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.[1] 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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[1]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.

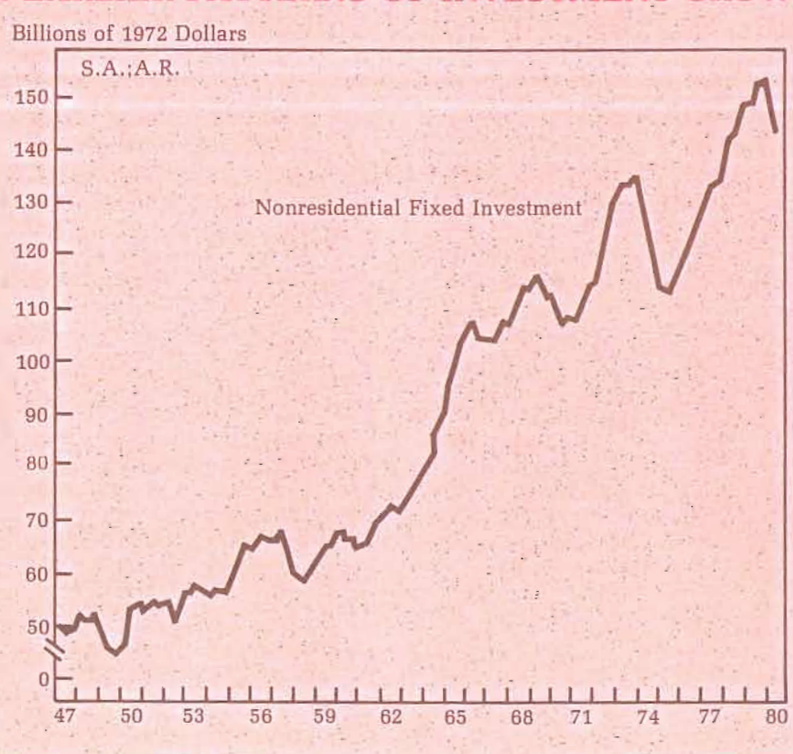
rapidly. If it declined in one year, it would start up again in the next, nearly always passing the previous high (Figure 1). With money flowing into plant and equipment, the U.S. was building a solid base for a more productive economy.

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,[2] the net cost of capital must be calculated on an after-tax basis.

[2]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 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

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.[3] In particular, the

[3]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.[4] 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.

"Generalized Costs of Adjustment and Dynamic Factor Demand Theory," *Econometrica* 41, 4 (July 1973), pp. 657-665.

[4]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.[5] 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.[6]

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.[7] It's claimed that one plan under

[5] In "Tax Policy and Investment Behavior," *American Economic Review* 57 (June 1967), pp. 391-414.

[6] 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 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.

[7] 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

Year	Percent Increases in Investment from: 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

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

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. λ measures the fraction of the gap between desired and actual capital stocks which the firm makes up in each period. λ 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, δ is the depreciation rate, and π is the inflation rate. τ 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 (τ) 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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