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The Macroeconomic Effects of Tax Reform
in the United States

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Abstract

This paper reviews the provisions and possible effects of the U.S. Tax Reform Act of 1986. The literature on the potential effects of tax reform on labor supply, household consumption and saving, and business fixed investment is surveyed, and a model of business fixed investment in the United States is developed. The major explanatory influence are real GNP and the cost of capital, with the latter related to interest rates, inflation, and tax variables. The model is used to provide estimates of the possible effects on business fixed investment of the taxation changes introduced with the Tax Reform Act.

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Summary

This paper reviews the provisions of the U.S. Tax Reform Act of 1986 and attempts to assess its possible effects on the U.S. economy. The Tax Reform Act made major changes in the structure of the U.S. tax system in order to enhance incentives to work, save, and invest and thus improve economic performance. The previous structure of personal taxation, which comprised 14 tax brackets with rates from 11 percent to 50 percent, was replaced--effective from 1988--with a two-bracket system, with rates of 15 percent and 28 percent. Statutory tax rates on corporate income were also lowered substantially, but the effective burden of corporate taxation was increased by removing or limiting many tax credits or deductions.

The paper surveys the literature on the impact of taxation on labor supply, saving, and investment, and then provides an empirical model of business fixed investment in the United States. Existing empirical work suggests that the labor supply decision in the United States is sensitive to changes in after-tax wages, but only slightly so, and the long-run effect of the recent tax reform is judged likely to be a 1 1/2 percent increase in the supply of labor, which would translate to a 1 percent rise in output, other things equal. The impact of tax reform on private saving is difficult to assess. Shifting the tax burden from households to business could reduce private saving, since the corporate saving rate is higher than the household saving rate, but such an impact could be nullified if households take full account of corporate saving behavior. The impact of higher after-tax interest rates on private saving would be likely to be small, since available studies suggest a small interest sensitivity of private saving.

Assessments of the impact of the Tax Reform Act on business investment have varied widely, from a view that the overall effect would be neutral to one that the corporate capital stock and GNP might be substantially reduced. The paper constructs a model of business fixed investment in the United States, with the major explanatory variables being real GNP and the cost of capital. While there are inevitably uncertainties in interpreting the results, simulations with the model suggest that tax reform would imply a 4 3/4 percent long-term reduction in investment in machinery and equipment and a 3 1/2 percent reduction in investment in nonresidential structures relative to what otherwise would have been. The overall impact of these changes on GNP would be to reduce output by roughly 1/2 percent.

In sum, the principal effects of tax reform are likely to be a shift in factor proportions, with labor supply higher and corporate capital stock lower than they would otherwise have been. On balance, GNP would probably rise a little.



I. Introduction

On September 27, 1986, the U.S. Congress passed the Tax Reform Act (TRA) and on October 22 the President signed the Act into law. The Act made sweeping changes in the structure of the U.S. tax system, by curbing tax preferences and by using the room thus created to lower marginal tax rates. In this way, it was hoped, incentives to work, save, and invest would be enhanced and economic performance would be improved. In addition, the elimination of many tax preferences was expected to help equalize the tax treatment of different investments, thus raising the efficiency of investment. The legislation was designed to be neutral in terms of its overall impact on revenue over the period 1987-91, but would significantly alter the distribution of the tax burden; the tax burden on corporations would increase by \$120 billion over the five-year period, while the personal tax burden would decline correspondingly. Receipts are increased substantially in FY 1987 but are reduced in FY 1989-91. Receipts are increased in FY 1987 because most of the provisions increasing taxes are effective in early 1987, while the implementation of those provisions which reduce taxes is phased in more gradually.

The Tax Reform Act is the most far-reaching revision in the history of U.S. tax law. On the side of personal taxes, the top individual tax rate for 1988--by which time the rate reduction will be fully phased in--will be at its lowest point since 1931, and personal income tax rates will no longer show a steep progression. On the side of business taxation, statutory tax rates are also lowered substantially. Nevertheless, the effective corporate tax burden is increased by repealing or limiting many tax credits or deductions in a way that will more than offset the revenue effect of the reduction in statutory corporate tax rates.

This paper attempts to assess the likely long-term effect of tax reform, albeit in a necessarily preliminary and tentative way. Section II outlines the major changes implemented by TRA, followed in section III by a survey of the literature on the impact of tax reform. Section IV presents the results of some empirical work assessing the possible effects of tax reform on business investment. Section V provides a conclusion.

II. The Tax Reform Act

1. Changes to the structure of personal income taxation

The previous tax structure comprised 14 personal income brackets (15 for single taxpayers), with statutory tax rates ranging from 11 percent to 50 percent. ^{1/} That structure is replaced by a two-bracket system, with tax rates of 15 percent and 28 percent, effective from January 1988 (see following tabulation); in the transitional year 1987, there is a five-bracket system, with rates ranging from 11 percent to 38.5 percent.

New Statutory Marginal Tax Rates by Income Class ^{2/}

<u>Marginal Tax Rate</u>	<u>Single Taxpayer</u>	<u>Married Filing Jointly (Two Children)</u>
<u>(Percent)</u>	<u>(Income in dollars)</u>	
15	0 - 17,850	0 - 29,750
28 ^{3/}	17,851 - plus	29,751 - plus

With regard to major deductions and exemptions, the personal exemption was increased from \$1,080 in 1986 to \$2,000 in 1989, and the zero bracket amount, which was previously built into tax schedules, was replaced with a standard deduction effective in 1987; this standard deduction rises from \$3,760 in 1987 to \$5,000 in 1988 for joint returns. Both the standard deduction and the personal exemption will be adjusted for inflation. The special deduction for married couples, both of whom are employed, is repealed along with the the income averaging provision.

The Act also curbed certain tax preferences. In the area of individual retirement accounts, the Act retained the previous deductibility for contributions to such accounts only for taxpayers not covered by an employer-provided pension plan and for those persons below certain

^{1/} The peak marginal tax rate had been reduced from 70 percent to 50 percent in the Economic Recovery and Tax Act of 1981.

^{2/} The tabulation provides only an outline of marginal rates and does not consider the effects of many detailed provisions that may generate unusual effective marginal tax rates for some taxpayers.

^{3/} For high income individuals, the benefits of the 15 percent bracket are gradually reduced over a certain income range, and the personal exemption is phased out in a similar way; this creates an effective marginal tax rate of 33 percent in the income range from \$43,151 to \$100,480 per annum for single taxpayers and \$71,901 to \$192,930 for married taxpayers.

income thresholds. The deduction for consumer interest expenses--chiefly credit cards, car loans, and other nonresidential consumer loans--is to be phased out over five years. Interest on second mortgages is made deductible on an unlimited basis only for those used to finance home improvements, medical expenses, or educational expenses. ^{1/} Preferential treatment for capital gains was also eliminated by the Act. Under the Act, capital gains are to be taxed at the same rates as ordinary income effective from 1987, except that the maximum rate is capped at 28 percent in 1987. ^{2/} The base to which capital gains tax is applied continues to be nominal capital gains, without inflation adjustment, which implies that the effective tax rate on real capital gains could rise sharply--as it did in the 1970s--if inflation were to increase significantly.

With regard to tax shelters and real estate, TRA created a new income category, "passive income", from which losses are not generally deductible against other income. Passive income is defined to comprise income generated from business activities and rental real estate in which the taxpayer does not materially or actively participate. Under previous law, high income taxpayers could invest in deliberately unprofitable real estate investments, use the losses to offset wage, salary, and other investment income, and thus reduce tax liabilities.

The impact of the Tax Reform Act on the distribution of income is difficult to assess. The increase in the personal exemption and the standard deduction together with other elements of the reform boost the amount of income that a family of four can receive before having to pay personal tax--from \$9,574 in 1986 to \$14,480 in 1988. The result is that the number of poor families required to pay federal income tax is estimated to fall by 4.3 million in 1988 under TRA. While TRA substantially reduces the degree of progressivity of statutory tax rates, the impact on effective tax rates across income classes is likely to be much less pronounced--because before the reform, many high income earners were avoiding taxation by use of tax preferences which have now been removed. According to calculations made by the President's Council of Economic Advisors, the effective average federal tax rate on those with income less than \$10,000 should fall from 2.0 percent pre-reform to 0.9 percent under TRA, while for those with income over \$200,000 the corresponding effective personal tax rate would fall from 13.6 percent to 13.4 percent. ^{3/}

A complete discussion of the effect of TRA on income distribution would in addition require analysis of the impact of corporate tax

^{1/} For interest to be deductible, loans for other purposes cannot exceed the homeowner's cash equity.

^{2/} Under previous law, only 40 percent of long-term capital gains were subject to tax, which thus set the top effective rate at 20 percent.

^{3/} Annual Report of the Council of Economic Advisers, 1987, page 85.

changes, given assumptions about the incidence of corporate taxation. Such an effort is beyond the scope of the present paper. However, it seems likely that a proper imputation of corporate taxes would suggest that TRA is relatively less favorable to high income earners than analysis based solely on personal tax liabilities would indicate--given the rise in the corporate tax burden under TRA and the plausible assumption that high income earners bear a relatively large share of the burden of corporate taxation.

2. Changes to corporate income taxation

As shown in the tabulation below, TRA revised the basic tax rate structure for corporations by replacing the previous system of five brackets (from 15 percent to 46 percent) with a system of three brackets (from 15 to 34 percent).

<u>Taxable Income</u> <u>(In Dollars)</u>	<u>Corporate Tax Rates ^{1/}</u> <u>(In Percent)</u>	
	<u>Previous Law</u>	<u>Tax Reform Act</u> <u>of 1986</u>
0-25,000	15	15
25,000-50,000	18	15
50,000-75,000	30	25
75,000-100,000	40	34
100,000 plus	46	34

The largest effective increase in corporate taxes provided by TRA results from repeal of the investment tax credit and a modification of the accelerated cost recovery system (ACRS) of depreciation. The 10 percent investment tax credit (6 percent for some short-lived assets) was repealed, effective January 1, 1986. The modification of ACRS lengthened the periods over which assets could be depreciated for tax purposes, and at the same time changed the depreciation formulas to 200 percent double declining balance for most machinery and equipment--previously 150 percent--and to straight line for the bulk of nonresidential structures--previously 175 percent declining balance. ^{2/} The Act

^{1/} A 39 percent rate is implicitly created in 1988 by the use of a 5 percent surcharge for incomes above certain levels.

^{2/} Under the new ACRS rules, most types of manufacturing equipment are depreciated over seven years, compared with five years under previous law. Some longer lived types of equipment are depreciated over ten years (five years previously). Cars and light trucks are depreciated over five years (three years previously). Nonresidential real property is to be depreciated over a 31.5-year period (19 years previously) while residential rental property is depreciated over 27.5 years (19 years previously).

also made a variety of specific changes ^{1/} including inter alia a revision of the corporate minimum tax to make it more difficult for large and profitable businesses to escape or pay very low taxes, and the cessation of the so-called "General Utilities" rule. ^{2/}

III. A survey of the literature on the implications of the Tax Reform Act

The potential effects of TRA on economic behavior and performance may conveniently be separated into several components, including its impact on (a) work effort; (b) saving by households and businesses; (c) business investment; and (d) the real estate market. Each of these effects is discussed in this section while the results of empirical work are presented in section IV. At the outset, it should be noted that TRA could well have additional macroeconomic implications that are not adequately captured in the essentially partial equilibrium framework employed in this paper and in most other studies. For instance, if TRA results in a significant reduction in the pre-tax rate of interest as argued by many (discussed below), the consequent narrowing in differentials between U.S. and foreign interest rates (relative to what otherwise would have been) would imply a lower exchange value for the U.S. dollar, and presumably higher output and profitability in the tradable goods sector. Quantification of such an impact is beyond the scope of the present paper. ^{3/}

Before proceeding further, two preliminary issues need to be addressed, the first of which is the size of the effect of TRA on marginal tax rates faced by households. According to estimates prepared by the U.S. Treasury Department, TRA should have a substantial impact on the marginal personal income tax rates faced by the bulk of taxpayers, as illustrated in the tabulation below. From 1986 to 1988, the Treasury figures show a 7 percentage point reduction in the marginal tax rate

^{1/} For a detailed discussion of the provisions of the Act, see "The Tax Reform Act of 1986" by Joseph C. Wakefield, Survey of Current Business, March 1987.

^{2/} This legal doctrine had generated a substantial tax incentive for corporate mergers and acquisitions. Under the rule, these activities provided a mechanism for liquidating appreciated assets without paying taxes on the gains; the repeal of the General Utilities rule took effect at the end of 1986, and may help to explain the surge in mergers and acquisitions in the second half of 1986. A detailed discussion is provided in "Tax Reform and the Merger and Acquisition Market: The Repeal of General Utilities" by Charles Steindel, Federal Reserve Bank of New York Quarterly Review, Autumn 1986.

^{3/} For a discussion of the importance of the linkages between tax policy, international capital mobility, and competitiveness, see "Tax Policy and International Competitiveness" by L. Summers, National Bureau of Economic Research Working Paper 2007, August 1986.

faced by a four-person family with median income, a 1 percentage point marginal tax rate rise for a family with one half the median income, and a 10 percentage point tax rate reduction for a family with twice the median income.

Marginal Tax Rate for a Four-Person Family 1/

	<u>One Half</u> <u>Median Income</u>	<u>Median</u> <u>Income</u>	<u>Twice</u> <u>Median Income</u>
1960	20.0	20.0	22.0
1970	15.0	19.5	25.6
1980	18.0	24.0	43.0
1985	14.0	22.0	38.0
1986	14.0	22.0	38.0
1988	15.0	15.0	28.0

Calculations based on the National Bureau of Economic Research's (NBER's) TAXSIM model 2/ broadly support the Treasury's estimates of the effect on marginal tax rates. The NBER estimates suggest that, as a result of tax reform, 11 percent of taxpayers will experience a marginal tax rate reduction of 10 percentage points or more, while for 48 percent, the marginal tax rate will fall by less than 10 percentage points; 14 percent of taxpayers will experience no change in tax rate. According to these calculations, 23 percent of the taxpayers would see their marginal tax rates rise by less than 10 percentage points, while 4 percent would experience a rise of more than 10 percentage points.

The second preliminary issue is the possible impact of tax reform on rates of interest. Analysis of the impact of tax changes has often proceeded on the assumption that pretax interest rates would remain unaffected. However, it has been widely argued that TRA would reduce interest rates below what they otherwise would have been, although estimates of the magnitude of the effect vary significantly. According to proponents of this view, TRA cuts marginal tax rates on personal and corporate income sharply, so that the after-tax rate of return and the after-tax borrowing cost associated with a given pre-tax interest rate are increased. The effects can be visualized as a leftward shift of a conventional IS curve, assuming that the vertical axis represents pre-tax interest rates. At the same time, for a given pre-tax rate of

1/ The family is assumed to be at the same relative position in the income distribution at each point of time. All income is assumed to be earned by one spouse.

2/ The TAXSIM model computes marginal tax rates and tax payments for a synthetic 1988 population of over 30,000 taxpayers: see "Household Behavior and the Tax Reform Act of 1986" by J. Hausman and J. Poterba, Journal of Economic Perspectives, Summer 1987.

interest, the fall in marginal tax rates implies a rise in the opportunity cost of holding money, which should imply a rightward shift of a conventional LM curve. Consequently, the effect of TRA is unambiguously to reduce interest rates.

As to the magnitude of this effect, Prakken ^{1/} suggests that TRA may induce a decline in pre-tax rates of interest of 1.3 percentage points while Hendershott ^{2/} suggests a figure of 1 percentage point. Hausman and Poterba (1987) argued that such estimates were made in a closed economy framework, and that about one half of the fall in interest rates was likely to be offset by an induced reduction in private capital inflows; thus the effect on pretax interest rates would be a reduction of 1/2 to 3/4 percentage point.

1. The impact on labor supply

Economic theory is agnostic as to the sign of the effect of a reduction in marginal tax rates on labor supply, as the income and substitution effects work in opposite directions. The bulk of the empirical work on labor supply in the United States ^{3/} suggests that the labor supply decision of prime age male workers is only slightly sensitive to changes in the marginal tax rate. By contrast, the labor supply decision of prime-age females, who frequently act as secondary workers--moving in and out of the work force from time to time--has typically been found to be quite sensitive to changes in after-tax wage rates, and thus to changes in tax rates.

According to the Council of Economic Advisers, ^{4/} TRA is likely to increase the supply of labor by 3 percent in the long run. This result in turn is the main element behind the CEA's estimate that the likely total long-run effect of tax reform is to raise output by 2 percent. The labor supply impact of TRA suggested by the CEA derives from an unpublished research study, in which a long-run closed economy growth model is solved numerically, given assumptions for various parameters that are considered plausible. ^{5/} Because the basis of the analysis is a theoretical model with assumed parameters, there is no guarantee that the model is capable of reproducing the patterns in historical data.

^{1/} "The Macroeconomics of Tax Reform" by Joel Prakken, prepared for the American Council for Capital Formation conference, September 1986.

^{2/} "Effects on Real Estate" by Patric Hendershott et al in J. Pechman (ed.) Tax Reform and the U.S. Economy, Brookings Institution, 1987.

^{3/} Surveyed in Tax Incentives and Economic Growth by Barry Bosworth, Brookings Institution, 1984.

^{4/} Annual Report of the Council of Economic Advisers, 1987.

^{5/} The CEA Report notes that the model is adapted from "Capital Taxation and Accumulation in a Life Cycle Growth Model" by Lawrence Summers, American Economic Review, September 1981, extended to allow for endogenous labor supply and an unfunded social security system.

Another difficulty is that the results may not be robust to variations in the underlying parameter assumptions over a reasonable range. 1/

An alternative estimate of the labor supply effect of tax reform is provided in Hausman and Poterba (1987). For the average prime age male, the authors estimate that labor supply would rise by 0.9 percent in the long run, while for secondary workers labor supply would rise by 2.6 percent. 2/ The long-run labor supply effect of TRA implied by the above figures is an increase of roughly 1.5 percent, approximately equivalent to a 1 percent rise in output, other things equal. It may be noted that the Hausman/Poterba estimates are based on labor supply sensitivities that are generally larger than those found elsewhere in the literature.

2. The impact on saving

The overall impact of TRA on national saving depends on the effects on household, corporate, and public sector saving. Since the Act is supposed to be revenue neutral at the federal level, the effect on federal government saving should be negligible. 3/ With regard to private saving, since the Act shifts the tax burden away from households toward businesses, and since the average propensity to save for businesses appears to be higher than that for households, 4/ tax reform could well have a negative effect on private saving, although the magnitude of this effect is difficult to quantify. However, to the extent that individuals see through the "corporate veil", such a shifting of private sector income would have little effect on private saving.

The sign and size of the effect of after-tax interest rates on household and private savings remains a subject of controversy. 5/ Economic theory gives no clear indication as to the sign of the effect because the income and substitution effects work in opposite directions.

1/ The results of the Summers model, of which the CEA model is an extension, have been shown to vary considerably depending on the parametric assumptions. See "Tax Policy, the Interest Elasticity of Saving and Capital Accumulation" by Owen Evans, American Economic Review, June 1983.

2/ The econometric work underlying these estimates was presented in "Labor Supply" by J. Hausman, in H. Aaron and J. Pechman (eds) How Taxes Affect Economic Behaviour, Brookings Institution, 1981.

3/ The Act generates a revenue bonus for state and local governments by broadening the tax base, so that the impact on the state and local government surpluses could be positive; the magnitude of any such effect would depend on the extent to which state and local governments take offsetting action by raising spending or lowering tax rates.

4/ In 1986, gross private saving amounted to 16.1 percent of GNP, of which 2.7 percent comprised household saving and 13.4 percent business saving.

5/ The theoretical issues are examined in Evans (1983) cited earlier.

The empirical literature is also inconclusive, with some studies finding no effect of after-tax interest rates on savings, and others finding substantial and significant effects. 1/ According to the CEA report, the overall impact of TRA is to reduce the supply of private saving slightly, because of an increase in the effective tax rate on income from capital.

3. The impact on business investment

The standard framework for analyzing the impact of taxation and interest rates on business fixed investment views business investment as determined by a scale variable (output or demand) and by the user cost of capital. 2/ The 1987 Report of the CEA finds that TRA raises the cost of capital by 62 percent for machinery and equipment investment and by 17 percent for investment in nonresidential structures. 3/ According to the CEA report, the long-run effect of this rise in the cost of capital is likely to be a decline in the net capital stock of 0.4 percent. If the adjustment to the new capital stock were completed in five years, business investment during the five-year transitional period on average would be 2 percent lower than it otherwise would have been.

Another possible avenue through which tax reform could influence output is through the efficiency of investment rather than its magnitude. By reducing or eliminating a large number of tax preferences, TRA sought to "level the playing field"--that is to ensure that different investment projects are taxed similarly, so that investment choices are made on the basis of economic considerations rather than for tax reasons. Steuerle--one of the contributors to the design of tax reform--suggested that one of the major benefits from tax reform was the move toward more neutral taxation of real and financial investment, which would remove the rationale for many socially wasteful tax arbitrage transactions and would permit alternative investments to be assessed

1/ The paper by M. Boskin ("Taxation, Saving, and the Rate of Interest" Journal of Political Economy, April 1978) is typically cited in favor of the existence of a positive interest elasticity of household saving while that by I. Friend and J. Hasbrouck ("Saving and After-Tax Rates of Return", Review of Economics and Statistics, November 1983) is frequently cited against that proposition.

2/ The classic reference is "Tax Policy and Investment Behavior" by Robert Hall and Dale Jorgensen, American Economic Review 1967.

3/ The CEA report cites two sets of figures, depending on which view is taken on a controversy about the relative importance of taxes on dividends and capital gains for determining the cost of equity capital; the figures cited above are those calculated presuming that taxes on capital gains are very important while taxes on dividends are nearly irrelevant.

with less attention to tax consequences. ^{1/} The magnitude of the effect is of course difficult to assess. According to the CEA report, the investment efficiency effect of TRA would likely raise output by 0.1 percent in the long run, an amount that would roughly offset the effects of the rise in the cost of capital. ^{2/}

In contrast with these results, the paper by Prakken, cited earlier, based on simulations with the Washington University Macro Model (WUMM), found that--even after allowing for a significant induced decline in interest rates--TRA was likely to have a large long-run negative effect on investment and the capital stock. Specifically, by 1995 the business capital stock was estimated to fall by 8 3/4 percent and GNP by 2 1/2 percent, relative to the baseline. The sharp difference between these results and those of the CEA reflects in part differences in assumptions about production technology. The WUMM study is based on a Cobb-Douglas production function, and thus assumes unitary elasticity of substitution between capital and labor; as a result, the long-run capital stock is relatively sensitive to changes in the cost of capital. The CEA report on the other hand assumed a technology in which the elasticity of substitution in production is less than one.

A recent paper by Fazzari ^{3/} supported a middle view of the impact of TRA on business fixed investment. He found that the impact on the desired capital stock could vary substantially depending on the assumed value for the elasticity of substitution in production, and the magnitude of the induced decline in interest rates. For a reasonable middle ground case, his results indicate a 5 percent reduction in the desired stock of equipment and a 1/2 percent increase in the desired stock of structures. ^{4/}

4. The impact on real estate

As noted earlier, TRA contains a variety of provisions reducing the tax advantages of investment in real estate. With regard to personal taxation, the reduction of statutory tax rates lowers both the average and marginal tax rates at which households can deduct mortgage interest;

^{1/} "Effects on Financial Decisionmaking," by Eugene Steuerle in J. Pechman (editor), Tax Reform and the U.S. Economy, Brookings Institution, 1987.

^{2/} Summers ("Should Tax Reform Level the Playing Field" NBER Working Paper No. 2132, January 1987) argues that leveling the playing field is an issue of little economic importance, and that even if all nonneutralities were eliminated--which TRA does not achieve--the gains would total about 0.3 percent of GNP.

^{3/} "Tax Reform and Investment" by Steven Fazzari, Federal Reserve Bank of St. Louis Review, January 1987.

^{4/} For elasticities of substitution in production of 0.55 for equipment and 0.16 for structures and an induced interest rate decline of 0.8 percentage point.

at unchanged pretax interest rates, this implies a significant decline in the attractiveness of investment in real estate versus investment in other assets. Moreover, the attractiveness of investment in rental real estate by households is likely to be substantially reduced as a result of the lengthening of depreciation schedules, and the new passive loss limitations (discussed in section II).

According to Hendershott et al (1987), the negative effect of TRA on overall real estate activity is not likely to be substantial, because of the offsetting effect stemming from the induced reduction in rates of interest--taken to be 1 percentage point. They suggest that the adverse effect of TRA on regular rental and commercial activity in real estate will be slight, while that on historic and old rehabilitation activity will be large. In contrast, they suggest that owner-occupied housing is favorably affected because the induced decline in interest rates will more than offset the withdrawal of tax benefits. As noted above, the interest rate decline of 1 percentage points assumed by Hendershott et al may be on the high side. Assuming instead an induced interest rate reduction of between 1/2 and 1 percentage point, the effect of TRA on overall real estate activity would be negative. The adverse impact would perhaps be small for owner-occupied housing, but would be noticeable for investment in rental housing. Under any interest rate assumption the new passive loss limitations are likely to lower significantly the value of recent loss-motivated real estate partnership deals.

IV. An Empirical Analysis of the Tax Reform Act

This section presents the results of empirical work on the impact of TRA on business fixed investment. ^{1/} The equations are based on the neoclassical theory of capital accumulation, according to which the optimal combination of factor inputs used by firms depends on their relative prices.

The analysis assumes that the structure of the estimated equations is invariant to fundamental changes in government policy and thus is subject to the Lucas critique. ^{2/} Some analysts have argued (Summers (1981)) that the magnitude of economic responses to basic changes in the tax system would be substantially greater than indicated by empirically estimated elasticities, because the latter summarize economic agents' reactions to relatively small and often temporary movements, not to

^{1/} The empirical results are an extension of earlier unpublished work by Corker and Kenward soon to be made available in updated form in "Tax Policy and Business Investment in the United States" by R. Corker, O. Evans, and L. Kenward.

^{2/} Lucas (1976) criticized standard econometric techniques of policy evaluation, arguing that when government policy changed in a significant way, private economic behavior would shift, making invalid the assumption of constant economic structure.

large enduring changes. There is no easy way to deal with this criticism. On the other hand, it has also been argued that initial responses to tax reform may be subdued, because--as a result of the frequency of tax changes in recent years--agents may be unsure as to whether the reform is permanent or temporary.

In the empirical work discussed below, business fixed investment is a function of output and the cost of capital, 1/ which in turn is related to interest rates, expected inflation and tax variables.

The formula for the cost of capital is as follows: 2/

$$c = q[i + \delta - p(1 - \tau)] [1 - k - u.z] / (1 - u)$$

Where

τ is the maximum tax rate on capital gains.

k is the investment tax credit per dollar of new investment.

z is the present value of depreciation allowances.

q is the price of capital assets.

u is the maximum marginal corporate tax rate.

i is the average cost of funds, after-tax. 3/

1/ The standard cost of capital framework for assessing the impact of taxation on investment assumes that each asset is depreciated for tax purposes only once. However, to the extent that a secondary market exists for a given asset category, it becomes possible for an asset to be depreciated for tax purposes several times. In this way, the tax benefits from accelerated depreciation schedules could be much higher than normally indicated, in the case of assets for which a secondary market is well established. This argument would imply that the possible impact of TRA on investment in business structures may be higher than indicated by a cost of capital calculation because the tax benefits which were removed by TRA might otherwise have been used several times.

2/ For a derivation and explanation of the formula, see D.J. Ott, A.F. Ott, and J.H. Yoo, Macroeconomic Theory, 1975.

3/ A weighted average of the 10 year BAA corporate bond rate, the Standard and Poor's dividend/price ratio for common stocks and the three-month Treasury bill rate, which is used as the proxy for the imputed cost of internally generated funds. The weights are the respective proportions of total credit market debt owed by private business, an estimate of total business equity, and corporate cash flow, in the sum of these items.

δ is the rate of economic depreciation. 1/

p is the expected rate of inflation. 2/

The equations specify investment as a function of output, the cost of capital, and the stock of capital goods. 3/ Separate equations, presented below, were estimated for producers' durable equipment and nonresidential structures by ordinary least squares, with a correction for first order serial correlation, over the period from the first quarter of 1964 to the fourth quarter of 1985. In both cases, all variables were normalized with respect to middle expansion path GNP, to reduce heteroskedasticity in the error term. The estimation results are reported below. Investment in machinery and equipment is related to the cost of capital and changes in output with a 14-quarter distributed lag, the largest coefficient being in the fifth quarter. Investment in nonresidential structures is related to these variables with a 12-quarter distributed lag, the largest coefficient being in the eighth quarter.

1/ A weighted average service life was calculated for equipment and for structures, and economic depreciation was taken to be the inverse of the estimated service lives.

2/ From 1979, the ten-year ahead survey of expected inflation conducted by Drexel Burnham Lambert. Before 1979, a four-quarter moving average of the University of Michigan's survey of one year ahead consumer price expectations. Strictly speaking, p should represent the expected rate of increase of prices of investment goods; the implicit assumption is that this is adequately captured by expectations of general price level movements.

3/ The specification follows the interpretation by Peter K. Clark ("Investment in the 1970s: Theory Performance and Prediction" Brookings Papers on Economic Activity, I:1979) of Bischoff's formulation of the neoclassical theory of investment ("Business Investment in the 1970s: A Comparison of Models" Brookings Papers on Economic Activity, I:1971). A more detailed discussion of the specification is provided in "Tax Policy and Business Investment in the United States" (to be issued shortly) by R. Corker, O. Evans, and L. Kenward.

Equation for producers' durable equipment

$$IE/Y^* = -10.31 (1/Y^*) + \sum_{i=0}^{14} w_i \frac{(Y_{-i} - Y_{-i-1})}{Y_{-i}^* CE_{-i-1}} \quad (1.2)$$

$$+ 0.088 KE_{-1}/Y^* - 0.003 D \quad (22.0) \quad (2.2)$$

$$\rho = 0.82 \quad \bar{R}^2 = 0.967 \quad DW = 2.15 \quad (13.0)$$

Where

$$\begin{aligned} w_0 &= 0.0066 & (4.8) \\ w_1 &= 0.0096 & (8.6) \\ w_2 &= 0.0118 & (10.5) \\ w_3 &= 0.0132 & (11.0) \\ w_4 &= 0.0139 & (11.1) \\ w_5 &= 0.0140 & (11.0) \\ w_6 &= 0.0136 & (10.6) \\ w_7 &= 0.0127 & (10.0) \end{aligned}$$

$$\begin{aligned} w_8 &= 0.0115 & (8.9) \\ w_9 &= 0.0100 & (7.6) \\ w_{10} &= 0.0083 & (6.3) \\ w_{11} &= 0.0066 & (5.1) \\ w_{12} &= 0.0047 & (4.0) \\ w_{13} &= 0.0030 & (3.2) \\ w_{14} &= 0.0014 & (2.4) \end{aligned}$$

$$\overline{\Sigma W} = 0.1410$$

Equation for nonresidential structures

$$IS/Y^* = 23.39 (1/Y^*) + \sum_{i=0}^{12} v_i \frac{(Y_{-i} - Y_{-i-1})}{Y_{-i}^* CS_{-i-1}} + 0.0370 KS_{-1}/Y^* \quad (1.2) \quad (4.7)$$

$$\rho = 0.90 \quad \bar{R}^2 = 0.934 \quad DW = 1.30 \quad (19.0)$$

Where

$$\begin{aligned} v_0 &= 0.00090 & (1.8) \\ v_1 &= 0.00099 & (2.3) \\ v_2 &= 0.00116 & (2.5) \\ v_3 &= 0.00138 & (2.8) \\ v_4 &= 0.00162 & (3.2) \\ v_5 &= 0.00185 & (3.7) \\ v_6 &= 0.00205 & (4.1) \end{aligned}$$

$$\begin{aligned} v_7 &= 0.00218 & (4.3) \\ v_8 &= 0.00222 & (4.3) \\ v_9 &= 0.00214 & (4.2) \\ v_{10} &= 0.00190 & (4.0) \\ v_{11} &= 0.00149 & (3.8) \\ v_{12} &= 0.00086 & (3.6) \end{aligned}$$

$$\overline{\Sigma v} = 0.02074$$

Variable notation:

IE is investment in producers' durables, 1982 dollars.

IS is investment in nonresidential structures, 1982 dollars.

Y is GNP in 1982 dollars.

Y* is middle expansion path GNP, 1982 dollars. 1/

CE is the real cost of capital for producers' durables.

CS is the real cost of capital for nonresidential structures.

KE is the stock of producers' durable equipment, 1982 dollars. 2/

KS is the stock of nonresidential structures, 1982 dollars. 2/

D is a zero/one dummy to allow for credit controls in 1980:II.

w_i and v_i are coefficients estimated using third degree Almon polynomials with a zero end-point constraint.

Under TRA, the average depreciation period for machinery and equipment is lengthened and the investment tax credit is abolished, both of which would tend to raise the cost of capital and reduce investment. At the same time, the use of 200 percent declining balance depreciation--previously 150 percent--is permitted, which would work to lower the cost of capital. With regard to structures, the investment tax credit--relevant for some components of structures--also was abolished and the tax life for depreciation is stretched from 19 to 31.5 years; both measures would raise the cost of capital. 3/

The net effects of these tax changes on the present value of depreciation allowances and the cost of capital are illustrated in Table 1 (attached). For machinery and equipment investment, the abolition of the investment tax credit is the most important element, raising the cost of capital by 1/2 percentage point, ceteris paribus. The changes to depreciation formulas for machinery and equipment reduce the present value of depreciation allowances only slightly and correspondingly raise the cost of capital only a little. For nonresidential structures, the

1/ Constructed by the Bureau of Economic Analysis, U.S. Commerce Department. See de Leuw and Holloway (1983) and Holloway (et al) 1986.

2/ Quarterly observations for the gross capital stocks were constructed by interpolating annual end of year stocks according to the patterns of gross investment throughout the year.

3/ Historical data for the cost of capital are illustrated in Chart 1.

most important element of TRA is the changed depreciation rules, which reduce the present value of a dollar of depreciation allowances by 17 cents, thereby raising the cost of capital significantly. Overall, tax reform is estimated to increase the cost of capital for equipment investment by 2 percentage points or by 27 percent, while for nonresidential structures the cost of capital is raised by 1.6 percentage points or 43 percent, assuming unchanged pretax interest rates (see panels 1 and 2 of Chart 2). ^{1/}

In order to assess the impact of TRA on investment and the capital stock, simple simulations were conducted over the period 1986-92 ^{2/} using exogenous assumptions for real GNP, inflation and interest rates that were in line with the medium-term baseline scenario of the current IMF World Economic Outlook forecasting exercise. According to these simulations, TRA would lower business investment in machinery and equipment by 4 3/4 percent by the end of 1992 assuming no induced change in interest rates (panel 3 of Chart 2); the bulk of the adjustment would take place during 1987-89, when the growth of machinery and equipment investment would be below the baseline by approximately 1 percent annually. By the end of 1992, TRA would reduce the stock of business machinery and equipment by 1 1/2 percent. Similar simulations for nonresidential structures indicated that TRA would lead to a 3 1/2 percent reduction in gross investment in nonresidential structures by the end of 1992 (panel 4 of Chart 2) with the bulk of the adjustment coming in the years 1987-90. By 1992, the stock of nonresidential structures would be reduced by 1/2 percentage point.

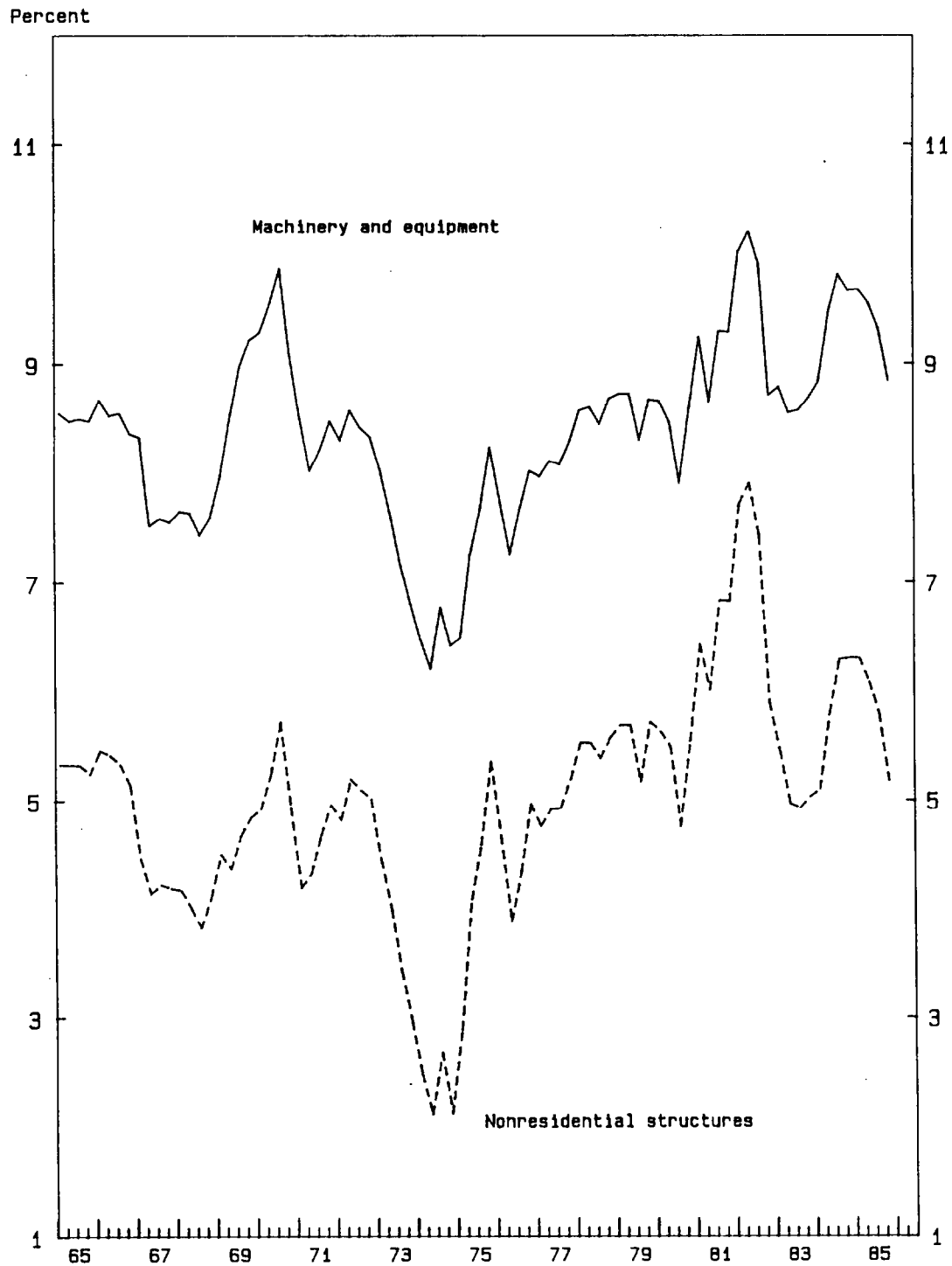
In order to allow for the effect of a decline in interest rates induced by TRA (discussed above), simulations were conducted assuming a 0.5 percentage point reduction in interest rates. In this case, gross investment in machinery and equipment would be 4 1/4 percent lower relative to the baseline by 1992, while investment in nonresidential structures would be 2 3/4 percent below the baseline by 1992. When an induced interest rate reduction of 1 percentage point was allowed for, machinery and equipment investment would be 3 3/4 percent below baseline by the end of 1992, while investment in nonresidential structures would be 2 1/4 percent below baseline by that time.

Taken together, the results indicate that tax reform is likely to lower the business capital stock by 1 percent in the long-run, and reduce the flow of gross fixed business investment by close to

^{1/} If tax reform is assumed to have induced a 1 percentage point decline in pretax nominal interest rates, then the estimated rise in the cost of capital for equipment is reduced to 22 percent and that for structures to 29 percent.

^{2/} The starting point was set at 1986, because the retroactive repeal of the investment tax credit to the start of 1986 was broadly anticipated. The terminal point of 1992 was chosen keeping in mind the long distributed lag terms in the investment equations.

CHART 1
UNITED STATES
REAL COST OF CAPITAL¹

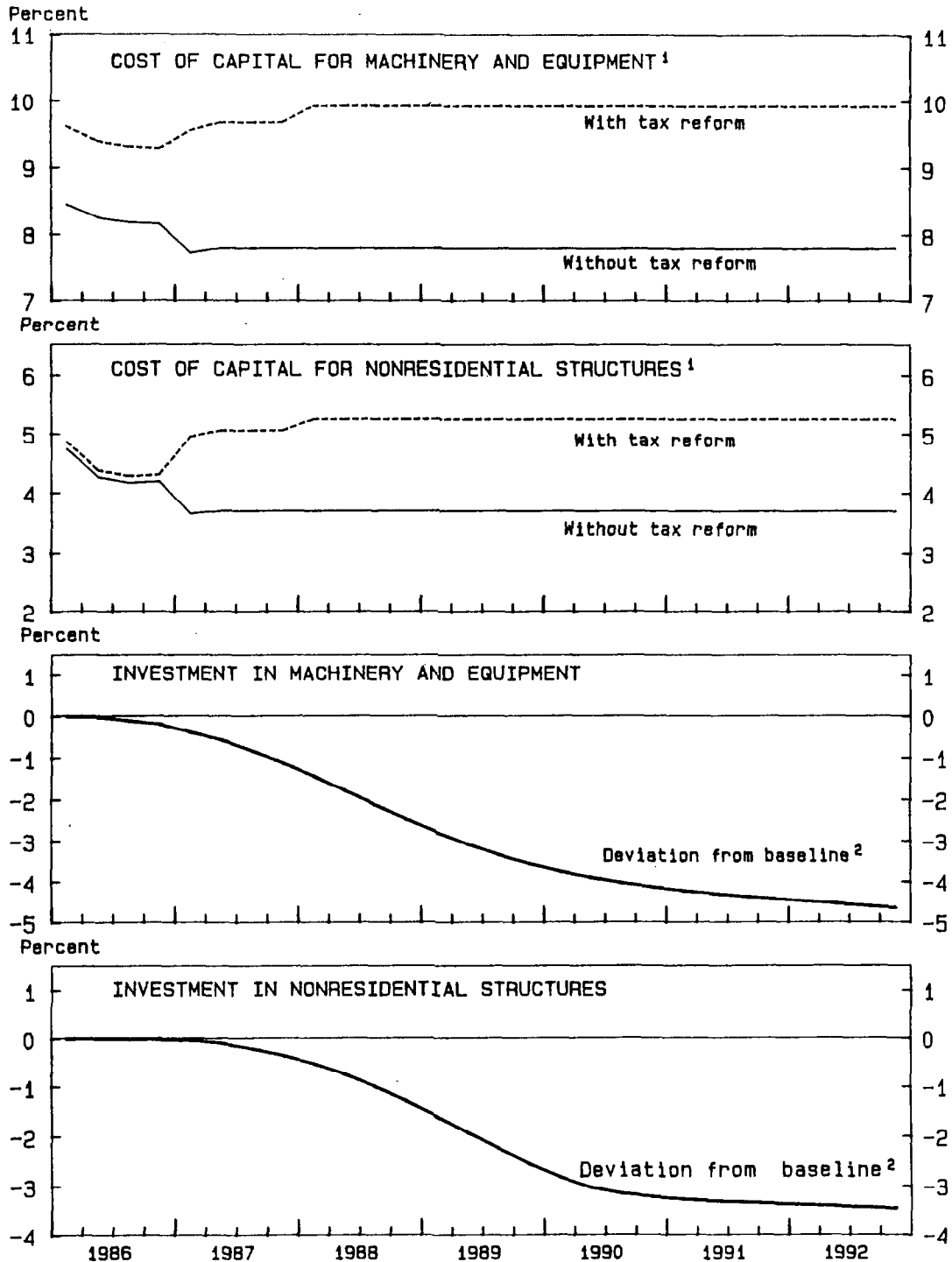


¹Excluding the relative price effects.



CHART 2
UNITED STATES

THE IMPACT OF TAX REFORM--SIMULATIONS



¹In real terms, excluding the relative price effect.

²The baseline is a simulation assuming no tax reform; the alternative assumes full implementation of the tax reform. The model, of course, requires a variety of assumptions and the results are thus necessarily subject to many uncertainties.



4 1/4 percent, assuming no induced reduction in pretax interest rates--which would be equivalent to a reduction of GNP by roughly 1/2 percentage point. A 1 percent reduction in the business capital stock in turn would be accompanied by a reduction in long-run output of 1/4 percent, assuming a Cobb-Douglas Production function and a capital coefficient of 0.25.

The simulations conducted may provide a useful guide to the order of magnitude of the likely effects on investment, but they have little to say on how rapidly these effects would in fact come through, because the estimated lag structures are driven primarily by the accelerator term on real GNP and rather less by the cost of capital. In addition, it is quite likely that because of announcement effects, tax reform may have caused a shift in the timing of investment spending from early 1986 into late 1985 and from early 1987 into late 1986, as businesses advanced their plans to take advantage of expiring tax concessions.

V. Conclusion

The Tax Reform Act of 1986 lowered marginal tax rates for both the household and business sectors. At the same time, it shifted the tax burden from the household to the business sector. Because the magnitude of the tax changes is relatively large, the assumption that historical response patterns--as summarized in estimated equations--can be extrapolated forward is more open to question than usual. Consequently the assessment presented here is necessarily tentative.

By reducing the marginal tax rate for households, tax reform will likely encourage new entrants to the work force, probably through a further increase in the labor force participation rate of women. The magnitude of the effect will be dampened by the repeal of the deduction for married couples both of whom are employed. Available estimates vary widely, but a review of available studies suggests a long-run labor supply increase of 1.5 percent and a corresponding output effect of 1 percent.

Through the abolition of the investment tax credit and the lengthening of depreciation schedules, tax reform will reduce the incentive to invest in both nonresidential structures and machinery and equipment. According to the estimates presented in section 4, tax reform would imply a reduction in machinery and equipment investment of 4 3/4 percent and a decline in investment in nonresidential structures of 3 1/2 percent by 1992, relative to what otherwise would have been, assuming unchanged interest rates. Correspondingly, the stock of machinery and equipment would be 1 1/2 percent lower and the stock of nonresidential structures 1/2 percentage point lower by 1992 compared with a no-tax reform scenario. The overall impact on GNP from these changes in investment would be a decline of roughly 1/2 percentage point. When an induced decline in interest rates of 0.5 percentage point was allowed for, the overall effect of tax reform on investment was smaller. The

empirical work did not attempt to assess the quantitative importance of the increased efficiency of investment resulting from "leveling the playing field," but the CEA suggested a gain through this channel of 0.1 percent of GNP. Another effect not directly assessed in the empirical work was the size of the adverse effect on real estate investment--which, however, may be expected to be small in terms of GNP.

In sum, the principal effects of tax reform would be likely to be a change in factor proportions, with the labor supply increasing and the business capital stock declining relative to what otherwise would have occurred. On balance, GNP would probably rise a little--by around 1/2 percentage point--according to the estimates discussed above.

Table 1. United States: Effect of Tax Changes
on the Cost of Capital ^{1/}

	Investment Category	
	Machinery and Equipment	Nonresidential Structures
<u>Base case (old tax law)</u>		
Present value of depreciation	0.91	0.72
Real cost of capital (percent)	7.8	3.7
<u>Effect of repeal of investment tax credit</u>		
Present value of depreciation	--	--
Real cost of capital (percent)	1.1	0.1
<u>Effect of revised deprecia- tion schedules</u>		
Present value of depreciation	-0.01	-0.17
Real cost of capital (percent)	0.1	0.5
<u>New law</u>		
Present value of depreciation	0.89	0.50
Real cost of capital	9.9	5.3

^{1/} The depreciation figures represent the discounted present value of \$1 of depreciation allowances. The cost of capital figures are in real terms, excluding the relative price term. The assumed rates of interest and expected rate of inflation are held constant across the various alternatives.

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