Policy, Planning, and Research
WORKING PAPERS
Public Economics

Country Economics Department
The World Bank
April 1989
WPS 178

Public Disclosure Authorized

Tax Holidays and Investment

Jack M. Mintz

The tax holiday — designed to encourage capital investments — actually penalizes long-term investments in some countries with high inflation rates and relatively fast writeoffs for depreciable capital.

Policy, Planning, and Research

WORKING PAPERS

Public Economics

The tax holiday — an incentive frequently used in developing countries to encourage capital investments — offers benefits for short-term investments but could in fact penalize long-term capital investments.

For some countries with high inflation rates and relatively fast writeoffs for depreciable capital, the effective tax rate on long-term investments is higher during the tax holiday than after.

For one thing, the tax law may require assets to be depreciated during the holiday. If so, the value of tax depreciation writeoffs — which is not indexed for inflation — may be lower than the true economic cost of depreciation.

For another, the tax benefit of nominal interest deductions associated with debt financing of capital are of no value to the firm during the holiday — whereas after the holiday they may be quite beneficial.

After estimating the effective tax rates on capital for holiday and post-holiday investments, the author concludes that for some countries the effective tax rate on long-term capital is highter during the holiday than after.

This paper is a product of the Public Economics Division, Country Economics Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Ann Bhalla, room N10-061, extension 60359.

Tax Holidays and Investment

by
Jack M. Mintz

Table of Contents

I. Introduction 2

II. A Detailed Description of Tax Holidays 4

A. Tax Holiday Provisions 5
B. Post-Tax Holiday Provisions 9

III. Theoretical Analysis 10

A. The Basic Theoretical Model 11
B. Some Complications 19

i. Deferral of Depreciation 20
ii. Associated Non-Tax Holiday Firms 22
iii. Personal Taxation and Debt Policy 26

IV. Empirical Analysis 32

V. Conclusions 38

Bibliography 41

I. INTRODUCTION

The corporate income tax holiday is a tax incentive frequently used by less developed countries (LDCs) to promote capital investment. The usual form of the holiday is to allow a "pioneer" firm operating in a designated industry to be fully or partly exempt from corporate taxation during its formative years with full taxation applying after the holiday period. Of the 54 LDC tax systems described in a Price Waterhouse survey [1986], 27 of these include tax holidays of one form or another. Although tax holidays are prevalent in LDC's, it is not difficult to find examples of holidays used in developed countries such as France and Belgium.

Much of the current literature on capital formation and effective tax rates[1] has concentrated on investment tax credits, accelerated depreciation, and statutory tax rate abatements as tax incentives (see, for example, King and Fullerton [1984] and Boadway, Bruce and Mintz [1984]). These tax incentives are not particularly difficult to analyze since it can be assumed that the firm anticipates the tax system to be unchanging overtime. With additional assumptions, time invariant effective tax rates are derived that are useful for describing the long run impact of the tax system on capital. For example, the usual assumptions include the following: (i) real capital good prices increase at a constant rate over time, (ii) capital depreciates

---

1/ The notions of the effective tax rate and the cost of capital are fairly well known now in the literature so they are only briefly defined here. The user cost of capital is depreciation and financing costs, adjusted for taxes, that are incurred by the firm when holding capital. Effective tax rates are conventionally defined as the difference between the marginal gross-of-tax rate of return (the user cost of capital net of depreciation costs) and the net-of-tax rate of return that savers earn when investing in the firm's capital. This difference may be divided by the gross-of-tax or net-of-tax marginal rates of return.

exponentially at a constant rate and (iii) the real net-of-tax discount rate of the firm is time invariant. The steady-state condition in a dynamic perfect foresight model without adjustment costs implies that the firm's capital decision is determined at the point where the value of marginal product per dollar of capital is equal to the tax-adjusted annual cost of depreciation and financing (see Boadway and Bruce [1979]). With this type of model, the cost of capital and effective tax rate faced by the firm is independent of time.

With tax holidays, the firm anticipates the tax system to be changing over time. In particular, the corporate tax rate rises after the holiday is finished. This implies that the cost of capital is no longer time invariant, making the tax holiday problem more difficult to analyze compared to other tax incentives that have been treated in the literature. The scant literature on this subject has concentrated on issues related to the reasons why tax holidays may be used as an incentive without trying to derive the effective tax rate on capital during a holiday (Bond and Samuelson [1986] and Doyle and van Wijnbergen [1984]).[2] The task of this paper is quite different. The user cost of capital, which varies over time, is derived for a firm that correctly anticipates the length of the holiday and the tax regime that exists after the holiday. The time consistency of tax policy is not an issue here.

2/ Two papers that also try to answer this question are by Agell [1982] and Bond [1981]. Each measures the effective tax rate by taking into account that income earned by capital during the holiday is taxed at the end of the holiday with the value of marginal product constant over the tax holiday period. As shown in this paper, this assumption, implying the capital stock is constant until the end of the holiday, is incorrect. Tax depreciation allowances are also modelled incorrectly.

If the firm is fully exempt from corporate income taxation during the holiday, what is its effective tax rate? A first response would be that capital bears no tax at all. This would be correct for short term capital that fully depreciates before the end of the holiday. However, as shown later, the effective tax rate on long term holiday investments depends on the relationship between tax depreciation and true economic depreciation. Even though the firm is tax exempt during the holiday, it must pay taxes on income generated by holiday investments once the holiday is finished. If the firm must write down the value of its assets for tax purposes during the tax holiday, the tax depreciation writeoffs after the tax holiday may be inadequate relative to the true cost of depreciation. For example, suppose capital is written off at a 100% rate of tax purposes but has an economic life that goes well beyond the holiday period. A firm that undertakes an investment during the holiday must expense the capital for tax purposes, yet pay taxes on profits generated by the remaining capital after the holiday period. In fact, the "rule" can be described as follows: the effective tax rate on depreciable capital during the holiday is positive [negative] if the tax depreciation rate (plus inflation rate with historical cost valuation of capital) is more [less] than the true economic depreciation rate.[3] Indeed, it is possible, in the case of long term depreciable capital, that the tax holiday may be no holiday at all in that the effective tax rate on investments during the holiday is higher than that on

---

3/ This rule applies when the firm cannot defer its tax depreciation writeoffs. As we review in the next section, some countries allow tax depreciation to be deferred until after the holiday. We show that capital is generally subsidized when income is fully exempt from taxation in the holiday period and firms are allowed to defer depreciation deductions.

investments after the holiday! This does not imply that the tax holiday is of no value to the firm. Short term investments and labor (compensated by profits) bear no tax during the tax holiday. It is only long term investments that may be penalized by the tax holiday.

The remainder of the paper is divided as follows. In Section II, details regarding the tax law for five countries that use tax holiday incentives are surveyed. Section III presents the theory used to derive the cost of capital and the effective tax rate on capital for each year during and after a tax holiday. Section IV presents some effective tax comparisons for the countries surveyed in Section II. Section V concludes with a discussion of the distortions that arise from tax holidays.

II. A DETAILED DESCRIPTION OF TAX HOLIDAYS

This section describes the details of the corporate income tax law that is relevant to tax holidays used in five countries: Bangladesh, Côte d'Ivoire, Malaysia, Morocco and Thailand. Table 1 provides a summary of various tax provisions in each country. Instead of describing the tax regimes in each country, I shall outline the general features of the tax law that apply to qualifying holiday investments. Many countries give other forms of tax relief during the holiday such as a remission of import duties on inputs, export taxes on goods, sales taxes, and personal taxes on dividends. Since this paper concentrates on the firm's investment decision, only the remission of import duties on capital goods and dividend taxes are considered.

A. Tax Holiday Provisions

In the five countries listed in Table 1, tax holidays officially last from 3 to 14 years depending on the law. In general, the firm is fully exempt from corporate income taxes during the holiday although this is not always true. Côte d'Ivoire only partly exempts the firm during the last three years of the holiday while certain Moroccco investments are given only a 50% exemption. In each of the countries, firms must apply for a tax holiday status and not all firms qualify.[4]

The tax holiday provisions for the treatment of depreciable assets vary considerably across countries. Morocco and Thailand require assets to be depreciated for tax purposes during the holiday while Malaysia explicitly permits the firm to depreciate assets after the holiday. Depreciation deductions in Côte d'Ivoire are not mandatory-these can be deferred indefinitely. Thus, a Côte d'Ivoire firm during the tax holiday may elect to defer its depreciation allowances until after the holiday. Bangladesh requires that depreciation deductions be claimed in the year but unused deductions may be carried forward indefinitely.[5] As shown later in the theoretical section, the deferral of depreciation deductions makes the tax holiday much more generous to the firm.

4/ Morocco grants tax holidays only for Zone III (50% exemption) and Zone IV investments (100% exemption) that are situated in rural areas. The length of Côte d'Ivoire tax holidays depend on region that the firm operates in. Most countries do not allow tax holiday firm to claim other tax incentives (Bangladesh, Malaysia, Côte d'Ivoire).

5/ If the firm earns taxable profits during the holiday, I interpret the rules to imply that these depreciation deductions during the holiday are fully used and thus not carried forward.

Table I: Tax Holiday Provisions
Industrial Enterprises

	Bangladesh	Côte d'Ivoire	Malaysia	Morocco	Thailand
Period	4-12 yrs	7-11 yrs	5-10 yrs	10-14 yrs	3-8 yrs + 5 yrs (optional)
Exemption	100%	100% for 4,6, or 8 yrs depending on region 75% 3rd last year 50% 2nd last year 25% last year	100%	100% Zone IV 50% Zone III	100% 50% for five additional yrs
Treatment of Depreciation	Unused mandatory deductions carried forward	Depreciation deductions not mandatory-can be deferred indefinitely	Depreciation delayed until end of holiday	Depreciation mandatory-carried forward in loss periods only	Depreciation mandatory
Rates of Depreciation	Declining Balance: Buildings 15% Machinery 30% Initial Allowance: Buildings 10% Machinery 20%	Straight line: Buildings 5% Machinery 10-[illegible]%	Straight line: Buildings 2% Machinery 12% (average) Initial Allowance: Buildings 20% Machinery 20%	Straight line: Conformity with book	Straight line: Conformity with book
Treatment of Losses	Not carried forward after holiday	Carried forward 3 years	Mandatory deduction of associated non-pioneer loss-pioneer loss only carried forward indefinitely	Four years carry forward	Pioneer and associated non-pioneer income and loss aggregated
Other Features of Holidays	5-30% of income invested in govt. bonds. Dividends of public firm exempt from personal tax	National Investment Fund levy - 10% tax fully recoverable at a rate that varies according to type of investment	Dividend exempt from personal tax		Dividends exempt from personal tax

	Bangladesh	Côte d'Ivoire	Malaysia	Morocco	Thailand
Post-Holiday Tax Provisions					
Corporate Tax Rate	40% (Public) 45% (Private)	40% + 10% (NIF)	43% less 5% abatement	49.5%	30% (Public) 35% (Private)
Depreciation Rates	Same as above Recapture rules apply	Same as above	Same as above Recapture rules apply	Same as above	Same as above Recapture rules apply
Other Tax Incentives					
- available after holiday	Investment allowance 25%. Depreciation base not adjusted	No	No	No	No
- not available for holiday	Accelerated at 100% or 80% and 20%	Accelerated at twice the normal rate	Accelerated at 40% Investment Tax Allowance of 100%	Investment Reserve - 20% of profits abated up to 30% of investment	None

Source: International Bureau of Fiscal Documentation 1987 and 1988.

If the firm is granted a holiday, it usually does not qualify for other tax incentives such as accelerated depreciation. Depreciation, except in Bangladesh, is based on the straightline methods unindexed for inflation. In some countries such as Bangladesh and Malaysia, an initial allowance is given. Morocco and Thailand require tax depreciation to conform with accounting depreciation. These rates of depreciation are applied to assets purchased both during and after the holiday period. Table 1 provides the rates of depreciation and initial depreciation or investment allowances. In most cases, annual tax depreciation is based on the original cost of asset without writing down the asset base by the initial allowance. Ignoring inflation, tax depreciation rates seem to be higher than economic depreciation rates particularly for buildings and machinery in Bangladesh, and, as a result of the initial allowances, buildings and machinery in Malaysia.

Another important provision regarding tax holidays is the treatment of tax losses. Thailand requires losses incurred by a pioneer firm to be written off against income of a related non-pioneer company. The same applies to the tax losses of the non-pioneer business-it must be set off against the income of the pioneer firm. Malaysia also requires losses of associated non-pioneer firms to be written off the income of pioneer firms, but unlike Thailand, not the converse (the pioneer firm tax losses are carried forward indefinitely). Bangladesh does not allow tax losses of holiday firms to be carried forward after the holiday while in Côte d'Ivoire and Morocco there is a limit on the time permitted for losses to be carried forward. In the case of Côte d'Ivoire, depreciation deductions can be deferred indefinitely so it is unlikely that the restriction on the carry forward of losses is binding for many firms.[6]

6/ Canada, similar to Côte d'Ivoire, allows the firm to defer depreciation deductions. For this reason, most reported tax losses are written off during the seven year maximum period in Canada. See Mintz [1988].

There are a few other features that apply to tax holidays. In Bangladesh, a certain percentage of income earned during the holiday must be invested in government bonds (the rate varies from 5% to 30% according to the region in which the investment is located). If the government bond rate is below the market rate, an "implicit" tax is imposed on the firm. Côte d'Ivoire has a similar provision associated with the National Investment Fund (this fund is financed by taxes levied on companies and the taxes are recoverable if the firm purchases government bonds or undertakes sufficient levels of investment). The rate of corporate income tax is 10% and the rate of recovery depends on the region in which the investment is located.[7]

Another feature of tax holiday is that dividends paid by a firm to its shareholders may be exempt at the personal level during the holiday. Malaysia and Thailand fully exempt dividends while Bangladesh only exempts dividends of holiday firms listed on the stock exchange. How dividend taxation affects the marginal investment decision of the holiday firm is an issue left for later analysis presented in Section III.

B. Post-Tax Holiday Provisions

When the holiday is terminated, the firm must pay corporate income taxes according the normal tax code provisions. The statutory tax rate imposed in the five countries currently varies from 30% in Thailand (public firms) to about 50% in Morocco.

7/ I have not been able to determine if the firm must pay the NIF tax during the holiday. I assume, if it does, that the tax does not affect the marginal investment decision since the funds can be fully recovered by investing in qualifying capital.

Tax depreciation rules, after the holiday is terminated, are the same as those described in the previous section. In general, the rates of depreciation do not change except for the case of Côte d'Ivoire where accelerated depreciation (twice the normal rate) might be available for qualifying capital after the holiday period (for later analysis, I assume that post-holiday investments do not qualify for accelerated depreciation). An investment allowance not available to firms during a holiday is available after the holiday in Bangladesh. Otherwise, accelerated depreciation and investment allowance incentives are generally not available after the holiday period in most of the countries.

The corporate tax law reviewed above and outlined in Table I is the basis for modelling in the next section and for estimating effective tax rates in Section IV. The information on the tax provisions were taken from published sources so it is quite possible that the tax law has been misinterpreted in some cases.

III. THEORETICAL ANALYSIS

In this section, the impact of tax holidays on the investment decisions of price-taking firms is analyzed. The analysis is simplified by assuming that there are no costs incurred by firm in adjusting its capital stock.[8] In addition, the firm, when undertaking investments, anticipates no

---

8/ It is straightforward to include adjustment costs so long as they are current and fully deductible from the corporate tax. If adjustment costs are capital in nature, the analysis is more complicated but adds little in theory to the model. For a discussion on effective tax rates and adjustment costs, see Boadway [1988].

changes in the tax provisions that are applied during and after the holiday period. Personal taxation and debt finance are ignored, at least initially. These assumptions imply that the firm uses a time invariant discount rate (the opportunity cost of shareholder funds) both during and after the holiday period to value its cash flows. Otherwise, in the presence of varying personal tax rates and financing policies, the firm's cost of finance, hence its discount rate, would be different during and after holiday period. Time varying discount rates are considered at the end of this section.

The first part of this section is devoted to the simplest model that can be formulated to evaluate the impact of tax holidays on investment. In this part, it is assumed that holiday firm is not associated with a non-tax holiday firm, its depreciation deductions cannot be deferred and that the firm has no accumulated losses at the end of the holiday period, thus being fully taxable when the holiday is finished. In the second part of this section, three complications are considered. The first is the possibility that depreciation deductions may be deferred. The second is the tax treatment of associated holiday and non-holiday firms. The third is incorporation of both debt and personal taxation in the model.

A. The Basic Theoretical Model

A competitive firm uses capital in each period with the objective of maximizing the value of shareholders' equity. With no debt, the payment made to shareholders is equal to the cash flow of the firm: revenues net of expenditures on gross investment and corporate taxes. Labor inputs are ignored since there are no tax consequences associated with the use of current inputs (as wages are fully deductible from the corporate tax base).

In each year, the firm earns nominal revenues equal to $(1+\pi)^t F[K_t]$ where π is the rate of inflation and K_t is capital stock. Real revenues are thus output which is represented by a strictly concave production function. The revenues are distributed as dividends to the shareholder or used for gross investment. Capital good prices rise with the general inflation rate, and the price is equal to unity. Real gross investment, I_t, is physical depreciation (which is assumed to be of the declining balance form) plus new investment:

$$I_t = (\delta K_t + K_{t+1} - K_t) \tag{1}$$

Corporate taxes paid by the firm in each period depends on whether the firm is operating during the tax holiday period or not. Let t=0 be the time when the firm starts up and t=t* be the time at which the tax holiday ends and the firm becomes fully taxable. Prior to t*, (t= 0....t*-1), the firm's taxable profits, revenues net of mandatory depreciation deductions, are taxed at the rate u_0 and, for $t \geq t^*$, at the rate u_1 with $u_1 > u_0$. The net-of-tax real revenues of the firm are thus equal to $F[K_t](1-u_0)$ and the real expenditure on gross investment net of the present value of tax allowances is equal to $I_t(1-A_t)$. During the holiday, the tax value of depreciation allowances per dollar of gross investment (A_t) varies at each point of time which is shown subsequently.

When the firm invests in capital at time $t < t^*$, it writes off its gross investment at the initial allowance rate of β. An annual depreciation allowance is also given based on the undepreciated capital cost base (UCC) which is increased at time t, in real terms, by the amount $(1-f\beta)I_t$, with f denoting the proportion of the initial allowance that is written off the UCC base. If there is full adjustment, f=1 and if no adjustment f=0. At each

point of time the annual allowance rate is α which is assumed to be of the declining balance form and based on the original purchase price of capital.[9] Thus at time $s > t$, the annual allowance deducted from profits is equal to $\alpha(1-\alpha)^{s-t}(1-f\beta)(1+\pi)^t$, in nominal terms. Prior to t^*, the initial and annual allowances are written off at the rate u_0 and after t^*, the remaining annual allowance on the investments made prior to the termination of the tax holiday is written off at the rate u_1. Since these tax depreciation writeoffs are valued in nominal terms, they are discounted at the nominal interest rate i. Deflating by the price index at time t, the real value of tax depreciation allowances, A_t, are computed as follows:

$$A_t = u_0\beta + (1-f\beta)\left[\sum_{s=0}^{t^*-1} \alpha u_0 \left(\frac{1-\alpha}{1+i}\right)^{s-t} + \sum_{s=t^*}^{\infty} u_1\alpha \left(\frac{1-\alpha}{1+i}\right)^{s-t}\right] \qquad (2)$$

Equation (2) yields a simpler expression for A_t which is the following:

$$A_t = u_0\beta + Z\{u_0 + (u_1-u_0)[(1-\alpha)/(1+i)]^{t^*-t}\} \quad \text{for } t < t^*. \qquad (3)$$

and $Z = (1-f\beta)(1+i)\alpha/(\alpha+i)$. The tax value of depreciation writeoffs are thus equal to the value of initial allowance ($u_0\beta$) plus the present value of the annual allowances written off during and after the holidays. Given $u_1 > u_0$, the firm is given an additional tax benefit arising from the deduction of

---

9/ The theory is easier to present with declining balance tax depreciation. Straight line depreciation is more common, as discussed in Section II, so depreciation rates were adjusted for the empirical work presented in Section IV.

depreciation allowances after the holiday. However, the value of the deduction is lower the earlier that the investment takes place during the holiday since $[(1-\alpha)/(1+i)]^{t^*-t}$ is lower in value for $t<t+1$.

For investments undertaken after the holiday period is terminated, real revenues are equal to $F[K_t](1-u_1)$ and the real cost of investment expenditure is $I_t(1-A_t)$ with

$$A_t = u_1\beta + (1-f\beta)\left[\sum_{t}^{\infty} u_1\alpha\left(\frac{1-\alpha}{1+i}\right)^{s-t}\right] = u_1(\beta + Z) \text{ for } t \geq t^*. \tag{4}$$

After the holiday is finished the present value of tax depreciation allowances is time invariant since β and Z are independent of t. This is the usual case found in the tax literature (note if $\beta=0$, $A_t = u_1\alpha(1+i)/(\alpha+i)$ which is the present value of annual tax depreciation on a declining balance basis).

Given the above description of cash flows, the value maximization problem is formulated. Let the real discount rate of the firm be 1+r which is equal to $(1+i)/(1+\pi)$. Shareholders' equity is the discounted value of real cash flows earned during and after the holiday period:

$$V = \sum_{t=0}^{\infty} \frac{1}{(1+r)^t}\left[F[K_t](1-u_t) - (\delta K_t + K_{t+1} - K_t)(1 - A_t)\right] \tag{5}$$

with A_t defined by equations (3) and (4) and u_t denoting time varying corporate tax rates. For convenience, let $A_t = A$ for $t \geq t^*$ since the present value of tax depreciation allowances on gross investment is shown to be time invariant after the tax holiday.

The firm maximizes its value choosing K_t in each period. The first order conditions are of three types:

For $t < t^*$:

$$\frac{\partial V}{\partial K_t} = \frac{1}{(1+r)^t}\left[F'_t(1-u_0) - (\delta-1)(1-A_t)\right] - \frac{1}{(1+r)^{t-1}}[1-A_{t-1}] = 0 \tag{6.1}$$

For $t = t^*$:

$$\frac{\partial V}{\partial K_{t^*}} = \frac{1}{(1+r)^{t^*}}\left[F'_t(1-u_1) - (\delta-1)(1-A)\right] - \frac{1}{(1+r)^{t^*-1}}[1-A_{t^*-1}] = 0 \qquad (6.2)$$

For $t > t^*$:

$$\frac{\partial V}{\partial K_t} = \frac{1}{(1+r)^t}\left[F'_t(1-u_1) - (\delta-1)(1-A)\right] - \frac{1}{(1+r)^{t-1}}[1-A] = 0 \qquad (6.3)$$

Equation (6.1) to (6.3) are rearranged using the expressions for A_t so that the familiar user cost of capital is derived as described below. Intuitively, the firm equates the discounted marginal value of capital in period t with purchase cost of acquiring capital in period t-1. The discounted marginal value of capital is net-of-tax marginal revenues, $F'_t(1-u_t)/(1+r)$, plus the discounted resale value of capital net of the tax value of depreciation allowances that would be lost to the firm if capital is sold in period t: $(1-\delta)(1-A_t)/(1+r)$. The cost of buying capital in period t-1 is its purchase cost (net of tax depreciation allowances), $1-A_{t-1}$. Each of the three cases are described according to when the investment takes place.

Investments During the Holiday Period:

When $t < t^*$, the user cost obtained from equation (6.1) is

$$\begin{aligned} F'_t &= \frac{(\delta+r)(1-A_t)}{(1-u_0)} + \frac{(1+r)(A_t-A_{t-1})}{(1-u_0)} \\ &= \frac{(\delta+r)(1-A_t)}{(1-u_0)} + \frac{(u_1-u_0)(1-f\beta)\alpha(1+r)}{(1-u_0)}\left[\frac{1-\alpha}{1+i}\right]^{t^*-t} \end{aligned} \qquad (7.1)$$

The user cost of capital during the tax holiday is composed of two parts as shown in the first line of equation (7.1). The first expression is quite familiar: the costs of holding a unit of capital are depreciation and financing costs adjusted for taxes. The expression $(1-A_t)$ is the real purchase cost of capital net of the tax value of depreciation and investment allowances at time t*. The expression is also divided by $(1-u_0)$ since marginal revenues (gross of depreciation costs) are taxed at the rate u_0. The second part of the expression (7.1) in the first line is the cost to the firm of purchasing capital in period t-1 rather than t. Since depreciation writeoffs increase in value over time, the firm is better off waiting one period. The expression of equation (3) is substituted into (7.1) and rearranged by combining terms, yielding the second term of the right hand side in line two of equation (7.1). This expression is interpreted as the tax depreciation penalty of investing in assets during the holiday rather than waiting until the holiday terminates.

In most cases, 100% of the firm's profits are exempt from taxation. This implies that $u_0=0$ and that the present value of tax depreciation allowances are based on writeoffs made after the tax holiday is completed: $A_t = u_1 Z\{(1-\alpha)/(1+i)\}^{t^*-t}$ (the value of tax depreciation allowances after the holiday is terminated). With a full exemption, the user cost of capital in equation (7.1) becomes the following:

$$F'_t = \delta + r - [\delta(1+\pi) - (\alpha+\pi)]u_1 Z[(1-\alpha)/(1+i)]^{t^*-t}/(1+\pi) \qquad (7.1')$$

Let $\delta\pi \to 0$. During the tax holiday, the user cost of capital is equal to the cost of depreciation and finance less the gain to firm in tax depreciation allowances after the holiday is terminated. The interpretation of this formula is straightforward. By investing in capital in period t-1 (yielding income in period t), the firm replaces δ units of capital in period t. This generates

tax depreciation allowances per dollar of capital equal to $u_1 Z [(1-\alpha)/(1+i)]^{t^*-t}$ after the period. However, the firm, by investing in capital in period t-1 rather than in t, loses in present value terms, tax depreciation that would be based on higher capital good prices. This is the term $\alpha+\pi$ multiplied by the present value of tax depreciation allowance later earned by the firm. Equation (7.1') leads to the following conclusion regarding a tax holiday that fully exempts a firm: <u>if the firm's economic depreciation rate were equal to the tax depreciation rate plus inflation, the capital good would be exempt from capital taxation during the holiday</u>.[10] If, however, economic depreciation were more (less) than tax depreciation plus inflation, capital during the holiday would be subsidized (taxed).

The user cost of capital in (7.1) and (7.1') also shows that there are other distortions associated with tax holidays. Non-depreciable assets such as land and inventories are fully exempt from taxation during the holiday (since Z=0). If depreciable assets are written off quickly or if there is high inflation, the non-depreciable assets are favoured by the tax holiday. Also, for a given tax depreciation rate, durable assets are favored less compared to non-durable assets during the tax holiday. It also easy to determine that the cost of capital during the tax holiday when profits are fully exempt rises (falls) continuously if $\alpha+\pi > \delta$ ($< \delta$).

10/ If the tax depreciation allowances were indexed for inflation, the inflation term would drop out and all that would matter would be the relationship between economic depreciation and tax depreciation.

Investment at the End of the Holiday Period:

When t=t*, the tax holiday ends and the firm becomes fully taxable. Its income, however, is based on its capital stock held in period t* but determined by the new investment decision taken in the previous period when the holiday was operating. Thus, the present value of tax depreciation allowances is in part influenced by investment decisions taken in period t*-1 even though the its income generated in period t* is fully taxed. All this is determined by equation (6.2) which is rearranged with substitutions made for A_t using the expressions in equations (3) and (4). The cost of capital for this case is the following:

$$F'_{t*} = \frac{(\delta+r)}{(1-u_1)}\,[1-A] + (1+r)\,\frac{(u_1-u_0)[B+(1-fB)\alpha]}{(1-u_1)} \qquad (7.2)$$

$$A = u_1[\beta + Z].$$

Intuitively, the user cost of capital stock for period t* is equal to the cost of depreciation and finance adjusted for taxes in two ways. First, the corporate tax levied on revenues earned after the holiday is based on the post-holiday statutory tax rate. Second, the purchase cost of holding capital is adjusted for the present value of tax depreciation allowances (A) that are incurred by the firm when replacing capital at time t*. However, because the capital stock decision at time t* is determined in the period before the end of holiday, a correction must be made for the loss in the tax value of initial and annual allowances arising from investing too early in period t*-1. This tax penalty is captured by the second term of equation (7.2).

Investments Made After the Tax Holiday:

When $t > t^*$, the firm is fully taxed both at the time of investment and when income is generated. In this case, the familiar user cost of capital formula for a firm is derived:

$$F'_t = \frac{(\delta+r)}{(1-u_1)}(1-A) \qquad \text{for } t > t^*. \qquad (7.3)$$

The post-holiday user cost of capital is adjusted for the full statutory corporate tax rate and the tax value of investment allowances that are available after the holiday period.[11] Note that the cost of capital after period t* is time invariant.

B. Some Complications

The above theory can be extended in three directions to take into account various complications in tax codes that are relevant to the impact of tax holidays on investment. The complications that are to be considered are the following: (i) the deferral of depreciation deductions until after the tax holiday: (ii) the treatment of associated tax holiday (pioneer) and non-pioneer firms; and (iii) financial policy and time varying personal tax rates.

11/ Some tax holiday provisions also exempt the firm from paying sales taxes and import duties on their capital good purchases. If taxes are paid on capital goods, the price of capital in real term is $(1+\tau)$ instead of 1 dollar (letter τ be the sale tax or import duty rate). The cost of capital is thus adjusted by multiplying the term [1-A] by $(1+\tau)$ in expression (7.1) to 7.3) where applicable, assuming that depreciation is based on the tax inclusive price of the asset.

(i) Deferral of Depreciation

When depreciation is deferred until after the holiday, the firm deducts the allowances from taxable income at the post-holiday corporate tax rate. This could cause the firm to be non-taxpaying for a lengthy time if unused holiday depreciation allowances are large relative to post-holiday net revenues. For convenience, it is assumed that the firm is taxpaying after the holiday so deductions are used immediately, beginning at time t*.

If deferral does arise, the present value of tax depreciation allowances are calculated beginning in period t as follows. At time s=t* (ie: when the holiday is over), the firm deducts the initial allowance at the value $u_1\beta$ or in present value terms at time s=t, $u_1\beta[1+i]^{-(t^*-t)}$. Investment expenditure in period t also adds $1-f\beta$ dollars of investment expenditure to the UCC base which is used to calculate the annual allowance given at the rate α on a declining balance basis.[12] The firm deducts an annual allowance only after the holiday is finished ($s \geq t^*$). The deduction for the annual allowance is equal to the nominal value $u_1\alpha(1-\alpha)^{s-t^*}$ in each post-holiday period. In present value terms, at time t, this is equal to $u_1\alpha(1-\alpha)^{s-t^*}(1+i)^{-(s-t^*)}$. The tax benefit of depreciation allowances is thus equal to the following:

$$A_t = [u_1\beta + (1-f\beta)\{\sum_{t=t^*}^{\infty} u_1\alpha\,[(1-\alpha)/(1+i)]^{s-t^*}\}]\,(1+i)^{-(t^*-t)} \qquad (8)$$

$$= u_1[\beta+Z](1+i)^{-(t^*-t)} \qquad \text{for } t \leq t^*.$$

12/ In some cases, the total amount of depreciation undeclared during the holiday may be expensed at the end of the holiday rather than written off in the post-holiday period at the rate α. This practice does not seem to be followed in the countries that are dealt with in this paper.

The cost of capital is derived following the same methodology as before except for the use of equation (8). The three expressions for the user cost of capital are the following:

Holiday Period ($t < t^*$):

$$F'_t = \frac{(\delta+r)}{(1-u_0)}\left[1- u_1(B+Z)(1+i)^{-(t^*-t)}\right] + \frac{u_1(B+Z)(1+i)^{-(t^*-t)}}{(1-u_0)(1+\pi)} \qquad (9.1)$$

End of Holiday ($t = t^*$):

$$F'_{t^*} = \frac{(\delta+r)}{(1-u_1)}\left[1- u_1(\beta+Z)\right] + \frac{iu_1(\beta+Z)}{(1-u_1)(1+\pi)} \qquad (9.2)$$

Post Holiday ($t > t^*$):

$$F'_t = \frac{(\delta+r)(1-A)}{(1-u_1)} \qquad (9.3)$$

Equations (9.1) and (9.2) are similar to (7.1) and (7.2) respectively except for the treatment of the value of tax depreciation allowances. The value of tax depreciation allowances for investments during the holiday period are the discounted value of writeoffs that begin after the holiday is completed. This is quite unlike the case (equation (7.1) when the firm must writeoff capital during the holiday (and thus has only $(1-\alpha)^{t^*-t}$ units of capital invested at time t to writeoff). The second term in equations (9.1) and (9.2) are also similar in interpretation. They denote the tax penalty of investing in capital prior to the end of the holiday and taking depreciation allowances afterwards. If the firm could carry forward its tax deductions at a rate of interest, then this second term would disappear. Equations (9.3) and (7.3) are identical as one would expect.

If the firm is able to defer its tax depreciation until after the holiday is completed, capital investment may be subsidized especially if the firm is fully exempt ($u_0 = 0$). For example in the first term of equation (9.1) the firm is able to deduct its depreciation allowances at the rate u_1 which is higher than the tax on revenues (u_0). The only cost to the firm of investing in capital at time t ($< t^*$) is the loss in the present value of tax depreciation allowances by investing in capital as captured by the second term in equations (9.1) and (9.2) respectively.

In some countries, such as Côte d'Ivoire, the firm may choose whether to deduct or not its depreciation allowances during the holiday period. The choice made by the firm is determined by comparing the present value of tax depreciation allowances for each strategy. Under deferral, the present value of tax depreciation (denote A_d) is equal to that shown in equation (8) and under no deferral, the present value (A_{nd}) is that shown in equation (3). Deferral is preferred if $A_d - A_{nd} > 0$, implying $u_1(\beta+Z) - u_0Z[1-\alpha]t^{*-t} > 0$. Given that $u_1 > u_0$, $\beta \geq 0$ and $(1-\alpha) < 1$, it is clear that deferral is always preferred. This is a useful result for empirical work presented later in that it can be assumed that a Côte d'Ivoire firm that is given only a partial exemption during the last three years of the holiday, would still prefer to defer its depreciation deductions.

(ii) Associated Non-Tax Holiday Firms

Tax holidays in many countries are given to designated firms that may be owned in association with other taxpaying firms. As result, there is a clear incentive for owners to shift income from taxpaying into tax holiday entities and similarly, shift tax deductible costs from tax holiday to taxpaying firms to minimize corporate tax payments. For example, one strategy would involve intercorporate transfer pricing. Transacted prices of goods and

services sold by a tax holiday firm to a taxpaying one can be overstated, thus allowing the firms to pass taxable income from the taxpaying firm to the tax holiday one (and vice versa if goods and services are sold from the associated taxpaying company to the tax holiday firm).

Unless tax administrators institute and enforce "tax-avoidance" rules, tax holidays provide significant advantages for investments undertaken by associated taxpaying firms. This argument can be elaborated upon by considering the following case which assumes that the post-tax holiday regime is the same that applying to all taxpaying firms.[13]

Suppose that the proportion, κ, of net revenues is shifted from taxpaying to non-taxpaying firms (but not so much that the taxpaying firm becomes a tax loss company). This implies that the effective statutory tax rate that is applied to the net revenues earned by the taxpaying company is $\mu = \kappa u_0 + (1-\kappa)u_1$. Since tax depreciation is deductible at the rate u_1, the present value of tax allowances for the taxpaying firm is $A = u_1[\beta + Z]$. Thus the user cost of capital for the taxpaying firm takes into account the low tax on the firm's net revenues. This implies the following cost of capital:

$$F' = \frac{(\delta+r)(1-u_1[\beta+Z])}{(1-\mu)} \tag{10}$$

Since $\mu < u_1$, capital investment undertaken by the taxpaying firm is encouraged by shifting net revenues into the associated tax holiday firm.

If a tax holiday firm is associated with a taxpaying firm, its investment decision is only affected to the extent that the firm can shift depreciation deductions to the taxpaying company. The discussion below applies

---

13/ As surveyed in Section II, several of the countries may give other tax incentives to non-tax holiday firms thus making post-holiday tax regimes different than the tax regime faced by associated taxpaying companies.

to both cases which involve either mandatory or permissive tax depreciation deductions. This can be achieved through leasing arrangements which allow the taxpaying company to own the capital (and deduct depreciation) and receive a taxable lease payment for use of the capital by the tax holiday firm. The tax holiday firm, however, can only deduct the lease payment at its effective statutory tax rate which could, in fact, be zero. Thus, since the asset held by the taxpaying company is fully taxed, the only tax minimizing strategy that can work is for the lease payment to be less than amount of depreciation deducted so that the taxpaying company incurs a taxable loss on the transaction. This "tax-avoidance" technique can be easily prohibited by requiring lease payments to be no less than the deductible costs incurred by the taxpaying company that holds the asset. If such a restriction applies, the capital stock decision made by the tax holiday firm is not affected at the margin.

The above discussion assumes that both types of associated firms do not incur taxable losses. In some countries, associated firms may have to consolidate accounts when losses are incurred so this may impact on the investment decisions of the two types of firms. If the taxable loss of the holiday firm is fully written off the income earned by an associated taxpaying firm, the holiday firm is able to transfer depreciation deductions to the non-holiday company. However, income is also transferred, and thus taxable, since the taxpaying firm adds the income to its own to determine the overall tax liability. If this happens every year during the tax holiday, the holiday firm's investment is taxed as if it were not in the holiday (again, assuming that post-holiday tax provisions are the same as those that apply to taxpaying firms in general). Thus the cost of capital for the tax holiday firm, for this particular case, is the same as that shown in equation (7.3).

If the tax loss is incurred by the taxpaying company and is written off against the income of the associated tax holiday firm, investment decisions made by the taxpaying company could be significantly affected. Without consolidation, a tax loss company may carry forward its tax losses for a maximum number of years, in some countries indefinitely. In present value terms, the tax benefit of marginal losses incurred in period t is the discounted value of tax writeoffs taken in th period t' when the firm becomes taxable. This implies that the tax on net revenues earned in period t by the tax loss firm is $v = u_1[1+i]^{-(t'-t)}$. As for depreciation, initial and annual allowances deductions are carried forward to t' and fully written off and remaining allowances are written off income after t'. Thus, the present value of depreciation deductions during the tax loss years is equal to $A_t = v\beta + v(1-s\beta)\{1-(1-\alpha)^{(t'-t)}\} + vZ(1-\alpha)^{t'-t}$. Without consolidation, the cost of capital for the tax loss company is the following (corresponding to equation (7.1)):

$$F'_t = \frac{(\delta+r)}{(1-v)}[1-A_t] + (1+r)\frac{(A_t-A_{t-1})}{(1-v)} \qquad (11)$$

If, however, the tax accounts of the associated companies must be consolidated, the non-holiday firm must deduct its loss against the income of the holiday firm which could be fully exempt from taxation. Since fewer losses are carried forward by the non-tax holiday firm, it becomes taxpaying earlier than t'. Thus, both current and future investment decisions of the non-tax holiday firm are affected by consolidation since future income is less sheltered from taxation.

When losses are transferred to the tax holiday firm that is fully exempt, the tax on income earned by the non-tax holiday firm is zero. As for depreciation deductions, there is some value still left to the non-tax holiday firm since non-transferred future annual depreciation allowances

remain deductible against future income. All this implies that, in expression (11), the discounted tax rate is $v=0$, and the present value of tax depreciation allowances is $A_t = u_1 Z[(1-\alpha)/(1+i)]^{t''-t}$ (t'' is the first year after t in which annual depreciation allowances are deductible by the taxpaying company). If assets, such as structures, are written off slowly over time, capital investment of the non-tax holiday firm could be encouraged if losses must be transferred to the tax holiday firm. However, future investment of the non-tax holiday firm is no longer sheltered from tax writeoffs so that it becomes more highly taxed as a result of consolidation.

(iii) Personal Taxation and Debt Policy

The analysis so far ignores both personal taxation and debt policy. To take both of these factors into account the model must be revised accordingly. This is done by first reformulating the firm's maximization problem to be one in which shareholders' equity is maximized rather than cash flows. The equity maximization problem is then converted into a value maximization problem which involves the firm discounting its cash flows by a discount rate that is a weighted average of the costs of debt and equity finance. As shown later, the discount rate actually varies over time because of the expected changes in tax rates after the holiday is terminated.

When a firm undertakes investment, it finances capital from three sources: retained earnings, debt and new equity issues. (The latter source of finance is ignored to simplify the presentation.)[14] Investors face

---

14/ Since dividends may be exempt during the holiday, new equity may be a favored source of finance during a holiday. It is quite easy to adjust the cost of capital of a holiday firm for new equity finance by letting the cost of finance faced by the firm to depend on the dividend tax rate faced by the shareholders. See Boadway [1988].

three types of personal taxation. The first is the tax on nominal interest income which is assumed to be levied at the rate m. The second is tax on dividends which is assumed to be levied at the rate θ_0 during the holiday and θ_1 after the holiday (note that the dividend tax rate is assumed to be net of dividend tax credits that may paid for integration of corporate and personal taxes). The third is the nominal capital gains tax that is assumed to levied at the rate c on an accrual basis.[15] At the individual level, interest, dividends and capital gains may be taxed at different rates according the individual's income and nationality. Below, it is assumed that investors in the tax holiday firm are identical and resident of the country.

In a capital market facing no imperfections such as credit rationing, shareholders are willing to hold equity at the margin if the net-of-tax dividends and capital gains earned by investing in equity equals the net-of-tax return on investing the same funds in a bond. This capital market constraint holds each period during and after the holiday period and is written as follows:

$$i(1-m)E_t = (1-\theta_{t+1})D_{t+1} + (1-c)[E_{t+1} - E_t] \qquad (12)$$

with $\theta_t=\theta_0$ for $t<t^*$ and $\theta_t = \theta_1$ for $t\geq t^*$. The dividend in each period is equal to the nominal net-of-corporate tax cash flow of the firm, X_t, plus new bond issues (used to finance capital acquired in period t) less net-of-corporate tax interest payments:

$$D_t = X_t + B_{t+1} - B_t - i(1-u_t)B_t \qquad (13)$$

15/ Unless capital gains are exempt from taxation, most countries tax capital gains on a realization basis. The accrual tax rate is derived by calculating the present value equivalent of capital gains taxes paid when the asset is disposed. See Auerbach [1983] for a discussion of this.

where $u_t=u_0$ for $t<t^*$ and $u_t=u_1$ for $t\geq t^*$. Cash flow (arising from transactions in real goods) is equal to nominal revenues net of nominal gross investment and corporate tax payments (the latter is the tax on revenues net of capital cost allowances):

$$X_t = (1+\pi)^t F[K_t](1-u_t) - (1+\pi)^t(K_{t+1}-K_t+\delta K_t)(1-u_t\beta) + u_t\alpha K'_t \qquad (14)$$

Note that K'_t is the UCC base for annual depreciation allowances.[16]

With differential taxation of capital income both at the company and personal level, there is an incentive for firms to issue securities which bear the least tax paid by investors. If equity income bears little tax relative to bonds, equity finance would be preferred and vice versa. In the model below, only retentions and bond finance are considered. Since dividend taxes are capitalized in share values, they have no impact on the marginal finance decisions.[17] On the other hand, capital gains taxes are relevant since the retention of profits increase the value of shares that are assumed to be taxed at the individual level at the rate c. Thus,

---

16/ The UCC base at time t, assuming no deferral of allowance, is equal to the following:

$$K'_t = K'_0(1-\alpha)^t + \sum_{s=0}^{t} (1-f\beta)(1+\pi)^s(K_{t+1}-K_t+\delta K_t)(1-\alpha)^{t-s}.$$

This equation, describing the nominal value of the UCC base, is used to compute the present value of tax depreciation allowances.

17/ The relevant personal tax rate on equity income depends on the view taken regarding the role of dividends in a financial model. One view, due to Auerbach [1979] is that the dividend tax is full capitalized in share values. If the firm uses retentions as a source of finance, the relevant tax rate is c. If dividends convey information to the market, the effective personal tax rate on equity income may be a weighted average of personal dividend and capital gains taxes (Poterba and Summers [1985]). Below, we assume "tax capitalization" of dividend taxes so that only the capital gains tax rate is relevant at the margin. If new equity is issued, the personal dividend tax would directly financial decisions.

the effective tax on a unit of retained profit is $u_t+(1-u_t)c$ and on bond interest m. Since equity income is taxed less during the holiday, a firm would favour equity finance compared to the period after the holiday.

If there were no cost to issuing different types of securities, only one least-taxed source of finance would be used-retentions or debt. However, securities are issued at cost so that the firms must minimize the cost of financial funds trading off tax benefits with other attendant costs. For example, debt may increase the cost of bankruptcy so it is unlikely that capital would be fully debt financed. This suggests that an optimal debt policy may exist although differing in the pre- and post-holiday periods. Without deriving an optimal debt policy, we assume that the firm finances itself keeping the its optimal debt-value ratio (denoted γ_t) constant in each regime: pre- and post-tax holiday. Note that the firm's value at each point of time, denoted V_t, is the sum of the "market" value of debt and equity.[18] There are thus two optimal financial policies in each period such that ($\gamma_0 < \gamma_1$).

These assumptions regarding financial policy may be used to derive a value maximization problem for the firm. If equation (13) is substituted into equation (12), it can be rearranged to obtain:

$$E_t[1+i(1-m)]+B_t[1+i(1-u_{t+1})]\frac{(1-\theta_{t+1})}{(1-c)} =$$

$$\frac{(1-\theta_{t+1})X_{t+1}}{(1-c)} + E_{t+1} + B_{t+1}\frac{(1-\theta_{t+1})}{(1-c)} \qquad (15)$$

18/ The financial policy of the firm is thus determined independently of the capital stock decision. This procedure is only valid for particular financial models. See Bartholdy, Fisher and Mintz [1987].

Let $V_t = E_t + B_t\ (1-\theta_{t+1})/(1-c)$ and $\gamma_t = B_t(1-\theta_{t+1})/(1-c)V_t$. The formulation of this problem requires one to interpret the "market" value of the firm carefully. The nominal value of bonds issued by the firm from the point of view of the equity investor must be corrected by the tax capitalization factor $(1-\theta_{t+1})/(1-c)$. The tax capitalization factor reflects the following. If the firm buys back its bonds in period t+1 that were issued period t (B_t), the value of equity falls by $(1-c)B_t$ but dividend payments increase by $(1-\theta_{t+1})B_t$. Thus the firm's value rises by $(1-\theta_{t+1})/(1-c)$ when the firm buys back one dollar of its bonds B_t.

The definition of V_t is substituted into equation (15) yielding:

$$V_t[1+R_t] = \frac{(1-\theta_{t+1})}{(1-c)} X_{t+1} + V_{t+1} \tag{16}$$

where $R_t = \gamma_t i(1-u_t) + (1-\gamma_t)i(1-m)/(1-c)$, the weighted average nominal net-of-corporate tax cost of equity and debt finance. Since tax rates and the weights only have values that differ according to when the firm is operating (pre- or post-tax holiday), R_t is only of two values, R_0 and R_1. Equation (16) holds at each point of time so it is straightforward to obtain the value maximization problem for the holiday firm that starts up at time t=0:

$$V_0 = \sum_{t=0}^{t^*-1} \frac{X_t(1-\theta_0)}{(1+R_0)^t(1-c)} + \sum_{t^*}^{\infty} \frac{X_t(1-\theta_1)}{(1+R_1)^t(1-c)} \varsigma_1 \tag{17}$$

$$\text{with } \varsigma_1 = \frac{(1+R_1)^{t^*}}{(1+R_0)^{t^*}}.$$

Equation (17) can be further manipulated by using the definition of the X_t and dividing terms by the price index $(1+\pi)^t$ to yield:

$$V_0 = \sum_{t=0}^{\infty} \frac{(1-\theta_t)\{F[K_t](1-u_t)-(K_{t+1}-K_t-\delta K_t)(1-A_t)}{(1-c)\ (1+r_t)^t} \varsigma_t$$

with $\varsigma_t = 1$ for $t<t^*$ and ς for $t\geq t_0$; $(1+r_t)^t = ((1+R_t)/(1+\pi))^t$ and

$$A_t = u_0\beta + [u_0 Z_0(1-Y_t) + u_1 Z_1 \frac{(1-\theta_1)Y_t}{(1-\theta_0)}] \qquad \text{for } t < t^*$$

$$A_t = u_1[\beta + Z_1] = A \qquad \text{for } t \geq t^* \qquad (18)$$

with $Z_t = (1-f\beta)(1+R_t)\alpha/(\alpha+R_t)$ and $Y_t = [(1-\alpha)/(1+R_0)]^{t^*-t}$.

The analysis of the previous section is repeated by finding the optimal choices for capital taking into account both personal taxes and financial policy. The user costs of capital for a firm during and at the end of its holiday are:

Holiday Period:

$$F'_t = \frac{(\delta+r_0)(1-A_t)}{(1-u_0)} + (1+r_0)\frac{(A_t-A_{t-1})}{(1-u_0)} \qquad (19.1)$$

End of Holiday:

$$F'_{t^*} = \frac{(\delta+r_0)(1-A)}{(1-u_1)} + (1+r_0)\frac{(A-A_{t^*-1}(1-\theta_1)/(1-\theta_0))}{(1-u_1)} \qquad (19.2)$$

The post-holiday period user cost of capital is the same as that derived earlier for equation (7.3) except that r is replaced by r_1 (the cost of finance is the weighted average cost of funds in the post-holiday period).

Expressions 19.1 and 19.2 are similar to 7.1 and 7.2 respectively except for three adjustments. First, the cost of finance is no longer the cost of equity finance; instead, it is now the weighted average cost of equity and debt finance during the holiday period. Second, the present value of tax depreciation allowance are discounted by the weighted average cost of finance rather than the cost of equity finance (with the discount rate varying from the holiday to post-tax holiday period). And third, the value of tax depreciation allowances are adjusted for the change in dividend tax rates from the holiday to post-tax holiday periods.

Although personal taxation and debt finance complicate the analysis, the results easily generalize. There are a few points that are worth noting. First, when the personal tax on dividends changes at the end of the holiday period, the dividend tax is not "lump sum" as found in the conventional analysis. A jump in the dividend tax directly affects the user cost of capital through depreciation deductions since they are less valuable after the holiday is terminated. Even though we began with the tax capitalization theory of dividend policy, we see that the dividend tax directly impacts on investment decisions. Second, the cost of capital is also affected by shifts in financial policy. Since debt interest deductions are less valuable during the holiday, the cost of funds is higher to the firm compared to the post-holiday period. This suggests that the firm investments during the holiday may not receive as much benefit as one might believe.

IV. EMPIRICAL ANALYSIS

In this section, the user cost of capital and effective tax rates for depreciable capital investments undertaken during and after the holiday period are estimated for the five countries described in Section II. These calculations are meant to be illustrative only since we lack the data needed for a more careful measurement of the user cost of capital. In particular, no country-specific data except for interest rates and inflation rates were available. Instead, we used data that were estimated for developed countries such as physical depreciation rates for capital. Certain developing country-specific corporate tax parameters were also used such as statutory corporate tax rates, dividend, tax rates and tax depreciation rates. However, no information was available regarding such items as the average length of tax

holidays, the weighted marginal dividend tax rate, and the distribution of machinery or building assets that is needed to calculate the average tax depreciation rate. Thus, the length of holidays, dividend tax rate and tax depreciation rates were chosen based on the country's tax code. It is also not known to what extent governments limit the number of times that a firm can claim a tax holiday. It is quite possible that the effective holidays may last longer than that indicated by statute.

In our estimates below, we assume that the rate of depreciation of buildings is 5% and machinery 15% on a declining balance basis.[19] We then convert straightline physical depreciation rates into declining balance rates using the well known approximation formula $\alpha=2/T$ (T denoting the life of the asset). As for debt-asset ratios of firms, we assume for one set of calculations that the firm finances capital during the holiday 50% by debt and after the holiday 75% by debt. Recent evidence[20] suggests that this would be reasonable to assume although it is clear that only country-specific information would be helpful in this regard.

Corporate tax rates and depreciation rates are based on 1987 tax law as reported by International Bureau of Fiscal Documentation. Tax depreciation rates of a straightline form are converted to declining balance depreciation rates when necessary. Depreciation is deferred until after the tax holiday for firms operating in Côte d'Ivoire and Malaysia.

19/ For Côte d'Ivoire, we assume that machinery, which generally includes vehicles and office furniture, depreciate at a 30% rate on a declining balance basis.

20/ See Bartholdy, Fisher and Mintz [1987] who estimate that a point increase in the corporate tax rate in Canada is associated with a three-quarter point increase in the debt-asset ratio.

Table II presents effective tax rates and user costs of capital for tax holiday investments that are assumed to be fully financed by equity. Note that personal taxes are ignored in this set of calculations.

For the five countries that are considered, effective tax rates on capital during a tax holiday (except for the final year) are generally below those that are faced by the firm after the holiday. This is not entirely surprising. What is surprising, however, is that the effective tax rates on capital during the holiday are generally high and positive in value. The implication of this is that there is rather large tax penalty arising from insufficient tax depreciation deductions taken after the holiday for investments made during the holiday. This tax penalty is highest in those countries with high inflation rates (Morocco and Bangladesh) and with tax provisions that require capital to be quickly written off during the holiday (Bangladesh). If, however, a country allows firms to defer tax depreciation until after the holiday, capital is taxed at a lower rate or subsidized (as indicated by negative effective tax rates). This particularly applies to Côte d'Ivoire and to a lesser extent Malaysia.

Table II also indicates that effective tax rates imposed on firms at the end of the tax holiday are particularly high. At this point, the firms are investing in new capital just before the end of the tax holiday but income earned is fully taxed after the holiday is terminated. Even in those countries that allow depreciation to be deferred, the firm does not get much benefit from this provision in the final year of the holiday since the allowances cannot be carried forward at a rate of interest. These extraordinarily high effective tax rates severely affect investment. In fact, the firm is selling off capital stock before the holiday is terminated and increases its capital stock after the holiday is completed.

TABLE II. Effective Tax Rates and User Costs of Capital for Holiday and Post Holiday Investments

(100% Equity Finance)

Effective Tax Rate a/

	Bangladesh (t=7)		Côte d'Ivoire (t=7)		Malaysia (t=7)		Morocco (t=10) Zone 3		Morocco (t=10) Zone 4		Thailand (t=5)	
	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery
During Holiday												
t = 0	15.7%	6.3%	-1.1%	-900.8%	-1.9%	-44.1%	28.0%	28.8%	1.4%	0.8%	0.4%	0.4%
t = 3	30.9%	22.4%	1.5%	610.4%	-2.7%	-76.2%	28.3%	29.2%	2.8%	2.1%	0.7%	1.0%
t = 5	44.6%	43.3%	1.8%	325.0%	-3.4%	-119.9%	28.7%	29.8%	3.8%	3.7%		
t = 8							29.7%	31.7%	6.2%	8.9%		
End of Holiday	89.1%	93.0%	56.0%	61.6%	51.5%	51.1%	59.1%	68.2%	63.9%	75.7%	41.9%	51.7%
Post Holiday	44.6%	46.7%	45.2%	34.9%	36.9%	8.4%	53.0%	54.3%	53.0%	54.3%	34.6%	32.9%

User Costs of Capital a/

	Bangladesh (t=7)		Côte d'Ivoire (t=7)		Malaysia (t=7)		Morocco (t=10) Zone 3		Morocco (t=10) Zone 4		Thailand (t=5)	
	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery
During Holiday												
t = 0	8.6%	18.2%	10.1%	30.5%	13.0%	20.6%	16.5%	26.7%	13.4%	23.4%	21.2%	31.2%
t = 3	9.3%	18.9%	10.1%	29.0%	12.9%	19.6%	16.6%	26.0%	13.8%	23.8%	21.2%	31.3%
t = 5	10.4%	20.3%	10.1%	27.7%	12.9%	18.7%	16.7%	26.6%	13.8%	23.6%		
t = 8							16.8%	27.2%	13.9%	24.1%		
End of Holiday	30.2%	57.7%	18.8%	43.5%	21.6%	31.6%	25.3%	41.1%	20.0%	49.1%	32.7%	48.4%
Post Holiday	20.4%	20.6%	14.5%	36.0%	17.9%	23.9%	22.7%	30.2%	22.7%	33.2%	29.6%	39.2%
Nominal Interest Rate	14.0%		9.9%		12.2%		15.5%				18.6%	
Inflation Rate	11.0%		4.7%		4.1%		7.2%				2.5%	

a/ Estimated as $t=(F'-\delta-r)/(F'-\delta)$ $(F'-\delta$ is the marginal gross-of-tax and r is net-of-tax rate of return on capital. The user cost of capital is equal to F', the value of marginal product earned by capital.

b/ Effective tax rate is highly negative.

These results can be quite sensitive to the degree to which firms finance capital by equity. In Table III, we allow for debt finance using the debt-asset ratios referred to earlier. In the case of Thailand, we also incorporate the exemption of dividends at the personal level during the tax holiday. Since the same exemption is not given to foreign investors, we effectively assume for these calculations that cost of equity finance for the firm is affected by personal taxes imposed on domestic investors.[21] Otherwise, domestic personal taxes could be ignored since they only affect the ownership of domestic assets rather than investment decisions of firms.

Since nominal interest costs are deductible from the corporate tax base, it is not surprising to find the user costs of capital and effective tax rates are much lower in Table III compared to Table II in the post-holiday period for all countries. It is well known that interest deductions can be quite generous to the firm since the deductibility of nominal interest payments allows the firm to writeoff part of the real value of the debt's principal. Of more interest, the incorporation of debt finance in the measures affects the relative ranking of tax rates during and after the firm's holiday. Since interest deductions are beneficial only after the holiday period, the effective tax rate may be higher during and at the end of the holiday than in the post-holiday period. As seen in Table III, effective tax rates on capital during the holiday are higher than those after the holiday for Morocco structure (Zone III) and Bangladesh. End of holiday investments also bear a high tax penalty for the same reasons cited earlier when Table II was discussed.

21/ In an open economy, equity financing may be available from the international market. If so, personal taxes imposed on domestic savers may only affect savings rather than the cost of finance faced by the firm that is determined exogenously in the international market.

TABLE III. Effective Tax Rates and User Costs of Capital for Holiday and Post Holiday Investments

(Debt Finance Case)

Effective Tax Rate

	Bangladesh (t=7)		Côte d'Ivoire (t=7)		Malaysia (t=7)		Morocco (t=10) Zone 3		Morocco (t=10) Zone 4		Thailand (t=5)	
	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery
During Holiday												
t = 0	30.9%	13.0%	-1.7%	-532.8%	-2.1%	-48.9%	5.9%	8.8%	2.7%	1.4%	0.8%	0.4%
t = 3	51.0%	38.3%	-2.2%	-269.4%	-3.0%	-81.5%	7.4%	9.6%	4.6%	3.3%	0.8%	1.1%
t = 5	64.8%	61.8%	-2.8%	-212.8%	-3.7%	-124.0%	8.8%	11.6%	6.8%	5.8%	1.3%	2.1%
t = 8	80.9%	87.0%	-3.4%	-169.8%	-5.1%	-312.3%	11.8%	16.3%	10.7%	13.0%	2.3%	5.3%
End of Holiday	90.8%	94.4%	53.6%	58.4%	48.6%	46.8%	58.8%	72.0%	63.4%	76.2%	50.5%	82.4%
Post Holiday	225.1%	301.0%	-13.8%	-34.7%	-17.2%	-114.8%	-29.3%	-7.8%	-29.3%	-7.8%	4.6%	2.6%

User Costs of Capital a/

	Bangladesh (t=7)		Côte d'Ivoire (t=7)		Malaysia (t=7)		Morocco (t=10) Zone 3		Morocco (t=10) Zone 4		Thailand (t=5)	
	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery	Buildings	Machinery
During Holiday												
t = 0	7.3%	16.8%	9.1%	29.0%	11.8%	19.0%	12.2%	22.4%	11.9%	21.8%	19.3%	29.3%
t = 3	8.3%	17.6%	9.1%	27.5%	11.7%	18.9%	12.3%	22.5%	12.1%	22.0%	19.4%	29.4%
t = 5	9.5%	19.2%	9.1%	26.3%	11.7%	18.1%	12.4%	22.6%	12.2%	22.4%	19.4%	29.6%
t = 8	13.4%	27.3%	9.1%	24.0%	11.6%	18.7%	12.7%	23.1%	12.6%	22.8%	19.6%	30.0%
End of Holiday	29.1%	56.2%	15.1%	41.3%	19.7%	29.1%	23.2%	41.6%	25.6%	46.7%	35.7%	55.4%
Post Holiday	8.2%	13.9%	9.1%	39.5%	11.4%	18.3%	10.6%	22.0%	10.8%	22.0%	20.9%	30.6%

V. CONCLUSIONS

The tax holiday provisions for long term investment are not as generous to the firm as one might initially conclude. Even if the firm is fully exempt during the holiday, its investment decision may be significantly affected by taxation during the holiday. As argued earlier, a firm that must write off tax depreciation allowances during the holiday may face a relatively high effective tax rate since the allowances that remain after the holiday may be inadequate relative to the income-generating capacity of the asset. Although effective tax rates during the tax holiday are generally lower than those imposed after the tax holiday, the holiday effective tax rates are far different from zero. Only when the firm is allowed to defer depreciation until after the holiday do effective tax rates become low or negative. In some cases, when deferral is allowed, the effective subsidy is so large that perhaps authorities would be taken aback by the generosity of the tax holiday.

A corporate tax holiday may also be generous to firms that use non-depreciable factors of production such as land and inventories since these investments are generally tax exempt (except for the last period of the holiday). The holiday may be generous as well to labor if such labor is compensated by profit distributions that may be exempt at the individual level. Moreover, the holiday provides tax planning opportunities for investors that may try to shift taxable income earned by associated companies into the tax holiday firm.

If the object is to encourage investment in structures and other durable capital, the tax holiday seems to be a very poor tax incentive at least relative to other potential tax incentives. Long term investment would be encouraged with accelerated depreciation or an investment tax credit that could lead to zero or negative effective tax rates. The loss in tax revenue would be

significantly lower for these other tax incentives since, unlike the tax holiday, taxes remain on other assets used by the firm. In fact, an investment tax credit or an investment allowance that applies to capital expenditures can induce the same amount of new long term investment but at less revenue cost compared to a tax holiday since the tax holiday allows firms to earn rents without paying taxes. This issue, however, goes beyond the scope of this paper.

As a final point, there are a few technical issues that should be briefly mentioned. The first is the impact of tax holidays on foreign investment which may taxed by both the capital-importing and capital-exporting countries. Although the theory developed in this paper could be easily generalized for this case, an empirical application would require measuring the the cost of funds for a foreign company. The second issue is with respect to imperfections in capital markets. The theory is based on households earning the same net-of-tax rates of return on assets in perfect markets. If investors are constrained in borrowing funds to finance equity investments, the standard capital market equilibrium does not apply. This is a general issue that is relevant to the current effective tax rate literature as applied to LDCs. The third issue is with respect to "recapture" rules that apply to the sale of assets by corporations. The theory in this paper assumes that the sale of an asset by a firm reduces the base used to calculate depreciation writeoffs. However, the treatment of depreciation in most tax systems is not symmetrical with regard to the sale and purchase of assets. If the firm sells an asset a "balancing charge" is imposed that may require the inclusion of the sale value of the asset (net of unclaimed tax depreciation) in the income of the corporation which is far less generous than writing down the undepreciated

capital base. Since a tax holiday firm is expected to spin off its capital particularly at the end of the holiday, a more carefully worked out theory would include "balancing charges". However, this suggests that the effective tax rates estimated in this paper are, if anything, underestimated if "recapture" rules were modelled correctly.

Bibliography

Agell, Nils J., "Subsidy to Capital Through Tax Incentives in the Asean Countries: An Application of the Cost of Capital Under Inflation Situations", International Monetary Fund, Fiscal Affairs Working Paper, 1982.

Auerbach, Alan J., "Wealth Maximization and the Cost of Capital", Quarterly Journal of Economics, 93, 1979, 433-56.

Auerbach, Alan J., "Taxation, Corporate Financial Policy and the Cost of Capital", Journal of Economic Literature, 21, 1983, 905-940.

Bartholdy, Jan, Gordon Fisher and Jack Mintz, "Taxation and the Financial Policy of firms: Theory and Empirical Applications to Canada", Economic Council of Canada, Discussion Paper, 324, 1987.

Boadway, Robin W., "The Theory and Measurement of Effective Tax Rates", in The Impact of Taxation on Business Activity, ed. by Jack M. Mintz and Douglas D. Purvis, John Deutsch Institute, 1988.

Boadway, Robin W. and Neil Bruce, "Depreciation and Interest Deductions and the Effect of the Corporation Income Tax on Investment", Journal of Public Economics, 11, 1979, 93-105.

Boadway, R.W., N. Bruce and J.M. Mintz, "Taxation, Inflation, and the Marginal Tax Rate on Capital in Canada", Canadian Journal of Economics, 17, 1984, 62-79.

Bond, Eric, "Tax Holidays and Industry Behavior", The Review of Economics and Statistics, 63, February 1981, 88-95.

Bond, Eric W. and Larry Samuelson, "Tax Holdings as Signals", American Economic Review, 76, 1986, 820-26.

Doyle, Chris and Sweder van Wijnbergen, "Taxation of Foreign Multinationals: A Sequential Bargaining Approach to Tax Holidays", Institute for International Economic Studies Seminar Paper No. 284, University of Stockholm, 1984.

King, M.A. and D. Fullerton, The Taxation of Income From Capital: A Comparative Study of the United States, the United Kingdom, Sweden and West Germany, University of Chicago Press, 1984.

Mintz, Jack M., "An Empirical Estimate of Corporate Tax Refundability and Effective Tax Rates", Quarterly Journal of Economics, 102, February 1988, 225-231.

Pellechio, Anthony J., Gerardo P. Sicat, and David G. Dunn, "Effective Tax Rates Under Varying Tax Incentives", DRD Discussion Paper #262, 1987.

Poterba, J. and L. Summers, "The Economic Effects of Dividend Taxation", in Recent Advances in Corporate Finance, ed. by E. Altman and M. Subrahmanyam, Richard Irwin, Norewood, Ill. 227-285.

Price, Waterhouse, Corporate Taxes: A Worldwide Summary, New York, 1986.

PPR Working Paper Series

	Title	Author	Date	Contact
WPS172	The Effects of Peru's Push to Improve Education	Elizabeth M. King Rosemary T. Bellew	March 1989	C. Cristobal 33640
WPS173	Staffing and Training Aspects of Hospital Management: Some Issues for Research	Julio Frenk Enrique Ruelas		
WPS174	Trade Restrictions with Imported Intermediate Inputs: When Does the Trade Balance Improve?	Ramon E. Lopez Dani Rodrik	March 1989	M. Ameal 61466
WPS175	An Integrated Model of Perennial and Annual Crop Production for Sub-Saharan Countries	Robert D. Weaver		
WPS176	Credit Rationing, Tenancy, Productivity, and the Dynamics of Inequality	Avishay Braverman Joseph E. Stiglitz		
WPS177	Cash-Flow or Income? The Choice of Base for Company Taxation	Jack M. Mintz Jesus Seade	April 1989	A. Bhalla 60359
WPS178	Tax Holidays and Investment	Jack M. Mintz	April 1989	A. Bhalla 60359
WPS179	Public Sector Pricing in a Fiscal Context	Christopher Heady	April 1989	A. Bhalla 60359
WPS180	Structural Changes in Metals Consumption: Evidence from U.S. Data	Boum-Jong Choe	April 1989	S. Lipscomb 33718
WPS181	Public Finance, Trade and Development: What Have We Learned?	Johannes F. Linn Deborah L. Wetzel	April 1989	M. Colinet 33490
WPS182	The Experience of Latin America With Export Subsidies	Julio Nogues	April 1989	S. Torrivos 33709
WPS183	Private Investment, Macromanagement and Trade Liberalization: The Case of Mexico	Alberto R. Musalem		

PPR Working Paper Series

	Title	Author	Date	Contact
WPS184	Women and Forestry: Operational Issues	Augusta Molnar		
WPS185	Uniform Trade Taxes, Devaluation, and the Real Exchange Rate: A Theoretical Analysis	Stephen A. O'Connell		
WPS186	The Uruguay Negotiations on Subsidies and Countervailing Measures: Past and Future Constraints	Patrick A. Messerlin	April 1989	S. Torrijos 33709
WPS187	The Flexibility of Wages When the Output Price Changes: An Empirical Study of 13 Industrial Countries*	Menahem Prywes	April 1989	J. Israel 31285
WPS188	International Comparisons of Wage and Non-Wage Costs of Labor	Luis A. Riveros		
WPS189	The Treatment of Companies under Cash Flow Taxes: Some Administrative, Transitional, and International Issues	Emil M. Sunley		
WPS190	Macro Performance Under Adjustment Lending	Riccardo Faini Jaime de Melo Abdel Senhadji-Semlali Julie Stanton	April 1989	M. Ameal 61466
WPS191	Openness, Outward Orientation, Trade Liberalization and Economic Performance in Developing Countries	Sebastian Edwards		
WPS192	Inflation, Price Controls and Fiscal Adjustment: The Case of Zimbabwe	Ajay Chhibber Joaquin Cottani Reza Firuzabadi Michael Walton		
WPS193	Bank Lending to Developing Countries in the 1980s: An Empirical Test of Major Hypotheses on Voluntary and Involuntary Lending	Peter Nunnenkamp		
WPS194	Efficient Debt Reduction	Jeffrey Sachs		
WPS195	Commercial Bank Claims on Developing Countries: How Have Banks Been Affected?	Harry Huizinga		