Managing the Costs and Risks of Housing Finance: A New Role for Actuaries

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A New Role for Actuaries

Anthony Asher*

Abstract

Housing finance is a nontraditional field where actuarial expertise could be
applied fruitfully. The development of mortgage instruments requires the ap­
plication of financial mathematics, while the evaluation and management of the
financial risks to which borrowers and lenders are exposed require a knowledge
of insurance principles. This paper splits the financial costs of home owner­
ship into several components: those that arise from inflation, risk, adminis­
tration, and the residual real interest charge. The risk component further is
partitioned into life contingencies, economic contingencies, and various moral
hazards. This analysis provides a basis for future financial innovation, high­
lights where government intervention may prove productive, and suggests a
number of areas of possible actuarial involvement.

Key words and phrases: mortgage, insurance, government guarantees, infla­
tion, life cycle

1 Introduction

In their search for new areas of involvement, actuaries may find the
field of housing finance both accessible and fruitful. The accessibil­
ity stems from the convergence of financial markets and the fading of
the boundaries between insurers and mortgage finance institutions. In

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addition, there is a fundamental similarity between insurers and mortgage lenders: both are concerned with risk and security. Whether this becomes a fruitful area of expansion depends on the skills and energies of the actuaries concerned.

In any event, it would help actuaries if they better understood why some of the risks associated with the various types of home mortgages can, and even should, be insured. The need for mortgage insurance (for both lender and borrower) offers opportunities for those actuaries involved in product development. This paper is intended to highlight some of those areas in the development and evaluation of new mortgage products (for borrowers and lenders) where actuaries can play a role.\(^1\)

In the following sections, the basic types of mortgage products are examined. To facilitate this examination, the interest charged by mortgage lenders is divided into four components:

1. An allowance for inflation;
2. Charges for risk of default;
3. Costs of administration;
4. Net real interest.\(^2\)

These components are discussed in Sections 2 to 5, respectively.

2 Inflation

2.1 The Need for Varying Payments

International norms are that housing loan payments should not exceed 25 percent to 30 percent of gross income and that the total amounts borrowed be no more than three to four years' annual salary. For a 20 year loan, these limitations are more or less compatible with nominal interest rates of 8 percent or less per annum. Once nominal interest rates exceed 8 percent (as is likely with double digit inflation rates), it is no longer possible to borrow three years' salary and still pay the

\(^1\)Financial innovation in home lending markets also includes variations on the theme of securitization (of mortgages) described by Woolford (1991) at a Society of Actuaries meeting. This subject has been covered extensively in the literature (see also, for instance, Schwartz and Torous (1992) and the March 1994 edition of *Housing Finance International*). It is not the business of this paper, however, which focuses more on the mortgage instruments themselves.

\(^2\)The interest charge will include an allowance for the profit of the mortgage lender. The considerations involved in determining the profit are too complex to discuss here.
interest charges from current income. Extending the term of the loan makes little difference. A 50 percent increase in the term, for instance, will increase the amount that can be borrowed by only 14 percent (at an interest rate of 8 percent).

As the rate of inflation increases, it therefore would seem that lending institutions should be prepared to lend a portion of these interest payments to the borrowers. This would restore them to the cash flow position they had enjoyed before the rise in inflation, assuming that the present value of future income remains unchanged. Malpezzi (1990) gives examples from a number of countries of experiments with a variety of mortgage products that allow for greater flexibility and affordability, particularly in an inflationary environment.

One obvious solution is a mortgage instrument where a proportion of the nominal interest due is added to the amounts outstanding and the mortgage repayments are increased in nominal terms each year. Several of these instruments have been devised and used in different countries, with the rate of increase being determined in a variety of ways. Though there appears to be no standard nomenclature, these instruments seem to fit into three broad categories: low start mortgages, progressive annuity mortgages, and indexed mortgages. Formulae for the different types of mortgage instruments are given in the appendix.

Given their expertise in manipulating interest rates, cash flow testing, and matching assets and liabilities, actuaries should be able to make significant contributions in designing mortgage products and in matching mortgage assets with appropriate liabilities.

2.2 The Slow Response

Not all countries have institutions that have responded to an increase in nominal rates by introducing appropriate instruments. For example, the annual inflation rate has averaged over 14 percent for the past 20 years in South Africa, with nominal mortgage rates averaging just under 16 percent. Yet no increasing mortgage product has been publicly offered. Malpezzi (1990) shows the problem is not unique to South Africa.

Why have financial institutions been so slow in adapting? The answer probably includes elements of inertia, lack of expertise, and (quite proper) prudence. In his chapter that examines the effects of inflation on savings, Hadjimatheou (1987) records several studies that have found that higher inflation rates appear to create greater uncertainty and lead to greater savings by individuals. There is other evidence, presented later in this paper, that higher inflation may increase the risk of
borrowers defaulting on their loans. This lends some justification to the decisions by financial institutions to reduce their lending in times of higher inflation.

To understand the issues better, the question needs to be placed within the broader problem technically described by economists as liquidity constraints within the life cycle. Hadjimatheou quotes a summary of this idea by Hubbard and Judd (1986, p. 56):

Hump-shaped lifetime earnings profiles rising towards middle age then leveling off and declining in old age imply that individuals will want to consume more than their current resources when young. They cannot do so if liquidity restraints are binding.³

Even in the United States, which has not experienced long periods of double digit interest rates, the literature provides evidence that higher nominal rates reduce the demand for debt.⁴ Megbolugbe and Linneman (1993) describe several studies that find a negative correlation between inflation and home ownership. These appear to be related to liquidity constraints. In economic terms, however, this represents a market failure. Begg, Fischer, and Dornbusch (1987) point out that market failure can occur as a result of the absence of appropriate insurance markets. They ascribe this absence to the presence of antiselection,⁵ moral hazard,⁶ and general lack of knowledge about the risks.

Actuaries have the expertise to address all of these questions (particularly those covering insurance) in a logically consistent manner.

³Liquidity restraints result from unnecessary restrictions on the ability to borrow—in this case on the strength of future earnings.

⁴This reduction in the demand for debt is consistent with a failure to introduce new mortgage instruments.

⁵Antiselection is defined by the Society of Actuaries Committee on Actuarial Principles (1992) as a result of inadequate refinement of the risk classification system.

⁶Moral hazard occurs when the future occurrence, timing, or severity of an insured event is controllable by the insured persons. Those risks that imply negligence rather than fraud are sometimes called morale hazard, but this distinction has not been used in this paper.
3 Risks

3.1 Some Background

3.1.1 Insurability: Private and Government

The conditions under which a risk (or event) is said to be insurable have been established by the Society of Actuaries Committee on Actuarial Principles (1992, p. 587). An event is insurable if:

1. It is associated with a phenomenon that is expected to display statistical regularity;

2. It is contingent with respect to number of occurrences, timing, or severity;

3. The fact of its occurrence is definitely determinable;

4. Its occurrence results in undesirable economic consequences for one or more persons; and

5. Its future occurrence, timing, or severity is neither precisely known nor controllable by these persons.

Moral hazards are not entirely unmanageable. Profit sharing, no-claim bonus, and the legal principle of indemnity all provide incentives to limit the number and size of claims. Careful definition of the insurable event that excludes those items under the control of the insured also allows for the extension of insurance markets. The courts can be used to challenge fraudulent claims.

Government attempts to insure, rather than to manage, the risks due to moral hazards are likely to result in unintended subsidies to unintended beneficiaries. Recent examples can be seen in the collapse of the savings and loans deposit insurance industry in the United States and the insolvency of the Motor Vehicle Accident Fund in South Africa. The latter has been driven to insolvency by, among other things, a large number of fraudulent claims.

The insurer can manage antiselection by obtaining sufficient information to refine its risk classification system adequately. Antiselection also can be managed through government intervention in the form of a mandatory insurance system. The need for personal information is reduced, if not eliminated.\(^7\)

\(^7\)Some persons' sense of equity might be offended if there were no differentiation between different risk classes. On the other hand, others might welcome the cross-subsidies involved.
Cyclical risks, such as unemployment, do not always display the statistical regularity required for insurability. Williams and Heins (1976) give an argument for government intervention to insure such risks. Where there is mandatory insurance, economic viability can be ensured by increasing premiums or reducing benefits.

Governments also may enter or create certain markets in countries where the private sector lacks the capital, technical capability, confidence, or energy to introduce economically viable financial products. There appears to be no inherent reason why such initiatives could not be privatized subsequently. Grigsby (1990) points out that in the United States mortgage guarantee insurance was introduced by government and later was followed by private initiatives.

3.1.2 Financial Planning

Appropriate responses to the risks faced by both mortgage lenders and borrowers must be developed. Duncan (1988) provides an interesting insight into the nature of the borrower’s risks. His paper is based on a detailed longitudinal study from 1968 to 1979 of 5,000 families and is called the “Panel Study of Income Dynamics.” He finds that family income is surprisingly volatile, with nearly one third of the sample experiencing a drop in income of 50 percent or more. (Family, in this context, can refer to individuals living on their own.) His analysis of the life events that cause some of these financial reverses will be used below. The results of the study highlight the need for financial planning and, where possible, appropriate insurance.

Bragg (1992) suggests that actuaries can find a new role in financial counselling. Are they not in the best position to know which risks are important, what insurance is available, and how finances should be managed?

Duncan’s paper and the life cycle hypothesis of Modigliani (1986) provide a good foundation for such planning. The issues, as mentioned earlier, are lifetime earnings and consumption and their variability, as well as current liquidity. The life cycle hypothesis assumes individuals behave rationally. But without assistance in planning their expenditures, it is difficult to understand how they can make rational decisions. Actuarial involvement in the design of lifetime income and expenditure models could provide a link between research and practical applications.

8It is the author’s conviction that the individual’s risks need to be considered first and that the need for the security of financial institutions derives from this primary concern.
Proper financial planning may indicate that the risk to the borrower of a home loan is larger than was previously thought and that the insurance necessary to manage the risk makes it too expensive. Thus, rather than making housing finance available to more persons, proper financial planning may reduce the demand for mortgages but fewer persons would suffer foreclosure.

3.1.3 Life and Disability Coverage

Mortgage lenders often require borrowers to obtain a credit death and disability life policy that covers the amount of the loan outstanding at the time of death or long-term disability. This may be inadequate, however, because death or disability can cause financial hardships of which meeting mortgage payments is only a part. The death and disability insurance policy rather should be designed with the family's future in mind. The family needs insurance to cover disaster and also may need assistance in rearranging its financial affairs after a claim. The institution's need to protect itself against loss probably can be met by a relatively small amount of life insurance (enough to cover the difference between the market value of the collateral and the outstanding loan if the latter is larger).

Duncan (1988) confirms that disability and illness are important causes of financial hardship. In his tabulation of the causes of the large declines in income, disability and illness are responsible in 12 percent of the cases for men between 25 and 45 and in 9 percent of the cases for women. This compares with only 3 percent for the death of a spouse, confirming the relative importance of disability compared to death. Unfortunately, disability coverage is not as readily available as life insurance. Lending institutions may be able to assist aspiring home owners obtain disability insurance by pooling borrowers into groups.

3.2 Cost Increases

Even if spared death or disability, borrowers still may find themselves unable to meet repayments because their costs and their incomes are not necessarily matched. This subsection looks at major reasons for cost increases, the next subsection examines other causes of income reduction.
3.2.1 Interest Rates

Holders of adjustable rate mortgages are particularly exposed to the risk of an increase in interest rates. Higher inflation rates appear to aggravate the problem; not only does the level of nominal interest rates rise, but short-term interest rates appear to display greater volatility (Chan et al. 1992).

Government protection from the risk of high interest rates, in the form of interest rate controls or subsidies, has not proved effective in volatile environments. Malpezzi (1990) argues against the use of such interventions. He finds that the distortions introduced into financial markets inhibit the appropriate allocations of resources without giving concomitant benefits to the poor.

Three mortgage products are commonly available as alternatives to government intervention: fixed interest mortgages; dual index mortgages; and privately subsidized mortgages.

- Fixed Interest Mortgages: Here the interest rate and the repayments remain unchanged throughout the term of the mortgage. This provides a level of certainty and probably makes this the most attractive mortgage product from the borrower's perspective. Such mortgages are particularly popular in the United States, but are regarded as too expensive in many other countries. Diamond and Lee (1992) show, however, that fixed interest mortgages are used in Denmark, France, and Germany (but without a prepayment option). This suggests that the product might be considered in other countries, at least those with relatively stable single digit interest rates.

Fixed interest mortgages, however, present a particular problem when it includes an option for borrowers to prepay the loan without penalty. Schwartz and Torous (1992) have calculated insurance fees for the prepayment risk, but it is not clear that the prepayments display sufficient statistical regularity to be insurable. Mortgage lenders at times have taken a large proportion of the risk themselves, but this can prove disastrous. Grigsby (1990)

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9 In an adjustable rate mortgage, interest rates and mortgage payments are fixed for a specified period (anywhere from one month to five years). At the end of this period, the outstanding balance is determined; new mortgage payments are recalculated using this outstanding balance and current market rates. The new rate and the new level of payments remain fixed for another specified period. This process is repeated until the mortgage is repaid. Adjustable rate mortgages are common outside the United States.

10 Borrowers tend to repay their loans early when interest rates have fallen and they can refinance at a lower rate of interest.
ascribes the American savings and loan debacle of the 1980s to, among other things, inadequate allowance for the mismatch of the term of their assets and liabilities caused partly by the pre-payment option.

- **Dual Index Mortgages:** Here the mortgage payments are increased in line with a wage-related index, while the cost of borrowing is related to market interest rates. Although not offering absolute protection against interest rate movements, the risk is deferred significantly and often will not give rise to losses. Dual indexed mortgages are more appropriate for countries with higher rates of interest; they are currently in favor with the World Bank.

Roldan and Spoor (1992) tell how dual index mortgages have been introduced in Mexico with apparent success.\(^{11}\) A variant of the dual index mortgage was tried by one company in South Africa in the early 1980s: the lenders, however, suffered losses from loans still outstanding in the early 1990s. The problem was that the incomes of some borrowers did not keep pace with the required increases in the repayments. The loans of these borrowers became too large to be serviced and also exceeded the current market value of their homes.

- **Subsidized Mortgages:** The third approach is for employers to offer a fixed and subsidized lower rate of interest or to subsidize housing expenses on an income-related basis, as mentioned in Malpezzi (1990). This not only addresses the interest rate risk, but also the affordability of the loan. These subsidies, however, have become less popular over time as they are expensive and encourage overspending on housing.

Asher (1992) describes yet another form of mortgage: a salary-linked mortgage.\(^{12}\) This type of mortgage links both the periodic mortgage payment and the interest rate to the borrower's income. The borrower is liable to pay a predetermined proportion of his or her income over the term of the loan. The proportion is equal to the initial loan divided by the product of current income and the agreed term. The amount outstanding at any time is the product of the proportion calculated, the borrower's income at that time, and the remaining term. The interest earned by the lender in a salary linked mortgage is therefore dependent on the growth of the borrower's remuneration. The loan can be

\(^{11}\)In Mexico repayments are linked to the national minimum wage.

\(^{12}\)The concept of salary linkage is not that different from the income contingent loans described in Nerlove (1975) and elsewhere.
described as being linked to the index of the borrower's own income. A portfolio of such loans is particularly appropriate for defined benefit pension funds as it provides an asset matched to the liabilities as both are dependent on income growth.

The link between income and mortgage payments introduces additional risks of antiselection and moral hazard. Antiselection may occur if individuals expecting lower salary growth are more likely to use such instruments. It should be feasible to develop classification models for potential borrowers to address this problem. Models can be developed that predict an individual's lifetime wage patterns.

Moral hazard risks are directly analogous to those that arise in collecting income tax. Income may be underreported (as in tax evasion), shifted to nontaxable sources (tax avoidance), and reduced by working less. Avoidance and evasion risks can be minimized by obtaining information on income from the employers who sponsor the pension fund making the loans.

Though the possible work disincentives cannot be gauged accurately, there are some studies of the problem. Tuomala (1990) reports that "most labor supply studies of men seem to indicate backward-sloping supply curves." Higher income leads to men taking more leisure (described as an income effect), but the leisure is more expensive relative to other goods (which creates a substitution effect and reduces the leisure taken.) He lists 11 studies undertaken in the 1970s, of which seven showed the backward slope. Studies of women, however, usually have shown the normal forward slope. Brown (1983) gives more detail on some of these studies. A typical regression result with ten different parameters would produce an $R^2$ of 0.25, explaining only 25 percent of variation between individuals. Little confidence, therefore, can be placed in these results.

### 3.2.2 Individual Changes in Circumstance

Increased costs for the borrower can arise from many sources including divorce, inflation, illness, loss of or damage to possessions, increased family size, and the increased costs associated with children as they grow older. Duncan (1988) highlights the importance of divorce, where another household with its overhead costs is created. The problems may be aggravated by excessive borrowing—often credit purchases not considered when the initial housing loan was granted.

Higher levels of inflation appear to increase the possibility that cost increases may be unmanageable. Vining and Elwertowski (1976) confirm the widely accepted view that higher and more uncertain inflation
rates are linked with a wider dispersion of price movements. Their paper covers all elements of the Consumer Price Index, including housing. This wider dispersion may increase the chances of a family being unable to meet all of their financial obligations and justifies greater prudence when lending in times of higher inflation.

Mortgage lenders normally require borrowers to have homeowners' hazard insurance to protect their collateral against damage (from storms, fire, flooding, etc.). While such damage can lead to significant losses that otherwise would cause the borrower severe financial hardship, there are other risks to be considered such as unexpected medical costs to be considered. Thus, lenders may consider making health insurance a requirement in situations where adequate public care is not available. It is not possible, however, to insure against all fluctuations in expenditure. As a result, mortgage lenders still focus on the quality of the collateral rather than on the borrower's current and future income and expenses.

An actuarial model of lifetime income and expenditure that allows for variability in income and expenditure would be helpful in the evaluation of loan applications. Such a model also could be used to assist in rescheduling mortgage payments.

3.3 Reduction in Income

3.3.1 Partial Reduction

The risk of partial income loss appears to be greater with manual workers and older workers (those over the age of 50); see the surveys by Her Majesty's Stationery Office (1992) and Human Sciences Research Council (1990). Affordability standards imposed by lenders should allow for such fluctuations in income, particularly for older borrowers. At the present time in South Africa, a limited allowance sometimes is made for the risk of women's earnings declining as a result of childbirth, but not for other reasons. The salary-linked home finance product described above also addresses this risk directly.

Because individual health insurance policies are relatively expensive, mortgage lenders may consider pooling borrowers to provide them with access to group health coverage.

It appears that the problem of partial loss of income is the main reason for the difficulties experienced by the South African dual index mortgage scheme mentioned earlier. If wage patterns in Mexico follow those in South Africa, similar problems are likely for some Mexican borrowers in the second decade of operation of Mexico's dual index mortgage scheme.
The work of Lee (1988) in the United Kingdom shows that inflation increases the dispersion or real wage increases, but the earlier work of Hamermesh (1986) found the reverse to be true in the United States. The ambivalent findings of these authors indicate that the risks do not appear to have a regular statistical basis. This and the moral hazard involved in insuring items such as the number of overtime hours probably make the risk uninsurable.

### 3.3.2 Unemployment

Though governments offer some form of national unemployment insurance in several countries, there is little involvement by private insurance companies. This may be because unemployment appears to be subject to the three major causes of uninsurability referred to earlier: moral hazard, antiselection, and irregular statistical experience.\(^{15}\)

There is clear evidence of moral hazard. Schmitt and Wadsworth (1993), in reviewing the research on its presence in unemployment insurance, report that in the United States and the United Kingdom the duration elasticity (the percentage increase in average duration of unemployment related to a percentage increase in the unemployment benefit) appears to be some 0.4 and 0.3, respectively. It appears probable that the moral hazard would be even higher with an increase in the replacement ratio.\(^{16}\)

Antiselection is also probable. At any given time unemployment falls heavily on particular categories of workers (defined by geography, by industry, or by skills). These categories are themselves unstable; it would appear to be difficult for potential private insurers to predict these changes ahead of the workers concerned.

This degree of uninsurability provides a strong argument for some form of compulsory national unemployment insurance, which is desirable for reasons other than a reduction in the costs of housing finance.

Doling (1990) mentions that Finnish banks respond to short periods of unemployment by rescheduling repayments. He points out that this is possible because of the shorter terms (10 years) of the original loans. This is consistent with a life cycle planning model that takes future uncommitted income into account and with Duncan's (1988) sample. In this sample, the major unemployment of the household head is a significant category, accounting for 19 percent of the large drops in income for men between 25 and 45. The importance of unemployment

\(^{15}\)There is also a cyclical aspect to unemployment.  
\(^{16}\)The replacement ratio is that of unemployment benefit to potential earnings.
on defaults also is confirmed in studies by Canner et al. (1991) and Clauretie and Herzog (1990).

3.4 A Note on Mortgage Guarantee Insurance

Mortgage guarantee insurance protects mortgage lenders against losses on their lending. It normally is required for all loans issued by a lender, unless the borrower has made a sufficiently large down payment on the home so that the difference between the loan and the value of the home is large. Significant losses can occur in the event of a general fall in house prices that coincides with widespread income losses—due, perhaps, to a jump in the unemployment rate. The doubts expressed earlier (about the statistical regularity displayed by unemployment rates) must be magnified in the case of mortgage guarantees, as the movement of house prices appears even less statistically stable.

The insurance industry in the United Kingdom has suffered losses from mortgage guarantee insurance business of thousands of millions of pounds that may lead to a shortage of capacity in this market. These losses were particularly severe because housing prices in different regions of the United Kingdom tend to move roughly in tandem. Herzog (1988) shows that in the United States default risks (and presumably house prices) in the different regions have not moved together. Mortgage guarantee insurance, therefore, has been able to continue to provide security to mortgage lenders in the United States.

The author, however, has misgivings about mortgage guarantee insurance's long-term viability as an insurance product. If there is a prima facie case for its non-insurability, actuaries should consider the damage that a spate of claims could do to the insurance industry. They also could lobby for some compulsory coverage to be provided by government. As with unemployment, a compulsory scheme could adjust premiums and benefits in order to ensure solvency. A more thorough argument for government intervention is given by Foster and Herzog (1981), which could be a base for such lobbying. As Grossman (1992) points out, however, government guarantees introduce a moral hazard because the mortgage lenders no longer bear the cost of inadequate evaluation of borrowers.

17For example, in the United States borrowers must borrow no more than 80 percent of the appraised value of the home to avoid mortgage guarantee insurance.
3.5 Other Approaches to Managing the Default Risk

Statistical models of housing prices could be useful in determining appropriate collateral requirements for loans and reducing default probabilities. Gyourko and Voith (1992) and DiPasquale and Wheaton (1993) provide two recent attempts at developing such models.

Another approach would be to hedge the risks through financial options and futures on a house price index. Dwonczyk (1992) has developed just such an index in Australia. There might conceivably be persons hoping to buy homes in the future—in addition to financial speculators—who would find it attractive to take bull positions in these instruments. Although Dwonczyk expressed confidence that his index would be free of manipulation and accurately reflect the overall level of house prices, he also reported that adaptations were required for the 23 submarkets he found in Sydney. It is unlikely that a market could develop in derivative instruments for each of these submarkets, which would limit their usefulness as hedging instruments.

4 Administration

4.1 Initial

Most of the costs of lending are front ended, being expended in selling, evaluating the collateral, and performing the legal and administrative procedures necessary to initiate loans. Various stamp duties and transfer taxes also may be payable. The costs of administration normally are charged as a percentage of the amount outstanding.

It is, therefore, necessary to estimate the average term of the loan in order to decide on a reasonable amortization period for the initial costs. The term will be longer if the mortgages are transferable (when the borrower moves to another house) or assumable (when the mortgage is assumed by the new owner).

Charging the borrower directly for all the initial costs would be consistent with the approach taken in the life insurance industry. It has the advantage of eliminating cross subsidies to borrowers who prepay and shifts the risk of underestimating the likely term of the loan from the institution to the borrower. It is likely to lead to lower charges, but because it emphasizes the initial costs, it may repel some prospective customers.

18In the United States, lenders do reduce the impact of prepayment of mortgages by requiring that initial expenses be paid in advance.
Ameliorating the tilt\(^{19}\) problem in countries with relatively high rates of inflation also should reduce the annual charges for initial costs. This is because there is less need to enter the lower end of the housing market and to trade up as larger dwellings become affordable.

4.2 Renewal

The ongoing costs of installment collection are relatively small and particularly amenable to automation. Berger and Humphrey (1991) find that efficiencies in administration differ markedly from bank to bank in the United States, but are not especially related to size. The critical issue is limiting input costs. This appears to accord with the South African experience. Mergers and acquisitions appear not to be appropriate strategies for the control of expenses.

4.3 Final

Final expenses are fairly trivial if the loan is fully repaid on or before due time. Costs can be considerable in the event of defaults and foreclosure. Insurance of the risks leading to foreclosure will reduce these costs. The administration costs of foreclosure should be added to the losses incurred as a result of the failure of the collateral, as a saving in one can create costs in the other.

5 Real Interest Charges

The real interest charge represents the balance between demand for, and supply of, loanable funds. It accords with the risk-free interest rate of financial theory and normally is regarded as the rate available on short-term government bills.

Financial innovation by mortgage lenders is unlikely to yield any long-term advantage over other financial institutions in reducing the cost of the real interest rate—any innovations can be copied. The best that can be expected is for the lending institutions' financial instruments on the liability side of their balance sheets to be up-to-date so that housing interest rates are comparable with the rest of the market. The development of secondary markets may be a necessary part of this activity. Actuaries could have a role in this area.

\(^{19}\)Level nominal mortgage repayments are tilted once they are adjusted for inflation.
Governments can, and frequently have, intervene(d) in financial markets to reduce the costs of housing finance. Mayo (1991), in summarizing the World Bank's view on housing, suggests that governments should focus on enabling markets to function and that positive real interest rates are more appropriate. It is difficult to ensure that the subsidies inherent in artificially low interest rates help those they are intended to help.

6 Concluding Remarks

Numerous cost effective housing finance instruments have been designed to adapt to unpredictable inflation. In addition, many conventional insurance products are available to cover the risks to both borrower and lender. Proper financial planning would indicate that these insurance coverages are required by borrowers whether or not they have home loans. Regarding these risks as part of the business of the mortgage lender represents, in some respects, an artificial increase in the cost of housing finance and can have the undesirable effect of unnecessarily dispossessing the homeowner.

Actuaries could have two roles in managing the cost of housing. First, there is the need for better financial planning and for new insurance products. Second, actuaries could find new fields in the employ of home lenders, especially in financial management and product development.

References


Appendix

The present value of annual payments in arrears over \( n \) years is given by:

\[
\text{Value} = X \sum_{k=1}^{n} \prod_{i=1}^{k} \frac{(1 + f_i)}{(1 + g_i)}
\]  

(1)

where \( X \) is the unadjusted base payment, \( X(1 + f_1) \) is the first payment, the interest rate in year \( i \) is \( g_i \), and the installment is increased by \( f_i \) in year \( i \).

Some of the more commonly used types of mortgages are defined in terms of the rules used to determine \( f_i, g_i, \) and \( n \) (\( n \) is assumed to be fixed unless otherwise stated).

- **Fixed interest mortgages:**

  \[
  f_i = 0 \text{ for all } i; \\
  g_i = g, \text{ a fixed rate of interest for all } i.
  \]

- **Adjustable rate mortgages:**

  \[
  f_i = \frac{a(n-i, g_{i-1})}{a(n-i, g_i)} - 1 \text{ for all } i; \\
  g_i = \text{ The market rate of interest in year } i
  \]

  where \( a(n, r) \) is the present value of an \( n \)-year annuity immediate at a rate of interest of \( r \) per annum, i.e.,

  \[
  a(n, r) = \frac{(1 - (1 + r)^{-n})}{r}.
  \]

- **Low-start mortgages:**

  \[
  f_i = \text{ Some low, predetermined, rate of increase for } (i < k); \\
  f_i = \frac{a(n-i, g_{i-1})}{a(n-i, g_i)} - 1 \text{ for } i \geq k; \\
  g_i = \text{ The market rate of interest in year } i.
  \]
• Progressive annuities:

\[ f_i = \frac{(1 + g_i)}{(1 + j)} - 1 \] where \( j \) represents the real rate of interest;

\[ g_i = \text{The nominal rate of interest in year } i. \]

• Price level adjusted mortgages:

\[ f_i = \text{The rate of inflation in year } i; \]

\[ g_i = (1 + f_i)(1 + j) - 1 \] where \( j = \text{the real interest rate.} \)

As a further generalization, these mortgages can be viewed as index-linked mortgages where \( f_i \) is linked to any index.

• Dual index mortgages:

\[ f_i = \text{Growth rate of index (usually related to wages) in year } i; \]

\[ g_i = \text{Interest rate in year } i \]

As \( n \) is no longer fixed, the series may not have a finite value.

• Salary linked home finance:

\[ f_i = \text{The rate of growth of the borrower's salary} \]

\[ g_i = f_i + r_i \]

where \( r_i \) is some nonnegative rate of interest in excess of salary growth.