# 6 Macroeconomic implications of fixed and variable-rate mortgages

6.1 In Section 3 evidence was presented that many households in the UK attach great weight to the level of current, short-term interest rates when they decide how much to borrow and what type of mortgage to take. Less weight seems to be placed upon the likely path of interest rates some years ahead, even though the great majority of households with mortgages will still have substantial amounts of variable-rate debt for many years. Furthermore, evidence from Section 1 showed that short-term interest rates are more volatile than longer-term rates.

6.2 Over the past thirty years the UK housing market has been consistently volatile. House prices, the level of lending and the volume of transactions have fluctuated greatly. Volatility in the housing market has certainly been driven by wider economic conditions but it has also contributed to macroeconomic fluctuations. How much macroeconomic volatility has been caused by the fluctuations in the housing market and the extent to which that reflects the reliance upon variable-rate borrowing are issues addressed in the first part of this section. The nature of the transmission mechanism of monetary policy reflects the structure of housing finance. A move to much greater use of fixed-rate mortgages would alter that mechanism. In the second part of this section the way in which monetary policy might be altered is analysed.

## VOLATILITY IN THE HOUSING MARKET AND IN THE WIDER ECONOMY

6.3 The structure of statistical models of UK house prices reflects the importance of short-term interest rates. In countries where longer-term, fixed-rate mortgages have been more important house prices tend, not surprisingly, to be less sensitive to movements in short-term rates. Empirical evidence has been examined from the US, where prepayable long-term fixed-rate mortgages dominate, and the Netherlands, where medium to long-term fixed-rate mortgages with mark-to-market redemption charges are the norm.

6.4 Meen (2002) estimates models for UK and US aggregate house prices using a common modelling framework. He finds that the short-term sensitivity (or elasticity) of house prices with respect to short-term interest rates in the UK is around six times larger than the elasticity of US aggregate house prices. In the long run the elasticity in the UK is around three times as great as in the US. Table 6.1 summarises his findings.

**Table 6.1: Interest rate sensitivity of US and UK house prices: estimated impact on house prices of a 1% change in the short-term real interest rate**

| | UK | US |
|---|---|---|
| Short-run impact | –0.60% | –0.10% |
| Long-run impact | –4.40% | –1.60% |

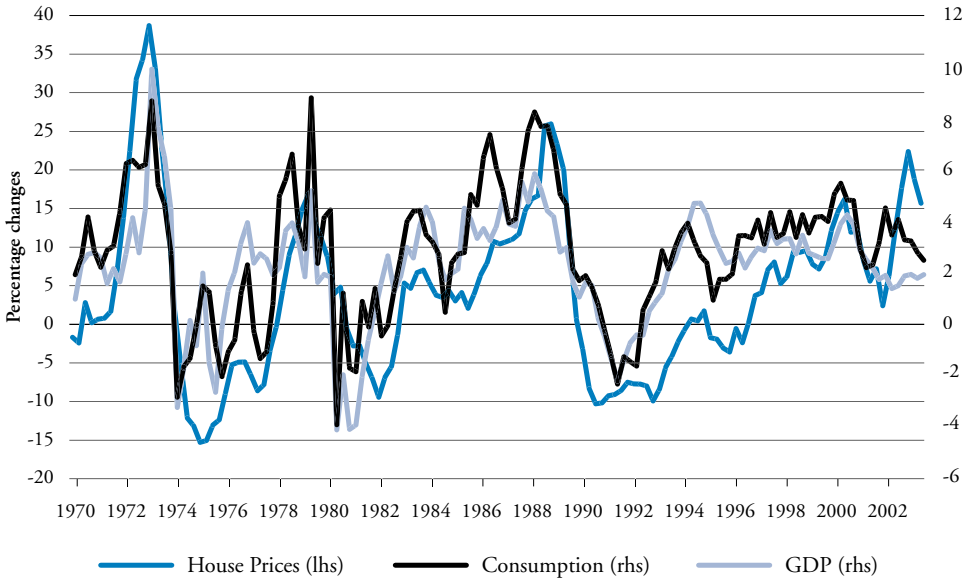
*Short-run and long-run impacts are based on columns (4) and (6) of Tables III and IV respectively in Meen (2002). For the UK real interest rates are based on the average UK mortgage rates less house price appreciation; for the US they are based on the 3-month Treasury bill rate less house price appreciation.*
*Source: Meen (2002)*

6.5 Recent research at the Dutch central bank (De Nederlandsche Bank, 2000) also shows a degree of sensitivity of Dutch house prices to longer-term rates lower than the sensitivity of UK house prices to short-term rates. The long-run impact of a 1 per cent change in longer-term interest rates upon house prices in the Netherlands is estimated to be 2.76 per cent. Movements in short-term rates only have a direct affect on house prices if such movements generate changes in longer rates.

6.6 All this means one should take seriously the idea that the structure of the housing finance system may have contributed to macroeconomic volatility.

6.7 Chart 6.1 shows that house prices in the UK have moved in line with movements in GDP and in consumption, but their volatility has been far greater: the range of the scale on the left hand side of the graph where house prices are measured is over three times as great as the right hand side where consumption and GDP growth are measured. Chart 6.1 shows that house prices have been volatile and that periods when house prices have risen particularly strongly have often been periods of rapid consumption and output growth. But in itself this tells us little about the contribution of housing market volatility to volatility in the wider economy. To assess this one needs to take account of the complicated interrelations between conditions in the housing market and in the wider economy.

**Chart 6.1: House prices, consumption and GDP growth**




*Source: Office for the Deputy Prime Minister, Office of National Statistics.*

6.8 Oxford Economic Forecasting (OEF) and the National Institute of Economic and Social Research (NIESR) were asked by the Review to use their large-scale macroeconomic models to assess the impact of house price volatility upon the economy and to consider how a switch to more fixed-rate lending might influence the way in which monetary policy affects the economy.

6.9 Oxford Economic Forecasting used the OEF model and a version of the Treasury model to assess how the economy might have performed if house prices had followed a less cyclical profile than that actually observed since the early 1980s. OEF were asked by the Review to construct counterfactual – i.e. historic – scenarios under two alternative assumptions for house prices:

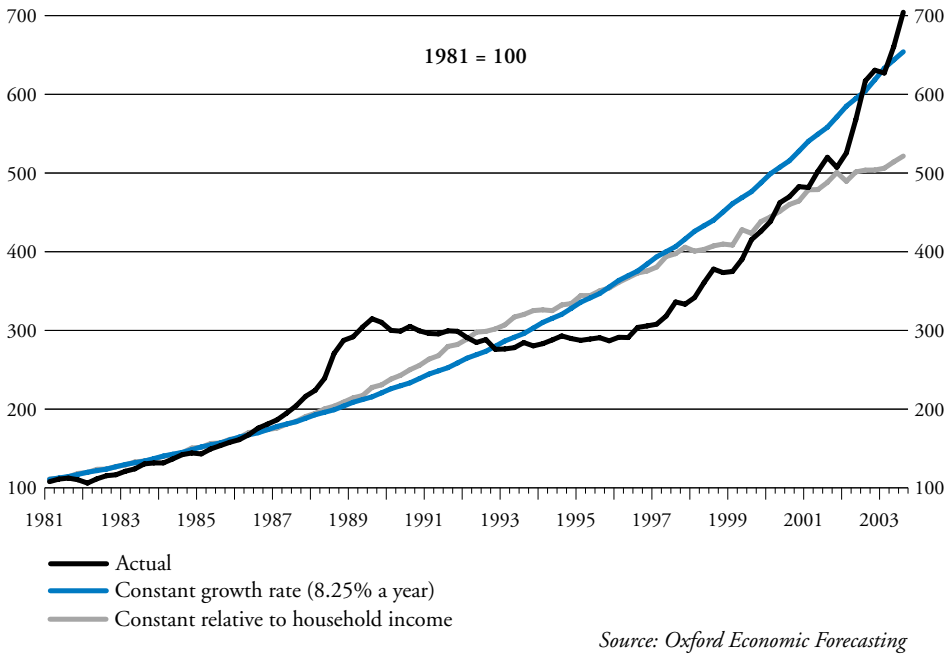
(i) *house prices remained constant relative to household disposable income from 1981 onwards (ie house price inflation was equal to household income growth); and*

(ii) *house prices rose each year from 1981 at 8.25 per cent, which is the average annual increase between 1981 and 2002*

6.10 Chart 6.2 compares the profile for house prices in the counterfactual scenarios with history. Clearly, house prices are much less volatile in the two counterfactuals, although volatility in disposable income means that there are still significant changes in house price inflation in case (i).

6.11 The difference between the behaviour of macroeconomic variables such as GDP as actually recorded – which we take as our 'base' case – and that predicted in these counterfactual scenarios then provides a measure of the 'contribution' of house price volatility to macroeconomic volatility. We do not specify here what could have made house prices less volatile – the results generated by OEF merely show what would have been the impact upon volatility in the wider economy of a less turbulent housing market.

**Chart 6.2: Alternative versions of the evolution of UK house prices**




*Source: Oxford Economic Forecasting*

6.12 Two further points should be noted in interpreting these simulations:

- first, OEF made no allowance for any impacts that changes in house prices may have on consumer confidence over-and-above that already implied in the OEF and Treasury model equations. In practice, however, such effects could be an important part of the transmission of volatility in house prices to overall macroeconomic volatility. Similarly, no allowance has been made for any direct impacts on investment in dwellings or housing turnover; and

- second, in the OEF counterfactual simulations allowance is made for a reaction on the part of the UK monetary authorities to changes in the macroeconomic environment. Interest rates would have been different if house prices had followed a different path. In the simulations short-term interest rates are based on a version of the Taylor rule that relates interest rates to both the output gap and the difference between inflation and a target rate. So, in periods when the counterfactual scenarios imply more modest house price inflation than in the base case, and therefore more subdued overall demand, this is likely to be partly offset

by interest rates being lower than in the base case, and vice-versa. It should be stressed, however, that the parameters of this Taylor rule were not changed to reflect the alternative behaviour of house prices in the counterfactual scenarios. In practice, the monetary authorities could well have adopted a different policy rule in these circumstances, given the implied change in the monetary transmission mechanism.

6.13 Chart 6.3 compares the profile of GDP growth in each of the counterfactual scenarios constructed with the OEF model with its actual behaviour. Chart 6.4 does the same for RPIX inflation. Table 6.2 compares the volatility of growth in GDP, consumer spending and house prices across the scenarios. The key points to note are:

- cycles in both GDP growth and RPIX inflation are less marked in the two counterfactual scenarios than in the base case;
- nevertheless, considerable volatility remains, and marginally more so in the case where house prices are held constant relative to incomes.

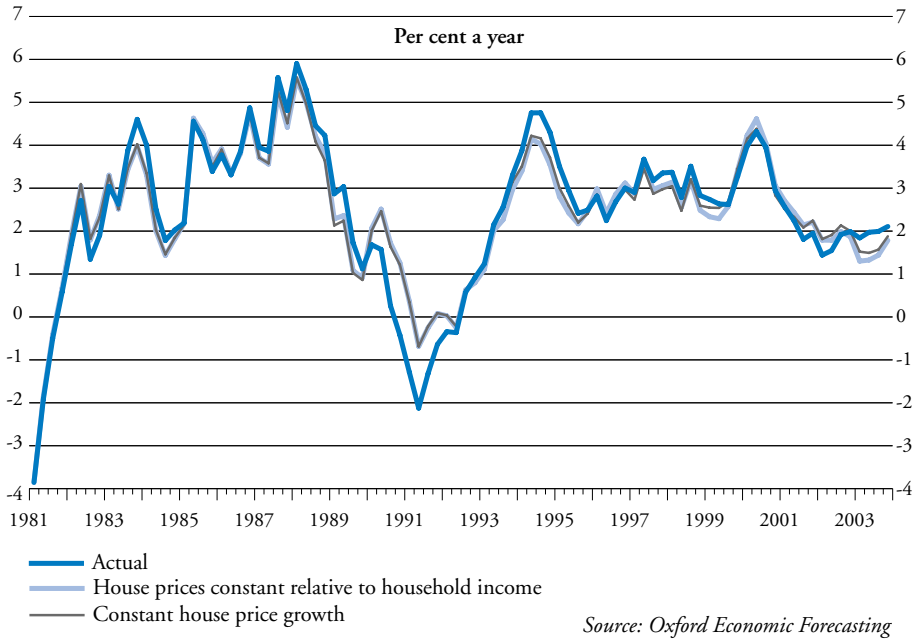
6.14 The implication of these counterfactual simulations is that the behaviour of house prices may have accounted for part, but by no means most, of the volatility of the UK economy over the last 25 years. To be more precise, the results suggest that had house prices followed a less volatile path – either one which kept house price inflation steady or one which had house prices move in line with incomes – then the path of consumption would have been less variable and as a result macroeconomic volatility would have been lower. The house price to consumption link is the key element behind the simulation results because the way in which house prices have an impact upon other parts of the economy in the OEF and Treasury model is through their influence over the level of consumer spending.

**Table 6.2: Impact of house prices on volatility. Standard deviations of year-on-year growth rates, 1981Q1–2003Q2**

| | Base case | Constant house prices relative to income | Constant growth rate of house prices |
|---|---|---|---|
| GDP | 1.79 | 1.55 | 1.54 |
| Consumer spending | 2.26 | 1.90 | 1.86 |
| House prices | 8.54 | 2.66 | 0 |

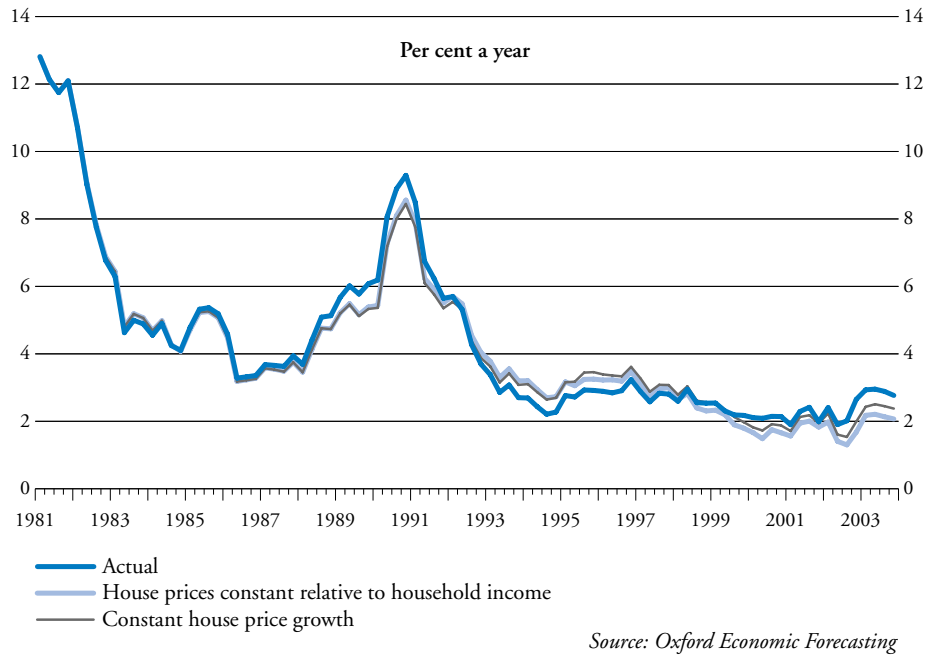
*Source: Oxford Economic Forecasting.*

## Chart 6.3: GDP growth under alternative scenarios




*Source: Oxford Economic Forecasting*

## Chart 6.4: RPIX inflation under alternative scenarios




*Source: Oxford Economic Forecasting*

6.15 Oxford Economic Forecasting repeated these counter-factual simulations using a version of the Treasury model. The Treasury Model does not include an equation for determining short-term interest rates – they are treated as exogenous. Such an assumption would, however, be inappropriate for the counterfactual scenarios. OEF therefore added an interest rate reaction function based on a standard Taylor rule.

6.16 In general, the Treasury model implies that the economy is much less sensitive to interest rate changes than the OEF Model. In part, this may be because the Treasury Model was solved assuming backward-looking expectations (as in its standard public release) and, given the form of the equation for the exchange rate in the Treasury model, this may understate the likely response of sterling to a change in interest rates. While the OEF Model is also solved assuming backward-looking expectations, its exchange rate equation is designed to generate larger immediate changes in sterling in response to interest rate changes.

6.17 Table 6.3 compares the volatility of growth in GDP, consumer spending and house prices across the various alternative scenarios using the Treasury model. As with the OEF Model counterfactual scenarios the results show that:

- The cycle in both GDP growth and RPIX inflation are significantly less marked in the two counterfactual scenarios than in the base case.
- Nevertheless, considerable volatility remains, and marginally more so in the case where house prices are held constant relative to incomes. In particular, the counterfactual scenarios imply a more marked slowdown in growth over the last few years than actually observed.

**Table 6.3: Impact of house prices on aggregate volatility based on HMT model. Standard deviations of year-on-year growth rates, 1987Q1–2003Q2**

| | Base case | Constant house prices relative to income | Constant growth rate of house prices |
|---|---|---|---|
| GDP | 1.68 | 1.33 | 1.27 |
| Consumer spending | 2.19 | 1.69 | 1.59 |
| House prices | 9.81 | 3.35 | 0 |

*Source: Oxford Economic Forecasting.*

6.18 As with the OEF Model findings, the implication of these counterfactual simulations is that the behaviour of house prices accounts for part, but by no means most, of the volatility of the UK economy over the last 25 years.

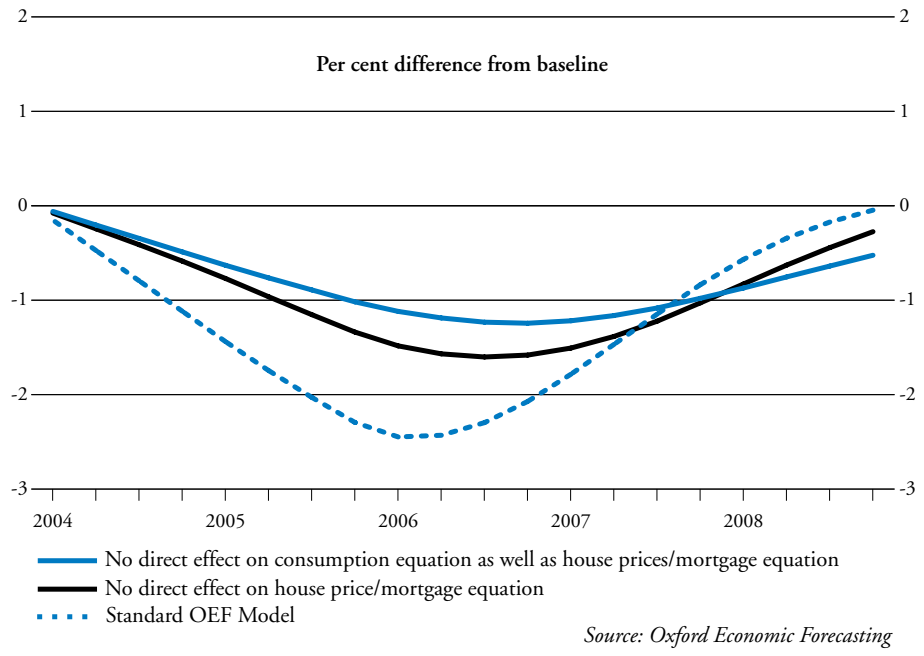
## THE SENSITIVITY OF THE UK ECONOMY TO INTEREST RATE CHANGES

6.19 OEF also considered the impact of changes in short-term interest rates on the UK economy. Simulations were designed to assess the extent to which the effect of changes in short rates reflects the knock-on impact of changes in mortgage interest rates on house prices, mortgage borrowing and consumer spending. The question we address here is how much of the overall impact of a change in short-term rates reflect mechanisms that work through the housing market. To assess this simulations were run where those elements of the transmission mechanism that operate through the housing market were "switched off". OEF were asked to simulate the effect of an increase of 100 basis points in short rates lasting for two years. Thereafter, interest rates are determined by the interest rate reaction function in the OEF Model. This policy change could be thought of as a reaction to an unexpected inflation shock in the context of a credible monetary framework. Long-term interest rates are assumed to be an average of expected short rates, with 10-year rates rising by 20 basis points immediately when short rates rise and then gradually falling back to their base level over two years.

6.20 Chart 6.5 compares the change in GDP relative to its baseline projection in response to the rise in interest rates under three assumptions:

- (a) The standard OEF Model
- (b) A modified version of the OEF Model in which the direct impact of the change in interest rates on housing prices and mortgage borrowing is 'switched off'.
- (c) As (b) but with the direct impact of the change in interest rates on consumer spending also switched off.

**Chart 6.5: Impact of an increase in short rates on GDP**

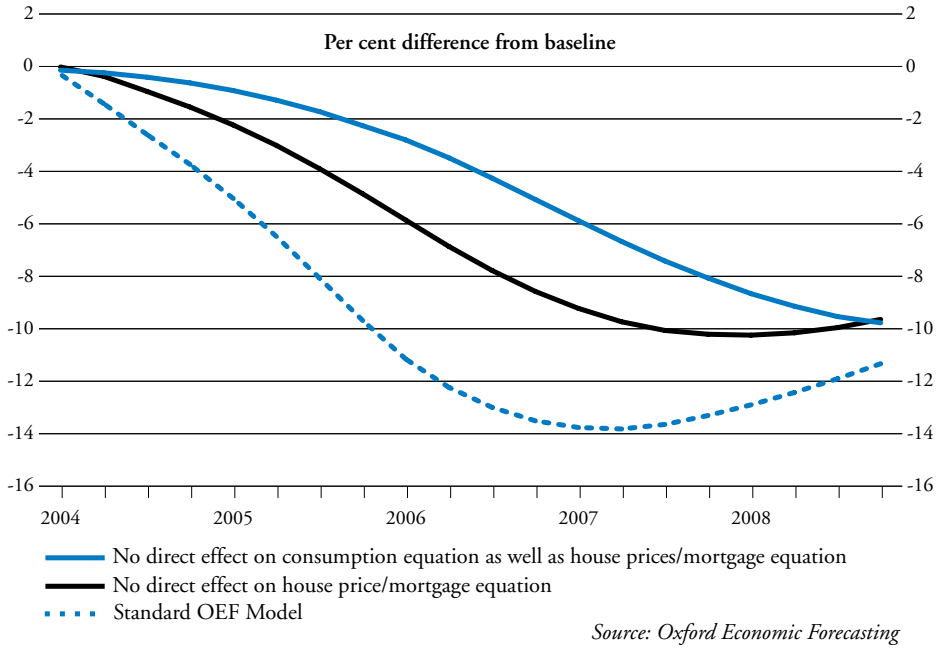



*Source: Oxford Economic Forecasting*

6.21 Chart 6.6 shows the profile of house prices in the three scenarios, while Chart 6.7 shows the profile of consumer spending. In all three simulations the indirect effects of changes in short rates upon house prices and consumption still operate.

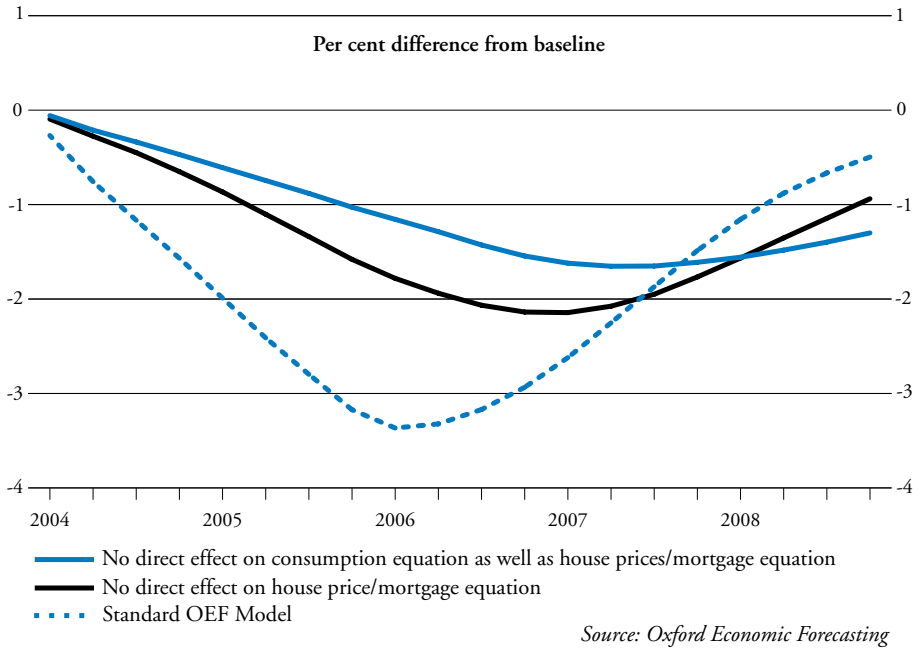
6.22 The standard OEF Model suggests that a 1 percentage point increase in the short rate will reduce GDP by up to 2.4 per cent relative to base, with the peak impact coming after two years. Switching off the direct effect of interest rates on house prices and mortgage borrowing reduces this peak GDP impact to 1.6 per cent and delays it by two quarters, while also switching off the effect on consumer spending also reduces it further to 1.2 per cent and delays the peak by a further quarter.

**Chart 6.6: Impact of an increase in short rates on house prices**




*Source: Oxford Economic Forecasting*

**Chart 6.7: Impact of an increase in short rates on consumption**




*Source: Oxford Economic Forecasting*

6.23 Based on the OEF simulations about a third of the impact of higher interest rates on GDP operates through the direct effect on house prices and mortgage borrowing, with a further sixth operating through the direct effect on consumer spending. But this still leaves a significant impact of interest rates on the economy, reflecting, for example, impacts on business and dwellings investment, and on the exchange rate. If mortgage lending were largely at fixed-rate there would still, however, be an impact of changes in short rates upon house prices because long rates would move and the indirect effects of short rates on other determinants of house prices, such as household income, would still operate. The transmission mechanism of monetary policy would still work, to some extent, through the housing market. How the transmission mechanism might change is considered in more detail below.

6.24 The standard Treasury Model suggests that a 100 basis point increase in short rates will reduce GDP by up to 0.6 per cent relative to base, with the peak impact coming after two years. Switching off the direct effect of interest rates on house prices and mortgage borrowing reduces this peak GDP impact to 0.4 per cent, while switching off the effect on consumer spending as well reduces it further to 0.3 per cent. Based on the OEF simulations about a third of the impact of higher interest rates on GDP in the Treasury model operates via the direct effect on house prices and mortgage borrowing, with a further sixth operating via the direct effect on consumer spending.

## THE IMPACT OF INTEREST RATE CHANGES UNDER ALTERNATIVE FORMS OF MORTGAGE FINANCE

6.25 The OEF and the National Institute of Economic and Social Research (NIESR) also considered the potential impact of a change in short-term interest rates on the UK economy under four forms of mortgage finance:

- variable-rate mortgages linked to short-term interest rates;
- variable-rate mortgages linked to long-term interest rates;
- long-term fixed-rate mortgages with no prepayment – In this case it is assumed that households take out mortgages on which the interest rates are fixed for ten years and which do not allow early repayment. It is assumed that housing demand and consumption would then be influenced by a weighted average of long-term interest rates over the last ten years; and
- long-term fixed-rate mortgages with free prepayment[1] – In this case it is assumed that households take out mortgages on which the interest rates are fixed for ten years but that they are able to prepay these and take out a new loan at no cost. When long-term mortgage rates fall below their previous lowest rate since the mortgage was taken out, households will refinance.

6.26 In all cases the existing house price equations in the models were replaced with one where the measure of interest rates is amended. The coefficient of the interest rate term in these equations is not altered. Implicitly a strong assumption is made that the sensitivity of the demand for housing with respect to long rates in an environment with borrowing costs linked to long-rates would be the same as the historic sensitivity to short rates in an environment of variable rate lending. This assumption is only plausible if in the past myopia and/or credit restrictions had led people to treat a short-term rate as an indicator of the overall cost of mortgage debt. Evidence summarised in Section 3 suggests that this is not a bad assumption.

6.27 Simulations of the effect of an increase of 100 basis points in short-term interest rates for two years were conducted. We first consider the OEF results and then describe simulations on the NIESR model.

### OEF Simulations of the monetary transmission mechanism

6.28 OEF considered the impact both where the change to the form of mortgage finance applies only to the OEF Model equations for house prices and mortgage borrowing and where the change also applies to the equation for consumer spending. It is far from clear the relevant interest rate variable in a model of consumption should be the mortgage interest rate. But for many, though not all, households the cheapest form of debt finance for consumption is mortgage lending. So it makes sense to allow for a potential impact of more fixed-rate mortgage borrowing on both house prices and consumption expenditure.

[1] We use the shorthand expression "free prepayment". This refers to a situation where there are no charges to repaying the fixed-rate mortgage early. The interest rate charged on such mortgages would be higher than if mortgages could not be repayed early, so the option is not literally free.

6.29 Charts 6.8 and 6.9 compare the OEF estimates of the impact on GDP of an increase in short rates under the first three forms of mortgage finance. Charts 6.10 and 6.11 show the impacts on house prices, while chart 6.12 and 6.13 show the impact on consumer spending. These results show:

- The impact of changes in short-term interest rates on the economy are significantly larger under the current variable rate mortgage system linked to short-term interest rates than under a variable rate system linked to long-term interest rates. This is because mortgage rates are assumed to rise by the full 100 basis points that short rates rise, while long-term interest rates increase by only 20 basis points.

- The impact of higher short rates is even more muted in a system of fixed long-term interest rates with no prepayment. This is because only those households either taking on a mortgage for the first time or having to re-mortgage a loan that has come to the end of its term are directly affected by the increase in long rates. Under a mature system of 10-year fixed-rate mortgages, this would be expected to be only around 10 per cent of households in the first year following a change in interest rates. So, the impact of a 20 basis point increase in long rates on the average mortgage rate paid under such a structure would be only around 2 basis points in the first year, although this might increase in subsequent years depending on how sustained is the increase in long rates.

- House prices would be significantly less sensitive to changes in monetary policy if most mortgages were at rates fixed for 10 years. A 100 basis points increase in short rates for two years reduces house prices by around 14 per cent after three years when mortgages are largely at variable-rate. That effect is reduced to 9 per cent with fixed rate mortgage with prepayment options and to about 8 per cent when there is no prepayment.

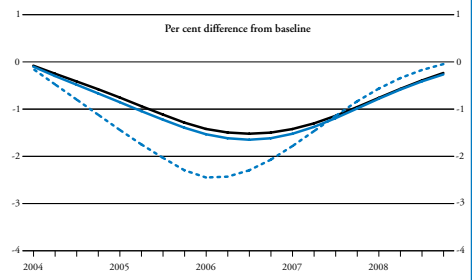
- Not surprisingly, the impact of increased interest rates is greater under all of these mortgage systems if there is a direct effect on consumer spending behaviour as well as on house prices and mortgage borrowing. It is far from clear however how a switch in the type of mortgages should be reflected in a change in the structure of the consumption equation in the model.

# OEF MODEL – EFFECTS UNDER VARIABLE LONG RATE AND LONG-TERM FIXED-RATE MORTGAGES WITHOUT A PREPAYMENT OPTION

## Assuming house prices and mortgage borrowing are linked to long rates

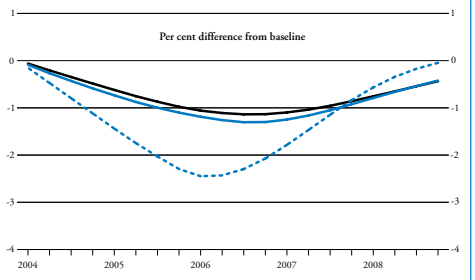
## Assuming consumption as well as house prices and mortgage borrowing are linked to long rates

Chart 6.8: Impact of an increase in short rates on GDP



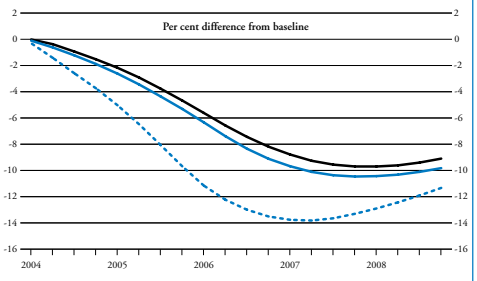

*Source: Oxford Economic Forecasting*

Chart 6.9: Impact of an increase in short rates on GDP



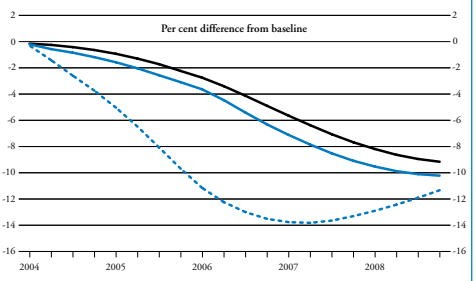

*Source: Oxford Economic Forecasting*

Chart 6.10: Impact of an increase in short rates on house prices



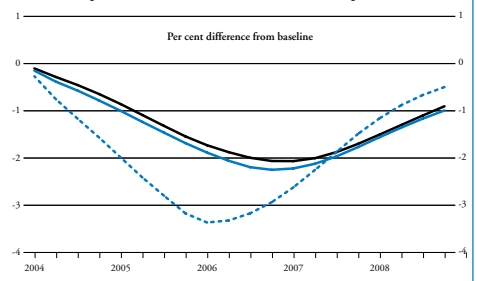

*Source: Oxford Economic Forecasting*

Chart 6.11: Impact of an increase in short rates on house prices



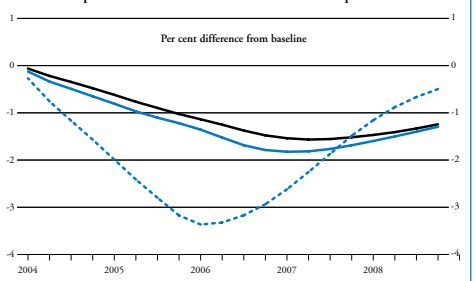

*Source: Oxford Economic Forecasting*

Chart 6.12: Impact of an increase in short rates on consumption




*Source: Oxford Economic Forecasting*

Chart 6.13: Impact of an increase in short rates on consumption




*Source: Oxford Economic Forecasting*

Variable rate mortgages linked to long rates
Long-term fixed-rate mortgage with no prepayment
Standard OEF Model

6.30 The impact of a change in interest rates under a fixed long-term interest rates system with free prepayment is more complicated to analyse. For one thing, it is likely to be asymmetric – i.e. the scale of response to an increase in interest rates is likely to be different to that in response to a fall in interest rates. This is because households are free to choose whether to prepay their loans and take out a new mortgage and will only do so if the terms available make this attractive. This may well be so for many households after a fall in interest rates, in which case the effect on the overall economy could be significant. But things will be different following an increase in interest rates, since more households will then choose to hold on to their existing mortgages, leaving their mortgage payments unaffected.

6.31 There is a further complication in analysing the impact of interest rate changes when there is free prepayment, because the response of households then depends on the path that interest rates would otherwise have taken – i.e. it is 'base dependent'. To see this, consider the following example.

6.32 Table 6.4 sets out two alternative base forecasts for long-term mortgage rates. In period 1, mortgage rates are 5.80 per cent in both, which we assume to be the lowest level of mortgage rates for at least a decade. On this basis, with free prepayment, all mortgage borrowers would re-mortgage in period 1 at 5.80 per cent. The base forecasts for period 2 are, however, different. In case A, long-term interest rates are assumed to remain unchanged, leaving mortgage rates at 5.80 per cent. In case B, long rates are assumed to fall by 15 basis points in period 2, reducing mortgage rates to 5.65 per cent. As a result, in the base version of scenario A, no-one would re-mortgage in period 2 – they would have nothing to gain having already taken out a mortgage at 5.80 per cent. In contrast, in the base version of scenario B, all households would re-mortgage again, since they could then take advantage of the new lower interest rate available.

**Table 6.4: Illustrative scenarios for mortgage rates and refinancing**

| | Mortgage rates (%) | | | |
|---|---|---|---|---|
| | Case A | | Case B | |
| | Base | After rate rise period 2 | Base | After rate rise period 2 |
| Period 1 | 5.80 | 5.80 | 5.80 | 5.80 |
| Period 2 | 5.80 | 6.00 | 5.65 | 5.85 |
| Do households refinance in period 2? | No | No | Yes | No |

6.33 Now consider the impact on scenarios A and B if we analyse the effect of an interest rate increase in period 2 that pushes up long rates by 20 basis points compared with their respective base forecasts. In case A, this would mean that mortgage rates in period 2 are now 6.00 per cent. In case B, mortgage rates in period 2 are now 5.85 per cent. This change in interest rates would have no effect on households' refinancing decisions under scenario A *compared with the base case.* Households were already choosing in the base case not to re-mortgage in period 2, and would clearly still not do so after the interest rate increase. In contrast, the effect of the increase on mortgage rates under scenario B is substantial. With rates now 5.85 per cent in period 2, there is no longer an incentive for any household to re-mortgage, whereas in the base case all households were re-mortgaging. So, the impact of the increase in interest rates relative to the base forecast is much greater under scenario B than A.

6.34 This implies that the impact of a change in monetary policy on the economy would have to be analysed much more carefully under a mortgage system that allowed free prepayment than under the existing structure of mortgage finance since its effects would depend on the precise past and, expected future profile of interest rates. Simple 'ready reckoners' of the effects of interest rate changes would be even less appropriate than they are under the current mortgage system. However, the assumption that all households would respond to any incentive to re-mortgage under such a system is unlikely to hold in practice, given the other non-monetary costs of re-mortgaging (e.g. searching out the best deal, completing paperwork, etc) and the natural inertia of many people. This would tend to significantly dampen the effect of changes in interest rates in such a system and reduce the degree to which the impacts are base dependent. Moreover, these asymmetries and base dependencies will only be quantitatively significant in circumstances where long-term interest rates change by large amounts. They do not cause significant differences in the simulations that OEF performed because they considered a shock in which long-term interest rates change by at most only 20 basis points.

6.35 In analysing the effects of a change in interest rates under a mortgage system with costless refinancing, OEF considered two alternative base line profiles for long-term interest rates. These are shown in Table 6.5. The impact of a change in short-term rates on the economy was assessed against both of these profiles. This makes some difference to the results since the impact of a change in short rates, and of the induced change in long rates, are dependent on the baseline history of long rates. In the first of these base line profiles, there would be no incentive to re-mortgage in 2004 whether or not interest rates increased relative to base. But in the second, many households would be expected to refinance in 2004Q1 if interest rates were at base levels, but would not do so if rates were 20 basis points higher.

**Table 6.5: Assumptions for the base case profile of long-term interest rates used in OEF Model simulations**

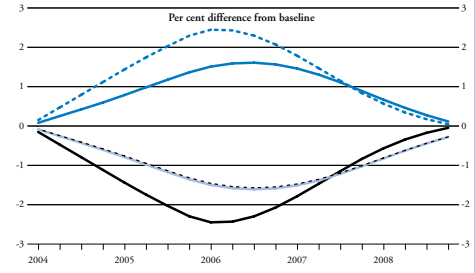
| | Central case, used as baseline for simulations of both 100 bp rise in short rates and 100 bp fall | Alternative case used as baseline for alternative simulation of impact of 100 bp rise in short rates |
|---|---|---|
| 2003Q1 | 4.28 | 4.28 |
| 2003Q2 | 4.20 | 4.20 |
| 2003Q3 | 4.47 | 4.47 |
| 2003Q4 | 4.50 | 4.25 |
| 2004Q1 | 4.38 | 4.00 |
| 2004Q2 | 4.50 | 4.15 |
| 2004Q4 | 4.85 | 4.55 |
| 2005Q1 | 5.00 | 4.75 |
| 2005Q2 | 5.00 | 4.90 |
| 2005Q3 onwards | 5.00 | 5.00 |

6.36 Charts 6.14 to 6.19 summarises the impact on GDP, house prices and consumption for both an increase in short rates of 100 basis points against these two baseline forecasts, and a 100 basis point reduction in short rates against the first of the baselines. The effects of an increase in short rates in this case are typically slightly larger than under the assumption of fixed long-rate mortgages with no prepayment, although the extent of these differences will depend on the exact baseline profile of mortgage rates. But they are again substantially less than under the current system of variable-rate mortgages.

# OEF MODEL – EFFECTS UNDER LONG-TERM FIXED-RATE MORTGAGES WITH A PREPAYMENT OPTION

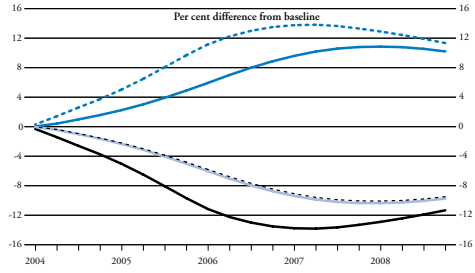
## Assuming house prices and mortgage borrowing linked to long rates

Chart 6.14: Impact of a change in short rates on GDP



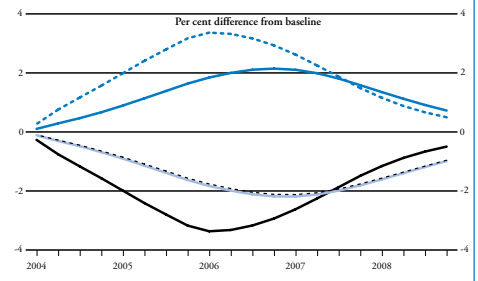

*Source: Oxford Economic Forecasting*

Chart 6.16: Impact of a change in short rates on house prices




*Source: Oxford Economic Forecasting*

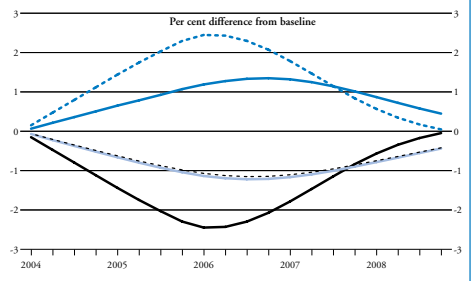
Chart 6.18: Impact of a change in short rates on consumption




*Source: Oxford Economic Forecasting*

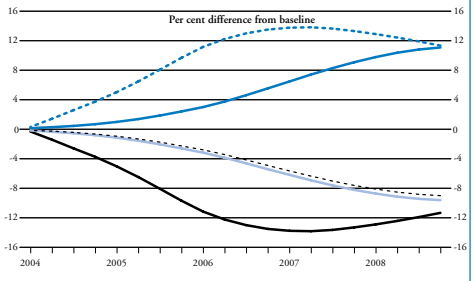
## Assuming consumption as well as house prices and mortgage borrowing linked to long rates

Chart 6.15: Impact of a change in short rates on GDP



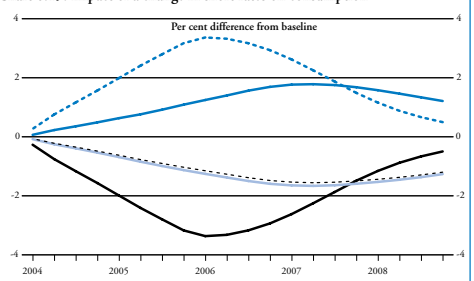

*Source: Oxford Economic Forecasting*

Chart 6.17: Impact of a change in short rates on house prices




*Source: Oxford Economic Forecasting*

Chart 6.19: Impact of a change in short rates on consumption




*Source: Oxford Economic Forecasting*

- Standard OEF model
- Impact of a rate cut
- Impact of a rate increase under Central Case baseline forecast for long rates
- Impact of a rate increase under Alternative baseline forecast for long rates
- Standard OEF model

6.37 OEF repeated the simulations using a version of the Treasury model. Charts 6.20 to 6.25 show estimates of the impact on GDP, house prices and consumption of a change in interest rates under a fixed-rate mortgage system with prepayment options using the HMT model. Simulations were run to show the impact of both a 100 basis points increase and reduction in short rates, and results were calculated of the impact of a rate increase under the two alternative baseline projections for long rates, as above. The results were, in broad terms, similar to those from simulations using the OEF model:

- the impact of changes in interest rates on the economy are larger under the current variable-rate mortgage system linked to short-term interest rates than under a variable-rate system linked to long-term interest rates;
- the impact of higher short rates is even more muted in a system of fixed long-term interest rates with no prepayment;
- not surprisingly, the impact of increased interest rates is greater under all of these mortgage systems if there is a direct effect on consumer spending behaviour (the difference between the behaviour of consumption in the OEF and Treasury simulations reflect different model properties[2]) as well as on house prices and mortgage borrowing; and
- house prices are less affected by monetary policy when a high proportion of mortgages are at rates fixed for 10 years.

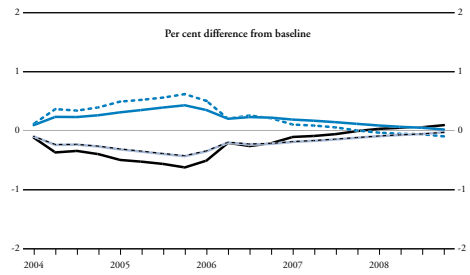
[2] The consumption equation in the OEF model has a levels effect from interest rates while the Treasury model has interest rates in first difference form. Therefore the effect of a temporary rise in interest rate gradually unwinds in the OEF model whereas the temporary rise and subsequent fall have equal and opposite effects in the Treasury model.

## TREASURY MODEL – EFFECTS UNDER FIXED RATE MORTGAGES WITH A PRE-PAYMENT OPTION

### Assuming house prices and mortgage borrowing linked to long rates

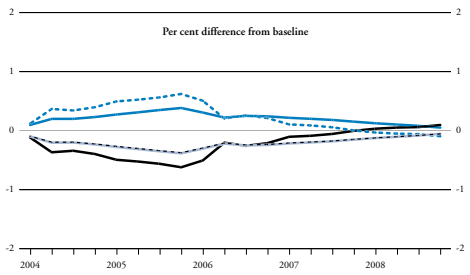
### Assuming consumption as well as house prices and mortgage borrowing linked to long rates

Chart 6.20: Impact of a change in short rates on GDP



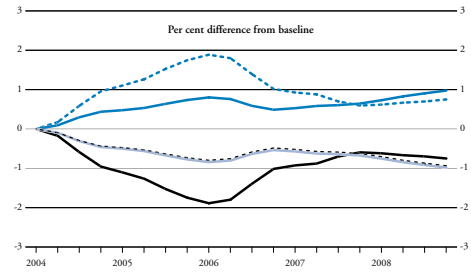

Source: Oxford Economic Forecasting

Chart 6.21: Impact of a change in short rates on GDP



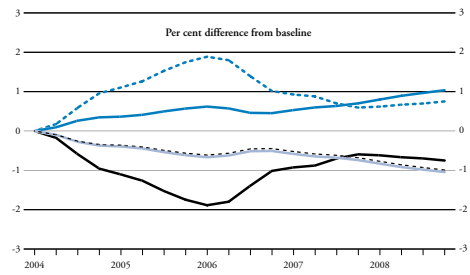

Source: Oxford Economic Forecasting

Chart 6.22: Impact of a change in short rates on house prices



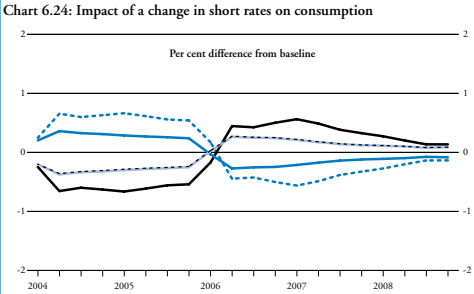

Source: Oxford Economic Forecasting

Chart 6.23: Impact of a change in short rates on house prices



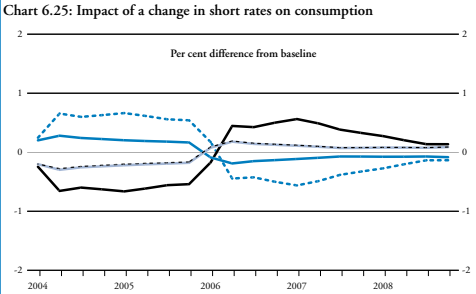

Source: Oxford Economic Forecasting

Chart 6.24: Impact of a change in short rates on consumption

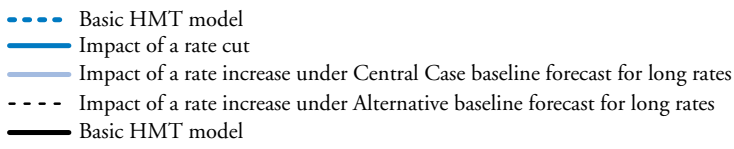



Source: Oxford Economic Forecasting

Chart 6.25: Impact of a change in short rates on consumption




Source: Oxford Economic Forecasting



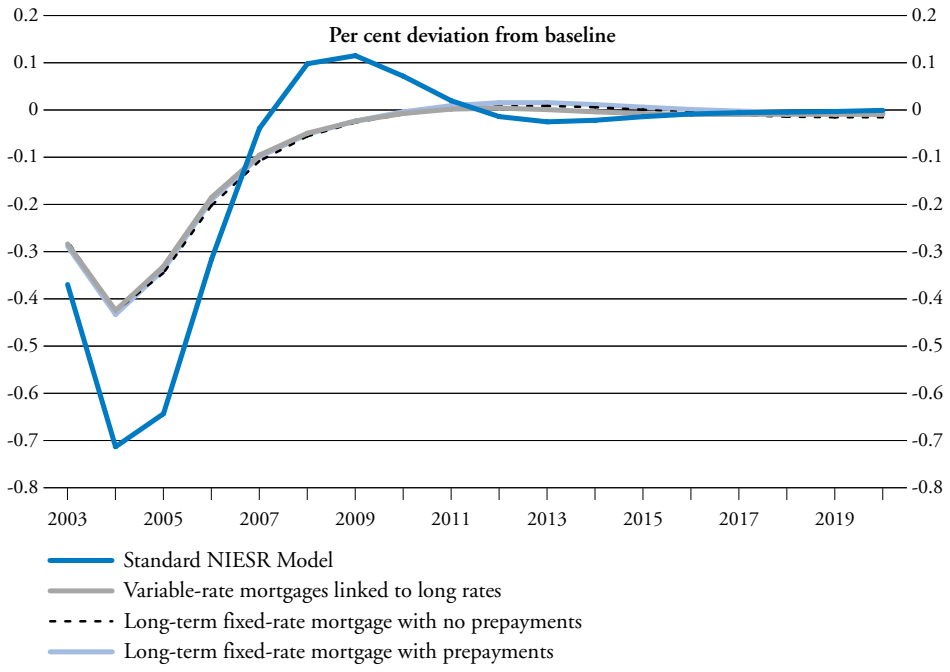

6.38 As with the OEF Model, the HMT model shows that the effects of an increase in short rates when people have fixed-rate mortgages with a prepayment option case are typically slightly larger than under the assumption of fixed long-rate mortgages with no prepayment, although again the extent of these differences depend on the baseline profile of mortgage rates. But they are again substantially less than under the current system of (predominantly) variable-rate mortgages.

## NIESR simulations of the monetary transmission mechanism

6.39 In the NIESR model interest rates affect house prices and personal income flows. In one simulation NIESR replaced the (short-term) interest rate in those equations with the current long-term interest rate (a long gilt yield). In a second simulation the impact of there being non-prepayable fixed-rate mortgages is estimated by having housing demand and consumption influenced by a weighted average of long rates over a 10-year period. As a simple approximation, the weights for each year are equal, although in reality they would vary depending on the level of mortgage activity in each year. The third simulation allows for an option to pre-pay fixed rate mortgages when long rates drop below the previous lowest fixed rates since the mortgage was taken out. In this case, the mortgage rate for each vintage will be the lowest of either the current long rate or the lowest long rate since the mortgage was taken out.

6.40 Each of the four models was used with a common shock to short rates in rational expectations mode, and hence long rates move by the forward integral of the change in short rates (with the same limited effect on long rates as in the OEF simulations). The short rate is increased by 100 basis points for two years. In these simulations after the first two years of the run the interest rate is set to follow a simple Taylor rule that ensures that the contractionary effects of the interest rate rise are sustained. Chart 6.26 plots the impact on output from the rate change; Chart 6.27 plots the impact on consumption; Chart 6.28 shows the impact on inflation and unemployment. Any of the fixed rate simulations show output, consumption, inflation and unemployment moving less than with variable-rate debt and they follow a less variable path relative to base.

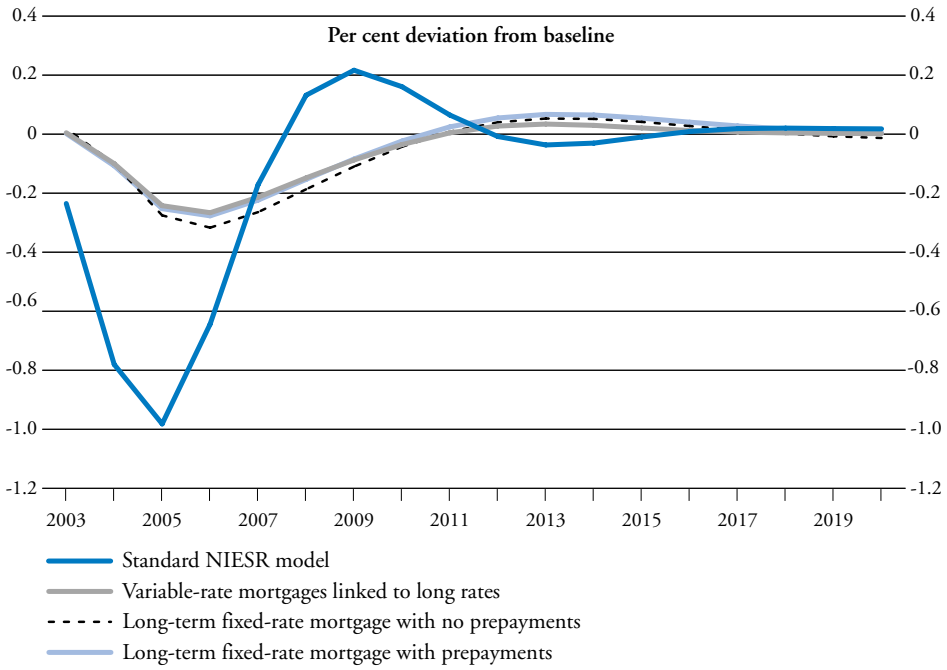
**Chart 6.26: The impact on GDP of a change in interest rates – NIESR Model**




*Source: National Institute of Economic and Social Research*

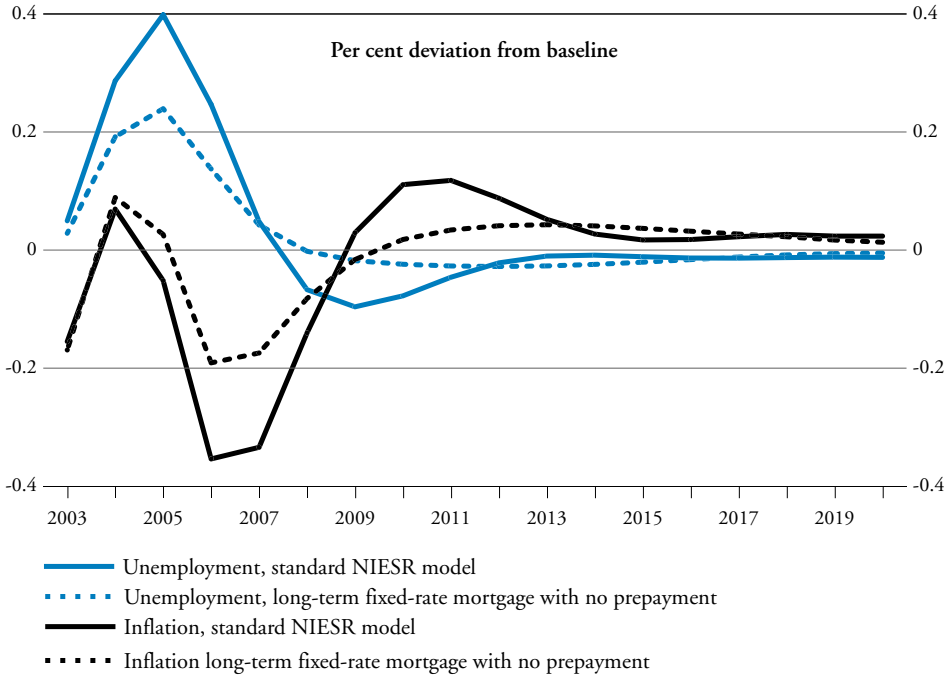
6.41 In the NIESR model, the three versions of a long rate system appear to have similar impacts on output. Over the first ten years after a change in short rates the root mean squared deviation of output from its baseline with any fixed-rate system is about 60 per cent of what it would be with variable-rate debt. Consumption effects are only about one third as large with a fixed-rate simulation. Under all three alternative fixed-rate simulations inflation and unemployment effects of changes in short rates would be about 60 per cent of that under the current system.

**Chart 6.27: The impact on consumption of a change in interest rates – NIESR model**




*Source: National Institute of Economic and Social Research*

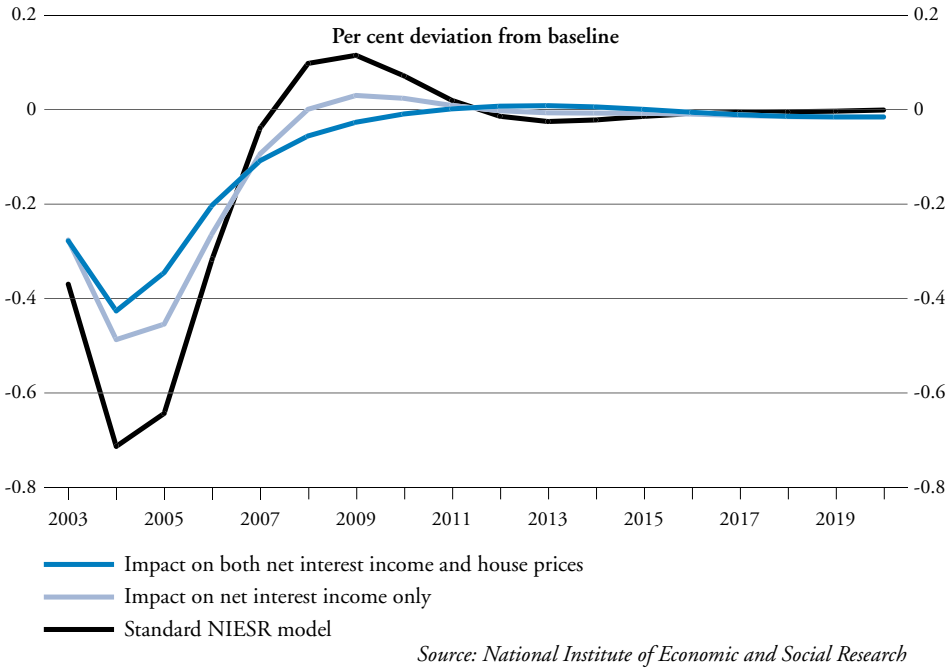
**Chart 6.28: The effect of a change in interest rates on unemployment and inflation – NIESR model**




*Source: National Institute of Economic and Social Research*

6.42 In the NIESR model it is possible to decompose the overall estimated change in the sensitivity of the economy to changes in short-term interest rates that would come about with fixed-rate mortgages into those caused by the change in net interest income and those caused by changes to the determinants of house prices. When only the net interest income equation is changed the impact upon the transmission mechanism is about half as great as when house price equations are also changed.

**Chart 6.29: Decomposing the impact of housing market changes on the transmission mechanism – NIESR model**




*Source: National Institute of Economic and Social Research*

6.43 NIESR undertook simulations to show how the response to a fiscal shock might be different with a mortgage market where interest rates are fixed. The simulations analysed the impact of an increase in government spending of 5 per cent. In all simulations a Taylor rule for the short-term interest rates was used. NIESR find that with fixed-rate, rather than variable-rate, mortgages aggregate consumption volatility would be about 6 per cent lower in response to the fiscal shock, and house prices would be 20 per cent less volatile.

## Conclusions from OEF and NIESR simulations

6.44 The main findings from the OEF and NIESR simulations suggest that the UK housing market has been a contributor to past volatility in the UK economy, and that moving to a world with much more fixed-rate lending would reduce the impact of a change in interest rates on key macroeconomic indicators; this is most marked with respect to house prices. This does not mean that the UK economy would *necessarily* be more stable with substantially more fixed-rate mortgages. That would depend on how monetary policy was then determined. This is an issue to which we return at the end of this section. Before doing so we consider one possible aggregate impact of more longer-term fixed-rate lending that is hard to assess with standard macroeconomic models. This is the potential effect upon the volatility of long-term interest rates.

## Impact of dynamic hedging on the volatility of long rates

6.45 More long-term fixed-rate lending would change the way households respond to shifts in short and long-term interest rates. A move to significantly more long-term fixed-rate mortgage lending may also have an impact on long bond yields. Given the size of mortgage debt in the UK, which is currently over twice the size of the outstanding stock of government debt, the scale of effects is potentially large. Greater issuance of long-term debt by lenders is likely to have an impact upon the shape of the yield curve. How large that effect might be depends on the sensitivity of the demand for long-term, fixed-rate instruments to changes in yields. There is a natural demand for longer-term fixed-rate debt from UK institutions; pension funds and life assurance companies have many longer-term fixed-income liabilities. But institutional investors are unlikely to want to take on pre-payment risk without hedging, so if long-term fixed-rate mortgages were to be financed with callable debt or pass through securities, the impact of the hedging that would be generated might be significant. Hedging pre-payment risk has the potential to increase the volatility of long rates. The scale of potential effects can be assessed by looking at the way pre-payment risk is hedged in the US and how it might have affected volatility there.

6.46 In the US the majority of long-term fixed-rate mortgages give borrowers the option to pre-pay without significant penalties. The resulting pre-payment risks are largely passed on to investors in mortgage-backed securities. As a result investors take on negative convexity – that is they hold positions in mortgage-backed securities or in callable bonds whose values do not rise in line with those of standard fixed-rate instruments when interest rates fall. There are many strategies to hedge the risk that fixed-rate mortgages will be prepaid in an environment where longer-term rates have fallen. Some strategies involve the purchase of interest rate options. Others aim to dynamically hedge. This involves lengthening the duration of other parts of an overall portfolio as falls in yields shorten the effective duration of holdings of mortgage-backed securities. Most hedging strategies have the potential to increase volatility in the price of long bonds because they would tend to increase the demand for duration in an environment of falling yields and reduce it in an environment of rising yields. When longer rates fall and bond prices rise hedging will tend to increase the demand for long duration assets, generating further price rises. The opposite happens when bond prices have fallen. Alternative strategies, such as changes to overall swap positions or adjustments of the duration of investors' liabilities, would ultimately have the same effect on the net demand for fixed income securities.

6.47 Perli and Sack (2003) assess the extent to which hedging of pre-payment risk has increased volatility of long rates in the US. They analysed ten-year swap rates. These are assumed to be driven by macroeconomic news, monetary policy developments and shifts in investors' preferences. Mortgage-related hedging activity is allowed to amplify the impact of these fundamental factors. The scale of the amplification factor is assumed to depend upon the duration and convexity of mortgage-backed securities and upon estimates of the amount of refinancing. The amplification factor, $\gamma$, is a linear function of one of these three alternative estimates which act as proxies of the amount of hedging of pre-payment risk.

$$\gamma = 1 + \beta X_t$$

6.48 The approach is complicated by endogeneity of variable $X_t$. This is influenced by the expected level of volatility and therefore the error term $\mu_t$. The lagged value of $X_t$ serves as an instrument in the following equation. The coefficient, $\beta$ captures the direct impact of MBS hedging on the level of volatility and as a scale term multiplying the error term ($\mu_t$).

$$\sigma^2\Delta_{r,t} = \alpha_0 + \alpha_0\beta X_{t-1} + \alpha_1\sigma^2\Delta_{r,t-1} + (1 + \beta X_{t-1})\mu_t$$

The left hand side in this equation is a measure of volatility in swap rates at time t (denoted $\sigma^2\Delta_r$).

6.49 The statistical relation between volatility and the scale of hedging of pre-payment risk was estimated using a sample of weekly data between 31 January 1997 and 23 May 2003 – a period of significant changes in long interest rates.

6.50 The results suggested that MBS hedging did, at times, significantly amplify movements in long rates, but only for short periods. Using the alternative measures of mortgage hedging resulted in amplification factors over the whole period since 1997 that averaged around 10 per cent. At times of significant re-mortgaging, the amplification was around twice as high.

6.51 The scale of the effects estimated by Perli and Sack is substantial. But for several reasons it is likely to be an upper limit on the long-run impact of a switch to more fixed-rate mortgage lending in the UK. First, most fixed-rate mortgages in the US remain 30-year mortgages with no redemption charges on pre-payment. UK fixed-rate mortgages are unlikely to have rates fixed for 30 years (the standard UK mortgage has a repayment period of 25 years) and might have redemption charges. Fixed-rate mortgages in the UK are also portable; US mortgages are not. This makes the likely amount of pre-payment in the UK lower. Over the period since 1997 Perli and Sack estimate that, on average, volatility at the long end of the US yield curve was about ten per cent higher because of hedging of pre-payment risk. The impact in the UK would probably be significantly lower even if fixed-rate mortgage lending became very much larger.

## IMPLICATIONS FOR MONETARY POLICY

6.52 It is clear that the monetary policy transmission mechanism would be different if a substantial proportion of mortgages in the UK were to have the interest rates fixed for ten or more years. The simulations reported above give some indication of the magnitude of the impact. The simulations are only a rough guide and various strong assumptions need to be valid in order for firm conclusions on the magnitudes of the effects to be drawn. But there are good reasons to draw some broad conclusions:

A. That with more fixed-rate mortgage lending the impact of a given change in short rates on house values and probably on consumption expenditure will be lower.

B. That with more fixed-rate mortgage lending a greater proportion of the overall impact of a change in short rates upon aggregate demand will stem from the effect on the cost of borrowing to companies and via induced impacts upon the exchange rate.

C. That the impact of a change in short rates will depend to a greater extent than now upon the induced impact upon longer-term bond yields.

6.53 It might appear that both B and C are in themselves undesirable because they make monetary policy less effective, even if that might be a price worth paying for greater stability in housing values and less variability and uncertainty in mortgage holders' spending power. But this is far from obvious. A situation where one of the main ways in which a cut in interest rates boosts demand is via its impact on house values and, partly as a result, on consumer spending can create problems. When the housing market is booming, consumer debt rising rapidly and the personal sector saving rate is very low while at the same time other sectors of the economy face falling demand and spare capacity it is *not* helpful to a central bank to have so much mortgage debt at variable rates. The Bank of England has faced a difficult situation for much of the past three years when the manufacturing sector has been weak while house price rises and mortgage borrowing have been exceptionally high. If a temporary cut in interest rates in the UK had its major effect on the economy because of a reduction in the cost of borrowing for companies and its impact on the exchange rate, and had limited effect on the housing market because longer rates would not change much, then it is at least plausible that interest rates in recent years in the UK would have been lower. Imbalances in the economy would have been reduced.

6.54 The evidence we have presented above suggests that house values in the UK seem more sensitive to shifts in the short rate than to shifts in longer-term rates. It is important to note once again that *if* this is true it is prima facie evidence that households pay relatively little attention to where interest rates will be moving. It is hard to believe that if this situation exists it is helpful to a central bank setting monetary policy.

6.55 The Bank of England is able to allow for the apparent unusual sensitivity in UK house values, and in mortgage lending, to short rates when setting monetary policy. If the UK were to adopt the euro the unusual sensitivity of the UK housing market to movements in short rates is a factor that the European Central Bank (ECB), in setting interest rates for the whole euro area, could attach only limited weight to. Just as the ECB could not attach great weight to the state of Irish house prices in the past few years it would, quite properly, not attach great weight to the state of the UK housing market. If a higher proportion of households were to take a more forward-looking approach to decisions about borrowing and the affordability of debt this would be less of a problem. Monetary policy would be easier to operate – this is so whether or not the UK adopted the euro.

## CONCLUSIONS

6.56 The impact of changes in interest rates on the economy would be different if a high proportion of mortgages were at rates fixed for 10 years or more. The impact of rate changes upon the housing market would be reduced. This is a two-edged sword. It reduces the impact of a given rate change on output, consumption and GDP. But situations where a change in rates would affect conditions in the housing market in a way that was undesirable, even though the knock-on effect upon overall demand in the economy might be helpful, would be less common. Reducing the sensitivity of conditions in the housing market to changes in the interest rates controlled by the central bank can bring advantages if the housing market is excessively sensitive to shifts in short-term rates. The microeconomic evidence presented earlier in this report suggests borrowers with variable-rate mortgages have a tendency to attach disproportionate weight to the level of repayments at current (short-term) interest rates. This is consistent with excess sensitivity in the housing market.

# 7 Conclusions

7.1 This Interim Report has sought to explain why there is so little mortgage lending in the UK that is at interest rates fixed for more than a small proportion of the maturity of the lending. It has analysed whether obstacles exist that might prevent a bigger market emerging in mortgages where rates are fixed for ten years or more – a market that might bring benefits to lenders, to borrowers and to those whose savings are channelled through the financial markets to homeowners. This report also considers some of the macroeconomic implications of there being more longer-term fixed-rate lending.

7.2 Some of the factors that explain why there is so little fixed-rate lending reflect wider problems in the UK financial system:

- A great many borrowers focus on the initial cost of debt and do not seem to consider carefully how those payments might change relative to their incomes, even though they will face debt repayments for many years.
- Many households seem to have a poor understanding of the risk characteristics of different financial products.

7.3 Some factors are more specific to the mortgage market:

- Cross-subsidisation in the pricing of mortgages has made mortgages where borrowers pay the same rate for several years *appear* expensive relative to the cost of discounted variable-rate deals and short-term fixed-rate mortgages.

These three factors combine in a way which leads households to make less forward-looking decisions than is desirable. What information people get about mortgages, their ability to understand it and the incentives of those that supply it are central to overcoming this problem.

7.4 These are significant factors behind the limited demand for longer-term fixed-rate mortgages. On the supply side there are also factors that might inhibit the emergence of thicker market in longer-term fixed-rate mortgages.

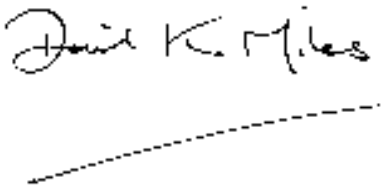
- The liquidity of sterling swap markets and in options on swaps is currently limited at horizons over 10 years;
- Buyers of mortgage backed securities that have embedded options that reflected the ability of borrowers to pre-pay fixed rate mortgages will find it hard to gauge the value of those options when data on pre-payments is limited;
- Building societies may run up against legislative limits if wholesale funding or securitisation of mortgages emerged as the most effective means to fund fixed-rate mortgages
- Some sorts of bonds used to finance mortgage lending in other countries may be harder for UK lenders to issue.
- Accounting rules may make lenders uncertain over how hedging of certain types of interest rate risk can be done in a way that avoids significant fluctuations in reported profits.

- Lenders may believe that certain types of redemption charges for pre-paying fixed-rate mortgages are effectively unenforceable. This may mean that the range of fixed-rate products offered to households is restricted and types of mortgage with desirable features not offered.

7.5 Some of these factors may prove to be temporary and some may simply reflect the initial environment where the amount of longer-term fixed-rate lending is small. But some reflect real obstacles.

7.6 Removing obstacles to the emergence of a larger market in longer-term fixed-rate mortgages is not easy but it is certainly desirable. The mortgage market would work better. This would also have desirable macroeconomic effects. The UK housing market has been volatile. That volatility has reflected, but also contributed to, volatility in the wider economy. Evidence on the modelling of house prices in the UK and in other countries suggests that there is a tendency for UK households to focus on the current cost of variable-rate mortgages as an indicator of the affordability of housing. This is likely to be a source of instability. It is likely to make the task of operating monetary policy harder.

7.7 None of this means that the housing finance system in the UK is fundamentally flawed. There are great strengths in the UK housing finance system – lenders compete in a market where innovation in products has been impressive; loans are available to a high proportion of the population; homeownership has risen steadily for decades and has risen greatly amongst households at the lower end of the income distribution. But to consider the evidence in this Interim Report and conclude that the UK housing finance system could not be improved would be strange – it would reflect a degree of complacency that I do not believe is widespread. Improvements can be made. It is with that goal in mind that I will make recommendations in my Final Report, in time for the next Budget.



David Miles
December 2003

# A Consultation list

Our thanks to all the organisations and individuals consulted so far.

Abbey National Group
John Arrowsmith, FCO
Asset and Liabilities Management Association
Association of Danish Mortgage Banks
Association of Independent Financial Advisers
Association of Mortgage Intermediaries
Jane Ball, Sheffield University
Bank of England
Banquo Management Limited
Barclays
Barclays Capital
Bear Stearns
Board of Governors of the Federal Reserve System
Mark Boleat
Britannia Building Society
Building Societies Association
Professor John Campbell, Harvard University
John Charcol Ltd.
Charles River Associates
Cheltenham & Gloucester
Citadel Investment Group
Debt Management Office
US Congress Committee on Financial Services
US Congressional Research Service
Consumers' Association
Council of Mortgage Lenders
Countrywide Plc.
Credit Suisse First Boston
Danica Pension
Danish National Bank
Danske Bank
US Department of Housing & Urban Development
Deutsche Bank AG London
Deutsche Bundesbank
Dresdner Kleinwort Wasserstein
Egg Banking plc
Dr. Don Eggington
Euro Hypo AG
European Central Bank

European Commission
European Mortgage Federation
European Mortgage Finance Agency Project
FannieMae
Finance Development Centre Limited
Financial Ombudsman Service
Financial Services Authority
Fitch Ratings Ltd.
Freddie Mac
GMAC-RFC Limited
Goldman, Sachs & Co
HBOS Plc.
Hewitt Bacon & Woodrow
HM Treasury
The Housing Corporation
International Accounting Standards Board
Professor John Kay
Leeds & Holbeck Building Society
Lehman Bros
Lloyds Bank Plc.
M&G Investment Management Limited
Mckinsey's
Kevin McMillan, Counsel, US House of Representatives
Professor Geoffrey Meen
Merrill Lynch International
Moody's Investors Service
Mortgage Bankers Association of America
Mortgage Strategy
Professor John Muellbauer, Oxford University
Paul Munin, Prime Lending
Nationale Hypotheek Garantie (Dutch Mortgage Guarantee Fund)
National Institute of Economic and Social Research
Nationwide Building Society
Northern Rock
Norwich Union Personal Finance
Nykredit Bank
Office of Fair Trading
Oxford Economic Forecasting
PMI Group, Inc.
PricewaterhouseCoopers LLP
Prime Minister's Office
Prudential
Realkreditradet Danmark (Association of Danish Mortgage Banks)
Nick Retsinas, Harvard's Joint Center for Housing Studies
N M Rothschild & Sons
Royal Bank of Scotland Group

Dr. Frank Skinner, University of Reading
Standard Life Bank
Standards & Poor's
Tillinghast-Towers Perrin
Mark Tinker, Execution Limited
Moody's
UBS AG
UK Accounting Standards Board
US Department of Housing and Urban Development
Woolwich

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