Business Fixed Investment in the 1980s: Prospective Needs and Policy Alternatives

By David W. Berson and V. Vance Roley

Recent public discussion of supply-side economics has once again highlighted the role business fixed investment plays in the economy. Along with the stimulating effects of lower marginal tax rates on labor supply and personal saving emphasized by proponents of the supply-side view, an increase in business expenditures on equipment and structures is seen to provide the impetus to achieve the long-run economic goals of lower inflation and higher labor productivity growth. Apart from the controversy surrounding certain elements of the "new" supply-side economics, most economists apparently believe that increased capital formation can help reduce inflation and spur productivity growth. Indeed, some economists claim that a significant part of the poor performance of labor productivity since the mid-1970s is directly due to a slowdown in capital formation.[1]

A number of analysts have argued, however, that substantial future investment will be required to reverse the slowdown in capital formation. For example, the Council of Economic Advisers under both Republican and Democratic presidents has projected that real business fixed investment must expand to over 11 per cent of real GNP to achieve adequate growth of the capital stock.[2] Investment spending of this magnitude is very high by historical standards. For this reason many analysts have suggested that business tax cuts are needed to encourage greater investment.

In this article, the prospective performance of business fixed investment in the 1980s is

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[1] For recent studies examining the impacts of lower marginal tax rates on labor supply and higher after-tax interest rates on personal saving, see Harvey S. Rosen, "What Is Labor Supply and Do Taxes Affect It?" *American Economic Review,* Vol. 70, May 1980, pp. 171-76; Martin Feldstein, "The Rate of Return, Taxation, and Personal Saving," *Economic Journal,* Vol. 88, September 1978, pp. 482-87; and E. Philip Howrey and Saul H. Hymans, "The Measurement and Determination of Loanable-Funds Saving," *Brookings Papers on Economic Activity,* No. 3, 1978, pp. 655-87. For recent discussions of the impact of capital formation on productivity growth, see Peter K. Clark, *"Capital Formation and the Recent Productivity Slowdown," Journal of Finance,* Vol. 33, June 1978, pp. 965-75, and Richard W. Kopcke, "Potential Growth, Productivity, and Capital Accumulation," *New England Economic Review,* May/June 1980, pp. 22-41.

[2] See *Economic Report of the President,* Washington, D.C.: U.S. Government Printing Office, 1976, 1977, 1980.

investigated. The first section analyzes the investment requirements of the 1980s. Next, empirical models of business fixed investment are used to judge whether there is likely to be a shortfall of investment from the amount required. In the third section, given at least the possibility of an investment shortfall, alternative business tax cuts are evaluated to determine which type is most effective in stimulating capital formation. The alternative tax cuts are then evaluated with respect to the additional investment they will obtain. The final section summarizes the main conclusions of this article.

INVESTMENT REQUIREMENTS IN THE 1980S

This section discusses the appropriate criteria for determining investment requirements and then analyzes what these requirements are likely to be in the coming decade. In assessing the amount of business fixed investment needed in the 1980s, it is generally believed that the major criterion should be to increase the growth rate of the nation's capital stock. For a given amount of labor, greater capital accumulation would accelerate the amount of output that may be potentially produced. Similarly, with a growing labor force, the growth rate of the capital stock must exceed employment growth to allow capital deepening—a rise in the amount of capital per unit of labor. By providing more capital to each worker, capital deepening would be expected to increase the amount of potential output per unit of labor. An increase in the growth of the capital stock may also accelerate the amount of technical progress by embodying technical advances in new capital. Such gains in technical progress would further increase potential output growth. A more rapid expansion of the capital stock would, through both of these channels, increase the rate at which output is produced per unit of labor. In turn, this rise in labor productivity growth would be expected to lower inflation by retarding the growth of unit labor costs which depend on the gap between the growth rates of nominal wages and labor productivity. Thus, an increase in the growth rate of the capital stock would increase the economic growth rate, stimulate greater productivity gains, and help reduce inflation.

This article assumes that an increase in the growth rate of the capital stock is desirable and adopts as a standard the rate of increase recorded from 1948 through 1969, a period of significantly higher capital stock and real output growth and significantly lower inflation than in recent years. As shown in Table 1, the capital stock grew at a rate of 4.5 per cent during the 1948-69 period. The table also shows the recent slowdown of capital formation, particularly during the late 1970s. Between 1975 and 1979, for example, the real net capital stock grew at a 2.7 per cent rate, more than a percentage point below that of the previous five-year period and about 1.75 percentage points below the rate recorded during the 1948-69 period.[3] Even more striking is the slowdown in the growth of the capital-labor ratio. Following the steady gains in the level of the capital-labor ratio from the beginning of the postwar period through the mid-1970s, this measure failed to increase during the late 1970s.

The lower part of Table 1 estimates the amount of real business fixed investment as a percentage of real GNP needed in the 1980s. The amount of gross investment needed each year equals the increase in the capital stock consistent with the desired 4.5 per cent growth rate plus the expenditures needed to replace

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[3] The recent benchmark revision of the national income and product accounts, NIPA, will alter capital stock series that are consistent with these accounts. The tables and empirical work in this article are based on data available prior to this revision. Virtually all of the revisions are after

stock—computed using NIPA data—may be seen in the following OLS regression using annual data from 1967 through 1979:

$$\%\Delta K^R = \underset{(2.6)}{0.0122} + \underset{(8.1)}{0.9595}\ \%\Delta K^0,$$

$$\bar{R}^2 = .84 \quad SE = .005 \quad DW = 1.63$$

where $\%\Delta K$ = growth of the real net stock of nonresidential structures

$\bar{R}^2$ = adjusted multiple correlation coefficient

SE = standard error

DW = Durbin-Watson statistic

with the superscripts R and 0 corresponding to the revised and old data series, respectively, and t-statistics in parentheses. This equation implies that 5 per cent capital stock growth using the old data is revised to approximately 6 per cent. Calculations using the revised data show a half percentage point slowdown of capital stock growth when comparing the 1970-79 period with 1948-69, and about a 1 percentage point drop when comparing 1975-79 with 1948-69.

The revisions in the NIPA data also change the investment-GNP shares reported in Table 1. Using the revised data, the average share for the 1975-79 period is 10.3 per cent. The differences between the old and revised investment-GNP ratios may be seen in the following OLS regression using annual data over the 1967-79 sample period:

$$(I/Q)^R = \underset{(0.9)}{0.0112} + \underset{(7.1)}{0.9202}\ (I/Q)^0, \quad \bar{R}^2 = .80 \quad SE = .002 \quad DW = .55$$

where I/Q = ratio of real gross investment in private nonresidential structures and producers' durable equipment to real gross national product.

This equation indicates that a 10 per cent ratio using the old data corresponds approximately to a 10.3 per cent ratio using the revised data. Thus, forecasts of business fixed investment using the revised data would probably be higher than those reported in this article. However, to achieve past rates of net capital accumulation, investment must surpass the amounts calculated with the old data because of the larger amount of economic depreciation implied by the larger capital stock. The possible investment shortfall reported below in the text should, therefore, change only slightly using the revised data because both investment requirements and investment forecasts would be higher.

Table 1
INVESTMENT NEEDED TO STIMULATE CAPITAL STOCK GROWTH

	Historical Performance Over Various Periods (In per cent)		
	Capital Stock Growth	Capital-Labor Ratio Growth	Investment-GNP Ratio
1948-69	4.5	2.3	9.0
1970-79	3.3	0.8	10.0
1970-74	3.8	1.7	10.3
1975-79	2.7	0.0	9.8

	Investment Requirements (In per cent)		
Assumptions	1980-84	1985-89	1980-89
Employment Growth	1.6	1.8	1.7
Capital Stock Growth	4.5	4.5	4.5
Implications			
Capital-Labor Ratio (Growth)	2.9	2.7	2.8
Investment-GNP Ratio	10.7	11.4	11.1

Notes: Capital stock = real net stock of nonresidential structures and producers' durable equipment (U.S. Department of Commerce, Bureau of Economic Analysis).

Labor = total employment in nonagricultural establishments (U.S. Department of Labor, Bureau of Labor Statistics).

Investment = real gross investment in private nonresidential structures and producers' durable equipment (U.S. Department of Commerce, Bureau of Economic Analysis).

GNP = real gross national product (U.S. Department of Commerce, Bureau of Economic Analysis).

Values for employment growth and GNP over the 1980-89 period are taken from the TRENDLONG0880 simulation of Data Resources, Inc.

depreciated capital. To represent investment as a share of real GNP, a baseline macro-model forecast is used to obtain values for real GNP during the 1980s.[4] Assumptions about the growth of employment during the 1980s are also given to determine a path for the capital-labor ratio consistent with the growth of the capital stock. The results of this experiment indicate that real business fixed investment must average 10.7 per cent of real GNP during 1980-84 and 11.4 per cent during 1985-89. These are historically high ratios. For example, during the 1975-79 period, the investment-GNP ratio was only 9.8 per cent.

The analysis also implies strong growth of the capital-labor ratio during the 1980s. In fact, the magnitude of the increases reported in Table 1 suggests that somewhat lower capital stock growth may be sufficient to attain labor productivity growth comparable with previous periods. Nevertheless, as a whole, the evidence in Table 1 suggests that historically high levels of business fixed investment are desired throughout the 1980s.

In addition to the amount of investment spending needed to attain past rates of capital formation, the 1980s are likely to have extraordinary investment requirements, requirements related to types of investment that do not add directly to measured output or that result from special circumstances unique to the 1980s. Extraordinary investment requirements in the 1980s are projected to fall into two general areas. First, businesses will be required under the Clean Air and Water Acts to devote some capital spending on pollution abatement. From 1970 through 1977, these investment expenditures averaged about 0.4 per cent of real GNP, with expenditures in 1977 perhaps approaching 0.6 per cent.[5] To meet existing environmental regulations alone, this share may continue to average between 0.3 and 0.6 per cent of real GNP. Any additional environmental regulations would, of course, push this share higher.

Second, because of the recent need to accelerate the development of domestic energy supplies, large amounts of energy-related investment will be required. Major increases in capital spending are needed in the oil industry—for exploration, development, production, and refining capacity—as well as in the coal and synfuel industries. These investment expenditures may total 1 per cent of real GNP.[6] In addition to these direct energy needs, increased investment spending may be required due to indirect energy factors. In particular, higher energy prices resulting from previous oil supply shocks may have accelerated the obsolescence of the capital stock. Such investment requirements are very difficult to quantify, but they could parallel the amounts of additional investment required for pollution abatement.

Together, the extraordinary investment requirements associated with pollution abatement and energy may range from 1.5 to 2.0 per cent of real GNP. It may not, however, be appropriate to simply add this amount of specialized investment to the amount needed to stimulate capital stock growth. This procedure

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[4] Underlying these calculations is the assumption that 9 per cent of the real net capital stock depreciates each year. Lower rates of economic depreciation would imply lower shares of gross business fixed investment. The assumption of 9 per cent economic depreciation conforms to the experience of the late 1970s. Also, as indicated on the bottom of Table 1, GNP and employment growth forecasts over the 1980-89 period are from Data Resources, Inc.

[5] See, for example, the estimates of past and future business capital expenditures on pollution abatement in U.S. Environmental Protection Agency, *The Cost of Clean Air and Water,* Report to Congress, August 1979.

[6] This estimate is derived from the requirement of higher investment levels found in *Economic Report of the President,* 1980. The figures reported there are further adjusted to take "normal" or trend levels of investment into account to derive the estimate reported above.

would imply that historical periods were not subject to any unique investment requirements of their own. The total business fixed investment needs of the 1980s, however, do appear to surpass those of previous periods, and as a percentage of real GNP they are most likely higher than 11 per cent.

FORECASTS OF BUSINESS FIXED INVESTMENT

To determine whether there is likely to be a shortfall of investment from the amount required, four different models of investment behavior are used to forecast future investment expenditures.[7] A variety of different investment models are often used for this purpose because there is no consensus about which model best represents actual investment behavior. Accordingly, the four alternatives emphasize somewhat different determinants of investment spending.

The four models used in this study, listed in Table 2, are the cash flow with accelerator, neoclassical, neoclassical with cash flow and pollution abatement adjustment, and the neoclassical with cash flow.[8] All the models in Table 2 include real business output, Y, as a determinant of real business fixed investment, I. In the cash flow with accelerator model, for example, current and past changes in real business output are one of two determinants of net investment.[9] This distributed lag on changes in business output represents expectations about future output. If output has increased steadily for several quarters, for example, businesses may expect future output to rise. They will then need additional plant and equipment to meet the increased demand for goods. The distributed lag also represents the time lag between the planning and completion of business investment projects. In particular, past increases in output may have caused businesses to initiate investment projects, but adjustment costs and production lags may have delayed actual expenditures. Through these channels, past changes in and levels of business output play a central role in all of the models considered here.

Another determinant of gross business fixed investment appearing in all of the models is the previous period's capital stock, K_{t-1}. This variable together with its multiplicative coefficient is included to represent the amount of investment devoted to replacing depreciated capital: replacement investment is added to net investment to form gross investment. This expression may also reflect the adjustment in moving from the actual to the desired capital stock. The last two models include the product of the capital stock and capacity utilization in an effort to measure the amount of depreciated

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[7] For examples of similar approaches, see Charles W. Bischoff, "Business Investment in the 1970s: A Comparison of Models," *Brookings Papers on Economic Activity*, No. 1, 1971, pp. 13-58; Richard W. Kopcke, "The Behavior of Investment Spending During the Recession and Recovery, 1973-76," *New England Economic Review*, November/December 1977, pp. 5-41; and Peter K. Clark, "Investment in the 1970s: Theory, Performance, and Prediction," *Brookings Papers on Economic Activity*, No. 1, 1979, pp. 73-113.

[8] See the references in note 7 for detailed discussions of the first two investment models. The last two models are based on the investment equations in the Data Resources, Inc., U.S. Macro Model. In addition to the four models listed in Table 2, the generalized accelerator model was also used to forecast business fixed investment. The forecast results from this model closely correspond to those of the neoclassical model with cash flow and pollution abatement adjustment. The generalized accelerator model is not discussed further in this article because it implies, *a priori*, that business tax cuts will have no direct effect on investment spending. Instead, only tax policy changes that initially stimulate business output will increase investment spending.

[9] Net investment represents the amount of gross investment spending minus the amount needed to replace depreciated capital. As is discussed below, net investment may be represented as $I_t - d \cdot K_{t-1}$.

Table 2
BUSINESS FIXED INVESTMENT MODELS

Cash Flow with Accelerator Term (CFA)

$$I_t = a + \sum_{s=0}^{19} b_s \bullet \Delta Y_{t-s} + \sum_{s=0}^{19} c_s \bullet \Delta CF_{t-s-1} + d \bullet K_{t-1} + u_t$$

Neoclassical (N)

$$I_t = a + \sum_{s=0}^{17} b_s \bullet \Delta(Y \bullet CV)_{t-s} + d \bullet K_{t-1} + u_t$$

Neoclassical with Cash Flow and Pollution Abatement Adjustment (NCFPA)

$$I_t = a + \sum_{s=0}^{5} b_s \bullet (YA \bullet CV)_{t-s-3} + \sum_{s=0}^{6} c_s \bullet DS_{t-s-1} + d \bullet K_{t-1} + e \bullet CU_t \bullet K_{t-1} + f \bullet (YE_t - YA_t) + u_t$$

Neoclassical with Cash Flow (NCF)

$$I_t = a + \sum_{s=0}^{5} b_s \bullet (Y \bullet CV)_{t-s-3} + \sum_{s=0}^{6} c_s \bullet DS_{t-s-1} + e \bullet CU_t \bullet K_{t-1} + u_t$$

Notes:
- CF = real cash flow of nonfinancial corporations
- CU = capacity utilization
- CV = inverse of the real rental price of capital services
- DS = ratio of interest payments on debt of nonfinancial corporations to cash flow
- I = real investment expenditures
- K = real net stock of capital of the private business sector
- Y = real gross domestic product of total business
- YA = real output adjusted for pollution abatement expenditures
- YE = expected real output
- u_t = stochastic error term such that $u_t = \rho \bullet u_{t-1} + \epsilon_t$, where $E(\epsilon_t, \epsilon_s) = 0$, $t \neq s$; σ_ϵ^2, $t = s$

Data for YA and YE are computed by Data Resources, Inc.

capital due to actual use in the production process.

Neither business output nor last period's capital stock is directly responsive to changes in business taxes—that is, changes in the corporate income tax rate, the investment tax credit, and depreciation allowances. In contrast, both the cash flow variable, CF, and the rental price of capital services variable, 1/CV, which appear in the last three investment models, are affected by changes in any of the business tax parameters. Cash flow variables are included in investment models as proxies for expected future profitability of businesses.[10] Because of imperfections in financial markets, cash flow variables are also included to reflect the possibility that internal funds are less costly than external finance. The other investment

determinant responsive to business tax changes—the rental price of capital services—is the cost of using one unit of capital goods for one year.[11] This cost can be interpreted either as the direct cost of actually renting capital goods, or as an implicit cost associated with a firm renting capital services to itself. In either case, the higher the rental price relative to the price of output, the lower the amount of desired capital, and vice versa. The three models including the rental price of capital services are all labeled as neoclassical. Two of these neoclassical models are influenced by corporate cash flow, and one of these two contains additional adjustments due to the significant amount of expenditures on pollution abatement since the late 1960s.

Separate equations are estimated for producers' durable equipment and nonresidential structures for each of the four models of investment behavior. Total business fixed investment is disaggregated to take account of the different effects of tax changes on these two categories of investment. Seasonally adjusted quarterly data are used in the estimations, with the sample period beginning in 1960:I and ending in 1978:IV. The estimation results are summarized in the Appendix.[12]

The estimated equations reported in the Appendix are used to forecast business fixed investment expenditures through 1989. Values for the lagged capital stock appearing in all of the equations are generated each period from investment spending forecasted in previous periods. Future values of the other variables on the right-hand side of the equations in Table 2 are taken from a baseline forecast of the U.S. Macro Model constructed by Data Resources, Inc. These baseline values are consistent with a smoothly growing economy where real GNP growth averages 2.5 per cent in the 1980-84 period and 3.5 per cent in 1985-89.[13] This macro-model forecast also contains its own forecast of real business fixed investment, and to the extent that the forecasts from the individual investment models differ from the baseline forecast, the difference is assumed to represent changes in the mix, not the amount, of real GNP.[14]

The forecasts of business fixed investment from the four investment models are illustrated in Chart 1, beginning in 1979 and ending in 1989. Actual data for business fixed investment are also plotted to illustrate the investment performance of the late 1970s and to allow a comparison of predicted and actual values during the 1979-80 period. The forecasts from the four models yield a range of outcomes. In 1981, for example, the neoclassical model predicts that real business fixed investment will comprise 10.2 per cent of real GNP, while the

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10 Cash flow is defined in this article as

profits before tax - profits tax accruals
+ capital consumption allowances + capital consumption adjustment
+ inventory valuation adjustment,

all of which correspond to nonfinancial corporations.

11 For discussions of the impact of tax policy on the rental price of capital, see Robert E. Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," *American Economic Review,* Vol. 57, June 1967, pp. 391-414.

12 The initial lag lengths used in the estimation procedure were those used by Clark, "Investment in the 1970s." However, in contrast to Clark's study, the investment equations are not deflated by potential GNP as a heteroskedasticity correction. Tests for heteroskedasticity indicated that such corrections were not needed. See Stephen M. Goldfeld and Richard E. Quandt, "Some Tests for Homoskedasticity," *Journal of the American Statistical Association,* Vol. 60, June 1965, pp. 539-47.

13 The baseline forecast using the DRI model was also adjusted to exclude any assumed future policy changes.

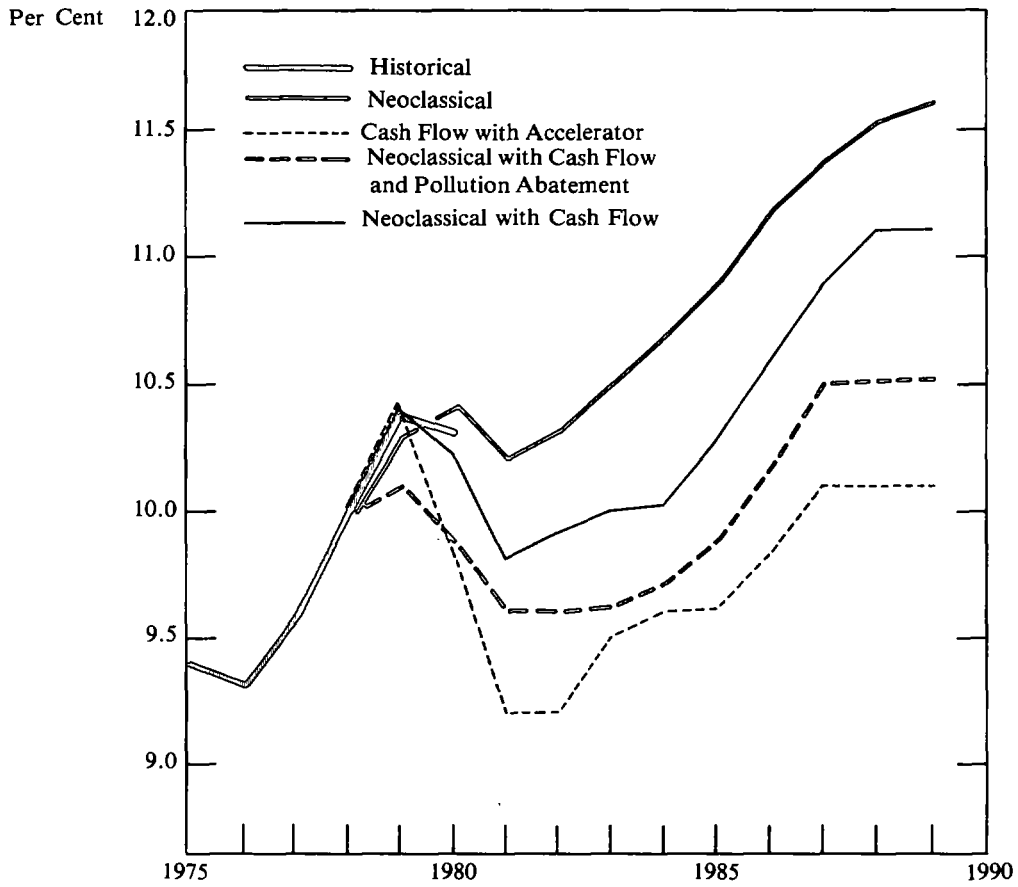
14 For comments on this common procedure of using investment equations apart from a general equilibrium macroeconomic model, see Robert E. Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior: Reply and Further Results," *American Economic Review,* Vol. 59, June 1969, pp. 388-401.

cash flow with accelerator model forecasts a 9.2 per cent share. In addition, according to the neoclassical model, the investment-GNP ratio will grow steadily to 11.6 per cent in 1989, while the cash flow with accelerator model predicts a 10.1 per cent share from 1987 through 1989. In the most favorable scenario—that using the neoclassical model—the investment-GNP ratio does not reach 11 per cent until 1986, and for the entire 10-year period investment is predicted to average 10.9 per cent of real GNP. The forecasts from the other two models fall between those of the neoclassical and cash flow with accelerator models.

Accepting the ranges of these forecasts as plausible investment outcomes, the evidence suggests that real business fixed investment may average between 9.7 and 10.9 per cent of real GNP during the 1980s. The upper end of this range may be close to being consistent with the investment needs of the 1980s discussed previously, but the lower end almost certainly is not. Because an investment shortfall is thus possible, the next section considers business tax cuts in terms of their relative effectiveness in stimulating investment spending.

Chart 1

FORECASTS OF REAL BUSINESS FIXED INVESTMENT AS A PERCENTAGE OF REAL GNP



A COMPARISON OF BUSINESS TAX CUTS

Different types of business tax cuts are empirically examined in this section using the models of business fixed investment listed in Table 2. The analysis of business tax cuts in the context of the four models focuses on the amount of additional investment spending for each dollar reduction in Treasury tax revenue. This concept measures the efficiency of the tax cut in terms of increases in the Federal deficit. In particular, the larger the amount of additional investment spending per dollar of Treasury revenue loss, the smaller the increase in the Federal deficit needed to attain a targeted amount of additional investment spending. Other criteria may be used to judge business tax cuts—such as simplifying tax law or increasing economic efficiency—but these factors do not have direct implications for the amount of additional investment spending and the size of the Federal deficit. Nevertheless, an "optimal" tax package would perform well under all possible criteria.

Three general types of tax cuts are examined here—corporate rate cuts, increases in the investment tax credit, and accelerated depreciation. The corporate tax rate cut considered in this article reduces the maximum statutory corporate income tax rate from 46 to 40 per cent. As is the case with the other tax cuts considered, this rate reduction changes both corporate cash flow—by reducing tax liabilities—and the rental price of capital.

The second policy considered would increase the investment tax credit from 10 to 20 per cent. This credit is available only for expenditures on producers' durable equipment. Thus, the amount of spending on nonresidential structures does not change in response to this type of tax cut.[15]

The final tax cut involves accelerated depreciation. This policy enables businesses to write off depreciation allowances more quickly. Because depreciation allowances are currently based on the historical price of a capital good, the rise in inflation during the 1970s has steadily eroded the real value of depreciation deductions. A shorter depreciation schedule would alleviate part of this problem during periods of high inflation.

Three different accelerated depreciation proposals are considered below—the 10-5-3 proposal, first-year capital recovery, and 40 per cent liberalization of depreciation allowances. The 10-5-3 proposal reduces the tax lives of structures and two types of equipment to 10, 5, and 3 years, respectively.[16] In the empirical analysis of this proposal, it is assumed that these changes are phased in over a five-year period. The first-year capital recovery plan would allow businesses to deduct the present, or discounted, value of depreciation allowances during the year of purchase.[17] Under this proposal, depreciation allowances would not erode over time due to inflation. The third proposal consists of accelerating depreciation rates by 40 per cent over current law.

The empirical results associated with the implementation of the business tax cut proposals in the first quarter of 1981 are presented in Table 3. In this table the effectiveness of the tax cuts in stimulating investment spending are ranked for each model of investment behavior. The rankings are based

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15 Nonresidential structures in the national income accounts do include some property defined as equipment for tax purposes. However, adjustments were not made to allow for this factor in the empirical work.

16 For more details concerning the 10-5-3 proposal, see the Conable-Jones Bill (S. 1435).

17 This tax policy change was recently proposed by Alan J. Auerbach and Dale W. Jorgenson, "The First Year Capital Recovery System," working paper, Harvard University, 1979. In contrast to the empirical analysis of this proposal presented above, Auerbach and Jorgenson assume that this tax change is gradually adopted by businesses.

Table 3
RANKING OF BUSINESS TAX CUTS BY INVESTMENT MODEL

Cash Flow with Accelerator			
1981-85 Avg.		1981-89 Avg.	
FYCR	(.29)	FYCR	(.48)
ITC	(.27)	ITC	(.45)
CRC	(.24)	CRC	(.40)
LD	(.19)	LD	(.39)
10-5-3	(.12)	10-5-3	(.29)

Neoclassical with Cash Flow and Pollution Abatement Adjustment			
1981-85 Avg.		1981-89 Avg.	
ITC	(1.10)	ITC	(1.17)
10-5-3	(.66)	10-5-3	(.64)
LD	(.64)	LD	(.62)
CRC	(.45)	CRC	(.44)
FYCR	(.37)	FYCR	(.41)

Neoclassical			
1981-85 Avg.		1981-89 Avg.	
ITC	(1.17)	ITC	(1.07)
10-5-3	(.89)	LD	(.68)
LD	(.75)	10-5-3	(.60)
CRC	(.50)	CRC	(.40)
FYCR	(.25)	FYCR	(.27)

Neoclassical with Cash Flow			
1981-85 Avg.		1981-89 Avg.	
ITC	(.99)	ITC	(1.07)
LD	(.77)	LD	(.81)
10-5-3	(.69)	10-5-3	(.67)
CRC	(.57)	CRC	(.57)
FYCR	(.38)	FYCR	(.44)

Notes: CRC = corporate rate cut of six percentage points
ITC = additional investment tax credit of 10 percentage points
10-5-3 = phased-in 10-5-3
FYCR = first-year capital recovery
LD = 40 per cent liberalization of depreciation allowances

Numbers in parentheses are the additional amount of nominal investment per dollar of nominal tax revenue loss.

on the additional amount of nominal investment per dollar of nominal tax revenue loss to the Treasury.[18]

[18] Two aspects of these results should be noted. First, the Treasury tax revenue loss data used in the computations correspond to static loss. That is, a baseline investment path unresponsive to the tax cuts is used to calculate the amount of Treasury tax revenue loss. The other measure sometimes used—dynamic revenue loss—is based on the changes in tax revenue allowing for economywide feedback from the tax cut. This method, therefore, requires a complete model of the economy. Furthermore, estimates of revenue loss using this method importantly depend on the empirical macroeconomic model used, as well as assumptions about future monetary and fiscal policy.

Second, the increase in investment spending reported in Table 3 also does not include the effects of economywide feedback. Only the initial impact is considered. The feedback effects may imply larger increases in investment due to subsequent increases in business output, or perhaps smaller increases due to inadequate gross saving. However, recent discussions of business investment spending suggest that depressed investment incentives are the primary problem, not the possibility of inadequate saving. Thus, the inclusion of economywide feedback would possibly imply higher figures in Table 3 by increasing the amount of investment and reducing tax revenue loss. On the other hand, some of the effectiveness of the business tax cuts may be reduced through changes in the price of capital goods relative to the price of output. For examples of the dynamic approach of investigating tax cuts, see Lawrence R. Klein and Paul Taubman, "Estimating Effects Within a Complete Econometric Model," in Gary Fromm, ed., *Tax Incentives and Capital Spending*, Washington, D.C.: The Brookings Institution, 1971, pp. 197-242; and Auerbach and Jorgenson, "The First Year Capital Recovery System."

The results in Table 3 indicate than an increase in the investment tax credit, ITC, is the most efficient in stimulating investment spending according to three of the models, and the first-year capital recovery plan, FYCR, has the highest ranking in one of the models. In the neoclassical model, for example, a $1 increase in the investment tax credit increases investment spending by an average of $1.17 over the 1981-85 period, and $1.07 during the entire 1981-89 period. In all of the models which include the rental price of capital—the three models based to some extent on the neoclassical approach—the investment tax credit is followed by either the 10-5-3 proposal or the 40 per cent liberalization plan, LD, with the corporate rate cut, CRC, and the first-year plan fourth and fifth in the rankings, respectively. In the cash flow with accelerator model, however, the first-year plan has the highest "bang for the buck," with the investment tax credit second.

As a whole, the results suggest that an increase in the investment tax credit is the most efficient policy to stimulate capital formation. As noted previously, however, the credit is applicable only to expenditures on equipment. An increase in the investment tax credit may therefore be expected to shift the composition of investment spending toward producers' durable equipment and away from nonresidential structures. Nevertheless, this problem could be eliminated in part by expanding the coverage of the credit to include structures.

WILL A BUSINESS TAX CUT SATISFY THE INVESTMENT NEEDS OF THE 1980S?

In this section, forecasts of the share of real business fixed investment in real GNP resulting from the different tax policy proposals are compared and the actual dollar amounts of the tax cuts are presented. The forecasts of investment-GNP ratios corresponding to the different tax policy proposals are used to determine whether a business tax cut is likely to provide enough investment stimulus to meet the investment needs of the 1980s.

The estimated sizes of the various tax cuts in terms of the static change in nominal tax revenue loss are presented in Table 4. The tax cuts presented in the table are assumed to become effective in the first quarter of 1981. The 1980-84 and 1980-89 averages therefore understate revenue loss by including 1980, which is chosen as the starting point to enable a direct comparison to the investment requirements calculated earlier.

The estimates in Table 4 indicate that the increase in the investment tax credit, the reduction in the corporate income tax rate, and the 40 per cent depreciation liberalization plan produce similar Treasury revenue loss. In addition, for all of these tax cuts the revenue loss is greater in the 1985-89 period than in 1980-84 due in part to the steady increase of nominal business fixed investment in the baseline forecast. The estimates presented for the phased-in 10-5-3 proposal and the first-year capital recovery plan indicate that these tax cuts are significantly more expensive in terms of Treasury revenue loss. The revenue loss associated with the 10-5-3 proposal is relatively small between 1980 and 1984, partly because of its phased-in implementation, but grows to an average of $57.4 billion during 1985-89. The first-year capital recovery plan involves large revenue losses at its inception and grows to an average revenue loss of $66.4 billion over the 1985-89 period.

The shares of real business fixed investment in real GNP resulting from the various tax policy changes are presented in the remaining rows of Table 4. For a 10 percentage point increase in the investment tax credit, for example, the neoclassical model yields an average investment-GNP ratio of 11.5 per cent

Table 4
REAL BUSINESS FIXED INVESTMENT AS A PERCENTAGE OF REAL GNP: BUSINESS TAX CUT RESULTS

	1980-84 Avg.	1985-89 Avg.	1980-89 Avg.
Additional Investment Tax Credit of 10 Percentage Points			
Revenue Loss	$14.9b	$31.1b	$23.0b
CFA	9.5%	10.2%	9.9%
N	11.0	11.9	11.5
NCFPA	10.1	11.1	10.6
NCF	10.4	11.4	10.9
Corporate Rate Cut of Six Percentage Points			
Revenue Loss	$10.9b	$25.3b	$18.1b
CFA	9.5%	10.1%	9.8%
N	10.6	11.5	11.0
NCFPA	9.8	10.5	10.1
NCF	10.1	11.0	10.5
Phased-In 10-5-3			
Revenue Loss	$ 9.3b	$57.4b	$33.4b
CFA	9.5%	10.2%	9.8%
N	10.7	11.9	11.3
NCFPA	9.9	10.9	10.4
NCF	10.1	11.4	10.7
40 Per Cent Liberalization of Depreciation Allowances			
Revenue Loss	$12.7b	$32.9b	$22.8b
CFA	9.5%	10.2%	9.8%
N	10.7	11.7	11.2
NCFPA	9.9	10.7	10.3
NCF	10.3	11.3	10.8
First-Year Capital Recovery			
Revenue Loss	$48.8b	$66.4b	$57.6b
CFA	9.7%	10.8%	10.2%
N	10.8	11.7	11.3
NCFPA	10.2	10.9	10.5
NCF	10.4	11.4	10.9

Notes:
- CFA = cash flow with accelerator term
- N = neoclassical
- NCFPA = neoclassical with cash flow and pollution abatement adjustment
- NCF = neoclassical with cash flow
- Revenue Loss = static change in U.S. Treasury nominal tax revenue in billions of dollars

over the 1980-89 period, while the cash flow with accelerator model predicts a 9.9 per cent share. The results of the corporate rate reduction experiment suggest somewhat lower investment-GNP ratios, but part of this is due to the difference in average revenue loss ($18.1 billion versus $23.0 billion). The 40 per cent liberalization of depreciation allowances has almost the same average revenue loss over the 1980-89 period as the investment tax credit, but its implied investment-GNP shares are from 0.1 to 0.3 percentage points lower. Of particular interest are the results of the phased-in 10-5-3 proposal and the first-year capital recovery plan in comparison to the investment tax credit. Despite the sharply higher costs of these two accelerated depreciation tax cuts, only in one case is the estimated investment-GNP share higher than the corresponding ratio under the investment tax credit.

As a whole, the empirical results indicate that investment-GNP ratios may average between 10 and 11.5 per cent, depending on the type of tax cut enacted. Thus, the enactment of a business tax cut may be expected to raise the investment-GNP ratio by about 0.5 percentage points. This outcome would imply a historically high investment share for a period as long as a decade.

It is possible that this amount of investment would ensure adequate expansion of productive capacity, but it is also possible that these tax cut policies by themselves may not be enough. Lower inflation and more rapid and stable growth of real GNP may also be needed to provide stimulus to business fixed investment. Additional fiscal and monetary policy actions may therefore be required to achieve these goals. Furthermore, if investment does not grow sufficiently during the early to mid-1980s, larger business tax reductions might be considered to respond to any apparent investment shortfall.

CONCLUSIONS

Substantial increases in business fixed investment will probably be required during the decade of the 1980s. Two main factors motivate this need for an acceleration in investment spending. First, increased investment is required to achieve past rates of capital stock growth and related benefits such as higher labor productivity growth. Second, a significant portion of future investment spending will be devoted to the extraordinary investment requirements associated with pollution abatement and past rises in the relative price of energy.

To guarantee rapid increases in capital formation throughout the 1980s, the early enactment of a business tax cut has been advocated by many observers. Among the three general types of business tax packages examined in this article, increases in the investment tax credit were found to be the most effective. Moreover, an analysis of different tax cut proposals indicated that business tax reductions may have to exceed $20 billion to ensure that the investment needs of the 1980s will be satisfied.

APPENDIX

Table A1
ESTIMATION RESULTS: EQUIPMENT

(1960:I-1978:IV)

Model	Coefficients a	Σb_s	Σc_s	d	e	f	rho	$\bar{R}^2$	SE	DW
Generalized Accelerator	-9.976 (-2.2)	2.138 (5.8)		.1778 (12.2)			.876 (11.8)	.995	1.33	1.67
Cash Flow with Accelerator	-13.38 (-3.8)	1.580 (4.9)	.2696 (2.5)	.1346 (6.1)			.830 (10.7)	.995	1.30	1.69
Neoclassical	-9.929 (-1.5)	.1407 (5.2)		.2093 (11.2)			.925 (21.7)	.993	1.51	1.73
NCFPA	-8.638 (-3.1)	.0163 (6.2)	-18.65 (-1.0)	-.0372 (-0.9)	.1184 (4.0)	-.0528 (-2.5)	.794 (9.3)	.996	1.16	1.77
Neoclassical with Cash Flow	-9.714 (-4.1)	.0012 (6.5)	-19.45 (-1.8)		.1420 (7.7)		.772 (10.0)	.995	1.26	1.89

Notes: NCFPA = neoclassical with cash flow and pollution abatement adjustment
rho = estimated autocorrelation coefficient
$\bar{R}^2$ = adjusted multiple correlation coefficient
SE = standard error in billions of 1972 dollars
DW = Durbin-Watson statistic

Numbers in parentheses are t-statistics.

Table A2
ESTIMATION RESULTS: STRUCTURES

(1960:I-1978:IV)

Model	Coefficients a	Σb_s	Σc_s	d	e	f	rho	$\bar{R}^2$	SE	DW
Generalized Accelerator	15.02 (2.6)	1.251 (4.6)		.0331 (2.4)			.938 (24.8)	.972	.904	2.05
Cash Flow with Accelerator	8.596 (3.2)	.9039 (4.4)	.1779 (4.6)	.0176 (2.7)			.806 (11.6)	.975	.855	2.01
Neoclassical	9.488 (1.2)	.0418 (3.5)		.0642 (3.6)			.958 (32.5)	.966	1.01	1.75
NCFPA	1.835 (0.3)	.0025 (1.4)	-44.87 (-3.7)	-.0231 (-0.5)	.1198 (1.8)		.850 (11.7)	.968	.975	1.93
Neoclassical with Cash Flow	-9.714 (-4.1)	.0012 (6.5)	-19.45 (-1.8)		.1022 (5.1)		.878 (15.1)	.967	.984	1.83

Notes: NCFPA = neoclassical with cash flow and pollution abatement adjustment
rho = estimated autocorrelation coefficient
$\bar{R}^2$ = adjusted multiple correlation coefficient
SE = standard error in billions of 1972 dollars
DW = Durbin-Watson statistic

Numbers in parentheses are t-statistics.