NBER WORKING PAPER SERIES

THE INVESTMENT TAX CREDIT: AN EVALUATION

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Working Paper No. 404

NATIONAL BUREAU OF ECONOMIC RESEARCH
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November 1979

The authors wish to thank Stanley Surrey for suggesting that we write this paper, and for comments on an earlier draft. Martin Feldstein, Richard Musgrave, and other participants in the Harvard Public Finance Seminar have also offered valuable comments. We are grateful to Data Resources, Inc. for access to their model, and especially to Sara Johnson of DRI for extensive help in its proper use. The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

Since 1954, the United States government has made numerous adjustments in the tax treatment of corporate income with the aim of influencing the level and composition of fixed business investment. The effects of these reforms, principally changes in the investment tax credit, are evaluated using a macro-econometric model. We find little evidence that the investment tax credit is an effective fiscal policy tool. Changes in the credit have tended to destabilize the economy, and have yielded much less stimulus per dollar of revenue loss than has previously been assumed. The crowding out of "non-favored" investment has been sufficient to offset a large percentage of the increase in the stock of equipment resulting from the use of the credit. We are led to conclude that the reliance on the investment tax credit and other investment tax incentives should be reduced. If a credit is to be maintained, it is of the utmost importance that its effect on all sectors of the economy be considered. We analyse several possible neutrality criteria, but conclude that no simple rule can guide the optimal structuring of incentives.

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I. Introduction

Since 1954, the U.S. government has made numerous adjustments in the tax treatment of corporate income with the aim of influencing the level and composition of business activity and, more specifically, fixed capital investment. Although it comprises less than 10% of gross national product,[1] private investment in nonresidential structures and equipment is considered a crucial determinant of the dynamic behavior of the economy. There are two important reasons for this. First, the level of production potentially available to the economy in any given year depends on the size of the capital stock, which is determined by the level of investment in the years preceding. A prolonged period during which capital investment is depressed may greatly reduce potential output. A second reason for concern is that investment is more volatile than other components of output.[2] Since current investments affect a firm's output capability many years hence, expectations of future demand conditions and interest rates may have a large impact on the level of investment today. Because the planned purchases of investment goods may be postponed or speeded up, the instability of these expectations implies that the demand for such goods may be subject to swings which, through effects on employment, feed back through the rest of the economy.

Changes in the corporate tax structure designed to encourage investment, generally referred to as tax incentives, operate chiefly by altering the profitability of given investment projects. Some channels available for tax incentives are:

Accelerated Depreciation. Over the life of a capital good, firms are permitted to deduct a fraction of its purchase price each year in calculating taxable income. Such deductions, referred to as depreciation allowances, are meant to account for the asset's annual decline in value. A deduction scheme which accurately mirrors this decline is referred to as "economic depreciation." To the extent that allowances in the years immediately following the asset's acquisition exceed its true loss in value, the depreciation schedule is "accelerated." By increasing the degree of acceleration, government is, in effect, making an interest-free loan to the corporate taxpayer. The greater the loan, the more attractive the investment.

Shortened Depreciation Lifetime. Effectively equivalent to accelerated depreciation, measures which shorten the period over which depreciation schedules are applied allow depreciation deducations to be used more quickly after an asset's purchase.

Investment Tax Credit. This measure permits a diminution of tax liability equal to a certain fraction of capital investment expenditures, subject to certain restrictions concerning the type of investment eligible and the total amount of credit claimed.

The effect of the credit is to lower the real cost of capital goods to firms, without altering the returns from such capital. This clearly increases the rate of return on investment.

Investment Grant. Never instituted in the U.S., this measure has been used in Great Britain and often suggested as an alternative to the investment tax credit. It provides for a direct government rebate to firms of a certain fraction of investment expenditures. It therefore differs from a tax credit in that it is not restricted to profitable enterprises with tax liabilities. This difference may be deemed a weakness of the grant approach if government sees the lack of current profits as indicative of inefficient operation which should not be subsidized.

Corporate Tax Cut. Seemingly the most obvious approach to stimulating investment expenditures, a cut in the statutory tax rate may actually discourage new investment when it occurs in the presence of accelerated depreciation. This anomalous result is possible because the tax savings from such excess deductions are reduced when the tax rate is lowered, so that the effective rate of tax paid by the firm may rise. Because interest payments are shielded from corporate taxation, such an outcome is more likely to occur in a highly levered firm, where savings on taxable profits are low relative to the scale of operation.[3]

A more certain disadvantage of a corporate tax cut is that it applies to income from all corporate assets, and so is likely to be less cost-effective than, for example, a tax credit, which subsidizes only new investment.

Except for the investment grant, all of the above incentives have been in effect for at least part of the period between 1954 and the present. As of 1954, the maximum marginal corporate tax rate was 52%, and straight-line depreciation was essentially the only method permitted for tax purposes. The Revenue Act of 1954 allowed firms to choose between straight-line and two other methods of depreciation, known as sum-of-the-years digits and double-declining balance. Both of the last two methods are more favorable to the firm than straight-line in that they accelerate depreciation allowances and thereby increase the present values of such allowances.

In 1962, two additional measures were enacted to further stimulate investment. First, lifetimes allowable for depreciation were shortened for equipment by the introduction of more liberal guidelines. Second, and more important, was the institution by the Revenue Act of 1962 of the investment tax credit at a rate of 7% of equipment purchases. The credit was accompanied by an appropriate adjustment of the depreciation base, so that only the net cost of assets could be depreciated. This provision, known as the Long Amendment, was repealed by the Revenue Act of 1964, making the credit even more generous. Also included in the act was a cut in the maximum statutory corporate tax rate from 52% to 50% in 1964 and 48% starting in 1965. As stated above, this policy cannot be viewed with certainty as expansionary. The corporate tax was raised again, temporarily, by the 10% tax surcharge which took effect in 1968, raising the statutory rate to 52.8%. All but one fourth of the surcharge was removed in 1970, the remainder in 1971.

By 1966, the economy was operating at unemployment rates of under 4%, and measures were sought to restrain aggregate demand. One of these was the suspension of the investment tax credit in October, 1966. Although the suspension was originally to hold until December 1967, it was removed in March, so that it was in effect less than five months. Concurrent with the 1966 suspension was a change in one of the depreciation options allowed for structures. The double-declining balance method was replaced by the 150% declining balance method. This change lessened the degree of acceleration in depreciation allowances for structures. The credit remained in effect until 1969, when it was repealed, again ostensibly permanently. This situation lasted until the passage of the Revenue Act of 1971, which reinstated the credit. Also introduced in the Revenue Act was the "asset depreciation range" (ADR) which allowed firms to raise or lower lifetimes used in depreciation calculations up to 20%, for equipment.

Because of the recession experienced beginning in 1974, stimulative measures were desired, and included in the Tax Reduction Act of 1975 was a "temporary" increase in the maximum rate of the tax credit from 7% to 10%. This increase has already been extended through 1980 by the Tax Reform Act of 1976, and proposals have been made to make it permanent.

Despite the frequent use of various investment incentives in recent years, uncertainty remains about the best way to use such policy tools. Indeed, it is problematic whether such instruments should be used at all. Even if they are to be used, unresolved questions still remain, and fall into two categories: how to apply the incentive, and when to apply it. The first type of question is often associated with the concept known as neutrality. It is argued that incentives should, naturally, encourage investment, but should not bias the relative choice between investments. There have been conflicting notions of what measures achieve neutrality, the controversy arising in part from the imprecise nature of the concept.

The choise of when to apply tax incentives is an extremely difficult one. The closer the economy is to what is referred to as "full employment,"[4] the less effect an incentive will have. When most available resources are already in use, encouraging firms to invest more will merely lead to higher interest rates and a "crowding out" of other, non-subsidized investment sectors such as residential housing and, to a lesser extent, the purchase of consumer durables such as automobiles. Thus, incentives will be most effective when there is sufficient slackness in the economy for expansion to occur. This leads to two problems for the policy maker. First, lags in the institution of an expansionary policy may cause the incentive to occur at the wrong time. There is evidence that this was often true for past incentives.[5] Second, by changing the incentive over time, the government may actually induce cycles in investment behavior and thereby further destabilize the dynamic path of the economy.

We consider the above issues in the following sections of this paper. In the next section, we discuss neutrality and related issues. In Section III, we present dynamic simulations of a large-scale econometric model to illustrate the effects of various policies with respect to the investment tax credit. Section IV contains a brief discussion of how the temporary nature of incentives may, when perceived by investors, further complicate the problem. We draw some conclusions in the final section.

II. Neutrality and Incentive Design[6]

Investment incentives are instituted when there is felt to be insufficient investment. However, there is a general perception that it is best not to disturb the relative incentives given to different investments, that the expansion should be "neutral." Because different criteria have been used to measure neutrality, conflicting prescriptions have appeared as to which policies are neutral. There are two particular conceptions of what constitutes a neutral incentive, but each is subject to fundamental criticisms. In the end, the policy maker must weigh the costs of violating the different measures in order to come up with the system of incentives most appropriate for a particular situation.

One of the important considerations in implementing an expansionary policy is the effect it will have on the rate of price inflation. As aggregate demand increases as a result of expansionary stimuli, different sectors must adjust to meet this demand. The more unbalanced this increase is, the more likely are bottlenecks and shortages to occur in strategic sectors. These dislocations will not only hamper the expansion. They will also lead to a rise in the prices of the scarce goods, causing an increase in the overall rate of inflation. This point has been recognized by government:

> In an effort to achieve continued progress toward full employment, we must not create inherently unstable and ultimately counterproductive conditions along the way. With a high inflation rate and many uncertainties still remaining to hamper the economy, stimulus which aims for a balanced composition of demand and a steady pace will provide the safest and surest path of advance.[7]

Several authors[8] have described as neutral a tax incentive scheme which induces a proportional reduction in what is known as the "implicit rental cost" of different types of capital goods used by corporations. Under rather general assumptions, such a policy will lead to a balanced expansion of corporate capital investment. Assuming that this expansionary policy does not lead to a rise in interest rates, this kind of neutrality may be achieved by the institution of a uniform investment tax credit on all investment, with an adjustment to the depreciable base, as mandated under the Long Amendment, equal to the amount of the credit.

However, it is likely that interest rates will rise a certain amount (see footnote 17). If they do, then neutrality in the above sense would require the credit to be larger for longer-lived assets, with the rate of increase being determined by the extent of the rise. Furthermore, if, as in the U.S. there is a preexisting credit, the foregoing analysis applies to <u>changes</u> in the level of the credit, rather than to the level itself.

Along with the desirability of a balanced expansion, economic efficiency looms as a major consideration in incentive construction. This concept dictates that it is generally in the public interest that resources should be invested in those projects yielding the greatest social return.[9] Were there no corporate taxes, the social return from a project would accure entirely to the investing firm. Thus, it would be in the best interests of each firm to choose those projects most profitable from the social viewpoint. In a system with corporate taxation, the private and social returns from a project are different because part of the social return is taken by government in the form of taxes. It is desirable that projects that are preferred from the social point of view are also more profitable to the firm making the investment choice. In particular, if project A has a higher social return than project B, the prospective profitability of A should be h igher from the firm's point of view as well.

This has been the motivation behind the second major approach to neutrality.[10] What is advocated is a tax system which proportionally changes the private internal rate of return on different investments. When no investment credit is present, the existence of this condition depends on the structure of depreciation allowances. If depreciation allowances correspond to "economic depreciation" (see Section I), then two assets which would have the same social rate of return were there no taxes would be of equal profitability in the presence of them.[11] There is no evidence that the currently used depreciation schedules bear any close resemblance to economic depreciation. Even if the depreciation allowances were appropriate, they are based on original cost and not replacement value. Thus, the real value of such tax deductions declines when there is an increase in the rate of inflation, with short-lived assets being hit the hardest.

Because of inflation, and because depreciation allowances tend to be more accelerated for longer lived assets even in the absence of inflation, the tax system, without the investment tax credit, is currently biased toward investments in more durable assets. Given the circumstances, how should the investment tax credit be designed? The introduction of a uniform tax credit raises the internal rate of return on all investments. However, a uniform credit will generally favor those investments which are less durable. To demonstrate this, we present a simple example.

Consider a firm with two projects. In Project A, a machine is purchased at the outset for $100, and yields a perpetual stream of annual $10 receipts, after taxes. Project B also begins with the purchase of a machine for $100. However, this machine lasts only one year, yielding $110 after taxes. Of these receipts, $100 is spent on a new machine of the same type. This procedure is repeated every year, giving an infinite stream of $10 per year, just as in Project A. Now, suppose a 5% investment tax credit is enacted. Since Project A entails no new purchases, its receipt stream is unaffected. However, since $100 is annually spent on new machines in Project B, $5 is added to annual receipts. Whereas A and B were previously equally profitable, B now has a higher rate of return for the firm.

If the existing tax system were neutral, in the present sense, without a tax credit, the maintenance of neutrality in the presence of a tax credit would thus call for a smaller credit for less durable assets. In the present system, the answer is less simple. In Table 1, we illustrate this by comparing the internal rates of return on two different hypothetical assets, one with a service life of ten years, one of thirty years. Each asset is assumed to provide receipts, before taxes, which decline at a rate of 1/T per year, where T is the service life, and then drop to zero in year T. Depreciation allowances are assumed to follow the sum-of-the-years-digits method. We take both assets to have an internal rate of return of 12% in the absence of all taxes.

The results confirm the argument stated above. With the introduction of the current tax system without the investment tax credit, the more durable asset has a higher rate of return when inflation is zero, 7.2% versus 6.8%. With an inflation rate of 6%, this bias is increased, with the rate of return on the thirty-year asset being almost three times that on the ten-year asset. The introduction of a uniform 10% credit raises the return on the shorter lived asset substantially more. However, the total bias of the tax system remains uncertain, and depends on the rate of inflation.

TABLE I

INTERNAL RATE OF RETURN FOR

TWO HYPOTHETICAL ASSETS

	Inflation = 0		Inflation = 6%	
	10 year	30 year	10 year	30 year
No taxes	12.0%	12.0%	12.0%	12.0%
u = 48%; k = 0	6.8	7.2	2.1	6.0
u = 48%; k = 10%	10.1	8.5	6.0	7.4

At a zero rate of inflation, the bias remains in favor of the more durable asset. In this case, a neutral credit would decrease with asset life.

Added to the limitation of the two approaches to neutrality discussion in this section is the fact that they treat the corporate sector in isolation. Various gross distortions exist in the tax treatment of non-corporate investment, especially owner-occupied housing.[12] Removing biases among the choice of assets within the corporate sector, while ignoring those between sectors, need not even constitute a step in the right direction. Even if it does, no one simple rule of thumb is likely to yield the best policy, given the complexities of existing tax provisions such as a selective tax credit, the acceleration of depreciation allowances, and the failure to index such allowances for inflation.

III. Dynamic Simulations

This section attempts an empirical evaluation of investment incentives -- principally the investment tax credit. The discussion focuses on the two main rationales offered for the use of investment incentives. We first consider the impact of the investment tax credit on the size and composition of the capital stock. Our results suggest that further increasing the tax credit is not likely to significantly increase the capital stock in the long run. Rather the primary effect of credit hikes is to alter the composition of the capital stock. Next, the viability of the tax credit as an instrument of countercyclical fiscal policy is assessed. We find that the credit is not a good stabilization tool. The long lags between implementation and effect and the extreme response of the economy to sharp changes make fine tuning impossible. Nor does it appear that the credit has a substantial effect on output per dollar of revenue loss.

Perhaps the principal justification given for the credit is the need to increase the nation's productive capacity by enlarging the capital stock. It is argued that the credit encourages investment by reducing effective cost of capital goods. At the same time, as emphasized in Section II, the credit alters the composition of investment. Firms are likely to substitute favored types of capital, for varieties not subsidized. There is evidence that the credit has induced a significant change in American investment behavior. In 1962, the year the credit was enacted, equipment accounted for 56% of business fixed investment. By 1976, when the credit reached 10%, the share of equipment had risen to almost 70%.

Proper evaluation of the impact of investment incentives on capital accumulation cannot be based just on analysis of the investment sector. While the credit raises firms' demand for investment goods, and hence loanable funds, this need not increase the level of investment. If the supply of loanable funds (savings) is fixed, the quantity of investment cannot rise no matter what happens to demand. In this case, the credit will serve only to raise the price of loanable funds -- the interest rate. Even when savings are free to rise, the credit-induced increase in the demand for investment goods will bid up interest rates. The increase in interest rates will, by raising the cost of financing investment, partially offset the credit's stimulus.

While it is relatively clear that the credit will spur investment in equipment, its effect on other forms of investment is ambiguous. The credit will bid up interest rates, raising the cost of investment and discouraging purchase of non-favored capital goods, principally structures. The interest rate will rise until enough investment has been "crowded out" to restore the balance between the supply and demand for loanable funds. On the other hand, when there is considerable slack in the economy, the credit may raise national product, increasing the income available to save. Increases in GNP also raise the demand for investment goods, as firms recognize the need to produce extra output. Thus, the key factor affecting the relationship between the credit and other investment is the response of loanable funds. When the supply of loanable funds can rise, the accelerator effect of more output will increase investment in all sectors. Otherwise the stimulus of the credit is likely to be significantly offset by "crowding out" in non-favored investment sectors.

Empirical evaluation of these issues requires a model of the U.S. economy. We have employed the Data Resources Incorporated (DRI) econometric model to "simulate" several different policy options for the investment tax credit. The model contains several hundred statistically estimated equations relating important macro-economic variables. It has been estimated using data from the period 1954-1976. The equations have been adjusted to ensure that when historical values of policy variables are assumed, the model traces two actual paths of the economy very accurately. In the DRI model, as in most econometric models, the level of each type of investment is primarily determined by four factors: 1) the cost of capital, 2) the level of GNP, 3) the amount of capital becoming obsolete or wearing out, and 4) corporate cash flow. As the cost of capital rises firms are assumed to reduce investment. Increases in the credit, liberalization of depreciation allowances, or decreases in the interest rate reduce the cost of capital. The level of GNP enters the equation because the demand for investment goods is assumed to be proportional to the output firms' produce. The amount of capital which must be replaced is an obvious determinant of investment. Finally, the equation recognizes that corporations are likely to invest more when they have more funds on hand.[14] The other sectors of the model embody relatively standard assumptions. The model is in the Keynesian tradition embodying substantial effects of both monetary and fiscal policies. While the level of output is determined primarily by aggregate demand, the DRI model does include a rather elaborate treatment of aggregate supply. Unlike some other macroeconometric models, interest rates and equity returns are explicitly modelled as adjusting to ensure portfolio equilibrium.[15]

Initially we focus on evaluating the credit as an instrument for encouraging investment in the long run. So as to emphasize the long-run effects of the credit, three hypothetical simulations with a constant credit were performed. Simulations I, II and III set the effective credit at a constant rate of 0, 5.6% and 12% respectively for the 1964-76 period. The effective credit is less than the statutory credit because of various provisions limiting firms' ability to receive the full credit.[16] The 5.6% effective rate corresponds to the 7% statutory rate in effect through much of the 1960s. A 12% effective rate is equivalent to about a 13% statutory rate under current law. In all three simulations, all other policy variables were set at actual historical values. Thus, we evaluate the effect of a pure change in the credit, with no accommodating or offsetting changes in other fiscal and monetary policies.[17]

Table II presents the results of the three simulations. Levels of output, investment and interest four, eight and twelve years after the introduction of the credit are presented. It is easy to see that the investment credit is expansionary. After twelve years, investment in equipment is raised $6.2 billion by a 5.6% credit, and $12.8 billion by a 12% credit. The increase in investment does not, however, generate enough savings to prevent increased investment demand from bidding up the interest rate. The 5.6% credit raises the interest rate by about 35 basis points in the long run. A 12% credit raises the interest rate by just over 1% within just four years. These increases in the interest rate crowd out investment

TABLE II

LONG-RUN EFFECTS OF THE INVESTMENT TAX CREDIT*

	1968	1972	1976
GNP			
RITC = 0	1051.3	1168.0	1265.9
RITC = 5.6%	1054.1	1174.1	1271.9
RITC = 12%	1059.3	1175.9	1272.9
Fixed Investment			
RITC = 0	149.4	177.6	158.2
RITC = 5.6%	152.5	181.4	162.4
RITC = 12%	157.3	183.7	165.5
Equipment			
RITC = 0	61.9	72.7	70.7
RITC = 5.6%	67.8	79.0	76.9
RITC = 12%	75.9	87.2	83.5
Business Structures			
RITC = 0	42.7	44.3	37.5
RITC = 5.6%	42.0	42.8	36.5
RITC = 12%	41.4	40.6	34.0
Residential Structures			
RITC = 0	43.8	59.6	48.9
RITC = 5.6%	41.8	58.5	48.0
RITC = 12%	39.1	54.8	47.0
Housing Starts			
RITC = 0	1.584	2.284	1.645
RITC = 5.6%	1.488	2.226	1.594
RITC = 12%	1.370	2.054	1.566
Interest Rate			
RITC = 0	5.85	7.15	8.01
RITC = 5.6%	6.23	7.49	8.33
RITC = 12%	6.85	8.03	8.54

*All variables are measured in billions of 1972 dollars, except housing starts, measured in millions of units, and the interest rate.

in other sectors in the long run. For example, in 1972 a 12% credit reduces housing starts by almost 230,000 units relative to the no-credit case. After twelve years the 12% credit raises investment in equipment by $12.8 billion but increases total fixed investment by only $7.3 billion. Hence more than 40% of the stimulus to equipment investment is offset by reductions in other investment. Rising interest rates do not only hurt investment demand. GNP rises less than does total investment as higher interest rates slighly reduce consumption demand.

It is noteworthy that, as the credit increases, the extent of the crowding out effect also rises. A 5.6% credit raises real GNP by $6 billion after twelve years. Further increasing the credit to 12% generates only an additional $1 billion output. Virtually all of the extra stimulus provided by the further increase in the credit is crowded out. It follows that increases in the credit from the current 10% rate may not have a substantial expansionary effect. Since structures deteriorate much less rapidly than equipment, comparison of annual investment may give a misleading picture of the credit's effect on the size and composition of the aggregate capital stock.

Table III presents estimates of the change in the stock of capital under each of the three policies discussed above. Historical changes in capital stocks are also presented. The credit has had a substantial effect on the stock of equipment. Had the credit never existed we would today have $42.3 billion less equipment representing

TABLE III

ALTERNATIVE POLICIES AND THE SIZE AND COMPOSITION OF THE CAPITAL STOCK[a]

	ΔK_{Total}	$\Delta K_{Equipment}$	$\Delta K_{NR\ Structures}$	$\Delta K_{R\ Structures}$[b]	ΔK_{Homes}[c]
RITC = 0[d]	828.0	162.5	197.5	468	15.6
RITC = 5.6%[d]	848.7	209.7	189.0	450	15.0
RITC = 12%[d]	846.8	252.3	174.5	420	14.0
RITC = Actual[e]	846.0	204.8	191.2	450	15.0

[a]Changes in the capital stock are computed from 1964-1976. They are expressed in billions of 1972 dollars.

[b]Approximate figure.

[c]Millions of units.

[d]Credit held at a constant level through entire period.

[e]Credit follows historical path.

about 9.5% of the current stock. However, the credit has reduced the stock of other business and residential structures. For example, with no credit, we would today have 600,000 more housing units. A constant 12% credit would have eliminated another one million housing units. While a constant 12% credit would have raised the equipment stock by $48.5 billion above historical levels, it would have increased the total capital stock by only $0.8 billion. Hence about 98% of the increase in equipment is offset by declines in structures investment. This reflects the "increasing crowding out" phenomenon discussed in the previous paragraph. Comparing the no-credit and 5.6% credit cases, one does find that total capital accumulation is increased by $20 billion by the latter option. However, raising the credit from 5.6% to 12% actually reduces total net capital accumulation by almost $1 billion.

While the investment tax credit may have potent short-run effects on investment, we are skeptical of its long-run effect on capital accumulation. The primary impact of the credit appears to be the reallocation of investment towards equipment. Unless policy-makers seek to shift the composition of investment towards equipment, the credit does not seem like a useful policy instrument for affecting long-run capital accumulation. Particularly, when the credit is already at a high level, increases appear to have costs in terms of reduced residential and nonresidential structures which at least balance any benefits.

It may be desirable to shift the composition of investment towards equipment. The tax system substantially favors investment in owner-occupied housing because martgage interest is tax deductible while imputed rental income is not taxed. This distortion may be offset by the various other institutional interferences, most notably Regulation Q, which pervade the mortgage mrakets. The credit was originally limited to equipment because it was felt that structures received much more favorable depreciation allowances. However, policy-makers should recognize that increases in equipment do come at a significant cost in terms of other forms of investment.

The second rationale offered for the use of the investment tax credit is that it is an effective countercyclical policy instrument. By raising the credit when the economy is slack, and lowering it in boom times, policy-makers can try to stabilize the level of investment and output. This has been the objective of the repeated changes in the credit in 1966, 1969, 1971 and 1973 detailed in Section I. We first examine the efficacy of these policy changes by contrasting the historical path of the economy with the path that the economy would have followed had the credit been kept constant at its initial 5.6% effective rate. The results are presented in Table IV. They suggest that the credit has actually contributed to economic instability. In every year, the unemployment rate along the actual path exceeds or equals the rate along the constant credit path. Unemployment, over the entire period averages about .1% higher than the model predicts it would have with a constant credit. Output

TABLE IV

COMPARISON OF CONSTANT AND VARIABLE INVESTMENT

TAX CREDIT POLICIES

	Real GNP ($72)	Unemploy- ment (%)	Interest Rate (%)	Investment ($72)
1964				
Actual Path	874.4	5.2	4.40	124.8
Constant 5.6%	874.4	5.2	4.40	124.8
1965				
Actual Path	925.9	4.5	4.49	138.8
Constant 5.6%	925.9	4.5	4.49	138.8
1966				
Actual Path	981.0	3.8	5.13	144.6
Constant 5.6%	981.0	3.8	5.13	144.6
1967				
Actual Path	1007.7	3.8	5.51	140.7
Constant 5.6%	1009.6	3.8	5.52	141.8
1968				
Actual Path	1051.8	3.6	6.18	150.9
Constant 5.6%	1054.1	3.5	6.23	152.5
1969				
Actual Path	1078.8	3.5	7.03	157.5
Constant 5.6%	1078.6	3.5	7.14	157.5
1970				
Actual Path	1075.2	5.0	8.04	150.4
Constant 5.6%	1081.5	4.8	8.14	154.3
1971				
Actual Path	1107.4	6.0	7.39	160.2
Constant 5.6%	1119.5	5.5	7.57	167.7
1972				
Actual Path	1171.0	5.6	7.21	178.8
Constant 5.6%	1174.1	5.4	7.49	181.4

TABLE IV (cont.)

	Real GNP ($72)	Unemployment (%)	Interest Rate (%)	Investment ($72)
<u>1973</u>				
Actual Path	1225.4	5.1	7.44	184.7
Constant 5.6%	1229.8	5.0	7.67	188.2
<u>1974</u>				
Actual Path	1213.4	5.8	8.56	170.8
Constant 5.6%	1217.9	5.7	8.58	174.6
<u>1975</u>				
Actual Path	1199.4	8.6	8.83	147.8
Constant 5.6%	1205.3	8.4	8.73	152.5
<u>1976</u>				
Actual Path	1265.9	7.7	8.44	158.1
Constant 5.6%	1271.9	7.7	8.33	162.4

over the twelve-year period is reduced $33.1 billion by the variable credit. Not only are output and employment lower in the variable credit simulation, they are also more variable. The standard deviation of unemployment in the constant credit simulation is .33% compared to .44% in the variable credit simulation. Nor is there any evidence that the credit stabilizes volatile investment demand. Investment is both lower and more volatile in the "historical" simulation than in the hypothetical constant credit simulation.

Careful examination of Table IV reveals the principal reason for the credit's destabilizing effect -- the sharp immediate response of the economy to policy changes. One year after the brief credit removal of 1966, the economy is actually in worse condition, operating at a lower level than it would have if the credit had never been enacted. To better illustrate this point, Table V compares the path of the economy from 1968 to 1976 with and without the 1969-1971 credit moratorium. Three features stand out. First, the termination of the credit exacerbated the small 1970-1971 recession. The removal of the credit caused an additional .5% or 450,000 workers to be unemployed in 1971 and reduced 1971's output by $11.9 billion. Second, the restoration of the credit further fueled an overheated economy in 1972 and 1973. The increased demand mostly led to higher prices, as the restoration of the credit caused prices to increase .4% faster in 1973 than they would have had the credit been maintained at a constant level. Third, the overheating of the economy in 1972 and 1973, partially due to the credit, exacerbated the sharp 1975

TABLE V

THE 1969 CREDIT REMOVAL*

	GNP (real in $1972)	Unemploy-ment (%)	Interest Rate (%)	Inflation % Δ CPI
1968				
Constant Credit	1051.8	3.6	6.18	4.8
Actual	1051.8	3.6	6.18	4.8
1969				
Constant Credit	1079.5	3.5	7.03	5.3
Actual	1078.8	3.5	7.03	5.3
1970				
Constant Credit	1082.8	4.8	8.08	6.0
Actual	1075.2	5.0	8.04	5.9
1971				
Constant Credit	1119.3	5.5	7.56	4.4
Actual	1107.4	6.0	7.39	4.3
1972				
Constant Credit	1173.7	5.4	7.49	3.3
Actual	1171.0	5.6	7.21	3.3
1973				
Constant Credit	1230.1	5.0	7.66	6.5
Actual	1234.8	4.9	7.44	6.1
1974				
Constant Credit	1218.6	5.6	8.58	10.6
Actual	1217.8	5.6	8.56	10.9
1975				
Constant Credit	1207.6	8.3	8.74	9.0
Actual	1202.2	8.5	8.83	9.2
1976				
Constant Credit	1279.7	7.5	8.40	5.7
Actual	1274.6	7.7	8.44	5.7

*In the "Constant Credit" simulation, the effective credit is held constant at 5.6% from 1969 to 1971. In the "Actual" simulation the credit is removed from 69:2 to 71:2 as actually took place. In both simulations, the 1975 credit hike to 9% takes place.

decline. Output fell in 1974 by an additional $5.4 billion because of the 1969-1971 credit moratorium. The variable credit thus depressed both business cycle troughs and raised the peak during the 1968-76 period. At each point, it acted in the wrong direction.

Poor timing of policy changes is not the sole cause of the credit's disastrous stabilization record. Much of the problem can be found in the lag structure of the economy's response. The credit, when enacted, immediately spurs investment and output. But the forces which ultimately crowd out some of the stimulus are also set in motion. When the credit is removed, these forces linger, leaving the econony worse off than it would have been without the credit, as the stimulative effects go away but the offsetting ones remain. This phenomenon can be seen in Tables IV and V. In Table IV, the removal of the credit in 1966 does not reduce significantly the interest rate. In Table V, the removal of the credit in 1969 does not lower the interest rate very much. Nor does its reimposition raise the interest rate significantly until 1974. This pattern of response makes successful control of the economy with the tax credit very difficult. For within a few years after its adoption, the credit itself generates a need for stabilization policy. Gordon and Jorgenson (1976) use the DRI model to find the optimum timing of credit changes. The conclude that a relatively stable policy is superior to even an optimally chosen variable credit policy. Their analysis assumed away any problems of lags in policy-maker recognition or implementation. It follows a fortiori, that, in actual practice, variable credit policies should be avoided.

While failures in the use of other stabilization instruments are well documented, the cause is typically poor implementation timing. Better executive and legislative decisions might be expected to lead to improved results. On the other hand, our results suggest that the failure of the credit as a countercyclical instrument is inherent in the dynamic pattern of the economy's response. This implies that countercyclical policy will be more successful if other instruments, such as personal tax changes and monetary policy, are relied on, rather than alteration of investment incentives.

The credit is often advocated on the grounds that it provides more "bang for the buck" than alternative tax incentive measures. More generally, the revenue cost of the credit is of obvious concern to policy-makers contemplating its use. Most estimates of the revenue cost of alternative credit policies, notably those found in the Concurrent Budget Resolution of the Congress make a fundamental error. These estimates are made on the assumption that the credit has no effect on output. They thus greatly overestimate its initial cost, by neglecting the increased revenues from other taxes following an increase in GNP. Calculations of revenue loss also frequently make the error of comparing only short-run revenue and investment impacts of the credit. Clearly the credit has substantial effects for several years, even after it has been removed. These effects should also be considered in assessing its true cost.

In order to measure the true revenue cost over the long run of the credit, we simulated the model starting in 1964 with a 5.6%

effective credit. The credit was removed permanently in the fourth quarter of 1966. Table VI presents estimates of the total revenue cost of the investment credit discounted at 5% and 10% rates. Both direct and net costs are calculated. Although the stimulus provided by the credit raises tax revenues initially, the direct cost is less the net cost because of the sharp downturn caused by the credit's removal. Table VI also contains impacts of the credit on total output, and investment. Per dollar of net revenue loss, the investment tax credit only raises output by between $0.51 and $0.85, depending on the discount rate. The impact on investment is even smaller, totally between $0.38 and $0.59. It is difficult to find a standard with which to compare these estimates. However, most models estimzte that a reduction of $1 in taxes will raise output by close to $2 over a several-year period.[18] It seems unlikely, therefore, that the credit is a particularly potent form of economic incentive. This conclusion is strengthened by the results in Tables II and II suggesting that increases in the credit above current levels would be even less powerful.

On balance, our examination of the empirical evidence leads us to conclude that the investment tax credit has had and continues to have an undesirable effect on the economy. The primary long-run effect of the credit is to reallocate capital from structures to equipment. The housing sector bears much of the burden of credit increases. Raising the credit from 10% to 12% as has been widely discussed would eliminate about 100,000 housing units by 1980.

TABLE VI

REVENUE COSTS VS. BENEFITS OF THE

INVESTMENT TAX CREDIT*

	Δ Direct Cost	Δ Deficit	Δ GNP	Δ Investment
0% discount	8.2	11.7	6.0	3.1
5% discount	7.8	9.9	6.7	4.2
10% discount	7.4	8.5	7.1	5.0

*Based on comparison over 12-year period 1964-1976 of a 5.6% credit through 66:4, with no credit. All figures are in real terms.

Short-run variations in the credit have been uniformly counterproductive since its inception. The prolonged and uneven response of the economy to changes in the credit make it unlikely that even the most carefully planned future variations will have better results. Finally, we find no evidence that the credit is a particularly useful instrument for maximizing economic stimulus per dollar of revenue loss. None of these considerations justify the credit's immediate removal. However, they do imply that further increases are almost certainly unwarranted, that temporary changes will be destabilizing, and that gradual removal would probably be desirable.

These conclusions can have no more validity than the model which generated them. We recognize that this factor implies that our results are somewhat tentative. While the DRI model is not perfect for answering the questions this paper addresses, it seems as suitable as any current alternative. Reliance on an imperfect model strikes us as preferable to the partial equilibrium, single-equation techniques used in most previous evaluations of investment incentives.

IV. The Effect of Temporary Incentives

The results of the previous section indicate that countercyclical use of the investment tax credit is ill-advised, because of the time lags in the effect of such policies. A brief consideration of the effect of temporary policies on anticipations by firms strengthens the argument.

The assumption implicit in our analysis so far, and in all previous estimates of the effect of investment incentives, is that firms take the current tax law to be permanent; that is, no changes are anticipated. While this may be valid when considering "once and for all" changes in the tax code, it is hardly so for policies which are, by their design, intended not to be permanent. It is more appropriate to assume that, if it is government's avowed purpose to use the investment tax credit as a countercyclical tool, firms will take this into account in their investment plans. Such anticipations may have strong and perverse results. In particular, firms will attempt to concentrate their investment spending in periods during which the credit applies. Thus, a mild recession may be exacerbated by firms delaying investment in anticipation of a credit increase. Symmetrically, an inflationary boom may be fueled by firms trying to squeeze in additional investment before the credit is removed.

Not only will a flexible credit affect the timing of investment, but also the distribution among assets of different durability. The longer the service life of an asset, the more difference it makes in firm profits over time whether a credit may be applied to the asset's purchase. Thus, the bunching of investment spending during the existence of a credit will be more pronounced for more durable assets.

The power of the anticipations effect may be emphasized by a simply numerical example. Suppose there is no tax credit presently in effect, and that a firm must make a decision as to the timing of a $100 machine purchase. Suppose also that, in the absence of any change in the tax law, the firm would be indifferent between investing now or waiting one year. Now, imagine that, because of a government policy, explicitly stated or not, to use the tax credit as a stabilization tool, the investment planner expects the institution next year of a 10% tax credit. Then, by waiting one year to invest, the firm may expect to gain 10% on the machine investment. If the rate of return on the investment is also 10%, then the firm can double its first-year profit on the investment by waiting one year, if its anticipation is correct. It is plausible to speculate that expected increases in the credit may be related to current investment shortfalls.

In sum, the already negative aspects of the investment tax credit as a stabilization tool are augmented by the fact that, when anticipated, it will perversely influence the timing of investment, and destabilize the mix between different types of investment over the cycle. The explicit announcement of future policy changes, as has been recommended in the proposal of a flexible tax credit,[19] can only exacerbate this problem by making anticipations more certain.

V. Conclusions

There is little evidence that a change in the investment tax credit is an effective tool for exapansionary fiscal policy. We find that it has tended to destabilize the dynamic behavior of the economy, and that the "bang per buck" of incentive stimulus is much smaller than has been assumed. The "crowding out" of non-favored investment has been sufficiently important to offset a large percentage of the increase in the stock of equipment resulting from the use of the credit. Because investment may be postponed or speeded up, anticipations of policy changes with respect to the tax treatment of investment may greatly exacerbate the destabilizing impact of such changes. While we have focused our attention on the investment tax credit, these conclusions may be applied also to other types of investment incentive such as the acceleration of depreciation allowances. There is no reason to believe that these other investment incentives are superior in any way to the investment tax credit.

To the extent that government deems investment incentives a viable policy instrument, considerations of economic efficiency and the desire for a balanced expansion must be taken into account. Given the distortions in the current tax structure, no simple rule of thumb is likely to dictate the best incentive structure. Of utmost importance is that the impact of incentives to corporate investment on investment in the rest of the economy should be recognized.

Appendix

In this appendix, we demonstrate a number of the propositions stated in Sections I and II of the paper. The discussion presumes a familiarity with the neoclassical investment model used in Hall and Jorgenson (1971).

Let τ be the corporate tax rate and k the investment tax credit. Without any loss of generality, we consider the case in which the credit is accompanied by an appropriate basis adjustment, as was the case under the Long Amendment (see text). The firm's debt-equity ratio is $b/(1-b)$. The nominal rate of return to equity-holders is p, and the nominal rate of interest is i. Since they do not influence the outcome of any of the effects studied below, we ignore personal income taxes. As shown in Auerbach (1979b), a wealth maximizing firm with debt and equity will strive to maximize the present value of the net revenues that would occur if it were entirely equity-financed, using as its nominal discount rate

$$r = bi(1-\tau) + (1-b)p \quad . \tag{A1}$$

We assume that capital decays exponentially at rate δ, and that prices inflate at rate π. It then follows that firms invest in capital as long as the marginal product of capital exceeds the "user cost" or implicit rental rate:

$$c = q(r-\pi+\delta)(1-\tau z)(1-k)/(1-\tau) \tag{A2}$$

where q is the price ratio between capital goods and output, z is the present value of depreciation deductions, D(t), allowed for a unit of capital purchased for one dollar.

$$z = \int_0^\infty e^{-rt} D(t)dt . \qquad (A3)$$

At every point in time after its purchase, capital decays at rate δ. Thus, the physical decay at time t is the decay rate times the capital remaining, $\delta e^{-\delta t}$. For a unit of capital which originally cost one dollar, replacement cost is $e^{\pi t}$ at time t. Thus, the value of z for economic depreciation is:

$$z_E = \int_0^\infty e^{-rt} \delta e^{-\delta t} e^{\pi t} dt = \delta/(r - \pi + \delta) . \qquad (A4)$$

If $z > z_E$, depreciation is said to be accelerated.

Using (A1) and (A4), (A2) may be rewritten:

$$c = q(1-k)[bi + (1-b)\frac{p}{(1-\tau)} + \left(\frac{\tau}{1-\tau}\right)(r - \pi + \delta)(z_E - z) - \frac{\pi}{(1-\tau)} + \delta] . \qquad (A5)$$

Clearly, if $z = z_E$, an increase in τ must increase the user cost, and will do so more the less levered the firm is. However, if $z > z_E$, this need not be so. As an extreme case, suppose immediate expensing is permitted, so that z = 1. Then (A5) reduces to:

$$c = q(1 - k)[bi(1-\tau) + (1-b)p - \pi + \delta] \qquad (A6)$$

Unless the firm has no debt, its user cost will increase with a reduction in τ, thereby discouraging investment.

It is evident that, were r fixed, a proportional reduction in c for different assets would be provided by a proportional decline in $(1-k)$. Thus, if the existing credit applicable for different assets were the same, a uniform increase in k would be called for. However, suppose a one percent reduction in c for all types of capital led to an η percent rise in the real cost of capital, $r-\pi$. Then, as shown in Auerbach (1978), the appropriate change in k for each asset is:

$$-\frac{dk}{dc} = \left(\frac{1-k}{c}\right)\left[1+\frac{\eta(r-\pi)}{(r-\pi)+(1-\tau)\delta}\right] \qquad \text{(A7)}$$

Thus, the smaller the value of δ, i.e., the more durable the asset, the larger the increase in k would be required for an equiproportional decrease in c.

Now, suppose that $k = 0$. Let G_K be the real marginal product of capital, which has relative price q. In the absence of corporate taxes, the internal rate of return, x, on a unit investment satisfied:

$$\int_0^\infty e^{-xt}\, G_K e^{-\delta t}\, dt = q \qquad \text{(A8)}$$

or

$$G_K = q(x+\delta) .$$

With taxes and depreciation deductions, the real internal rate of return, x' satisfies:

$$\int_0^\infty e^{-x't}(1-\tau)\, G_K\, e^{-\delta t}\, dt + \int_0^\infty e^{-x't}\, \tau q D(t) e^{-\pi t}\, dt = q \qquad \text{(A9)}$$

which, using (A8), yields:

$$x' = (1-\tau)x + \tau(x'+\delta)[z' - \delta/(x'+\delta)] \qquad \text{(A10)}$$

where

$$z' = \int_0^\infty e^{-x't}\, D(t) e^{-\pi t}\, dt \ . \qquad \text{(A11)}$$

Note first that if depreciation allowances follow economic depreciation, then $D(t) = \delta e^{-\delta t} e^{\pi t}$, so that $z' = \delta/(x'+\delta)$ and $x' = (1-\tau)x$, so that the reduction in the internal rate of return is independent of δ.

If depreciation allowances are not indexed, but otherwise follow true depreciation, then $D(t) = \delta e^{-\delta t}$, and (A10) becomes:

$$x' = (1-\tau)x - \tau\pi\delta/(x'+\pi+\delta) \ . \qquad \text{(A12)}$$

For positive rates of inflation, $x' < (1-\tau)x$, so that we may think of the failure to index depreciation allowances as an additional tax on corporate income. Further, it is easy to verify that, for given x, $\frac{dx'}{d\delta} < 0$, so that the magnitude of this extra tax increases with δ, i.e., decreases with asset life. As stated in the text, short-lived assets are the hardest hit. This is because depreciation allowances represent a greater proportion of the total return from short-lived assets.

Footnotes

1. In 1976, gross private domestic investment, excluding residential investment, was $115.7 billion in 1972 dollars. Gross national product was $1,265.0 billion.

2. For the period from 1948 to mid-1977, investment averaged 14% of GNP. However, absolute quarter-to-quarter changes in investment were, on average, 28% of absolute changes in GNP. Thus, investment has contributed more to the volatility of GNP than its share alone would indicate.

3. See the appendix for further discussion.

4. There will always exist some unemployment in the economy because of sectoral shifts in the demand and supply of labor. The unemployment rate at which only this "frictional" unemployment in present has been estimated to lie between 4% and 6%.

5. See Gordon and Jorgenson (1976).

6. A mathematical treatment of the material in this section is presented in the appendix.

7. Economic Report of the President, 1977, pp. 29-30.

8. Including White and White (1972), Sunley (1973) and Sandmo (1974).

9. There are important limitations to this approach, relating to the fact that different types of assets yield different service patterns over their productive lives. An analysis of this problem is beyond the scope of this paper, and may be found in Auerbach (1978).

10. See Musgrave (1959), Tideman (1975) and Sunley (1976).

11. This special characteristic of economic depreciation was explored first by Samuelson (1964).

12. See Laidler (1969).

13. This exposition has relied on the "loanable funds" approach to interest rate determination. Equivalent conclusions could be reached within a "liquidity preference" framework. The formal identity of the two approaches has long been recognized.

14. For a discussion of alternative approaches to the econometric explanation of investment, see Bischoff (1971). The basis of the DRI equation is the neoclassical theory of investment described in Hall and Jorgenson (1971). However, the equation does include a cash flow variable, which was omitted in the original Hall-Jorgenson specification.

15. A full discussion of the properties of the DRI model, as well as its construction, may be found in Eckstein, Green, and Sinai (1974).

16. The most important of these are: 1) the credit applies fully only to assets with a greater than seven-year life; 2) until 1975, utilities did not receive the full credit; 3) credits are limited to 50% of the taxes firms pay, although limited carryovers are permitted.

17. It might be argued that it would be more reasonable to assume that the Fed accommodates changed in investment incentives, by increasing the money supply so as to keep interest rates constant. Such an assumption appears inconsistent with historical evidence.

Feldstein and Summers (1978) estimate that increases in investment incentives do have a significant impact on interest rates. Our assumption of constant monetary policy is traditional in analyses of fiscal policy effects.

18. A good general discussion of the effects of fiscal policy changes can be found in Blinder and Solow (1974).

19. See Gordon and Jorgenson (1976) for references on this subject.

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