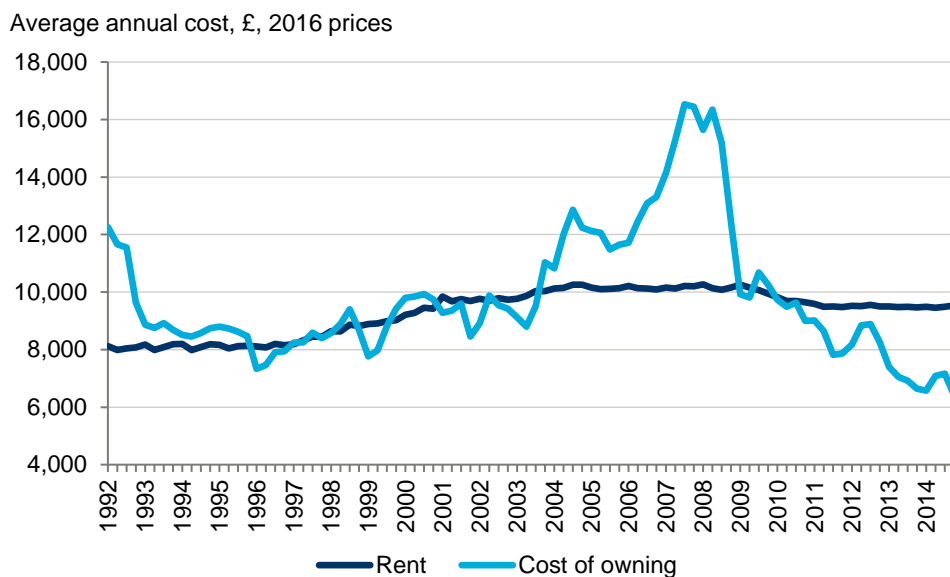
Our estimates of the cost of owning and renting over the period are plotted in Fig. 26. The user cost of owning in this case is comprised of the mortgage rate, the opportunity cost of housing equity, taxes, subsidies and depreciation. It excludes any expected capital gain or inflation component, and therefore simply shows the tangible costs faced by the owner of an average-priced property in 2016 prices. The rent series draws on industry estimates of average rental yield at the end of 2015, based on estimates made by Reeds Rains/Your Move, and the ONS' IPHRP index to derive the cost of renting the average-priced property in 2016 prices.

One notable thing here is that as equation (1) would suggest, the overall user cost of owning tends to equal the rent on a property. In the run-up to the financial crisis, rapidly-rising house prices and increasing interest rates meant the user cost of owning (based on the concrete elements of the user cost) diverged markedly from rent. Unsurprisingly, home ownership rates fell in response, as more people chose the cheaper option of renting. When the user cost reverted to the same level as rent, it did so partly by a fall of around 20 percent in real house prices and partly by a substantial fall in interest rates.

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<sup>36</sup> G. Meen, "Ten new propositions in UK housing macroeconomics: an overview of the first years of the century", *Urban Studies*, 45(13) (2008): p. 2759-2781.

**Fig. 26. Cost of rent versus cost of owning**



Source: Oxford Economics, Bank of England, HMRC, ONS, Land Registry, Reeds Rains/Your Move

Since 2011, the user cost has begun to diverge again, this time falling below rent, as low mortgage rates feed through to owners during a period of relatively stable prices. All else equal this should push home ownership rates up. Indeed, in Fig. 25 above, we see that falling house prices and interest rates made a positive contribution to the home ownership rate even though the rate fell overall. Instead, the impact of falling relative earnings and rising relative mortgage costs for first-time buyers has conspired to continue to push home ownership down.

More generally, the chart suggests that the annual costs of ownership were some way below rent by the end of 2014. Hence it is unsurprising to see house prices rising rapidly since that point—a trend which will cause the cost of owning to converge with rent once again. One clear risk to the cost of owning is a rise in interest rates from their current lows.

## 8. FORECASTS AND SCENARIOS

The last two chapters have described and interpreted the results of our models of rent, house prices and home ownership rates based on data from 1992 to 2014. The relationships derived from that exercise can then be used to develop forecasts of house prices and home ownership under assumptions about the future trend of the various determinants. The results of those forecasts are described in this chapter.<sup>37</sup> In addition we go on to look at some scenarios for each forecast, to illustrate how specific developments or policies might change the outlook.

Many of the determinants of the forecasts, such as earnings, inflation and interest rates, are drawn from Oxford Economics' macroeconomic outlook as at the end of October 2016. This forecast for the UK economy holds that GDP will grow at 1.8 percent in 2016 and 1.1 percent in 2017. It assumes that the UK is heading for a relatively loose trading relationship with the EU—a 'hard Brexit'. Related to this we anticipate a weaker investment environment and labour market, together with somewhat higher inflation due to the recent depreciation of sterling. Meanwhile, the weakness in sterling is expected to benefit net exports to a degree and expansionary monetary policy is set to provide some stimulus.

In line with this, mortgage interest rates are forecast to remain at historic lows until near to the end of the decade. This macroeconomic outlook affects our house price and home ownership forecasts, mainly by reducing real earnings per household, as inflation reduces purchasing power and sluggish economic growth weighs on earnings and employment. Another channel of impact on the housing market is the likelihood that the user cost of capital will fall with interest rates initially, before rates eventually begin to rise again.

More detail on both the macroeconomic and housing market underpinnings of our forecasts are set out in appendix four.

### 8.1 HOUSE PRICE FORECAST AND SUPPLY SCENARIO

A number of housing market determinants are highly uncertain, particularly in the wake of the result of the referendum result to leave the European Union. This makes it very hard to predict how levels of new housing supply or household numbers are likely to evolve. Consequently, we have assumed that supply keeps pace with household formation throughout the forecast period, something that has broadly been the case over the period since 1992. We also assume that mortgage lending volumes remain at their current level relative to long-term expectations. Finally, depreciation, expected inflation and expected capital gains are all assumed to remain at their current level. This means that our house price forecast is driven by changes in mortgage interest rates, earnings and inflation.

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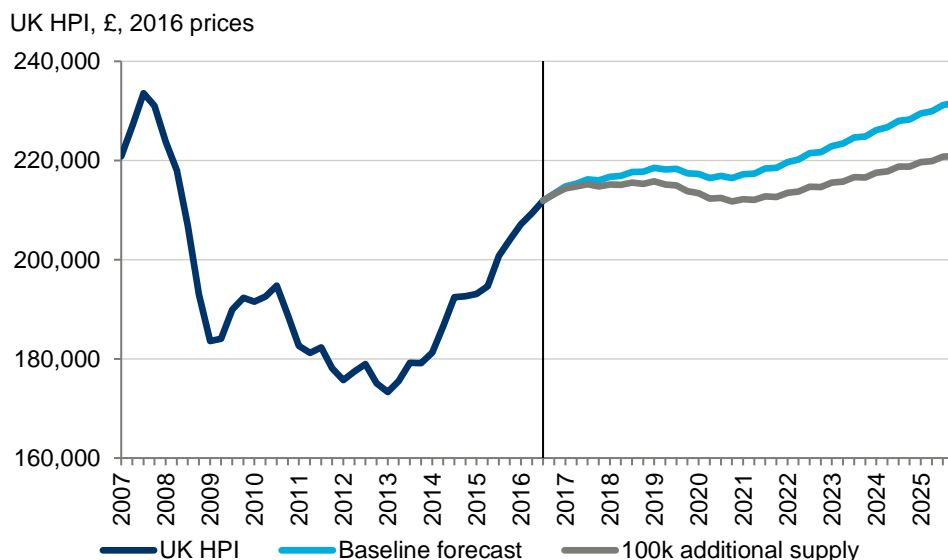
<sup>37</sup> The house price forecast presented here differs from Oxford Economics' house view. This is inevitable given that this study involves the estimation of an entirely new model, which is ultimately focused on analysing home ownership rates.

Our baseline forecast, shown in Fig. 27, suggests that real house price increases will tail-off as we head into 2017, remaining broadly flat until 2021. This is driven by two key trends. Initially, the negative impact of the EU referendum vote is expected to subdue economic growth and therefore earnings growth. Real earnings growth then resumes in 2018, but the positive impact of this on house prices is then offset by increases in interest rates, which are currently forecast by Oxford Economics to begin around the end of the decade. As a result, real prices are expected to remain almost static over the next five years, with cumulative growth of around 11 percent predicted over the next decade as a whole. This represents average annual real price growth of around 1.1 percent.

How would additional supply alter this picture? This is an obvious question give the heavy focus of policy debate on the need for additional supply. Our baseline forecast assumes the steady addition of around 210,000 dwellings each year with a similar number of households being formed. To put downward pressure on prices new supply would need to outstrip underlying household formation.

In the scenario shown in Fig. 27 we have simulated the impact of boosting the annual supply figure by a further 100,000 per year above the rate of household formation. This is around 310,000 new dwellings per year on our household growth assumptions. The scenario forecast shows how the extra supply helps to keep prices in check although they end the forecast period only around five percent below the baseline forecast. Consequently we can see that even at historically high rates of building, this has to be sustained each year over a long time before new supply begins to have a substantial impact on prices.

**Fig. 27. Real house price forecast and additional supply scenario, 2016-26**



Source: Oxford Economics

## 8.2 HOME OWNERSHIP FORECASTS<sup>38</sup>

Turning to the home ownership forecast, the key unknowable determinants in this case relate to the first-time buyer mortgage interest rate differential and the earnings differential. For the baseline forecast we therefore assume that these variables remain at their current level. We also assume that the social rented sector remains at its current proportionate size. Other variables are as described above.<sup>39</sup>

The model predicts that the market sector home ownership rate will stop falling and stabilise after 2016. If borne out, this would then represent the end of the 14-year plunge in home ownership rates. In our forecasts the factors driving the stabilisation are the end of three forces that have pushed the rate down since 2002. As described in chapter seven, before 2008, rising house prices reduced home ownership, while in the aftermath of the recession, a jump in the relative mortgage rates for first-time buyers continued the trend. Since 2010, however, it is the declining relative earnings of younger people that appears to have been to blame for the continued fall in ownership rates. Clearly, if that ratio were to continue deteriorating we would expect home ownership rates to fall, but this seems unlikely.

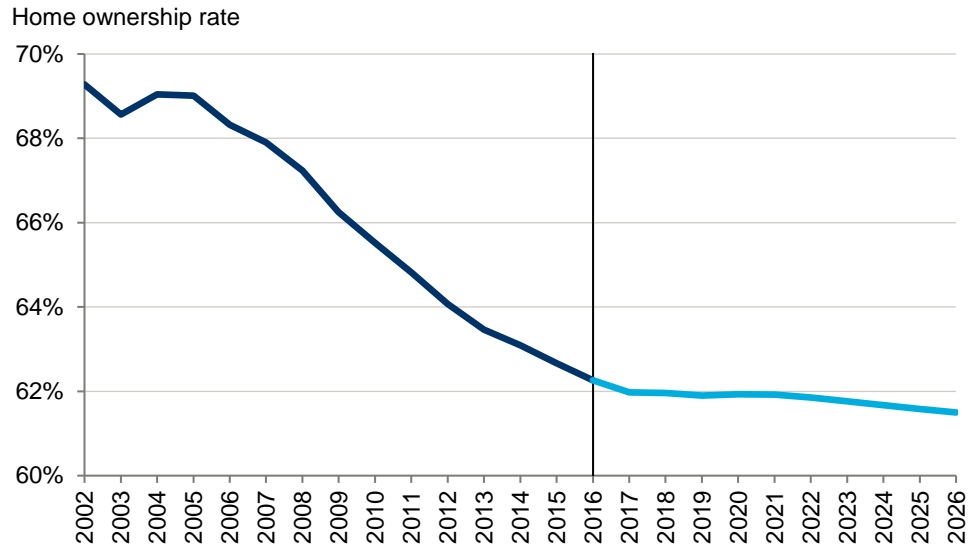
An assumption underpinning the forecast is that the proportion of social rented sector dwellings in the total housing stock remains at its March 2014 level of 17.9 percent. If this were to fall, the home ownership rate would be marginally higher by the end of the forecast. Other risks to our forecast include house prices rising faster than forecast, marked shifts in the relative earnings of younger workers, and changes in the high relative to low LTV mortgage rates.

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<sup>38</sup> The last available official UK-wide home ownership estimate relates to 31 March 2014. Changes from 2014 Q1 to 2016 Q2 have been inferred from the Labour Force Survey.

<sup>39</sup> The latest available official data point for the UK home ownership rate relates to 31 March 2014. The series is then based on estimates of the home ownership rate from the LFS up to 2016 Q2. The forecast begins from 2016 Q2.

**Fig. 28. Home ownership forecast, 2016-26**



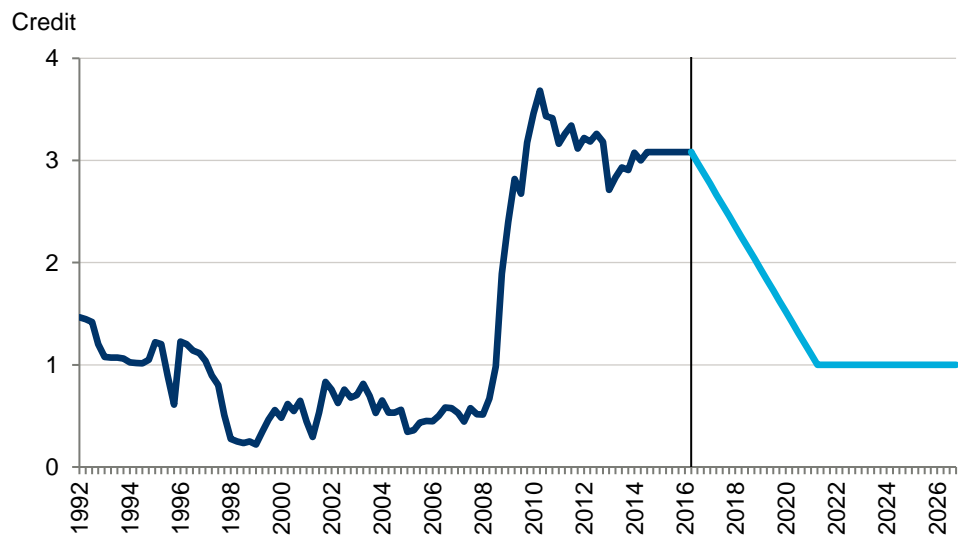
Source: Oxford Economics

### 8.3 HOME OWNERSHIP SCENARIOS

Finally we explore what might happen to home ownership rates if we alter the outlook for two of the determinants: first-time buyer relative mortgage rates and their relative earnings.

Turning to the relative mortgage rates first, we simulate a situation where the difference between the interest rate on 95 percent LTV mortgages and 75 percent mortgages declines from around three percentage points today to one percentage point by 2020. This would still be about twice the size of the spread seen in the run-up to the financial crisis.

**Fig. 29. Scenario 1: First-time buyer mortgage constraints ease**



Source: Oxford Economics

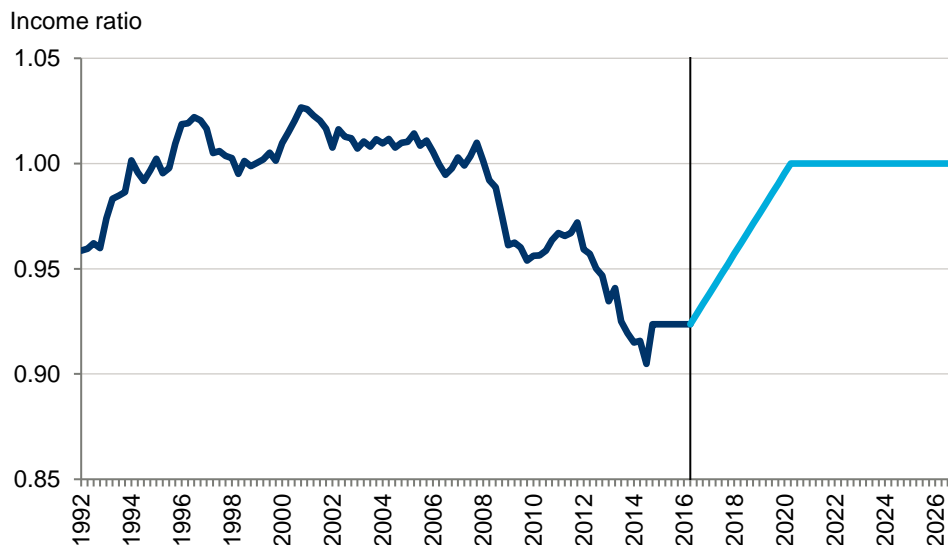
Such a change could be affected by policymakers either by targeting more generous credit guarantees to lenders serving first-time buyers, or by fiscal



measures targeted at that group. As an illustration of the potential cost of a fiscal policy of this type, if all first-time buyer mortgage lending enjoyed a tax break or subsidy sufficient to lower the effective interest rate gap with higher LTV borrowers to one percentage point for the first three years of the loan, this could cost in the region of £4 billion per year based on 2015 numbers.<sup>40</sup>

Our second simulation looks at the impact of younger people's earnings reverting to parity with the 40-plus group by 2020, as shown in Fig. 30.

**Fig. 30. Scenario 2: Income ratio returns to parity by 2020**

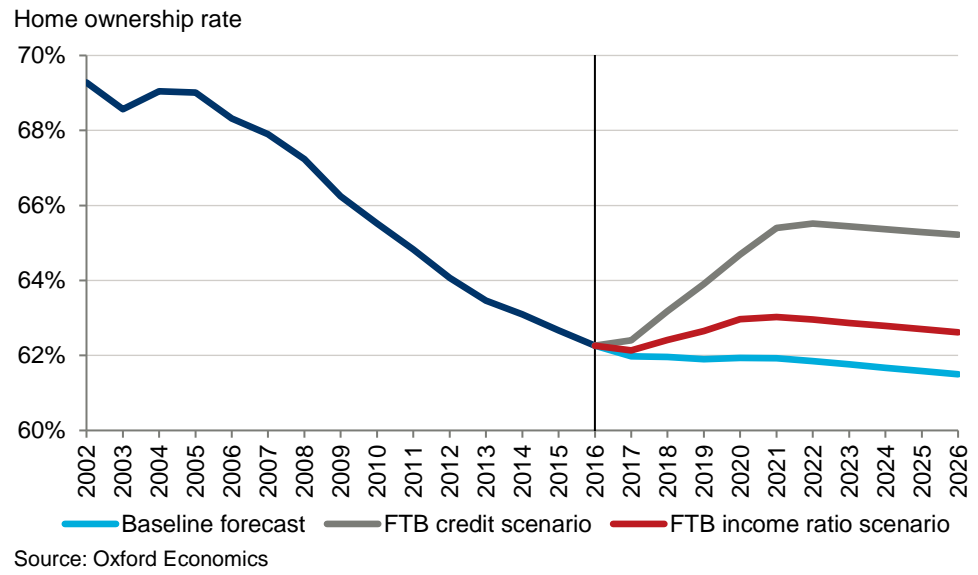


Source: Oxford Economics

Under the first-time buyer credit scenario we see home ownership bouncing back and gaining almost four percentage points relative to the baseline. This would be sufficient to recover over half of the drop in the home ownership since the early 2000s. On the income ratio scenario, the effect is still positive but more muted, with home ownership rising by just over a percentage point compared to the baseline.

<sup>40</sup> In 2015, Council of Mortgage Lenders data suggests that approximately £63.9bn of mortgage lending was issued to first-time buyers. Reducing the effective interest rate on this debt by two percentage points for three years would therefore cost around £3.8bn. If first-time buyers were to borrow more as a result of the policy, the cost would increase, hence £3.8bn represents a lower-bound estimate.

**Fig. 31. Baseline home ownership forecast and scenarios, 2016-26**



## 9. CONCLUSION

The analysis in this report has uncovered a number of results that may be unexpected in the context of the public debate around the housing market.

Most notably, we have found that the very rapid house price increases of the past 20 years do not appear to have been the result of insufficient supply. This conclusion is based on results that are in line with past analysis in this area. Could a less tightly-regulated housing market have allowed supply to respond more aggressively to dampen price growth? It is possible that a liberalised planning regime might have dampened the 151 percent price increase in the decade from the end of 1996, but our results suggest that the effect, at any realistic rate of new supply, would have been limited.

This has important implications for a policy debate that has focused heavily on supply as both the cause of the problem of high house prices and its solution. It suggests instead that the major sources of volatility in house prices lie beyond housing policy's focus on the need to provide sufficient dwellings to house the population at reasonable cost.

If a credible commitment to sustained high levels of new supply were made, it is possible that this could have a bigger impact on prices than the one measured here, by causing a step change in people's expectations of future capital gain.

Second, this study has found that additional housing supply is unlikely to have an impact on the rate of home ownership. Nevertheless, it may stimulate new household formation via its effect of lowering rent, which could raise the absolute number of home owners (and renters).

Despite these conclusions on prices and home ownership rates, we should not lose sight of the fact that additional housing supply is the main lever that can affect one, perhaps more important, outcome: the cost of housing, as distinct from the price of houses. Whether for owners or renters, for any given number of households or level of earnings, housing supply is the major determinant of the annual cost of housing, even if its impact on prices is small relative to other factors. While owning is a choice, living in a house of some tenure is not. Consequently, even though the impact of increased supply will take time to build, its effect of lowering the annual cost of housing – even if marginal – is arguably more important to wellbeing than the level of prices or prevalence of home ownership.

Finally our analysis has pointed to tighter constraints on borrowing for first-time buyers and the fall in their relative earnings as the key drivers of declining home ownership. Addressing these issues is perhaps a matter for wider economic policy than levers associated specifically with the housing market.

Worse relative credit conditions for higher LTV borrowers, in particular, are a significant result of financial regulation decisions taken in the wake of the financial crisis. This implies that policymakers face three broad options in this area: retain tighter borrowing constraints for reasons of financial stability, and see home ownership levels remain at their current level; ease those constraints in pursuit of more home ownership; or, if high levels of home ownership are

deemed to be socially valuable but financial stability requires current levels of regulation, consider fiscal policy options (or further lending guarantees) as a more direct route to raising the home ownership rate.

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# 11. APPENDIX 1: RENT 'BACKCASTING'

## RENTAL PRICE 'BACKCASTING' MODEL

The new Index of Private Housing Rental Prices (IPHRP), produced by the ONS, is the most reliable rental index available for Great Britain. A major advantage of using this series over the rental components of RPI or CPI is that IPHRP is unaffected by changes in the composition of the private rented sector. As higher-value properties have moved into the private rented sector in recent years, this has tended to push up the index level in CPI and RPI. But changes in composition do not affect the level of rent for a given type of house - the relevant metric for modelling purposes - hence the rental components of RPI and CPI are inappropriate for our purposes.

There are two problems with using this index however. First, it relates only to Great Britain, rather than the UK, although we do not think that the disparity materially affects our analysis. More problematically, however, the earliest data available for IPHRP is 2005Q1.<sup>41</sup> Reliable time series econometrics analysis requires much longer time dimensions. Consequently we exploit the regional dimension of the data to create a rent model than can be used to 'backcast' the national rent series prior to 2005.

We estimate a panel data model for rent using the nine English regions for which we have full data since 2005. In our initial model, rent is expressed as a function of housing stock per household ( $HSHH_t$ ), real wage per household ( $rWage_t$ ) and real house prices ( $RHP_t$ ).<sup>42</sup> The model was estimated using both fixed effects and random effects models. Both the Hausman and Durbin-Wu-Hausman tests conclude that the fixed effects model is more efficient. The initial specification and results of our fixed effects model are given as Model A in the table below. All the coefficients have the expected sign and are statistically significant.

There is a problem with this specification however, since it may be the case that housing stock per household or real house prices are affected by rent levels, rather than simply the other way around. This 'two-way causality', if present, will introduce a simultaneity bias in Model A, invalidating the apparent relationships observed.

To overcome this problem we therefore use an instrumental variables (IV) model, with the lag of the endogenous variables—stock and house prices—as instruments. This corrects for the bias in Model A and gives strikingly different results, which are reported in the table as Model B. It can be seen that house prices are no longer statistically significant in predicting the level of rent. This suggests that the price-to-rent relationship picked up in Model A was solely the result of the effect of rent on prices rather than any effect of house prices on rent. This confirms empirical result confirms our theoretical rationale described in chapter three. Similarly, the results suggest that there is at least some impact of rent on housing stock per household, indicating that in lowering rents, new supply can induce some new household formation.

<sup>41</sup> For Scotland and Wales, the earliest data points are 2011 Q1 and 2009Q1, respectively.

<sup>42</sup> The model is estimated in growth rate (first difference of log values) such that the 'backcasting' does not suffer from scale effect when substituting higher UK values in the model.

Given the results, real house prices are therefore dropped from the model, and our final specification is given as Model C. The results show that Model C has a very good R-squared value, at 0.79. The final model passed the underidentification and overidentification tests, suggesting that the instruments used are valid.

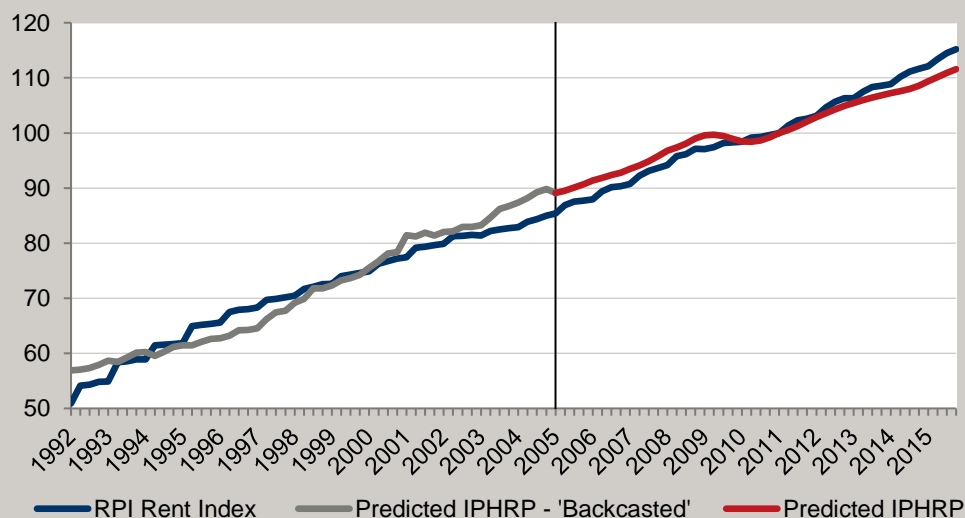
**Fig. 32. Rent 'backcasting' model results**

Variables	model A	model B	model C
Real wage per household	1.111***	1.044***	1.082***
Stock per household	-1.851*	2.273***	-2.476***
Real house price	0.039***	0.0034	
Constant	-.0006***		
R-Square	0.79	0.73	0.77
Underidentification test (Kleibergen-Paap rk LM statistic)	-	Passed	Passed
Overidentification test (Hansen J statistic)	-	Passed	Passed
Endogeneity test (Wu-Hausman F-test)	-	Stock/HH & Price are endogenous	Stock/HH is endogenous

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

Armed with these model results we go on to predict values for what the rent index level in Great Britain would have been prior to 2005. We use early values of UK housing stock per household and real wage per household to predict earlier values of rent for the UK from the model. As can be seen in Figure 36, the 'backcasted' values look sensible and have a similar pattern to the rental component of RPI, with growth in the latter outpacing the former over the period as anticipated.

**Fig. 33. 'Backcasted' IPHRP Rent and RPI Rent Index**



Source: Oxford Economics



# 12. APPENDIX 2: MORTGAGE AVAILABILITY

## MORTGAGE GAP ESTIMATION

The mortgage gap is estimated as the difference between the observed and expected mortgage demand given the economic fundamentals. If observed demand falls short of expected demand, this can be interpreted as a sign that either the supply of or demand for credit are different from what would be anticipated based on history. Following Meen and Auterson, we estimate mortgage demand as a function of the cost of mortgage capital ( $i1_t$ ), real house prices ( $rHP_t$ ), real earnings ( $rEarnings_t$ ) and the average LTV ratio ( $ltv_t$ ). The model is estimated using an Error Correction Model (ECM) and the results are given in the table below.

Fig. 34. Mortgage demand results

Variables	Coefficients
Mortgage Demand (lag)	-0.015*
Value of housing stock (lag)	0.013
Mortgage Demand ( $\Delta$ )	0.767***
User cost of capital ( $\Delta$ )	-0.001
Real house price ( $\Delta$ )	0.036
Real disposable income ( $\Delta$ )	0.019
Dummy 2012Q2	0.007*
Constant	0.013
R Square	0.915
DFGLS  t stats  :  1% critical value	5.206 > 2.603
Philip-Perron ADF  t stats  :  1% critical value	8.344 > 3.523

legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

All the coefficients have the expected sign. Most importantly, the value of the error correction term (the coefficient of the lag of mortgage demand) is between -1 and 0 and is significant, showing that the model is stable and is explaining coherent long run relationships among the variables. This is confirmed by the cointegration tests (DFGLS and Philip and Perron) which show that the estimated relationship is not spurious and the residual is stationary over time.

The mortgage gap is estimated as the difference between the predicted demand from the model and the observed demand, that is, the residuals. Positive differences tell the story of the mortgage constraints in the wake of the financial crisis, while negative values, such as those just prior to the financial crisis, illustrate periods of apparently lax lending.

# 13. APPENDIX 3: COINTEGRATION TESTS

## COINTEGRATION TESTS

The Structural Equation Model estimated the equations for real house price, real rent and home ownership in levels terms over time. It is therefore very likely that the variables exhibit a trend and are non-stationary. As a result, it is possible that the estimated equations are spurious making inference from the model invalid. However, Engle and Granger<sup>43</sup> argue that regression with non-stationarity is still valid if the overall relationship is stable and non-spurious, that is, if the relationship is 'cointegrated'. Testing for cointegration therefore involved testing for whether the residuals from the models are stationary or not. Figure 38 shows the test results for each model using various types of cointegration tests for robustness.

**Fig. 35. Cointegration tests for real house price, real rent and home ownership**

Tests	Real House Price		Real Rent		Home Ownership	
	t-stat	Outcome	t-stat	Outcome	t-stat	Outcome
Augmented Dickey-Fuller	-3.344	Cointegrated**	-3.675	Cointegrated***	-3.047	Cointegrated**
DF-GLS	-2.502	Cointegrated**	-2.995	Cointegrated***	-3.559	Cointegrated***
Phillips-Perron	-3.311	Cointegrated**	-3.547	Cointegrated***	-3.175	Cointegrated**

legend: \* p<0.1; \*\* p<0.05; \*\*\* p<0.01

All the tests confirm that the three models estimated in the housing market system are actually described by a long run economic relationship and are not spurious. We can therefore be confident that the estimated coefficients are measuring true causal effects.

<sup>43</sup> R. F. Engle and C. W. J. Granger, "Co-Integration and Error Correction: Representation, Estimation, and Testing", *Econometrica*, 55(2), 1987: pp. 251-276.

# 14. APPENDIX 4: FORECAST ASSUMPTIONS

## FORECAST BASELINE ASSUMPTIONS

The baseline assumptions used in the forecasts are based on Oxford Economics' macroeconomic outlook as of the end of October 2016. Recent indications from the new government reinforce our view that a 'hard Brexit' - resulting in the UK and EU reverting to a relatively loose trade relationship—is the most likely outcome from the process, and our macroeconomic forecast for the UK economy is informed by this assumption.

Our forecasts for 2016 and 2017 GDP growth stand at 1.8 percent and 1.1 percent, respectively. The main drivers behind these growth forecasts are:

*Uncertainty in investment:* The decision to leave the EU is likely to amplify the degree of uncertainty, with some firms set to postpone capital spending at least until the UK's future trading relationship with the EU become clearer.

*Weaker jobs market:* Lower confidence in the corporate sector is likely to dampen employment and affect consumption relative to expectations before the vote.

*Increases in price levels:* Depreciation of the pound is likely to increase consumer prices and further reduced consumption.

*Weaker pound will boost net exports:* Lower imports and higher exports as a result of a weaker pound sterling are likely to boost GDP.

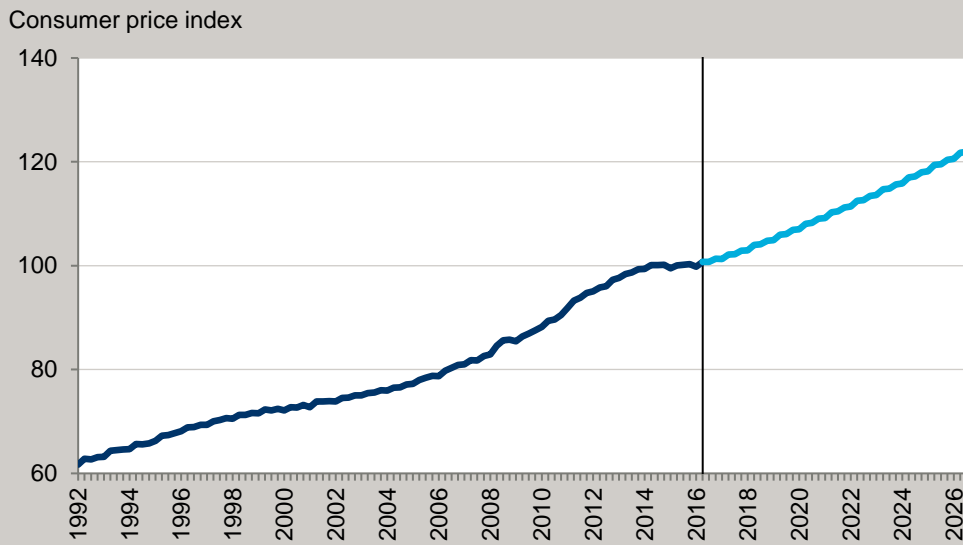
*Expansionary monetary policy:* The August 2016 meeting saw the Monetary Policy Committee announce a four pronged package of measures to loosen monetary policy, including: a cut in Bank Rate to 0.25 percent; the introduction of the Term Funding Scheme ensuring that rate cut is passed to consumers; the purchase of gilts and corporate bonds; and a potential further cut in the Bank Rate to its "effective lower bound". With the effective lower bound estimated to be "close to, but a little above, zero", we expect the MPC to cut Bank Rate to 0.1 percent in the end of the year.

## HOUSING MARKET DETERMINANTS

In this section, we highlight how the variables in the models that are used for forecasting behave in the baseline.

The *Consumer Price Index* is expected to increase over time as inflation rises following the depreciation of sterling. This increase is expected to dampen growth in real earnings over time.

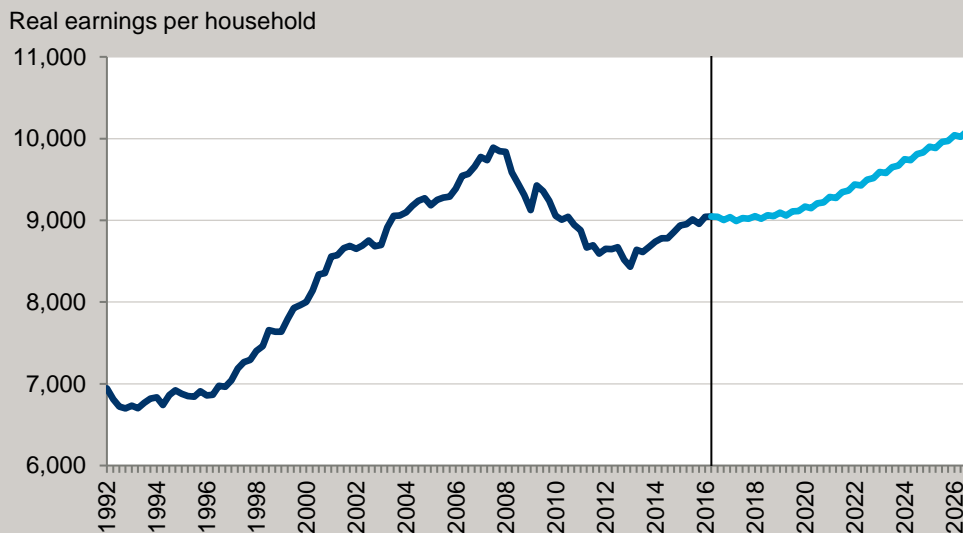
**Fig. 36. Consumer price index outlook**



Source: Oxford Economics

*Real earnings per household* is forecast to be broadly flat for a number of years, as the short- and longer-term shocks of the Brexit referendum work their way through the economy. Growth in this variable is expected to resume, slowly at first, in late 2018.

**Fig. 37. Real earnings outlook**

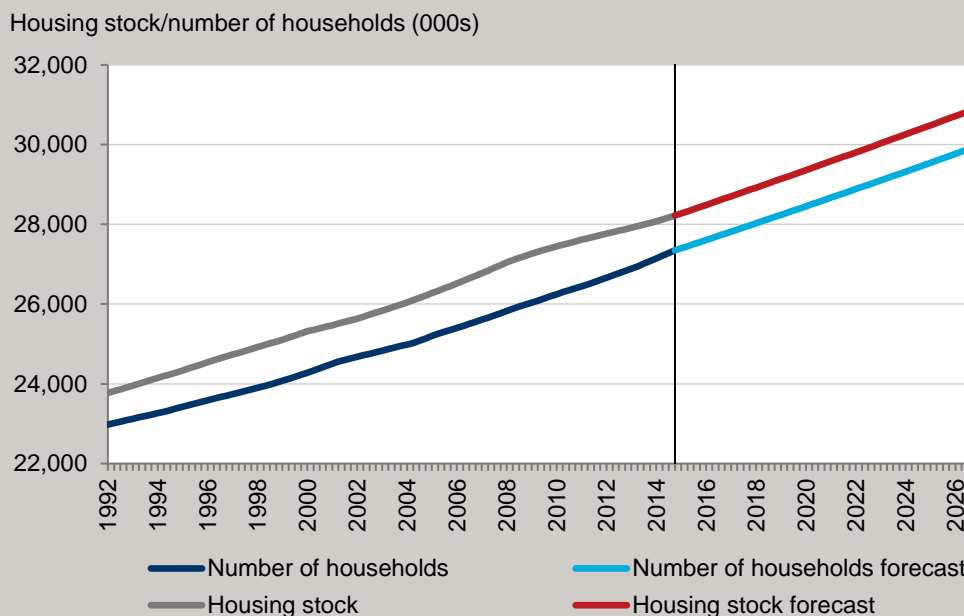


Source: Oxford Economics

*Housing stock per household* is obviously a potentially very important driver of rent and house prices. The prediction for the number of households is obtained from DCLG and does not include any adjustments for Brexit as a result of potential changes to migration rules. This forecast shows a significant increase in the rate of household formation relative to past trends. However, not least in light of the Brexit referendum result, this forecast appears highly uncertain.

On the other side of the ratio, forecasts for total housing stock are hard to find. We assume an annual addition to the housing stock of 0.76 percent, which is the average annual growth rate of the stock since 1992. Given the uncertainty around household numbers we assume that they grow in line with this new supply assumption. This is shown in Fig. 38. In other words housing stock per household is assumed to remain constant throughout the forecast.

**Fig. 38. Housing stock and number of households outlook**

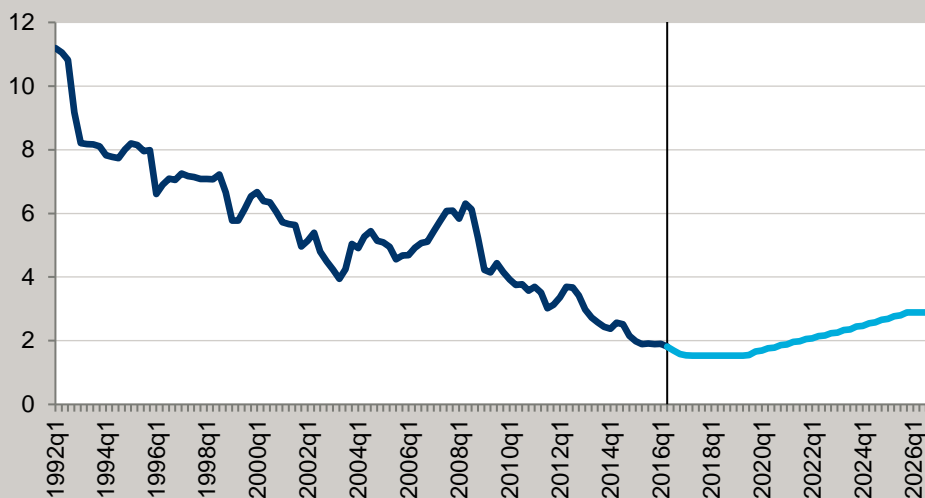


Source: Oxford Economics

Oxford Economics' forecast of mortgage interest rates tracks our forecast for the Bank of England base rate. In particular, it is assumed that mortgage interest rates will continue to fall until they reach their effective lower bound, in early 2017, and remain at that level for three more years. The resulting path of 75 percent LTV mortgage interest rates is shown in Fig. 39.

**Fig. 39. Outlook for interest rates on 75 percent LTV**

Mortgage interest rates, 75% LTV



Source: Oxford Economics

In addition, the user cost of capital is affected by expected capital gain, which in turn is based on past real increases in house prices, as set out above. Consequently this element evolves in a backward-looking manner in accordance with forecast house price movements.

For all other variables included in the models—the other elements of the user cost of capital, the mortgage gap, the first-time buyer income ratio and the first-time buyer credit constraint - we assume that these remain constant throughout the forecast period. These are important assumptions given the salience of the first-time buyer income ratio and credit constraint variables in determining recent shifts in the home ownership rate. However, forecasting the evolution of these variables is beyond the scope of this paper.

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