MORTGAGE STUDY REPORTS

Report #1

SOME ECONOMIC IMPLICATIONS OF THE INDEXING OF FINANCIAL ASSETS WITH SPECIAL REFERENCE TO MORTGAGES*

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PUBLICATIONS

1. Some Economic Implications of the Indexing of Financial Assets With Special Reference to Mortgages by Franco Modigliani

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I - The Basic Role of Indexation of Financial Assets in the Presence of Price Level Uncertainty

As long as loan contracts are expressed in conventional nominal terms, a high and variable rate of inflation - or more precisely a significant degree of uncertainty about the future of the price level - can play havoc with financial markets and interfere seriously with the efficient allocation of the flow of saving and the stock of capital. Indeed it may be argued that this is one of the most damaging unfavorable implications of unpredictable inflation rates, potentially as serious as the capricious redistribution of income and wealth, which, in the popular view, is the hallmark of a disorderly inflationary process. It has been suggested by many economists for quite some time now that these unfavorable effects on resource allocation as well as the redistributive effects can be eliminated or at least greatly alleviated by the device of "indexing" financial contracts, especially long-term contracts. Indexation consists in denominating the principal and the interest in "real terms" i.e., in terms of "a suitable commodity basket." In practice, this means that the nominal value of the principal is revalued periodically on the basis of an index of the changing nominal value of the stated basket, and that the agreed interest is to be applied to the revalued principal.

The reason for the unfavorable effect of inflation on financial markets and efficient allocation of resources and for the view that it can be remedied by indexation can be compactly stated as follows.

When the price level is stable (more generally, perfectly predictable) there exists in society one man created intangible asset whose outcome is sure, namely that arising from loans to borrowers who are essentially default proof. The existence of such an asset plays a fundamental role in the process of efficient allocation of capital because it permits separating the function of accumulating and holding wealth from that of managing physical assets and bearing the risk typically associated with such assets. Even though for society as a whole, capital or wealth must finally consist of physical assets (except for net claims on the government and the rest of the world) any individual can shed the risk associated with physical capital by holding at least some of his wealth in the form of claims fixed in terms of money as long as other members of society are prepared to assume more risk than they have wealth by issuing money fixed claims against themselves and using the proceeds to acquire physical assets or financial claims to such assets (equities). The sure contract can, in turn, form the basis for more complex "intermediation" in which a financial intermediary is the initial borrower and, in turn, lends directly, or through further intermediaries, to the final borrower. This type of contract together with efficient and competitive financial markets permits physical capital to be allocated so as to produce the highest return adjusted for risk as assessed by all wealth holders through the market. The analysis of this process is the essential contribution of modern asset market theory.

When the future price level is uncertain, however, there is no asset which offers a sure outcome. If the uncertainty about future price levels becomes large enough the return from loan contract can become more risky than that from certain physical assets; hence, holders of wealth may be induced to invest their wealth in such assets even though from the point of view of society their real return may be small or even negative -(e.g. gold), and this course of action will displace investment in potentially higher yielding assets. This is the so-called flight into commodities (corsa ai beni rifugio) which may also contribute to kindling the inflationary process if the "flight" is directed toward commodities with inelastic supply.[1]

This outcome may also be encouraged by the fact that monetary authorities quite frequently endeavor to stabilize interest rates, which prevents the nominal interest rate from changing enough to offset the expected changes in the rate of inflation. The result is that, when inflation is growing, even the expected real return from lending is reduced and may become negative, compounding the effect of greater uncertainty or dispersion around the expected outcome.

Even when this does not happen, and interest rates are allowed to rise to reflect increases in the expected rate of inflation, misallocation may be fostered by the fact that uncertainty about the price level may also tend to increase the risk of the outcome for the

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[1] If the supply is completely inelastic, as would be the case, e.g. with land, so that net investment can only be zero, the final result might well be an increase in consumption spurred by the rise in the (real) market value of private wealth, and a corresponding decline in investment.

borrower especially for long term contracts (when the nominal 20-year rate has reached, say 25% because the expected rate of inflation over the next twenty years is 20%, a 20 -year loan may be quite risky for the borrower as well as the lender). Thus at least the volume of long term loans may diminish because of the greater uncertainty about the average long-term rate of inflation, reducing the possibility of hedging against future movements of rates (even real rates).

Indexation prevents all this by reintroducing a contract with a "reasonably" sure real outcome - regardless of the length of the contract and the actual future course of inflation - thus revitalizing financial markets and reestablishing the possibility of intermediation and efficient allocation of capital. In addition, of course, indexation has desirable distributive effects in that it eliminates the capricious redistribution of income and wealth resulting from unforeseen inflation (or deflation).

It is sometimes argued that these redistributive effects may have some positive consequences in that inflation typically "robs" the lender in favor of the borrowers, who on the average have a greater propensity to save and are more willing to bear risk. These effects would seem desirable in a society where both capital and willingness to assume risk are scarce. But the argument about the different propensity to save is, in my view, very doubtful - at least in the long run - on the basis of my own work and that of others on the life cycle model of saving (cf. the results of a recent analysis of the Italian experience by Modigliani and Tarantelli).

Furthermore, the view that inflation systematically robs the borrower is valid only to the extent that nominal rates are prevented from reflecting the market's best estimate of the future rate of inflation. In this case, however, the inflation will also tend to produce, to a serious extent, the distortion in allocation referred to above. If, on the other hand, nominal rates do reflect an unbiased estimate of the future rate of inflation, lessening the misallocation problem, then the actual outcome is as likely to be a redistribution in favor of the lender as in favor of the borrower.

It has also been suggested that inflation may tend to reduce the overall level of saving and capital formation by reducing the expected real return on financial assets (when nominal rates are kept artificially low) and by causing the return on all assets to become uncertain. Unfortunately the validity of these propositions is hard to assess. As is well known, a fall in the rate of interest may either increase or decrease the rate of saving depending on whether the substitution or the income effect predominates, and at least some evidence suggests that income effect may be the dominant one (cf. Modigliani and Tarantelli and the references cited therein). Similarly recent work on the theory of saving under uncertainty (e.g. Dreze and Modigliani) leads to the conclusion that, under plausible assumptions about attitude toward risk (decreasing absolute risk aversion), an increase in uncertainty results in an <u>increase</u> rather than a <u>decrease</u> in saving, though in the case of uncertainty about rates of return either outcome

is consistent with rational behavior and plausible assumptions about tastes.

In summary, in the presence of substantial uncertainty about the future rate of inflation, indexation of financial assets would seem likely on balance to do considerably more good than bad though one cannot rule out a priori some minor unfavorable effect. Many economists nowadays point to the Brazilian experiment with indexation as providing empirical evidence in support of the above conclusions, at least in extreme circumstances.

II. The Special Case for the Indexation of Mortgages

More recently some economists have pointed out that a case may be made for the indexation of mortgage contracts that is even stronger than the general case made above. (See e.g. Poole, Baffi.) It can be argued that inflation may distort the allocation of resources between housing and other physical assets and variable rates of inflation may contribute to the instability of construction activity - even when inflation is largely predictable and adequately reflected in nominal rates; and that these problems could be relieved by the indexation of mortgages. As a result of these considerations research is presently getting under way at M.I.T. to investigate in depth the theoretical as well as the practical issues involved in indexation of mortgages, and to compare indexation with alternative approaches to the stabilization of construction by way of improved financial instruments.

What follows is largely based on the preliminary and still tentative analysis developed in preparation for that project.

The propositions stated above about the unfavorable effect of high and variable rates of inflation on residential construction rest on two main considerations: (1) in most of the developed countries, the prevailing vehicle for financing residential housing, notably owner-occupied dwellings or small rental units, is the traditional level payment mortgage; (2) the financing through this instrument is provided by specialized institutions such as savings banks, or, in some countries, mortgage banks (frequently also connected with savings type institutions). Under these conditions a high rate of inflation will tend to curtail the demand for housing, while variable rates of inflation are likely to produce instability in construction both through the demand for housing and through the availability of mortgage funds, for reasons detailed below.

II-1 Demand Effects of the Rate of Inflation

The demand effect occurs because the high nominal rates of interest which result from the addition to the "real" rate of interest of a premium roughly equal to the expected rate of inflation has the effect of increasing the level of the annual payment relative to the rate of earnings in the early year of the mortgage contract. This point is illustrated in Column 1 of Exhibit I which shows the level annual payment required on a $30,000, 30-year mortgage. Assuming

a 3% real rate of interest, it is seen that with zero inflation (case No. 1) the first year (as well as all subsequent) payment amounts to $1,517; with a 2% rate of inflation, and hence a 5% nominal rate (case No. 2), it is nearly 25% higher or $1,931; for a 6% rate of inflation the payment is almost twice as high, $2,895. The reason for the positive association between rate of inflation and initial payment is that, in the presence of inflation, the constant nominal payment will imply an annual payment, which in "real" or purchasing power terms, decreases in time at the rate of inflation. Thus with a 6% rate of inflation, by the year 5, the real payment is $\$2,895/(1.06)^4 = 2,294$; by the year 12 it is 1,525, or about the same as with no inflation and, thereafter, it becomes lower, being reduced in the terminal year to a mere 524. Of course the real present value of this declining stream of real repayments is always $30,000 no matter what the rate of inflation; it is precisely in this sense that the higher nominal rate corresponding to higher rates of inflation compensates for the gradual erosion of the purchasing power of the nominal stream. But precisely because the present value of the real stream must be the same and the stream is declining in time, it must start at a higher level. The higher the rate of inflation the greater the tilting in the rate of real repayment and hence the higher the initial payments. This point is illustrated graphically in Figure 1, which compares the behavior of the real payment at successive dates over the life of the contract. (In this figure, the assumed real rate is 4% and the mortgage is for $20,000.)

But why is the real rather than the nominal rate of repayment the important magnitude? The simple answer is that under generalized inflationary conditions the income of the typical home buyer may be expected to rise in the long run at a rate at least equal to that of the price index. In the limiting case where the growth of nominal income precisely equals the rate of inflation, the behavior of the real rate of repayment in Figure 1 is proportional to the behavior of the ratio of the nominal payment to nominal income. Columns (3) and (4) of Exhibit 1 provide a numerical illustration. One can see from Column (4) that for that illustration, in

the absence of inflation carrying the house will absorb some 15% of the person's income throughout the life of the contract. But with a 2% inflation the annual payment for the very same house will require 19.3% of his income at the beginning of the contract, and will continue to absorb more than 15% for some twelve years, though in the terminal year, it will take only 10.8%. With a 6% inflation it will absorb at the outset nearly 30% of his income, declining to 5% in the terminal year.[1]

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[1] On the assumption of a steady rate of inflation, $\dot{p}$, fully incorporated in the nominal rate $R = r+\dot{p}$, where r is the "real" rate, the effect of inflation on the annual payment (which is also the initial real payment) relative to what it would be without inflation, is given by

$$(a) \qquad \frac{r+\dot{p}}{1-(1+r+\dot{p})^{-T}} \qquad \frac{1-(1+r)^{-T}}{r}$$

T being the length of the contract. If the borrower's income is growing at the rate $\dot{p}$ then the ratio of nominal payment to nominal income in the n^{th} year of the contract is proportional to

$$(b) \qquad \frac{(r+\dot{p})}{[1-(1+r+\dot{p})^{-T}](1+\dot{p})^{s}}$$

To find the number of years over which the ratio of annual payment to income is above the level prevailing with no inflation, one can equate (a) to $(1+\dot{p})^{s}$ and solve for s.

It is obvious from this example that with conventional mortgage financing a rapid rate of inflation even if fully and correctly anticipated may be expected to reduce the demand for owner-occupied housing space by raising the ratio of annual payment to income in the early years of the contract. Exhibit 2, reproduced from Tucker [1973] shows that even the relatively modest increase in the mortgage rate that occurred in the U.S. between 1963 and 1973, as a result of the relatively modest rise in the rate of inflation, has been sufficient to cause the initial payment, computed in Column D (from an index of prices of new houses, the average mortgage rate and the prevailing length of contract), to rise appreciably faster than average wage income, shown in Column E.

The nature of the unfavorable effect on the demand for housing of a higher nominal rate due to inflation is quite similar to that of shortening the length of the contract. This point is brought out graphically in Figure 2 which shows that a faster rate of inflation, much as a shorter maturity, forces the borrower to repay his real debt - or equivalently to accumulate equity in his house - at a faster rate. Of course the ratio of annual payment to income eventually declines as inflation erodes the purchasing power of the payment. But this only means that inflation causes the burden of owning a house to be very unevenly distributed over time. The extent of this unevenness is even greater than implied by Column (4), when it is recognized that a major group of potential home buyers is represented by young households, (cf. Baffi). This group can look forward to an increase in income even in the absence of inflation

both because of the general effect of productivity growth, which tends to raise all incomes, and because typically, even in the absence of productivity growth, income tends to rise with age, at least for a while, (though the specific shape of the life cycle of income will be influenced by individual factors such as education, social institutions etc.) Column (7) exhibits the share of income absorbed by the payment under the conservative assumption that income rises but 2% per year. It is seen that even in the absence of inflation a conventional mortgage already implies a rather uneven burden over life. But if the rate of inflation reaches 6% the unevenness becomes rather dramatic.

It should be apparent, in fact, that, if the rate of inflation becomes very high, the conventional mortgage contract becomes so onerous for the potential buyer as to become practically unusable, except possibly for those who already have the means to pay in cash a substantial portion of the price. To be sure, this problem could be remedied, in perfect markets, by recourse to second mortgages or similar devices. But such facilities are seldom readily available, and are unlikely to develop in an inflationary climate. On the contrary, if, as frequently happens in such periods, the rate of interest on deposit is kept artificially low, and falls short of the rate of increase in the price of houses, there may be little hope for lower income groups, having a very limited menu of assets available beyond some type of savings deposit, to ever accumulate a sufficiently high equity to use as downpayment. One of the serious consequences of this situation is that, in many countries, pressure has developed to provide relief for the home buyers through various types of government subsidies - e.g. direct contributions to the interest.

In addition to the above effect there may be unfavorable dynamic effects on construction from a rise in the rate of inflation if, as frequently happens, the seller of a house cannot transfer his mortgage to the buyer but instead must repay his loan. This tends to "lock" the owner in the house he initially owns when a rise in the rate of inflation raises the mortgage rate on new contracts, and by selling his house he loses the benefit of the lower rate on the present mortgage.

II-2 Supply Effects

In addition to these demand effects, rapid changes in the rate of inflation have tended to have a destabilizing effect on residential construction by destabilizing the supply of mortgage funds - though the precise nature of this mechanism depends on the nature of the institutions providing funds to the mortgage market.

In the U.S., and other countries, the bulk of these funds has come from specialized thrift institutions that secure funds through deposits - essentially a short term liability - and then invest them in long term mortgage assets. When a spurt of inflation raises money market rates these institutions find it hard to offer competitive deposit rates, because their earnings do not promptly adjust upward; in addition as the market value of their assets decline they may even approach technical insolvency. In order to limit the losses that these institutions would face if left free to raise competititvely their deposit rates, as well as to hold down the overall level of long-term rates in order to minimize the negative effect of rising rates on these institutions and on potential home buyers, monetary authorities have imposed ceilings on the deposit

rate that can be offered by the thrift institutions and by their close competitors such as on time deposits at commercial banks. But ceilings have contributed to induce the public to switch their savings from traditional deposits to other type of assets (disintermediation). Thus even if the ceilings may have helped to protect the solvency of the intermediaries they have tended to dry up their inflow of funds and, hence, their ability to supply funds to the mortgage market, curtailing construction activity through supply of fund effects.

A similar mechanism has been at work even when, as in the case of Italy, mortgage funds come in part from the floating of mortgage bonds by specialized mortgage banks. This has come about because the mortgage banks have endeavored to stabilize the price of their bonds in the face of rising long term market rates on competing instruments, by limiting net new issues, even to the point of making negative new issues, using the repayment flows to buy back outstanding bonds. To pursue this course they have been led to ration funds at the artificially low rate they endeavored to maintain, (though the cost to the borrower has been allowed to reflect to some extent market rates through variations in the spread between the market price of mortgage bonds and the amount paid to the borrower).

II-3 - The Role of Indexation in Eliminating Demand and Supply Effects

The institution of indexed mortgages (IM) could help considerably in eliminating both the demand and the supply effects. On the demand side, since the rate on an IM is a real rate, it should be largely independent of the rate of inflation, making the initial payment equally independent of inflation. It is true, of course, that if the anticipated inflation occurs the level of payment will rise precisely at the same rate as the price level as illustrated in column (2) of Exhibit 1.

In fact in the presence of productivity - or real income-growth the ratio of annual payment to income will still tend to decline in time as shown in Column (8). However, this declining pattern is independent of the rate of inflation. Furthermore, it could be eliminated - or modififed to any desirable extent - by combining indexation with another reform of the mortgage contract, namely non-level repayments. We need not be concerned here with this reform which is quite separate from indexation, but it should be pointed out that indexation can be readily combined with any appropriate contractual repayment schedule stated again in real terms, thus giving rise to a non-level repayment schedule in real terms. We may finally note that indexation should also greatly reduce, if not eliminate, the lock-in effect, since all available evidence suggests that the major source of variation in nominal rates is due to changing rates of inflation, and related changes in expected rates of inflation.

On the supply side, where mortgage funds come from mortgage bonds, indexed mortgages would be matched by the issue of indexed mortgage bonds. This instrument, one should expect, would be very attractive to investors, especially small investors, under conditions of high and uncertain rates of inflation as it would provide them with a hedge against inflation whether predicted or not. Hence it might, on the average, raise the flow of funds available for mortgages, especially if mortgages were the only, or main, type of indexed long term instruments. More important, however, the indexed mortgage rate needed to equate the supply of mortgage funds with the stabilized demand for mortgage funds might be expected to be fairly stable, even in the face of wide movements in nominal rates on other instruments, insofar as these

reflect changes in inflationary expectations unrelated to the real rate; there would, therefore, be little need for the mortgage banks to endeavor to stabilize the market price of indexed mortgage bonds by restricting issues and rationing funds.

Where the mortgage funds come from depository institutions, these again would now be in a position to offer indexed deposits, whose principal would be adjusted periodically to the price level, since any change in their liability due to such revaluation would be matched by similar changes in the value of these assets; and again the indexed deposit rate needed to maintain a stable inflow of deposits should remain reasonably stable despite inflation-induced variations in the nominal rates on competing financial assets. Alternatively the depository institutions could continue to offer nominal deposits but the rate they could offer on such deposits could be based on the contract (real) rate on their indexed mortgages plus the rate of change of the price index: that is, the revaluation of principal could be treated as income currently available to remunerate depositors, on the ground that the mortgage could then be carried on their books at nominal value. Being able to pay such a nominal rate they might be expected to remain competitive with market rates on competing short term instruments.

When the rate of inflation is not only high but also subject to high degree of uncertainty, the indexation of mortgages, as well as possibly of mortgage bonds and other instruments, such as deposits which are used to provide funds for indexed mortgages, would also achieve the desirable

result of enabling borrowers and lenders to hedge against the risk of uncertain price fluctuations. This would be true even if indexation were limited to mortgages and mortgage market related instruments.

II.4 Variable Rate Mortgages as an Alternative to Indexation

It is worthwhile noting briefly that the unfavorable effect of high (and variable) rates of inflation on the financial health of depository intermediaries and on the supply of funds might be also eliminated or reduced through another device which is also receiving considerable attention and has already been tried out to some extent (e.g. in the U.K., in Canada, and to a very limited degree in the U.S.), namely through so-called variable rate mortgages (VRM). In this version the interest rate charged to the borrower is not fixed in the contract but is allowed to float up and down being tied to some market rate, generally a short term one. This approach clearly enables the intermediary to offer deposit rates competitive with other short term market instruments and also disposes of the need for rate ceilings and other related disruptive devices. Furthermore, insofar as short term rates reflect fairly accurately the actual rate of inflation over the lifeof the short term instrument, VRM could also provide a reasonably good hedge against uncertainty of the price level.

However, in our view, this approach is distinctly inferior to indexed mortgages in three important respects: (1) the welfare of the borrower (2) its effects on the level and stability of the demand

as distinguished from the supply side of the market, and (3) the ability of the monetary authority to pursue an appropriate monetary policy.

The basis for propositions (1) and (2) can be most conveniently clarified by reference to Exhibit 3 which compares the annual payment required of the borrower under three alternative arrangements: conventional level mortgage (CLM) - block 1; variable rate mortgage - block 2; and Indexed Mortgage - block 3. The rate currently applied on the VMR is a nominal rate; hence it will be higher , the higher the rate of inflation, and so will the initial annual payment, just as in the case of CLM. Accordingly in the presence of high inflation VRM, in contrast to IM, has the same unfavorable effect on demand as CLM. (see column 1 of Exhibit 3.) In addition, if the rate of inflation, and hence the applicable interest rate changes, VRM will cause changes in the next annual payment which may be quite large and largely unrelated to the rate of inflation and hence to the changing income of the borrower. This can be seen by inspection of Column (1) and (2) in the last row of the VRM block and by comparison with the corresponding figures for the IM block. If the rate of inflation rises from 3 to 5% the scheduled payment under IM rises by 2% above what it would have been if inflation had remained at 3%, an increase commensurate with the likely effect of the higher inflation on the borrower's income. On the other hand, under VRM the scheduled payment rises from $1,453 to $1,798 or some 24%; the reason for this much higher percentage change is that the higher inflation, by raising the nominal rate used in computing the constant payment for the rest of the contract, implies a further tilting of the real repayment schedule - a higher front end load as it were. For similar reasons a decline in inflation produces a large percentage decline in the scheduled payment. (Cf. col. (3) and (4)).

Thus while the VRM approach protects the intermediary (and presumably insures a smoother supply of funds), it does so at the expense of imposing a good deal of additional real risk on the borrower, especially since short rates, as well as the short run behavior of $\dot{p}$, may be quite variable (see e.g. Kaufman). For the same reason it might do little to mitigate variability on the demand side. In contrast, IM tends to reduce the real risk to the borrower, as well as to reduce variability.

Some of these undesirable features of VRM can be eliminated by an alternative design, that has already been applied in some countries, under which the variable rate is used not to change the rate of annual payment, but rather the length of the contract, while the payment itself remains fixed. However, this alternative creates other difficulties, notably that the length of the contract can grow uncomfortably long, when the floating rate rises substantially above the one used in fixing the initial level of the annual payment; indeed the maturity will approach infinity if the rise in the rate is such that the fixed annual payment approaches the interest bill due on the remaining principal. This difficulty is intimately related to the fact that, in the presence of high rates of inflation, a level payment in nominal terms does not make much sense. Tucker [1973] and [1974], has suggested an interesting modification of the VMR which would combine it with the variable repayment scheme. His proposal relies on two basic ingredients: 1) the annual payment would be scheduled to rise in time at some constant

rate which could be based initially on the rate of inflation expected at the time the contract was written. This would permit an initial rate of payment similar in size to that prevailing under IM, ii) the rate used in computing the annual payments would be revised periodically, as under VRM. But the change in rate would change neither the current payment nor the length of maturity but would instead change the rate of growth of the scheduled annual payment. Under some fairly reasonable assumptions this scheme would work in a way rather similar to indexed mortgages. But one can see little reason for preferring this roundabout "imitation" to straightforward indexation.

Finally the IM retains one desirable feature of the traditional level mortgage under constant prices, that would be lost under any form of VMR, namely that it permits the borrower to hedge against future movements of the "real rate", since this is fixed by contract. To have available such an hedging option would seem to be rather valuable when entering into a long run commitment such as the acquisition of a house, considering the sizeable transaction costs associated with changing houses.

The third drawback of VRM listed above is suggested by the consideration that variations in the nominal rate affect very significantly the rate of payment of all mortgage borrowers. This feature is likely to generate a lot of pressure toward avoiding or delaying changes in nominal rates which might be desirable from a stabilization point of view. Under IM, on the other hand, the payment rises only because of inflation and hence the pressures will be toward avoiding it, whereas changes in nominal rates as such would be of no consequence.

III. The Effect of Indexation of Mortgages on Other Financial Markets

The considerations developed in II suggest that considerable advantages might be anticipated from making available to borrowers an indexed mortgage instrument--possible with non-level real repayment schedule--and to lenders indexed mortgage bonds, and or deposits, or at least deposit rates reflecting more nearly the rate of inflation. However these conclusions were based, as it were, on a partial equilibrium analysis of the residential and mortgage markets, more or less in isolation. Before we can confidently advocate that legislation be adopted to make such an instrument available one has to give some consideration to at least two other major issues: 1) the effect of indexation on other financial markets and, 2) implications it may have on the effectiveness of traditional stabilization policies and/or the stability of the economy as whole. Both topics are being included in the pilot phase of the MIT project, and the best that I can do at this time is to report some preliminary thoughts on the issues and on the methodology by which the issues might be attacked.

The questions to be examined under heading (1) range all the way from whether there would, in fact, be a sufficient market for indexed mortgages and supporting instruments to warrant the costs of establishing such markets, to the issue of whether the introduction of such instruments would play havoc with the markets for conventional nominal instruments. The latter concern has been often put forward as an argument against allowing the introduction of any indexed instrument.

These issues can be partly attacked by examining the experiences of the few countries that have made use of such instruments in the post war period. But it needs to be attacked also through the tools of economic analysis applied to financial markets, especially since the experience so far has been quite limited and for various reasons not too conclusive.

III.1 Country Experiences

A summary of experiences with indexation is provided in a recent OECD publication. [1973].

The main countries which have had significant experience with these devices are Finland, Israel, and some Latin American countries notably, Brazil. In every case, indexation was applied more generally to instruments to finance housing. The most favorable experience seems that of Brazil, to which reference was made earlier. The one raising most questions is that of Finland. Exhibit 4, reproduced from the OECD publication, shows that the proportion of bond issues taking the indexed form rose rapidly to some 80% from 1952-1956 and, thereafter, fluctuated between one quarter and four-fifths, responding apparently positively, but with some lag to the rate of inflation in the recent past. However, the marginal rate was fairly uniformly above the average rate so that the share of the stock of bonds outstanding having indexed form rose fairly uniformly to 3/4 in 1967. In the case of deposits the trend is similar but at a lower level, reaching one-third by 1967. Unfortunately, in that year indexation was abolished, though, apparently, for reasons having little to do with market acceptance of the instrument as such. It appears that, following the devaluation of 1967, aimed at bringing under control the large trade deficit, it was felt necessary to abolish the indexation of wages. To secure labor consent to this step, indexation was abolished also on mortgages and other instruments. In Israel some forms of indexation (namely on foreign exchange) were abolished under circumstances somewhat reminiscent of those of Finland. This experience, which *prima facie* is not encouraging, will bear closer scrutiny. One lesson that it seems to suggest is that, at least in a small open economy subject to significant changes in terms of trade, the index used

for indexation of financial instruments as well as of other contracts like wages should perhaps not be that of the basket of goods bought like a "cost of living" index but that of the basket of goods produced, or domestic value added like the GNP deflator; in other words, it should aim to protect against redistribution of domestic income arising from wage or mark up push, but not protect against changes in purchasing power due to changes in terms of trade. Had indexing been of this variety, it might have survived the devaluation.

III.2 Some Inferences from Economic Analysis

Several attempts have been made recently to examine the implications of the presence of indexed financial assets on the working of financial and other markets, as testified, for example, by the bibliographical references in recent studies - e.g., one by the OECD cited earlier, and the essays by Scholtes. The most recent of these endeavors is represented by the just completed and still unpublished paper of Fischer which is especially valuable because of its rigor and promise for further development, and on which I will lean heavily in this section.

Fischer relies for his analysis primarily on the powerful approach developed by Merton for the study of individual saving and portfolio decisions under uncertainty and their implications for asset market equilibrium. In this approach economic agents are assumed to make instantaneous and continuous decisions about their rate of consumption and the allocation of their wealth between the menu of assets available to them so as to maximize the

expected utility of consumption over life. It is further assumed that investors' expectations about the return on assets as well as the behavior of the price level, are identical and can be described by a continuous time stochastic process, known as Ito process; the instantaneous stochastic distribution is essentially normal, though the resulting distribution of returns over any finite length of time is log normal. Fischer analyzes a succession of models of increasing complexity but for our present purpose, it will be sufficient to concentrate on the results of his simplest model in which there is a single consumption good, and three assets 1) a bond indexed on the consumption good with contractual non-stochastic real return r_1; 2) equity, with (instantaneous) expected return r_2, and (instantaneous) variance σ_2^2; 3) nominal bonds with contractual nominal return R_3. The price of the consumption good is also stochastic; the expected rate of inflation is Π and its variance, which is also the variance of the rate of return on the nominal bond is σ_3^2. (Note that because the real rate of return on the nominal bond depends on the reciprocal of the price level, its expected real rate of return turns out to be $r_3 = R_3 - \Pi + \sigma_1^2$.)

Assuming at first a deterministic labor income, Fischer derives the instantaneous demand equations for the three assets. Letting w_i denote the proportion of net wealth invested in asset i, and ρ the correlation coefficient between the real rate of return on equity and the rate of inflation, he finds

$$1) \quad w_1 = 1 - \frac{A}{(1-\rho^2)\sigma_2\sigma_3}\left[\frac{(r_2-r_1)(\sigma_3+\rho\sigma_2)}{\sigma_2} + \frac{(r_3-r_1)(\sigma_2+\rho\sigma_3)}{\sigma_3}\right]$$

$$2) \quad w_2 = \frac{A}{(1-\rho^2)\sigma_2}\left[\frac{r_2-r_1}{\sigma_2} + \frac{\rho(r_3-r_1)}{\sigma_3}\right]$$

$$3) \quad w_3 = \frac{A}{(1-\rho^2)\sigma_3}\left[\frac{r_3-r_1}{\sigma_3} + \frac{\rho(r_2-r_1)}{\sigma_2}\right]$$

where A is a positive number measuring the so-called relative risk aversion. ($A = J_w/-WJ_{ww}$ where J_w is the "derived" marginal utility of wealth, W).

From these results he draws the conclusion that in order for the investor to choose to hold a positive quantity of indexed bonds, the contractual real rate of return on indexed bonds r_1 may have to exceed the expected real rate of return on nominal bonds (and hence a fortiori to exceed the nominal rate R_3 less the expected rate of change of prices). In other words, the indexed bond need not command a premium over the nominal bond; this result he finds striking and surprising since it runs contrary to the intuitive view that, with risk aversion, indexed bonds would be preferred to nominal bonds, other things equal. A necessary condition for this counterintuitive outcome to occur is the not implausible one that the real rate of return on equity be positively correlated with the rate of inflation. Under these conditions some doubts might arise as to whether indexed bonds could, in fact, exist, or whether instead they might not be dominated by nominal bonds.

My own interpretation of his results, however, is rather different; specifically, they can be shown to imply that, at least, in a closed system without government, in which the net supply of both indexed and nominal bonds must be zero (i.e. the value of bonds privately held exactly offset the liability of the private issuers) and under the usual assumption of homogeneous expectations, indexed bonds dominate nominal bonds. That is, only indexed bonds would be issued and held, while the gross amount of nominal bonds issued and held would tend to be zero.

To establish this conclusion we merely need to note that the coefficient of the square bracket in (3) is necessarily positive under the assumption of risk aversion. Hence, if the quantity in square brackets were positive, then every transactor would have a positive net demand for nominal bonds; but since the net supply is zero, there would then be a positive excess demand for nominal bonds. By the same token, if the quantity in square brackets were negative, there would be an excess supply of these bonds. Hence the market can only clear if the relation between the rates is such that the quantity in brackets is precisely zero. But this means that at these market-clearing rates no one would either wish to lend or to borrow in the form of nominal bonds. In other words, the existence of the indexed bond would cause nominal bonds to disappear. This is clearly a rather remarkable result which, incidentally, readily generalizes to the case where there is not one but many "equities."

One may throw some further light on this result by observing that, for the problem on hand, the demand equations derived by Fisher with Merton's approach are analogous to those obtained under the mean-variance approach of Tobin and Markowitz. It is well known that the basic result of their model is that, when there exists a sure asset, and a plurality of risky assets (in our case the equity and the nominal bond), for every wealth holder the optimum portfolio is a linear combination of the sure asset and a portfolio of risky assets; furthermore, the percentage composition of the portfolio of risky assets is the very same for all investors. In our case then the optimum portfolio is a combination of the riskless indexed bond and of a portfolio containing the equity and the nominal bond in fixed proportions. But since the net supply of the nominal bond is zero, in market equilibrium, i.e., when the returns have

been adjusted so as to clear all markets, the proportion of the nominal bond can only be zero.

With the help of Fischer's equations, we can establish just what the market clearing relation must be between r_1 and r_3. Specifically from (3) the necessary and sufficient condition for $w_3 = 0$ can be stated as

$$(4) \quad r_3 - r_1 = - \rho \frac{\sigma_3}{\sigma_1} (r_2 - r_1)$$

This equation is readily recognized as the basic equation of the Capital Asset Price Model (CAPM) of Sharp-Lintner-Mossin, since $- \rho \frac{\sigma_3}{\sigma_1}$ is the regression (or β) coefficient of the return of the nominal bond on the return on equity (which, when the net supply of bonds is zero, is also the return on the market portfolio). Since $r_2 - r_1$ must be positive under risk aversion, we can conclude that

$$r_1 \gtreqless r_3 \quad \text{as} \quad \rho \gtreqless 0$$

This result, of course, conforms to Fischer's conclusion: however, it now appears that a positive correlation between the real returns on equity and the rate of inflation is both necessary and sufficient to make the market clearing expected real rate on the nominal bonds smaller than the return on the indexed bond.

This result can be given intuitive meaning as follows. A positive value of ρ implies a negative correlation between the return on equity and the return on nominal bonds. But then lenders holding only indexed bonds could reduce portfolio risk by substituting nominal for indexed bonds. Hence, if r_3 equalled r_1, there would be a positive demand for nominal bonds. However, by the same token, people wishing to lever their portfolio would find nominal bonds unattractive, since the negative covariance of the return on equity with the real rate to be paid on nominal bonds implies that borrowing through nominal rather than indexed bonds would increase portfolio risk. Accordingly they will be willing to pay a real rate on indexed bonds sufficiently higher to induce lenders to accept these instead of nominal bonds.

At the same time, Fischer's analysis suggests that if there existed in the market some positive net supply of nominal bonds - say because they were issued by the government or were the result of earlier contracts, the presence of indexed bonds would by no means have a disruptive effect on the market for nominal bonds. On the contrary, at least if ρ were positive, nominal bonds might well command a premium over indexed bonds.[1/]

[1/] Allowing for a net positive supply of positive nominal bonds, say issued by the government, would mean that w_3 would have to be positive for all private investors. It appears from (4) that if ρ were zero or negative, $w_3 > 0$ would require a negative premium on nominal bonds; but with ρ sufficiently positive and the net supply of nominal bonds sufficiently small, the premium could still be positive.

It should be added that Fischer shows that once we allow for a stochastic labor income, then it will no longer be the case that indexed bonds must drive nominal bonds out of existence, unless for all participants real labor income was uncorrelated with the real rate of inflation. But especially if for some participants interested in borrowing this correlation was negative, making for them the issue of nominal bonds relatively more attractive, than the two kinds of bonds could be expected to coexist. Dropping the assumption of homogeneous expectations would also work in this direction. It is also clear from the above reasoning that the presence of stochastic labor income would, on balance, act in the direction of a positive premium for indexed bonds if the correlation between real labor income and the rate of inflation was prevailingly negative, and of a negative premium in the opposite case.

In summary Fischer's results suggest that if inflation had no real effects on the economy (or to use an expression coined by Tobin, money were not only neutral but also "superneutral") then the expected real rate of return would tend to be similar on both indexed and nominal bonds. On the other hand the well known debate on the Phillips curve would lead one to expect a prevailingly positive correlation between (unexpected) inflation on the one hand and real labor income and return on physical assets on the other. Unfortunately, there is at present little empirical evidence to settle the issue, at least with respect to the effect of inflation on the return on equity, though casual observation suggests that, in recent years, the correlation has tended to be negative. The analysis, however, does suggest that in the case of indexed mortgages, considering also the advantages that such an instrument would offer the borrower, one should not be too surprised if the market clearing real rate for such instruments were to exceed the expected real rate of nominal instruments.

IV - Effects of Indexation of Mortgages on the Stability of the Economy

The analysis so far suggests that indexation of mortgages should help to stabilize residential construction without disrupting markets for nominal instruments. This conclusion, however, was based on a "partial" equilibrium" analysis; to understand the full implications of such a reform one needs to consider also the interaction of construction with other components of aggregate demand and, in particular, effects on the stability of the economy as a whole and on the effectiveness of stabilization tools, especially monetary ones. There seems little question that reliance on conventional mortgages and the specific institutional arrangements controlling this supply of mortgage funds, has helped to make residential construction very sensitive to monetary policy; and to bear the brunt of stabilization policies through monetary tools. In particular, it would appear that it has made possible the containment of aggregate demand with smaller fluctuations in interest rates than might have been required otherwise. This is true both because the demand presumably responded in part to variations in nominal rates; and because the restraint has been obtained in part by quantity rather than by price rationing. One point is worth mentioning in this connection. While the measurement of real rates is extremely difficult in the absence of indexed instruments because of the difficulty of measuring price expectations, insofar as one can rely on past rates of inflation as at best a rough indication of expected rates, at least for the U.S. there is little evidence of large changes in the real rates in the postwar period. This might well reflect the fact that, through residential construction, aggregate demand could be influenced by nominal rates alone.

IV-1 - Effects of Indexation of Mortgages in the Presence of Exogenous Changes in Aggregate Demand

With the indexation of mortgages residential construction, like other components of demand, should tend to respond mainly to real rates, and only through its effect on demand. Thus, if real rates were to remain stable, this reform should indeed tend to stabilize residential construction. But in the presence of exogenous changes in demand some components must adjust. and this means that, unless stabilization rested on fiscal policy, real rates would have to fluctuate. Thus some instability in construction could not be avoided. Presumably, for given fiscal policy, the fluctuations would be smaller since other components would share more in the role of accommodating the exogenous changes. However, since it seems likely that the elasticity of construction with respect to real rates would be larger than for other components, variations in construction activity might still bear a major burden. The question here is fundamentally an empirical one. Some efforts are presently being made in the course of the MIT research to shed some light by simulation with econometric models - such as the MIT-Penn-SSRC model which has a well developed housing and mortgage sector - though the model will require modifications to allow more explicitly for the likely effect of indexation on the demand for housing. These simulations should also help to throw light on the interaction between indexation, the conduct of monetary policy, the variability of real and nominal rates, and the overall stability of the economy and thereby help to assess the desirability of indexation.

IV.2 - Should Construction be Stabilized?

For a full assessment, however, it is not sufficient to determine the effect of indexation on stabilizing construction. Since this stabilization must be at the expense of unstabilizing other components, one also needs to be concerned with the issue of the social cost of instability of various components. A case might be made that residential construction is a particularly suitable sector to absorb fluctuations, for at least two reasons. First because of the durability of housing short-run variations in construction activity have but a small effect on the stock of houses and hence on the supply of housing services, although the force of this argument is considerably weakened by the geographical immobility of houses. But the very geographical dispersion of housing also means that construction activity is widely dispersed and hence variations in this activity produce equally dispersed variations in the demand for labor. Furthermore the skills of the construction labor force may be fairly readily transferable to other uses, such as non residential construction. Also in developing countries, employment in construction seems frequently to constitute the gateway through which labor enters the modern sector. Hence fluctuations in employment in this industry may tend to have smaller social costs than in other segments of the modern sector since the labor force can be more readily attracted and also more readily returned to earlier activities, (though the evaluation of this social cost is a complex task). These arguments, as well as others pointing partly in the opposite direction, (e.g., the effect on the supply price) need to be assessed carefully to reach a balanced judgment as to the relative costs of instability.

V - Summary and Conclusion

The major themes developed in this paper, many of them in a preliminary and tentative form, can be summarized as follows:

1) Indexation of financial activities can perform a very useful function in the face of substantial uncertainty about the future course of the price level. In addition to the traditional argument centering on the elimination of capricious redistribution of income and wealth, we have stressed its role in maintaining well functioning capital markets with ample opportunities for financial intermediation, portfolio diversification and resulting efficient allocation of resources.

2) A special case can be made for the indexation of mortgages because inflation has major effects on the demand and supply of this instrument even when perfectly predictable. It reduces the demand for mortgages and housing by increasing the ratio of annual payment to income in the early years of the contract. Also because of the special nature of the institutions involved in the provision of mortgage funds, short-run variations in interest rates, even if due entirely to variations in expected inflation, produce sharp variations in the supply of funds. Both difficulties could be eliminated or alleviated through indexation, possibly supplemented by variable real repayment schedules.

3) It would seem perfectly possible to limit indexation to this instrument and perhaps to some related ones, in the sense that such a reform should not produce serious disturbances or dislocation in the markets for nominal assets. Indeed our analysis

suggests that it would not be at all surprising if indexed mortgages were to command a higher expected real yield than corresponding nominal instruments.

4) While indexation looms as a useful and powerful device for stabilizing residential construction, one risks to exaggerate its effect if one considers the housing market in isolation. Taking into account the economic system as a whole suggests that the very forces which tend to stabilize construction must tend to unstabilize real interest rates and other components of demand, and the greater variation in real rates may be expected to feed back on the housing market reducing the direct stabilization effect.

5) In assessing the desirability of mortgage indexation and the resulting likely stabilization in construction, one must also assess the social costs of instability in residential construction versus instability in other sectors.

6) Many of the conclusions summarized above, especially those under 2) to 5) must be regarded, at present, as tentative. Hopefully the research which is presently getting under way at MIT will help to confirm them, reject them or modify them and provide a firmer footing for those that survive.

EXHIBIT 1

Lifetime Comparison of Index-Linked and Conventional Mortgages*

($30,000 30 year mortgage)

Year	Annual Payment		Payment / Salary					
	Conventional Mortgage	Index-Linked Mortgage	0% Real Salary Growth Salary	Payment/Salary Conv.	Indexed	2% Real Salary Growth Salary	Payment/Salary Conv.	Indexed
Case #1	**0% Inflation**		**3% Real Interest**			**3% Interest on Conv. Mtge.**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	1517	1517	10,000	15.2	15.2	10,000	15.2	15.2
5	1517	1517	10,000	15.2	15.2	10,833	14.0	14.0
10	1517	1517	10,000	15.2	15.2	11,972	12.7	12.7
15	1517	1517	10,000	15.2	15.2	13,323	11.4	11.4
20	1517	1517	10,000	15.2	15.2	14,623	10.4	10.4
25	1517	1517	10,000	15.2	15.2	16,160	9.4	9.4
30	1517	1517	10,000	15.2	15.2	17,786	8.5	8.5
Case #2	**2% Inflation**		**3% Real Interest**			**5% Interest on Conv. Mtge.**		
1	1931	1517	10,000	19.3	15.2	10,000	19.3	15.2
5	1931	1643	10,833	17.6	15.2	11,735	16.3	14.0
10	1931	1816	11,972	16.0	15.2	14,333	13.3	12.7
15	1931	2021	13,323	14.4	15.2	17,507	10.9	11.4
20	1931	2218	14,623	13.1	15.2	21,382	8.9	10.4
25	1931	2451	16,160	11.8	15.2	26,117	7.3	9.4
30	1931	2698	17,786	10.8	15.2	31,899	6.0	8.5
Case #3	**4% Inflation**		**3% Real Interest**			**7% Interest on Conv. Mtge.**		
1	2393	1517	10,000	23.9	15.2	10,000	23.9	15.2
5	2393	1780	11,735	20.4	15.2	12,712	18.8	14.0
10	2393	2174	14,333	16.7	15.2	17,160	13.9	12.7
15	2393	2656	17,507	13.7	15.2	23,164	10.3	11.4
20	2393	3244	21,382	11.2	15.2	31,268	7.7	10.4
25	2393	3962	26,117	9.2	15.2	42,207	5.7	9.4
30	2393	4839	31,899	7.5	15.2	56,973	4.2	8.5
Case #4	**6% Inflation**		**3% Real Interest**			**9% Interest on Conv. Mtge.**		
1	2895	1517	10,000	29.0	15.2	10,000	29.0	15.2
5	2895	1928	12,712	22.8	15.2	13,771	21.0	14.0
10	2895	2603	17,160	16.9	15.2	20,544	14.1	12.7
15	2895	3514	23,164	12.5	15.2	30,648	9.4	11.4
20	2895	4743	31,268	9.3	15.2	45,721	6.3	10.4
25	2895	6403	42,207	6.9	15.2	68,208	4.2	9.4
30	2895	8643	56,973	5.1	15.2	101,754	2.8	8.5

* All calculations assume continuous compounding of interest and inflation as well as payments on a continuous basis.

(*)

EXHIBIT 2

Year	A Price index of new 1-family houses sold	B Contract rate for mortgages on new houses	C Average mortgage term on new houses	D Index of monthly payments required for level-payment mortgage of average term on standard house	E Index of average wage and salary income of employed civilians
1963	90.2	5.84%	25.0 yr.	98.1	91.2
1964	91.1	5.78	24.7	99.0	95.0
1965	93.2	5.74	25.2	100.0	100.0
1966	96.6	6.14	24.7	108.6	106.5
1967	100.0	6.33	25.2	113.5	111.0
1968	105.1	6.83	25.5	124.4	118.5
1969	113.6	7.66	25.5	144.9	126.0
1970	117.4	8.27	25.1	158.7	131.9
1971	123.2	7.60	26.2	155.0	138.6
1972	131.0	7.45	27.2	160.7	146.7
1973 (est.)	143.0	7.72	26.3	181.6	156.0

Sources:

Column A: U.S. Department of Commerce, "Price Index of New One-Family Houses Sold", Current Construction Reports No. C27-73-2 (November, 1973)

Columns B and C: Table "Terms on Conventional First Mortgages," Federal Reserve Bulletin, various issues

Column D: Derived from columns A, B, and C, assuming same percentage down payment in every year.

Column E: Index of series derived by taking the sum of ("total wages and salaries" plus "proprietors' income" minus "military wages and salaries") and dividing by "total employed" (excluding armed forces), from U.S. Department of Commerce, 1971 Business Statistics and various issues of Survey of Current Business.

(*) From DONALD TUCKER, 1973.

EXHIBIT 3

Computation of Annual Mortgage
Payments Illustration

Year	(1) 1	(2) 2	(3) 3	(4) 4
Real Interest Rate, r	3%	3%	3%	3%
Rate of Inflation, q	3%	5%	5%	4%
Nominal Interest Rate, i	6%	8%	8%	7%
Years to Maturity	30	29	28	27
Conventional Mortgage				
Beginning Principal	20000.00	19747.00	19478.82	19194.55
plus Interest (6%)	1200.00	1184.82	1168.73	1151.67
less Annual Payment	1453.00	1453.00	1453.00	1453.00
Ending Principal	19747.00	19478.82	19194.55	18893.22
Scheduled Payment (next period)*	1453.00	1453.00	1453.00	1453.00
Variable Rate Mortgage				
Beginning Principal	20000.00	19747.00	19873.76	19665.28
plus Interest (Nominal Rate)	1200.00	1579.76	1589.90	1376.57
less Annual Payment	1453.00	1453.00	1798.38	1798.38
Ending Principal	19747.00	19873.76	19665.28	19243.47
Scheduled Payment (next period)*	1453.00	1798.38	1798.38	1627.23
Index-Linked Mortgage				
Beginning Principal	20000.00	20166.99	20707.15	21236.13
plus Interest (3%)	600.00	605.01	621.22	637.08
less Payment	1020.40	1050.90	1103.48	1158.64
Ending Principal	19579.60	19721.10	20224.88	20714.57
Ending Principal (adjusted for inflation)	20166.99	20707.15	21236.13	21543.16
Scheduled Payment (next period)*	1050.90	1103.48	1158.64	1205.12

* Annuity required to amortize principal over remaining life of mortgage at applicable rate of interest.

EXHIBIT 4

Table I. **INDEX-TIED FINANCIAL ASSETS IN FINLAND**

Year	Cost of living index change %	Bonds* sold during year			Bonds* outstanding at end of year			Deposits outstanding in all banking institutions		
		Total million marks	Index-tied		Total million marks	Index-tied		All term deposits million marks	Index-tied	
			Million marks	% of total		Million marks	% of total		Deposits million marks	% of total
1952	4.0	45	6	13.3	516	6	0.1			
1953	1.8	279	46	16.5	600	51	8.5			
1954	-0.5	142	96	67.6	675	145	21.5			
1955	-3.0	94	69	73.4	724	204	28.2	3,158	3	0.1
1956	11.4	121	102	84.3	901	284	31.5	3,230	225	7.0
1957	11.4	122	101	82.8	899	348	38.7	3,390	824	24.3
1958	6.5	210	111	52.9	924	412	44.6	3,852	833	21.6
1959	1.6	190	56	29.5	999	422	42.2	4,542	281	6.2
1960	3.3	216	173	80.1	1,077	544	50.5	5,405	151	2.8
1961	1.9	220	112	50.9	1,089	589	54.1	6,270	38	0.6
1962	4.4	406	299	73.6	1,295	807	62.3	6,707	68	1.0
1963	4.8	518	125	24.1	1,611	844	52.4	7,185	281	3.9
1964	10.4	478	224	46.9	1,803	919	51.0	8,158	1,287	15.8
1965	4.9	768	472	61.5	2,073	1,163	56.1	9,199	1,670	18.2
1966	3.9	704	427	60.7	2,221	1,468	66.1	10,437	2,217	21.2
1967	5.3	276	216	78.3	2,022	1,502	74.3	11,538	3,997	34.6

* Excluding Government indemnity bonds.

Source: OECD, 1973

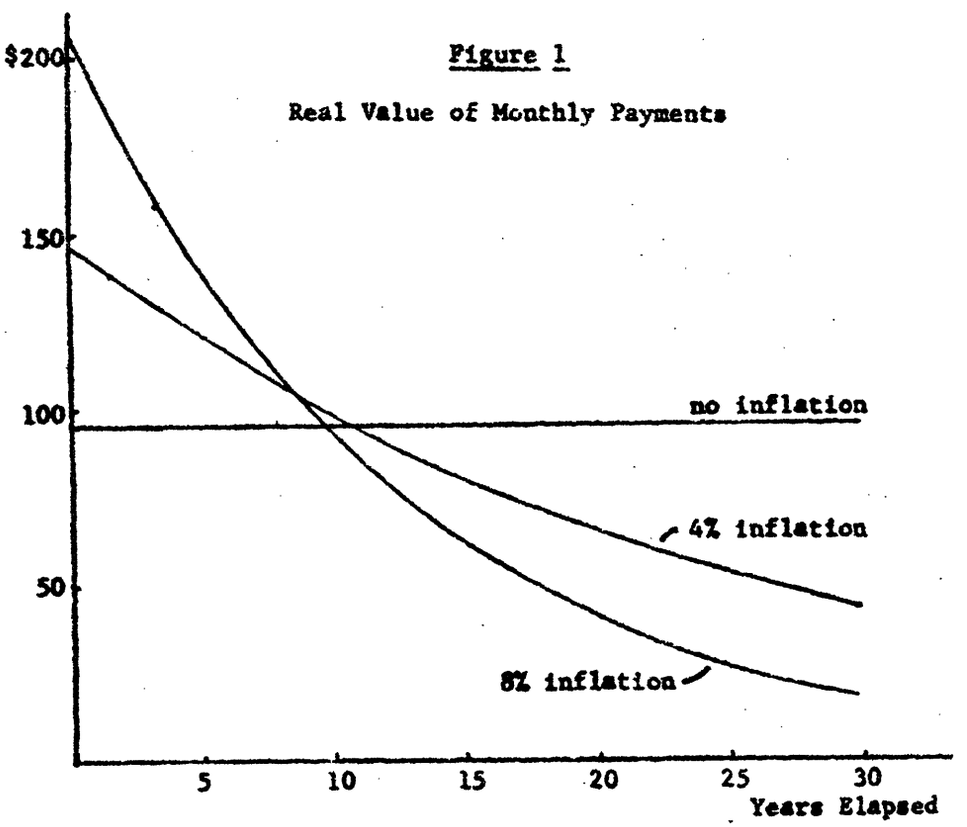

Figure 1

Real Value of Monthly Payments

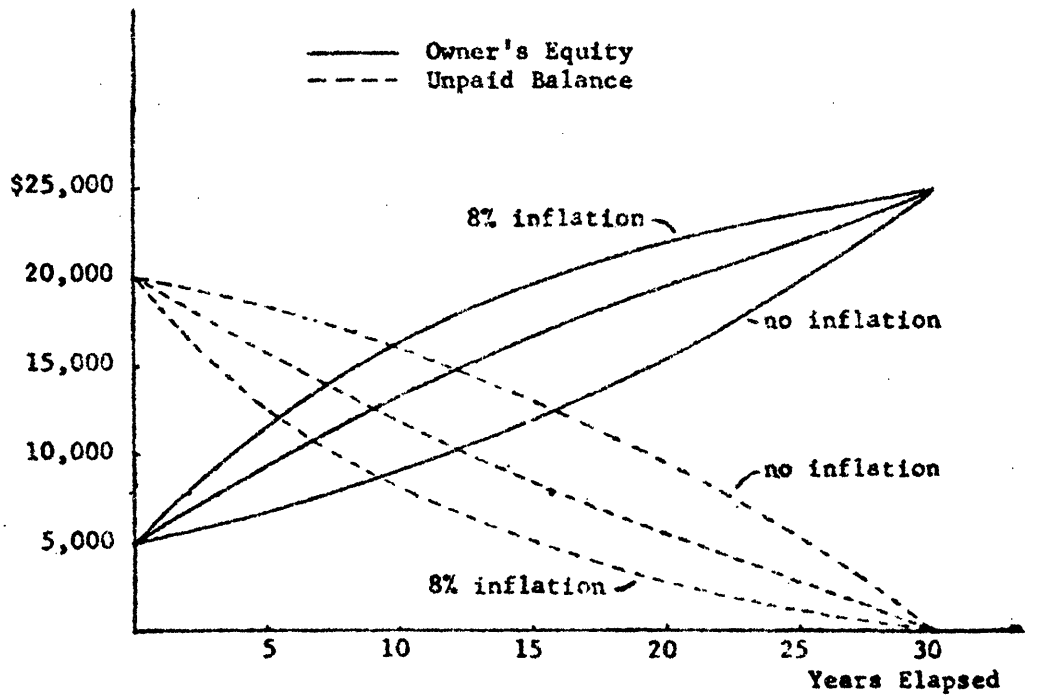

Figure 2

Real Value of Owner's Equity and Unpaid Balance

REFERENCES

Baffi, P. "Il Risparmio in Italia oggi," (Realzione introduttiva alla tavola rotonda sul tema in oggetto, svoltasi presso l'Accademia nazionale dei Lincei il giorno 8 marzo), Bancaria, Roma, February, 1974.

Dreze, J., and F. Modigliani. "Consumption Decisions under Uncertainty," Journal of Economic Theory, Vol. 5, No. 3, December, 1972.

Fischer, S. "The Demand for Indexed Bonds," Working Papers, Department of Economics, M.I.T., No. 132, May, 1974.

Kaufman, G.C. "The Questionable Benefit of Variable-Rule Mortgages," Quarterly Journal of Economics and Business, University of Illinois, Autumn, 1973.

Merton, R.C. "Lifetime Portfolio Selection under Uncertainty: The Continuous-Time Case". Review of Economics and Statistics, August 1969, pp.247-257.

Merton, R.C. "Optimum Consumption and Portfolio Rules in a Continuous-Time Model". Journal of Economic Theory, December, 1971, pp.373-413.

Merton, R.C. "An Intertemporal Capital Asset Pricing Model", Econometrica, September, 1973, pp.867-887.

Modigliani, F. and E. Tarantelli, "The Consumption Function in a Developing Economy and the Italian Experience," Banca d'Italia, Modello Econometrica dell'Economia Italiana (May, 1974 (Multilith.)

OECD, Indexation of Fixed Interest Securities, Paris, 1973.

Poole, W. "Housing Finance under Inflationary Conditions" in Ways to Moderate Fluctuations in Housing Construction, Board of Governors, Federal Reserve System, Washington, 1972.

Poole, W., and B. Negri Opper, "The Variable Rate Mortgage on Single Family Homes" in Ways to Moderate Fluctuations in Housing Construction, Board of Governors, Federal Reserve System, Washington, 1972.

Scholtes, C. The Indexation of Financial Assets: An Economic Analysis for Monetary Policy, Memoire presente en vue de l'obtention du grade de Licencie et Maitre en Sciences Economiques et Sociales, Facultes Universitaires Notre-Dame de la Paix-Namur, 1972-1973.

Tucker, D.P. "The Variable-Rate Graduated-Payment Mortgage," Multilith, 1973.

Tucker, D.P. "Easing the Home Mortgage Burden," Wall Street Journal, June 12, 1974.