Capital is an important ingredient in the national economy. In the form of machinery it makes workers more productive and generates high real wages in almost every sector of the economy. In the form of housing it provides shelter for the population. As infrastructure, like roads, utilities, and schools, it helps provide many public and quasi-public services, such as transportation, electricity, and education. Clearly, many kinds of capital exist and they have many uses.

In the U.S., the kinds and uses of capital are mainly decided in complex financial markets, influenced by many government tax and regulatory programs. Economists are naturally interested in whether this system of taxes and regulations has resulted in an efficient allocation of capital. Efficiency means that scarce capital resources are used so as to produce as much as possible of the commodities and services that people want to buy.[1]

[1] The efficient allocation of capital among its various uses is not the only criterion for judging how well the economy is structured. Questions of equity, which involve the distribution of *ownership*, matter as well for economic well-being. But, for the purposes of this paper, the focus will be exclusively on efficiency.

A number of analyses of capital allocation have concluded that the U.S. has overinvested in housing capital relative to industrial and other kinds of capital. A remarkable new data set on capital stock compiled by the Department of Commerce allows us to calculate new estimates of how efficiently the capital stock has been allocated. These estimates confirm the conclusions of earlier studies. They also allow us to measure how much we have overinvested in housing.

CAPITAL FORMATION
AND ECONOMIC GROWTH

Research during the last three decades has provided economists with a much improved appreciation of the relationship between capital accumulation and economic performance. The term "capital" refers to a varied set of assets (such as buildings, equipment, and homes) and to an equally varied set of entitlements to those assets (such as stocks, bonds, and mortgages).

The growth and use of capital assets are important because they affect living standards. U.S. real incomes and living standards have risen during most of our history for three closely related reasons. First, increasing amounts of productive capital per worker have raised worker productivity and real wages (wages adjusted for inflation). Second, improved education and training of the labor force—which comes heavily into play as we introduce more complex modern capital—also has raised worker productivity and real wages. Third, as technology has improved through time, it also has improved the productivity of both workers and the capital they work with. Most new technology must be built into capital in order to raise productivity and living standards.

Economists debate the relative importance of the three causes of rising living standards. Part of the problem is the difficulty of measuring gradual improvements in technology and labor force productivity. But the important point here is that all three reasons are furthered by capital accumulation. Without capital accumulation, living standards would rise only slowly.

Focusing on Fixed Reproducible Capital. If only we had adequate data, we could measure the nation's wealth by adding up either the value of the assets or the value of the entitlements to those assets. But our data are far from perfect. For example, data for land and other natural resources are not complete. We know how much land there is in the U.S. and some estimates have been made of its market value, but they only cover a few years and are not reliable. No one has estimated the amounts or values of most other natural resources, such as water, minerals, fossil fuels, and so forth.

But at least for man-made physical assets, comprehensive data on capital accumulation have been published, and they are available in some sectoral detail from 1925 to 1984. This is the result of a remarkable data collection effort by the Department of Commerce. The assets in this data set include consumer durables, such as refrigerators, televisions, and automobiles, and fixed reproducible assets.[2] "Fixed" means not normally moved after production and "reproducible" means made as part of the economy's production. The important kinds of fixed reproducible assets are: industrial plant and equipment; housing; non-housing real estate, including offices, retailing and wholesaling structures, hotels and motels, and warehouses; and infrastructure, such as transportation systems, water supply and waste disposal systems, schools and other public buildings.

Fixed reproducible capital assets are economically important because they provide services that directly or indirectly benefit households or businesses. The dollar value of these capital services combined with the dollar value of labor services and other inputs in the production process represent the gross national product

[2]The Commerce Department's data set does not include inventories, that is, commodities at various stages in the production and distribution process. Inventory data are available from other sources, but they are not strictly comparable to the data in the Commerce Department's capital stock data series, and they are not included in the analysis to follow.

(GNP) or the market value of the economy's output. Industrial machinery, when combined with labor, fuel, and raw materials, provides services that produce commodities. Likewise, office and industrial buildings provide services that enable workers to produce commodities and services for people. Unlike most assets, housing structures provide services directly to consumers instead of through a production process. Infrastructure capital provides services both to consumers and to production activities. For example, roads are used both for social outings and for transporting commodities.

DIVIDING INVESTMENT
AMONG ALTERNATIVE ASSETS

Since total capital accumulation is so important in promoting growth and productivity, allocating capital formation among alternative kinds and uses is also extremely important. Large amounts of resources are involved, with some 10 percent of the economy's total production devoted to capital formation. Total physical capital, almost all accumulated during the last half century or so, is about four times the economy's total annual output or income.

The most important classification of kinds of capital assets is between housing and other kinds of fixed reproducible assets. The distinction is important partly because both categories are large and have important effects on people's living standards. In addition, the two kinds of capital are accumulated and allocated through different kinds of institutions and are subject to different kinds of tax provisions and regulations. Therefore, economists have been concerned to estimate whether the complex laws and institutions result in an appropriate allocation of fixed reproducible capital between housing and other uses.

The historical allocation of capital between housing and non-housing assets is presented in Figure 1 (p. 16). Non-housing capital in this figure includes all non-housing fixed reproducible assets regardless of ownership. Most is privately owned, but a considerable amount is owned by federal, state, and local governments. The housing capital includes both owner-occupied and rental dwellings. Owner-occupied dwellings are privately owned, but rental dwellings may be owned privately or by government. In total, governments own about 20 percent of the economy's fixed reproducible assets.

Interestingly, non-housing capital has increased faster than housing capital during the 55-year period between 1929 and 1984. By 1984, the non-housing capital stock was nearly twice as large as the housing capital stock. Even though investment was small during the 1930s, the total decrease in both housing and non-housing capital was less than 1 percent. Both kinds of capital increased during World War II. At the end of the war, non-housing capital fell by about 9 percent, mainly because much wartime capital rapidly became obsolete thereafter. Both capital stocks have increased every year since 1949, and they have increased at approximately the same rate—3 percent per year—for the total 1949 to 1984 period.

Reflecting gains in productivity, GNP has risen more rapidly than either housing or non-housing capital, both during the entire 55-year period and during the period of postwar prosperity. The depression of the 1930s had a devastating effect on real output and income. Real GNP fell about 25 percent during the 1930s and first exceeded its 1929 level only in 1939. The postwar period is remarkable for its economic growth, with GNP increasing almost every year for the last 40 years. Output, of course, has also grown faster than labor input. This record of increased output per worker has resulted from the increases in physical capital per worker as well as technological change, and from an increasingly productive labor force.

Efficiency Means Equating Social Returns. With so much of the economy's resources and such large effects on economic growth at stake, it is important that the country allocate its capital assets as efficiently as possible. If too much capital is used in any sector relative to labor, then the return to capital in that sector falls.

Likewise, if too much of any commodity or service is produced relative to consumer demand, then prices fall and the returns to both capital and labor in the production of that commodity fall. Efficiency requires an allocation of the capital stock such that a small increment to capital will add the same amount to the value of output whether the capital is invested in plant and equipment or in housing. The market value of the extra output produced is referred to as the social return to capital. The social return is the output or income produced by additional units of capital, before taxes and regardless of ownership. Part of the social return goes to private owners, such as corporations or households, and part goes to governments. Governments' shares of returns result partly from taxes on private capital income and partly from government ownership of considerable amounts of capital stock. Some is housing, mostly built for military personnel and for low-income people. Some is roads and other infrastructure, and some is public utility plants.

Equality of social returns in all uses is necessary to ensure that the capital stock is being used to produce the commodities that people want most. Social returns may not be equated if tax provisions or regulations differ from one use of capital to another. Equality of social returns among sectors is, of course, a long-run criterion of efficiency. Fixed reproducible capital can be reallocated only to a limited degree once it is built. However, in a growing economy, modest shifts in investment among sectors can maintain a

FIGURE 1
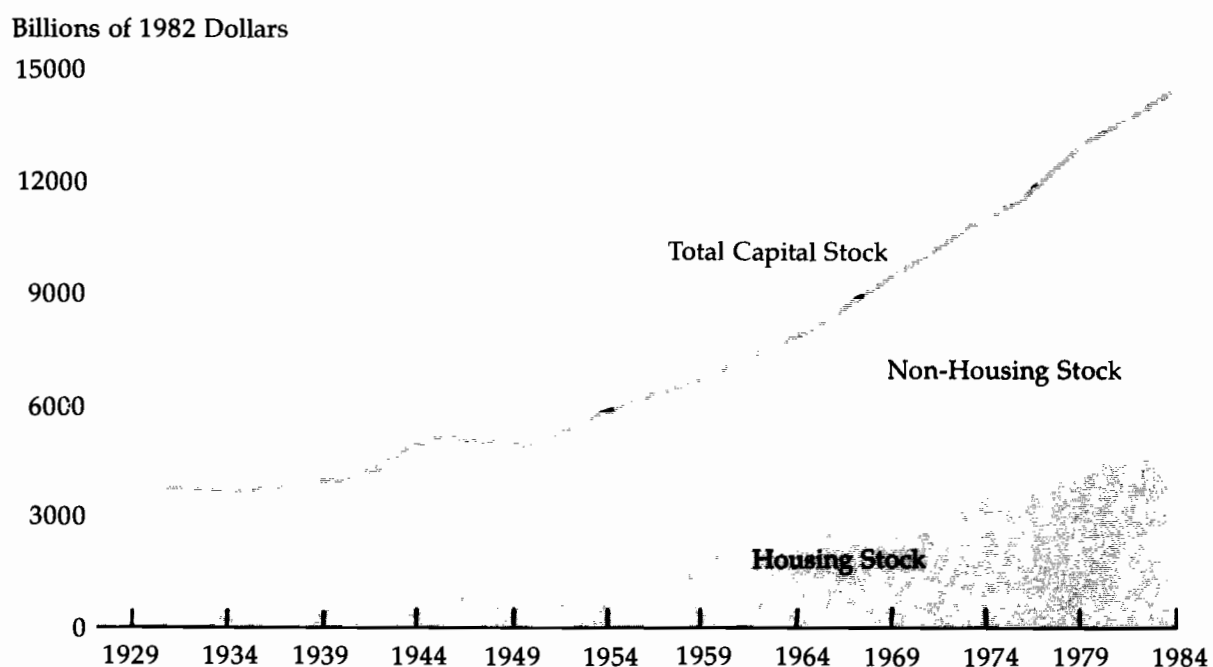
SOURCE: *Survey of Current Business*, January 1986.

capital allocation that equates returns among sectors.

Estimating the social return to capital is conceptually easy. Most non-housing fixed reproducible capital is used to make products that are sold in markets. From the market value of the product, subtract returns to labor and other non-capital inputs. The remainder is the return to capital. That total return can be divided by the capital stock, yielding the return per unit of capital, or rate of return on capital. For rental housing, rents collected are the relevant value of the output of housing services. The same procedure can be followed as for non-housing capital to calculate returns per unit of rental housing capital. For owner-occupied housing the calculation is somewhat more complex because the output is not sold on a market. The government, however, estimates rents for owner-occupied housing from market rents on comparable rental housing and imputes such rents to owner-occupied housing. These imputed rents can be divided by the owner-occupied housing capital stock to obtain the return per unit of owner-occupied housing.

"Reality" Means Equating Private Returns. In the U.S. economy, capital is allocated among sectors and uses mostly by market decisions. Typically, corporate and individual owners try to obtain the highest return possible to themselves on their assets, that is, the highest private return. In so doing, they tend to equalize after-tax returns on capital. Taxes that are levied differently on various kinds of capital result in private returns that are different from social returns to capital, and the difference varies from sector to sector. This distorts the efficient allocation of capital.[3] Tax rates are known, so pre-tax and post-tax returns can be calculated on major capital categories (although our intricate tax provisions make the calculations more complex than might be imagined!). Thus, the economists

[3]Some such distortions have been instituted by governments as a matter of social policy.

who estimate capital distortions have concentrated on tax-induced distortions.

However, differential tax rates are by no means the only possible culprits in distorting capital allocations. Depreciation rates allowed for tax purposes vary from economic depreciation rates—that is, the decline in market value due to aging—and they vary differently among types of capital and have been changed over the years. The same is true of investment tax credits. Also, there are many federal government financial assistance programs, such as the Federal Housing Administration's (FHA) home mortgage insurance and subsidy programs for health services investments, that are designed to stimulate particular kinds of capital formation. In addition, housing is heavily taxed at the local level. Some housing is owned by governments and rented at subsidized rents to low-income people and to military personnel, generating low returns. Both housing and non-housing investment are strongly regulated by local government land use and other controls, and no one knows how distorting such controls are.

Finally, private capital markets simply may not work as well as they should. Different kinds of capital accumulation are financed through different government and private institutions, and money may not move smoothly among them in search of the highest return. This is true not only in housing but in other areas as well. For example, investments in proprietorships and partnerships are financed by different institutions and on different criteria from corporate investment in plant and equipment. For housing, investment has traditionally been financed through savings and loans, savings banks, and commercial banks—institutions that have typically raised their funds locally and, to some extent, from small savers. Industrial fixed capital, by contrast, is usually financed through stock and bond markets, investment banks, and other such institutions to which small savers have had only limited access. During some periods, investors in institutions that primarily finance housing earned small or negative returns, after account-

ing for inflation, while the returns to investors in stocks and bonds were larger. No one knows how much distortion in capital formation might result from such segmentation of capital markets.

Thus, at the conceptual level, there are many reasons that capital markets may not equate social rates of return among the many types of fixed capital. Different reasons have different effects on private returns to different kinds of capital. In this situation, facts should be the final arbiter in deciding how efficiently we have allocated our valuable capital assets.

PREVIOUS STUDIES SHOW OVERINVESTMENT IN HOUSING...

Whether we allocate capital efficiently is not only an intellectually interesting question but also a concern of policymakers designing national government programs. To get an answer, it would be ideal to have estimates of the social and private returns to a comprehensive set of investments: industrial fixed capital, housing, and various other kinds of real estate. But we are far from such a goal.

For housing, a few studies have compared social and private rates of return on owner-occupied housing. As U.S. homeowners realize, the tax status of owner-occupied housing is different from that of other investments. An owner of rental housing, or of any other income-producing asset, pays federal income tax on his profits from the asset—that is, his revenues less costs. For the landlord, revenues are rents received from tenants, and costs include mortgage interest paid, local real estate taxes, depreciation, maintenance, repairs, insurance, and so forth. For owner-occupiers, the analogous sum would be imputed rent less the same costs. But the federal income tax code does not require owner-occupiers to pay tax on imputed rent net of costs; furthermore, the code does permit two large costs—mortgage interest and local real estate taxes—to be deducted from other income before computing tax liability. The 1986 Tax Reform Act reforms will continue these provisions. Of course, industrial investments and

rental housing have also been subject to special provisions in the federal tax code, notably artificially short depreciable lives of assets, accelerated depreciation, and investment tax credits. These provisions are being made less generous under the 1986 Tax Reform Act.

A sequence of increasingly careful and detailed studies has compared before-tax and after-tax returns to owner-occupied housing with returns to industrial and other investments.[4] Roughly speaking, such studies conclude that when homeowners receive the same *private* returns on their homes as on other investments, the *social* return on their housing investment will be 15 to 25 percent lower than the social return on those other investments. All the scholars who have done such studies conclude that the U.S. economy has overinvested in owner-occupied housing relative to industrial and other kinds of capital.

...AND NEW ESTIMATES CONFIRM AND QUANTIFY IT

The Department of Commerce's complete set of accounts of fixed reproducible capital has provided the basis for a more comprehensive look at the issue of overinvestment in housing. The assets in this data set are classified into owner-occupied and rental housing and various non-housing categories. By matching data from these capital accounts with components of GNP from the Commerce Department's national income and product accounts, it is possible to compare returns to housing and other fixed reproducible capital. Both the capital accounts and the national income and product accounts go back to 1929 and are available in both current

[4]See, for example, Henry Aaron, *Shelter and Subsidies*, (Washington: Brookings Institution, 1972); Martin Feldstein, "Inflation, Tax Rates and the Accumulation of Residential and Nonresidential Capital," National Bureau of Economic Research, Working Paper No. 753 (September 1981); and Patric Hendershott, "Government Policies and the Allocation of Capital Between Residential and Nonresidential Uses," National Bureau of Economic Research, Working Paper No. 1036 (December 1982).

and 1982 prices. All the data presented in this section are in real terms, using 1982 prices.

In order to estimate the social returns to housing and other kinds of fixed reproducible capital, a statistical model must be estimated. (See the Appendix, p. 22, for details of this model.) The model relates the returns to the two kinds of capital to the amounts of such capital employed in producing housing services and other commodities and services. The market values of the outputs are related both to production costs and to the demands for the commodities and services.

How close has the U.S. economy come to equating social returns to housing and other fixed reproducible capital? As Figure 2 shows, the social returns to housing capital have been much smaller than the social returns to non-

housing capital, with housing returns averaging somewhat more than half of non-housing returns. In fact, estimates from the model in the Appendix indicate that the social return to housing is about 55 percent of the return to non-housing.[5]

The data in Figure 2 make clear that the low social returns to housing are not entirely the result of the deductibility provisions for home-owners. If they were caused entirely by deducti-

[5]This estimate was made using GNP and gross housing and non-housing capital stock. The model was also estimated using net capital stocks and net national product and its components. With these data, the housing returns are even less than the 55 percent of non-housing returns estimated with gross data. See Edwin S. Mills, "Has the U.S. Over-invested in Housing?" Federal Reserve Bank of Philadelphia Working Paper No. 86-1 (January 1986).

FIGURE 2
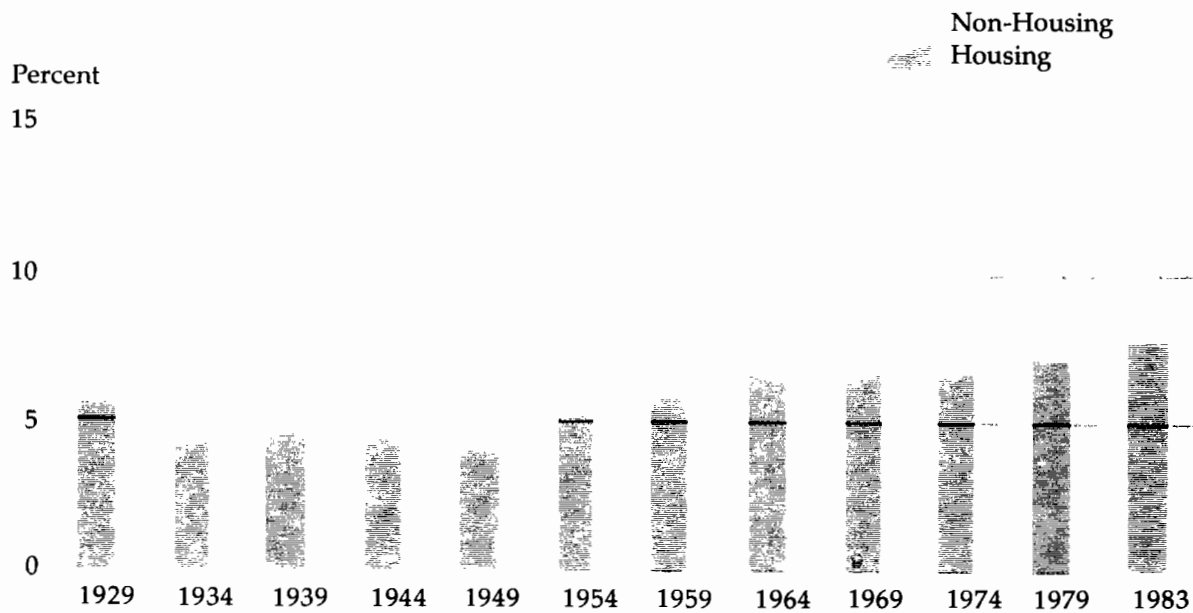
SOURCE: Edwin S. Mills, "Has the U.S. Overinvested in Housing?" Federal Reserve Bank of Philadelphia Working Paper No. 86-1 (January 1986).

bility provisions, then social returns to housing would have been smaller relative to non-housing during the postwar period than in the pre-war period, because marginal income tax rates were higher after the war, and therefore the value of the deductibility provisions for homeowners was greater. During the 30 years between 1954 and 1983, the rate of return to non-housing capital has risen and fallen, but has not been subject to a trend. The return to housing in that period, in contrast, has been steadily upward. Thus, the gap between the two social returns is narrowing.

How much resource misallocation of capital do these results imply? The criterion for efficient allocation of capital investment is that any new capital be devoted to that use which earns the highest social rate of return, until the return is the same in all uses. On this basis, we would have invested a larger share of savings in non-housing and a smaller share in housing than we did during the last 55 years. If this had been the case, the ratio of non-housing to housing capital would be greater than it is today. But this does not necessarily mean that there would be less housing capital today, because total capital would have increased faster over the entire period. The discrepancy in social returns for housing and non-housing capital implies that real incomes have been lower than they would have been if social returns had been equated. Since total saving rises proportionately with income, total savings and capital formation would have been greater if social returns had been equated. Thus, housing capital would be a smaller share of a larger total, and it is not easy to calculate whether equalizing social returns would have resulted in a larger or a smaller housing capital stock.

A beginning has been made in calculating the resource misallocation by looking at a hypothetical situation. Suppose the social return to housing and non-housing capital *had* been the same in 1983. Then what would the allocation between housing and non-housing capital have been? And what would total GNP have be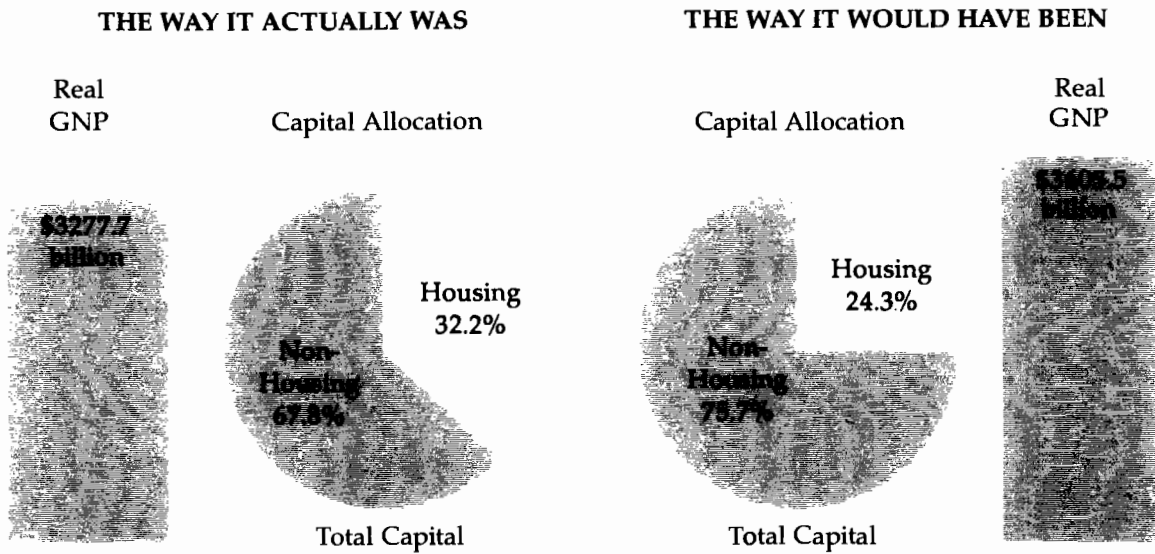en? To answer this question, take the total capital stock at the end of 1982 as given, but not the division between housing and non-housing. Suppose that, at the end of 1982, housing could magically be converted into non-housing capital. Of course, in the long run, the mix of capital can change as old capital wears out and is replaced by new capital that may be in the same sector or in a different sector. The calculation for 1983 is merely intended to obtain an approximation to what would happen in the long run. Now, require that the social returns to housing and non-housing be equal in 1983. Using the actual 1983 values for the size of the labor force and other variables, what does the model we used to estimate the return to housing imply about the division of capital between housing and non-housing? This calculation shows not only the effect of the capital stock reallocation, but also the effect of the larger GNP that it would have generated in 1983. The calculation is described in somewhat more detail in the Appendix.

The results presented in Figure 3 are quite striking. The 1983 housing stock would have been almost 25 percent smaller than it was, and non-housing capital would have been about 12 percent greater than it was. (The non-housing capital stock was about twice the housing capital stock in 1983.) Real GNP would have been about 10 percent greater than it was in 1983. The relative price of housing services, in turn, would have been 28 percent greater.

It is likely that the hypothetical reallocation would imply that income would be shifted somewhat from high to low income people. If social returns were equated, the real interest rate would fall by almost one percentage point to 7 percent, and the share of wages and salaries in total income would rise. Even this one-year calculation indicates that wages would increase 13 percent, which is greater than the 10 percent increase in GNP. In the long run, the shift from property income to earned income would be greater. Since earned income is less unequally distributed than is property income, the move to a socially efficient capital allocation could also reduce income inequality.

FIGURE 3

1983

THE WAY IT ACTUALLY WAS	THE WAY IT WOULD HAVE BEEN

Real
GNP   Capital Allocation   Capital Allocation   Real
GNP

$3277.7 billion

Housing
32.2%

Non-Housing
67.8%

Total Capital

Housing
24.3%

Non-Housing
75.7%

Total Capital

$3608.5 billion

SOURCE: Edwin S. Mills, "Has the U.S. Overinvested in Housing?" Federal Reserve Bank of Philadelphia Working Paper No. 86-1 (January 1986).

CONCLUSIONS

We have calculated the size of the discrepancy between social returns to housing and non-housing capital and have presented a simple calculation of the implied resource misallocation. The results indicate that the social return to housing is only about 55 percent of that to non-housing and that, based on an efficiency criterion, we have accumulated about 25 percent too much housing.

We have not tried to identify the causes of this misallocation. Although the special provisions for owner-occupied housing in the federal income tax code must be an important contributing cause, they cannot account for the entire discrepancy. Other studies have concluded that federal income tax provisions account for no

more than half the discrepancy in social returns that has been found here.

What other causes might be at work? Earlier, it was suggested that discrepancies between social returns to housing and other fixed reproducible capital probably result from differences in tax provisions, regulatory controls and capital market segmentation. The present study does not permit estimation of the relative importance of these factors. However, some hints about the causes of the discrepancy between social returns are provided by the apparent reduction in the discrepancy during the last 30 years covered by the sample data. At least the last decade of that interval saw gradually decreasing average marginal federal income tax rates. That reduces the value of the deductibility provisions and there-

fore should reduce the discrepancy between social returns to housing and non-housing capital. The Tax Reform Act of 1986 will reduce average marginal tax rates even more, and should further reduce the discrepancy between social returns.

It also seems likely that capital markets have gradually become more efficient in allocating savings where returns are highest during the last 30 years. Deregulation, computerization, and generally increasing sophistication of capital markets have probably reduced the segmentation of capital markets. Previously, small and low income savers had few alternatives to investing their savings in commercial banks and savings institutions, which used much of their money to finance housing. Recently, mutual funds, money market funds, certificates of deposits, variable rate mortgages and other instruments have become available to a wide segment of the public and have forced institutions that finance housing to compete on a more nearly equal basis for funds with other kinds of investments.[6] Only further research can indicate how important these various factors have been in causing the discrepancy between social rates of return, and what the explanation is for the recent narrowing of that discrepancy.

[6]In addition, the possibility of bad data cannot be excluded. Although the U.S. national income and product accounts are compiled with care and expertise, the Commerce Department may simply underestimate the imputed rents to owner-occupied housing.

This appendix briefly describes the model in which the social returns to housing and other fixed reproducible capital are estimated. It also describes the simulation from which the overinvestment in housing was calculated. For more detail, see Edwin S. Mills, "Has the U.S. Overinvested in Housing?" Federal Reserve Bank of Philadelphia Working Paper No. 86-1 (January 1986).

The model can be written as follows:

(1) $\quad X_1 = A_1 e^{g_1 t} N^\alpha K_1^{1-\alpha}$

(2) $\quad X_2 = A_2 e^{g_2 t} K_2$

(3) $\quad Y = X_1 + P_2 X_2$

(4) $\quad A_1 e^{g_1 t} \alpha N^{\alpha-1} K_1^{1-\alpha} = W$

(5) $\quad A_1 e^{g_1 t} (1-\alpha) N^\alpha K_1^{-\alpha} = r$

(6) $\quad P_2 A_2 e^{g_2 t} = \theta r$

(7) $\quad S_0 + S_1 Y = \Delta K_1 + \Delta K_2$

(8) $\quad X_2 = \gamma_2 N + \beta_2 [(1 - S_1) Y - S_0 N] / P_2 + \gamma_1 N / P_2$

(9) $\quad K_1 = K_{1,-1} + \Delta K_1$

(10) $\quad K_2 = K_{2,-1} + \Delta K_2$

Here,

X_1 = output per year of non-housing commodities and services

X_2 = output of housing services

N = labor input in non-housing production

K_1 = capital input in non-housing production

K_2 = capital input in production of housing services

Y = real income, in units of non-housing prices

P_2 = relative price of housing services

W = real wage rate

r = social return to capital in non-housing

θr = social return to capital in housing

ΔK_1 = annual investment in non-housing capital

ΔK_2 = annual investment in housing capital.

Equations (1) and (2) are the production functions for non-housing and housing services, where $e^{g_1 t}$ and $e^{g_2 t}$ allow for technical progress in the two sectors. Equation (3) defines real national income. Equations (4)–(6) are the first order conditions for capital and labor in the two production sectors. They ensure that the social returns equal the value of the marginal products, but θ permits the social returns to differ between housing and non-housing capital. Equation (7) equates savings, as a function of income, to investment in non-housing and housing capital. Equation (8) is the demand for housing services. (The demand for non-housing is satisfied identically.) Equations (9) and (10) define investment in the two sectors.

The ten equations can be solved for the ten endogenous variables: X_1, X_2, K_1, K_2, Y, P_2, W, r, ΔK_1 and ΔK_2. N and t are exogenous, and $K_{1, -1}$ and $K_{2, -1}$ are lagged endogenous variables. The model was estimated with data from 1929 to 1983 using the full information maximum likelihood procedure.

The simulations consisted in setting $K_{1,82} + K_{2,82}$ at its actual 1982 value, and N at its actual 1983 value, and putting $t = 1983$. Then the model was solved, using estimated parameters, for the ten endogenous variables for 1983 with $\theta = 1$, that is, equating social returns to housing and non-housing capital. This calculation shows what $K_{1,83}$ and $K_{2,83}$ would have been if social returns had been equal in 1983.