INFLATION, INCOME TAXES AND THE INCENTIVE FOR CAPITAL INVESTMENT

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ABSTRACT

It is well known that depreciation based upon historical acquisition cost is less than "real" depreciation during periods of inflation. Various incentives have been enacted in the federal income tax law, e.g., accelerated depreciation, asset depreciation range, and the investment credit, in part to offset this difference. This article reports a measurement model developed by the authors for the purpose of measuring the extent to which these statutory incentives overcome the tax impact of historical cost depreciation. The model is then applied in order to measure the extent to which The Tax Reduction Act of 1975 compensates for recent changes in the rate of inflation experienced in the United States.

Accountants, legislators and taxpayers generally accept the proposition that federal income tax laws have an effect on the level of investment in plant and equipment. When Congress recently enacted the Tax Reduction Bill of 1975 they followed this reasoning in providing for a temporary increase in the investment tax credit. However, the use of income tax incentives to stimulate capital investment did not originate in 1975. Some previously enacted provisions designed to serve this end include other versions of the investment credit, accelerated depreciation methods and the Class Life ADR system. Each of these provides a financial benefit to the purchaser of qualifying assets and, therefore, is considered to constitute an incentive to capital investment.

However, the tax laws contain an opposing force. Certain provisions of the federal income tax law tend to discourage capital investment under conditions of rising prices due to monetary inflation. An excessive tax, in relation to real economic income, often results under conditions of inflation. This is caused by basing allowable depreciation deductions and taxable disposition gains upon historical dollar cost measures of capital investment. This financial penalty for holders of productive fixed assets may impact economic growth by deterring investment.

The purpose of this article is to measure, under various rates of inflation, the overall incentive (disincentive) toward capital investment provided by certain fixed asset related provisions of the income tax law. This measurement shows the extent, on a strictly quantitative basis, to which intended incentive tax provisions actually provide an incentive. Do they offset and exceed, or possibly fail to offset, taxes imposed on "paper" gains? "Paper" gains are defined as inflationary dollar gains which do not represent real economic income. Special emphasis is placed on an evaluation of the former 7% and the current 10% rates of investment credit.

Model Requirements

Accomplishment of the task undertaken requires the development of a measurement model that can determine the amount of net economic incentive for each of numerous combinations of tax provisions and asset characteristics. For purposes of this research, 572 unique cases are defined in terms of the following variables:

Independent Variable	*# of Values*	*Range of Values Employed*
Investment Credit	2	Old law (7%) or new law (10%)
Asset Life in Years	11	3, 4, 5, 6, 7, 8, 10, 15, 20, 25, or 30
Percentage Rate of Inflation	26	0, 1, 2, . . . 24, 25

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Model values held constant for each of the 572 cases were:

1. Cost of asset as \$100.
2. Salvage value of asset as 10% of real cost.
3. Inflation adjusted interest rate of 3½%.

The Measurement Model

A capital budgeting approach, implemented by computer, was used to calculate the net economic incentive or penalty for each of the 572 cases. The incentive or penalty for any individual case is the present value, as of date of asset acquisition, of all annual tax differences calculated. These differences are the differences in tax assessments, after allowable credits, resulting from the application of statutory tax rates to the annual differences between two depreciation schedules calculated by different procedures. The two depreciation schedules compared are (1) the "best" allowable measures of deductible depreciation under current tax law and (2) a surrogate measure for real economic depreciation.

The "best" allowable measure of deductible depreciation is based on consistent application of that combination of allowable depreciation method, allowable depreciable life and allowable investment credit which maximizes the present value of the stream of associated tax savings over the entire life of the asset. The surrogate measure for economic depreciation which serves as a standard for comparison is based on straightline depreciation and price-level accounting techniques.[1]

It is important to note that the model defines the tax penalty inherent in depreciation based on historical cost dollars as the difference which would result if price-level adjusted depreciation were allowed and the tax that would result if depreciation were taken on historical cost. In both cases depreciation is taken on a straight line basis over the economic life of the asset. Also observe that the *net* economic incentive is defined as the difference between the tax which would result if the "best" combination of accelerated depreciation, allowable lives and investment credit were taken and the tax that would result from the taking of the previously described price-level depreciation.

Interpretation of the computed amounts of net economic incentive (penalty) requires comparison of cases involving assets with different useful lives. Comparability in the incentive measures is achieved by annualization of the net economic incentive associated with each case. The annualized measure is defined as the annual payment of an annuity over the useful life of the asset which, when discounted at the inflation adjusted interest rate of 3½%, produces a present value equal to the net economic incentive for that case. This procedure results in a uniform measurement unit, purchasing power, after allowing for both the investment's duration and the real time value of money. In other words, the annualized figure represents the real economic incentive or penalty per year of asset use per \$100 in original capital investment.

Model Illustration

Tables I and II are illustrations of the overall manner in which the net economic incentive is determined for a given combination of investment credit, inflation rate and useful asset life. Each table presents the net present value of all relevant tax effects, both in total and on an annualized basis. A negative result, a tax reduction, is referred to in the text and in later tables as an investment incentive. On the other hand, a tax increase results in an economic penalty on capital investment. Both rationale and procedure for each step in the measurement model will be discussed in later sections. But first, examine the results shown in these two tables.

The net economic incentive of \$.02 (or .02% of original asset cost) shown in Table I relates to an asset having a useful life of four years during which the annual inflation rate was 6%. This example also reflects the 7% investment credit provision actually in effect

TABLE I

ILLUSTRATION OF PROCEDURES EMPLOYED IN DETERMINING NET ECONOMIC INCENTIVE RESULTING FROM INTERACTION OF INFLATION AND FEDERAL INCOME TAX LAW

(7% Investment Credit Provision)

Assumed Facts

1. Investment credit in effect: 7% provision
2. Inflation rate: 6% per year
3. Useful life of asset: 4 years
4. Acquisition date of asset: 1-1-X1
5. Cost of asset: $100
6. Salvage value of asset: 10% of real cost
7. Inflation adjusted interest rate: 3½%

Tax Options Elected

1. Asset life: 3 years
2. Depreciation method: Double Declining Balance with automatic switch to straight-line
3. Investment credit

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Year	Price-level Index	St. Line Historical Cost Depreciation	St. Line Price level Depreciation (2)x(3)	Best Allowable Depreciation	Effect on Taxable Income (4)-(5)	Allowable Investment Credit	Effect on Income Taxes (6)x48% +(7)	Tax Effect in 1-1-X1 Dollars (8)-(2)	Discounted Present Value of Tax Effect in 1-1-X1 Dollars (9)-1.035[(1)]
X1	1.06	$22.50	$23.85	$66.67	$(42.82)	$2.33	$(22.89)	$(21.59)	$(20.86)
X2	1.12	22.50	25.28	22.22	3.06	-0-	1.47	1.31	1.22
X3	1.19	22.50	26.80	1.11	25.69	-0-	12.33	10.35	9.34
X4	1.26	22.50	28.41	-0-	28.41	-0-	13.63	10.80	9.41
X4	Cost deduction on Asset disposition		12.60	10.00	2.60	-0-	1.25	.99	.87
								Effect on tax liabilities	($ .02)
								Net economic incentive	$ .02
								Annualized incentive*	$ .0054

*This annualized measure is derived by finding the annual payment of an annuity over the useful life of the asset which, when discounted at the inflation adjusted interest rate of 3½%, produces a present value equal to the net economic incentive.

TABLE II

ILLUSTRATION OF PROCEDURE EMPLOYED IN DETERMINING NET ECONOMIC INCENTIVE RESULTING FROM INTERACTION OF INFLATION AND FEDERAL INCOME TAX LAW

(10% Investment Credit Provision)

Assumed Facts

1. Investment credit in effect: 10% provision
2. Inflation rate: 6% per year
3. Useful life of asset: 4 years
4. Acquisition date of asset: 1-1-X1
5. Cost of asset: $100
6. Salvage value of asset: 10% of real cost
7. Inflation adjusted interest rate: 3½%

Tax Options Elected

1. Asset life: 5 years
2. Depreciation method: Double Declining Balance with automatic switch to straight-line
3. Investment credit

(1) Year	(2) Price-level Index	(3) St. Line Historical Cost Depreciation	(4) St. Line Price-level Depreciation (2)x(3)	(5) Best Allowable Depreciation	(6) Effect on Taxable Income (4)-(5)	(7) Allowable Investment Credit	(8) Effect on Income Taxes (6)x48% +(7)	(9) Tax Effect in 1-1-X1 Dollars (8)-(2)	(10) Discounted Present Value of Tax Effect in 1-1-X1 Dollars (9)-1.035 (1)
X1	1.06	$22.50	$23.85	$40.00	$(16.15)	$6.67	$(14.42)	$(13.60)	$(13.14)
X2	1.12	22.50	25.28	24.00	1.28	-0-	.61	.54	.50
X3	1.19	22.50	26.80	14.40	12.40	-0-	5.95	5.00	4.51
X4	1.26	22.50	28.41	10.80	17.61	-0-	8.45	6.71	5.85
X4	Cost deduction on asset disposition		12.60	10.80	1.80	-0-	.86	.68	.59
								Effect on tax liabilities	($1.69)
								Net economic incentive	$1.69
								Annualized incentive*	$ .46

*This annualized measure is derived by finding the annual payment of an annuity over the useful life of the asset which, when discounted at the inflation adjusted interest rate of 3½%, produces a present value equal to the net economic incentive.

until March 28, 1975. The variables in Table II differ only in that the new 10% investment credit provision is used. This increases the net economic incentive from $.02 to $1.69. As indicated earlier, comparability among investment alternatives with different useful lives is obtained by annualization. The net incentive of $.02 shown in Table I represents a per annum incentive of $.0054. In Table II, the $1.69 net economic incentive translates as $.46 per annum. Each of these annualized measures of economic incentive can be compared directly with similarly derived measurements for the other 570 cases because this computation puts them on a comparable basis.

In order to achieve uniformity of presentation and simplicity of computation, all asset acquisitions are treated as occurring at the beginning of the year while related taxes are assumed paid at the end of each year. In addition various allowable options under current tax law are used to ascertain the "best" allowable depreciation deductions. The more important of these tax options are identified in the illustrations.

Real Economic Depreciation

A surrogate measure of real economic depreciation is obtained by using price-level accounting procedures to determine an inflation adjusted measure of asset depreciation. We do not represent price-level accounting to be either a theoretical or practical approximation of any form of current value accounting in its entirety. However, it does constitute a convenient means of assessing the effect of the tax law's failure to permit tax free recovery of the general purchasing power embedded in an asset's original cost.

The only price-level accounting procedures used are those relating to depreciation measurement. No consideration is given in this research to the manner of financing fixed assets. The measurement of price-level and tax related incentives and penalties inherent in financing arrangements constitutes a distinct issue lying beyond the scope of the present article.

A conservative view of cost expiration is adopted for computing the price-level adjusted annual depreciation charges which serve as surrogate measures for real economic depreciation. Inflation adjustment procedures were applied to annual depreciation charges based on a straight line allocation over useful life with allowance for estimated salvage value. Thus the acceleration effect under the DDB and SYD methods is reflected as one of the statutory benefits against which "inflation taxes" are offset by the measurement model in determining the overall incentive or penalty resulting from the interaction of inflation and tax rules.

Best Allowable Depreciation

Determination of best allowable depreciation deductions involves a number of considerations. A tax rate of 48% is used since this is the current marginal rate applicable to the ordinary income of most U.S. industry. Additional 20% first year depreciation is not considered because its limitation of $2,000 per taxpayer makes its effect insignificant for all but the very smallest firms. Neither does the model give consideration to various investment credit restrictions related to used property acquisitions, limits relating to gross income tax liabilities, carryover rules or recapture provisions. In summary, this study is based on a simplified typical situation in order to show the general impact of current income tax law in the area under consideration.

The selection of the depreciation method, Double Declining Balance (DDB) or Sum of the Years' Digits (SYD), is a particularly difficult problem in the determination of the best allowable depreciation. Fortunately, this issue has already been rather thoroughly investigated by Davidson and Drake.[2] Decision rules based on their results are used to determine which depreciation method is more beneficial for each combination of asset life and discount rate. The decision rules established include switchover to straight-line when desirable. In general, DDB tends to be preferable for shorter life assets while SYD is more advantageous for longer life assets. In addition, higher discount rates (representing higher rates of inflation) tend to favor DDB in contrast to SYD. For details and a derivation of these findings, reference should be made to Davidson and Drake's original article. The example in Table I is based on DDB depreciation for years X1 and X2 with an automatic switchover to straight-line in year X3. In Table II the switchover to straight-line occurs in year X4.

Asset Life

Allowable asset life used in calculating annual depreciation deductions was determined under the Asset Depreciation Range (ADR) System which permits a taxpayer to elect any life within the asset's class range. These allowable lives are within about ±20% of the asset's guideline life. The ADR System, and thus this article, applies to personal properties and not to real estate. In addition, while ADR depreciation computations generally do not take salvage value (up to 10% of asset cost) into account in determining annual depreciation deductions, the net asset basis cannot be depreciated below salvage value. These rules are followed in calculating the amounts shown as best allowable depreciation in Tables I and II.

Whatever ADR life is adopted must be used for both depreciation purposes and investment credit determination. For example one could elect to use three, four or five years for the tax life of the asset shown in Tables I and II as having a useful life of four years. Use of a three year life would maximize the present value of depreciation related tax savings. On the other hand, use of a five year life would increase the applicable investment credit amount. The question is whether the increase in investment credit or the deduction delay is more valuable. The answer depends upon both the amount of the allowable credit and the appropriate discount rate which is, in turn, a function of the rate of inflation. In effect, the shorter life is preferable under conditions of extremely high rates of inflation and the longer life, with greater investment credit, is preferable when inflation is low. Reiterative calculations are used to determine the more advantageous life to use in the calculations in this study. For the case in Table I (four years life, 6% inflation) a three years allowable life resulted in the best allowable annual depreciation deductions if the investment credit was 7%. However, with the new 10% investment credit provision (see Table II) it proved to be to the taxpayer's advantage to use the longer asset life of five years.

The impact of inflation on the overall relative advantage of different lived properties lies beyond the scope of this paper. Although there is no doubt that tax provisions play an important role in asset acquisition decisions that differentiate between long and short lived assets of different costs having the same annual service potential. The results reported herein do not directly relate to this problem. These figures reflect only the tax related incentive (penalty) in relation to the conventional financial accounting concept of income. They do not consider other inflation related influences on the capital budgeting model. Thus, a larger annual incentive for a long lived investment relative to a short lived one does not necessarily mean that the long lived asset is the better buy. That question is left to other studies. Rather, our results show only the annual incentive (penalty) per $100 of investment under the stated conditions. There is no intent to indicate that these results relate to the same asset or to assets that could yield the same service.

Real Rate of Interest

In order to find the present value, in terms of current purchasing power units, of the net investment penalty or incentive for any given combination of inflation rate and asset life, a two step procedure was adopted. First, any tax deficiency or excess was expressed in terms of date of asset acquisition purchasing power dollars. Secondly, the total present value of all such measures was obtained by employing the annual discount rate of 3.5%.

This rate of 3.5% was adopted as the long-term real rate of interest on the basis of a study conducted by Yohe and Karnosky.[3] Using alternative lag techniques to eliminate inflationary influences, Yohe and Karnosky determined two different estimates for the long-term real interest during the period 1961 through 1969. During this decade both of these estimates of the long-term real interest rate remained within the range of 3% to 4%

while nominal rates almost doubled during the same period. On the basis of these findings, 3.5% was adopted as an approximation for the true time value of money apart from inflationary influences.

1975 Tax Reduction

Tables III and IV display the annualized incentive for selected inflation rates, years of asset life and investment credit rates. Considerable variation in the annual rate of inflation may occur over the life of an asset, but the exact amounts for individual years are not forecastable. In addition, there is no satisfactory way to illustrate a varying set of future inflation rates in an article of this length. Therefore, constant rates of inflation are assumed for all calculations.

As a general rule, one can observe that the longer the life of the asset the smaller (on an absolute basis) the incentive or penalty. This is illustrated by data in Table III for asset lives of 8, 10 and 20 years. On the other hand, lives of 4 and 6 years are affected by the offsetting intermix of the tax provisions, especially those related to asset lives. While an asset with an expected useful life of four years can be depreciated over either three or five years, the life selected must also be used in determining the allowable cost qualifying for the investment credit. Thus the incentive impact of the 1975 increase in the investment credit is dampened for firms which adopt longer lives in order to qualify for a greater portion of the expanded credit. We can but wonder to what extent this tradeoff is recognized by lawmakers.

Arguments for restoration of the investment credit in 1971 emphasized that its purpose was to stimulate the economy, to increase the productivity of the nation, to increase our ability to compete with foreign countries and to create jobs for the nation's unemployed.[4] These goals are at least as applicable today as they were in 1971. However, as shown in Table IV, the tax incentive for making capital investments is considerably less than it was then, despite the recent temporary increase in the investment credit from 7% to 10%. Thus, while liberalization of the investment credit provision has had a positive effect, it has not been sufficient to offset the increase in the annual rate of inflation from 5% to 11%.[5]

The four tables present a numerical measurement of the effect of the subject tax provisions under conditions of inflation. Figure 1 provides a pictorial representation. The vertical axis shows annualized incentive or penalty while the horizontal axis shows various rates of inflation. Each line is a combination of years of asset life and investment credit rate. Notice the manner in which the assumption of higher rates of inflation converts an incentive into a penalty. Perhaps graphs similar to Figure 1 would be helpful to those who will determine the tax law when the present 10% investment credit provision expires.

Summary and Conclusions

A technique for the measurement of the quantitative economic incentive provided by various provisions of the income tax law was developed, described and applied in this study. The question was asked whether these provisions provide a true quantitative incentive in times of inflation. The answer required consideration of related tax provisions regarding accelerated depreciation, allowable asset lives, and a consideration of the effect of using historical cost as the basis for depreciation deductions. This last factor, the use of historical cost during inflationary times, is seen as an offset to the benefits sought in the other tax provisions under consideration. The result is a measurement model which yields a net economic benefit or penalty for these fixed asset related tax provisions under conditions of inflation. It should be noted that the model, which assumes a constant rate of inflation over the asset's useful life, deals only with depreciation measures and gives no weight to any impact of financing methods employed.

The measurement model was applied to some 572 cases representing various combinations of investment credit rates, asset lives and rates of inflation. Selected results are provided to illustrate the measurement technique and to show the quantitative effects of

TABLE III
ANNUALIZED INCENTIVE (PENALTY) RESULTING FROM INTERACTION OF INFLATION AND FEDERAL INCOME TAX LAW
(Expressed as a percentage of original investment)

Annual Rate of Inflation	Investment Credit	Asset Life In Years: 4	6	8	10	20
0%	7%	1.33%	1.48%	1.33%	1.20%	.87%
	10%	1.95	2.03	1.75	1.55	1.08
2%	7%	.82	1.01	.95	.86	.58
	10%	1.42	1.55	1.37	1.20	.78
4%	7%	.34	.58	.61	.55	.34
	10%	.92	1.11	1.02	.88	.53
6%	7%	.01	.19	.30	.27	.13
	10%	.46	.70	.70	.60	.32
8%	7%	- .31	- .14	.01	.03	- .04
	10%	.03	.33	.40	.35	.14
10%	7%	- .61	- .42	- .25	- .20	- .19
	10%	- .38	- .01	.14	.12	- .01
12%	7%	- .90	- .68	- .49	- .40	- .33
	10%	- .66	- .33	- .11	- .09	- .14
14%	7%	-1.17	- .93	- .71	- .59	- .44
	10%	- .94	- .61	- .34	- .28	- .26

TABLE IV

POST 1971 INCREASE IN INFLATION

VS.

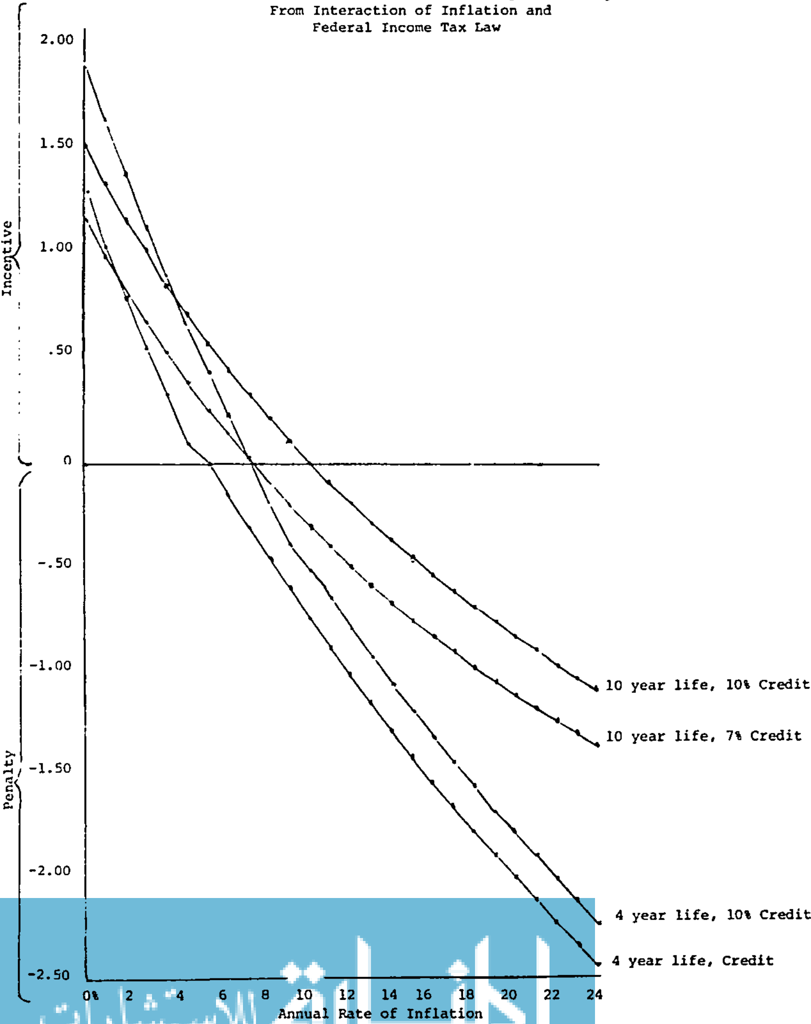
1975 TAX REDUCTION ACT

(Expressed in percentage annualized incentive (penalty) measures)

	(1)	(2)	(3)	(4)	(5)	(6)
				Impact of Increase in Inflation Since 1971	Impact of Change in Rate of Credit	Inflation Impact Net Offset (4)+(5) or
Year:	1971		1975			
Credit:	7%	7%	10%			
Inflation:	5%	11%	11%	(2)-(1)	(3)-(2)	(3)-(1)
Life: 3 years	.04%	-1.14%	- .83%	-1.18%	.31%	- .87%
4 years	.11	- .76	- .52	- .87	.24	- .63
5 years	.26	- .76	- .37	-1.02	.39	- .63
6 years	.38	- .55	- .17	- .93	.38	- .55
7 years	.42	- .50	- .07	- .92	.43	- .49
8 years	.45	- .37	.01	- .82	.38	- .44
10 years	.41	- .30	.01	- .71	.31	- .40
15 years	.28	- .30	- .07	- .58	.23	- .35
20 years	.23	- .26	- .08	- .49	.18	- .31
25 years	.21	- .23	- .07	- .44	.16	- .28
30 years	.20	- .19	- .05	- .39	.14	- .25

Figure 1

Annual Economic Incentive or (Penalty) Resulting
From Interaction of Inflation and
Federal Income Tax Law



the 7% and the 10% investment credit provisions. Review of the data shows a sizeable difference in the benefits yielded when the economic lives of the assets differ. More significantly, the economic penalty inherent in this package of tax considerations in times of high inflation is also illustrated.

Increasing the rate of investment credit from 7% to 10% has not been sufficient to offset the penalty resulting from tax accounting on the historical cost basis, given recent inflation experience in the U.S. Whether the solution should be a higher investment credit, a change in the method of tax accounting or some other provision is not the subject of this study. In fact, a broader approach may question any proposed solution as being only a partial solution in an economy where many diverse groups are penalized by inflation. However, the measurement of the effects of current and proposed policies is a necessary prelude to any well-designed solution. A means for performing this measurement is the primary contribution of this article.

Two benefits may be derived from measurement of the economic incentives or penalties inherent in these selected tax provisions under conditions of inflation. Businessmen, accountants and other individual taxpayers can use it to better understand and appraise the effects of decisions made under existing tax provisions. Equally importantly, this technique or similar measurement techniques could be used as a tool in the design and testing of current and proposed tax changes. This would seem to be an especially practical consideration in view of the temporary nature of the current 10% investment credit provision.

FOOTNOTES

[1] Price-level accounting techniques employed in this study are fully consistent with those set forth in the exposure draft, *Financial Reporting in Units of General Purchasing Power*, issued December 31, 1974 by the Financial Accounting Standards Board.

[2] Sidney Davidson and David F. Drake, "Capital Budgeting and the 'Best' Tax Depreciation Method," *The Journal of Business*, October 1961, pp. 442–52.

[3] William P. Yohe and Dennis S. Karnosky, "Interest Rates and Price Level Changes, 1952–69," *Federal Reserve Bank of St. Louis Monthly Review*, December 1969, pp. 18–38.

[4] Hearings on the Tax Proposals Contained in the President's New Economic Policy: House Committee on Ways and Means, 92nd Congress, 1 Sess., Vol. 1., p. 151.

[5] As observed by a reviewer of this paper, the data of Table IV reflects a different "basis for comparison" from that employed earlier in the study. Previously the comparison has been between taxes based upon "true" economic depreciation and taxes actually imposed. In Table IV, the comparison is between the level of net incentive provided by tax law in 1971 vs. that present in 1975. This "What have you done for me lately?" approach is not intended as a substitute for the former but rather is examined only for the purpose of showing that recent changes in tax law do not fully compensate for recent changes in the rate of inflation. If a given level of capital investment incentive was justified in 1971, it would seem to be justified in 1975.