

Contrasting Corporate Tax Policies: Canada and Taiwan

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PRÉCIS

Cet article compare les politiques fiscales du Canada et de Taiwan en matière d'impôts sur les sociétés de même que celles de leurs principaux concurrents régionaux (les États-Unis pour le Canada, et Singapour, la Thaïlande et l'Indonésie pour Taiwan). L'article analyse trois questions importantes concernant les politiques fiscales appliquées aux sociétés : dans quelle mesure un régime donné d'impôts sur les sociétés produit-il des revenus, dans quelle mesure l'utilise-t-on dans le cadre d'une politique industrielle, et dans quelle mesure est-il concurrentiel pour ce qui est d'attirer des capitaux étrangers? Les taux d'intérêt réels ont été calculés pour chaque pays et ont servi à évaluer l'efficacité des politiques fiscales en termes des objectifs visés. Comme le montre cet article, le régime fiscal du Canada est axé sur la création de revenus, mais il n'est pas très efficace pour attirer les investissements étrangers ici plutôt qu'aux États-Unis. De son côté le régime de Taiwan est très concurrentiel par rapport aux régimes des autres pays du Sud-Est asiatique, mais beaucoup moins efficace que le régime canadien pour produire des revenus. L'article conclut en discutant des mérites et des coûts associés à l'utilisation d'une politique d'impôts sur les sociétés comme instrument de politique industrielle pour sélectionner les industries qui ont de l'avenir, et pour concurrencer son voisin face aux investissements étrangers.

ABSTRACT

This article compares the corporate tax policies of Canada and Taiwan with each other and with the policies of the two countries' regional competitors—the United States in the case of Canada and Singapore, Thailand, and Indonesia in the case of Taiwan. The article examines three corporate tax policy issues: the extent to which a given corporate tax regime generates revenue, the extent to which the tax regime is used as an instrument of industrial policy, and the

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competitiveness of the tax regime. Effective tax rates are computed for all countries and used to evaluate the effectiveness of each country's tax policy in attaining its objectives. The article's results indicate that the Canadian tax regime is geared toward raising revenues and is not very effective as a means of competing for foreign investment with the United States. The Taiwanese regime, on the other hand, is very competitive relative to the regimes of the other Southeast Asian countries but is less effective than the Canadian regime as a means of raising revenue. The article concludes with a discussion of the merits and costs of using corporate tax policy as an industrial policy instrument in order to pick "winning" industries and compete within a given geographic region for capital.

INTRODUCTION

There has been a conspicuous movement throughout the world in recent years toward the liberalization of finance and trade. Some of the consequences of this movement have been an increase in the mobility of capital and goods within the European Economic Community; the free trade agreement between Canada and the United States, which may soon include Mexico as well; and the recent talks regarding the possible creation of new trading relations among the countries of the Pacific region. The overriding motive that has led so many countries to pursue better trade relations and the liberalization of capital markets is a desire to increase the level of real income in their domestic economies.

As capital markets become more liberal and more closely integrated, however, capital flows across national boundaries become increasingly sensitive to the many different economic and political factors that affect the attractiveness of a potential host country for investment. This article will consider just one of these factors—taxation. Differences across countries in the taxation of investment can influence the movement of capital across national boundaries, and as capital flows become more sensitive to such differences countries make increasing use of tax policy as a means of competing for investment. Tax competition has become especially important for many of the smaller open economies. Taiwan is concerned about its ability to compete with other countries of the Pacific Rim; Canada must compete with its large neighbour to the south, the United States.

By the term, "tax competition" we mean the use of tax policy to attract capital from international markets. To be more specific, tax competition implies the use by a country of tax policies designed to ensure that the required rate of return of an investment is lower within its boundaries than it would be elsewhere.¹ The article compares the tax burdens on corporate

¹ An alternative definition of tax competition is the following: tax competition arises when a country adjusts its tax structures or rates in response to new tax policies adopted by other countries. What is important is that a tax policy in one country can affect the welfare of another country. For a detailed discussion of tax competition, see Jack M. Mintz, *Is There a Future for Capital Income Taxation?* OECD Economics Department Working Paper no. 108 (Paris: Organisation for Economic Co-operation and Development, 1992).

capital in Canada and Taiwan. In addition, because competition for investment is especially intense within regions, it also compares tax burdens in Taiwan with those in Indonesia, Singapore, and Thailand and tax burdens in Canada with those in the United States.

A tax policy designed to attract investment by reducing corporate tax burdens has both benefits and costs. Some benefits of attracting capital are the importation of managerial skills along with capital resources, the transfer of technology from abroad, and improved international linkages for exports. There is the danger, however, that tax concessions will ultimately result in a substantial revenue loss and hence in a shortfall in the resources needed to maintain and upgrade the country's infrastructure and to finance government goods and services. Most countries that operate as open economies attempt to strike a balance between the two opposing implications associated with tax concessions: attracting new skills and technology and losing revenue.

One highly relevant issue that corporate tax policy needs to address is the question of the extent to which capital should be taxed. A second issue is whether the corporate tax should be used only to raise revenue or as an instrument of industrial policy as well. Recent tax reforms in a number of industrialized countries have eliminated corporate tax incentives in favour of lower corporate tax rates, on the ground that tax policy should not distort the allocation of resources by markets. Canada has followed this philosophy of "levelling the playing field." There is no common agreement, however, that a corporate tax system should be neutral. Some countries continue to use corporate tax policy to favour some activities over others. Taiwan exemplifies this approach.

The remainder of the paper will concentrate on several issues. The next section discusses the determinants of investment and the methodology used in the article to compare tax burdens on investments made in specific countries. The third section considers the differences between the approaches to corporate tax policy taken by Canada and Taiwan. The fourth section provides an empirical analysis of how Canada's and Taiwan's corporate tax systems compare in their taxation of investment. The final section deals with lessons that can be learned from alternative approaches to corporate tax policy issues in the Canada-Taiwan context.

BACKGROUND

Before we examine the corporate tax structures of Taiwan and Canada, it will be useful to identify briefly some of the more important non-tax and tax factors that can affect the private sector investment decision.²

² For a more complete survey of the various tax and non-tax factors that affect investment, see Organisation for Economic Co-operation and Development, *Taxation and International Capital Flows: A Symposium of OECD and Non-OECD Countries* (Paris: OECD, 1990). For a detailed analysis of the non-tax factors, see Paul Halpern and Jack Mintz, "Taxation and Canada-U.S. Cross-Border Acquisitions" in Leonard Waverman, ed., *Corporate Globalization Through Mergers and Acquisitions* (Calgary: University of Calgary Press, 1991).

The non-tax factors that affect investment include the availability of skilled and unskilled labour, the size of the market, the supply of natural resources, and the potential for earning above-normal profits. It can be argued, however, that the most important non-tax factor is the host country's political environment. An unstable political environment creates uncertainty for businesses and increases the risk associated with an investment. Political factors that can plague investments include threats of expropriation and the possibility that existing policies will not prove stable, a possibility that creates uncertainty for businesses and thus affects expectations of the future and the risk associated with investments.

Another category of non-tax factors that affect the investment decision is that of non-tax forms of government intervention in markets. Regulations that restrict the repatriation of funds to foreign investors or that require minimum levels of local participation in capital funding or use of factors of production can deter investment. On the other hand, incentives such as guaranteed loans or cash grants can encourage investment. Regulations and non-tax incentives ultimately affect the costs associated with potential investment projects and the relative attractiveness of investing in one country rather than another.

Tax incentives for investment can take several forms. Perhaps the most visible and popular of the measures used by developing economies to entice investment is the tax holiday. Tax holidays specify a period during which the enterprise is either exempt from taxes or pays tax at a low rate. Two other popular tax incentives are the investment tax credit, which allows the investor to credit a pre-specified percentage of the acquisition cost of an asset against tax, and the investment tax allowance, which allows the investor to deduct a percentage of the cost from income. Similarly, many countries offer accelerated depreciation allowances as a means of reducing the corporate tax burden associated with investment projects. Other commonly used tax incentives are export allowances, tax abatements, and the expensing of capital and inventory according to methods that reduce a firm's tax burden in times of high inflation. Finally, a number of countries provide tax-free zones for exporting companies.

The intent of both tax and non-tax incentives is ultimately to reduce the corporate tax burden or operating costs of firms within the country that provides the incentives and thus increase the attractiveness of new investment prospects. We use two measures to assess the impact that tax incentives have on the tax competitiveness of the six countries discussed in this article: the cost of capital and the effective tax rate.³

The cost of capital is defined as the minimum required rate of return that an investment must earn to cover the operating costs⁴ associated with the

³ For further explanation of these measures, see Robin W. Boadway, Neil Bruce, and Jack M. Mintz, *Taxes on Capital Income in Canada: Analysis and Policy*, Canadian Tax Paper no. 80 (Toronto: Canadian Tax Foundation, 1987).

⁴ The operating costs include depreciation, inventory, financing (both interest on debt and the cost of equity), risk, and taxes.

investment. As defined, the cost of capital is adjusted for taxes by taking into account those tax provisions that affect it. The relevant tax provisions are the statutory corporate income tax rate; the present value of depreciation allowances for tax purposes; the valuation of inventory cost; and the deductibility of interest, unadjusted for inflation, from taxable income.

Given the differences in tax provisions across countries in regard to tax rates, writeoffs, and credits, it is helpful to have as well a summary measure that captures the impact of a tax system on the profitability of investments. This summary measure is the effective tax rate, which is calculated as the additional taxes paid as a percentage of gross-of-tax returns when the firm uses one more unit of capital. For example, if the before-tax rate of return on investments is 20 percent and the effective tax rate is 40 percent, then the after-tax rate of return is 12 percent.

TAX INCENTIVE SYSTEMS

Table 1 provides an overview of the tax incentives offered by each of the six countries considered in this article. Singapore, Thailand, and Taiwan all offer tax holidays of varying lengths. Taiwan and Singapore also offer tax allowances for investments in machinery, and Singapore extends this incentive to structures as well. Taiwan also offers accelerated depreciation incentives for qualifying firms. The other five countries do not offer accelerated depreciation allowances. Although this list of the tax incentives offered by the six countries is not exhaustive, it does capture the incentives that are most commonly applicable to new investment projects.

Table 1 Tax Incentives 1991

	Canada	United States	Taiwan	Singapore	Thailand	Indonesia
Tax holidays . . .	No	No	2-5 yrs.	2-10 yrs.	2-10 yrs.	No
Accelerated depreciation . . .	No	No	Machinery, 50%; buildings, 8%	No	No	No
Investment allowance	No	No	machinery, 10%	machinery, 10%; buildings, 25%	No	No
Inventory	FIFO	LIFO	FIFO	FIFO	FIFO	FIFO
Corporate tax rate	43% ^a	39% ^b	25%	32%	35%	35%

^aCombined federal-provincial corporate tax rate for large corporations across different industries. ^bCombined federal and state corporate tax rate.

Source: International Bureau of Fiscal Documentation, *Supplement*, various numbers and years.

Table 2 Tax Policy in Canada and Taiwan—Objectives and Constraints

Objective/constraints	Canada	Taiwan
Revenue raising	Yes	Yes
Industrial policy	No	Yes
Tax competition	Yes—USA	Yes -Singapore -Indonesia -Thailand -South Korea -Malaysia -Hong Kong

COMPARATIVE CORPORATE TAX POLICIES: CANADA AND TAIWAN

Canada's and Taiwan's corporate tax policies differ in their objectives, constraints, and results. Table 2 summarizes these differences.

One objective of corporate tax policy shared by Canada and Taiwan is the raising of revenue. The corporate income tax, if properly designed and implemented, is an ideal tax for raising large amounts of revenue. It can also be quite efficient⁵ if only rents, or above-normal risk-adjusted returns on capital, are taxed.

In Taiwan, but not in Canada, tax incentives are an integral part of industrial policy. To encourage the use of machinery, Taiwan's tax regime offers substantial incentives to firms that are capital-intensive in their production technology. For instance, a company that acquires machinery in order to adjust its capital/labour ratio or improve its production methods may depreciate its machinery fully in 2 years. In addition, if a capital acquisition does not qualify for the accelerated depreciation incentive, it may qualify for an investment allowance that is equal to 10 percent of the purchase cost of the machinery. Of the other five countries, only Singapore offers similar investment tax allowances for machinery. Taiwan also provides tax holidays of from 2 to 5 years for newly established enterprises. Qualifying enterprises must fall within 1 of 15 prescribed investment categories.⁶ Singapore and Thailand offer tax holidays of up to 10 years.

Canada offers few tax incentives other than relatively low corporate income tax rates for manufacturing (about 35 percent) and small businesses (about 25 percent). Like most other capital-importing countries, however, Canada competes with the United States for investments, a circumstance

⁵ A tax is deemed efficient if it does not affect the investment or financing decisions of the firm. Tax policy specialists have shown that a tax on the cash flow of a firm is neutral (cash flow is equal to revenue net of current and capital costs with no deduction for depreciation or interest). See David F. Bradford, *Untangling the Income Tax* (Cambridge, Mass.: Harvard University Press, 1986).

⁶ Manufacturing, mining, agriculture, hotels, fishing, transportation, warehousing, hotels, technical services, heavy machinery construction, and the construction of public facilities. Taiwan recently abolished tax holidays but is now reconsidering its decision.

that has led to a considerable degree of tax competition between the two countries. The United States has several advantages in this competition: it offers a lower statutory corporate tax rate (except in manufacturing) and a more generous schedule for the depreciation of machinery, and it permits the costing of inventories on a last-in-first-out (rather than a first-in-first-out) basis. Otherwise the two countries' corporate tax systems are very similar. The principal instrument used by Canada to compete in tax terms with the United States is the statutory corporate income tax rate, though Canada's concern with the statutory rate has more to do with the protection of tax revenues than with attracting capital: if the statutory rate in Canada were high relative to the rate in the United States, companies would have an incentive to take deductions in Canada and report taxable income in the United States.

Taiwan faces considerably more competition for capital within its geographic region than Canada does. Taiwan's major regional competitors are Singapore, Hong Kong, Thailand, Malaysia, Indonesia, and South Korea. The primary tax incentive used by Taiwan, apart from accelerated depreciation allowances and tax holidays, is a statutory corporate income tax rate that is lower than the statutory rates of its Southeast Asian competitors.

RESULTS

Tables 3 and 4 provide our estimates of the capital cost rates and effective tax rates for various sectors and types of assets in each of the six countries. The primary purpose of the analysis in this section is to determine, in the light of these results, the extent to which the Canadian and Taiwanese corporate tax regimes conform to their desired objectives, as discussed in the previous section.

To start with the revenue-raising objective, it is quite clear that Canada's corporate tax regime appears to be more effective than Taiwan's and those of the other Southeast Asian countries. Canada's aggregate effective tax rate is approximately 27 percent. Taiwan's aggregate effective tax rate is -0.3 percent, a figure that implies that the tax value of deductions under the

Table 3 Cost of Capital

	Canada	United States	Taiwan	Singapore	Thailand	Indonesia
				<i>percent</i>		
Agriculture	5.3	4.6	2.5	1.7	10.4	11.2
Manufacturing	7.2	5.2	3.1	1.7	10.2	11.6
Services	5.8	5.1	3.0	2.0	10.1	10.7
Buildings	6.2	5.4	3.2	2.4	9.5	10.3
Machinery	6.6	6.0	2.7	0.8	10.2	10.6
Inventories	8.6	4.4	3.4	2.8	10.7	14.7
Land	5.4	4.4	2.6	2.0	10.4	10.9
Total	6.8	5.1	2.9	1.8	10.2	11.3

Note: The cost of capital is net of economic depreciation.

Table 4 Effective Tax Rates

	Canada	United States	Taiwan	Singapore	Thailand	Indonesia
				<i>percent</i>		
Agriculture	12.5	15.6	9.8	-0.5	19.2	26.9
Manufacturing	34.6	26.5	-2.4	-35.6	7.6	11.3
Services	14.8	14.3	-17.9	-28.1	4.2	-2.2
Buildings	18.5	25.2	8.7	3.8	1.4	0.0
Machinery	25.4	31.2	-39.4	-206.6	6.9	1.3
Inventories	42.8	8.4	15.6	20.0	15.8	30.6
Land	10.3	10.0	8.1	4.5	14.2	26.3
Total	27.3	21.1	-0.3	-23.7	10.2	12.6

corporate income tax is slightly more, in present value terms, than the tax paid on revenues earned by a new investment over time. At the extreme is Singapore's aggregate effective tax rate of -24 percent.⁷

Several factors account for the differences in effective tax rates across countries. Canada's effective tax rate is high relative to the rates in Taiwan and Singapore because Canada offers few tax incentives. Taiwan's accelerated depreciation for machinery and its tax-holiday provision reduce the country's overall corporate tax burden and thus lower its aggregate effective tax rate. As a result of the depreciation incentives offered for the acquisition of machinery, the effective tax rate for machinery in Taiwan is considerably lower than the rates for other assets. Singapore has the lowest aggregate effective tax rates primarily because it offers the most generous depreciation incentives for both machinery and structures. Moreover, Singapore allows firms to postpone depreciation until a holiday is completed, and the maximum tax holiday is longer in Singapore (10 years) than it is in Taiwan (5 years).

Taiwan's corporate income tax regime stands out clearly from those of the country's Southeast Asian neighbours in the extent to which it favours investments in particular assets and industries. Only Singapore's capital cost rate for investments in machinery is lower than Taiwan's. In addition, of the asset categories we consider, machinery in Taiwan is the only one for which the effective tax rate is negative—that is, investment in machinery is subsidized. Finally, the effective tax rate for manufacturing in Taiwan is -2.4 percent, and the effective tax rate for the service sector is -17.9 percent. The effective tax rates for manufacturing and services are low mainly because these sectors are machinery-intensive and hence benefit more than other sectors do from the generous tax incentives offered to machinery. A second factor that lowers the cost of capital and effective tax rates for these sectors is their high debt/asset ratios—55 percent for services and 45 percent for

⁷ A negative effective tax rate, as in the case of Singapore, implies that the company must be able to deduct the full value of tax writeoffs against taxable income earned on all investments. If a company cannot take deductions and must therefore carry them forward at no rate of interest until a later year, the effective tax rate will less negative or even positive.

The methodology rests on a number of assumptions. First, we assumed that firms maximize profits—that is, that firms invest in capital until the marginal revenue product of capital equals the user cost of capital. We also assumed that firms choose the level of debt and equity that will minimize their cost of finance. Minimization of financing costs implies that firms issue debt until the marginal tax benefits from additional debt equal the marginal bankruptcy and agency cost associated with incremental debt. In addition, we treated the six countries studied—Taiwan, Canada, the United States, Thailand, Indonesia, and Singapore—as open economies. In an open economy, corporations can acquire financing from either the domestic market or the international market and the domestic market interest rate is determined by the international market.

We estimated the user cost of capital and effective tax rates for two different tax incentive schemes. Although the calculation of r , the after-corporate-tax rate of return gross of the personal taxes paid by the saver, remains constant across the six tax incentive schemes (for each industry within each country), the estimation of the user cost of capital and effective tax rates varies considerably from scheme to scheme.

The mathematical expression for the after-corporate-tax risk-adjusted rate of return on savings (gross of personal taxes) for each industry is

$$r = \beta i + (1 - \beta)g - p, \quad (1)$$

where i is the nominal interest rate, β is the portion of capital financed by debt, g is the nominal cost of equity finance, and p is the expected rate of inflation. The net return to savers, as formulated above, is essentially a weighted average of the after-corporate-tax rate of return available to savers from holding debt, βi ; corporate bonds; and equity, $(1 - \beta)g$. It is also important to note that at the margin the after-personal-tax rate of return earned by bonds must equal the after-personal-tax rate of return earned by equity. This relationship between the rate of return earned by bonds and the return earned by equity yields the following expression:

$$g = \frac{i(1 - m)}{1 - \theta}, \quad (2)$$

where m is the personal income tax paid on interest and θ is the tax on equity income, given that θ is a weighted average of personal tax rates on dividends and capital gains.

We defined the 1989 lending rate as the nominal interest rate and the annual change in the consumer price index (CPI) as the inflation rate. The data source for both variables, for all of the countries except Taiwan, was the International Monetary Fund.¹⁰ The source for the Taiwan data was the *Statistical Yearbook of the Republic of China*.¹¹ The 1990 Taiwan nominal

¹⁰ *International Financial Statistics*, monthly, various issues and tables.

¹¹ Republic of China (Taiwan), Directorate-General of Budget, Accounting and Statistics, *Statistical Yearbook of the Republic of China 1990* (Taipei: the directorate, 1990), various tables.

interest rate used in the calculations was 9.1 percent. The expected inflation value used, 2.8 percent, was the three-year average forecast of the CPI estimated by a first-order auto-regressive model.

For all of the countries except Canada and the United States, our source of data for the debt/asset ratio, β , was the Bank Negara Malaysia.¹² Our source for the US and Canadian debt/asset ratios was the Canadian Department of Finance. The components of the debt data were debentures and loan stocks, term loans from financial institutions, loans and advancements from headquarters and subsidiaries, short-term borrowing, and other creditors. We estimated the debt/asset ratio for each of the three sectors.

We obtained the statutory annual depreciation rates and the relevant tax rates, such as the corporate, income, and dividend tax rates, from the International Bureau of Fiscal Documentation.¹³

Absence of Incentives

For a profit-maximizing firm, capital is acquired until the marginal revenue earned on capital equals the user cost of capital. The user cost of capital, for buildings and machinery, is mathematically defined as

$$F^* = \frac{(\delta + r')(1 - A)}{1 - u}, \quad (3)$$

where F^* is the marginal physical product per dollar of capital and δ is the economic depreciation rate. We modified the user cost of capital for Canada to account for capital taxes. The user cost of capital for Canada is defined as

$$\begin{aligned} F^*_{\text{CAN}} &= \frac{(\delta + r')(1 - A)}{1 - u} + \frac{t(r' + \delta)}{\alpha_2 + R} \\ &= \frac{\delta + r'}{1 - u} \left[1 - A + \frac{t(1 - u)}{\alpha_2 + R} \right]. \end{aligned} \quad (3.1)$$

The variable t represents the capital tax rate that varies by province. A , the per dollar present value of the tax depreciation allowances, is given by the following:

$$\begin{aligned} A &= u \left(a_1 + \frac{a_2}{\alpha_2 + R} \right) \\ &= u(a_1 + Z), \end{aligned} \quad (4)$$

¹² Bank Negara Malaysia, *Survey of Private Investment in Malaysia* (Kuala Lumpur: the bank, 1989), tables 3.0-3.6. We have not included Malaysia among the countries discussed in this article because recent changes in the Malaysian corporate tax make it difficult to compare the Malaysian regime with other regimes at this time.

¹³ International Bureau of Fiscal Documentation, *Supplement*, various numbers and years.

where a_1 is the initial writeoff of capital and a_2 is the annual declining balance depreciation rate. Z is the present value of annual depreciation allowances. R is the firm's nominal cost of financing, defined as follows:

$$R = \beta i(1 - u) + (1 - \beta)g + h, \quad (5)$$

$$r' = R - p.$$

The term h is the risk premium on capital and r' is the real cost of financing. For inventories, the user cost of capital, given a first-in-first-out (FIFO) system, consists of the cost of financing and the additional corporate taxes that apply to the inflationary appreciation of a firm's inventories, adjusted for the deductibility of the cost of borrowing. Under a last-in-first-out (LIFO) system, there is no taxation of inflationary gains arising from the holding of inventories. The user cost of capital for inventories is defined as follows:

$$F'_{\text{INV}} = \frac{r' + up\phi}{1 - u} + t, \quad (6)$$

such that $\phi = 1$ for FIFO and $\phi = 0$ for LIFO.

Given no economic depreciation and hence no tax depreciation allowances, the user cost of capital for land is expressed as follows:

$$F'_{\text{LAND}} = \frac{r'}{1 - u} \left[1 + \frac{t(1 - u)}{r' + p} \right], \quad (7)$$

We defined the effective corporate tax rate, U , as the difference between the cost of capital net of economic depreciation, r_g , and adjusted for risk, h , and the after-tax rate of return required to compensate savers for savings invested in the firm's particular capital. That is,

$$U = \frac{(r_g - r)}{r_g}, \quad (8)$$

where

$$r_g = F - \delta - h \quad (9)$$

and

$$r = \beta i + (1 - \beta)g - p. \quad (10)$$

We obtained depreciation rates for Canada and the United States from McKenzie and Mintz.¹⁴ For Canada, the rates used were 4 percent for buildings in the service and manufacturing sectors and 6 percent for buildings in the agriculture sector. For machinery, the figures were 16 percent for agriculture, 17 percent for manufacturing, and 22 percent for services. US depreciation rates were based on the modified accelerated cost recovery system (MACRS). Buildings are depreciated on a straightline basis for 31.5 years, and machinery is written off according to 3-, 5-, 7-, or 10-year categories. Effective rates of depreciation vary by industry and asset type. We set the

¹⁴ Kenneth McKenzie and Jack M. Mintz, "Tax Effects on the Cost of Capital: A Canada-United States Comparison," in John Shoven and John Whalley, eds., *Canadian-US Tax Comparisons* (Chicago: University of Chicago Press, forthcoming).

risk premium, h , at 0 percent for all countries and used a 40 percent leverage ratio.

In the cases of Taiwan, Thailand, Singapore, and Indonesia, we used a single depreciation rate for all four countries for each capital commodity (buildings and machinery) by sector. We calculated the rates by dividing the average annual replacement value of the capital stock in a given category (such as agricultural machinery) by the average annual value of the total assets in that category. We obtained the data for these calculations from the Bank Negara Malaysia.¹⁵ Our estimated economic depreciation rates for the four Asian countries were 10 percent for agricultural buildings, 4 percent for buildings used in manufacturing or the service sector, 24 percent for agricultural machinery, 13 percent for manufacturing-sector machinery, and 10 percent for machinery used in the service sector.

Accelerated Depreciation

In estimating the user cost of capital and the effective tax rates for the Taiwanese accelerated-depreciation-rate case, we used the same equations we had used in the absence-of-incentive situation but doubled the annual depreciation rates.

Tax Holidays

Of the five types of tax incentive schemes we considered, the one that added the most complexity to the analysis was the tax holiday, since it was necessary to take into account how long before the expiration of the tax holiday the investment was undertaken.

It will suffice to present the final form equations for the tax holiday cost of capital without deriving the underlying methodology.¹⁶ For Taiwan and Thailand, where there is no deferral of depreciation allowances, the following formulas apply:

$$F^* = \frac{(\delta + r_0)(1 - A_t)}{1 - u_0} + \frac{(1 + r_0)(A_t - A_{t-1})}{1 - u_0}, \quad (12)$$

where

$$A_t = u_0 \alpha_1 + \left[u_0 Z_0 (1 - Y_t) + u_1 Z_1 \left(\frac{1 - \theta_1}{1 - \theta_0} \right) Y_t \right] \quad (13)$$

for $t^* - t > 0$;

$$\frac{(1 - f\alpha_1)(1 + R_t)a_2}{a_2 + R_t}, \quad (14)$$

and

$$Y_t = \left(\frac{1 - a_2}{1 + R_0} \right)^{t-t^*}. \quad (15)$$

¹⁵ Supra footnote 12, tables 9.0-9.4.

¹⁶ For a derivation of results, see Jack M. Mintz, "Corporate Tax Holidays and Investment" (January 1990), 4 *The World Bank Economic Review* 81-102.

The term u_0 represents the corporate tax rate for the tax holiday period ($t^* - t > 0$) and is set to zero. The variable f represents the proportion of the initial allowance written off the undepreciable capital cost base. Throughout the study, f was set at zero to imply an absence of adjustment. R_t is the nominal weighted average net-of-corporate-tax cost of equity and debt financing. A_t is the present value of the tax depreciation allowances, and Y_t is the value of the depreciation deduction after the holiday, which is lower the earlier is the investment ($Y_t > Y_{t-1}$).

The tax-holiday user cost of capital, equation 12, consists essentially of two terms. The first represents the real cost of holding a unit of capital net of taxes; it consists of economic depreciation and financing cost adjusted for tax value of investment and depreciation allowances at time $t^*(1 - A_t)$. The second term captures the cost of purchasing capital in period $t - 1$ rather than period t .

The estimation of Singapore's tax holiday cost of capital involved one additional complication: the allowance for deferral of depreciation until after the tax holiday period. Singapore's user cost of capital is expressed by the following formulas:

$$F^* = \frac{\delta + r_0}{1 - u_0} [1 - u_1(a_1 + Z)(1 + R_0)^{t^* - t}] + \frac{R_0 u_1(a_1 + Z)(1 + R_0)^{-(t^* - t)}}{1 - u_0} \quad (16)$$

and

$$Z = (1 - a_1 f) \frac{a_2}{a_2 + R_0}, \quad (17)$$

where f represents the degree of deferral allowed for initial allowances; $f = 0$ implies no deferral and $f = 1$ represents the full deferral case. For Singapore, $f = 0$ for building and $f = 1$ for machinery. The interpretation of equation 16 is similar to that of equation 12 except in regard to the deferral of depreciation. In equation 16 (the first expression), the value of the tax depreciation allowances is the discounted value of the writeoffs that are deferred until after the holiday period. The second expression in the equation represents the tax penalty associated with investing in capital before the end of the tax-holiday period.

For all tax-holiday situations, the estimation of the effective tax rates followed the same set of equations as were followed in the absence-of-incentive case.

Aggregation

The aggregation of the effective tax rates for each type of capital stock and industry and the calculation of totals for each country involved, first, the individual weighting of r_g and r by the corresponding capital stock weight and, second, the use of equation 8 to determine the effective tax rates. The aggregation of the effective tax rates can be formally expressed as follows:

$$U^*_{ij} = \frac{\sum_{ij}(r_{gi}CSW_{ij}) - \sum_{ij}(r_{ij}CSW_{ij})}{\sum_{ij}(r_{gi}CSW_{ij})}$$

Table 5 Summary of Input Data—All Countries

Variable	Taiwan	Thailand	Indonesia	Singapore	Canada	United States
				<i>percent</i>		
a_1 —agriculture/ building	0	0	0	25	0	0
a_1 —agriculture/ machinery	10	0	0	10	0	0
a_1 —manufacturing/ building	0	0	0	25	0	0
a_1 —manufacturing/ machinery	10	0	0	10	0	0
a_1 —services/building	0	0	0	25	0	0
a_1 —services/ machinery	10	0	0	10	0	0
a_2 —agriculture/ building	6	5	10	5	8.5	5.8
a_2 —agriculture/ machinery	25	20	25	25	26	25.8
a_2 —manufacturing/ building	4	5	10	5	5.6	4.4
a_2 —manufacturing/ machinery	25	20	25	25	29	18.6
a_2 —services/building	4	5	10	5	8	2.9
a_2 —services/ machinery	25	20	25	25	29	23.2
u	25	35	35	32	43	39
m	40	20	30	30	25	31
i	6.5	15	21.8	6.5	11	8.3
p	2.07	3.9	7.9	3.1	5	4.2

Note: a_1 is the initial investment allowance, a_2 is the annual straight line book depreciation rate, u is the corporate income tax rate, m is the personal tax rate paid on interest income, i is the nominal interest rate, and p is the expected inflation rate.

where i represents the three industries and j the capital stocks. We obtained the capital stock data for each industry from the Bank Negara Malaysia¹⁷ and the Malaysian Industrial Development Authority.¹⁸ Because data for the countries considered here were unavailable, we used the Malaysian capital stock weights for all six countries.

Table 5 summarizes all of the relevant input data that we used in the user cost of capital and effective tax rate calculations for all six countries.

¹⁷ Supra footnote 12, tables 3.0-3.6.

¹⁸ Malaysian Industrial Development Authority, *1989 Annual Report*, various tables.