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FISCAL IMPLICATIONS OF PRICE LEVEL CHANGES AND INVESTMENT DECISIONS

by

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FISCAL IMPLICATIONS OF PRICE LEVEL CHANGES AND INVESTMENT DECISIONS

The literature on capital budgeting has generally ignored the effect of inflation in the analysis of capital expenditure decisions. Often, there is a tendency to assume that price level remains unchanged throughout the life of the project or even if it changes, inflation would presumably only augment both future cash flows and discount rates by comparable amounts, thus having no effect on present value calculations. Under the existing tax laws, however, after-tax cash flows are not neutral with respect to different rates of inflation, because depreciation charges in computing taxable income are based on historical costs basis. Although this bias may not be serious when there is modest inflation, it seems apparent that at high rates of inflation the related tax effects must be an important factor in many present value comparisons arising in practice.

This paper explores the effect of inflation on investment decisions particularly the tax effect of depreciation charges based on historical costs. It discusses some of the policy issues involved in the proposal that depreciation charge should be based in some way to replacement cost rather than on original cost. How this proposal stands if project is partly financed by debt?

II

In order to focus on the role of the tax effect of inflation in the capital budgeting decisions, it is necessary that we define our problem clearly, conceptualize it, structure it and state our terms and assumptions explicitly. Any theoretical structure, because it contains generalizations and abstractions, may be called a model. Model differs from practice in part because unnecessary details have been withdrawn. I have granted myself a minimum number of "simplifying assumptions" so that the model is kept close to reality.

Two major assumptions used throughout the study are to hold constant both real pretax cash flows associated with alternative investment projects and real discount rates. The question of whether real pretax cash flows and discount rates are in fact systematically related to the rate of inflation is essentially empirical one and goes beyond the scope of the present paper. I have made no attempt to analyse the effect of cash flows not being fully responsive to price level changes. Intuitively, it could be claimed that input costs and output prices are not going to be responsive to the full extent to price level changes. Some costs increase at a more rapid rate than others, for example, material costs normally tend to respond more quickly to the general price changes than labour costs which are sticky due to comparative long term wage agreements. Likewise, for a

firm it may not be easy to change output prices in accordance with general price level changes. For our study purposes, I have assumed that specific price changes for firm's input and output items fully correspond with general price level changes. A restrictive assumption but necessary to keep study manageable and not to get lost in other issues.

The other assumption that real discount rates are unrelated to the rate of inflation, of course, goes back to Fisher[1] and enjoys support from a large body of empirical research.[2] The resolution of the controversy whether real discount rates get affected by inflation is immaterial to our discussion. To evaluate the capital expenditure decisions, the discount rate used in discounting the cash flow contains a premium for business and financial risk in addition to the real discount rate. To compensate for inflation an additional premium for inflation risk could be added to the discount rate. We have also ignored the distinction between actual and expected future rates of inflation or cash flows. Whether one wishes to regard the discussion as an analysis under perfect certainty or prefers to interpret future magnitudes as certainty equivalents is immaterial for present purposes.

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[1] Irving Fisher. The Theory of Interest, New York: Kelley and Macmillan Co. (1954).

[2] See for example, Yohe and Karnosky, "Interest Rates and Price Level Changes, 1952-1969." Federal Reserve Bank of St. Louis Review (December, 1969) p. 18-38.

II

It should be my endeavour throughout these pages to be extremely explicit about my terms and assumptions, for they determine the results. The symbols used in this study are as follows:

NPV = Net Present Value of the project without inflation

$\overline{NPV}$ = Net Present Value of the project with inflation

E = Equity investment in the project

B = Amount Borrowed to finance the project

F_i = Net Cash Flow during ith year from a project with no inflation

$\bar{F}_i$ = Net Cash Flow during ith year from a project with inflation

R = Cash Revenue from the project

C = Cash expenses on the project

D = Depreciation charges allowed for computing tax liability.

I = Interest expenses paid on borrowings.

t = Corporate tax rate proportional to firm's taxable income.

a = Ratio of new price level to the old price level.

k = Cost of equity including premium for inflation and other risks.

Inflation is defined as a rise in general level of prices for goods and services, which in turn results in a decline in the purchasing power of a unit of money. While there is disagreement as to what index is most representative of purchasing power, we bypass this problem and assume that a single index exists that reflects effectively

the general price level at various moments in time. The rate of inflation (a) is defined as annual rate of change in this index. For simplicity, we assume this rate is the same for all future periods ($a_1 = a_2 = a_3 \ldots = a_n$).

To repeat, we have also assumed that cash inflows (R) and outflows (C) are fully responsive to the price level changes (a); and the discounting factor used in times of inflation would include a compensating factor for inflation risk in addition to the cost of equity (k). Throughout our study, we have also assumed zero salvage value for convenience and simplicity without affecting our results.

Case I - No Taxes, No Borrowings

Let us proceed in our analysis with a simple situation where there are no corporate taxes to be paid and the firm finances entire project from the equity funds. There are no borrowed funds. The net present value of a project then could be determined by:

$$NPV = -E + \sum_{i=1}^{n} \frac{F_i}{(1+k)^i}$$

$$\overline{NPV} = -E + \sum_{i=1}^{n} \frac{\bar{F}}{a^i(1+k)^i}$$

where $F = R-C$

$\bar{F} = a(R-C)$ which also equals to aF.

Therefore, $NPV = \overline{NPV}$

Thus, we can see that in a tax-less world, inflation can easily be ignored in analysing the capital investments. Inflation increases both future cash flows and discount rates by comparable amounts, thus having no effect on present value calculations.

Case II - Tax World, No Borrowings

In this situation, taxes are paid regularly in proportion to firm's taxable income. Besides operating cash costs the depreciation charges, calculated according to existing laws, is a deductible expense in determining the firm's corporate tax liability. Payment of tax liability gives rise to a cash outflow, and in this way the depreciation charges affect the net cash flow generated from the project. The tax depreciation is provided on the original asset costs, whether there is inflation or no inflation. The NPV under this situation would be as follows:

$$NPV = -E + \sum_{i=1}^{n} \frac{F_i}{(1+k)^i}$$

$$\overline{NPV} = -E + \sum_{i=1}^{n} \frac{\overline{F}}{a^i(1+k)^i}$$

where $F = (R-C)(1-t)+tD$

$\overline{F} = a(R-C)(1-t)+tD$

or $\overline{F} = aF - tD(a-1)$

substituting this value of $\overline{F}$ in $\overline{NPV}$, we get

$$\overline{NPV} = -E + \sum_{i=1}^{n} \frac{a^i F_i}{a^i(1+k)^i} - \frac{tD(a-1)}{a^i(1+k)^i}$$

Differential in NPV due to inflation would be

$$\overline{NPV} - NPV = - \sum_{i=1}^{n} \frac{tD}{(1+k)^i} \left(1 - \frac{1}{a^i}\right)$$

During inflationary period $a > 1$, therefore, the differential in NPV would be negative. The firm looses money in real terms to the extent that tax benefit on depreciation charges does not increase in proportion to the price-level index. The receipts and the non-tax cash costs rise in the same proportion as the price level, but the income tax liability increases in a somewhat larger proportion, if the tax depreciation charges are tied to the original asset costs.

This analysis support the general belief that profits are overstated in an inflationary environment. The other items in the income statement rise in the same proportion to the inflation, but depreciation cost does not increase, so that total expenses increase in a smaller proportion and profits in a larger proportion than inflation. The full protection against inflation can take place only if the tax depreciation chargeswere increased in the same proportion as general price level. In such a situation, a case can be made to revise tax laws so as to provide tax depreciation based on replacement cost or inflation adjusted costs.

Case III - Tax World with Borrowings Available

In this situation, project is partly financed by borrowings,

partly by own funds. On borrowings the interest expenses are paid in every period and the principal amount is paid at the end of the period. The interest expenses are tax deductible. The computed NPV would be

$$NPV = -E + \sum_{i=1}^{n} \frac{F_i}{(1+k)^i} - \frac{B}{(1+k)^n}$$

$$\overline{NPV} = -E + \sum_{i=1}^{n} \frac{\bar{F}}{a^i(1+k)^i} - \frac{B}{a^n(a+k)^n}$$

where $F = (R-C-I)(1-t)+tD$

$\bar{F} = a(R-C)(1-t)-I(1-t)+tD$

or $\bar{F} = aF + (a-1)\left[I(1-t)-tD\right]$

substituting value of $\bar{F}$ in $\overline{NPV}$ and substracting NPV therefrom

$$\overline{NPV} - NPV = \left(1 - \frac{1}{a^n}\right)\frac{B}{(1+k)^n} + \sum_{i=1}^{n}\left(1 - \frac{1}{a^i}\right)\frac{I(1-t)-tD}{(1+k)^i}$$

The equation can be analysed by splitting it in two terms. The first term $\left(1 - \frac{1}{a^n}\right)\frac{B}{(1+k)^n}$ is the discounted value of gains on borrowings due to price-level changes. During inflationary time, a^n would be greater than 1, as a result the expression $1 - \frac{1}{a^n}$ would be positive, thus creating a monetary gain on liabilities. This gain would be realized only when the debts are repaid and it accrues as a result of repaying the loan in cheaper rupee due to decline in its purchasing power.

The second term is discounted value of gain or loss due to price-level changes on account of proportionately smaller or larger cash outflow resulting from interest and tax payments. In times of inflation, the interest costs being of fixed nature do not rise in proportion to the price level changes, while the tax liability on profits is larger in proportion to the price level changes due to lower depreciation allowance. The firm gains if interest payment on debt is large enough relative to the depreciation charges (i.e., $I(1-t) > tD$). This relationship between interest expense and depreciation charges can be explained in the following way.

The interest expense involves regular cash outflow to the debt holders for use of their funds. The interest expense is tax deductible item which reduces the tax liability. It results in a smaller cash outflow on account of tax payment. Thus, the net cash outflow on account of interest payment is after tax interest costs, that is, $(1-t)\ I$. The effect of depreciation charges on cash flow is through reduced tax liability which can be considered as negative cash outflow, equivalent to a cash inflow. Thus, we have fixed cash outflow $I(1-t)$ and inflow Dt in every period. The net cash outflow would be $I(1-t)-Dt$ which does not change due to inflation.

Thus, we see that during inflationary periods even if we do not recognize the controversial gain or loss on monetary items

[i.e. the first term $\frac{B}{(1+k)^n}\left(1 - \frac{1}{a^n}\right)$] the firm gains if $D < I\frac{(1-t)}{t}$ and losses in real terms only if $D > I\frac{(1-t)}{t}$. With current corporate tax rates of 57.5 per cent in India, the firm during inflationary periods gains only if its depreciation expenses based on historical costs are less than 74 per cent of its interest expenses. While the ratio of interest costs to the depreciation charges is highly variable in India, a casual inspection of income statements of Indian corporations suggests that depreciation charges far exceed the interest costs.

Further, we can also observe from the term $\sum_{i=1}^{N} \frac{I(1-t)-Dt}{(1+k)^i}\left(1 - \frac{1}{a^i}\right)$ that in the earlier years of the project the effect would be small as a^i is closer to 1. In later years a^i becomes larger resulting in larger gain due to price level changes (assuming that $I(1-t)$ exceeds Dt) but the discount factor applied to such gain is also much larger compared to earlier years. As a result, the net effect of NPV may be insignificant. This raises the basic question: Is it worthwhile to make adjustment for price-level changes? We shall discuss this and other policy implications of the above analysis in the following pages.

III

In the earlier section, we have analysed a capital budgeting problem which can be easily extended to the valuation theory of a

firm. Initially the shareholders finances the firm by contributing towards its equity and later on enjoy the cash flow generated from its activities. These cash funds can be withdrawn in the form of dividend or can be reinvested in the firm. If we accept for the time being the Modigliani and Miller[3] contention of the irrelevancy of dividend in determining the value of the firm, the extension of capital budgeting problem to valuation of the shareholders' equity in a firm holds perfect. Question to be asked then is whether real value of the stockholders' equity will decline during inflation given the current depreciation policy with respect to the corporate income tax? Does partly debt financing of the firm's activities make any difference? We have noticed from our analysis that where firm has both debt and equity financing it is not necessary to increase the tax depreciation charges in the proportion to the inflation to protect the shareholders of the firm. Even for purely equity financed firm the shareholders will be fully protected if tax depreciation charges are increased in proportion to the price level changes as inflation takes place.

Conclusion

The analysis brings out the relevant economic issues on which tax depreciation policy during inflation should be based, that is, its impact on the net cash flows to the firm. Nevertheless, there are some gaps in the analysis that should be mentioned

[3] Modigliani and Miller, "Dividend Policy, Growth, and the Valuation of Shares," Journal of Business (October 1961).

specifically. First, we have ignored the possible effect of inflatio on real discount rate. Does the expected return on equity increases in proportion to the inflation? No conclusive evidence seems to be available on this account. Second, what is the debt effect on discount rate. Increasing leverage implies larger financial risk which would require a higher premium to be included in the discount rate. Third, the inflation analysed in this paper ignores the specific price changes for firm's input and output. Should fiscal policy be such as to protect investors only from average price levels and not the relative price changes? Fourth, we have also ignored the question of salvage value in analysing the capital budgeting problem under inflation. But in extending the analysis to the valuation of the firm with perpectual life, salvage value may not be important except to the extent that it may create a "balancing charge" or "terminal allowance" for tax purposes which might affect the cash flow.

The main objective of the analysis was to compare the situation of the firm and stockholder with inflation to their situation without inflation. Our conclusions are that to protect the stockholders from the vagaries of inflation, we need to have tax laws such that each firm adjust its depreciation charge according to its particular debt structure. The proposal to increase depreciation in proportion to the inflation would lead to a gain for stockholders, except in the case

of a completely equity financed firm. The gain, however, will be smaller than it would be in the absence of a corporate income tax. This is because interest, as well as depreciation, is tax deductible expense which does not increase in proportion to the inflation, and the same kind of analysis applies to interest costs as to depreciation charges.