MICHAEL C. LOVELL
Wesleyan University

Unraveling the Real-Payment Twist

TWO GROUPS in U.S. society have been particularly hard pressed by inflation: potential first-time homeowners and people in retirement. A major problem for these two groups arises from the failure of financial institutions to provide mortgages and pensions suitable to the current inflationary environment. The first section of this paper shows that, while the variable-rate mortgage and the shared-appreciation mortgage—two principal innovations in mortgage financing—may meet certain needs of traditional mortgage lenders, they do not address the difficulties that the conventional level-payment mortgage creates for first-time homeowners. The second section illustrates the difficulties that level-payment pensions and annuities create for retirees and contrasts them with indexed pensions. The third section explains how the development of both indexed mortgages and pensions might be encouraged by exploiting the symmetry between them. In important respects, indexed pensions are the mirror of indexed mortgages, so that the creation of one would facilitate creation of the other. With only enabling federal legislation, financial intermediaries and markets should be capable of creating both, thus easing much of the hardship of inflation for major groups in society.

Home Mortgages

The level-payment mortgage was well designed for a stable price environment; the borrower could plan on making the same payment each month until the mortgage document could be ceremoniously burned at

This paper has benefited from the comments of Basil J. Moore and Richard A. Miller.

0007-2303/81/0001-0283$01.00/0

Table 1. Characteristics of Traditional Level-Payment Mortgages for $50,000

Item	*Alternative mortgages*		
	Mortgage 1	*Mortgage 2*	*Mortgage 3*
Length of mortgage (years)	25	25	30
Rate of inflation (percent)	2	10	10
Annual interest rate (percent)	6	14	14
Monthly payment (dollars)[a]	322	602	592
Qualifying income (dollars)[b]	15,463	28,890	28,437
Real value of monthly payment (dollars)			
After five years	292	374	368
After ten years	264	232	228
After twenty-five years	196	56	55
After thirty years	...	...	34

Source: Calculations by the author.

a. Payments are calculated with the standard formula, $M = Pr/[1 - (1 + r)^{-T}]$, where M is the payment to be made for T months, P is the principal, and r is the monthly rate of interest. In accordance with standard banking practice, r is one-twelfth of the quoted annual rate of interest. Figures are rounded.

b. The minimum annual income required to qualify if mortgage payments cannot exceed 25 percent of income.

maturity. This type of mortgage was a major improvement over the older, "balloon" mortgage, which left the borrower with a sizable outstanding balance to be paid off or refinanced on maturity, subject to threat of foreclosure. When prices are not stable, however, the traditional mortgage has serious defects: one problem stems from the effects of unanticipated changes in inflation; another exists even with steady and correctly anticipated inflation that is fully reflected in the mortgage interest rate.

If future inflation is underestimated at the time a mortgage is made, lenders suffer and borrowers gain. The real interest rate on the mortgage turns out to be lower than intended and possibly negative. Today savings banks that made long-term loans by issuing 6 percent mortgages must pay a much higher interest rate on their short-term deposits. If inflation turns out to be lower than anticipated, the impact on borrowers and lenders will be reversed. However, because the borrower can refinance an existing mortgage when interest rates fall, the situation is not, in fact, symmetric. With respect to the level-payment mortgage, the uncertainty of inflation is primarily the bankers' problem.

When inflation is correctly anticipated, there are no surprises in the real interest rate and no unanticipated gains or losses between buyer and seller. Nonetheless, the level-payment mortgage raises a serious problem for the borrower, as illustrated in table 1. Mortgage 1 and mortgage 2 op-

tions show the characteristics of a $50,000 mortgage with 2 percent and 10 percent anticipated inflation rates, respectively, and corresponding mortgage interest rates of 6 percent and 14 percent. The monthly payment is almost twice as high under mortgage 2. As a result, many potential homeowners who could qualify under mortgage 1 would find it difficult to do so under mortgage 2 using the usual bankers' rule that the mortgage payment must consume no more than 25 percent of the borrower's monthly income. Thus at a time of inflation, even if their incomes have kept pace with home values, many prospective buyers must scale down the size of the home they purchase while others are frozen out of homeownership entirely.[1]

The real value of the monthly payment on a 14 percent mortgage drops dramatically over time if the anticipated 10 percent inflation materializes. This is unimportant to the lender who is continually reinvesting in new mortgages. For the potential homeowner, however, the promise of a drop in the real burden of future mortgage payments cannot ease the problem of qualifying for a mortgage or of meeting the high real burden of the mortgage payments in the initial years of homeownership. The possibility of deducting mortgage interest payments in the computation of personal income tax liability only moderates the problem. Furthermore, as the payments under the option of mortgage 3 in table 1 show, the burden is only slightly lifted by extending the term of the mortgage from twenty-five to thirty years.

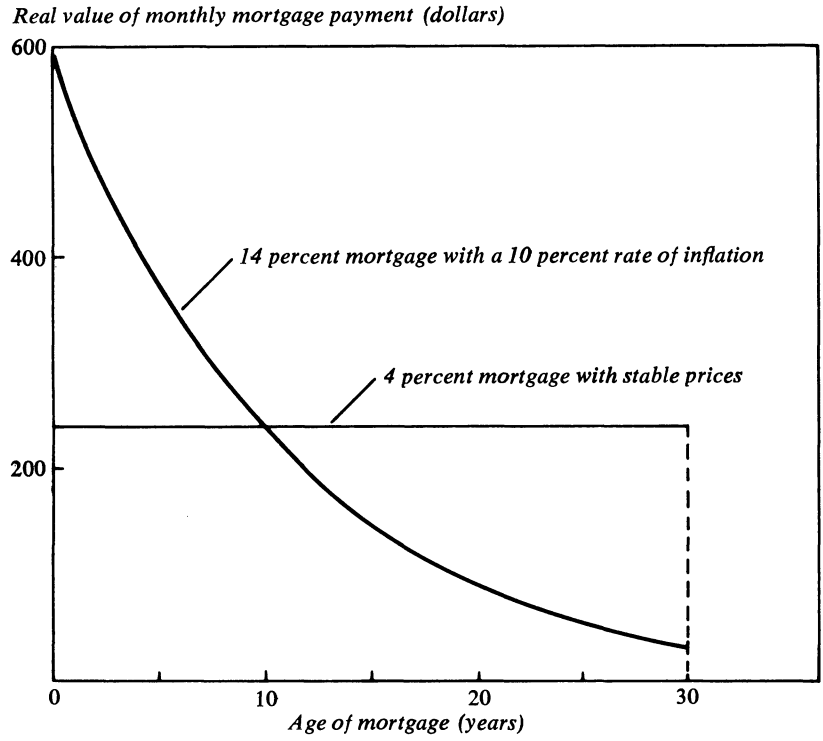
Figure 1 illustrates this "real-payment twist" that characterizes all level-payment mortgages during a period of inflation. For the case of 10 percent inflation, it shows how much higher initial mortgage payments must be to compensate for the eventually trivial real value of those monthly payments in the later years of the mortgage.

MORTGAGE INNOVATIONS

While there has been no shortage of suggestions for modifying the traditional mortgage instrument, most innovations have focused on prob-

1. In an effort to help potential borrowers qualify, many lenders liberally interpret the bankers' income rule by including income of spouse, applying the formula to before-tax rather than to after-tax income, by computing monthly ownership costs net of property tax and insurance costs, or by shifting to a requirement of no more than 33⅓ percent of the borrower's monthly income.

Figure 1. The Real-Payment Mortgage Twist, Ten Percent Inflation



lems created for bankers by fluctuations in short-term interest rates rather than on the difficulties created for borrowers by the real-payment twist. The *variable interest-rate mortgage,* a popular innovation that may replace the traditional mortgage instrument in many sectors of the country, allows for the periodic adjustment of the nominal interest rate for the duration of the long-term loan in response to changes in short-term money-market rates.[2] The variable interest-rate mortgage thus aids mortgage bankers by shifting at least a part of the risk of fluctuating short-term interest rates to the borrower; but this innovation does not help the borrower (except insofar as it makes credit available at a lower cost in

2. Such loans are often called rollover mortgages by savings and loans; the U.S. comptroller of the currency used the term adjustable rate loans in the spring of 1981 in authorizing national commercial banks to make this type of mortgage.

return for the sharing of risk). To see this, observe that if short-term rates remained stable in a period of correctly anticipated 10 percent inflation, nominal monthly payments would be stable and would correspond to the declining real payments illustrated in figure 1. Thus the real-payment twist remains.[3]

The *shared-appreciation mortgage,* a second alternative to the traditional instrument, allows the lender to share in the capital gain that the homeowner realizes in inflationary times. Under one variant of this type of mortgage, the monthly payments are computed as though the loan were for thirty years. If the house is sold within ten years, the lender receives a specified percentage of the realized capital gain; and if the house is not sold, after ten years the mortgage instrument matures and the borrower has to pay the specified share of the property's appreciation based on its estimated fair market value. Because the borrowing homeowner will be forced to refinance at whatever terms exist in the market ten years hence, this reform resurrects some aspects of the balloon mortgage in the effort to cope with inflation. This type of mortgage makes it easier for the would-be homeowner to qualify for the loan because the monthly payment is computed at a lower nominal interest rate in return for the commitment to share the capital appreciation with the lender; for instance, the lender might receive one-third of the appreciation in return for a one-third reduction in the nominal interest rate. But the shared-appreciation mortgage does not eliminate the real-payment twist inflicted by rising prices, for it still provides for fixed nominal payments.

The *graduated-payment mortgage* provides for lower initial payments in return for higher nominal mortgage payments later, with the graduation specified in advance. If inflation is correctly anticipated and fully reflected in the graduation of payments, this mortgage allows the borrower to escape the real-payment twist. Full graduation, with payments indexed to a 10 percent inflation rate, would require an initial payment of $241 and a final payment of $4,165 on a thirty-year, $50,000 mort-

3. Donald R. Lessard and Franco Modigliani discuss a complex dual-rate form of variable-rate mortgage that might eliminate much of the real-payment twist. See their discussion in "Inflation and the Housing Market: Problems and Potential Solutions," in Federal Reserve Bank of Boston, *New Mortgage Designs for Stable Housing in an Inflationary Environment,* Conference Series 14 (FRBB, January 1975), particularly pp. 37–41.

gage with a real interest rate of 4 percent.[4] The low initial payment makes it easier for the borrower to qualify for a loan in terms of the bankers' income rule; and the ratio of mortgage payment to income will remain fairly stable for the duration of the mortgage. While the nominal outstanding value of the mortgage will rise initially, the value of the home serving as collateral is also likely to increase in step with the inflation. Thus, aside from possible tax complications, the borrower finds in an era of 10 percent inflation that a graduated mortgage computed at 14 percent nominal interest is equivalent in real terms to a 4 percent mortgage issued in a period of stable prices.

The graduated mortgage does not allow for variations in the inflation rate and thus does not deal with inflation uncertainty. It exposes the borrower to the risk of a growing real payment burden if actual inflation is less than anticipated in the mortgage. This risk to the borrower can be mitigated if the mortgage allows prepayment; but the lender has no similar protection against the uncertainty of inflation. Even with the possibility of prepayment, the high nominal payments specified in the later years of a fully graduated mortgage are unnerving, and it is not surprising that, in practice, the graduated payment mortgages appearing on today's market are a compromise providing for level nominal payments after a few years. Such partial graduation only moderates the real-payment twist of the level-payment mortgage.

4. The monthly payment of a mortgage graduated at rate g grows according to the following expression:

$$M_t = (1 + g)M_{t-1} = (1 + g)^t M_0 \qquad t = 1, \ldots, T,$$

where M_0 is set so as to equate the amount borrowed, P, with the sum of T future mortgage payments, discounted at nominal interest rate r; that is,

$$P = \sum_{t=1}^{T} M_t/(1 + r)^t = M_0 \sum_{t=1}^{T} \left(\frac{1 + g}{1 + r}\right)^t.$$

The discount factor can be approximated by

$$i = \frac{1 + r}{1 + g} - 1 = \frac{(r - g)}{(1 + g)} \approx r - g.$$

Thus, using i, the M_0 can be determined with standard tables used by mortgage bankers. Alternatively, by summing the geometric series, a convenient expression can be obtained for use on a modern electronic calculator:

$$M_0 = \frac{P_i}{[1 - (1 + i)^{-T}]}.$$

INDEXED MORTGAGES

An *indexed mortgage* eliminates the real-payment twist by adjusting payments to actual inflation rates. Thus, unlike the fully graduated mortgage, it deals with the uncertainty of inflation. The monthly payment on an indexed mortgage increases in proportion to the price level. Let M_0 be the initial monthly payment and p_0 the initial level of the index (possibly the consumer price index) to which the nominal payments are to be indexed. Then the mortgage payment in month t, when the index is at level p_t, is

$$M_t = \left(\frac{p_t}{p_0}\right)M_0. \tag{1}$$

As in the case of a conventional mortgage, part of each monthly payment meets the interest on the outstanding balance and the residual is applied toward the retirement of the loan. Specifically, if B_{t-1} is the outstanding balance at the end of the preceding month and ρ the specified real interest rate, the retirement of the loan each month is

$$R_t = M_t - \rho\left(\frac{p_t}{p_{t-1}}\right)B_{t-1}. \tag{2}$$

But the outstanding balance is influenced by the amount of inflation that has taken place during the month as well as the amount of the principal retired,

$$B_t = \left(\frac{p_t}{p_{t-1}}\right)B_{t-1} - R_t = \left(\frac{p_t}{p_{t-1}}\right)(1 + \rho)B_{t-1} - M_t. \tag{3}$$

To illustrate, consider an indexed, thirty-year, \$50,000 mortgage with a 4 percent real interest rate. In the absence of inflation, the monthly payment will be \$239, as given by a mortgage banker's standard table at 4 percent interest or with the formula given in note a of table 1. Suppose, however, that prices rise by 2 percent during the first month that the mortgage is outstanding. The payment due at the end of the first month will be $(1.02)(\$239) = \$244$ by equation 1. Of this payment, the amount required to service the debt is $(0.04/12)(1.02)\$50{,}000 = \$170$, leaving \$74 for debt retirement in accordance with equation 2. Taking inflation into account, the outstanding debt after the mortgage payment increases

by 2 percent less debt retirement, or \$51,000 − \$74 = \$50,926. Although the nominal liability of the borrower increases, after adjusting for inflation the debt in real terms declines to \$49,927, exactly what it would be in a zero-inflation environment with a standard 4 percent level-payment mortgage.

As this example makes clear, the indexed mortgage insulates the debtor-creditor relationship from the distortions of inflation. The debt may at times increase in nominal terms, but the value of the home serving as collateral will probably rise with the general price level. The final payment, to be made thirty years hence, will just suffice to pay the outstanding balance; and this is so even though the dollar magnitude of that final payment, because it depends on future price movements in accordance with equation 1, cannot be determined in advance.

If the pace of inflation could be accurately predicted over the entire life of an indexed mortgage, it would be possible to design a graduated mortgage that would be identical. The advantage of an indexed mortgage is that it does not require clairvoyance in specifying the future rate of inflation. It automatically adjusts for inflation, imposing a constant real burden on the borrower and eliminating the real-payment twist. The borrower is assured that, if nominal income grows with the rate of inflation, whatever that rate turns out to be, the mortgage payment will remain at a fixed and manageable percentage of income.

While many potential first-time home buyers are unable to qualify for level-payment mortgages, the problem arises from the real-payment twist rather than from high nominal mortgage rates. With indexed mortgages, a 14 percent nominal mortgage with 10 percent inflation is no more burdensome than a 4 percent nominal mortgage in a time of stable prices. Thus the pain that inflation inflicts on these first-time home buyers does not come from the high nominal interest rates that naturally arise when inflation is generally anticipated; it results from the reluctance of financial intermediaries to offer indexed mortgages.

It is by no means obvious why financial intermediaries do not offer indexed mortgages, for the technique of indexing is widely understood. McCulloch mentions certain legal obstacles, including the issue of collectability stemming from the 1933 "Gold Clause," which was not revoked until 1977, as well as state usury restrictions.[5] But banks and thrift

5. J. Huston McCulloch, "The Ban on Indexed Bonds, 1933–77," *American Economic Review*, vol. 70 (December 1980), pp. 1018–21.

institutions constitute a potent lobbying force that could press for enabling legislation if they were interested in offering indexed mortgages.[6] It may be that innovation by these institutions is inhibited by government regulation coupled with the financial squeeze imposed by the hangover of low yield mortgages in their portfolios. The troubled thrift institutions are in no position to issue indexed mortgages with their low initial nominal payments because they are not covered with indexed liabilities. While innovation is never easy, the last section of this paper explains how indexed mortgages can be safely issued by financial intermediaries without resorting to government subsidies or guarantees.

Retirement Options

Life-income retirement annuities are well designed for an environment of stable prices, for their promise of a level monthly nominal payment for life relieves retirees from concern about longevity risk. There is no need for people to worry that they might exhaust their savings prematurely as a result of living longer than expected or, alternatively, that they might live too frugally during retirement because they overestimate their life span. Although holders of pensions and retirement annuities are freed from this longevity risk in times of inflation, the level nominal payment is subject to erosion by a painful real-payment twist that mirrors the twist confronting the homeowner holding a mortgage. As can be seen in table 2, with 10 percent inflation the real value of the monthly pension will be whittled down to about 20 percent of its initial value after seventeen years —which is life expectancy at age sixty-five.

When a given amount is invested in a conventional annuity, expected inflation affects the size of the nominal benefits as well as the real value of those benefits through time. The following cases illustrate the implications of alternative inflationary environments for an individual who has invested $100,000 in a life annuity.[7]

6. Special enabling legislation was required in New York State for the establishment in 1952 of CREF (College Retirement Equities Fund), a variable retirement annuity based on a broadly diversified common stock fund.

7. Annuity valuations reported in this paper are based on current unisex group annuity mortality tables. The information was provided by Marnie W. Mueller of the Connecticut Mutual Life Insurance Company.

Table 2. The Real Value of a Level-Payment Pension or Annuity[a]

Rate of inflation (percent)	*Real dollar value by year into retirement and age*				
	0 (age sixty-five)	*Ten years (age seventy-five)*	*Seventeen years (age eighty-two)*	*Twenty years (age eighty-five)*	*Thirty years (age ninety-five)*
0	100	100	100	100	100
5	100	61	44	38	23
8	100	46	27	21	10
10	100	39	20	15	6
20	100	16	5	3	*

Source: Calculations by the author.
* Less than $1.00.
a. Amounts shown are per $100 of nominal payment. Figures are rounded.

Case A. Price stability—in a period of price stability with long-term investments yielding about 4 percent, $100,000 would provide for a level-payment life annuity of $752 a month. If prices remain stable, the annuity provides a steady lifetime stream of real purchasing power.

Case B. Inflation and the real-payment twist—when 10 percent inflation is generally anticipated and long-term investments yield 14 percent rather than 4 percent, a $100,000 accumulation yields a nominal annuity of about $1,381 a month. Thus the retiree begins with a higher initial annuity but its purchasing power erodes rapidly if the anticipated inflation materializes. After seventeen years the real value of the annuity will be only $273 per month.

A retired worker with a *defined-benefit* nonindexed pension will suffer a more severe loss from anticipated inflation. Such a worker does not receive the higher nominal payments that accompany the real-payment twist for the annuitant.[8] For example, a retiree entitled to a $750 per month level-payment pension will receive that nominal payment even though investment yields rise because of a higher anticipated rate of inflation. The pension fund gains; instead of the $100,000 required to fund the $750 monthly pension on the date of retirement with 4 percent interest, only $54,453 is needed at the 14 percent nominal interest rate that

8. Federal government pension benefits, including military, are formally tied to the consumer price index. While it is hard to find estimates of the extent to which private employee pensions are indexed, Stanley Fischer reports that railroad employees and a third of state and local government employees are covered by indexed pensions. See his "Adapting to Inflation in the United States Economy," Conference Paper 94 (National Bureau of Economic Research, January 1981), p. 19.

would be available with 10 percent inflation and the same real rate of interest.[9]

Advising retirees on how to cope with inflation is far from easy. Dale R. Corson, in an article on inflation and retired professors, lists two basic options.[10] The retired professor can adjust the mix between fixed annuities and variable annuities whose yield depends on the performance of investments in common stock. The unfortunate experience of the 1970s testifies to the lack of inflation protection provided by annuities tied to the stock market. The second option Corson considers is to save a portion of one's pension during the early years of retirement in order to accumulate a nest egg to be drawn upon later when the purchasing power of the annuity payment has been undermined by inflation. Besides the risk to the retiree from incorrectly estimating the rate of inflation, this nest-egg strategy exposes the retiree to longevity risk, the danger that one may die too soon or live too long.

A *graduated-payment life annuity,* with the monthly payment rising at the expected rate of inflation, would alleviate the real-payment twist if inflation were predicted with precision. As an alternative to a level-payment annuity of $1,381 a month, a $100,000 accumulation in a time of 14 percent nominal interest rates can generate a stream that grows at 10 percent a year. The initial payment must be less, only $752 a month; but it will rise to $1,465 in seven years and to $3,455 in sixteen years in order to preserve the real value of the monthly payment *if* the anticipated inflation occurs. But like the graduated-payment mortgage, such an annuity carries a risk for both the retiree and the provider of the annuity in a world of uncertain inflation.

Such uncertainty makes an *inflation-indexed life annuity* a much preferred remedy for the real-payment twist that inflation imposes on the retiree. With an indexed pension, retirees receive a guaranteed stream of real rather than nominal payments. In exchange for this guarantee of purchasing power, the initial payments are less in nominal terms in order to balance the greater payments to be received in later years if anticipated inflation materializes. If prices turn out to be stable, the indexed life an-

9. When the defined-benefit pension is tied to terminal salary, the pension fund may be underfunded as a result of inadequate earnings during the accumulation period—this is the case if the pension has acquired long-term assets with yields reflecting a gross underestimate of inflation.

10. Dale R. Corson, "Inflation and the Retired Professor," *Academe,* vol. 65 (March 1979), pp. 119–32.

nuity based on a 4 percent real return will be equivalent to the level-payment pension plan. With steady 10 percent inflation, the indexed pension will be equivalent to the 10 percent a year graduated-payment pension.

Index Entrepreneurship

Although the uncertainty of inflation makes both the indexed mortgage and the indexed life annuity too risky for financial institutions when each instrument is considered individually, the separate risks are offset if they are taken together. Indexed mortgages and annuities are complementary instruments: an annuity fund can index both sides of its balance sheet, matching its indexed life-annuity liabilities through the acquisition of offsetting indexed mortgage assets. If inflation accelerates, the increased payments due the holder of the indexed annuity will be offset by the increased receipts from the indexed mortgage payments; if prices stabilize, the unanticipated reduction in indexed mortgage receipts will be balanced against the reduction in indexed annuity payments.

Life insurance companies and pension plans have traditionally engaged in maturity matching, insulating themselves from short-run fluctuations in money-market conditions by offsetting their long-range commitments with bonds or mortgages of comparable maturities. With inflation uncertainty, the appropriate strategy is to double-match, offsetting real defined-benefit pension liabilities with indexed mortgages.[11]

Introducing indexed mortgages may be difficult because mortgages are customarily originated by banks and thrift institutions; but a secondary mortgage market in indexed mortgages will facilitate the process of adapting to inflation. Once a market for long-term indexed securities develops, a number of participants are likely to enter the market. For example, universities and other permanently endowed institutions have suffered

11. In recent months many state pension funds have been increasing their holdings of mortgage-backed securities issued by the Government National Mortgage Association. The Connecticut State Employees Pension Fund is currently arranging to invest in traditional level-payment mortgages, which will be passed through to it by local savings banks being commissioned to originate the mortgages. Although the pension's liabilities are to be defined as level nominal payments, by acquiring indexed mortgages the pension fund could better protect its defined-benefit liabilities against the danger of unanticipated inflation up to the time benefits commence.

considerably in the past decade; in the face of rapidly rising costs the average total return on university portfolios of 7.6 percent over the last decade has meant a negative real rate of return.[12] Such institutions might be attracted to indexed mortgages that provide a more stable yield protected from the inroads of inflation. Many retired faculty members drawing on TIAA-CREF annuities might welcome the option of placing at least a part of their retirement nest egg into an indexed life annuity.

There should also be room for an arbitrage market that offers indexed life annuities to retired employees who are now entitled to pension benefits denominated in nominal dollars. Under such a scheme, a retiree would agree to exchange the entitlement to the stream of constant nominal dollar annuity payments for an alternative stream, starting at a lower initial figure, but tied to the price index. In effect, the retiree would be using the fixed monthly nominal pension income provided by the employer to purchase an indexed life annuity on an installment plan. During the early years the retiree would be a net contributor to the pool; in later years, if inflation materialized, the retiree would make withdrawals. Although the life span of each individual retiree is not predictable, the process can be made actuarially sound in much the same way as a standard annuity. This procedure, applied to a group of retirees, eliminates the longevity risk experienced when retirees attempt individually to follow the nest-egg strategy suggested by Corson.

The appropriate real interest rate for indexed securities will have to be determined by the market in equating the demand and supply for such securities. An extremely high real rate of return will discourage the demand for indexed mortgages; a very low rate will reduce the attractiveness of indexed annuities. It may be reasonable to conjecture that the real rate would be positive, but a negative rate is also conceivable, for many retirees have concluded from the experience of the 1970s that they can anticipate only a negative real rate of return on their savings. The real rate will also be influenced by demographic factors, with the aging of the population increasing the demand for indexed annuities relative to that for indexed mortgages.

A fully developed market for indexed obligation could offer a variety

12. According to the National Association of College and University Business Officers, the average rate of total return realized by the seventy-five universities responding to a recent survey was 7.6 percent for the decade ending June 30, 1980; for the decade ending June 30, 1979, the average return was 4.8 percent.

of alternative mortgages and annuities tied to different indexes. Retirees who want to share in the rising standard of living brought about by increased worker productivity could index their annuities according to the money wage rather than to a measure of consumer prices such as the CPI, trading a somewhat lower initial retirement payment for a gradual increase in pension purchasing power that would help preserve their relative income position.[13] And homeowners borrowing mortgage funds from their employer might appropriately index their monthly payment to an index of wages or salaries rather than to the general price level; in this way the ratio of income to mortgage payments would remain fairly stable for the duration of the mortgage.[14] Lenders now interested in the shared-appreciation mortgage might find it administratively simpler to tie mortgage payments to an index of housing prices.

Conclusion

High nominal interest rates and errors in anticipating the rate of inflation are not the primary source of the hardship that inflation inflicts on the public. A large part of that hardship comes from the real payment twist that results from traditional level-payment mortgages and pensions even with correctly anticipated inflation. This twist erodes the real incomes of retirees in their later years and increases the real cost of homeownership in the early years of a mortgage. Indexed instruments, which eliminate the real payment twist, would remove these hardships. By simultaneously issuing indexed mortgages matched by indexed pensions and annuities, financial intermediaries could eliminate the risk they would be exposed to

13. Indexing to wages rather than prices would have made only a moderate difference in the United States during the past decade, for hourly earnings rose 103 percent while consumer prices rose 98 percent. In West Germany the distinction is much more marked, for the comparable increases were 130 percent and 61 percent. For the United States, see *Economic Report of the President, January 1981,* p. 274. For Germany, see International Monetary Fund, *International Financial Statistics,* various issues.

14. For a university, issuing indexed mortgages may be a particularly attractive form of home-purchase assistance. An indexed mortgage tied to the average level of faculty salaries would provide the university with a guaranteed real return linked to a major component of its future payment obligations; it would allow the buyer to purchase a home at a much reduced initial monthly payment by eliminating the real-payment twist.

by issuing only one or the other instrument. It is the failure of the market to produce these financial innovations, after more than a decade of accelerating inflation, that is causing a major problem for retirees and potential homeowners.

Discussion

THE PARTICIPANTS conjectured about why financial institutions had not supplied the indexed instruments Lovell suggested. Donald Hester pointed out that indexing did not promise an exceptional rate of return that would encourage commercial banks and other financial institutions to pioneer. He also believed that a portfolio confined to indexed mortgages would not be diversified enough to support indexed life annuities. Franco Modigliani observed that the tax deductibility of nominal interest and the uncertain tax treatment of indexed assets and liabilities may have inhibited their introduction. Varying interest payments might be treated either as capital gains and losses or as conventional interest payments. He also reasoned that a volume of indexed instruments would have to be available before they were useful to institutions. Yet it would be difficult to develop indexed assets and liabilities simultaneously on a sufficient scale. Stanley Fischer suggested that the government should pioneer by issuing indexed bonds. With that market established, private institutions might then follow, creating the kinds of instruments Lovell described. James Tobin observed that indexed government bonds would have other desirable effects—improving monetary control, reducing the real interest burden of the government debt, and providing partial inflation adjustment for the government budget.

Some alternatives to approximating indexing were discussed. Benjamin Friedman introduced the idea of annuities invested in short-term money-market instruments. These had produced slightly positive real returns over extended periods and thus promised to be a hedge against inflation. During the payout period, the annuity might have graduated nominal payments based on an expected inflation rate. Modigliani described a proposal he had made previously, which would provide units of annuity payments based on a guaranteed rate of interest set at the

expected real rate. The value of each unit would be changed by the difference between the guaranteed rate and the nominal interest rate actually experienced. Thus if the nominal interest rate kept pace with inflation, the real value of the annuity would remain constant; the annuity would be effectively indexed to inflation. Such a plan could be implemented without the creation of new, indexed securities in which to invest. Fischer pointed out that the guaranteed real rate of interest that could be offered in such a plan, as with any indexed instrument, would be near zero, reducing its attractiveness to those who optimistically expected more. He observed that the risk on the real rate of return was borne by the annuitant in Modigliani's plan and by the issuer of the annuity in a truly indexed plan. Charles Holt believed plans such as the one Modigliani described were urgently needed. But if it could be achieved, he preferred Lovell's alternative because it provided for the needed indexing of mortgages as well as annuities.

Robert Hall distinguished three positions regarding indexation and inflation. One is that the absence of indexation implies that inflation is not very costly. A second is that inflation requires new institutions but that these develop slowly because of the new investment in human capital they entail. People have not yet realized that a graduated annuity may be advantageous for the annuitant despite the lower initial payments. A third is that inflation should be ended to save the costs of either changing to an indexed system or living without one in a world of inflation.