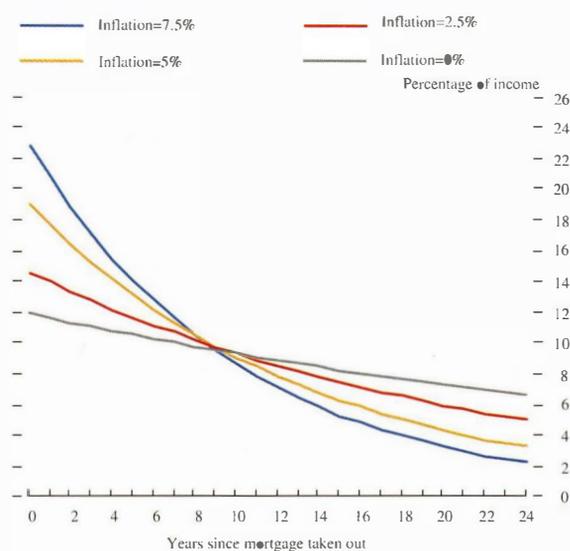


The risk with fixed nominal rate contracts is that inflation may be lower than expected and the real value of payments correspondingly higher. So, if short rates move closely in line with price inflation and future prices are uncertain, the real net present value of total interest and capital payments is likely to be more volatile on fixed-rate debt than on variable-rate debt. By contrast, the time-profile of servicing payments is likely to be more volatile with adjustable-rate debt. If inflation is high when a variable-rate debt contract is written, but is expected to fall, the real value of debt repayments is initially high and tails off in the future. A more rapid decline in inflation than anticipated, and a corresponding fall in short-term nominal interest rates, would unexpectedly delay real repayments. The opposite phenomenon—in which unexpected increases in inflation and nominal interest rates bring forward the burden of debt payments—is known as front-end loading.

Charts 1 to 4 illustrate the different risks involved with fixed and variable-rate debt contracts and show how the real burden of debt servicing varies for each type of contract. They show the ratio of debt-servicing payments to the borrower's income over the life of a variable and fixed-rate debt contract, and illustrate how these ratios respond to unanticipated changes in inflation or real interest rates. For both variable and fixed-rate debt contracts, we assume that interest and capital are repaid over a fixed horizon. With a variable-rate contract, the interest charged on the outstanding balance of the debt in any period will depend on the prevailing nominal short-term interest rate. For the fixed-rate contract, the level of payments in nominal terms is known in advance and is not affected by changes in nominal short-term interest rates. We consider amortised loans: that is, loans where the capital is repaid gradually over the term of the contract. In order for payments to be smooth (at least in nominal terms), this implies that interest will take up a large proportion of payments in the early years of the contract and capital payments a large proportion at the end. (Much mortgage lending in the United Kingdom has been of this type.) The annex on page 45 describes precisely how the debt-servicing burden is calculated.

Chart 1 shows the path of the debt-servicing ratio—the ratio of payments in each period to income in that period—for various steady rates of inflation, with a variable-rate debt contract. We assume that short-term real interest rates are constant, so that the nominal interest rate is equal to the real rate (which we take to be 2.5%) plus an inflation adjustment, and that real income grows in line with the real interest rate. To express the debt service burden we assume that an initial loan is made to finance the purchase of a durable asset. We use a ratio of the asset price to income of 2.5, a loan-to-value ratio of 0.9 and a loan maturity of 25 years—figures which are typical for a young, first-time homebuyer in the United Kingdom, but which could also be relevant for a company making a large, highly geared investment in a durable asset. These figures imply that the loan-to-income ratio at the time of purchase is 2.25 (which is close to the ratio of average advance to average house price for first-time homebuyers).

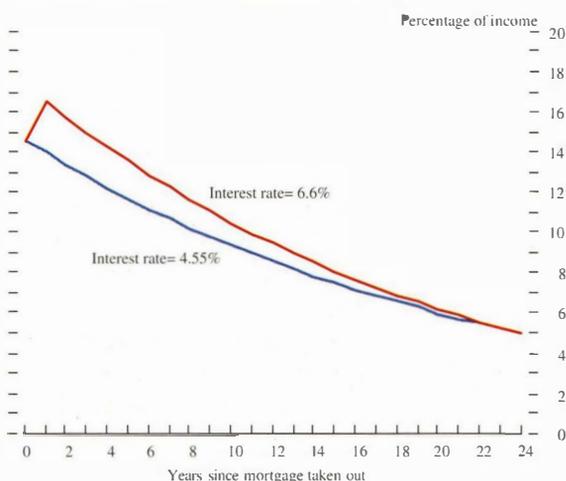
Chart 1
Debt-servicing burden for various steady inflation rates, with variable-rate loan



The chart shows that at zero inflation, loan payments initially take up around 12% of income; this falls to 10% by year six as real income grows. When inflation is low, but above zero, the impact on the servicing ratio is still significant: with prices rising at 2% a year, the initial repayments are over 14.5% of income and only fall to 10% by year nine. At 5% inflation, the initial burden of servicing debt is 19%; but by year ten the combination of inflation and real income growth reduces the ratio by half. When consumer price inflation is 7.5%, debt payments take almost 23% of initial income; the front-end loading of payments is now severe, and by year eight payments are down to around 10% of income, while by year 15 payments account for only 5% of income.

Chart 2 shows the impact on the debt service burden of a change in the short-term *real* interest rate, from 2.5% to 4.5%, one year after a variable-rate loan is taken out. We assume that inflation has been running at 2% and that the

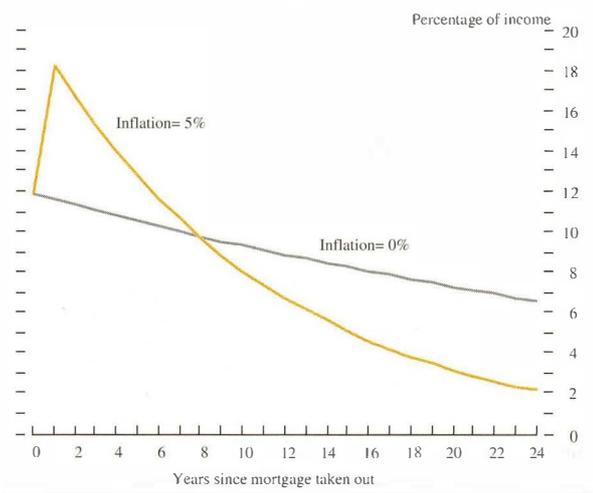
Chart 2
Increase in interest rate in year one (inflation constant), with variable-rate loan



loan-to-value ratios are as before. Notice that as time passes the servicing burdens approach each other, since the interest element in payments falls to zero as the loan approaches maturity. But at the time of the change in interest rates, debt-servicing payments on a variable-rate debt jump from 14% of income to almost 17%.

Chart 1 shows that higher steady inflation increases front-end loading on variable-rate debt. But it is also important to see what would be the effect of a *jump* in inflation from, say, 0% to 5%, and a rise in nominal interest rates sufficient to keep real rates constant. Chart 3 shows what happens to the debt-servicing ratio with variable-rate

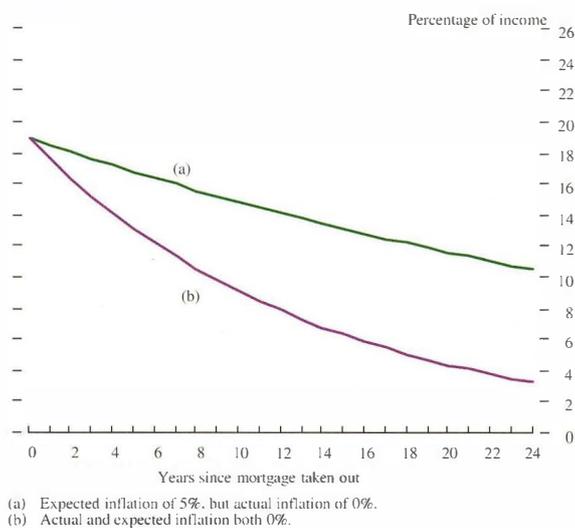
Chart 3
A rise in inflation in year one, with variable-rate loan



loans after a 5% rise in inflation and nominal interest rates one year into a loan contract. With no inflation, the debt repayment would have been 11.5% of income after one year. If inflation and nominal interest rates jump at that point, the burden rises to over 18%. Eight years later, the burden along the high inflation path is lower than it would have been with constant prices.

Charts 2 and 3 show that the burden of payments with variable-rate contracts is sensitive to changes in the nominal rate of interest stemming either from real rate rises (Chart 2) or from changes in price inflation (Chart 3). Although nominal interest rate changes *per se* cannot alter the debt-servicing burden on fixed-rate debt, unanticipated changes in inflation *will*. The danger with fixed-rate debt is that inflation may turn out lower than expected. Chart 4 shows the debt-service burden when inflation had been running at 5%, and had been expected to continue at that level, but falls to 0% one year into the loan contract. The nominal interest rate on fixed debt is assumed to be high enough to generate an annual real rate of 2.5% over the life of the loan, assuming constant, 5% price rises. When inflation falls to 0%, there is no immediate increase in the real burden of debt repayments, but the burden rises as time passes. Nine years into the loan, the servicing burden would have been 10% at steady 5% inflation; at zero inflation, interest payments would constitute 15% of income.

Chart 4
Falling inflation with fixed-rate loan



Charts 3 and 4 reveal the important and distinct risks of variable and fixed-rate contracts. Chart 3 shows how, with variable-rate debt, a sharp rise in inflation and nominal interest rates causes a step jump in the real burden of repayments; but real debt payments later in the life of the contract become lower. Although there is no change in the overall real value of debt servicing, there is a significant shift forward in the time-profile of repayments. Chart 4 shows that an analogous risk for a fixed-rate borrower—a 5% unanticipated *fall* in inflation—changes the overall real burden of debt repayments but has no *immediate* impact on the real servicing cost. By contrast, unexpected changes in short-term real interest rates at unchanged inflation raise the overall burden of payments on variable-rate debt but leave real payments on fixed-rate debt unchanged.

(c) The risks to households and companies

Whether one type of contract is more or less risky than another will depend on the specific characteristics of the borrower. The most important factors include:

- the extent to which unanticipated changes in the *total*, real value of interest and capital payments covary with unanticipated changes in the borrower's income (or profits); and
- how well borrowers are able to cope with unanticipated changes in the time-profile of payments.

Households and companies are likely to respond differently to the kinds of risks illustrated in the charts. If many companies do not expect their future ability to borrow to be restricted (they may, for instance, have access to overdraft facilities), they are likely to be less concerned with the risk of unanticipated shifts in the time-profile of real repayments⁵. For such companies, cash flow problems could be handled by borrowing more, so spreading the burden of repayments more evenly. These companies would be more concerned about unpredictable changes in the real value of the total repayments. For this reason, one might expect variable-rate

borrowing to be more attractive to the corporate sector, at least if most of the fluctuation in short-term nominal interest rates reflects variability in price increases rather than volatility in short-term real rates.

By contrast, borrowing constraints are more likely to be a problem for households, who may have borrowed heavily to finance a particular acquisition (a house or car) and are unlikely to be able to borrow much more on the basis of existing collateral. For people in this position, the risk of unanticipated changes in the time-profile of real debt payments may be more important than uncertainty about the total present value of all debt repayments.

A second factor which differentiates households from corporate borrowers is the extent to which the relevant income streams covary with (or are linked to) unanticipated changes in the value of debt repayments. Corporations have many more ways of financing expenditure from external sources than do households; most obviously, they can issue equity—but they can also use derivatives (options, futures and swaps) to offset interest rate risk. This greater flexibility is likely to mean that larger companies are more willing to take on debt with volatile repayment obligations. The fact that corporations are owned by investors who may hold diversified portfolios also means that the willingness of an individual company to take risks may be greater than for any one household.

A third factor which separates companies from households is the different types of assets they acquire. In the United Kingdom, most household borrowing is to finance house purchase. Although companies borrow to finance long-term investment, they also borrow to finance working capital requirements: overdraft finance may be used to handle cash flow shocks and will often not be collateralised against fixed assets. These differences in the maturity of the assets acquired with debt may influence the preferences of borrowers for fixed-rate as against floating-rate debt. But they will also affect the willingness of lenders—banks, building societies and buyers of corporate debt—to provide long-term funds.

(d) *The supply of fixed and variable-rate finance*

The terms on which lenders—either the ultimate providers of funds or the financial intermediaries through which their savings are channelled—are prepared to offer loans also depend on the degree of uncertainty over future inflation and short-term interest rates, and on the nature of their commitments and other sources of income. Deposit-taking financial intermediaries have three main ways of funding loans:

- they may choose to match the interest rate structure of liabilities to assets, funding fixed-rate lending by borrowing at fixed rate and at the same maturity;
- they may handle a mismatch in the structure of interest rates on assets and liabilities by swapping the flow of interest payments on their liabilities (or assets) into a

stream of payments which matches the interest income on their assets (or liabilities). This technique depends on a corresponding demand for a reverse swap from some counterparty. Interest rate mismatch could also be hedged by holding options, though once again there must be a counterparty willing to write the option; and, lastly,

- the intermediary may accept interest rate risk—as would occur if fixed-rate loans were financed by accepting variable-rate deposits. In this case, the initial spread between the fixed rate charged on loans and the expected, average cost of deposits (or wholesale funds) over the life of the debt would need to compensate for the risk of adverse changes in short rates.

Households are very unlikely to be able to enter into swap agreements or to want to hold hedging portfolios of options on bonds. So, if fixed-rate funds are provided directly by persons—through purchasing corporate bonds for example—then they must be prepared to hold assets with fixed returns. The value of such securities will fluctuate with unexpected changes in short-term, nominal interest rates. And the terms on which households would be prepared to hold such securities would depend on the volatility of short rates, the degree of uncertainty over price inflation and the horizon over which people expect to invest their funds. If households place a high value on liquidity *and* capital certainty, they are unlikely to be willing to switch a substantial proportion of their savings from variable-rate deposits to fixed-rate securities, unless the relative return on such securities were to rise substantially.

Ultimately, the cost of fixed-rate funds will depend on how willing savers (somewhere) are to accept securities or deposit contracts offering fixed returns. In section V we consider the supply of fixed-rate saving in more detail. In the next two sections we analyse the structure of debt in the United Kingdom and other developed economies.

III The composition of corporate and household debt in the United Kingdom

There are severe practical and conceptual problems in producing a summary measure of how much household or company debt in the United Kingdom is at variable rate. First, there is no clear dividing line between variable and fixed-rate contracts: interest rates are fixed for different periods and to varying degrees. Second, data on the degree of variability in the interest rates charged on debt are patchy, particularly on corporate debt. And third, the degree of variability in the interest rates on debt held by agents may be misleading as an indicator of their exposure to changes in nominal interest rates. The possibility of swap agreements, under which the interest payment obligations of two agents are transferred, means that some borrowers with variable-rate debt may effectively pay at fixed rates (and vice versa). This makes analysis of the interest rate exposure of the corporate sector particularly difficult.

Despite these problems, published sources can tell us something about the debt of the household and corporate sectors. Tables A and B reveal features of UK company borrowing. Table A, based on responses by seven large UK banks responsible for a high proportion of debt finance to smaller companies,⁽¹⁾ shows that most debt granted to small firms is at rates related to base rate. Only 15% of loans are at rates fixed for significant periods. Since small firms are less likely to be able to swap floating for fixed-rate debt, and are also unlikely to be able to issue fixed-rate bonds, it is likely that the impression given by the figures is reliable: small companies overwhelmingly borrow at variable rates of interest that are likely to respond quickly to changes in official rates.

Table A
Bank lending to small firms^(a)

£ billions: percentages in italics

	June 1991		November 1992	
Base rate related	37.2	83	35.1	80
Managed-rate	1.8	4	2.2	5
Fixed-rate	6.0	13	6.3	15

(a) Firms with turnover of less than £10 million.

Data on the proportion of all corporate debt that is at adjustable rates are less easy to obtain. For the UK banks which operate in the United States, there is a requirement to report the proportion of all loans (to persons *and* corporates) that is fixed-rate. For Barclays, National Westminster and Midland, variable-rate lending (ie loans where the interest rate can be changed within one year) made up between 80% and 90% of total UK lending at the end of 1992. If these figures are typical of bank lending to the UK private sector, it would seem that most bank lending to companies is at variable rates of interest. (Even if one assumed that *all* fixed-rate bank lending is to the corporate sector, it would still be true that the great majority of corporate bank loans are at variable rates.)

Most corporate bonds, however, offer fixed coupons. So the proportion of overall corporate debt at fixed rates is significantly higher than the proportion of bank debt at fixed rates. Table B shows the structure of UK industrial and

Table B
Liabilities of industrial and commercial companies: debentures and loan stock and sterling bank lending

£ millions

	Debenture and loan stock	£ bank lending	Share of debenture and loan stock <i>1/(1+2)</i>
	1	2	
1980	5,354	28,406	15.9
1981	4,740	31,412	13.1
1982	4,296	39,651	9.7
1983	5,008	41,721	10.7
1984	6,116	47,092	11.4
1985	11,125	53,623	17.0
1986	24,446	59,191	28.5
1987	30,545	68,068	31.0
1988	40,418	89,300	31.1
1989	49,287	116,329	29.8
1990	63,648	138,926	31.4
1991	71,141	144,254	33.0
1992	74,012	141,712	34.3

Source: Central Statistical Office, Table 14.7, *Financial Statistics*.

commercial companies' debt liabilities, and reveals that the proportion of total debt accounted for by corporate securities rose over the 1980s and now represents about one third of total corporate debt.

These figures imply that, whereas smaller companies rely heavily on variable-rate debt, fixed-rate finance is of major importance for the corporate sector as a whole: around 40% of all corporate debt is now likely to be at rates of interest which are not closely linked to short-term market rates. That proportion got bigger over the 1980s, and reflects the increasing importance of issues of fixed-rate corporate debt. But the exposure of the corporate sector to variations in short-term rates may be higher than the figures suggest, because some of the payments on fixed-rate debt have been swapped.

Table C
The take-up of fixed-rate mortgages in the United Kingdom

	Variable-rate	Rate fixed for up to one year	Rate fixed for more than one year
	1992 Q2	79	5
1992 Q3	77	4	19
1992 Q4	70	7	23
1993 Q1	65	6	29
1993 Q2	54	6	40
1993 Q3	40	10	50

Source: *Housing Finance*.

For the United Kingdom, as for most developed countries, mortgages are by far the most important type of personal sector debt. In the middle of 1993, loans for house purchase accounted for over 75% of the total bank and building society lending and hire purchase loans extended to the personal sector. In the 1970s and 1980s, variable-rate mortgages were the dominant form of debt contract, so that the great majority of existing mortgages—and nearly all the other components of the debt of the personal sector—are now at adjustable rates. These rates move (though often with a lag) in response to changes in official rates. Since 1990, however, an increasing proportion of new lending—to new buyers and existing homeowners—has been at rates that are fixed for up to five years (and in rare cases for longer periods). Table C shows that in the third quarter of 1993, 50% of mortgages granted by banks and building societies had rates fixed for at least one year.

IV International comparisons

As in the United Kingdom, in most other developed countries there are significant differences in the composition of the debts of the corporate and household sectors. The corporate sector has a wider range of types of debt instrument, primarily because at least the larger companies are able to issue debt securities directly, an option not open to individuals. Table D brings together information from a wide range of sources on the structure of corporate debt.

(1) Source: *Bank of England Quarterly Bulletin*, February 1993.

Table D
The structure of corporate debt

Germany:	Approximately 84% of funds borrowed by western German corporations in 1992 were bank loans. Of these, over a third were short-term loans. Of the bank debt which was not explicitly identified as short-term, the Bundesbank estimates that around two thirds is extended at rates which are orientated to medium or long-term capital market rates. These estimates suggest that the proportion of corporate debt that is at fixed rates may be slightly over 50%.
France:	The Bank of France estimates that around 40% of the gross indebtedness of French corporations (excluding equities) is at long-term or fixed rates. About 30% is at fixed rates and about 10%, including bonds, is indexed on long-term rates and so not directly sensitive to variations in official rates.
Sweden:	Around 60%–65% of private enterprise debt is at fixed interest rates, much of it fixed for five years.
Austria:	It is estimated that about one third of the direct credits granted by Austrian banks to private non-banks are credits on a fixed-term basis; two thirds are dependent (though often with a significant lag) on indicator rates (usually money-market rates but sometimes the central bank discount rate).
United States:	National accounts data show that of the total non-financial corporate sector debt outstanding, around one third is corporate bonds (most of which pay at fixed rate) and perhaps 20% is mortgage debt (the majority of which is also fixed-rate). Bank loans, commercial paper and finance company loans account for about 30% of debt; the majority of this is at variable rate. Radecki and Reinhart (1993) estimate that about 30% of total debt owed by the non-financial sector (corporates and households) would reflect a higher level of short-term interest rates within a year.
Spain:	The Bank of Spain estimates that in 1992 just over 70% of the credit extended to the private sector was at fixed rate.
Japan:	The balance sheets of Japanese banks reveal that in 1992 around 70% of all loans charged interest at rates linked to short-term money-market rates. Fixed-rate loans (excluding mortgages) accounted for around 15% of all loans. Corporate bonds represent a significant part of the debt liabilities of the corporate sector; and a high proportion of these pay fixed interest. The fraction of total corporate debt that is at variable rate may be around 50%.
The Netherlands:	In 1992, around 25% of bank loans to the corporate sector had an original maturity of less than two years; the rates on these loans move in line with money-market rates. Long-term loans are the dominant source of debt held by corporates; the interest rates on these loans are based on long-term bond yields and are generally fixed for extended periods (eg five years).
Italy:	Of the total debt of the Italian corporate sector in 1992, over 60% was short-term. Even assuming that medium and long-term bonds all pay fixed rates of interest, and that the interest rate on most existing medium and long-term bank debt is not responsive to movements in short rates, at least two thirds of corporate debt is at variable rate.
Australia:	Around two thirds of bank loans to businesses are made at variable rates. Fixed-rate bank loans generally have the interest rate fixed for a period of between three and five years. Most firms do not have access to securities markets to issue long-term, fixed-rate bonds.
Canada:	In 1992, about 60% of all forms of credit to the non-financial corporate sector were at variable rates of interest (Table E2, Bank of Canada Review).

Source: Papers presented at a Bank of International Settlements (BIS) meeting, November 1993, by the Deutsche Bundesbank, the Bank of France, the Bank of Sweden, the Austrian National Bank (Pech, H), the US Federal Reserve Bank (Radecki, R and Reinhart, V), the Bank of Spain (Estrada, A, Sastre, T and Beja, T), the Bank of Japan (Okina, K and Sakuraba, C), De Nederlandsche Bank (Mallekoote, P and Moonen, R), the Bank of Italy (Buttiglione, L and Ferri, G), the Bank of Canada (Cliston, K) and the Reserve Bank of Australia (Lowe, P).

What emerges from the table is that variable-rate debt is significant for the corporate sectors of most developed countries. In the United States, Germany and France, variable-rate debt accounts for between 30% and 50% of total debt; in Italy and Japan, the proportion of variable-rate debt may be even higher. In terms of reliance on variable-rate debt, the UK corporate sector remains at the higher end of the range. But the overall dependence of UK companies on debt relative to equity is comparatively low. Table E shows that in 1990 (a year when UK nominal interest rates were relatively high) gross interest payments by the UK corporate sector were significantly lower, in relation to income, than in other EU countries.

Table E
Corporate sector interest payments (percentage of income)

Per cent	1979	1990
Belgium	54	44
France	38	33
Germany	23	26
Italy	45	31
The Netherlands	34	30
Spain	..	24
Portugal	69	52
United Kingdom	13	24

.. not available.

The story is very different for the personal sector. Both the quantity of debt held by the personal sector in the United Kingdom (relative to income) and the proportion that is at variable rate is substantially higher than in other developed economies. Table F shows that in 1990 personal sector interest payments made in the United Kingdom were around three times higher than in other European countries, a

Table F
Personal sector interest payments (percentage of income)

Per cent	1979	1990
Belgium	2.2	2.4
France	2.3	3.7
Germany	1.9	3.2
Ireland	1.5	2.2
Italy	4.6	4.0
The Netherlands	2.4	3.6
Spain	3.5	4.2
Portugal	3.7	2.6
United Kingdom	4.0	10.9

statistic which reflects the dramatic increase in United Kingdom household debt in the 1980s. For all these countries, and also for Japan and North America, mortgages are the most important component of total household debt. Table G (on page 41) summarises information on the kinds of mortgage contracts offered in the major economies. With the exception of the United Kingdom, fixed-rate mortgages are the dominant mortgage contract. In the United States, most mortgage contracts still have the interest rate fixed for the full period of the loan (often 30 years). In Germany and France, rates are generally fixed for between five and fifteen years. Only in Japan, where volatility in nominal rates of interest has been low, are interest rates on existing mortgage

debt reviewed at frequent intervals, and even these are adjusted in line with changes in longer-term interest rates.

V The future of debt contracts in the United Kingdom

These comparisons of debt contracts across the major economies show that the corporate sector in the United Kingdom is not unusual in relying heavily on variable-rate debt. Furthermore, fixed-rate debt instruments comprise a significant proportion (at least one third) of United Kingdom corporate debt. But the United Kingdom is distinct from other developed countries in the predominance of variable-rate debt in the liabilities of the personal sector, and in the size of households' gross debt liabilities relative to income. Mortgages are the most important element of the debt liabilities of the household sector in nearly all countries; but in all the major countries bar the United Kingdom the major part of that debt is at rates of interest fixed for substantial periods.

The type of debt contracts most commonly issued in the United Kingdom has made mortgagors vulnerable to dramatic and hard-to-predict variability in the proportion of income that needs to be used to meet payment obligations. Unanticipated increases in nominal interest rates, as the result of an unexpected pick-up in inflation, can generate serious front-end loading problems for homeowners who are at the limit of their borrowing. The most crippling combination of events for recent buyers is an increase in inflation—which makes the front-end loading problem serious—which prompts the monetary authorities to raise *real* interest rates to counter the inflationary pressure. Chart 5 is based on the same assumptions about loan-to-value ratios and real income growth as used in Charts 1–4. It shows what happens to the servicing ratio of a household one year into homeownership when a jump in the rate of inflation from 0% to 5% causes the authorities to raise the nominal rate of interest by an amount sufficient to increase the short-term real rate from 2.5% to 4.5%. The chart assumes that the increase in the real interest rate is

Chart 5
Rising inflation and real rates in year one, with variable-rate loan

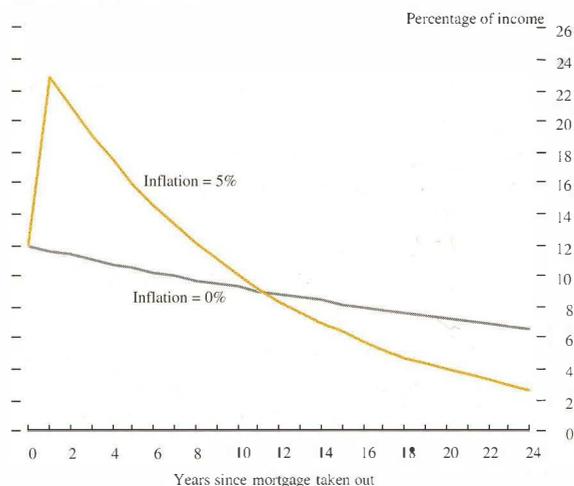


Table G
Mortgage contracts in the major economies

United Kingdom:	The overwhelming majority of existing mortgages is at variable rate. The ratio of households' mortgage debt to GDP is currently just under 60%.
France:	Loans are predominantly at fixed rate, usually available for between 15 and 20 years. Some variable-rate mortgages are used, often with caps on the increase in interest rates possible. The mortgage debt to GDP ratio in 1992 was around 22%.
Sweden:	Only between 8% and 10% of mortgage lending is at variable rate. Fixed-rate loans are mainly financed by issues of securities by lenders.
Germany:	Most loans are at rates fixed for 5 to 10 years and are funded by long-term fixed-rate savings or by the issue of fixed-rate bonds. The ratio of secured, residential mortgage debt to GDP was around 25% in 1990. (Total residential debt to GDP was between 35% and 40%.)
Canada:	The most common mortgage instrument has a fixed interest rate for a term of between one and five years.
United States:	74% of mortgages are at fixed rates; rates are often fixed for the life of the mortgage (often 30 years). The ratio of household's mortgage debt to GDP at the end of 1993 was around 45%.
Australia:	The overwhelming majority of existing mortgages are at a variable rate. However, changes in interest rates frequently lead to a change in the term to maturity of existing loans, rather than a change in payments. Fixed-rate mortgages (up to five years) were introduced in 1989.
Denmark:	Most loans are at fixed rate for an original maturity of between 20 and 30 years. The residential mortgage debt to GDP ratio was 44% in 1990.
The Netherlands:	Nearly all household sector borrowing is in the form of long-term loans with fixed rates.
Japan:	Most lending is at reviewable rates, but these are related to the long-term prime rate. The housing loan corporation, which accounts for about 40% of loans, reviews rates twice a year and has a cap on rates which is currently 5.5%. The ratio of mortgage debt to GDP in 1989 was 25%.
Italy:	Italian households make comparatively little use of mortgage debt to finance house purchase (the ratio of mortgage debt to GDP (in 1986) was only 7%). Around a half of mortgages are at variable rates.

Sources: 'Housing finance—an international perspective', *Bank of England Quarterly Bulletin*, 1991; 'Housing finance in developed economies', special edition of the *Journal of Housing Research*, vol 3, no 1, 1992; 'The decline of special circuits in developed country housing finance', Diamond, D and Lea, M (1992), *Housing Policy Debate*. Other information is from sources referenced in Table D.

slow to affect actual inflation, which remains at 5%; in fact, the initial impact on the debt burden will be as shown, even if inflation is quick to respond to the tightening of monetary policy. The chart shows how dramatic that initial impact is: the servicing ratio doubles from 11.5% to around 23%.

This simulation shows one of the implications of using short-term interest rates as the counterinflationary policy instrument in an economy where house purchases (especially for new owner-occupiers) are financed largely on credit, the servicing costs of which vary with nominal rates of interest. But the extent of variable-rate debt in the United Kingdom means that interest rate changes affect personal disposable incomes quickly and significantly, so the increases in rates

needed to reduce demand may be lower than in other countries. Debt is not, however, evenly distributed and the impact of rate changes falls particularly heavily on recent homebuyers.

Events in the United Kingdom between the late 1980s and the early 1990s illustrate the problem (Table H). Between 1986 and 1987, consumer prices rose on average at an annual rate of slightly under 3.7% and short-term nominal interest rates fell to 7.5% by the middle of 1988. In 1988 consumer prices rose by over 5% and in 1989 by over 6%. As it became clearer that inflation was increasing, short-term nominal interest rates were raised, and by much more than the rise in inflation, to put downward pressure on prices.

Table H
Inflation and interest rates in the United Kingdom

Per cent

	Consumer price inflation	Interest rates	Change in house prices
1984	4.1	9.6	8.5
1985	5.1	11.5	8.6
1986	3.4	11.0	13.4
1987	3.9	8.5	15.4
1988	5.1	13.0	34.2
1989	6.1	15.0	4.9
1990	9.3	14.0	0.3
1991	5.6	10.5	-2.5
1992	3.7	7.0	-8.0

Notes: Inflation is the percentage change in the retail price index excluding mortgage interest payments (fourth quarter on fourth quarter); the interest rate is the base rate of selected retail banks at the year-end; house price inflation is the change in the Halifax House Price Index (fourth quarter on fourth quarter).

Source: Economic Trends 1993.

Base lending rates—which are tied to the short-term money-market rates most closely controlled by the Bank of England—rose from 7.5% in May 1988 to 15% by October 1989. Mortgage rates followed. Consumer price inflation was slow to respond: indeed, inflation increased to more than 9% in 1990. But the *level of nominal* house prices was flat in 1990 and in 1991 fell by 2.5%; in 1992 average house prices fell by 8.0%. House price falls were most dramatic in those regions—the South East and East Anglia—where prices had been highest and where first-time buyers had needed to borrow most to enter owner-occupation.

The increasing use of mortgages at rates which are fixed (albeit for relatively short periods) is a natural response to the problems of front-end loading experienced by many homeowners in the early 1990s. Whether this move towards fixed-rate funding continues will depend on:

- how averse the personal sector is to unanticipated increases in the immediate burden of nominal debt repayments;
- how great is the perceived uncertainty over the future course of short-term nominal rates; and
- at what price financial intermediaries will find it attractive to offer debt contracts with rates fixed for several years.

The first two factors are hard to measure and are likely to change significantly in response to events. If nominal money-market rates remain stable for an extended period, the *demand* for long-term fixed-rate debt by the personal sector might evaporate; a period of interest rate volatility would have the opposite effect. The forces governing the *supply* side of the market are also related to interest rate variability. The risk of financing fixed-rate mortgages by continuing to rely on funds which pay interest at variable rates depends on the unpredictability of short-term interest rates. It is, of course, unrealistic to assume that lenders should choose to continue financing mortgages by issuing variable-rate liabilities if the interest on the assets were fixed; the fact that banks and building societies in the

United Kingdom currently issue predominantly variable-rate debt is a reflection of the nature of their current asset structure.

Clearly, interest rate risk can be avoided if lenders issue liabilities with the same duration as their assets.⁽¹⁾ This would imply that lenders issue long-term, fixed-rate instruments to finance fixed-rate mortgages. In the United Kingdom, this would mean a fundamental change in the nature of the balance sheets of banks and building societies. In the past they have relied for the majority of their funds on retail deposits, gathered through an extensive branch network, most of which paid interest at a variable rate that moved closely with the mortgage rate; a high proportion of the wholesale funds raised by these institutions has also been at short-term, money-market rates.

The counterpart to the variable-rate liabilities issued by deposit-takers to finance their loans are liquid, variable-rate assets held, in the main, directly by the personal sector. At the beginning of 1993, around a quarter of the financial assets of the personal sector were deposits with banks and building societies. If a large proportion of those funds were to become long-term and fixed-rate, the portfolio of the personal sector would look very different; in effect, either direct or indirect holdings of long-term bonds, which would be comparable to government bonds (gilts), would have to rise dramatically. Whether or not the cost of funds to lenders—and therefore the cost of mortgages—would have to rise would depend on:

- how willing the personal sector might be to switch a substantial proportion of its wealth to less liquid, fixed-interest assets;
- how willing the public sector might be to make greater use of variable-rate debt; and
- whether alternatives to raising fixed-rate funds from the domestic personal sector are easily available to banks and building societies.

So far as the third factor is concerned, the abolition of most capital controls within Europe makes it easier to tap overseas capital. But there remains substantial variability in European exchange rates which limits substitutability between assets denominated in different currencies. And even if a substantial switch to using fixed-rate, wholesale funds (partly from overseas) were possible at little extra cost, it is doubtful whether banks and building societies, which have high fixed investments in their branch network, would find it optimal to switch rapidly from using retail funds.

Even if the maturity of each side of the balance sheet is balanced, there are still risks that borrowers will repay mortgages early if short-term interest rates fall unexpectedly and if new fixed-rate loans are available at lower rates paid. In some countries, prepayment is either prohibited

(1) Duration measures the sensitivity of asset prices to changes in short-term interest rates: it is a function of the term to maturity of an asset and of the repayment profile of the debt: see, for example, Elton and Gruber, 'Modern portfolio theory and investment analysis', John Wiley, (1991).

(Germany) or else carries high penalties (France and the United Kingdom). In those countries where prepayment is not prohibitive, either the suppliers of funds to lenders who finance fixed-rate mortgages, or the lending institution itself, bear risk. In the United States—where many state laws prohibit lenders making penalty charges for early payment of mortgages—many of those who hold fixed-income, mortgage-backed bonds bear the risk that their securities will be called if mortgages are pre-paid. The risk is that, as rates fall, securities will be redeemed and the proceeds can only be reinvested at lower rates. This risk is reflected in the yield on the securities and, ultimately, on the fixed rates charged on mortgages. In the United States, the rate of interest on 80% loan-to-value, long-term, fixed-rate loans fell between 1990 and the middle of 1993 from around 10.5% to below 7%. Over that period, the level of applications for mortgage refinancing more than tripled.

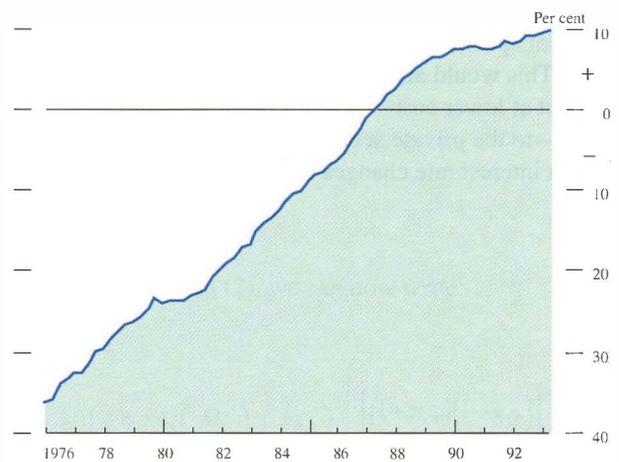
Whichever way prepayment risks are handled—through explicit charges (as is the case for many fixed-rate loans currently issued in the United Kingdom) or indirectly via mortgage rates being high enough to compensate the providers of loans for their risk—the cost will be reflected in the terms of debt contracts.

VI The transmission mechanism of monetary policy

A significant switch to fixed-rate debt would affect both sides of the balance sheets of financial institutions and also of the household sector—who are ultimately the providers and users of most of the funds intermediated through banks and building societies. The resulting change in the duration of liabilities (and perhaps assets) held by the private sector would have an important effect on the way in which changes in monetary policy would be transmitted through the economy.

One of the mechanisms through which interest rate changes affect spending decisions is the result of income effects. When rates rise, holders of net variable-rate debt face higher interest payments, while holders of net liquid assets have higher current income flows. The personal sector in the United Kingdom currently has net liquid liabilities (Chart 6). But the net position is relatively small, and if income effects depended only on the stock of *net* variable-rate debt outstanding their importance would be limited. Differences in the propensity to consume of net lenders and borrowers would account for substantial income effects; and there is some evidence that such differences do exist.⁽¹⁾ The short-run impact on expenditure of changes in interest rates stemming from this sort of income effect would be reduced if fixed-rate debt became more important. Indeed, the direction of the effect could be reversed if the household sector were to retain a substantial holding of floating-rate assets while switching to holding predominantly fixed-rate

Chart 6
Households' net interest-bearing debt^(a)



(a) Interest-bearing liabilities minus interest-bearing assets as a percentage of personal disposable income.

debt. Whether that would be feasible would depend on the ways in which providers of mortgages finance their loans; it would certainly be misleading to assume simply that the duration of the debt liabilities of the household sector could be substantially changed independently of the structure of their assets.

By contrast, it is important to note that another important mechanism through which monetary policy changes are transmitted—via changes in the required returns on durable assets that could be acquired (a substitution effect)—would *not* be diminished by a switch to greater fixed-rate borrowing. The important factor in determining the attractiveness of acquiring an asset (a machine or a consumer durable) is the opportunity cost of the funds tied up. For any one period, that cost is the return on alternative investments available at that time. This return is likely to be influenced by the short-term (or one-period) rate of interest. The fact that a durable asset might best be financed by a long-term loan at a fixed rate of interest does not detract from the point that the appropriate way to evaluate the project at its inception is by reference to the expected opportunity cost of funds at each point in its useful life, ie by reference to a sequence of short-term interest rates.

The average of the expected future opportunity costs of funds will be reflected in the current cost of fixed-rate debt whose maturity matches that of the asset. To the extent that changes in short-term interest rates change the expected course of future short rates, they will also tend to be reflected in changes in long yields. The fact that longer-term rates tend not to increase as much as shorter rates⁽²⁾ reflects the belief that rate changes are not expected to persist. Rather than an indication of the limitations of monetary policy, this is better seen as evidence that increases in current short-term rates, intended to bear down on inflation, are expected to be effective in reducing price increases and can be reversed once inflation subsides.

(1) See King, M A (1993): 'Debt deflation: Theory and evidence'. Presidential address to the European Economic Association, forthcoming in the *European Economic Review*.

(2) See Dale, S (1993): 'The effect of official interest rate changes on market rates since 1987'. *Bank of England Working Paper No 10*.

Perhaps the most important impact on monetary policy of greater use by the private sector of fixed-rate debt would be that the sharp impact of short-term interest rate rises on the cash flow of specific households and corporations would be reduced. This would allow interest rates to be increased quickly but at lower cost—in terms of induced liquidity problems—to the private sector. But the impact of short-term interest rate changes on the returns on liquid

financial assets and the cost of short-term borrowing—both of which are key determinants of flows of funds across the international currency exchanges—would be unchanged. So the effect of interest rate changes on the exchange rate, an important element in the transmission mechanism of monetary policy, is unlikely to be weakened by greater use of fixed-rate borrowing by the corporate and household sectors.

The calculation of debt-servicing burdens

Denote the outstanding debt (or mortgage) t periods into the life of the loan by M_t and the size of the original loan, which we assume is made when an asset (a house or a machine) was purchased, by M_0 . Let y_t denote the current value of disposable income of the borrower; for a corporate borrower we can think of y_t as current profit. The nominal interest rate at time t is r_t and we let the consumer price index be p_{ct} .

A standard, variable-rate, amortised repayment loan is one where if nominal, short-term interest rates were to remain unchanged nominal debt payments would be constant and the present value of future repayments discounted at the current interest rate would equal the size of the loan. If we denote the period t repayment by m_t this implies that for a variable-rate loan:

$$m_t = \left(\frac{r_t}{1+r_t} \right) \cdot \left(\frac{M_t}{1 - \left(\frac{1}{1+r_t} \right)^{T+1-t}} \right) \quad (1)$$

where T is the original (at $t=0$) term to maturity of the loan.

We can write the ratio of debt repayments to income:

$$\frac{m_t}{y_t} = \left(\frac{r_t}{1+r_t} \right) \cdot \left(\frac{M_t}{p_{ho}} \right) \cdot \left(\frac{p_{ho}}{y_t} \right) \cdot \left(\frac{1}{1 - \left(\frac{1}{1+r_t} \right)^{T+1-t}} \right) \quad (2)$$

where p_{ho} is the value of the asset acquired when the loan was made at time $t=0$. Denote the per-period consumer price inflation rate between time 0 and time t by π_{ct} and let per-period, real (in terms of consumer goods) income growth over the same period be g_{yt} . Thus:

$$(1 + \pi_{ct})^t \equiv \left(\frac{p_{ct}}{p_{co}} \right) \quad (3)$$

$$(1 + g_{yt})^t \equiv \left(\frac{y_t}{y_0} \right) \cdot \left(\frac{p_{co}}{p_{ct}} \right) \quad (4)$$

Using (3) and (4) in (2), we can now write:

$$\left(\frac{m_t}{y_t} \right) = \left(\frac{r_t}{1+r_t} \right) \cdot \left(\frac{M_t}{p_{ho}} \right) \cdot \left(\frac{p_{ho}}{y_0} \right) \cdot \left(\frac{\left[(1 + \pi_{ct})(1 + g_{yt}) \right]^{-t}}{1 - \left(\frac{1}{1+r_t} \right)^{T+1-t}} \right) \quad (5)$$

If interest rates have not changed between 0 and t , we can write the outstanding debt at t as a simple function of M_0 , t , T and r_t . Using (1), and noting that if interest rates are unchanged between 0 and t , $m_0 = m_s$ for all s where $0 < s \leq t$, we can deduce:

$$M_t = M_0 \cdot \left(\frac{1 - \left(\frac{1}{1+r_t} \right)^{T+1-t}}{1 - \left(\frac{1}{1+r_t} \right)^{T+1}} \right) \quad (6)$$

Finally substituting (6) into (5) gives:

$$\left(\frac{m_t}{y_t} \right) = \left(\frac{r_t}{1+r_t} \right) \cdot \left(\frac{M_0}{p_{ho}} \right) \cdot \left(\frac{p_{ho}}{y_0} \right) \cdot \left(\frac{\left[(1 + \pi_{ct})(1 + g_{yt}) \right]^{-t}}{1 - \left(\frac{1}{1+r_t} \right)^{T+1}} \right) \quad (7)$$

(7) expresses the debt service burden on a variable-rate loan at time t as a function of the original loan-to-value ratio (M_0/p_{ho}), the asset price to income ratio at the time of the asset purchase (p_{ho}/y_0), the rates of increase of the borrower's real income (g_{yt}) and of consumer good prices (π_{ct}) over the period since the loan was granted, the term to maturity of the loan (T), the time since the loan was taken out (t) and the nominal interest rate (r_t). Equation (7) is used to derive the debt service burdens used in Charts 1–5.