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Can It Break  
the Capital Formation Deadlock?

EXEMPTIONS  
INCOME SAVINGS  
PRODUCTIVITY  
WRITE-OFFS  
TAXES  
CONSUMPTION  
INVESTMENT  
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CONSUMPTION

Structuring Corporate Taxes  
for a More Productive Economy

# EDITOR'S NOTE: TAX POLICY AND PRODUCTIVITY GROWTH

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Boosting the rate of productivity growth in U.S. industry is considered by many to be among the chief economic policy tasks of the 1980s.

Most economists agree that heavier investment in new plant and equipment would boost productivity growth. Thus measures have been proposed to increase private saving, which would make more money available for business investment, and to encourage capital expansion by reducing the real cost of capital facing business planners. A favored vehicle for accomplishing both aims is tax policy.

In this issue of the *Business Review*, Laurence S. Seidman suggests that converting from the present personal income tax to a personal consumption tax might stimulate saving without producing inequitable side effects for any income group. Robert Rossana addresses the effects on business investment of changes in investment tax credits, depreciation allowances, and corporate tax rates.

Each author's views are his own and are published here to stimulate informed discussion. Neither article should be interpreted as representing an official position of this bank or of the Federal Reserve System.—J.J.M.

# A Personal Consumption Tax: Can It Break the Capital Formation Deadlock?

By Laurence S. Seidman\*

Over a period of many decades, the United States' standard of living was the envy of the world. U.S. industry thrived, churning out immense quantities of products ranging from the heaviest of heavy equipment to the most delicate of consumer goods. Other nations looked to America for the pattern of a productive economy.

In recent years, however, some of the glamour of the U.S. economy has worn off as the relative productivity growth of American business has taken a nosedive. The causes of the fall in U.S. productivity growth

have proved elusive to researchers, but many believe that tax policy is a major contributor. If tax policy could be made to favor saving over present consumption, they say, the United States would have the dollars to reinvest and rebuild its aging industrial plant and to become the world's model for productivity once again.

One way to tilt the balance in favor of saving and against consumption is to modify the income tax so that the income from saving—whether interest, dividends, or capital gains—would be wholly or partially exempt from taxation. But while this approach clearly would encourage saving, it also would tend to give a tax break to those who enjoy high consumption financed by capital income and thus might be objected to

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\* Laurence S. Seidman is Assistant Professor of Economics at Swarthmore College and recently has conducted research on several facets of tax policy at the Federal Reserve Bank of Philadelphia.

on equity grounds. Another approach is to transform the income tax into a direct tax on personal consumption. A personal consumption tax with graduated rates might well turn the trick of encouraging capital investment without running afoul of equity objections.

### WHY TAX AT ALL?

It would be nice to live in a world without taxes. But as Ben Franklin noted, taxes are as inevitable as death. The reason is that, although a strong case can be made for relying on the private sector for much of our economic activity, certain tasks can be performed only by government. Public goods, such as national defense, and social insurance programs, such as social security, can be financed only by compulsory taxation.

Any tax, however, directly imposes a burden on people. Further, it indirectly reduces the efficiency of resource allocation in the private sector and alters the distribution of income. Thus in deciding how to go about taxing, policymakers have to add the indirect burden from the inefficiency of a tax to its direct burden in order to determine whether the total cost of a government program is less than its benefits. And they must attempt to determine as well what the incidence of the tax will be—on whom it will fall, and how heavily.

Altering the mix of taxes generally will affect both economic efficiency and the distribution of income. Thus both the level and the mix of taxation are important. Some economists believe that changing the tax mix to encourage saving and investment could improve both economic efficiency and the equity of income distribution. Such questions of efficiency and equity seem especially pressing after a decade in which Americans have seen little advance in the standard of living of the average household.

### SAVING AND THE STANDARD OF LIVING

The standard of living of an American

worker in 1970 was much higher than that of his counterpart in 1920. Further, he was much better off than a worker in a developing country in 1970. The single most important cause of these differences was that the productivity—output per manhour—of the American worker had grown tremendously in the half-century preceding 1970. And this growth in productivity was induced primarily by investment in more and better machinery (physical capital) and more and better education and training (human capital) per worker. The accumulation of capital per worker has been the key to a rising standard of living and gradual reduction of poverty.

Capital formation comes only from investment, however, and investment comes mainly from private saving. When individuals and business firms reduce their current consumption, more resources are released to produce machinery, factories, education, and training, and to develop new technology. A nation must sacrifice consumption today to enjoy higher output and consumption tomorrow.

The decade of the 1970s witnessed a significant slowdown in the growth rate of labor productivity in the United States—from 3 percent in the early 1960s to perhaps 1 percent at the close of the 1970s. Although the causes are hard to pinpoint, one important source of this deterioration almost surely was inadequate investment. Since 1973, the capital-labor ratio has grown less than 2 percent per year in contrast to the 3-percent average growth rate from 1948 to 1973.<sup>1</sup> This slow growth in the capital-labor ratio has been associated with declining U.S. saving rates, which, in fact, were significantly below those in most other advanced economies even prior to the recent slowdown.

One obstacle to raising the rate of saving and capital formation is the income tax. The income tax discourages saving, and the

<sup>1</sup>The Economic Report of the President 1979, p. 68.



degree of discouragement increases with the rate of inflation. In the year when saving occurs, the saver is taxed as much as the nonsaver with equal income; and in the future, the saver is taxed on the return he earns. With inflation nibbling away at whatever is left of interest income, saving loses much of its attractiveness.

Thus advocates of capital formation often have recommended the exemption of capital income from personal taxation under the income tax along with the reduction of business taxation. They have argued that if interest, dividends, and capital gains were exempt from tax, individuals would be more encouraged to save; and if business taxes (such as the corporate income tax) were cut, business would find it more profitable to increase spending on new plant and equipment.

But the exemption of capital income has run into significant opposition on grounds of equity. In effect, this approach would convert the income tax into a tax on labor income alone. Exemption of capital income would make it possible for wealthy people who enjoy a high level of consumption to pay little or no tax if the consumption were financed primarily by capital income. While defenders of the exemption reply that the past saving and investment of the wealthy helped raise productivity and thus the standard of living of the average worker, these arguments to date have won only a partial exemption of capital income. A wholesale exemption appears to fail the test of political feasibility.

Because attempts to adjust the income tax in favor of saving so far have run into so much resistance, some tax theorists have proposed moving away from the income tax altogether. Their proposal is to tax people on the basis of how much they *consume* rather than on how much they *earn*. Such a consumption tax approach, they believe, could break this capital formation deadlock by overcoming equity objections.

Taxable consumption would be computed by a process of subtraction that is quite similar to the current procedure under the income tax. Each year, in preparing his return, the taxpayer would add all cash receipts (including wages, salaries, interest, dividends, and receipts from the sale of assets such as stocks and bonds) and subtract the purchase of investment assets along with the net increase in his savings account balance and actual tax payments. The difference—consumption—would be subject to the tax rates given in the tax tables (after any adjustments that Congress decided were appropriate). And these tax rates could be scaled to make sure that the tax fell equitably on all taxpayers (see . . . AS PROGRESSIVE AS AN INCOME TAX overleaf).

Thus the basic mechanics of a consumption tax are not hard to envisage. But what impact would such a tax actually have?

## WHAT A CONSUMPTION TAX WOULD DO

Any shift in tax policy represents a step from the known to the unknown. Policy changes of almost any sort affect the economy in ways that sometimes are unintended and unforeseen. In the case of a consumption tax, however, it seems fairly clear that certain effects can be predicted.

**It Would Raise the Reward to Savers.** Savings represent forgone consumption; and since many people find it hard to delay gratification, they find it hard to save. The benefit to saving, however, is that it can allow a larger volume of consumption in the future. It hardly seems farfetched to argue that the more future consumption people can obtain by postponing consumption today, the more they are likely to save.

One way to calculate the benefit from saving is to consider the amount of future consumption it permits relative to the amount of consumption an individual forgoes when he makes a savings decision. If a person saved \$1,000 at an interest rate of 6 percent,



## A CONSUMPTION TAX CAN BE MADE AS PROGRESSIVE AS AN INCOME TAX

In a given year, most low-income households devote a smaller fraction of their income to saving and a higher fraction to consumption than do high-income households. It follows that if consumption tax rates were the same for all households, the ratio of tax to income would be greater for a low-income than for a high-income household; the consumption tax would be regressive.

The consumption tax rate schedule, however, can be whatever Congress decides that it should be. A consumption tax can be made more than, less than, or just as progressive as the current income tax.

The accompanying Figure shows how consumption tax rates can be set to achieve equal progressivity with respect to income, at least in principle. Under the progressive income tax in this illustration, the \$60-thousand household would pay \$15 thousand in tax (a 25-percent average tax rate), while the \$15-thousand household would pay \$1,500 in tax (a 10-percent average tax rate).

## A CONSUMPTION TAX COULD PRESERVE THE SAME RATIOS OF TAX TO INCOME FOR EACH INCOME CLASS

<b>Income Tax</b>							
	Income	I-Tax Rate	I-Tax	Disposable Income	Consumption	Saving	Tax/Income
High Income	\$60,000	25%	\$15,000	\$45,000	\$30,000	\$15,000	25%
Low Income	15,000	10	1,500	13,500	13,500	0	10

<b>Consumption Tax</b>							
	Income	Saving	Consumption and Tax	C-Tax Rate	Consumption	C-Tax	Tax/Income
High Income	\$60,000	\$15,000	\$45,000	50%	\$30,000	\$15,000	25%
Low Income	15,000	0	15,000	11 1/9	13,500	1,500	10

Under a consumption tax regime, a \$60-thousand household that saved \$15 thousand (as it did under the income tax) would have \$45 thousand to divide between consumption and tax. At a 50-percent rate, consumption would be \$30 thousand and tax would be \$15 thousand, just as under the income tax. The ratio of tax to income also would be the same. To keep the tax payment for the lower income household at the same dollar level as under the income tax, the consumption tax rate would have to be 11 1/9 percent.

While a consumption tax could be designed to be as progressive as the income tax, it might in actuality be more or less progressive. Why? For precisely the same reason that the income tax is not actually as progressive as it is designed to be. Instituting a tax structure creates incentives for some people to restructure their activities so as to reduce their tax burden. Exactly what form this different behavior will take, however, is difficult to predict. As a result, it would be close to impossible to design a consumption tax schedule that would guarantee the same degree of progressivity as the current income tax.



for example, then the ratio of consumption one year ahead to consumption forgone in the present would be  $\$1,060/\$1,000$  or 1.06, provided that interest is not taxed and that there is no inflation. If interest were taxed, this ratio would, of course, be lower, since part of the reward for saving would not be available for future consumption. But a tax which exempts capital income or a consumption tax would not affect this ratio.

Consider what would happen with an income tax of  $33\frac{1}{3}$  percent. A person who earned  $\$1,500$  last year would have had to pay  $\$500$  in tax and would have  $\$1,000$  left over to spend or save. If he saved it, interest on the  $\$1,000$  still would be  $\$60$ , but it would be taxed  $\$20$ , so after-tax interest would be only  $\$40$ . The future-consumption factor now would be  $\$1,040/\$1,000$ , or 1.04. Thus an income tax reduces the future consumption that can be obtained for a given sacrifice of present consumption. Under a tax that

exempts all capital income, the factor would stay at 1.06.

Suppose instead that there is a consumption tax—for example, of 50 percent (any rate will do). Out of  $\$1,500$  of income, the person can consume  $\$1,000$  on which a tax of  $\$500$  would be owed or he can save the  $\$1,500$  and earn  $\$90$  of interest. Out of  $\$1,590$  in the next year, he can consume  $\$1,060$ , on which a tax of  $\$530$  would be owed. The ratio of future consumption to presently forgone consumption facing the person would be  $\$1,060/\$1,000$ , or 1.06.

Thus, even with no inflation, the reward to saving would be greater under a consumption tax than under an income tax. In the real world, with inflation, this gap in reward widens (see INFLATION, TAXES, AND THE REWARD TO SAVERS) as the inflation rate rises; the real return to savers becomes smaller and can even become negative under an income tax. In contrast, a consumption

## INFLATION, TAXES, AND THE REWARD TO SAVERS

Because lenders want to maintain the purchasing power of their saving, and because business borrowers who expect higher prices for their products are willing to pay higher rates for money, a given percentage increase in the expected inflation rate will tend to raise the rate of interest by approximately the same percentage, provided rates are not constrained by regulatory ceilings. If the interest rate without inflation were, say, 3 percent, then an increase in both actual and expected inflation of 9 percent would raise the interest rate to about 12 percent. With this 12-percent rate under the income tax, interest would be  $\$120$  on each  $\$1,000$  saved for a year's time; taxes (at  $33\frac{1}{3}$  percent) would be  $\$40$ . So consumption one year ahead can be  $\$1,080$ .

But there is a snag here from the consumer's point of view. Because of inflation, this sum of money a year from now will not buy as many goods as it would today. In fact, at today's prices it will buy only  $\$991$  ( $\$1,080$  divided by 1.09) worth of goods. Thus the ratio of future real consumption (after adjustment for inflation) to today's forgone consumption is  $\$991/\$1,000$ , or .99. An individual in effect reduces his total ability to consume by saving. Instituting a consumption tax would prevent this consumption loss and thus should stimulate saving.

Under the consumption tax, assuming a 12-percent interest rate and a tax rate of 50 percent, the  $\$1,500$  earned in the prior year could be invested for a year and would grow at 12 percent to  $\$1,680$ . If this whole sum were drawn out after earning a full year's interest (it could be left to grow further),  $\$1,120$  could be used for consumption while  $\$560$  went to taxes. Because prices were 9-percent higher, this sum of  $\$1,120$  would buy only  $\$1,028$  worth of goods expressed in today's prices. But the ratio of real future consumption to consumption presently forgone still would be  $\$1,028/\$1,000$ , which is approximately 1.03.

Thus a consumption tax maintains incentives to save in the face of high inflation, whereas an income tax produces less incentive to save the higher the rate of inflation.



tax preserves a positive return for savers.

It seems likely that the higher the return people expect, the more they will choose to save. Although empirical studies have yielded mixed results, one recent study suggested that saving would be increased sharply by a higher return.<sup>2</sup> Stronger confirmation, however, must await further empirical research.

**It Would Put More Money in the Hands of Those More Inclined To Save.** Just as consequential as the size of the reward to savers is the shifting of after-tax income from heavy consumers to those with more of a saving bent.

People who earn the same incomes may differ greatly in their attitudes toward consumption and thrift. But under an income tax, regardless of their spending and saving behavior, they would pay the same tax, all other things being equal, and would be left with the same after-tax income. The high spender would have as much to spend on consumption as the high saver would have to put away.

The consumption tax would alter this situation by leaving more after-tax dollars with the saver than with the spender of the same income level. And so the saver would have more money available to put into saving. Even if people were not much influenced by an increase in the reward to saving that a consumption tax would bring, the shifting of after-tax dollars to those who are more inclined to save would raise the volume of saving and make more funds available to finance spending on construction and business equipment.

**It Would Raise the Real Wage of Labor.** A higher saving rate also would enable industry to provide workers with more and better

facilities, and the more capital per worker, the higher would be labor productivity and the buying power of wages. Thus converting the income tax to a consumption tax eventually should result in a higher standard of living for workers.

Conversion of the income tax to a consumption tax therefore can be regarded as a longer run antipoverty policy. While social insurance and transfers to those unable to work have an important income-stabilizing role to play, reducing poverty for everyone able to work must depend on a rising growth path for the real wage of labor. Those who give important weight to this goal might find conversion to a progressive consumption tax attractive.

### BUT SOME SEE DIFFICULTIES

Although the consumption tax appears to have much to recommend it, some economists and policymakers believe that it could pose certain dangers. These range all the way from recession to inequity to excessive administrative costs.

Some income tax supporters caution, for example, that a switch to a consumption tax could be detrimental to the economy's performance, at least in the short or medium run. If a consumption tax reduces consumption demand, the slack must be taken up by an increase in the demand for capital goods by firms, or total demand will fall and recession will follow (Keynes called this the paradox of thrift). To the extent that increased saving reduces interest rates, business demand for investment goods should be stimulated. But a long time lag, it's feared, could intervene before investment responded, so that a period of weak overall economic activity might follow should a consumption tax be instituted.

The likelihood of this prospect is quite difficult to predict, since a consumption tax never has been tried in the United States. Indeed, if one could anticipate reasonably closely how the macroeconomy would re-

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<sup>2</sup>Michael Boskin, "Taxation, Saving, and the Rate of Interest," *Journal of Political Economy* 86 (April 1978). Boskin's results, however, are challenged by Philip Howrey and Saul Hymans, "The Measurement and Determination of Loanable-Funds Saving," *Brookings Papers on Economic Activity* 1978:3. who detect little responsiveness.



spond to a consumption tax, it might be possible to offset any undesirable consequences with monetary or fiscal policies. But it has been doubted that policymakers possess such knowledge. From this point of view, the uncertainty surrounding the short-term effects of a consumption tax on total economic activity must be regarded as one of the costs of such a policy to be balanced against expected gains. Not all economists, however, share these fears. They point to the German and Japanese experiences, in which higher saving rates have proved consistent with strong economic performance.

It's possible, also, that changing the rules in the middle of the game—moving from an income tax to a consumption tax—would produce inequities. It would be unfair to tax the consumption of retirees, for example, who had accumulated assets only after paying the income tax all their lives, unless some offsetting adjustment were made. But this inequity could be avoided if, when the consumption tax first was introduced, people above a certain age were given the option of choosing the income tax instead—an option that would be phased out over time. Thus inequities caused by the conversion might be avoided by designing the tax package with care.

Finally, it may seem that a consumption tax would be more difficult to compute for the taxpayer and the IRS. How would saving and investment be distinguished from consumption in practice, and how would consumer durables such as housing and autos be treated? Consumption tax advocates have tried to address these practical questions. One approach suggested for housing, for example, would be to treat annual mortgage payments as a measure of housing consumption in the year they are paid. Further, the

consumption tax would eliminate some administrative costs imposed by the income tax, such as the requirement to measure depreciation.

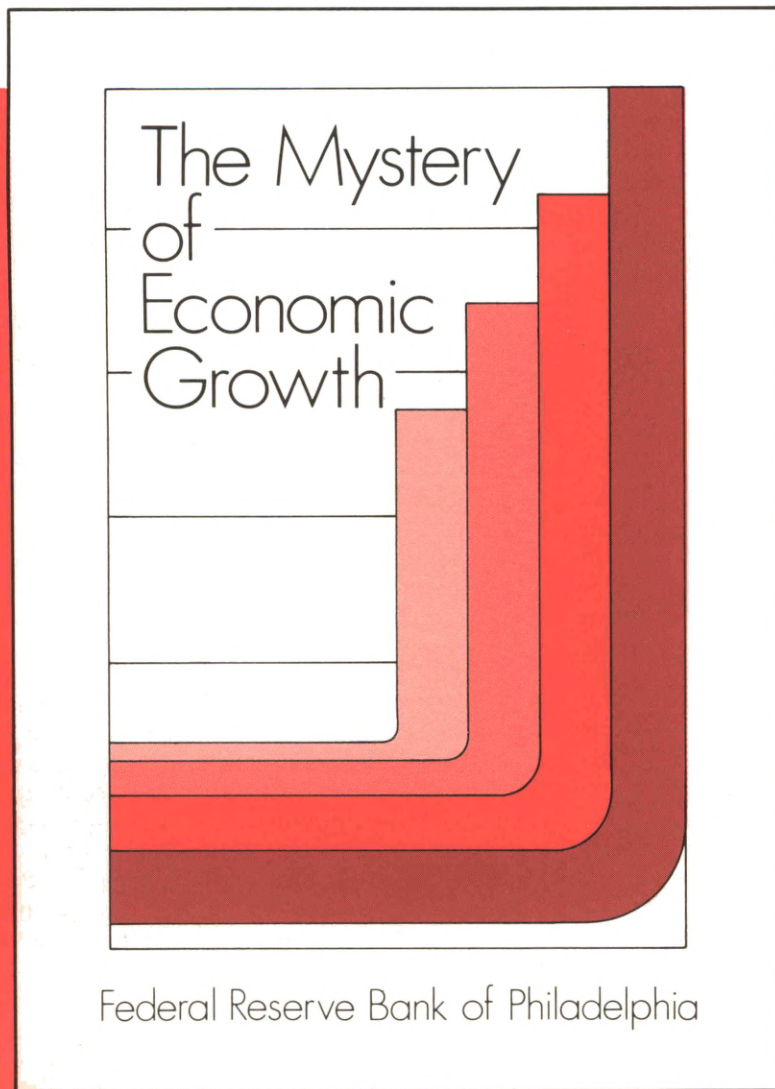
There would be difficulties in switching from an income tax to a consumption tax. On balance, however, many believe that they can be dealt with at an acceptable cost or that they fall short of offsetting the anticipated benefits of a consumption tax.

## CONCLUSION

Converting the income tax into a personal consumption tax could end a prevailing stalemate concerning tax policies to stimulate investment. Advocates of capital formation usually have sought the exemption of capital income under the income tax. Although eliminating the taxation of capital income almost certainly would stimulate saving and investment, opponents have argued that it would be inequitable because it would allow some of the wealthy whose consumption is financed by capital income to pay little or no tax.

A progressive personal consumption tax would ensure that any wealthy person who enjoyed high consumption would pay a correspondingly high tax. At the same time, by excluding saving from taxation in the year it occurred, the consumption tax would encourage saving. Conversion to a consumption tax therefore should promote capital formation and productivity and eventually should raise the real wage of labor. Given current concern about weakness in these areas and about the deadlock that has prevailed over exempting capital income, the proposal to convert the income tax to a consumption tax deserves serious consideration.

## FROM THE PHILADELPHIA FED . . .



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# Structuring Corporate Taxes for a More Productive Economy

By Robert J. Rossana\*

Is there too little spending by business on plant and equipment these days? Lots of people—and most all the politicians—appear to think so. All three candidates in the recent Presidential election and both party platforms advocated policies to stimulate private capital formation. And the Joint Economic Committee recently held hearings on changes in tax legislation that might spur investment spending.

While economists disagree about the causes of the current shortfall in investment spending, there seems to be a general view that certain changes in the structure of business taxation—the corporate income tax rate, the investment tax credit rate, and the nature of depreciation allowances—could stimulate business spending on new plant and equipment. Which of the various proposals under consideration is likely to be

implemented is difficult to say, but the current tenor of economic and political discussion suggests that some form of investment-oriented revision in the tax code is in the offing.

## WHAT EVER HAPPENED TO INVESTMENT?

Investment hasn't exactly come to a halt in the U.S. In fact, businesses are investing in plant and equipment to the tune of some \$150 billion a year.<sup>1</sup> But the present dollar value of investment is less revealing than its rate of growth over time. And that rate has slacked off alarmingly in the last decade.

Over the 20 years beginning in 1950, average annual investment spending in inflation-adjusted dollars grew quite steadily and

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\* Robert J. Rossana, Senior Economist at the Federal Reserve Bank of Philadelphia, received his Ph.D. from the Johns Hopkins University in 1980. He specializes in real-sector policy.

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<sup>1</sup>See "Total Nonresidential Fixed Investment," *Economic Report of the President* 1980. For rate of net investment see Lawrence H. Summers, "Tax Policy and Corporate Investment," paper presented at a conference on "The Supply Side Effects of Economic Policy," Washington University and the Federal Reserve Bank of St. Louis, October 24-25, 1980, Table I.

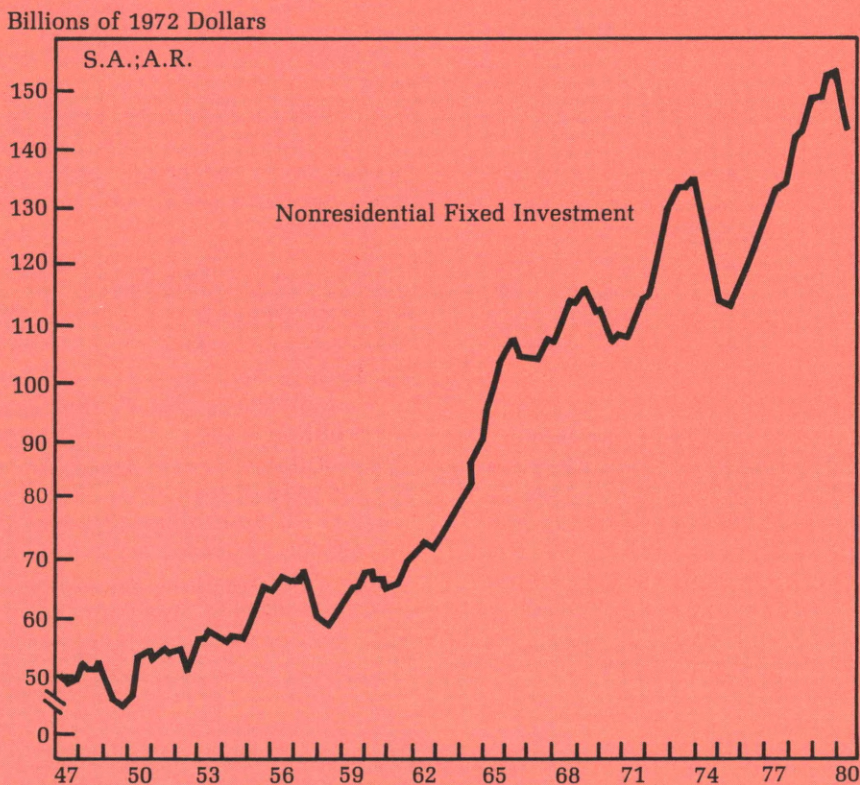
rapidly. If it declined in one year, it would start up again in the next, nearly always passing the previous high (Figure 1). With money flowing into plant and equipment, the U.S. was building a solid base for a more productive economy.

The last decade also started well, with about \$110 billion in real dollars set aside for new plant and equipment in 1970. And while the following year showed a somewhat lower figure, investment reached a new peak of \$131 billion in 1973. This upward movement was broken, however, with the onset of the

1974-75 recession. And even though the rest of the economy recovered pretty well, it took investment spending until 1978 to reach its peak of five years before.

The weakness in investment is particularly evident when viewed in relation to the size of the economy. The rate of net investment (gross investment less expenditures to replace worn-out equipment) as a fraction of gross corporate product has dropped sharply in recent years. While this figure averaged 0.036 over the 1951-79 period, it dropped to 0.024 over the years 1975-79—a 33-percent

**FIGURE 1**  
**THE 1970s WITNESSED AN INTERRUPTION**  
**IN EARLIER PATTERNS OF INVESTMENT GROWTH**





decline in the rate of net capital formation.

In a decentralized competitive economy such as that of the U.S., government is not in a position to increase private industry investment directly. Only the corporate planners who make investment decisions can do that. But these planners typically make their decisions after they have calculated the expected return on proposed capital investments. If government can color the environment in which those decisions are made, it should be able to have at least an indirect influence on investment levels. And it can, by adjusting the way corporations calculate their tax bills.

### HOW BUSINESS PLANNERS DECIDE TO INVEST

Any business that's going to maintain a competitive position must be on the lookout for better ways to do things—more cost-effective, more profitable ways. Indeed, economists contend that the drive for higher profits underpins key business decisions such as how many workers to hire, how large a plant to build, and which machines to install. Cost calculations naturally play a part in all this, but getting a handle on these is not always an easy matter, especially when it comes to considering the cost of new plant and equipment—the so-called cost of capital (see Appendix).

Figuring capital costs can be quite complex. The nominal dollar price of new equipment obviously matters, but so does the price of whatever the firm is producing. And since inflation and interest rates also affect capital costs, these too must be taken into account. Finally, because the tax laws make certain allowances for changes in a firm's capital stock,<sup>2</sup> the net cost of capital must be calculated on an after-tax basis.

The cost of capital affects a firm's calculation concerning the ideal size of its capital stock. Since investment is defined as the change in the capital stock, a decision to increase capital will mean a higher rate of investment. But businesses cannot change their respective capital stocks at a moment's notice. Rather, physical constraints, as well as economic considerations, suggest that firms will adjust gradually over time to that constellation of plant and equipment consistent with maximum profitability. The fact that firms move gradually in making and carrying out capital equipment decisions suggests there are two ways that tax policy can affect investment in a given period: first, it could induce firms to want to hold more capital equipment; and second, it could encourage firms to adjust more rapidly toward their ideal holdings.

**How Much, How Soon?** Business managers must determine what amount of capital goods will be most profitable for their firms (see THE DESIRED STOCK OF CAPITAL AND REAL WAGES overleaf). But new plants cannot be built overnight, and new machines cannot be acquired and installed at a moment's notice. Thus managers must plan their capital acquisition programs with considerable care. This planning process is costly, since it draws resources away from production.

The more machinery brought on board, the more costly will be the adjustment. As increasing amounts of new machinery are brought into the plant, more labor probably will be required for installation, and the labor force probably will need to work harder and longer, requiring the payment of overtime wage rates. Production processes can be disrupted, and the plant may even need to shut down for major equipment upgrading. Thus the costs of installing new equipment tend to rise as the amount of new equipment is increased. And so firms have an incentive to move gradually to their desired capital stock position so as to spread these costs

<sup>2</sup>The terms 'capital stock' and 'net capital investment' denote *real* as opposed to *nominal* magnitudes. The physical amount of machinery, not its dollar value, is what helps to produce output.



## THE DESIRED STOCK OF CAPITAL AND REAL WAGES

The firm that's devoted to maximizing profits will choose its capital stock with an eye to labor wages. But the wages that matter in this process are *real wages*—the money wage rates paid to workers relative to the prices at which the firm sells its output—not just money wages pure and simple.

Suppose the firm considers hiring an additional worker. Since profits are what matter, the extra revenues and costs must be compared in order to see if it's profitable to hire her. Hiring this worker requires paying her the money wage rate in return for her services. But the firm will earn some extra revenues by using this additional labor. Having more labor means that it can produce more output which can be sold in the marketplace at a given price. As long as these extra revenues exceed the money wage rate, then it pays the firm to keep hiring extra labor. When these extra revenues and costs are just in balance, the firm is hiring its labor in the most profitable way.

The same thing can be said in real rather than nominal terms. Firms may compare the extra (or marginal) product of an additional worker—a *real magnitude*—to the extra real cost of the last employee (the money wage rate relative to the output price of the firm—the *real wage*). From this perspective, profits are at a maximum when the real wage and the marginal product of the last worker are equal.

But what does this have to do with the choice of a capital stock by the firm? The extra output obtained from one more worker will depend on how efficiently that worker can be employed, which in turn depends upon the firm's capital stock. A carpenter working on a construction site is not going to be very productive if he does not have any tools; there must be some machinery around if the labor force is to produce anything. The firm therefore must choose a capital stock which is consistent with its choice of labor force. Thus the real wage will help to determine the most profitable labor and capital input levels.

over time.

Some changes in tax policy might induce firms to alter their decisions concerning the speed with which they adjust toward their ideal (profit-maximizing) holdings of capital. If firms suddenly become aware of a *forthcoming* change in the tax structure, for example, they might alter their planned pattern of plant and equipment expenditures if profits could be increased thereby. Indeed, some economists have argued that one reason why investment has been sluggish in 1980 is that firms are anticipating an increase in the investment tax credit in 1981 and consequently are postponing some spending until the increase is in place. Most proposals to use the tax system to stimulate investment, however, focus not on the timing of capital equipment decisions but rather on attempts to induce firms to hold more capital in the long run. In particular, they try to reduce the cost of capital as firms perceive it.

**Real Capital Cost Is the Key.** The concept of capital cost is more complex than it might seem. Figuring capital cost is not simply a matter of looking at vendor quotes on new machines. Since plant and machinery are used to produce certain goods, the prices of those goods also matter.<sup>3</sup> In particular, the

<sup>3</sup>For simplicity, the firm is assumed to produce a nonstorable product in a perfectly competitive output market, labor and capital goods markets also are assumed to be competitive, and everything is assumed to be known with certainty. Further, complications which arise from the possibility of bond and equity financing are ignored so that the discount rate may be thought of as an ordinary interest rate.

The framework employed here is one in which the firm hires only one factor of production which is subject to adjustment costs. In principle, a firm may hire other factors which are subject to these costs so that its investment rule will be modified; and although the determinants of investment spending may be specified, it may be impossible to tell at the conceptual level how investment responds to shifts in real tax rates. The issue then becomes an empirical one. See D. T. Mortenson,



price of a new machine relative to the price of a firm's product is what matters.<sup>4</sup> In the face of a decline in machinery prices relative to output prices, a firm will want to have more equipment. But there are a number of additional steps to calculating the cost of capital, since the inflation rate, the interest rate, and the tax treatment of the corporation all will play a significant role.

When a firm considers investing in capital improvements, it will be sensitive not only to current prices but to expected inflation. Suppose that the firm is considering the purchase of two machines which will yield different rates of return. One machine may yield a return on investment of 13 percent, the other 5 percent. If the expected inflation rate is 10 percent, one machine yields a real return of 3 percent (the nominal yield less expected inflation); the other machine loses 5 percent. Other things being equal, the firm will have an incentive to buy the machine with a yield which exceeds the inflation rate, since the purchase of the other asset results in a loss.

Further, if capital costs decline because of falling interest rates, the firm definitely will want to own more machinery. But purchase prices, inflation rates, and interest rates alone do not define the cost of capital. Taxes also must be figured into the equation.

**Taxes Can Change Real Capital Costs.** When a firm is deciding whether to buy a new machine, it compares the extra revenues that the machine is expected to generate to its extra costs. But a fraction of these additional revenues will be taxed away by government through the corporate income tax. The firm gets only the after-tax price for its extra output. This is why corporate tax rates affect

the cost of capital.

And taxes enter the firm's calculation of capital costs in still other ways. Tax laws allow firms to adjust their taxable income to account for the wear and tear on machinery—depreciation—before taxes are levied, for example, just as they allow pretax adjustments for labor costs. The greater the allowance for depreciation in a given year, the lower will be taxable income. Thus depreciation write-offs affect the cost of capital. If a machine were to wear out in one year, it would need to be replaced then, and the firm could write off the whole cost a year after the machine was acquired. But most machines do not wear out in a year. Instead of waiting until the machine is worn out completely, the firm is allowed to write off some of the depreciation each year—say one-tenth the cost of a machine whose useful life is ten years. Thus instead of paying the full cost of replacing scrapped machines, it pays a lesser amount.

Finally, investment tax credits will affect the cost of capital since they allow the government to pay the firm for some fraction of the value of new equipment purchases. When buying an additional machine, the firm in effect pays only a fraction of the purchase price, once the tax credit is taken into account.

In calculating an investment tax credit, the firm first computes its taxable income and then figures out the taxes owed to the government. Then a fraction of the value of newly acquired capital goods may be subtracted directly from the firm's tax bill. Assuming that the tax credit rate is 20 percent, for example, if a firm owes \$100 in taxes but buys new equipment worth \$100, its tax payment will be reduced to \$80. The cost of capital must be amended to take account of this credit.

Discussions in Congress about changing corporate tax policies to stimulate investment spending actually are debates about the desirability of lowering the cost of capital.

<sup>4</sup>“Generalized Costs of Adjustment and Dynamic Factor Demand Theory,” *Econometrica* 41, 4 (July 1973), pp. 657-665.

<sup>4</sup>In fact, machines provide present and future benefits, so that the relevant calculation is that the discounted or present value of these benefits must equal the cost of the last machine.



Reducing the corporate income tax rate, increasing depreciation write-offs, or increasing tax credits will lead to a lower cost of capital and thus stimulate investment.

But by how much? If changes in these tax provisions were to have only a negligible impact upon investment spending, then perhaps it would be wiser to look elsewhere for productivity improvements. It turns out, however, that the tax effects probably would be fairly large.

### ESTIMATING TAX EFFECTS

Perhaps the best known study of the impact of capital costs on investment spending was that done some years ago by R. E. Hall and D. W. Jorgenson.<sup>5</sup> What these economists did, among other things, was to ask how investment spending would react in several industries when tax code revisions authorized investment tax credits on purchases of new capital goods.

Hall and Jorgenson conducted an experiment to determine what effect a 7-percent investment tax credit on equipment purchases would have on investment spending. They found that one year after the change was enacted, fully 41 percent of net equipment investment in the total manufacturing sector could be attributed to the investment tax credit, and in the nonfarm sector, over 48 percent of net equipment investment would be traceable to the investment tax credit. In slightly different terms, over 10 percent of gross (before depreciation) investment in equipment in manufacturing was estimated to be attributable to this tax credit. These results clearly suggest that tax policy could have powerful effects on real investment spending.<sup>6</sup>

<sup>5</sup>In "Tax Policy and Investment Behavior," *American Economic Review* 57 (June 1967), pp. 391-414.

<sup>6</sup>The Hall-Jorgenson study has been criticized by a number of economists. See, for example, R. Eisner and M.I. Nadiri, "On Investment Behavior and Neoclassical Theory," *Review of Economics and Statistics* 50 (August

Subsequent to Hall and Jorgenson's work, a number of studies have estimated smaller effects of investment tax credits. But a recent analysis by Lawrence Summers indicates a somewhat larger impact, at least in the case where businesses perceive the change in the credit as permanent rather than transitory.

Summers also investigates the effect of a number of other policy strategies for stimulating investment, including a reduction in the corporate tax rate (Figure 2). Dropping the corporate tax rate from 48 percent to 40 percent would have a substantial effect on investment, he finds. Interestingly, Summers's results suggest that a tax cut announced today to take effect at a later date would have a larger short-run effect on investment than an immediate reduction in the tax rate. The reason has to do with the effects of accelerated depreciation and with adjustment costs. Knowing that a tax reduction is coming down the road, firms would recognize that the value of depreciation allowances (which are larger for a higher tax rate) would be less once the tax cut takes effect. Thus they would attempt to accelerate some of their equipment purchases in order to take the larger depreciation expenses available before the tax cut. The policy of prior announcement of tax cuts has the additional advantage that it would avoid an immediate loss to the Treasury. In the long run, the immediate tax reduction and the delayed but announced tax reduction would have precisely the same effect on investment.

There is also talk of allowing firms to increase the amount of depreciation they may write off.<sup>7</sup> It's claimed that one plan under

1968), pp. 369-382. The Hall-Jorgenson study ignores the interaction of other sectors of the economy with the industries analyzed in their empirical work. For more on this, see A. Auerbach and L. Summers, "The Investment Tax Credit: An Evaluation," National Bureau of Economic Research, Working Paper No. 404, November 1979.

<sup>7</sup>One approach currently under consideration uses a so-called 10-5-3 method for depreciation. Under this



**FIGURE 2**  
**A CORPORATE TAX REDUCTION**  
**FROM 48 PERCENT TO 40 PERCENT**  
**STIMULATES INVESTMENT SHARPLY**

Percent Increases in Investment from:

Year	Immediate Tax Reduction	Preannounced Tax Reduction, Implemented in Year 4
1	7.1%	9.5%
2	7.2	10.8
3	8.5	12.2
4	7.3	8.5
5	8.6	8.6
10	9.0	10.3
15	10.5	10.5
20	10.8	10.8
50	14.7	14.7

SOURCE: Lawrence H. Summers, "Tax Policy and Corporate Investment," paper presented at a conference on "The Supply Side Effects of Economic Policy," Washington University and the Federal Reserve Bank of St. Louis, October 24-25, 1980.

consideration would increase equipment investment by \$6 billion and nonresidential investment by \$9 billion, all within a five-year period. These gains would come partly from revising the rules to reflect the replacement cost of capital goods which wear out rather than what firms actually paid for them—their historical cost.

method, all physical assets are classified either as structures with useful lives of 10 years, as durable equipment that can be written off over 5 years, or as short-lived assets with 3-year write-downs. This plan shortens the useful lives of most capital goods for accounting purposes and so increases depreciation write-offs. Another approach is designed to match the depreciation period to the actual useful life of a capital asset but to avoid the inflation-imposed penalty that this matching produces under present law. Firms currently are allowed to write off only the historical cost of an asset, not its replacement cost. In inflationary times, replacement costs differ from historical costs, and the difference increases with the inflation rate. This second approach allows firms to write off the present (inflation-adjusted) value of depreciation allowances on an asset in the first year of its life.

Thus the empirical evidence suggests that a reduction in the corporate tax rate, an increase in the investment tax credit, and liberalized depreciation allowances could have a substantial impact on how much businesses choose to add to their plant and equipment. The channel of influence is that each would reduce the cost of capital as corporations see it.

### SUMMARY

How much investment is appropriate for the U.S. economy is an important question not only for current members of society but also for future ones. Concern over the sluggish performance of investment spending really reflects concern that the present generation is consuming too much of its current product at the expense of future generations. Exactly how much consumption should be postponed to allow for greater future consumption is not easy to determine, but a social consensus appears to have emerged

that something should be done to encourage both investment and savings.

Whether the enactment of some or all of the various proposals under consideration will prove sufficient to return investment to

its prior trend over the next five years or so remains to be seen. But the theory and evidence available do suggest rather strongly that such policies would move the economy well along in that direction.

## APPENDIX . . .



## ... THE FLEXIBLE ACCELERATOR

The decision rule for capital investment is the so-called flexible accelerator. An approximate representation of the firm's decision rule may be written

$$K_t - K_{t-1} = \lambda(K_t^* - K_{t-1}),$$

where  $K_t$  is the stock of capital goods held by the firm at time  $t$ ,  $K_{t-1}$  is the stock held at  $t-1$ , and  $K_t^*$  is the stock that the firm would like to hold in period  $t$ .  $\lambda$  measures the fraction of the gap between desired and actual capital stocks which the firm makes up in each period.  $\lambda$  is between 0 and 1 and usually is assumed to be constant in all firms over time.

This formula shows how costs of adjustment affect the firm's behavior. Since the costs associated with acquiring new capital goods are assumed to rise at the margin, the firm has an incentive to spread these costs over time. Thus the firm moves only a part of the way in each period to its desired position.

Real wages and real after-tax capital costs determine the firm's desired stock, so that

$$K_t^* = K_t^*(w/p, c),$$

where  $w$  is the money wage rate paid to the labor force and  $p$  is the firm's output price.  $w/p$  is the real wage rate.  $c$  is real after-tax capital costs defined as

$$c = [p_K(1 - k)/p(1 - \tau)] [(r - \pi + \delta)(1 - \tau z)],$$

where  $p_K$  is the price of a unit of capital.  $p_K/p$  gives a measure of real capital goods prices. The terms in the brackets adjust the cost of capital to take tax provisions into account.  $r$  is the nominal after-tax discount rate,  $\delta$  is the depreciation rate, and  $\pi$  is the inflation rate.  $\tau$  is the corporate income tax rate.  $z$  is the value of present and future depreciation deductions.  $k$  is the fraction of the value of new capital goods which may be deducted from tax liability because of an investment tax credit. This formula assumes that the dollar value of new investment goods eligible for depreciation is reduced by the dollar value of the tax credit.

If the cost of capital rises, both the desired capital stock and net capital investment will decline. The cost of capital may decline if the investment tax credit fraction ( $k$ ) increases, if the corporate tax rate ( $\tau$ ) declines, or if the depreciation deduction ( $z$ ) increases.

The basic model of investment behavior which underlies this article may be found in Arthur B. Treadway, "On Rational Entrepreneurial Behavior and the Demand for Investment," *Review of Economic Studies* 36, 2 (April 1969), pp. 227-239. For a discussion of the influence of tax rates on the investment decision, see Dale W. Jorgenson, "Capital Theory and Investment Behavior," *American Economic Review* 53 (May 1963), pp. 247-259.



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100 North Sixth Street  
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