The large flood of literature on the topic of capital budgeting during the last ten years has tended to focus around two or three key problem areas. In particular, the problem of the cost-of-capital has received considerable discussion and is still a controversial and knotty topic. The question of the correct criterion to use in making capital budgeting decisions, especially the relative merits of the present value criterion and the internal rate-of-return, has received attention. In addition to this, writers and researchers have persistently in much more detail the nature of economic relationships and practices in this important area of managerial decision making. This literature, however, contains relatively little explicit consideration of the impact of fiscal measures on the budgetary process. This aspect of the subject has usually been treated from either a qualitative standpoint or considered more from a more-economic point-of-

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analyzing for its impact on investment decisions at the firm level. Recent changes in depreciation laws and the availability of a tax-credit for qualified investment expenditures, however, have re-emphasized the need to examine more carefully how such measures might affect investment decisions at the level of the firm.

This paper examines the possible effects of the investment credit which recently became part of the tax laws. The focus here is the problem of establishing the impact of the stimulus provided by a tax-credit that applied to a given investment opportunity. It examines and discusses how to arrive at this impact or the magnitude of an investment opportunity (particularly the initial one at the time of the decision to enter into the opportunity). Whether it will be noted that a firm's investment opportunity is determined mostly by the investment credit and the decision-making process. The paper examines whether the effect of the credit on investment decisions is significant at a given firm level. It suggests that the presence of the investment credit will cause a firm to enter into a given investment opportunity, whereas the absence of the credit will not. The paper also examines whether the effect of the credit on investment decisions is significant at the level of the firm.
For instance, this paper shall discuss certain aspects that need to be known about the investment. For qualified investors, it is important to consider the corporation's tax liability of an amount which is a function of the dollar amount of the investment and its life. This deduction is also affected by the depreciation base of this asset. For example, an asset costing $1,000 with a 10-year life for a qualified investor in the corporation's tax liability of an amount of the asset which is a function of the dollar amount of the investment and its life, is $930. It is as if that the deduction to be made from the corporation's tax liability can be made in fact that is, that the carry-forward/carry-back option is not included and that the deduction is made available. This latter assumption introduces a slight element of bias, however, given that present institutional arrangements, the payment of the income tax is not made simultaneously. If the asset is sold, it is considered the sale at the standard sales price. There is evidence to suggest that this approach apart from providing the...
value, the present value of the investment assuming continous discounting is:

$$ PV_0 = \int_0^\infty (1-t)R(t)e^{-0.05t} \, dt + \int_0^\infty \text{salvage} \, dt - C $$

The availability of an investment credit \( k_C \) for this asset would give a new present value of:

$$ PV_{1} = \int_0^\infty (1-t)R(t)e^{-0.05t} \, dt + \int_0^\infty (C - k_C) \, dt - C + k_C $$

Equations (2) and (3) represent the present values of the after-tax cash flows of a given investment opportunity calculated without and with the application of the investment credit, respectively. In addition to increasing the present value, investment credits also allow for the consideration of the time value of money. This is important in determining the net present value of the investment. The consideration of these complications is reserved until later.

Given this highly simplified model, the question to be explored is: to what extent does the introduction of the investment credit \( k_C \) stimulate investment?
A convenient approach to an analysis of the stimulating effect of the investment credit is to consider its effect on "marginal" investments, that is, those which are just on the borderline between acceptance and rejection prior to the application of the credit. This would mean looking at the effect on investments for which $PV_c$ equals zero. The benchmark seems to square with businesspersons' thinking in the sense that they appear to weigh the effect of the investment credit in relation to "marginal" projects. Thus, for example, a recent survey by the Wall Street Journal found that over 100% of the corporate finance departments indicated that the introduction of an investment credit would have then to take a second look at "marginal" projects. A more general approach to the problem, however, may be made by not concentrating the analysis on the case in which $PV_c$ is zero.

Pursing this approach, the increase in present value attributable to the availability of the investment credit is given by equation (1):

$$PV_c = PV_0 e^{-r_c t}$$

(1)

The present-value model of capital investment and the increased use of these programs during the 1960s is further examined. Concerning the "marginal" determination, that is, the determination of the very small set of projects that are just on the borderline between acceptance and rejection, it must be emphasized that the analysis can only handle economic conditions for the marginal project. The increment may be relevant only to this project.

Analysis of the Wall Street Journal survey on corporate willingness to invest in new capital expenditures indicates that over 100% of the corporations surveyed indicated that the introduction of the investment credit would have a major effect on their capital spending. The Wall Street Journal survey is summarized in Table 1, which shows the percentage of companies indicating that the investment credit would have a major effect on their capital spending, broken down by industry. The results are striking, with over 80% of the companies in each industry indicating a major effect. This suggests that the investment credit is a powerful tool in stimulating capital expenditures.  

Table 1: Percentage of Companies Indicating Major Effect of Investment Credit on Capital Spending

<table>
<thead>
<tr>
<th>Industry</th>
<th>Percentage Indicating Major Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>85%</td>
</tr>
<tr>
<td>Construction</td>
<td>83%</td>
</tr>
<tr>
<td>Utilities</td>
<td>88%</td>
</tr>
<tr>
<td>Retail</td>
<td>81%</td>
</tr>
<tr>
<td>Services</td>
<td>82%</td>
</tr>
</tbody>
</table>

It is convenient to evaluate this in terms of the increase in present value per dollar of cost ($C$) thus:

$$\Delta PV = y = k(1 - T) \sum_{t=1}^{n} d(t, c) e^{-\delta t} dt$$

Unless the precise form of the depreciation policy (i.e., $d$) is specified, it is impossible to evaluate the quantitative impact of the investment credits. A number of qualitative implications, however, may be formulated even in the absence of an explicit depreciation policy. Clearly $\Delta PV$ is always positive. The introduction of an investment credit always increases an investment's present value so that with depreciation policy is followed and no matter what the characteristics of the investment opportunity may be. This implication follows from the fact that the numerator value of the integral in equation (3) is unity, and the numerator is also always positive. Clearly, the lower the tax rate, the higher the increase in present value per dollar of cost. All marginal investments will have a positive present value as a result of taking the credit, and some marginal projects will be pushed over the borderline. This is consistent with the proposition that:

$$\Delta PV = k(1 - T) \sum_{t=1}^{n} d(t, c) e^{-\delta t} dt$$

9. All marginal investments will be positive with the investment credit.

10. When $\Delta PV = 0$.
some corporations used exceedingly high costs of capital to justify depreciation policies which favored delayed write-offs. On the other hand the increase in present value will never drop below zero. This limiting case would occur for a tax-rate of unity coupled with either a depreciation policy which permitted immediate write-off of an asset or a cost-of-capital of zero. The investment credit has a more stimulating effect if the corporation bases its decisions on straight line depreciation rather than on an accelerated form of depreciation policy. If two corporations consider identical investment opportunities and use identical depreciation policies the effect of the investment credit will be more favorable to the corporation which uses the higher cost-of-capital. This follows from the fact that $dy/dt$ is positive.

Thus, if $\alpha(t)$ is the tax-rate of unity and $\beta(t)$ is the depreciation rate, we can write:

$$\frac{dy}{dt} = \alpha(t) \beta(t) \frac{dC}{dt}$$

This effect can be examined by considering the sign of $\frac{dy}{dt}$ which is:

$$\prod_{k=1}^{n} \left( 1 + \frac{dy}{dt} \right)$$
Hence the sign of \( \text{dy/di} \) depends on the sign of the term in square brackets which in turn is negative. Hence \( \text{dy/di} \) is positive and the investment credit has a more beneficial effect on longer lived assets.

From equation (4) it is clear that given the institutionally defined parameters \( k \) and \( T \) plus the economic life of the investment the quantitative effect of the credit requires specification of \( d(t, n) \).

Assume that \( d(t, n) \) represents straight-line depreciation that is, \( d(t, n) \) represents \( t \) for each value of \( t \). Substituting this explicit function for \( d(t, n) \) into the general expression for the increase in present value gives:

\[
\Delta PV = \left( B_n - B_0 \right) e^{-(k/T)}
\]

From equation (7), it is clear that when the economic life is very large or when their product is large, the increase in present value per dollar of cost is insignificant compared to the cost itself. A precise quantitative evaluation of the impact of the investment credit requires study of the dependence of the increase in present value on the 

identification of the economic life and the rate of depreciation, among other variables. This dependence is tabulated in Table 1. By varying among the life and the rate of depreciation, the effective size of the credit is also varied.

1. Not a number in this paper. 2. Not a number in this paper.
for \( r = 20\% \) as a result of taking investment credit. Table 2 presents the same information but under the assumption of a lower tax rate. Tables similar to Tables 1 and 2 could be easily generated for other "institutionalized" depreciation policies. It is interesting to consider, however, what the stimulant to investment would be if a "theoretical" depreciation policy were followed. For example, say the depreciation policy is such that an annuity is set aside each period as the depreciation allowance subject to the condition that the present value of these allowances equals the cost of the asset. If this annuity is \( X \) per dollar of depreciation base then \( X \) is the solution to the equation:

\[
\int_0^n X e^{-nt} \, dt = 1 - \frac{1}{8}
\]

and hence \( d(t, n) \) in this case is \( r(1-e^{-nt}) \). If a corporation employed this policy or an equivalent one then equation (1) would give:

\[
\int_0^n e^{-nt} \, dt = 1 - \frac{1}{8}
\]

Carful interpretation is required here. The increases tabulated consider (i) the investment credit and (ii) a change in **T**ife considered is that of the investment credit applied under conditions of a different tax-rate. The problem of evaluating the double effects would involve the use of **T** in equation (1) above and \( T' \) (the simultaneous change in the tax-rate) in equation (2). Keep the simpler problem is considered: the effect of an increase in the cash flows. Obviously the annuity assumption is no more than a simplification. Any depreciation policy which satisfies the equation

\[
\int_0^n X e^{-nt} \, dt = 1 - \frac{1}{8}
\]

will lead to the same discussion above. An alternative case, but from a fiscal policy point of view, is that which allows basis of the cost of the asset. Here \( d(t, n) \) is 1 for the first period for all other values of \( t \). It should, however, be noted that this not necessarily imply a

\[
d(t, n) \, dt = 0
\]
<table>
<thead>
<tr>
<th>R</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.123365</td>
<td>0.257517</td>
<td>0.399792</td>
<td>0.446554</td>
<td>0.446222</td>
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<td>0.389646</td>
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<tr>
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<td>0.303833</td>
<td>0.438279</td>
<td>0.491822</td>
<td>0.491776</td>
<td>0.512578</td>
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<td>0.534831</td>
<td>0.534703</td>
<td>0.557229</td>
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</tr>
<tr>
<td>0.25</td>
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<td>0.409953</td>
<td>0.552121</td>
<td>0.608354</td>
<td>0.608321</td>
<td>0.631724</td>
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</tr>
<tr>
<td>0.30</td>
<td>0.214286</td>
<td>0.474327</td>
<td>0.628072</td>
<td>0.684736</td>
<td>0.684713</td>
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</tr>
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<td>0.214286</td>
<td>0.535255</td>
<td>0.577958</td>
<td>0.658191</td>
<td>0.658165</td>
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<td></td>
</tr>
<tr>
<td>0.40</td>
<td>0.217286</td>
<td>0.594722</td>
<td>0.636967</td>
<td>0.719827</td>
<td>0.719806</td>
<td>0.745997</td>
<td></td>
</tr>
</tbody>
</table>

**Tax Rate = 0.22**
TABLE 27

INCREASE IN PRESENT VALUE PER DOLLAR OF COST

<table>
<thead>
<tr>
<th>N</th>
<th>4</th>
<th>5</th>
<th>8</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>0.123257</td>
<td>0.077117</td>
<td>0.0423025</td>
<td>0.016107</td>
<td>0.0066565</td>
<td>0.00204</td>
</tr>
<tr>
<td>0.17</td>
<td>0.142308</td>
<td>0.0920732</td>
<td>0.0573537</td>
<td>0.022092</td>
<td>0.0089607</td>
<td>0.0029776</td>
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<tr>
<td>0.19</td>
<td>0.152066</td>
<td>0.0970346</td>
<td>0.0630131</td>
<td>0.026807</td>
<td>0.0093130</td>
<td>0.003115</td>
</tr>
<tr>
<td>0.22</td>
<td>0.157885</td>
<td>0.0998901</td>
<td>0.0667824</td>
<td>0.027733</td>
<td>0.0097782</td>
<td>0.00336</td>
</tr>
<tr>
<td>0.25</td>
<td>0.164011</td>
<td>0.1036911</td>
<td>0.0705190</td>
<td>0.030432</td>
<td>0.0102030</td>
<td>0.00361</td>
</tr>
<tr>
<td>0.30</td>
<td>0.166990</td>
<td>0.1054687</td>
<td>0.0737693</td>
<td>0.035270</td>
<td>0.0107701</td>
<td>0.00396</td>
</tr>
<tr>
<td>0.35</td>
<td>0.178817</td>
<td>0.1078212</td>
<td>0.0770346</td>
<td>0.037237</td>
<td>0.0113702</td>
<td>0.00433</td>
</tr>
<tr>
<td>0.40</td>
<td>0.183230</td>
<td>0.1102600</td>
<td>0.0802187</td>
<td>0.039226</td>
<td>0.0119932</td>
<td>0.00470</td>
</tr>
</tbody>
</table>

**TAX-RATE = 0.60**
which is independent \( k \) of \( n \), the life of the asset. This result will be derived from a different approach later where the effect of the investment credit on the asset’s life is discussed. There is, of course, very little difference between these two different depreciation policies — straight line and "theoretical" — if the asset has no salvage. This can be seen if \( k \) is expanded as a Taylor’s series as far as a linear function in \( n \).

Then equation (7) becomes:

\[
\text{(10)} \quad \frac{1}{k} \log \left( \frac{1}{1 - \frac{n}{n(1 - p)}} \right) \approx \frac{1}{1 - \frac{n}{n(1 - p)}}
\]

which corresponds exactly with equation (9).

For an approximation of \( e^m \) by \( 1 + m \) up to a linear function the value of \( f(T, k, n) = 0.038 \) for an asset having \( n = 10 \) and \( r = 0.05 \) is 0.085. The correct value for \( f(T, k, n) \) is 0.035 (assuming \( r = 0.05 \)).
leads to essentially no basic changes in the analysis presented above. The modifications required would be the addition of the term $9_n^2$ to the right-hand sides of equations (1) and (2) along with the appropriate readjustments to the depreciable base and the investment credit. The change in the present values of an asset having salvage value can then be examined in the same way as equation (3) was examined except that the interest in present value is in terms of the net cost, that is, reduced by the salvage value. This line of analysis again leads to the need to make explicit assumptions with respect to the depreciation policy before any quantitative effects can be expected. Tables 1 and 2 can again be used and applied to the net investment to find the overall effect of the credit.

The effect of the investment credit on the age-distribution of assets is an important question to which the above analysis has yielded no answer. The questions raised include: in questions such as the optimal time of writing off the expenses involved, and the equipment of neutrality?

An approach to this problem is an analysis of the investment credit in terms of its effect. The problem is a central issue in capital budgeting, and a method can be worked out for which we shall use a diagrammatic representation. We shall need

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The image contains a page of text with mathematical equations and financial analyses. The text discusses the effects of modifications on the present values of assets, the addition of terms to equations, and the need for explicit assumptions in analysis. It also touches on the neutrality of the investment credit and its implications for capital budgeting.
The present value of an asset having salvage value (without the credit) is given by:

\[ PV = \frac{1 - \left( 1 - \frac{C - S}{T} \right)^n \cdot e^{-rT}}{r} \]

To find the optimal life, the derivative of equation (11) with respect to \( n \) is equated to zero. This leads to:

\[ \left( 1 - \frac{C - S}{T} \right) \cdot e^{-rT} = 0 \]

The corresponding expression for the optimal condition if the investment costs are used in the calculations is:

\[ PV = \frac{1 - \left( 1 - \frac{C - S}{T} \right)^n \cdot e^{-rT}}{r} \]

The salvage value is assumed to be a constant in this model.
In the discussion of the impact of different depreciation policies in terms of changes in present value it was noted that some depreciation policies led to an effect independent of the life. This suggests that perhaps the use of the investment credit would be neutral with respect to the optimal life of the same asset assuming the investment credit is applied. Since the term in square brackets on the right-hand side of equation (13) is negative the net effect of the credit is to shorten optimal lives.

Examining the optimizing conditions for the two cases: pre-investment credit and post-investment credit given by equations (12) and (13) it is seen that in optimal life only the term in square brackets of equation (13) has an effect in that case so the investment credit has a zero net effect.

For other factors and other forms it is not clear how the use...
Hence, 

\[ \int (d(t,n)) \, dt = \left( \int e^t \, dt \right) + \left( \int e^t \, dt \right) \]

is equivalent to?

\[ \int (d(t,n)) \, dt = \left( \int e^t \, dt \right) + \left( \int e^t \, dt \right) \]

which reduces easily to zero.

Thus if corporations employed depreciation policies having the property that the present value of the depreciation allowances equalled the initial cost the introduction of the investment cost would not alter the optimum life.
In summary: starting with an investment opportunity defined in a general way but having zero salvage value the effect—in terms of increased present value—of introducing the investment credit is generally found to depend on the method of depreciation used, the life of the asset and the interest rate used in discounting. The longer lived assets and those being discounted at higher costs-of-capital experience the largest increase in present value. The less accelerated the form of depreciation policy used the more the asset benefits from employing the investment credit. But in this connection it was noted that some forms of “theoretical” depreciation lead to results independent of life and interest rate. These results carry over into investments with non-zero salvage value. Finally the tendency for bias to be introduced into the effect on optimal lives—resulting in a shortening of lives—obtained by using the investment credit was discussed but the absence of the form of accelerated depreciation methods was explored.
This appendix provides a brief indication of the law relating to the investment credit. For the details, the reader should consult section two of the Revenue Act of 1962.

The credit varies depending on the life of the asset in question. The full 7% is available for assets having lives of 10 or more years. Thus the purchase of a $5,000 piece of equipment which has a 10 year life yields a tax credit of $350. This 7% is the depreciation rate for the investment tax liability. The amount of the capital expenditure which may be depreciated is also reduced by the tax credit with lives less than this the following schedule applies:

- For lives of 10 or more a credit of 7% of 7%
- For lives of 9 to 6 years a credit of 4.5% of 7%
- For lives of 5 to 4 years a credit of 3% of 7%
- For lives of 3 to 2 years a credit of 1.5% of 7%
- Assets with lives less than 2 years do not qualify.

Investment expenditures must, of course, be for appropriate kinds of assets before they qualify for the credit under the law. The main kinds of tangible assets bought by businesses qualify, even the purchase of used assets. In this latter case however, only purchases up to $50,000 in any one year would qualify. The investment credit schedule for different lives noted above also apply in this case. The main kinds of tangible assets bought by businesses qualify, even the purchase of used assets. In this latter case however, only purchases up to $50,000 in any one year would qualify. The investment credit schedule for different lives noted above also apply in this case.
Importantly, limitations exist in the availability of the credit. Clearly the amount of the credit in a given year cannot exceed the tax-liability for that year. Carry-back and carry-forward provisions to the extent of three and five years respectively are available to the corporation so that it may increase the use of the credit. Perhaps a more important limitation is the "twenty-five-percent limitation" - if the level of qualified expenditures in any given year gives rise to an investment credit in excess of $25,000 the maximum credit which can be claimed is $25,000 plus 25% of the excess. Assuming the first limitation is not already satisfied, the balance of the credit due to the corporation but not available as result of these limitations can be recovered through the carry-forward and carry-back provisions noted above.

One of the remaining features of the law which appears to be very

The lessor has the option of passing the tax credits to the lessee. For leases of ten years or more, the lessor would obtain the credits under the usual way.