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ESSAYS ON THE TAXATION OF CAPITAL INCOME

by

Chairat Aemkulwat

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
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ABSTRACT

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This dissertation consists of three essays on the taxation of capital income. The first essay examines the effects of the interactions of home and host country tax provisions on capital investment decisions by a U.S. multinational before and after a capital-importing country switches from a conventional corporate income tax to a consumption-based business cash flow tax. The analysis considers the cases in which the U.S. deems the cash flow tax to be creditable, non-creditable or partially creditable. In addition, two methods of implementing a consumption-based business tax are considered — the R-base and the R+F-base — and the importance of the firm's choices between local debt finance and parent multinational finance is analyzed. A numerical application considers the case in which a U.S. multinational invests in Thailand.

The second essay examines the incidence of a general and a classified property tax, using an n-community, two-sector, three-factor general equilibrium model in which residents are assumed to benefit from property taxation. The government distributes residential tax revenues so that a worker, a capitalist or a landlord receives benefits equal to the amount of housing tax paid, and distributes commercial property tax revenues such that either each resident receives equal benefits, or only workers receive equal benefits.
Aggregate welfare depends on labor population and most of the tax burden is borne by the individuals whose resources are taxed.

The third essay provides a review of the literature on the optimal taxation of capital income in a small open economy setting and of the econometric evidence that examines the effects of taxation on business location decisions. Theoretical analyses generally suggest that the optimal tax on capital income is zero, although there are some exceptions. Various explanations of why capital may not be perfectly mobile are also discussed. In the econometric review, it is argued that if the tax has a negative effect on business location measures, the small open economy assumption is to some extent a valid proposition. The essay argues that this assumption is a valid one.
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My pursuit of a Ph.D. in economics would not occur without my mother's utmost value of education. My mother, Ma Pensri, desires her children to obtain the highest education possible. Ma Pensri has always inspired me with her love and words of encouragement that provide me inexhaustible strengths and will power to work hard for this degree and to believe that I can attain anything in life (and I will). I am thankful that I was born to be her son, and here, Ma Pensri, is a too small gift for you.

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To My Mother
Ma Pensri
CHAPTER ONE
INTRODUCTION

This dissertation contains three essays on the taxation of capital income. The first essay examines the effects of tax reforms on the user cost of capital and marginal effective tax rate for mature multinational subsidiaries. The second essay studies the incidence of a general and a classified property tax. The final essay reviews the literature on optimal taxation in a small open economy and the effects of taxation on business location decisions.

The first essay examines the user cost of capital and marginal effective tax rate for mature multinational subsidiaries when the capital importing (host) country switches from a conventional corporation income tax to a consumption-based or cash-flow tax (CFT) system in which total deductions for investment expenditures or immediate expensing, rather than depreciation, is allowed. Although the CFT is argued to be a nondistorting (or less distorting) tax that would promote domestic investment and savings, the issue of the creditability of foreign taxes in the U.S. (and other capital exporting countries) has always been a major concern among the countries that have considered the adoption of the consumption-based tax; all of these countries fear that the possible noncreditability of foreign taxes by the U.S. would sharply curtail foreign investment.

This essay therefore examines the effects on the user costs of capital and on marginal effective tax rates if the U.S. treats the foreign taxes assessed by a country switching to the CFT in one of three ways: (1) it allows "full" foreign tax credits for both foreign corporate taxes and dividend withholding taxes, (2) it allows for a partial credit system in which only dividend withholding taxes are creditable, and (3) it allows only a deduction for foreign taxes paid. Moreover, the analysis also incorporates two types of CFT systems — the R or "real" based CFT under which financial transactions such as interest expense and loan proceeds are ignored from the base, and the R+F or "real plus financial" based CFT under which financial transactions are included in the base.
The model utilized is based on Leechor and Mintz (1991, 1993). A numerical application is also examined; Thailand is chosen as the host country. In the analysis, the multinational firm’s discount rate is assumed to be either the cost of debt raised in Thailand or a fixed weighted average of the after-tax cost of debt and the cost of equity raised in the parent country.

Given a fixed discount rate, the analysis demonstrates the standard result that, since immediate expensing is more generous than depreciation, the marginal effective tax rates under the R-based and R+F-based CFT systems are much lower than under current Thai income tax, regardless of which U.S. foreign tax treatment is used. However, a rather counterintuitive result is also obtained. Specifically, after the host country switch to a CFT, the marginal effective tax rate under the fully creditable tax, which is commonly viewed as most generous of the three U.S. foreign tax treatments analyzed, is actually larger than those under the partial credit and the deduction methods. The essay provides sufficiency conditions for this surprising result to hold analytically. These conditions are that (1) the real discount rate is fixed, (2) the net-of-tax dividend payout ratios are equal, and (3) there is no inflation in the host and home countries.

When the firm uses the cost of debt raised in Thailand as the discount rate, another interesting result obtained is that the marginal effective tax rates under the R-based and R+F-based systems are higher than under current Thai income tax, regardless of which U.S. foreign tax treatment is used. The reason is due to the elimination of interest deductibility — explicitly under the R-based CFT or implicitly under the R+F-based CFT. Finally, the essay concludes that the summary estimates such as the user cost of capital and the marginal effective tax rate are very sensitive to the discount rate used by the firm; thus, foreign investment may be discouraged by one type of finance but may not by another type of finance.

The second essay analyzes the incidence of a general (uniform) and a classified property tax using an n-community, two-sector, three-factor general equilibrium model in
which residents of the taxing community benefit from public expenditures. This model is based on Lin (1986). Three innovations and modifications are made to Lin's model: (1) a social welfare function is introduced so that aggregate welfare, an alternative measure to the level of aggregate activity, can be examined, (2) the export sector good is produced by capital and labor, rather than land and labor as in Lin's model, and (3) commercial property taxation is introduced into the model, along with two types of distributions of commercial tax revenues — which are that every resident benefits from public expenditures by the same amount and that only workers benefit equally from the tax.

The goal of this essay is to extend the analyses of Lin (1986) and Sonstelie (1979). Sonstelie analyzes the incidence of the classified property tax system in which a community imposes a differentially higher tax on commercial properties, using a two-sector, two-factor model in which labor is excluded from the model. The weakness of his analysis is stated in his conclusion: "These results can only be regarded as tentative, however, because the model presented here fails to incorporate several factors of potential importance. Chief among these is the effect of classification on the return to labor." This shortcoming can be overcome by examining the effects of the differentially higher tax on commercial properties using Lin's formulation. With prefect competition, a constant-returns-to-scale production function and fixed export price, the analysis shows that wages decrease in the taxing community since the negative output effect on labor demand is very strong due to perfectly elastic demand of the export good, while wages increase in the rest of the nontaxing communities in the economy.

Since Lin analyzes the incidence of only the residential property tax, his model can be viewed as a classified property tax system in which a differentially higher tax on residential properties is imposed. To complete his analysis, the effects of the single-rate taxation on both residential and commercial properties are examined. This study is of practical importance, as most communities levy the property tax both on the residential and commercial properties at the same rate.
The analysis divides residents into three groups within each community: workers, capitalists, and landlords. The utility change for each income group is examined in terms of changes in factor return, housing price, and public expenditure benefit (if any). Under the cases examined, one strong result is that under either the classified or the general property tax, the individual whose resource is taxed is the one who bears the tax burden. Finally, the examination of the impact of property taxation on aggregate welfare provides an interesting result: if the change in labor population can be determined unambiguously, the change in aggregate welfare can also be determined unambiguously. This is a result of analyzing from the optimum in which initial taxes are zero and an assumption that all residents, except workers, are immobile in the model.

The final essay reviews theoretical analyses on the optimal taxation of capital income in a small open economy and econometric analyses that analyze the effects of taxation on business location decisions. There are two sections. The first examines whether the optimal tax for a small open economy — which is characterized as an economy facing a perfectly elastic supply of capital — should be zero, and discusses some explanations of why capital may not be perfectly mobile across countries. Most theoretical forecasts, in particular Gordon (1986) and Diamond and Mirrlees (1971), suggest that the optimal tax should be zero for a small open economy that takes world prices as given. The reason is that a capital tax imposed in a small open economy simply increases before-tax rate of return on capital by the amount of tax and thus other immobile factors (such as land) would be the ones that bear the tax burden. With less capital, the tax will incur excess burden to the economy and a tax on immobile factors is argued to be a more superior tax.

However, even if the economy is facing with a fixed world rate of capital return, some theoretical forecasts suggest nonzero taxation. The reasons hinge on certain specific assumptions made to the model. For example, capital income taxation may be optimal if the economy has a suboptimal level of capital, if the government is required to raise a targeted level of tax revenues exclusively through capital taxes, if capital accumulation is not fixed,
and if the economy has market power in the good market but is unwilling or unable to tax the relevant good directly.

The second section of this essay reviews the literature on econometric evidence that examines the effects of taxation on business location decisions. This provides some insights into whether the small open economy assumption is a valid proposition. This section is divided into examinations of the effects of state and local taxation on business location decisions in the U.S. and the impact of taxation on international business location decisions. Various measures for industrial location decisions are based on individual firm-level data such as single-establishment start-ups and branch openings and on aggregate measures such as investment, employment, output and personal income. Tax variables are based on statutory, average, relative and marginal effective tax rates or some combinations of these.

Most countries, or even states and localities, impose some form of tax on capital. It is argued that if the tax on capital has a detrimental effect on business location measures, then the small open economy assumption to some extent is a valid proposition. The review shows that not all studies strongly and unanimously support that taxes do affect business location decisions; however, all except Carlton (1979,1983) have at least one negative effect of a tax variable on some measure of business location. Moreover, the more recent and more carefully-modeled studies — for example, those based on pooled data and a series of studies by Papke, Slemrod (1991) and Shah and Slemrod (1991) who carefully define the tax variable using the marginal effective tax rate approach — appear to support the proposition that taxes discourage economic activity. The essay concludes that taxes do have a negative impact on the economy and therefore the small open economy is to some extent a valid one.
CHAPTER TWO
CREDIBILITY OF A CONSUMPTION-BASED TAX:
EFFECTS OF ALTERNATIVE HOME COUNTRY TAX TREATMENTS ON
INVESTMENT INCENTIVES

I. Introduction

The advantages of direct taxation on the basis of consumption rather than income have been discussed at length in the literature. Advocates of direct consumption-based taxes have argued that they are superior to income taxes in terms of fairness, simplicity of administration and compliance, and economic efficiency; in addition, many proponents of consumption taxes stress their beneficial effects on saving and investment, as the marginal effective tax rate on capital income under a consumption-based tax is zero (in a closed economy).\(^1\) Nevertheless, use of direct consumption taxes is very limited around the world.\(^2\) One critical reason that direct consumption taxes have not been adopted more widely is the concern that the U.S. would not deem the cash flow tax\(^3\) (CFT) assessed on businesses under a consumption-based tax system to be creditable against the domestic tax liability of U.S. multinational firms; for example, Mexico, Colombia and Bolivia have all recently contemplated a switch to a consumption-based business tax, but decided not to do so primarily out of concern regarding the double taxation of U.S. source income that would arise if the tax were deemed to be not creditable.\(^4\)

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\(^1\) For example, see Bradford (1986) and the papers in Pechman (1980) and Rose (1990); for a recent discussion, see Zodrow (forthcoming).
\(^2\) Croatia recently enacted a consumption-based tax, and Mexico applies such a tax to small businesses.
\(^3\) The essential feature of a cash flow tax is that all business-related non-financial purchases, including those of depreciable assets, are deducted immediately from the tax base, or "expensed". In addition, as discussed below, deductions for interest expense are either explicitly or implicitly denied. For a discussion of the economic effects of cash flow taxation, see Zodrow and McLure (1991).
\(^4\) The U.S. Internal Revenue Service has not issued a formal ruling on the creditability issue. McLure, Mutti, Thuronyi and Zodrow (1990) provide arguments for and against the creditability of consumption-based business taxes, and McLure (1990, p. 183) argues that it "would be mistake for several reasons" to deny the creditability. In contrast, McNulty (1990, p. 693) and Musgrave (1990, p. 478) argue that a consumption-based direct tax would not qualify for foreign tax credits under the U.S. tax law.
This essay examines the effects on the investment incentives facing a multinational whose home country is the U.S. when a host country adopts a consumption-based tax. Three different cases are analyzed: (1) the home country allows a foreign tax credit, (2) the home country allows only a deduction for foreign taxes paid, and (3) the home country provides for a "partial credit system," allowing only a credit for dividend withholding taxes.\(^5\) The emphasis will be on investment made by mature multinational subsidiaries under the deferral system, that is, firms whose income is taxed only when it is remitted to the home country. The model considers both of the types of CFTs commonly advocated — the "R" or "real" based CFT, under which interest income and expense and loan proceeds are ignored in determining tax liability, and the "R+F" or "real plus financial" based CFT, under which the tax base includes the proceeds of loans, interest income and repayments of loans extended, while deductions are allowed for interest expense and the repayment of loan principal, and for the amounts of loans extended.\(^6\) The differences between the host country tax systems and these three methods of the home country tax treatments are reflected in the user costs of capital and the discount rates of the firm derived below. The analysis considers two forms of finance — funds raised by the subsidiary through retained earnings and funds borrowed from financial institutions in the host country.

The results of the analysis are driven by the interactions of the host and home country taxes assessed on multinational subsidiary income. These interactions are rather complex since, in addition to the host country collecting taxes at source, the home country assesses domestic tax on foreign source income but also has provisions that reduce double taxation of foreign source income. These interactions are captured in the calculation of the user cost of capital — which is affected by both host and home country tax systems, including the deductions allowed for investment expenditures. In particular, a critical factor

\(^5\) Musgrave (1990) supports the partial credit system.

\(^6\) See the Meade Committee Report (Institute for Fiscal Studies, 1978), which shows that the two approaches are equivalent in present value terms under the appropriate circumstances.
in the user cost formula is the "dividend-payout ratio" or the fraction of taxable income (as defined by the home country) net of foreign taxes that is paid out as dividends.

For example, a marginal investment would generate nominal revenues as well as tax deductions allowed for investment expenditures. It is useful for purposes of exposition to separate the tax effects of the investment into revenue and deduction components. Consider first the contribution of revenues to the firm's tax burden. The host country includes the revenues in the corporate tax base and any earnings remitted will be subject to a further withholding tax; then, the home country will also tax the revenues but will at the same time provide some form of relief, such as a tax credit or a deduction, for taxes paid in the host country. In order to determine the amount of tax relief, the home country must specify the amount of the total host country corporate taxes paid that is deemed to be attributable to the remitted earnings. This is defined as the product of the "dividend payout ratio" defined above and total corporate taxes paid to the host country.

In order to understand the results derived below, it is important to note that by generating additional revenues, a marginal investment increases income net of foreign taxes paid and thus increases the denominator of the dividend payout ratio. This so-called "base-broadening effect" 7 reduces the dividend payout ratio and thus reduces the amount of income that is deemed to have been repatriated. (The base of the dividend payout ratio equals income less host country taxes paid; an increase in revenues raises the base of the dividend payout ratio and thus reduces dividend taxes attributed to remitted earnings.) Note that the base-broadening effect offsets the effects of taxes on the revenues and the associated dividends generated by the investment (the numerator of the dividend payout ratio).

At the same time, a marginal investment increases tax deductions. This reduces taxable income and dividends and generates an analogous "base-narrowing effect" (by reducing the taxable income term in the denominator of the dividend payout ratio); this

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increases the tax burden. As will be shown below, these effects — especially the base broadening effect — are critical in interpreting the user costs of capital for the multinational firm.

The main results of the essay are as follows. The first is rather counterintuitive. Specifically, in comparing the three types of alternative home country treatments after the host country switches to a consumption-based business tax, suppose that in the steady state (1) the discount rate of the firm is fixed, (2) the net-of-tax dividend payout ratios are equal, and (3) there is no inflation. Under these circumstances, the user cost of capital under the fully creditable tax method, which is commonly viewed as the most generous tax treatment, is actually greater than the costs of capital under both the partial credit and the deduction method. The rationale behind this surprising result is as follows.

Let first assume that in addition to no inflation, the host and home countries are under an income tax and allow firms to depreciate capital for tax purposes at the same rate. This leads to identical income tax bases and the net home country tax (or dividend repatriation tax) to be exogenous and independent of time under the three home tax treatments. Thus, the Hartman result is obtained in that only the host country's (not the home country's) tax provisions are relevant in multinational investment decisions. This result can also be shown using the steady-state user costs of capital. With no inflation and the steady-state assumption of zero growth in new investment (without restricting the value of the statutory depreciation rate), the steady-state host and home country tax bases are equal. The reason is that the firm only makes investment to replace worn-out capital; thus, with no inflation, different depreciation rates do not affect tax bases in the steady state. Thus, the steady state dividend repatriation tax equals \((u^*-u)/(1-u)\) under the fully creditable tax, \(u^*/(1-u)\) under the partial credit and \((u^*-u^*/u)/(1-u)\) under the deduction tax where \(u\) (\(u^*\)) is the host (home) corporate tax rate. Under these circumstances, the effective home country tax rate applied to nominal revenues, gross of deductions, equals zero and thus the

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8 See Leechor and Mintz (1993, Lemma 1, p. 85).
9 Note that the exposition ignores dividend withholding taxes.
only effective tax is the host corporate tax applied to nominal revenues. This occurs because the relatively low (high) home country effective tax rate applied to repatriated dividends under the credit system (other two systems) is offset exactly by a relatively small (large) base broadening effect.\textsuperscript{10} In addition, if depreciation rates are the same, the tax deductions allowed on repatriated dividends are also exactly offset by the base-narrowing effect, and the only tax deduction is the host depreciation. This lead to the Hartman result in which only host country tax provisions are relevant.

However, if the host country switches to a consumption-based business tax and the home country is under a corporation income tax system, with no inflation, the host and home tax bases are also identical in the steady-state. The reason is that with no inflation and no growth in new investment (i.e., firms simply make investment to replace obsolescent capital), the firm is indifference between deducting total amount of investment expenditures immediately and depreciation allowances; the steady-state dividend repatriation taxes therefore are as described above. This results in the effective home country tax rate applied to nominal revenues, gross of deductions, equal to zero, and the remaining tax is the host corporate tax as the effective home tax rate applied to repatriation dividends is exactly offset by the base-broadening effect. Thus, the determining factor of the user costs lies in the tax deductions allowed on investment expenditures since investment allowances are different under an income and a cash-flow tax system.

Consider first the case when the base-narrowing effect is ignored. In this case, the net tax deduction for investment expenditures is smaller under the fully creditable tax than under the partial credit and the deduction method. The reasons are as follows. Under all three home tax treatments, when the subsidiary deducts or expenses immediately the total amount of investment expenditures, it reduces taxes paid to the host country by an amount equal to the host corporate tax rate times the amount of investment. On the remitted income,

\textsuperscript{10} The base-broadening effect is defined by the base times the net home tax paid on a dollar of dividends. The net home tax on dividends or the "dividend repatriation tax" is lower under the fully creditable tax than under the other two tax treatments.
the home tax system allows depreciation allowances, which also reduces taxes by the home

corporate tax rate times the present value of home depreciation allowances. The differences
in the net tax deduction under the three home tax treatments lie on how tax relief is
provided. The net tax deduction is found to be the smallest under the fully creditable tax.
The reason is that an increase in immediate expensing results in a reduction in the host tax
liability which in turn reduces a credit or a deduction of foreign taxes. Since a reduction in
foreign tax credits would be greater than a reduction in foreign tax deductions, the net tax
deduction under the fully creditable tax would be smaller and thus the user cost of capital
would be larger than the cost of capital under the deduction method. Moreover, the net tax
deduction (cost of capital) under the partial credit is the largest (smallest) among the three
since this system does not provide for a credit or a deduction for corporate cash flow taxes
paid to the host country.\textsuperscript{11} Extending the analysis to include the base-narrowing effect does
not change the qualitative nature of the result as proved in Section III. This counterintuitive
result is also obtained in the numerical simulation when inflation rates in the host and home
countries are not equal to zero.

Second, in the numerical simulation in which Thailand is the host country, if the
multinational uses a fixed weighted average after-tax cost of debt and cost of equity raised
in the home country to discount a stream of net-of-tax dividends, the marginal effective tax
rate — which can be computed from the user cost of capital and fixed required real rate of
return to the U.S. international investor — would be lower after the switch to the R-based or
R+F-based CFT system than under current Thai income tax system, regardless of which tax
treatment is used by the home country. The main reason is that immediate expensing
allowed under a consumption-based business tax is much more generous than depreciation
allowances given under current Thai income tax.

\textsuperscript{11} The dividend withholding taxes do not affect the user cost of capital under the fully creditable tax and
the partial credit system. Note that a full credit of dividend withholding taxes is allowed under both
systems.
Third, the marginal effective tax rates under the R-based and R+F-based CFT are found to be roughly equal. This result is quite standard as the tax bases of these two CFT systems are theoretically equal under appropriate conditions. The reason they are not exactly equal in this analysis is that interest expense and new borrowing are not equal in the steady state.

Fourth, if the firm uses the cost of debt raised in Thailand as the discount rate, the marginal effective tax rates under the R-based and R+F-based system would be larger than the tax rate under current Thai income tax system, regardless of which tax treatment used by the home country. This result is due to the elimination of interest deductibility — explicitly under the R-based or implicitly under the R+F-based system — that considerably increases the marginal effective tax rates, despite more generous investment allowances through total deductions of investment expenditures, rather than depreciation, that tend to reduce the tax rates. Specifically, the combination of expensing and the denial of interest deductions under a consumption-based tax results in an entity-level tax rate of zero, while the combination of full deductibility of interest payments and depreciation deductions under current Thai income tax system results in a negative entity-level METR.

Finally, the marginal effective tax rates are found to be affected by the exchange (inflation) rate differential between countries and the personal tax rate system of the international investors (other than investment incentive effects) when the cost of Thai debt is used as the discount rate. This occurs because the assumption of open market arbitrage, where the U.S. international portfolio investors ensure that after-personal-tax Thai interest rate plus after-tax foreign currency gain or loss is equal to after-personal-tax U.S. interest rate, is used to determine the Thai interest rate. These effects are shown in the numerical simulation. Under the case in which the firm is in an excess foreign tax credit position or the home tax provisions are irrelevant, the marginal effective tax rates under the R-based and the R+F-based CFT are the same but would not equal to zero since the Thai interest rate

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used to find the user cost of capital is larger than the U.S. interest rate earned by the U.S. international investors. This occurs because Thai inflation is assumed to be larger and in the U.S. and the effective accrual tax rate on foreign currency gain is smaller than the personal tax rate on interest income. These effects have not been pointed out previously, although several numerical simulations such as those by McKenzie and Mintz (1992) and Leechor and Mintz (1991) use this arbitrage assumption in deriving the marginal effective tax rates.

The basic model is specified in the following section. Section III analyzes the effects of the three home country tax approaches outlined above using a user cost of capital approach, while Section IV examines the nature of the assumed financial equilibrium. Marginal effective tax rate (METR) calculations are presented in Section V for the various cases analyzed. These illustrate how investment incentives would be affected under the three alternative home country tax treatments noted above; the parameter values used assume that the host country is Thailand. To complete the analysis, Section VI calculates user costs of capital and METRs for multinational branches when tax deferral is no longer allowed, while concluding observations and directions for future research are provided in Section VII. Details of the derivations are provided in the appendix.

II. Model

The model assumes that a multinational firm resident in the home country invests in a host country by establishing a single affiliate (i.e., a subsidiary or branch). Both countries are initially under a corporate income tax system; the analysis considers the case in which the host country switches to a consumption-based system that includes a cash flow business tax. The model closely follows Leechor and Mintz (1991, 1993) which should be consulted for further details. Notation for the model is summarized in Table 2.1; note that (1) asterisks reflect quantities calculated in the home country currency, (2) the prices of output and capital are assumed to equal one at time \( t=0 \), and (3) the calculation of the exchange rate
\( x_t \) assumes purchasing power parity or \( x_t = e^{\pi_t^{*} / \pi_t} \), where \( \pi^{*} \) and \( \pi \) are the inflation rates of the home and the host countries at time \( t \).

The multinational firm is assumed to maximize the present value of the affiliate's remitted dividends, net of host and home taxes, discounted at rate \( \rho \):

\[
(2.1) \quad E_{0}^{*} = \int_{0}^{\infty} e^{ho t} (D_{t}^{*} (1-\theta) - T_{t}^{*} - c^{*} E_{t}^{*}) \, dt,
\]

where \( D_{t}^{*} \) is gross dividends remitted, \( \theta \) is the withholding tax rate in the host country, \( T_{t}^{*} \) is the corporate income tax liability in the home country, and \( c^{*} E_{t}^{*} \) reflects the capital gains tax, assessed at an annual equivalent accrual tax rate of \( c^{*} \), that the firm would have to pay to the host country if it sold the operation in the future.

Gross dividends, expressed in the home country currency, are

\[
(2.2) \quad D_{t}^{*} = x_t \{ e^{\pi_{t} F(K_t)} + \hat{B}_{t} - iB_{t} - e^{\pi_{t}} (\hat{K}_t + \delta K_t) - u \Pi_t \},
\]

where \( F(K_t) \) is a strictly concave function that reflects nominal gross revenues after all non-capital business-related expenses such as employee compensation and raw materials, \( B_{t} \) is the stock of net local borrowing, \( i \) is the nominal interest rate on that debt, \( e^{\pi_{t}} (\hat{K}_t + \delta K_t) \) is the total amount of investment expenditures, including new investment \( \hat{K}_t \) and replacement investment \( \delta K_t \), where \( \delta \) is the real economic depreciation rate, and \( u \Pi_t \) is corporate taxes paid to the host country, where \( u \) is the corporate tax rate and \( \Pi_t \) is the corporate (income or consumption) tax base as defined by the host country. \( \Pi_t \) is defined as

\[
(2.3) \quad \Pi_t = e^{\pi_{t} F(K_t)} + f_1 \hat{B}_{t} - f_2 iB_{t} - f_3 \alpha K_{t} - f_4 e^{\pi_{t}} (\hat{K}_t + \delta K_t),
\]

where \( f_i \) are binary variables that equal to zero or one depending on the tax system utilized, and \( \hat{K}_t \) is the tax basis of the capital stock existing at time \( t \), which equals the remaining undepreciated portion of the capital stock at time \( t=0 \) assuming a tax depreciation rate of \( \alpha \), \( e^{-\alpha t} \hat{K}_0 \), plus the sum of undepreciated investment expenditures from time 0 to time \( t \):

\[
(2.4) \quad \hat{K}_t = e^{-\alpha t} \hat{K}_0 + \int_{0}^{t} e^{\pi_{s}} (\hat{K}_s + \delta K_s) e^{-\alpha (t-s)} \, ds.
\]
The host country corporate tax base (2.3) can reflect an income tax base \((f_2=f_3=1\) and \(f_1=f_4=0\)), the R-based cash flow tax \((f_4=1\) and \(f_1=f_2=f_3=0\)), and the R+F-based cash flow tax \((f_1=f_2=f_4=1\) and \(f_3=0\)).

Under the deferral system used in the U.S., the home tax liability \(T_t^*\) is assessed only upon repatriation of dividends to the home country, and depends on the tax provisions of both the home and host countries including any credits or deductions the home country provides for foreign taxes paid. A critical parameter is the dividend payout ratio \(\Omega_t^*\),\(^{13}\) which is defined as the fraction of total taxable profits, as defined by the home country and after foreign corporate taxes, that is distributed as dividends, or

\[
(2.5) \quad \Omega_t^* = \frac{D_t^*}{\Pi_t^* - u \Pi_t x_t} = \frac{D_t^*}{\gamma_t^*},
\]

where \(u^*\) is the corporate tax rate and \(\Pi_t^*\) is taxable profits as defined by the home country or

\[
(2.6) \quad \Pi_t^* = e^{\pi^*_t F(K_t)} - i B_t x_t - \alpha^* \hat{K}_t x_t,
\]

which reflects deductions for interest expenses and the depreciation deductions allowed under home country tax system, where \(\alpha^*\) is the statutory home depreciation rate, and the tax basis of the capital stock is

\[
(2.7) \quad \hat{K}_t^* = e^{-\alpha^* t} \hat{K}_0^* + \int_0^t e^{\pi_s (K_s + \delta K_s)} e^{-\alpha^* (t-s)} \text{ds}.\(^{14}\)
\]

Given \(\Omega_t^*\) and assuming the firm qualifies for any tax credits provided by the system (this issue is discussed below), the home tax liability can be expressed as

\[
(2.8) \quad T_t^* = g^c (\Omega_t^* u^* \Pi_t^* - \theta D_t^* - \Omega_t^* \phi u \Pi_t x_t) + g^d [\Omega_t^* u^* (\Pi_t^* - \theta D_t^* - u \Pi_t x_t)],
\]

\(^{13}\) This terminology follows Bruce (1989).
\(^{14}\) Note that in defining taxable profits, the home country allows records of capital expenditures to be kept in the host currency; that is, the host currency is the functional currency. When income is remitted, depreciation allowances are calculated and converted to the home currency.
where \( g^c \), \( g^d \) and \( \phi \) are binary variables whose values depend on whether the home country provides credits or deductions for foreign taxes paid. Under the full credit system, tax credits are allowed both for dividend taxes and corporate taxes deemed to paid on dividends (\( g^c = 1, g^d = 0, \phi = 1 \)). Under the partial credit system, tax credit is allowed only for dividend taxes paid (\( g^c = 1, g^d = 0, \phi = 0 \)). Finally, under the deduction system, a deduction rather than a credit is allowed for both dividend taxes and corporate taxes deemed to paid on dividends (\( g^c = 0, g^d = 1 \)).

Finally, note that all countries that allow a foreign tax credit impose some type of limitation on the amount of foreign tax credits allowed. For example, the U.S. limits the credit to the amount of tax that would be assessed on the same income if it were earned in the U.S. The analysis assumes that the firm is not in an "excess foreign tax credit position" — that is, that it does not have more credits than it can use to offset current tax liability.\(^{15}\)

The firm's optimization problem is to maximize\(^{16}\)

\[
(2.1') \quad E_0^* = \int_0^\infty e^{-\rho t} (1-c^*) Y_t \left[ \frac{D_t^*}{1-c^*} (1-\sigma_t^*) \right] \, dt,
\]

where \( \sigma_t^* \) is defined as the dividend repatriation tax rate

\[
(2.9) \quad \sigma_t^* = g_c \left( \frac{u^* \Pi_t^* - \phi u \Pi_t X_t}{Y_t^*} \right) + g_d \left( \theta + \frac{u^* (\Pi_t^* - \theta D_t^* - u \Pi_t X_t)}{Y_t^*} \right),
\]

subject to two constraints which describe the evolution of the tax bases of the capital stocks as measured by the host and home countries:

\[
(2.4) \quad \hat{K}_t = -\alpha \hat{K}_t + e^{rt}(\hat{K}_t + \delta K_t),
\]

\[
(2.7) \quad \hat{K}_t^* = -\alpha^* \hat{K}_t^* + e^{rt}(\hat{K}_t + \delta K_t).
\]

\(^{15}\) For further discussion, see McLure, Mutti, Thuronyi and Zodrow (1990, p. 307-310) and Leechor and Mintz (1993).

\(^{16}\) See the appendix for a derivation.
III. User Costs of Capital under Income and Consumption Taxes

This section compares the steady-state user costs of capital before and after the host country switches from an income tax to a consumption tax system, and the home country either allows a full or partial tax credit or a deduction for foreign taxes paid; derivations are provided in the appendix. The analysis begins with the two basic cases — the host country utilizes a creditable income tax and the host country utilizes a creditable R-based cash flow tax — and then turns to the other cases discussed above.

Leechor and Mintz show that steady-state the user cost of capital under a creditable home country income tax, assuming an interior solution where the costs of debt and equity finance are equal, is

\[
F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[u^*-u-\sigma^*(1-u)]} \{1 - uZ[1 - d(1-\sigma^*)] - dZ^*(u^* - \sigma^*)\},
\]

where the "tax-adjusted" dividend-payout ratio, \(d = D_t^*/Y_t^*(1-\sigma^*)\), is the ratio of repatriated dividends to the home tax base net of host corporate taxes (implicit in \(Y_t^*\)) and dividend repatriation taxes (\(\sigma^*\)), and the present values of depreciation allowances in the host and home countries are \(Z = \alpha/[\rho/(1-c^*)+\alpha-\pi^*+\pi]\) and \(Z^* = \alpha^*/[\rho/(1-c^*)+\alpha^*-\pi^*+\pi]\). This expression reflects the real cost of equity (and thus debt) finance \(\rho/(1-c^*)-\pi^*\) plus economic depreciation rate \(\delta\), and is increased by effects related to the taxation of revenues which appear in the denominator, and decreased by terms related to deductions for capital expenditures, which appear in the term in braces in the numerator.

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17 The user costs of capital discussed are those for mature subsidiaries. That is, in the steady state, local borrowing and capital stocks and the real value of the undepreciated capital tax bases are constant in real terms (i.e., \(K_t = 0, \hat{B}_t = \pi B_t, \hat{\lambda}_1 = (\pi^*-\pi)\lambda_1\) and \(\hat{\lambda}_2 = (\pi^*-\pi)\lambda_2\); see Appendix). The costs of capital for immature subsidiaries can be found by assuming capital and borrowing stocks increase in real terms at certain rates in the steady state; however, the solutions are very complex and thus are not examined here.


19 Note that since the model uses the host currency as the functional currency in keeping track of depreciation, \(Z^*\) is affected by the exchange rate differential (through differences in inflation rates). However, if the home currency is used as the functional currency, \(Z^*\) is independent of the exchange rate differential and equals \(\alpha^*/[\rho/(1-c^*)+\alpha^*]\), since depreciation is calculated from investment expenditures that are translated to the home currency at the time of purchase. Leechor and Mintz (1991, 1993) use the latter assumption in their model.
This result can be rearranged so that the "revenue taxation" effects (in the denominator) and tax deduction effects (in the braces) are symmetric:

\[ F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[u^*Z^*-uZ^*-\sigma^*(Z^*-uZ)]} \{1 - uZ-d[u^*Z^*-uZ^*-\sigma^*(Z^*-uZ)]\}. \]

The revenue taxation effects reflect corporate taxation by the host country at rate \( u \), and home country taxation after tax credits at the net "repatriation tax" rate of \( d[u^*-u-\sigma^*(1-u)] \).

The latter includes the "deduction effect" \( d(u^*-u) \) which reflects taxation of remitted dividends at rate \( u^* \) coupled with a credit at rate \( u \) and the base-broadening effect \( d\sigma^*(1-u) \) which decreases tax since, with more investment, the base of the dividend repatriation tax (\( Y_t^* \)) is broadened.\(^{20}\) The base-broadening effect lowers dividend repatriation taxes because a marginal investment increases income net of foreign taxes (the base of the dividend pay-out ratio, \( Y_t^* \)), and thus reduces the dividend payout ratio (and dividend taxes) as defined by the home government.

Analogously, in the tax deduction effects expression, the tax saving from depreciation allowances in the host country is reflected in \( uZ \), and the "repatriation tax saving" due to the effects of home tax provisions on depreciation deductions is \( d[u^*Z^*-uZ^*-\sigma^*(Z^*-uZ)] \), which corresponds to the repatriation tax term \( d[u^*-u-\sigma^*(1-u)] \), and includes the deduction effect \( d(u^*Z^*-uZ) \) and the "base-narrowing effect" \( d\sigma^*(Z^*-uZ) \) which reflects higher taxes when depreciation deductions are increased. The base-narrowing effect increases dividend repatriation taxes because a marginal investment increases depreciation deductions and thus reduces income net of foreign taxes (the base of the dividend payout ratio), thereby increasing dividend payout ratio (thus dividend taxes).

If instead the home country adopts a full (\( \phi=1 \)) or partial (\( \phi=0 \)) credit system and the host country switches to the R-based or the R+F-based cash flow tax (\( Z=1 \),\(^{21}\) the user cost of capital is:

\(^{20}\) This terminology follows Leechor and Mintz (1993).
\(^{21}\) As will be shown in the following section, the difference between the R-based and R+F-based cash flow taxes is captured entirely in the discount rate.
\[ (2.12) \quad F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[u^*\phi u-\sigma^*(Z^*-u)]} \{1-u-d[u^*Z^*-\phi u-\sigma^*(Z^*-u)]\}. \]

Compared to (2.11), one critical parameter changed is that, in the tax deduction effects, \( uZ \) is replaced by \( u \) since immediate expensing is allowed under a consumption-based business tax.

Alternatively, the home government may allow only deductions for foreign taxes paid. The user cost of capital under the deduction system is

\[ (2.13) \quad F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[\theta(1-u)+u^*[1-u-\theta(1-u)]-\sigma^*(1-u)]} \times \]

\[ \{1-u-d[\theta(Z^*-u)+u^*[Z^*-\theta(1-u)]-\sigma^*(Z^*-u)]\}. \]

Upon repatriation, the firm is taxed at the net withholding tax rate of \( d\theta(1-u) \) and the net corporate tax rate of \( du^*[1-u-\theta(1-u)] \), and obtains a tax reduction due to the base broadening effect of \( d\sigma^*(1-u) \). The tax deduction effects are analogous.

Musgrave (1990) advocates the partial credit system that allows a credit for dividend withholding taxes paid and disallows a credit or even a deduction for the host business cash flow tax.\(^{22}\) She argues that since corporate earnings remitted from the host country are tax-free, the partial credit system would ensure capital import neutrality. This would also yield the Hartman (1985) result in which only the host country tax provisions influence multinational investment. However, (2.12) shows that the user cost of capital under the partial credit method depends on the interactions of tax provisions of the host and home countries.

Her result can be obtained under three sets of circumstances: (1) the firm is in an excess foreign tax credit position or never remits dividends (i.e., \( d=0 \)); (2) the home country no longer requires dividends to be grossed up for foreign business cash flow taxes, which implies the dividend repatriation tax rate equals \( \sigma_t^* = u^*\pi_t^*/\pi_t^* = u^* \) so that the net-of-tax

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\(^{22}\) See Musgrave (1990, p. 478).
dividend equals $D_t^*(1-u^*)$;\(^{23}\) (3) if dividends are grossed up for foreign taxes, the home country grants a credit for dividend withholding taxes and allows a deduction for foreign business cash flow taxes paid to the host country, which also implies $\sigma_t^* = u^*$.

In comparing the user costs of capital after the adoption of a cash-flow tax by the host country under the three alternative home country tax treatments, if there is no inflation in the host and home countries, and the tax-adjusted dividend payout ratio ($d$) and the real discount rate of the firm ($\rho/(1-c)-\pi$) are fixed, the following propositions can be established:

(1) $F_k$ under the fully creditable tax exceeds that under the deduction system, (2) $F_k$ under the deduction system is larger than that under the partial credit system, and (3) $F_k$ under the fully creditable tax exceeds that under the partial credit system. These propositions suggest a very counterintuitive result since the fully creditable tax system is thought as the most generous tax treatment on foreign source income.

Before proving the proposition, one important result found by Lee and Mintz is that if the host and home countries have zero inflation\(^{26}\) and are under an identical corporation income tax system in which corporations are provided depreciation deductions at the same rate (i.e., $\alpha=\alpha^*$), the dividend repatriation tax $\sigma_t^*$ under the fully creditable tax is shown to be exogenous and independent of time; that is, $\sigma_t^* = (u^*-u)/(1-u)$.\(^{27}\) The reason is that in the world with no inflation equal depreciation rates result in identical income tax bases in the host and home countries (see equation 2.9). This leads to the Hartman (1985) result in which only the tax provisions of the host country, not of the home country, are relevant in multinational subsidiary investment decisions. This result is also relevant if the home country provides only a partial credit or a deduction for foreign taxes, as the dividend

\(^{23}\) Note that the dividend repatriation tax rate $\sigma_t^*$ becomes exogenous.

\(^{24}\) The net-of-tax dividend equals $D_t^*(1-\theta) + \theta D_t^*$ minus home corporate taxes $\Omega_t^* (\Pi_t^* - u^* \Pi_t x_t)$. Note that the dividend payout ratio $\Omega_t^* = D_t^*/(\Pi_t^* - u^* \Pi_t x_t)$; after canceling out common terms, the net-of-tax dividend is $D_t^*(1-u^*)$.

\(^{25}\) If dividends are not grossed up for foreign taxes and a deduction for foreign business cash flow taxes is allowed, this case would not yield neutrality result sought by Musgrave. The user cost of capital equals

$$F_k = \frac{\rho/(1-c)-\pi^* + \delta}{1-u-d[u^* Z^*(1-u)-\sigma]},$$

\(^{26}\) They assume equal inflation rates.

\(^{27}\) See Lee and Mintz (1993, Lemma 1, p. 85).
repatriation tax rate is also exogenous and independent of time, or $\sigma_t^* = u^*/(1-u)$ under the partial credit and $\sigma_t^* = \theta + u^*[1-\theta(1-u)-u]/(1-u)$ under the deduction method.

To show the Hartman result using the steady-state user costs of capital, under the fully creditable ($\phi=1$) or the partial credit ($\phi=0$), it can be written as

$$
(2.12') \quad F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[u^*u-\sigma^*(1-u)]} \{1 - uZ - d[u^*Z^* - \phi uZ - \sigma^*(Z^*-uZ)] \}.
$$

Without losing generality by ignoring the withholding taxes, under the deduction method, it can be written as

$$
(2.13') \quad F_k = \frac{\rho/(1-c^*)-\pi^*+\delta}{1-u-d[u^*u-\sigma^*(1-u)]} \{1 - uZ - d[u^*Z^* - u^*uZ - \sigma^*(Z^*-uZ)] \}.
$$

In the steady state, when the host and home countries have zero inflation rates (without assuming equal statutory depreciation rates), it can be shown that the steady-state host and home tax bases are equal.\(^{28}\) The reason is that with no inflation, different statutory depreciation rates would not affect the host and home tax bases in the steady state when corporations only make investment to replace obsolescent capital. Thus, the steady-state dividend repatriation tax rate $\sigma^*$ equals $(u^*-u)/(1-u)$ under the fully creditable tax, $u^*/(1-u)$ under the partial credit and $(u^*-u^*/u)/(1-u)$ under the deduction method.\(^{29}\) Substituting these dividend repatriation tax rates into (2.12') and (2.13'), the net repatriation tax in the revenue taxation effects under all three systems equals zero. In addition, if depreciation tax rates are equal, the net repatriation tax saving in the tax deduction effects also equals zero since $Z^*_t=Z$. Thus, the user costs in (2.12') and (2.13') depends only on the host tax provisions as argued by Hartman, or

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\(^{28}\) In the steady state, the undepreciated capital stock in the host country equals $K^*_t = \delta K_t e^{\rho t} / (\alpha+\pi)$ and that in the home country equals $K^*_t = \delta K_t e^{\rho t} / (\alpha^*+\pi)$; see appendix. Assuming zero inflation and plugging these values into $\Pi_t = F - \alpha K_t$ and $\Pi_t^* = F - \alpha^* K_t^*$, the host and home tax bases equal $\Pi_t = \Pi_t^* = F - \delta K$. Note that there is no borrowing when inflation rates equal zero.

\(^{29}\) The subscript $t$ of the dividend repatriation tax is suppressed to denote steady state.
\[ F_k = \frac{\rho}{(1-c^*)-\pi^*+\delta} \frac{1}{1-u} (1-u \theta). \]

If both host and home countries switch to a cash flow tax, the Hartman result would also be obtained, and the user cost would simply equal \( F_k = \frac{\rho}{(1-c^*)-\pi^*+\delta} \).

To prove the above propositions, one critical assumption is that there is no inflation in the two countries. This assumption leads to an equal steady-state tax base even when the host country switches to a consumption-based business tax and the home country is under a conventional income tax system.\(^{30}\) The reason is that in the steady state there is no growth in capital stock or firms simply make investment to replace worn-out capital; with no inflation, firms are indifference between deducting total amount of investment expenditures immediately or depreciating capital at any statutory depreciation rate. Thus, as shown above, the steady-state dividend repatriation tax rate equals \((u^*-u)/(1-u)\) under the fully creditable tax, \(u^*/(1-u)\) under the partial credit and \((u^*-u^*u)/(1-u)\) under the deduction method; note that for analytical convenience, dividend withholding taxes are ignored.

Using these steady-state dividend repatriation taxes, the net repatriation tax equals for all three alternative tax treatments; hence, the remaining tax on revenues is the host corporate cash flow tax \( u \). Thus, to prove that the user cost of capital under the fully creditable tax is larger than the costs of capital under the deduction and the partial credit method is to show that one minus tax deductions allowed by the host and home countries of the former exceeds that of the latter. Specifically, compare \(1-u-d[u^*Z^*-\phi_u - \sigma^*(Z^*-u)]\) in (2.12) with \(1-u-d[u^*Z^*-u^*u - \sigma^*(Z^*-u)]\) in (2.13).\(^{31}\) Substituting the corresponding steady-state dividend repatriation tax rate and rearranging, the tax deduction effects under the fully creditable or the partial credit tax can be written as

\(^{30}\) In the steady state, the undepreciated capital stock in the home country equals \( K_t^* = \delta K_t^0 e^{\pi t}/(\alpha^*+\pi) \) and immediate expensing equals \( \delta K \). Assuming zero inflation and plugging these value into \( \Pi_t^* = F - \alpha^* K_t^* \), the home country income tax base equals \( \Pi_t^* = F - \delta K \). This is equal to the host country’s cash flow tax base, \( \Pi_t^* = F - \delta K \). Note that with zero inflation, there is no borrowing in the steady state.

\(^{31}\) The inclusion of the dividend withholding tax does not change the qualitative result.
(2.12") \quad 1 - u - d\{ u^*Z^*- u^* \frac{Z^*-u}{1-u^*} - u [\phi - \frac{Z^*-u}{1-u^*}] \},

while the tax deduction effects under the deduction method can be written as

(2.13") \quad 1 - u - d\{ u^*Z^*- u^* \frac{Z^*-u}{1-u^*} - u^*[1 - \frac{Z^*-u}{1-u^*}] \}.^{32}

Comparing the fully creditable tax (\( \phi=1 \)) with the deduction method, the only difference between (2.12") and (2.13") is the effect of the type of foreign tax relief for double taxation used by the home country appeared in the last term in the braces (i.e., \( u \) or \( u^*u \)). This shows that while immediate expensing reduces the host tax liability, it increases the home tax liability through a credit or deduction for foreign taxes. Specifically, an increase in immediate expensing results in a reduction in host corporate cash flow taxes which in turn reduces foreign tax credits or deductions. The reduction in foreign tax credits (at the tax value of immediate expensing \( u \)) decreases the tax deduction more than the reduction in foreign tax deductions (at the rate of the home corporate tax rate \( u^* \) times the tax value of immediate expensing \( u \)). This leads to a very counterintuitive result that the user cost of capital under the fully creditable tax is larger than the cost of capital under the deduction method. Moreover, using (2.12") to compare the fully creditable tax (\( \phi=1 \)) with the partial credit method (\( \phi=0 \)), and using (2.12") and (2.13") to compare the deduction method with the partial credit method, it is also true that the user cost of capital under the partial credit method is less than the costs of capital under the fully creditable tax and the deduction method.

Intuitively, with the above assumptions, the net repatriation tax on subsidiary revenues equals zero as the net home tax rate applied to repatriated dividends is exactly offset by the base-broadening effect under all three home country tax treatments; thus, the effective tax on revenues, gross of tax deductions, equals the host corporate tax rate under

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32 If the dividend withholding tax is included in the analysis, the tax deduction effects equals

\[ 1 - u - d\{ u^*Z^*- u^* \frac{Z^*-u}{1-u^*} - u^*[u+\theta(1-u)](1 - \frac{Z^*-u}{1-u^*}) \}.\]

Note that an increase in immediate expensing in the host country reduces foreign tax deductions by \( u^*[u+\theta(1-u)] \) instead of by \( u^*u \).
all three cases. The differences between alternative home country foreign tax treatments lie in the effects of tax deductions for investment expenditures allowed by the host and home countries. This can be explained in two steps. The first ignores the base-narrowing effect. On a dollar of marginal investment, the host country allows immediate expensing and the home country under all three systems allows home depreciation on the amounted remitted of the dollar investment. Thus, the only critical factor determining differences between these three cases lies in how the tax relief for double taxation affects the tax deductions for investment. Under the fully creditable tax, the amount of foreign tax credits is reduced at rate $u$ when a dollar of investment is expensed in the host country while under the deduction method, the amount of foreign tax deduction is reduced at rate $u^*$. In addition, there is no tax relief under the partial credit system as it provides no credit or deduction for corporate cash flow taxes paid to the host country. Since the reduction in tax relief is the largest under the fully creditable tax, the user cost of capital under this method is thus the largest among the three tax treatments. The second step is to include the base-broadening effect; as shown in the proof above, this rather counterintuitive result still holds and the reasons are analogous.

IV. Optimal Financial Equilibrium

The user cost of capital in the previous section assumes an interior solution in which the cost of equity finance in the form of subsidiary retained earnings equals the cost of debt finance in the form of local borrowing. This section elaborates on these conditions for financial equilibrium conditions for the various cases considered in the analysis. An interesting feature of the solutions presented below is that there are important differences between the R-based and R+F-based cash flow taxes; these differences occur because, under the steady state assumption used in the analysis, annual interest expenses exceed the proceeds of new loans, which in turn causes the R+F tax base to be lower than it would be if these quantities were equal in the steady state.

$^{33}$ These conditions are obtained by differentiating (2.1') with respect to $B_t$. 
When the home country allows either full or partial tax credits, the optimal financial policy under the R-based cash flow tax requires

\[(2.14) \quad \frac{\rho}{1-c^*} - \pi^* = [1-d(u^*-\sigma^*)]i - \pi,\]

The left-hand side is simply the real discount rate of the firm for equity finance. Note that since the host country tax system ignores financial transactions, only interest deductions allowed by the home country affect the cost of debt. Thus, on the right hand side of (2.14), interest cost is reduced upon remittance by \(du^*\) and is increased by \(d\sigma^*\) due to the base-narrowing effect of larger interest deductions that reduce the dividend repatriation tax base.

By comparison, if the host country switches to an R+F-based cash flow tax and the home country allows either full or partial tax credits, the optimal financial equilibrium requires

\[(2.15) \quad \frac{\rho}{1-c^*} - \pi^* = \left\{ \frac{1 - u - d[u^* - u\phi - \sigma^*(1-u)]}{1 - u + du(\phi - \sigma^*)} \right\} i - \pi,\]

The cost of debt finance is more complex since loan proceeds are included in the host tax base and interest expenses are deductible. The effects of interest deductions are shown in the numerator (in the braces) and the effects of the inclusion of loan proceeds appear in the denominator.\(^{34}\)

In the numerator, \(1-u-d[u^*-u\phi-\sigma(1-u)]\) reflects the cost of one dollar of local interest expenses after taxes, which is reduced by \(u\) and \(du^*\) due to the allowance of interest deductibility by the host and the home country and is increased by \(du\) (when \(\phi=1\)) due to the reduction in the foreign tax credit, and by \(d\sigma(1-u)\) due to the base-narrowing effect of additional interest deductions. In the denominator, \(1-u+du(\phi-\sigma^*)\) reflects the effect of including loan proceeds in the tax base. Specifically, the benefit of a dollar of loan proceeds is reduced by inclusion in the host tax base at rate \(u\) and, upon remittance, it is increased by a foreign tax credit at rate \(du\phi\) and is reduced by the base-narrowing effect \(du\sigma^*\). Note that

---

34 Leechor and Mintz (1993, p. 90) also provide the result for the case of an income tax. His result can be found from this condition by ignoring the effects of loan proceeds.
a reduction in after-tax interest expenses or an increase in after-tax loan proceeds lowers the cost of debt.

Suppose next that the home country allows only a deduction for foreign taxes paid. For the R+F-based CFT, financial equilibrium requires

\[
\frac{\rho}{1-c^*} - \pi^* = \left\{ \frac{1-u-d(\theta(1-u)+u^*(1-u-\theta(1-u))-\sigma^*(1-u))}{1-u+d[\theta u+u^*(u+\theta(1-u)-\sigma^* u)]} \right\} i - \pi.
\]

As above, the effects of interest deductions and loan inclusion are shown in the numerator and denominator respectively.\(^{35}\) The cost of a dollar of interest expense is lowered by \(u\) due to interest deductibility allowed by the host country, reduced by \(d\theta(1-u)\) due to the net host dividend withholding tax, and by \(du^*(1-u-\theta(1-u))\) due to the net home corporate tax, but is increased by the base-narrowing effect \(d\sigma^*(1-u)\). Moreover, in the denominator, a dollar of loan proceeds is reduced by \(u\) as a result of inclusion of new loans in the host tax base. Upon repatriation, foreign tax deductions for host withholding and corporate taxes increase the value of a dollar of loan proceeds by \(d[\theta u+u^*(u+\theta(1-u))]\), but the base-narrowing effect decreases it by \(d\sigma^* u\).

Finally, if the host country switches to the R-based CFT, financial equilibrium requires

\[
\frac{\rho}{1-c^*} - \pi^* = \left\{ \frac{1-d[\theta+u^*(1-\theta)-\sigma^*]}{1+du^* \theta} \right\} i - \pi.
\]

The cost of a dollar of interest expense is reduced upon repatriation of the associated dividends by \(d\theta\) due to foreign tax deductions for dividend withholding taxes and by \(du^*(1-\theta)\) due to host corporate taxes, and is increased by the base-narrowing effect of \(d\sigma^*\). The denominator shows that a dollar of after-tax local borrowing is worth more than one dollar \((1+du^* \theta)\), since dividend withholding taxes are deducted from the home taxable income in computing home tax liability.\(^{36}\)

\(^{35}\) If the host country is under an income tax, only the effects on interest deductions influence the equilibrium condition for the deduction system.

\(^{36}\) More borrowing leads to higher dividends and thus higher withholding taxes.
V. Marginal Effective Tax Rate Results

The marginal effective tax rate (METR) is defined as the difference between the
gross-of-tax real rate of return on a marginal capital investment \( r_g \) and the after-tax real
rate of return to the supplier of funds \( r_n \), divided by the gross-of-tax real rate of return.
The analysis assumes that the marginal investor is a U.S. citizen, who requires a net real rate
of return of

\[
(2.18) \quad r_n = \beta^*i^*+(1-\beta^*)e^*-\pi^*,
\]

where \( i^* \) is the nominal U.S. interest rate on corporate bonds, \( e^* \) is the nominal rate of return
on equity, and \( \beta^* \) is the proportion of household assets invested in corporate bonds. Note
that domestic personal taxes, which determine the level of savings, do not affect the
minimum rates of return required on bonds and equity, as \( i^* \) and \( e^* \) are assumed to be
determined in international markets.

Two sets of METR results are provided. The first assumes that the marginal
investment is financed entirely with funds from the multinational parent, so that the
appropriate discount rate is a weighted average of the costs of debt and equity within the
parent country.\(^{37}\) The second set of results assumes that the marginal investment is
financed entirely with local debt, in which case the discount rate is derived as described in
Section IV. The parameter values used to calculate the METRs for 1991 are summarized in
Table 2.2. Following Leechor and Mintz (1991), the "tax-adjusted" dividend payout ratio, \( d \),
is assumed to be fixed at 48 percent.

100 Percent Parent Finance

In this case, the discount rate for the firm is assumed to equal the weighted average
of the cost of debt and equity within the parent country,\(^{38}\) or

\[^{37}\) This case may be viewed as 100 percent "subsidiary finance" by assuming the discount rate that reflects
cost of equity finance through retain earnings is equal to the weighted average of costs of equity and debt
of the parent firm.

\[^{38}\) Note that (2.19) reflects interest deductibility in the U.S. However, the U.S. may disallow full interest
deductions if debt is used to finance multinational subsidiary investment. In this case, the gross interest
rate in the simulations would replace the net-of-corporate-tax cost of debt.
where \( \beta^* \) is the proportion of assets financed by debt, \( u^* \) is the U.S. corporate tax rate of 38.3 percent, which is the sum of federal corporate tax rate of 34 percent plus the net state corporate tax rate of 4.3 percent (OECD, 1991). \( i^* \) is the U.S. lending rate of 8.5 percent in 1991 (International Financial Statistics Yearbook, 1992). \( e^* \) is assumed to be determined by the condition that U.S. savers earn the same net-of-personal-tax rate of return on debt as that on equity; that is, \( e^* = i^*(1-m^*)/(1-z^*) \), where \( m^* \) is the marginal personal tax rate on interest income of 36 percent (OECD, 1991) and \( z^* \) is the effective tax rate on accrual capital gains at the personal tax level of 12.3 percent (thus, \( e^* = 6.2 \) percent). Since the firm would pay annual equivalent capital gains tax at rate \( c^* \) of 13 percent at the firm level if it sold the foreign operation, the discount rate \( \rho/(1-c^*) \) equals a fixed 6.6 percent; hence, the real discount rate equals 2.3 percent (i.e., \( \rho/(1-c^*) - \pi = 6.6 - 4.3 = 2.3 \) percent). In addition, as shown in (2.19), using parameter described above, the net-of-corporate-tax (gross-of-personal-tax) real rate of return for a U.S. international investor is 2.8 percent, assuming that the debt-asset ratio for investors equals that for firms. Note that the real discount rate of the firm falls short of the minimum rate of return required by US investors since firms are allowed interest deductibility.

Table 2.3 presents the results, assuming that the firm uses the fixed discount rate of 2.3 percent in all cases examined. This case demonstrates the standard result that the METR under the income tax regime far exceeds the METRs after Thai adoption of a consumption-based tax, regardless of whether the U.S. allows full creditability or switches to a partial credit or the deduction method. As a benchmark, consider the case in which the firm is in a permanent excess foreign credit position, so that the user cost of capital depends only on tax.

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\(^{39}\) Following OECD (1991, p. 212) and King and Fullerton (1984, p. 23), the effective accrual capital gains tax rate equals \( \beta z^R(1+j)/\beta+j \), where \( \beta \) is the fraction of assets sold, \( z^R \) is the personal tax rate on capital gains upon realization and \( j^\pi(1-m^*) \) is the after-personal-tax interest rate. Assuming \( \beta=0.1 \) and using data from Table 2, \( \beta z^R(1+j)/\beta+j = 24.6 \). Since half of gains in the U.S. are never realized because of the increase of basis at death, the accrual capital gains tax used in the simulation is 12.3 percent.
provisions of Thailand. Since immediate expensing under a consumption tax is more generous than the depreciation allowances under the Thai income tax, the METR (-21.2 percent) after the Thai tax switch is much lower than before the switch (39.6 percent), as shown in Table 2.3.40

If the firm is in a deficit FTC position, the METR also falls from 37.5 percent under the current tax system to 8.5 percent after the Thai tax system switch. If the U.S. Treasury switches to a partial credit or a deduction method, the METR would fall even lower to -52.5 and -15.8 percent, respectively. This result is rather counterintuitive, since a partial credit or a deduction for foreign taxes paid is commonly viewed as much less generous than the full creditability allowed by the U.S.

The counterintuitive result obtained is due to two reasons. First, the net repatriation tax (in the denominator of the user cost formulas) under all three alternative home country tax systems is very small because when investment is increased, not only additional home taxes are paid upon dividend remittances but the base of the dividend repatriation tax is also broadened.41 Specifically, the net repatriation tax rates range only from -0.7 to 0.4 percent.42 Second, for the case of fully creditable tax system, in computing the repatriation tax saving the home tax depreciation is offset by the host immediate expensing (a reduction in foreign tax credits), resulted in a negative deduction effect. However, there is no deduction effect under the partial credit and the deduction system and the analogous effects, including only the net home tax depreciation, are positive. After taking account of the base-narrowing effect, the repatriation tax savings under fully creditable tax system equals a large -5.0 percent while those under the partial credit and the deduction system equal 3.1 and -0.7 percent. When combined the distorting home taxes with the neutral host cash-flow tax, this counterintuitive result is obtained.

40 The METR is negative because interest is deductible for the U.S. parent corporation. Note that the calculations do not take into account any taxation at the personal level.
41 This is a feature of allowing deferral of taxation in that only a fraction of subsidiary earnings is taxed.
42 Specially, it equals -0.7 percent under the fully creditable tax system, 0.4 percent under the partial credit system, and -0.1 percent under the deduction system. This result should come at no surprise since, as shown in Section III, when the host and home tax bases are equal the repatriation tax equals zero.
100 Percent Local Debt Finance

The case of 100 percent local debt finance can be viewed as reflecting arbitrage taking place at the firm level such that the firm's discount rate equals the Thai interest rate, net of the effective tax shown in Section IV.43 Note that this case is of quantitative importance; for example, Feldstein (1994) reports that foreign borrowing constitutes roughly half of all the assets of U.S. foreign affiliates.

Since Thailand is small and fairly open to capital flows, the local interest rate is assumed to be determined by international market conditions. Following Boardway, Bruce and Mintz (1984), if the marginal investor is a U.S. investor, open market arbitrage would ensure that the after-tax return on Thai corporate bonds adjusted for a foreign currency loss (assuming \( \pi^* < \pi \)) equals the after-tax return on U.S. corporate bonds, or

\[
(2.20) \quad i (1-m^*) + g(1-z^*) = i^*(1-m^*),
\]

where \( i^* \) and \( i \) are the nominal interest rates of the U.S. and Thailand, respectively, \( g \) is the foreign exchange rate loss that follows purchasing power parity perfectly \( (g = \pi^* - \pi) \); i.e., \( g = \dot{x} / \dot{x} \) where \( x = e^{(\pi^* - \pi) t} \), \( m^* \) is the personal tax rate on interest income in the U.S., and \( z^* \) is the effective accrual tax rate on foreign currency gains.44 Thus, (2.19) implies

\[
(2.21) \quad i = i^* - (\pi^* - \pi) \frac{(1-z^*)}{(1-m^*)}.
\]

Using the actual U.S. interest rate (8.5 percent) and parameter values given in Table 2.2, \( i \) equals 10.1 percent. It is further assumed that all assets that a marginal U.S. investor holds are corporate bonds, so that the net-of-corporate-tax real rate of return equals the U.S. interest rate less inflation (i.e., \( r_n = i^* - \pi^* = 4.2 \) percent), derived from (2.20) by setting \( \beta^* \) equal to unity.

---

43 In the closed economy context, Bradford and Fullerton (1981) also assume that arbitrage takes place at the firm level such that the costs of debt and equity finance are equal and the discount rate of the firm equals the net-of-corporate-tax interest rate.

44 In the U.S., exchange gains and losses are taken in account on a realization basis. The tax rate used is assumed to equal the personal accrual capital gains tax rate.
Since the Thai interest rate is assumed to be determined by marginal U.S. portfolio investors and thus influenced by unequal personal tax rates on foreign currency gains and on interest income, the marginal real rate of return on capital \( r_g \) and thus the METR are affected by foreign exchange rate gain or loss. This can be seen by examining the marginal effective tax wedge:

\[
(2.22) \quad r_g-r_n = \left[ i(1-t_1)-\pi+\delta \right] \frac{(1-A)}{(1-t_2)} - \delta - r_n.
\]

where the first expression of \( r_g \) on the right hand side is the general form of user cost of capital formula, \( i(1-t_1)-\pi \) is the real discount rate under 100 local debt finance (replacing \( \rho/(1-c^*_{net})-\pi^* \) in the user cost formula derived in Section III), \( t_1 \) is the combined host and home tax rate at which Thai interest expenses are deducted, \( A \) is the present value of net investment allowances and \( t_2 \) is the total combined host and home tax rate on a dollar of nominal revenues.

To show the foreign currency effects, substituting \( i \) from (2.21) into (2.22) yields

\[
(2.23) \quad r_g-r_n = \left\{ i^*(1-t_1)-\pi^* \right\} + (\pi^*_{net})[1 - \frac{1-z^*}{1-m^*}] + t_1(\pi^*_{net})\left[ \frac{1-z^*}{1-m^*} \right] + \delta \left[ \frac{(1-A)}{(1-t_2)} - \delta - r_n \right].
\]

If prices in the steady state in the two countries are equal (i.e., \( \pi = \pi^* \)), the real rate of return on capital reduces to (2.22) where \( i(1-t_1)-\pi = i^*(1-t_1)-\pi^* \) since the nominal interest rates of the two countries would be equal (i.e., \( i=i^* \)). With unequal inflation rates, the effects of foreign currency gain or loss are reflected in the second and third expressions in the braces. The second term shows the additional interest cost caused by the real foreign exchange loss (gain) as a result of investing in Thailand if \( \pi > (\leq) \pi^* \). The third term shows that, because of deductibility of nominal interest expenses, the nominal exchange rate loss (gain)

\[45\] The real Thai interest rate can be written as the real U.S. interest rate plus the real foreign exchange gain or loss by rearranging (2.20):

\[ i-\pi = i^*_{net}-\pi^* + (\pi^*_{net})(1 - \frac{1-z^*}{1-m^*}). \]

Thus, the second expression in the braces of (2.23) represents the real exchange gain or loss.
is reduced (increased) by rate $t_1$. We shall call the METR with the foreign currency effects the adjusted METR.

Table 2.4 shows the METR results when there are no foreign currency effects (i.e., $\pi^* = \pi$) and Table 2.5 shows the adjusted METR results when the inflation rates differ in the steady state. Three results are of particular interest. First, since Thai inflation is assumed to be larger than the U.S. inflation in the steady state, the Thai interest rate exceeds the U.S. interest rate; this contributes to a larger adjusted METR under each case examined. The effect of the foreign currency gain or loss on the adjusted METR is obvious when the firm is in an excess FTC position and Thailand adopts the R-based or R+F-based cash flow tax. Since the marginal rate of return to capital of a firm in this position is independent of home tax provisions, the firm does not benefit from debt financing (i.e., $t_1=0$), and the value of immediate expensing per dollar of capital expenditures equals to the Thai corporate tax rate ($A=t_2=u$), the marginal tax wedge equals

$$
(2.24) \quad r_g-r_n = [i^*-\pi^*] + (\pi^*-\pi)[1 - \frac{1-z^*}{1-m^*}] - r_n.
$$

Since $r_n$ equals $i^*-\pi^*$, the tax wedge is still nonzero due to exchange rate gains or losses even when the METR depends only on a neutral Thai consumption tax when the firm is in an excess FTC position. Specifically, the adjusted METR under this case equals 11.1 percent (Table 2.5), and the METR equals zero when $\pi=\pi^*$.

Second, the METRs under the R-based and R+F-based cash flow taxes are roughly — but not precisely — equal under each of the three cases examined. The adjusted METR differentials between R and R+F-based taxes, as shown in Table 2.5, range from zero to 14 percent (4 percent excluding the case of full credit). This unexpected METR differential occurs because the cost of finance and the dividend repatriation tax rate are different, as given in Table 2.6 under each case examined. The real costs of finance\textsuperscript{46} (denoted by $r_f$) for the R-base (R+F-base) are 3.0 (3.0) percent under the credit method, 5.7 (6.1) percent

\textsuperscript{46} Note that the costs of debt are also affected by the base-changing effects. See Section IV of how they affect these measures.
under the partial credit, and 4.5 (4.4) percent under the deduction method, while the steady-state dividend repatriation tax rates ($\sigma^*$) are 5.0 (9.5), 58.9 (56.2), and 44.1 (44.1) percent, respectively.\footnote{The explanation why $\sigma^*$ differs is given in Appendix. Note that $\sigma^*$ appears only in the "base-changing" effects and that the base-broadening effect generally exceeds the base-narrowing effect, resulting in lower METR for any given $\sigma^*$. Thus, the higher is $\sigma^*$, the lower is the METR.} The higher is the cost of finance or the lower is $\sigma^*$, the higher is the METR. Under the credit system, since $r_t$ under the R-base and R+F-base are roughly equal, the higher $\sigma^*$ under the R+F-base tax contributes to a smaller METR. Under the partial credit method, the lower $\sigma^*$ and the higher $r_t$ under the R+F-base tax result in a larger METR.\footnote{It can be shown algebraically that the discount rate under the R+F tax is higher than that under the R-base tax assuming that $\sigma^*$ are given (note that the actual $\sigma^*$ are roughly equal). The discount rate differential equals $i[d(\sigma^*-u^*)(u+\sigma^*)/(1-u-\sigma^*)]$ and is positive since $\sigma^*-u > 0$. Note that under the R+F tax, the numerator and denominator of $\Pi_t^*$ contain the base-narrowing effect that tends to increase the cost of debt finance.} Finally, under the deduction method, the lower $r_t$ under the R+F-base tax leads to a lower METR.

Third, under 100 percent local debt finance, the METRs under a Thai consumption tax would be higher than those under current Thai income tax system, regardless of the treatment of foreign taxes in the U.S. Specifically, the METRs under consumption taxes range from -12.3 to 15.6 percent, while the METR under the current system is -14.2 percent. The main reason is that U.S. international investors require the same required minimum real rate of return ($r_n$); thus, since the current Thai income tax system allows full deductibility of interest payments and depreciation deductions based on historical cost economic depreciation, the entity-level METR is negative.\footnote{The dividend repatriation tax under the partial credit system equals $u^*\Pi_t^*/(\Pi_t^*-u^*\Pi_t^*)$. Since in the steady state interest expenses exceed loan proceeds under the R+F-based cash flow tax, foreign taxes paid ($u^*\Pi_t^*\Pi_t^*)$ are less than those under the R-based cash flow tax, resulting in higher $\sigma^*$}. By comparison, the
combination of expensing and the denial of interest deductions (explicit under the R-based cash flow tax or implicit under the R+F-based tax) results in an entity-level tax rate of zero.

For example, when the multinational firm is in an excess FTC position, the cost of local debt equals 4.7 percent while it equals only 1.6 percent under the Thai income tax that allows interest deductibility. This contributes to a higher METR of 11.1 percent under a consumption tax than the -14.2 percent under the income tax. Moreover, when the firm is in a deficit FTC position, with higher discount rates under a consumption tax, the METRs for the credit system are higher than those under the income tax (-19.1 percent versus 1.4 percent under the R-base and -12.3 percent under the R+F-base).

VI. Multinational Branches

Although most foreign direct investments are made through subsidiaries, roughly 10 percent is made through multinational branches.51 Multinational branches are treated as an extension of the parent firm; that is, the home tax authority views all revenues and expenses as if they are earned and incurred domestically by the parent firm, and thus profits are taxed on an accrual basis — there is no tax deferral for foreign branch earnings. To make the analysis complete, the user cost of capital formulas and METR results for branches are provided under the credit systems and the deduction system.

The user costs of capital for branch investment are much simpler to derive since complex tax deferral provisions do not have to be taken into account. The results for the credit systems and the deduction system are found by setting $\Omega_t^*=1$ (i.e., the total amount of foreign earnings is taxed) in (2.5). Assume, as above, that the host country imposes additional withholding taxes only on remitted income. Leechor and Mintz (1991) have examined the cost of capital under the full credit method when the host country is under an

\footnote{Using data from the Survey of Current Business, Hartman (1981) reported that foreign direct investment by branches in 1979 comprised 10 percent of total U.S. direct investment abroad; investment in manufacturing sector, 15 percent. However, annual foreign direct investment through branches may fluctuate indiscriminately; for example, Howenstine (1984, p. 23) reported that 90 percent of total direct investment were branch investment in 1983, while its capital stock was only 19 percent of total U.S. capital stock abroad. Unfortunately, more recent data could not be obtained because Survey of Current Business since 1983 no longer published data that distinguished investment made by branches and subsidiaries.}
income tax. In this case, since the multinational firm receives a full credit for foreign taxes paid when the firm is in a deficit foreign tax credit position, the user cost of capital depends only on home tax provisions. Specifically, the tax effect only includes the home corporate tax at rate \( u^* \) and the tax deduction effect only includes home depreciation allowances at rate \( u^*Z^* \).

If the host country switches to a creditable consumption-based tax, the user cost of capital will be the same as before the host tax change. However, if the home country allows only a partial credit, the firm bears host corporate taxes at rate \( u \) in addition to home corporate tax at rate \( u^* \) and benefits from host tax deductions for the total amount of investment expenditures at rate \( u \) in addition to home tax depreciation at rate \( u^*Z^* \).

Finally, if deductions, rather than credits, for foreign taxes are allowed, the cost of capital is

\[
F_k = \frac{\rho(1-c^*)-\pi^*+\delta}{1-u-\theta(1-u)-u^*[Z^*-u-\theta(1-u)]}. \tag{2.25}
\]

This expression can be interpreted as the user cost under the deferral case in which all earnings are taxed (i.e., \( d=1 \)) and there are no base-changing effects (i.e., \( \sigma(1-u) = 0 \)). The tax effects include those of the host corporate tax \( u \), the net dividend withholding tax \( \theta(1-u) \), and the net home corporate tax \( u^*[1-u-\theta(1-u)] \), with analogous deduction effects.

The METR results of a U.S. branch investing in Thailand are given in Table 2.7 under the assumption of 100 percent parent finance. Under the current system, the METRs for the firm in an excess and deficit credit position, respectively, are 39.6 and 45.2 percent. There is a gap between the METRs as the effect of a higher U.S. tax rate outweighs that of more generous depreciation allowances. If Thailand switches to the R-based or R+F-based cash flow tax, the METRs for the firm in an excess (deficit) foreign tax credit position equals \(-21.1\text{}(45.2)\) percent. Compared to the current income tax system, the METR for the firm with excess credits decreases dramatically since immediate expensing is much more generous, whereas the METR for the firm in the deficit credit position remains the same.
Finally, if the firm is in a deficit FTC position and the home country responds by allowing only credits for dividend withholding taxes or only deductions for foreign taxes paid, the METRs increase considerably from 45.2 percent under the current system to 64 percent under the partial credit system and to 58.6 percent under the deduction system.\textsuperscript{52}

**VII. Conclusions and Directions for Future Research**

Most research done on consumption-based taxation is in a closed economy context and argues in favor of a consumption-based business tax on the premise that investment would be nondistorting and tax-free. This may be true if there are no international capital flows between countries. For a developing country that relies significantly on foreign investment, the switch to a consumption-based business tax may or may not necessarily lower the cost of capital for multinational investment, since foreign investment income remitted to the home country is also subject to home country taxation. In addition, assumption regarding the discount rate used by the firm has considerable impact on the values of the user cost of capital.

This essay considers two extreme cases of subsidiary financing. The first is 100 percent parent finance. In this case, the analysis shows that METRs would decrease after the host country switches to a consumption tax regardless of which relief method for foreign taxes is used. Moreover, one surprising result is that the METR under the fully creditable system exceeds the METRs under the partial credit and the deduction system. By comparison, in the case of 100 percent local debt finance, this reform would increase METRs regardless of which relief method for foreign taxes is used by the home country; this result obtains because the combination of full interest deductibility and depreciation deductions under the income tax implies that investment is being subsidized at the entity level, and this subsidy is eliminated with a consumption-based cash flow tax with an entity level METR of zero.

\textsuperscript{52} The results obtained here are typical of those found in literature. For example, Musgrave (1987, p. 216) and McLure, Mutti, Thuronyi and Zodrow (1990, p. 344-346) show that foreign investment income is more heavily taxed under the deduction method.
For future research, the user costs of capital for mature multinational subsidiaries in this model hinge on the steady-state assumptions that new borrowing is growing at zero rate and interest expense is growing at the inflation rate. In an attempt to find the user costs of capital for immature subsidiaries and at the same time equivalence between the R-based and R+F-based CFT systems, new borrowing is assumed to grow at the same rate as interest expense in the steady state. However, the solutions are too complex to provide a meaningful result. A fruitful extension to this essay is to find some constraint or other steady-state conditions so that intuitive user costs of capital for the immature subsidiaries can be found and easily compared with those for the mature subsidiaries.
Table 2.1. Summary of Notation.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>home country variable</td>
</tr>
<tr>
<td>$\rho$</td>
<td>discount rate of the firm</td>
</tr>
<tr>
<td>$D_t$</td>
<td>dividends remitted to the parent company</td>
</tr>
<tr>
<td>$\theta$</td>
<td>host dividend withholding tax rate</td>
</tr>
<tr>
<td>$T_{t^*}$</td>
<td>home tax liability net of foreign tax credits or deductions</td>
</tr>
<tr>
<td>$\Delta t$</td>
<td>change in the firm value at each time $t$</td>
</tr>
<tr>
<td>$s_t$</td>
<td>foreign exchange rate</td>
</tr>
<tr>
<td>$F(Q)$</td>
<td>production function</td>
</tr>
<tr>
<td>$K_t$</td>
<td>capital stock at time $t$</td>
</tr>
<tr>
<td>$\dot{K}_t$</td>
<td>new capital purchase at time $t$</td>
</tr>
<tr>
<td>$B_t$</td>
<td>local borrowing stock at time $t$</td>
</tr>
<tr>
<td>$\dot{B}_t$</td>
<td>new local borrowing at time $t$</td>
</tr>
<tr>
<td>$\delta$</td>
<td>economic depreciate rate</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>statutory exponential depreciation rate</td>
</tr>
<tr>
<td>$u$</td>
<td>corporate tax rate</td>
</tr>
<tr>
<td>$\pi$</td>
<td>inflation rate</td>
</tr>
<tr>
<td>$\Pi_t$</td>
<td>tax base</td>
</tr>
<tr>
<td>$f_1$</td>
<td>binary variable equal one if interest deductions are allowed</td>
</tr>
<tr>
<td>$f_2$</td>
<td>binary variable equal one if loan proceeds are included in the base</td>
</tr>
<tr>
<td>$f_3$</td>
<td>binary variable equal one if depreciation allowances are allowed</td>
</tr>
<tr>
<td>$f_4$</td>
<td>binary variable equal one if immediate expensing is allowed</td>
</tr>
<tr>
<td>$\hat{K}_t$</td>
<td>tax basis or undepreciated capital at time $t$</td>
</tr>
<tr>
<td>$\Omega_t^*$</td>
<td>subsidiary dividend-payout ratio as defined by the home country</td>
</tr>
<tr>
<td>$g^c$</td>
<td>binary variable equal one if a credit system is used</td>
</tr>
<tr>
<td>$g^d$</td>
<td>binary variable equal one if a deduction system is used</td>
</tr>
<tr>
<td>$\Pi_d^{*}$</td>
<td>home tax base under the deduction system.</td>
</tr>
<tr>
<td>$Y_t^*$</td>
<td>denominator (base) of the dividend-payout ratio $\Omega_t$ and of $\sigma$</td>
</tr>
<tr>
<td>$\phi$</td>
<td>binary variable equal one if a credit of host corporate taxes is allowed</td>
</tr>
<tr>
<td>$\lambda_1, \lambda_2$</td>
<td>Lagrange multipliers used in the maximization problem</td>
</tr>
<tr>
<td>$F_k$</td>
<td>user cost of capital</td>
</tr>
<tr>
<td>$Z$</td>
<td>net present value of depreciation allowances</td>
</tr>
<tr>
<td>$\sigma^*$</td>
<td>dividend repatriation tax rate</td>
</tr>
<tr>
<td>$r_g$</td>
<td>gross-of-corporate-tax rate of return</td>
</tr>
<tr>
<td>$r_n$</td>
<td>net-of-corporate-tax (gross-of-personal-tax rate) rate of return required by savers</td>
</tr>
<tr>
<td>$g$</td>
<td>foreign currency gain or loss</td>
</tr>
<tr>
<td>$\beta$</td>
<td>debt-asset ratio</td>
</tr>
<tr>
<td>$m^*$</td>
<td>personal tax rate on interest earned by home marginal investors</td>
</tr>
<tr>
<td>$z^*$</td>
<td>personal accrual capital gains tax rate on foreign currency gains</td>
</tr>
<tr>
<td>$c^*$</td>
<td>corporate accrual capital gains tax rate if foreign operation is sold</td>
</tr>
<tr>
<td>$t_1$</td>
<td>combined host and home tax rate at which Thai interest expenses are deducted</td>
</tr>
<tr>
<td>$t_2$</td>
<td>combined host and home tax rate on a dollar of nominal revenues.</td>
</tr>
<tr>
<td>$A$</td>
<td>present value of net investment allowances</td>
</tr>
</tbody>
</table>
### Table 2.2. Parameter Values Used in Simulation (in Percentage).

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Thailand</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate tax rate — u and u* (3), (4)</td>
<td>30.0</td>
<td>38.3</td>
</tr>
<tr>
<td>Dividend withholding tax rate — θ (3)</td>
<td>10.0</td>
<td>-</td>
</tr>
<tr>
<td>Inflation rate — π and π* (1)</td>
<td>5.7</td>
<td>4.3</td>
</tr>
<tr>
<td>Statutory depreciation rate — α and α* (2)</td>
<td>10.0</td>
<td>13.6</td>
</tr>
<tr>
<td>Economic depreciation rate — δ (2)</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Debt-asset ratio — β* (4)</td>
<td></td>
<td>41.0</td>
</tr>
<tr>
<td>Subsidiary’s dividend payout ratio — d (2)</td>
<td>-</td>
<td>48.0</td>
</tr>
<tr>
<td>Interest rate — i and i* (1)</td>
<td>10.1b</td>
<td>8.5</td>
</tr>
<tr>
<td>Personal tax rate on interest income — m* (4)</td>
<td></td>
<td>36.0</td>
</tr>
<tr>
<td>Personal tax rate on realized capital gains — zR (4)</td>
<td></td>
<td>36.0</td>
</tr>
<tr>
<td>Personal effective accrual capital gains tax rate — z*</td>
<td></td>
<td>12.3</td>
</tr>
<tr>
<td>Corporate accrual capital gains tax rate — c (2)</td>
<td></td>
<td>13.0</td>
</tr>
</tbody>
</table>


a Based on 1991 consumer price index.  
b Calculated using open economy arbitrage.

---

### Table 2.3. Small Host Country Income to Consumption Tax Switch, 1991 under 100 Percent Parent Finance. (i.e., $\rho = \beta^* i^*(1-u^*)+(1-\beta^*)e^* = 5.8; \ r_f = \rho/(1-c) - \pi^* = 2.3; \ r_n = 2.8$)

<table>
<thead>
<tr>
<th></th>
<th>LM</th>
<th>METR (Income)</th>
<th>METR (R&amp;R+F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territorial System or Excess FTCs</td>
<td>42.7</td>
<td>39.6</td>
<td>-21.2</td>
</tr>
</tbody>
</table>
| Worldwide Income Taxation
| Case 1 — Deferral Allowed
| Full credit — corp. and with. taxes       | 46.1 | 37.5          | 8.5          |
| Partial credit — with. taxes only         | 40.7 | -52.5         |
| Deduction — corp. and with. taxes         | 40.0 | -15.8         |
| Case 2 — No deferral Allowed
| Full credit — corp. and with. taxes       | 50.3 | 45.2          | 45.2         |
| Partial credit — with. taxes only         | 78.3 | 64.0          |
| Deduction — corp. and with. taxes         | 69.2 | 58.6          |
Table 2.4. Small Host Country Income to Consumption Tax Switch, 1991 under 100 Percent Local Debt Finance, Equal Inflation Rates. (i.e., Optimal Debt Policy: \( r_f = \rho/(1-c) - \pi^* = i(1-u) - \pi; \ r_n = i^* - \pi^* = 4.2 \))

<table>
<thead>
<tr>
<th></th>
<th>LM</th>
<th>Income Tax</th>
<th>R-base</th>
<th>R+F-base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territorial System or Excess FTCs</td>
<td>42.7</td>
<td>1.6</td>
<td>-19.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Worldwide Income Taxation Case 1 — Deferral Allowed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full credit — corp. and with. taxes</td>
<td>46.1</td>
<td>1.6</td>
<td>-25.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Partial credit — with. taxes only</td>
<td>1.6</td>
<td>-16.6</td>
<td>5.0</td>
<td>-0.2</td>
</tr>
<tr>
<td>Deduction — corp. and with. taxes</td>
<td>1.5</td>
<td>-21.6</td>
<td>4.0</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Table 2.5. Small Host Country Income to Consumption Tax Switch, 1991 under 100 Percent Local Debt Finance. (i.e., Optimal Debt Policy: \( r_f = \rho/(1-c) - \pi^* = i(1-u) - \pi; \ r_n = i^* - \pi^* = 4.2 \))

<table>
<thead>
<tr>
<th></th>
<th>LM</th>
<th>Income Tax</th>
<th>R-base</th>
<th>R+F-base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territorial System or Excess FTCs</td>
<td>42.7</td>
<td>1.6</td>
<td>-14.2</td>
<td>4.7</td>
</tr>
<tr>
<td>Worldwide Income Taxation Case 1 — Deferral Allowed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full credit — corp. and with. taxes</td>
<td>46.1</td>
<td>1.5</td>
<td>-19.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Partial credit — with. taxes only</td>
<td>1.6</td>
<td>-11.9</td>
<td>5.7</td>
<td>11.7</td>
</tr>
<tr>
<td>Deduction — corp. and with. taxes</td>
<td>1.4</td>
<td>-16.6</td>
<td>4.5</td>
<td>10.5</td>
</tr>
</tbody>
</table>

Table 2.6 Comparisons of \( \sigma, r_f \) and METRs under R and R+F-Based Taxes.

<table>
<thead>
<tr>
<th></th>
<th>R-base</th>
<th>R+F-base</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma^* )</td>
<td>( r_f )</td>
<td>METR</td>
</tr>
<tr>
<td>Credit</td>
<td>50.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Partial Credit</td>
<td>58.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Deduction</td>
<td>44.1</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 2.7. Small Host Country Income to Consumption tax Switch, 1991 under 100 Percent Parent Finance for Multinational Branches. (i.e., \( \rho = \beta^* i^* (1-u^*) + (1-\beta^*) e^* = 5.8; \ r_f = \rho/(1-c) - \pi^* = 2.3; \ r_n = 2.8 \))

<table>
<thead>
<tr>
<th></th>
<th>LM</th>
<th>METR (Income)</th>
<th>METR (R&amp;R+F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territorial System or Excess FTCs</td>
<td>42.7</td>
<td>39.6</td>
<td>-21.2</td>
</tr>
<tr>
<td>Branch Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full credit — corp. and with. taxes</td>
<td>50.3</td>
<td>45.2</td>
<td>45.2</td>
</tr>
<tr>
<td>Partial credit — with. taxes only</td>
<td>78.3</td>
<td>64.0</td>
<td></td>
</tr>
<tr>
<td>Deduction — corp. and with. taxes</td>
<td>69.2</td>
<td>58.6</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER THREE
THE INCIDENCE OF THE CLASSIFIED AND GENERAL PROPERTY TAX

This essay analyzes the balanced-budget incidence of both a general and a classified property tax in a general equilibrium framework of n communities, two sectors, and three factors. The model generally follows Lin (1986); however, unlike Lin (1986), who analyzes the effects of the property tax only on the residential sector, this essay also examines the incidence of a general property tax that is levied on all properties owned by the residential and commercial (export) sectors at the same rate. This approach is easily justified, since practically all communities in the United States impose the property tax on both sectors and available data show that each of the two sectors possesses roughly half of the value of the reproducible structures.53

The Census of Governments (U.S. Department of Commerce, 1994), however, points out that in 1992 fourteen states allowed communities to impose a classified property tax system in which different property tax rates are levied on different classes of properties.54 Sonstelie (1979) has analyzed such a classified property tax — in which commercial properties are taxed more heavily than residential properties — using a two-sector, two factor general equilibrium model. The shortcomings of his model are that labor is ignored in the analysis,55 and the community analyzed is a small community that takes the price of capital as given so that his analysis focuses solely on the "excise" tax

53 Specifically, Musgrave and Musgrave (1989) report that the value of residential structures in 1985 is $2269 billion and the value of the commercial and industrial structures is $1987 billion, using the data from the Statistical Abstract of the United States (Department of Commerce, 1987).
54 Those fourteen states include Alabama, Arizona, Colorado, Kansas, Louisiana, Michigan, Mississippi, Missouri, Montana, North Dakota, South Carolina, Tennessee, Utah, and Wyoming. At the time Sonstelie (1979) examines the classified property taxation, only eight states used this tax.
55 Sonstelie states, "These results can only be regarded as tentative, however, because the model presented here fails to incorporate several factors of potential importance. Chief among these is the effect of classification on the return to labor."
effects of the property tax in which the tax burden is shifted backward to immobile land and/or forward to consumers of residential and nonresidential products.\textsuperscript{56}

The goal of this paper is to extend the analyses of Sonstelie (1979) and Lin (1986). Since Sonstelie (1979) excludes labor from his two-sector, two-factor model, it cannot be used to determine the effects of the property tax on wages. Using Lin's three-factor model, this shortcoming is overcome. Lin also incorporates two sectors; however, rather than having both sectors use capital and land, the residential sector in his model employs capital and land, and the commercial sector employs labor and land. Moreover, he introduces public expenditure benefits into his model and divides the community into two groups with community 1 imposing the residential property tax while the rest of the communities in the economy levying zero tax; thus, the effect of the property tax and its benefits can be analyzed for both the taxing community and the rest of the economy.

Although Lin's three-factor, two-sector model is a major step forward in examining property taxation, his description of the commercial sector, which uses land and labor in production, is not a realistic one. According to the \textit{Statistics of Income Corporation Income Tax returns} (Department of Treasury, 1990), the ratio of land to depreciable assets of all industries excluding real estate is 1:26. In light of this fact, the model constructed in this essay assumes that the export sector uses capital (rather than land) and labor in production.\textsuperscript{57}

Lin analyzes from a pre-tax optimum the effects of the residential property tax on all prices and quantities in the goods and factor markets. Thus, the tax used in his analysis can be viewed as a classified property tax system that levies a higher tax on residential properties than on commercial properties. Since most states have a single-rate

\textsuperscript{56} As shown by Brown (1924), Mieszkowski and Zodrow (1984) and Lin (1986), the property tax imposed by a community, however small, would depress the net real rate of return on capital as long as capital in the economy as the whole is fixed.

\textsuperscript{57} As in Lin's model, each community has a fixed amount of land. Since land is assumed to be used only in the residential sector, there is no tax-induced substitution effect of land between sectors. A more meaningful analysis would be a model of two sectors in which each uses three factors in production; however, with the general functions used in the model, the theoretical results would be intractable. Using other simpler forms of functions such as Cobb-Douglas or CES would be a fruitful exercise for future research.
property tax system that levies taxes on both types of properties, the essay will examine the incidence of the general or uniform property tax. Moreover, it will also examine the incidence of a commercial property tax, as in Sonstelie (1979), which can be viewed as a classified property tax in which commercial properties are taxed more heavily than residential properties.

One of the salient features of Lin's model — which is followed in this analysis — is that revenues are not assumed to be wasted. Rather, Lin assumes that residents, who are either a worker, capitalist or landlord, benefit from the tax; specifically, Lin assumes that the amount of housing tax paid by each resident exactly equals the amount of benefit received.\(^{58}\) Since our model also analyzes commercial property taxation, how residents benefit from this tax must also be specified. Two alternative assumptions on how residents benefit from the commercial property tax are analyzed: (1) every resident receives an equal lump sum rebate or public expenditure benefit and (2) only workers receive the lump sum benefit. In the analysis of the general property tax, residential property tax revenues are assumed to be distributed as in Lin's analysis and commercial property tax revenues are distributed as described above.

The main results of the analysis are as follows. First, the classified property tax used in Sonstelie (1979) (a differentially higher tax rate on commercial capital) or the general property tax would cause a wage reduction in the taxing community coupled with a wage increase in the rest of the economy.\(^{59}\) With perfect competition, a constant-returns-to-scale production function and a fixed price of the export good, real wages in the taxing sector decrease due to a negative output effect on labor demand. This effect is

---

58 Note that residents are not homogenous since workers, capitalists, and landlords may spend different fraction of their income on housing and would earn different after-tax factor returns. Thus, this type of distribution described by Lin implies that individuals who pay more residential property taxes receive more public expenditure benefits. This may be justified by arguing that individuals living in a wealthy neighborhood get better police protection and education for their children than those in the poor neighborhood.

59 See Lin (1986) for the effect on wages of the classified tax in which a differentially higher tax rate on residential properties. He shows that the residential property (land and capital) tax increases wages throughout the economy as it causes land to shift to the commercial sector, resulting in an increase in the marginal productivity of labor.
large due to the assumption of a perfectly elastic demand for the export good, and far exceeds the positive effect on wages attributable to the firm’s substitution of relatively cheaper labor for taxed capital.\textsuperscript{60} At the same time, real wages in the nontaxing communities increase solely due to the effect of capital inflows that increase the marginal productivity of labor.

Second, since mobile workers can shop freely for the community with the best package of wage rate, housing price, and public expenditure benefit, the community wage differential — the difference between the wage rate in the taxing community and that in the rest of the economy — is eliminated when commercial property tax revenues are distributed equally to workers in lump sum fashion.\textsuperscript{61} When coupled with government distribution of residential property tax revenues such that each resident receives a benefit equal to the housing tax paid, the change in net housing price — the change in housing price plus the benefit — for an income group in the taxing community is equal to the reduction in the housing price of the same income group in the nontaxing communities. With these assumptions, the "net-of-benefit" wages and housing prices are equalized across communities.\textsuperscript{62} In contrast, if revenues are distributed equally to all residents, net-of-benefit wages and housing prices are not necessarily the same across communities.

Third, if only workers benefit from the commercial property tax under the classified property tax or if this is coupled with the distribution system under the general property tax in which the benefit from the residential property tax for each resident equals the amount of housing tax paid, labor mobility will ensure that land rents change by the same amount across communities.\textsuperscript{63} With equal changes in the net-of-benefit (if any) factor returns and housing prices across communities under each tax regime, the welfare

\textsuperscript{60} In this fixed national capital stock model, the overall after-tax real rate of capital decreases.
\textsuperscript{61} Note that initially all communities are identical and workers have a common indirect utility function.
\textsuperscript{62} Although the benefit from the residential property tax is capitalized in the housing price, the general property tax is not a nondistortionary benefit tax since the general property tax causes the net-of-benefit housing prices to decrease, wages to increase, and the returns to capital and land to go down throughout the economy.
\textsuperscript{63} Lin also obtains this result.
of each income group changes uniformly across communities, while the tax affects factor returns and thus welfare among different income groups differently.

Fourth, when the government distributes commercial property tax revenues to workers under the classified property tax or when this is coupled with the distribution of the residential property tax revenues as in Lin's analysis under the general property tax, individuals whose resources are taxed are the ones who bear the tax burden. For similar reasons, the general property tax (on capital and land) unambiguously improves the welfare of workers and reduces the welfare of capitalists and landlords. This tax incidence on various income groups shows that the property tax is not a nondistortionary benefit tax, although workers are allowed to shop freely for the community with the best bundle of wages, housing prices, and public expenditure benefits. This occurs because a tax on capital and land would bear by capital and land owners as the taxing community levies a tax on fixed land and all capital used within the community; with a fixed national capital stock and capital mobility, the tax burden is shifted to capital owners throughout the economy.

Finally, this essay shows that the change in aggregate welfare in a community can be determined unambiguously as long as the change of labor population within a

64 Lin does not find this strong result for landlords in his analysis of the differentially higher tax on residential properties as the reduction in land rent is moderated since land can be shifted to the commercial sector; thus, when the land rent reduction combined with a real income increase attributable to the housing price reduction, the welfare of landlords is ambiguous. In our model, the residential property tax unambiguously decreases the welfare for land owners since land is only used in the residential sector.

65 This is true for landlords if the price elasticity of housing demand exceeds the elasticity of substitution between land and capital in housing production. Mieszkowski and Zodrow (1989, p. 1118) report that most empirical evidence shows that this condition is true (e.g., see McDonald (1981)).

66 Hamilton (1975, 1976) argues that perfect zoning or perfect capitalization would ensure that the property tax is a nondistortionary benefit tax when residents are perfect mobile. Income is location-independent, local governments provide a menu of tax and expenditure packages that satisfy all individuals' tastes, and local public service is the publicly provided private good. Note that this model does not satisfy most of these requirements. See Mieszkowski and Zodrow (1989) for a recent review of the incidence of property taxation.
community is known, although the effect of the property tax on the level of aggregate economic activity may be indeterminate. This result is obtained because the model is analyzed from an initial optimum in which taxes equal zero and all residents, except workers, are immobile. Specifically, since the social welfare function of the community depends on housing price and aggregate income, using initial factor endowments and prices, the excess burden equals zero since the changes in product prices are equal to the weighted (by factor shares) average changes in factor prices plus public expenditure benefits. However, since all factor endowments, except labor, are fixed, the welfare change, therefore, depends on the number of workers in the community. One interesting result obtained is that the general property tax improves (worsens) aggregate welfare in the taxing community (the rest of the economy) since the tax attracts workers into the taxing community, if the government distributes residential property tax revenues as in Lin's analysis and commercial tax revenues equally to workers.

The model is presented in the next section. Section III analyzes the effects of the classified and general property tax on factor and product prices, while Section IV examines the aggregate welfare and utility changes of various income groups in the taxing community and the rest of the economy. For comparison purposes, Section V examines the incidence of general property taxation if tax revenues are wasted. Section VI concludes and discusses directions for future research. Details of the derivations are given in Appendix.

II. Model

Suppose there are n identical communities. Each community has two sectors producing the commercial (export) good, \( H_i \), and the housing good, \( X_i \), where \( i = 1, \ldots, n \). (See Table 3.1 for summary of notation.) The housing good is produced by capital and fixed land, \( K_i^{h} \) and \( l \), whereas the export good is produced by capital and labor, \( K_i^{x} \) and \( L_i \). The production functions of the two goods, \( H_i = f(K_i^{h}, l) \) and \( X_i = g(K_i^{x}, L_i) \), are homogenous of degree one.
Let $s_i$, $r_i$, and $w_i$ be the net returns per unit of capital, land and labor, respectively, and $p_i$ be the housing price. Suppose all prices initially equal one and the export good $X_i$ is the numeraire good of which its price is determined exogenously (e.g., by the world market) and thus fixed at unity.

Analyzing from the pre-tax optimum, assume that only community 1 levies a classified or a general (uniform) property tax and provides public expenditure benefits or lump-sum tax payments to residents, while the rest of communities in the economy do not levy any tax. The classified property tax is defined as the differentially higher tax on commercial properties or the tax assessed only on capital used in the export sector, whereas the general property tax is a tax levied on all commercial and residential properties (capital and land) at the same rate. Capital used in the commercial sector is taxed at rate $\tau_i$ while capital and land used in the housing sector are taxed at same rate of $t_i$, which is equivalent to a tax assessed on housing services at rate $t_i/(1+t_i)$.\footnote{Specifically, $p_i H_i = (1+t_i) [s_i K_i^{h_1} + r_i l_i]$ is equivalent to $[1/(1+t_i)]p_i H_i = s_i K_i^{h_1} + r_i l_i$. In other words, a tax on housing services at rate $[t_i/(1+t_i)]$ is equivalent to an equal tax rate of $t_i$ on capital and land. See Musgrave (1959) and McLure (1975) for discussions on other equivalences.}

Residents within a community is either a worker, a capitalist or a landlord. They benefit from public expenditures as follows. Under the classified tax, the taxing community distributes tax revenues in such a way that (1) each resident benefits equally from public expenditures, or $\phi^j = \tau_i s K_i^{x/N}$, where $j = L, K, l$ (worker, capitalist, or landlord) and $N$ is the initial population in each community, or (2) only workers benefit equally, or $\phi^j = \tau_i K_i^{x/L}$. Under the general property tax, two methods of distribution considered are (1) that commercial property tax revenues are distributed equally only to workers and residential property taxes are distributed so that each resident receives the benefit, $\delta^j$, equal to the amount of housing tax paid, $b^j [t_i/(1+t_i)]$, where $b^j$ is the amount of housing consumed by individual $j$, or $\phi^j = \tau_i K_i^{x/L}$ and $\delta^j = [t_i/(1+t_i)]b^j$ and (2) that the government is completely wasteful, or $\phi^j = 0$ and $\delta^j = 0$.\footnote{Specifically, $p_i H_i = (1+t_i) [s_i K_i^{h_1} + r_i l_i]$ is equivalent to $[1/(1+t_i)]p_i H_i = s_i K_i^{h_1} + r_i l_i$. In other words, a tax on housing services at rate $[t_i/(1+t_i)]$ is equivalent to an equal tax rate of $t_i$ on capital and land. See Musgrave (1959) and McLure (1975) for discussions on other equivalences.}
The equations of change of the model are as follows. In each community $i$, factor demand conditions can be derived from cost minimization:

(3.1) $\text{d}K_i^{h*} = -\sigma^h(ds_i^* - dr_i^*)$,

(3.2) $\text{d}K_i^{x*} - \text{d}L_i^* = -\sigma^x(ds_i^* + \tau_i - dw_i^*)$,

where asterisk (*) denotes the natural logarithm (e.g., $\text{d}L_i^* = \text{d}L_i/L_i$), $\sigma^h$ is the elasticity of substitution between capital and land in housing production and $\sigma^x$ is that between capital and labor in export production. For notational convenience, let denote the change in the infinitesimal commercial property tax as $\tau_i$ (i.e., $d\tau_i = \tau_i$). Note that $dl = 0$ since land is fixed.

Assume a linear homogenous production function and perfect competition in factor and product markets. For the housing sector, total differentiating the condition for zero profit maximization, $p_iH_i = (1+\tau_i)[s_iK_i^{h*} + r_iL_i]$, implies

(3.3) $\text{d}H_i^* = f_k dK_i^{h*}$,

(3.4) $\text{d}p_i^* = f_k ds_i^* + f_i dr_i^* + \tau_i$,

where $f_k$ and $f_i$ are initial relative factor shares of capital and land in the housing sector; For notational convenience, let denote the change in the infinitesimal residential property tax as $\tau_i$ (i.e., $d\tau_i = \tau_i$).

For the export sector, total differentiating $X_i = (1+\tau_i)s_i K_i^{x*} + w_i L_i$ implies

(3.5) $0 = g_L dw_i^* + g_k ds_i^* + g_k \tau_i$,

where $g_k$ and $g_L$ are initial factor shares in the export sector. Since the demand for $X$ is perfectly elastic ($X$ is numeraire), its price change equals zero as shown on the left hand side of (3.5). Walras' Law allows the equation similar to (3.3) for the export sector to be ignored.
Labor and capital are assumed to be perfectly mobile, whereas land is fixed. As individuals, workers are assumed to be perfectly mobile but have to work and live in the same community, while land and capital owners are immobile.\(^{68}\) The aggregate community income, \(Y_i\), can be written as

\[
(3.6) \quad Y_i = s_iK + w_iL_i + r_iI + (t_i/(1+t_i))p_iH_i + \tau_i s_i K_i^x,
\]

where \(K\) and \(l\) are the stocks of capital and land equally endowed in each community, and \((t_i/(1+t_i))p_iH_i\) and \(\tau_i s_i K_i^x\) are tax revenues collected from the housing and the export sector. The community aggregate welfare can be written as \(V_i = V(p_i, Y_i)\), where \(V\) is a common indirect utility function.

Assume preferences are homothetic in that workers, capitalists and landlords spend fixed proportions of their income on the two goods. The aggregate community demand for housing services can be written as \(H_i = D(p_i, Y_i)\). Two assumptions are made to find the change in housing demand: (1) the government distributes all tax revenues to residents, or (2) under the case of wasteful government, it behaves exactly like consumers in that its spending would just counterbalance the reductions in private spending. Under either assumption, the change in housing demand is independent of income effects; total differentiating \(H_i = D(p_i, Y_i)\) yields

\[
(3.7) \quad dH_i^* = -E^h dp_i^* + MdL_i^*,
\]

where \(E^h\) is the negative of the income-compensated elasticity of aggregate housing demand with respect to its own price and \(M\) is the elasticity of community housing demand with respect to labor population (see Appendix). Walras' law allows the community demand for the export good to be ignored.

The supplies and demands for capital and labor are as follows. National stocks of capital and labor are fixed; however, capital can flow costlessly between communities

\(^{68}\) This assumption can be relaxed if the benefits are distributed as described under the general property tax.
and sectors, and workers can migrate freely to obtain the highest utility taking into account the wage rate, housing price and public expenditure benefit (if any). In equilibrium, net rental rates on capital are equal for any community h and i, or

\[(3.8) \quad ds_h = ds_i = ds,\]

and workers utilities between communities are equal, or

\[(3.9) \quad V(p_h, w_h + \phi_i^j + \delta_i^j) = V(p_i, w_i + \phi_i^j + \delta_i^j),\]

where \(V\) is a common indirect utility function of housing price and total labor income, which includes the wage rate \(w_i\) and public expenditure benefits, \(\phi_i^j + \delta_i^j\).

Since capital endowments \(K\) are equal, the national capital stock can be written as \(K_1 + K_2 + \ldots + K_n = nK\), where \(K_i\) is capital used in community \(i\). Total differentiating this condition yields \(dK_1^* + dK_2^* + \ldots + dK_n^* = 0\), where \(dK_i^* = dK_i/K\). Suppose all communities except community 1 follow the same policy; thus, \(dK_2^* + \ldots + dK_n^* = (n-1)dK_2^*\). Thus, full capital employment condition can be written as

\[(3.10) \quad dK_1^* + (n-1)dK_2^* = 0.\]

Since \(K_i\) in each community is allocated between sectors, \(K_i = K_i^h + K_i^x\), the equations of change can be written as

\[(3.11) \quad dK_i = k^h dK_i^h^* + k^x dK_i^x^*,\]

where \(k^h = K^h/K\) is the fraction of initial capital endowment used in the housing sector and \(k^x = K^x/K\) is that used in the export sector. These shares are identical across communities initially.

Total differentiating the full labor employment condition, \(L_1 + L_2 + \ldots + L_n = nL\), yields

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69 This labor mobility condition is introduced by Brueckner (1981) and Hobson (1986) and later extended by Lin (1986). Note that utilities, rather than wages, are equalized.
(3.12) \( dL_1^* + (n-1)dL_2^* = 0. \)

Since only community 1 levies a tax while other n-1 communities follow the same no-tax policy, the labor demand of community 1 can be defined as \( L_1 = z(V_1, V_2); \) total differentiating yields

(3.13) \( dL_1 = - b^{L_1} L_1 e^L (dr_1^* - dr_2^*) + e^L (b^L L_1 - d^L) + e^L (\frac{dK}{dL} \tau_1 - d\phi^L), \)

where \( e^L = Y^L(\partial z/\partial V_1) \) in which \( (\partial z/\partial V_1) \) is the change in labor population in community 1 with respect to utility change and \( Y^L \) is the marginal utility of income for workers.\(^70\) Thus, \( b^L e^L \) is the elasticity of labor population with respect to the land rent differential between the two communities. Since labor is perfectly mobile, a small increase in utility would cause an infinite increase in labor population in community 1; thus, the analysis will be examined by assuming \( (\partial z/\partial V_1) = \infty \) implying \( e^L = \infty. \)^71

Using equal-net-rate-of-return-on-capital condition in (3.8), equations (3.1)-(3.5), (3.7), (3.10)-(3.13) yield 17 equations and 17 unknowns: \( L_i, K_i, K_i^h, K_i^x, H_i, p_i, w_i, r_i, s. \)
A system of four equations and four unknowns \( (dr_1^*, dr_2^*, ds^*, dL_1^*) \) can be formed. The derivation is given in Appendix.

III. Factor and Product Prices

This section analyzes the effects of the classified and the general property tax on factor and product prices. When the commercial or residential properties are taxed, the costs of taxed factors (capital and/or land) used in production would increase. Since capital is perfectly mobile but fixed in the economy, either tax would cause capital to seek higher returns in the untaxed sector within the community and in the untaxed sectors of other nontaxing communities until all capital earns the same rate of return, as assumed in (3.8).

\(^70\) See Appendix for derivation.
\(^71\) Note that in the case of immobile labor, the model can be solved by assuming \( (\partial z/\partial V_1) = 0 \) implying \( e^L = 0. \)
Analyzed from a pre-tax optimum, the tax causes the overall net rate of return to capital to reduce by

\[
(3.14) \quad ds^* = - \frac{(k^h\sigma^h/(\sigma^h + f_1 E^h))\tau_1 + [E^h k^h\sigma^h]t_1}{n[k^hE^h\sigma^h + (k^x\sigma^x/\sigma^h)(f_k\sigma^h + f_1 E^h)]},
\]

where setting \( \tau_1 > 0 \) and \( t_1 = 0 \) yields \( ds^* \) under the classified property tax and setting \( \tau_1 = t_1 > 0 \) yields \( ds^* \) under the uniform property tax.

If community 1 imposes the classified property tax (i.e., \( \tau_1 > 0, \ t_1 = 0 \)), the taxed-induced lower net rate of return on capital in the export sector would cause capital flight to the untaxed housing and export sectors throughout the economy.\(^{72}\) Capital outflows would continue until the new equilibrium rate of capital return is established, and thus capital throughout the economy would bear the tax burden imposed by the single community. This suggests an important result of the "new" view of property taxation pointed out by Brown (1924), Lin (1986) and Mieszkowski and Zodrow (1984) that even if there are a large number of communities, the property tax, even imposed by a single community, however small, would depress the return to capital owners throughout the economy.

The capital rental reduction in (3.14) under the classified property tax depends on the complex interactions of the price elasticity of housing demand, and production elasticities and relative factor shares of the two sectors. The magnitude of the reduction is less when export producers cannot easily substitute cheaper labor for capital, or in the housing sector when home builders can easily substitute cheaper capital for land or residents are not very responsive to housing price. Specifically, if \( \sigma^x \) is small (large), \( \sigma^h \) is large (small) or \( E^h \) is small (large), the less is the reduction in the rental price. Nevertheless, the absolute magnitude of the rental reduction would not be larger than

---

\(^{72}\) Ignoring the effects of labor migration on capital demand (this occur when only workers receive lump sum payments), algebraically, capital used in the export sector in community 1 is reduced by \( (\sigma^x/\sigma^h)f_1 ds^* \), while that in other \( n-1 \) communities is increased by \( (\sigma^x/\sigma^h)ds^* \); moreover, capital used in the housing sector throughout the country is increased by \( k^x\sigma^xE^h(\sigma^h/\sigma^x)/n\Omega \) \( \tau_1 \).
\( t_1/n \); this suggests that the rental reduction is insignificant if there are an infinite number of communities.

If community 1 imposes a uniform property tax (i.e., \( t_1=\tau_1 \) in 3.14), the capital rental reduction would be independent of factor shares and elasticity parameters and would simply fall by \( t_1/n \). The reason is that capital used in both sectors is taxed by community 1 at the same rate and capital mobility ensures that all capital in the economy earns the same rate of return.

In the export sector in which capital and labor are used in production, the commercial or the uniform property tax would lower wages in the taxing community, but raise them in the rest of the nontaxing communities in the economy, or

\[
(3.15) \quad dw^*_i = -\frac{g_k}{g_L} (\tau_1 + ds^*),
\]

where \( i = 1, 2 \) and \( \tau_1 > 0 \) and \( \tau_2 = 0 \). This is derived from (3.5) that relates housing prices to factor prices. Although the pattern of wage changes is the same under the classified and the general property tax, the magnitude is smaller under the classified property tax.

The reduction in the wage rate in community 1 is due to two opposing effects. On one hand, the tax would induce export producers to substitute untaxed labor for capital; this substitution effect would increase the wage rate in community 1 by \( g_k/g_L(-ds^*) \). On the other, since demand of the export goods is perfectly elastic, the tax would depress export production as the gross-of-tax cost of capital is increased. As a result, the output effect on labor demand would depress the wage rate in community 1 by \( g_k/g_L(\tau_1) \). Since the output effect is much greater than the effect of substituting labor for capital (e.g. this equals \( g_k/g_L(t_1/n) \) under the uniform tax), the wage rate falls. In contrast, workers in the rest of the economy (i.e., \( i=2 \)) would enjoy an increase in the wage rate as capital inflows increase the marginal product of labor by \( g_k/g_L(-ds^*) \) (i.e., \( \tau_2=0 \) in (3.15)). In comparing wages, the community wage differential will be defined as the difference between the
wage rate in the nontaxing communities and the wage rate of the taxing community, or the negative of the output effect equal to $\frac{\partial k}{\partial \Sigma} \tau_1$.

In the housing sector in which capital and land are used in production, the general or the classified property tax depresses the return on capital as described in (3.14), and causes changes in land rents as follows.

(3.16) $d\tau_1^* = \frac{[f_k(E^h-\sigma^h)(k^x\sigma^x/g^l)] \tau_1 + [E^h(k^h\sigma^h + k^x\sigma^x/g^l)] t_1}{n\{k^hE^h\sigma^h + (k^x\sigma^x/g^l)[f_k\sigma^h + f_lE^h]\}} + (n-1) \frac{W^x}{nbL^l_1} + (n-1) \frac{W^h}{nbL^l_1},$

(3.17) $d\tau_2^* = \frac{[f_k(E^h-\sigma^h)(k^x\sigma^x/g^l)] \tau_1 + [E^h(k^h\sigma^h + k^x\sigma^x/g^l)] t_1}{n\{k^hE^h\sigma^h + (k^x\sigma^x/g^l)[f_k\sigma^h + f_lE^h]\}} + \frac{W^x}{nbL^l_1} + \frac{W^h}{nbL^l_1},$

where $W^x = (g_k/g^l)\tau_1 - d\delta^L$ and $W^h = b^l - d\tau_1^* - d\delta^L$. $W^x$ represents the difference between the community wage differential and the benefit from the commercial property tax received by workers, and $W^h$ represents the difference between the housing tax paid and the benefit from the residential property tax received by workers.

Under the classified property tax, (3.16) and (3.17) show that the returns to land are affected although land is not taxed. The changes in land rents across communities can be explained by the substitution and output effects caused by price changes and by the excess of the community wage differential over the benefit from the commercial property tax received by workers ($W^x$). The latter effect works its way to affect land rents because of labor mobility.

The reasons of these effects are as follows. The substitution and output effects on land rents of the classified tax are shown in the first term in (3.16) and (3.17). These effects change land rents uniformly across communities and will be called the global effect on land rents. These two effects are opposing; the substitution effect depends on the ease at which housing producers can substitute capital for land, $\sigma^h$, while the output effect depends on the responsiveness of housing demand to housing price, $E^h$. Specifically, the substitution effect causes a fall in land rents since a lower price of capital causes excess supply of land as cheaper capital is substituted for land; thus, the
higher is $\sigma^h$, the lower is the price of land. The output effect causes an increase in land rent since a lower housing price due to lower price of capital causes higher demand for housing and thus for land; thus, the higher is $E^h$, the higher is the price of land. These opposing effects lead to an uncertain change in the price of land; however, if $E^h > (<) \sigma^h$, land rents would increase (decrease). Since empirical studies find that $E^h$ is generally larger than $\sigma^h$ — the position taken in this analysis — the global effect on land rents is positive.\textsuperscript{73}

Land rents are also affected by labor mobility. Labor mobility would ensure that if there is a positive wedge between the community wage differential and the benefit from the commercial property tax received by workers, land rents in community 1 would decrease by the second term in (3.16) and this amount would divide among the n-1 nontaxing communities, resulting in an increase in land rents by the second term in (3.17). Since this effect is different between the taxing and nontaxing communities, it will be called the local-specific effect on land rents. The reason is that workers will move if the tax causes the package of wage rate, housing price, and available public expenditure benefit in one community to better than the package in the another community, or until workers utilities are equalized as in (3.9); that is, $V(p_1, w_1 + \phi^L) = V(p_2, w_2)$. Finding the changes in workers utilities between the two communities by total differentiating (3.9) yields

\begin{equation}
(3.18) \quad b^L f_1 d r_1 + \left[(g_k / g_0) r_1 - d \phi^L \right] = b^L f_1 d r_2.\textsuperscript{74}
\end{equation}

Equation (3.18) shows that if there is an excess of the community wage differential over the benefit received by workers in community 1, this would cause land rents in community 1 to be lower than those in the rest of the economy.

\textsuperscript{73} See McDonald (1981)

\textsuperscript{74} This can be found by using the Roy's Identity $\partial V / \partial p_1 = -b^L (\partial V / \partial I^L)$ where $I^L$ is total worker income, price relation in (3.4), wage changes in (3.15) and equal capital-rental-rate change in (3.8). For more rigorous derivation, see Lin (1986, p. 119-20).
The effects of the two types of government distribution are as follows. If commercial tax revenues benefit workers equally, the wedge between the community wage differential and the benefit received by workers is zero, resulting in land rents to equalize across community by the positive global effect on land rents. The reason that the wage rate in community 1 adjusted for the benefit from the commercial property tax would just be equal to the wage rate in community 2. Thus, workers would have no incentive to move. Moreover, labor mobility ensures that land rents are equalized across communities, as shown in condition in (3.18).

However, if every resident in community 1 benefits equally from public expenditures, the wedge will be positive and land rents in community 1 will be less than land rents in the rest of the economy. This can be justified algebraically since the amount of benefit or \( d\phi^L=(K_1^L/N)\tau_1 \) in (3.18) is less than the community wage differential, \((g_{w}/g_{L})\tau_1=(K_1^L/L)\tau_1\), as the total number of residents \( N \) is more than the total number of workers \( L \). The rationale is that the wage rate plus the public expenditure benefit in community 1 is less than the wage rate in the rest of the economy; workers therefore will migrate from community 1 to other nontaxing communities. The price of land in community 1 relative to that in the rest of the economy falls because there is less demand for housing as labor population decreases.

If commercial property tax revenues benefit workers equally and residential property tax revenues benefit residents equal to the amount of housing tax paid, the general property tax causes land rents to fall by \( t_1/n \) uniformly across communities. The reasons are that \( W^x \) and \( W^h \) equal zero under the assumed distribution systems.\(^75\) For comparison purposes, if all tax revenues are distributed equally to residents, although \( W^x \) is nonnegative, \( W^h \) is positive (negative) if the amount of housing tax paid by workers is larger (smaller) than public expenditure service equally received by residents, or the

\(^75\) This can be shown by examining the equal worker utilities condition, \( V(p_1,w_1+\phi^L+\delta^L) = V(p_2,w_2) \). Differentiating and simplifying yields \( b^L_dr_1 + (g_{k}/g_{L})\tau_1 - d\phi^L + (b^L_t_1 - d\delta^L) = b^L_dr_2 \). If \( g_{k}/g_{L}\tau_1 = d\phi^L \) and \( b^L_t_1 = d\delta^L \), then \( dr_1 = dr_2 = -t_1/n \).
amount of housing consumed by workers is larger (smaller) than the average amount of housing consumed by residents. With equal distribution to residents, the changes in land rents are indeterminate.

*Housing Price Effects*

While the export price is determined outside the model, the classified or the general property tax causes changes in the prices of housing services by affecting costs of factors in production. The price change in community i is equal to the residential property tax (applicable under the uniform tax) plus the weighted (by initial factor shares) average of changes in the net-of-tax costs of land and capital. Note that the rental on capital reduces globally by the same amount while the changes in the price of land contain the global effect and the local-specific effect on land rents. Substituting (3.14) and (3.16) into (3.4) yields \( dp_1^* \) and (3.14) and (3.17) into (3.4) yields \( dp_2^* \):

\[
(3.19) \quad dp_1^* = -\frac{E^h[k^h\sigma^h+f_i(k^x\sigma^x/\gamma^x)][t_1 + (k^x\sigma^x/\gamma^x)f_k\sigma^h+\tau_1]}{\{k^hE^h\sigma^h + (k^x\sigma^x/\gamma^x)[f_k\sigma^h+f_iE^h]\}n} - (n-1)\frac{W^x}{nb^L} - (n-1)\frac{W^h}{nb^L} + t_1,
\]

\[
(3.20) \quad dp_2^* = -\frac{E^h[k^h\sigma^h+f_i(k^x\sigma^x/\gamma^x)][t_1 + (k^x\sigma^x/\gamma^x)f_k\sigma^h+\tau_1]}{\{k^hE^h\sigma^h + (k^x\sigma^x/\gamma^x)[f_k\sigma^h+f_iE^h]\}n} + \frac{W^x}{nb^L} + \frac{W^h}{nb^L},
\]

where the first term in (3.19) and (3.20) represents the reduction in housing price due to the weighted average of the "global" reduction in net capital rental rate and the global effect on land rents, and the second and third terms equal the initial land share \( (f_i) \) multiplied by the local-specific effects on land rents.

Under the classified tax, if only workers benefit from public expenditures, housing prices fall equally across communities by a weighted average of the (global) changes in input costs, or \( (E^h[k^h\sigma^h+f_i(k^x\sigma^x/\gamma^x)])/n\Omega \). If every resident receives the benefit by the same amount, the housing price decreases in the taxing community but is

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\(^{76}\) \( W^h \) is positive if the housing tax paid, \( (1/1-t_1)p_1b^L \), exceeds the public sector benefit, \( (1/1+t_1)p_1(H/N) \). This is true if the amount of housing consumed by workers is larger than the average amount of housing consumed by residents, or \( b^L > H/N \).
indeterminate in the nontaxing communities. Specifically, in addition to the "global" changes in input costs that reduce housing price as described above, the negative (positive) local-specific effect on land rents in community 1 (2) tends to reduce (increase) the housing price.

If commercial tax revenues benefit only workers and residential property taxes are distributed as in Lin's model, the general property tax has the following effects. Since \( W^x = W^h = 0 \), the housing price in community 1 would rise by \( t_1 - t_1/n \) and that in community 2 fall by \( t_1/n \). Note that only the global reductions in the prices of land and capital are relevant. This lowers the housing cost by \( t_1/n \); thus, in the nontaxing communities the housing price falls, but in the taxing community it increases by \( t_1 - t_1/n \) since community 1 imposes a tax on housing services at rate \( t_1 \). Note that the changes in prices are ambiguous if all tax revenues benefit equally to residents as land prices are indeterminate.

IV. Welfare Effects

This section examines the effects of the classified and the uniform property tax on aggregate welfare and utility (real income) changes of the three income groups in the taxing community and the rest of the economy.

To examine whether the community aggregate welfare improves or deteriorates, differentiating the social welfare function of each community, \( V_i = V(p_i, Y_i) \), where \( Y_i \) is the aggregate community income as defined in (3.6), yields

\[
(3.21) \quad \frac{dV_i}{\lambda} = L_i^* \left[ dL_i^* \right],
\]

where \( \lambda \) is the marginal utility of income assumed to be the same for the community as for each income group, and

\[
(3.22) \quad dL_1^* = \frac{n-1}{nM} E_{ht} t_1 - \frac{n-1}{nM} \frac{W^x}{b^l_{t_1}} t_1,
\]

\[
(3.23) \quad dL_2^* = - \frac{1}{nM} E_{ht} + \frac{1}{nM} \frac{W^x}{b^l_{t_1}} t_1.
\]

\footnote{See Appendix for derivation.}
Equation (3.21) shows that a community would gain (lose) welfare when labor population increases (decreases). The reason is that this model analyzes from an optimum in which initial taxes equal zero; using initial factor endowments and prices, excess burden equals zero since the changes in product prices are equal to the weighted average of the changes in factor prices plus public expenditure benefits. With all residents, except labor, being immobile, the change in aggregate welfare depends solely on the change in labor population.

This result is of interest for at least two reasons. First, our analysis does not assume that public expenditures are wasted; thus, the taxing community does not suffer additional welfare loss due to thrown-away tax revenues of \( \frac{t_i}{(1+t_j)}p_iH_i + \tau_i s_iK_i^x \) as in the balanced-budget incidence analyses examined by Harberger (1962), McLure (1970) and Hobson (1986). Second, as long as labor population is known, the community welfare change provides an alternative measure to aggregate economic activity that is often found to be indeterminate.

Equation (3.22) and (3.23) show how the classified and the uniform property tax affect labor population and thus aggregate welfare. Under the classified property tax \((\tau_1 > 0; t_1 = 0\) in 3.22 and 3.23), if commercial tax revenues benefit only workers, there is zero welfare change as \( W^x = 0 \), while the aggregate economic activity is ambiguous in the taxing community and increased in the rest of the community. The reason is that although there would be no change in labor population as the post-tax wage rate plus benefit in the taxing community equals the post-tax wage rate in the nontaxing communities, the capital outflow from (inflow into) the commercial sector in the taxing community (the rest of the economy) decreases (increases) export production while the capital inflow into the untaxed housing sector increases housing production throughout the economy. However, if commercial property taxes benefit residents equally, the aggregate welfare decreases (increases) as it loses (gains) labor population, although the aggregate economic activity is indeterminate (increased). The reason is that in addition
to production effects above, the excess of the community wage differential over the public expenditure benefit will cause labor emigration (immigration) from the taxing community (to the rest of the world), resulting in a shrinkage (an expansion) of the export sector, and will cause land rents to fall (rise), resulting in a shrinkage (an expansion) of the housing sector as the price of capital relative to land increases (decreases). The net results are that export sector shrinks (expands) but housing sector is indeterminate (larger).

Under the general property tax \((t_1=\tau_1>0)\) in which commercial tax revenues benefit only workers and residential property taxes benefit residents as in Lin's analysis, the aggregate welfare improves (deteriorates) as it gains (loses) labor population.\(^78\) The reason is as follows. Suppose only the residential property tax is levied. Analyzed from the pre-tax optimum, the tax-induced capital transfer from the housing sector to the nonhousing sector increases capital-labor ratio and thus wage rate in the taxing community. Workers migrate to the taxing community until wages are equalized. When combined with zero effect of the commercial property tax system on worker population, it increases (decreases) in the taxing community (nontaxing communities). Under this case, aggregate economic activities are also indeterminate throughout the economy. For example, the commercial property tax decreases (increases) export production in the taxing community (the rest of the economy), but labor immigration (emigration) increases (decreases) the export sector.

For comparison purposes, if every resident receives an equal benefit from the general property tax, the aggregate welfare in each community would be indeterminate; for example, in the taxing community,

\[
(3.24) \quad dL_1^* = \frac{n-1}{nM} E_t^{h} t_t - \frac{n-1}{nM} \frac{W^x}{b_L t_t} \tau_t - \frac{n-1}{nM} \frac{W^h}{b_L t_t} \tau_t.
\]

\(^78\) This result can also be derived from Lin's analysis of the residential property tax. Although it is true that aggregate economic activities are undetermined in his analysis, since the tax shrinks the housing sector while expanding export production, Lin does not point out that aggregate welfare of the taxing community improves due to labor immigration.
This shows that if \( W^x = W^h = 0 \), the general property tax increases a number of workers in the export sector. However, under equal distributions, the excess of community wage differential over the benefit from the commercial property tax repels workers, and the excess (deficit) of housing tax paid over the benefit from the residential property tax repels (attracts) workers.

As well known in incidence literature that although the society as a whole may benefit or suffer after the imposition of the tax, individuals that have different sources and uses of income may also gain or lose. The utility changes for the three classes of income groups can be examined by assuming that the community welfare function is separable and that individuals have homothetic preferences and a common indirect utility function. Thus, the social welfare function \( V(p_i, Y_i) \) can be written as \( V_i = L_i V_i^L + K V_i^K + l V_i^l \), where

\[
(3.25) \quad V_i^j = V(p_i, R_i^j + \phi_i^j + \delta_i^j),
\]

where \( j = L, K, I, \phi_1 > 0, \delta_1 \geq 0, \phi_2 = \delta_2 = 0 \), and \( R_i = w_i, s \) or \( r_i \).

Total differentiating (3.25) yields

\[
(3.26) \quad \frac{dV_i^j}{Y_i} = dR_i^j* + d\phi_i^j + d\delta_i^j - b\delta p_i^*,
\]

where \( dR_i^j* \) is the change in the factor income of individual \( j \) in community \( i \). Equation (3.26) suggests that each income group's utility change depends on the change in factor income \( (dR_i^j) \), the public expenditure benefits \( (d\phi_i^L \) and \( d\delta_i^j \)), and the change in housing spending \( (b\delta p_i^*) \).

The classified and the uniform property tax would affect factor returns and product prices differently, which in turn affect each income group's real income differently. Rather than exhausting all cases here, only two cases are examined here. First, the incidence of the classified property tax is examined when commercial tax revenues benefit only workers (i.e., \( d\phi_i^L = (g_k/g_L)\tau_i \)). Second, the incidence of the
uniform property taxation is examined when commercial property taxes benefit only workers and residential property taxes benefit residents as in Lin's analysis (i.e., \(d\delta^L = b^L \tau_1\), \(d\phi^L = \tau_1 K_1 \gamma / L\)). The cases ignored here are those when all revenues are distributed equally to residents since utility changes would mostly be indeterminate; note that if the majority of residents in a community are workers, then the incidence effects would be the same as the above cases (i.e., \(N \rightarrow L\); \(d\phi^L = K_1 \gamma / N \rightarrow (g_k/g_L) \tau_1\), and \(b^L \rightarrow H/N\)). Appendix examines the case when the majority of residents are not workers under the classified property tax when commercial property tax revenues benefit residents equally.

*Incidence of the Classified Property Tax*

It has been shown that only land rents and thus housing prices, not the returns to capital and labor, are affected by the type of government distribution of the taxing community. When each resident receives an equal benefit, the change in individuals' real income would mostly be indeterminate; since solutions are less straightforward, they are provided in the appendix (also see Table 3.2 for the summary of results).

When only workers benefit from the commercial property tax, the effects on factor and product prices are as follows. The return to capital falls throughout the economy, the return to workers decreases (increases) in the taxing community (the rest of the economy), the returns to land are equalized across communities and increases if \(E^b > \sigma^h\) and decreases if \(E^h < \sigma^h\), and the price of housing services falls.

Substituting price changes into (3.26), the utility changes for the three income groups can be written as

\[
\begin{align*}
(3.27) \quad dV_i^L / Y^L & = d\delta^L + d\phi^L + b^L \left( \frac{k^x \sigma^{x/y} / g_L}{n\Omega} \right) f_k \sigma^h \tau_1, \\
(3.28) \quad dV_i^K / Y^K & = - \left( \frac{k^x \sigma^{x/y} / g_L}{n\Omega} \right) f_k \sigma^h \tau_1 + b^K \left( \frac{k^x \sigma^{x/y} / g_L}{n\Omega} \right) f_k \sigma^h \tau_1, \\
(3.29) \quad dV_i^L / Y^L & = \frac{[f_k(\sigma^{h,y} / g_L)] k^x \sigma^{x/y} / g_L}{\Omega} \tau_1 + b^L \left( \frac{k^x \sigma^{x/y} / g_L}{n\Omega} \right) f_k \sigma^h \tau_1.
\end{align*}
\]
where $\Omega = k^h E^h \sigma^h + (k^x \sigma^x/g_L)(f_k \sigma^h + f_l E^h)$.

It can be shown that throughout the economy, the real income decreases for capital owners, but increases for workers and for land owners, if $E^h > \sigma^h(1-b^l)$. For capitalists and landowners, since $d\phi^K = d\phi^l = 0$, their utility changes are exactly the same across communities as shown in (3.28) and (3.29). Specifically, capital owners are worse off since the reduction in the rental rate of $(k^x \sigma^x/g_L)(f_k \sigma^h + f_l E^h)\tau_1/\Omega$ is much larger than the benefit from housing price fall of $b K f_k \sigma^h(k^x \sigma^x/g_L)\tau_1/\Omega$. If $E^h > \sigma^h$, land rents increase across communities; with falling housing price, the condition that ensures an increase in landlords' welfare becomes $E^h > \sigma^h(1-b^l)$. Finally, all workers are also better-off since in the taxing community, the change in wage rate plus the benefit from the commercial property tax equals an increase in the wage rate in the rest of the nontaxing communities in the economy; with housing price decrease, workers' real income increases.

**Incidence of the Uniform Property Tax**

The incidence here hinges on the assumptions that only workers benefit from the commercial property tax and that each resident benefits from the residential property tax equal to the amount of housing tax paid. It has been shown that the economy-wide returns to land and capital owners fall by $t_1/n$, the wage rate falls by $(n-1)(g_k/g_L)(\tau_1/n)$ and the housing price rises by $t_1-t_1/n$ in the taxing community, and the housing price falls by $t_1/n$ and the wage rate rises by $(g_k/g_L)(\tau_1/n)$ in the rest of the economy.

Although factor and product prices may vary between communities, the welfare of each income group across communities changes by the same amount; that is, workers are better off while capital and land owners are worse off. The reasons are that the taxing community uses commercial property tax revenues solely to compensate workers so that the benefit completely offsets the community wage differential, and uses residential property tax revenues to exactly counterbalance the rise in housing prices caused by the nominal property tax on housing (not changes in net factor prices). Thus,
in the post-tax optimum, the wages and housing prices after adjusted for benefits in the taxing community are equal to the wages and housing prices in the rest of the economy.

Specifically, on the uses side of income (fourth term in 3.26), an increase in housing price in the taxing community reduces each resident's real income by \( b^{\cdot}t_1(n-1)/n \), while a decrease in housing price in the nontaxing communities increases each resident's real income by \( b^{\cdot}t_1/n \). However, each resident in the taxing community benefits from the residential tax equal to \( d\delta=b^{\cdot}t_1 \) (third term), the real income change attributable to housing spending \( (-b^{\cdot}t_1(n-1)/n) \) plus the benefit \( (b^{\cdot}t_1) \) equals an increase in real income, \( (b^{\cdot}t_1/n) \) attributable to housing price fall in the nontaxing communities; thus, the "net" housing spending decreases for all residents in the economy. Moreover, on the remaining sources of income (first and second terms), none but workers in the taxing community benefit from the commercial capital tax (i.e., \( d\phi_1^{\cdot}=\left(g_k/g_L\right)t_1; d\phi_1^L=d\phi_1^L=0 \)). All workers are better off because, in addition to reduced housing spending, those in the nontaxing communities earn higher wages and those in the taxing community also earn higher net wages after taking account of the benefit from the commercial property tax. Capital and land owners are worse-off because all lose from a reduction in factor returns by \( t_1/n \), which is much larger than their gains in real income by \( b^{\cdot}t_1/n \) due to reduced housing spending.

V. Wasteful Government

In most studies on balanced budget incidence such as Harberger (1962), McLure (1970), and Hobson (1986), the government is assumed to be completely wasteful in that individuals do not benefit at all from public spending. This assumption seems unrealistic, since even in the simple case of transfer payments the targeted residents would benefit from taxation. Since several studies rely on this assumption, this section will examine briefly the impact of the general property tax on factor and product prices and real income of various income groups.
Compared to the cases of public expenditure benefits, three main results are as follows. First, using initial factor endowments, the aggregate welfare of the taxing community would likely be decreased since the sum of individual losses equals the amount of tax revenues being thrown away. Second, the tax would have the same effect on the returns to capital and labor but would increase land rent relatively more (less) in the taxing community (in the rest of the economy). Third, the welfare for all workers in the post-tax equilibrium does not change (equals zero) since the tax burden is shifted to capitalists and landlords (particularly in the taxing community) as workers can shop freely for the community with the best bundle of the wage rate and the housing price. The latter two main results will be explained by providing results for changes in land and housing prices and then utility changes of different income groups.

The changes in land and housing prices are as follows. Since there is no public sector benefit, $W^x$ equals the community wage differential, $g_k/g_L \tau_1$, and $W^h$ equals the housing tax paid by workers, $b_l^{-1} t_1$. Substituting $W^x$ and $W^h$ into (3.16) and (3.17), the changes in land rents are

\[
(3.16') \quad dr_1^* = \frac{t_1}{n} - (n-1) \frac{1}{b_l^{-1} t_1} g_k \frac{\tau_1}{g_L} n - (n-1) \frac{1}{f_l^{-1} t_1} n,
\]

\[
(3.17') \quad dr_2^* = \frac{t_1}{n} + \frac{1}{b_l^{-1} t_1} g_k \frac{\tau_1}{g_L} n + \frac{1}{f_l^{-1} t_1} n.
\]

Land rents decrease unambiguously in the taxing community and increase unambiguously in the rest of the economy. The reason is that the global effects of the tax reduce land rents equally by $t_1/n$ and the local-specific effects further reduce land rents in the taxing community as taxes borne by mobile workers are shifted entirely to land owners. Moreover, the local-specific effects increase land rents in the nontaxing communities so much that these effects outweigh the global effect on land rents.

Because the price of land falls (rises) drastically in the taxing community (rest of the economy), the housing price decreases (increases) unambiguously; this occurs despite
the net-of-tax cost of capital falls throughout the economy. Specifically, in the taxing community, the nominal residential property tax is completely offset by the weighted average of the reduction in capital return, the negative global effect on land rents, and the negative local-specific effect on land rents attributable to the residential property tax; the remaining change is the product of land share and the negative local-specific effect on land rents attributable to the commercial property tax, or

\[(3.18') \quad dp_1^* = - \frac{n-1}{n} \frac{1}{bL} \frac{gK}{gL} \tau_1.\]

For analogous reasons, the housing price in the nontaxing communities increases by the land share times the positive local-specific effect on land rents attributable to the commercial property tax, or

\[(3.19') \quad dp_2^* = \frac{1}{n} \frac{1}{bL} \frac{gK}{gL} \tau_1,\]

as the weighted average of the reduction in capital return, the positive global effect on land rents and the positive local-specific effect on land rents attributable to the residential property tax equals zero.

The utility changes of various income groups can be easily examined since they depends on changes in housing prices and returns to factor groups (i.e., \(dV_j^*/Y_j = dR_j^* - bLdp_j^*\)). In particular, the welfare for all workers does not change since a rise (fall) in real income due to reduced (increased) housing price is exactly offset by a decrease (an increase) in wages in the taxing community (the rest of the economy). For immobile residents, the welfare of landlords deteriorates (improves) since a fall (rise) in land rents can be shown to exceed the gain (loss) in real income due to reduced (increased) housing price. Finally, the welfare for capitalists is uncertain (decreased) since a reduction in capital return by \(t_1/n\) may or may not be larger than (reinforces) the gain (loss) in real income due to reduced (increased) housing price.\(^79\)

\(^79\) For capitalists in community 1, it is undetermined whether \(ds^* > bLdp_1^*\), or...
VI. Conclusions and Directions for Future Research

This essay examines the effects of a classified property tax and a general property tax in the context of a model with mobile labor. It focuses on the determination of wage effects and changes in welfare and aggregate economic activity. It shows that the property tax is not a nondistortionary benefit tax, as after-tax welfare varies across income groups in each community. This result holds even if the government distributes commercial property tax revenues only to workers so that the wage differential between the taxing community and the rest of the economy is eliminated and if the government distributes residential property tax revenues such that each resident receives a benefit equal to the amount of housing tax paid, so that the housing price differential between communities is eliminated. The property tax is more like a profit tax as described in the "new view" of property taxation in that it reduces the welfare of those individuals whose resources are taxed; that is, capitalists and landlords are the ones that bear the ultimate tax burden. Under the cases examined, the classified property tax is a tax on capital and only the welfare of capital owners unambiguously decreases, whereas the general property tax is a tax on capital and land, and the welfare of capitalists and landlords unambiguously decreases.

Although the model presented in this paper provides some interesting results, it still cannot provide conditions that specify when a local property tax is a nondistortionary benefit taxation as envisaged by Hamilton (1975, 1976) and thus equivalent to the head tax (see Tiebout, 1956). One reason is that this model does not incorporate some important assumptions which are necessary to obtain efficient public goods provision. These would include (1) all residents are perfectly mobile, (2) all residents within a community are homogeneous with respect to demand for local public services, (3) income is location-independent, (4) there exist sufficient communities that

\[ t_1/n > \frac{n-1}{n} b^k \frac{g_k}{b^L g_L} t_1. \]
satisfy individual needs in terms of tax and public sector service, (5) the cost per unit of public services is assumed to be constant or the local public good is a publicly provided private good. Zodrow and Mieszkowski (1986) comes very close in incorporating these assumptions into their two-community, two-sector, three-factor general equilibrium model, but their model assumes that each sector employs the same factors as in this model and residents are immobile. A more meaningful model would be a model of two sectors in which each sector uses three factors in production and make assumptions along the line made by Zodrow and Mieszkowski. The Cobb-Douglas or CES functions may be used instead of general functions so that the analysis is tractable. The strongest results sought would be to find conditions in which the property tax is the benefit tax, in which property tax is the tax on capital, and the property tax is partly a benefit tax and partly a tax on capital.
Table 3.1. Summary of Notation.

- $n$: number of communities
- $i$: community $i$
- $j$: individual $j$ (worker $L$, capitalist $K$, or landlord $l$)
- $H_i$: housing good
- $X_i$: commercial (export) good
- $f_O$: housing supply function
- $K_i^h$: capital used in housing production
- $L_i$: labor used in housing production
- $g_O$: export supply function
- $K_i^x$: capital used in export production
- $l$: fixed land in each community
- $t_i$: commercial property (capital) tax rate
- $t_i$: equal tax rate on capital and land used in the housing sector
- $\phi_j$: benefit from the classified (commercial) property tax
- $\delta_j$: benefit from the residential property tax
- $b_j$: amount of housing consumed by individual $j$
- $s_i$: net rental rate of capital
- $r_i$: land rent
- $w_i$: wage rate
- $p_i$: housing price
- $\ln$: natural logarithm
- $d_{pi}^*$: proportionate change in $p_i$
- $\sigma^h$: substitution elasticity between capital and land in housing production
- $\sigma^x$: substitution elasticity between capital and labor in export production
- $f_k$: initial capital share in total production cost of the housing sector
- $f_l$: initial labor share in total production cost of the housing sector
- $g_k$: initial capital share in total production cost of the export sector
- $g_l$: initial labor share in total production cost of the export sector
- $Y_i$: aggregate community income
- $K_i$: capital endowment in each community $i$
- $E^h$: owned-price, income-compensated elasticity of aggregate housing demand
- $M$: elasticity of community housing demand with respect to labor population
- $V$: common utility function
- $k^h$: fraction of initial capital endowment used in the housing sector ($K^h/K$)
- $k^x$: fraction of initial capital endowment used in the export sector ($K^x/K$)
- $z_o$: labor demand function of community $l$
- $e^L$: change in labor population in community $l$ with respect to utility change
- $Y^L$: marginal utility of income of workers
Table 3.2. Incidence of the Property Tax with Public Expenditure Benefits.

**Classified (Commercial) Property Tax**

\[
V_1^L + V_1^K - V_1^L + (\text{if } E^h > \sigma^h (1-b^l))
\]

**Equal Benefit to Workers**

\[
V_1^L \quad V_1^K \quad V_1^L \quad ?
\]

**Equal Benefit to Residents**

\[
V_2^L \quad ? \quad V_2^K \quad V_2^L \quad + (E^h > \sigma^h)
\]

**General (Uniform) Property Tax**

**Public Expenditure Benefits**

\[
V_1^L + V_1^K - V_1^L -
\]

**Wasteful Government**

\[
V_1^L \quad 0 \quad V_1^K \quad ? \quad V_1^L \quad -
\]

\[
V_2^L \quad 0 \quad V_2^K \quad V_2^L \quad +
\]

†See Appendix
CHAPTER FOUR
OPTIMAL TAXATION AND BUSINESS LOCATION:
A THEORETICAL AND ECONOMETRIC REVIEW

I. Introduction

This essay inquires whether and to what extent business location decisions in a small open economy are affected by taxation. In a closed economy framework, the traditional view is that the country (or state or locality) is endowed with a fixed amount of immobile capital, and thus a tax on capital is fully borne by the capital owners without any allocation and redistribution effects on the economy. In marked contrast, if the country imposing a tax is small and open to unrestricted capital flows, capital would not bear any tax burden. A tax would drive capital out of the country and the before-tax rate of return would rise by exactly the amount of tax. Therefore, capital owners would still earn the same rate of return as that before the tax, and immobile factors would be the ones that bear the tax burden (e.g., labor and land). As shown in a simple graphical model by Slemrod (1988) of the allocation and distributive effects of source-based taxation in an open economy, the basic conclusion is that a country that can be characterized as a small open economy should not impose a source-based tax on capital since it is borne by local factors and also generates deadweight losses associated with a reduction in the overall level of investment. Thus, for a small open economy, the optimal capital tax should be zero, as taxes on immobile factors are superior since they do not incur excess burdens (Gordon 1986 and Diamond and Mirrlees 1971).

However, almost all countries and most states and localities (e.g., in the U.S.) impose taxes on capital. Does this mean that the small open economy assumption, often used in policy analyses, is inappropriate? This essay will attempt to answer this question by
investigating theoretical analyses of optimal capital taxation (Section II)\textsuperscript{80} and providing a literature review on econometric evidence of the effects of taxes on industrial location decisions (Section III).

The first section is divided into two subsections. The first provides optimal tax rules when capital is perfectly mobile or the country faces a perfectly elastic supply of capital. Most theoretical analyses suggest that the optimal capital tax equals zero under the small open economy assumption. However, even if the country takes the world rate of return on capital as given, this result may no longer hold when (1) the economy has a suboptimal capital stock, (2) the government uses capital taxes as the only instrument to raise required level of revenues, or (3) the country has market power not in the capital market but in the goods market and is unwilling or unable to tax the relevant good directly. The second subsection discusses reasons why capital may not be perfectly mobile internationally. The econometric evidence provided by Feldstein and Horioka (1980), suggests that the net capital flows between developed countries are rather small and the correlation between domestic investment and savings is very high. This influential paper, along with other studies suggesting both a lack of international portfolio diversification and the existance of real interest rate differentials between countries, calls into question the zero capital tax result of optimal capital taxation as well as the small open economy assumption. Gordon and others provide at least five explanations why optimal capital taxation is nonzero and the capital may be immobile; these are discussed in this subsection.

The second section of the paper examines the econometric evidence of the impact of taxes on business location decisions. This section is also divided into two subsections. The first reviews the literature on tax effects on various measures of business activity among regions and states in the U.S. These studies are divided into those examining the effects on

\textsuperscript{80} Since this paper focuses on the impact of taxation on business location decisions, the optimal tax examined, therefore, is the source-based capital tax. Note that a source-based tax is a tax based on income earned within the jurisdiction of the taxing authority; an example is a corporation income tax. In contrast, a residence tax is a tax based on citizenship or individuals who live in the taxing jurisdiction; an example is an individual income tax.
business location measures based on micro-level data, which consist of new single-establishment start-ups and new branch openings, and those based on aggregate data, on capital investment, employment, income and output. The second subsection examines relatively scare evidence of the impact of taxes on international investment location, primarily foreign direct investment in the U.S. Tax variables are carefully defined in the review, since the econometric studies based on the marginal effective tax rate, argued to be a better measure of expected tax burden on prospective new investment, provide much stronger results of a negative tax impact than those based on average tax rates calculating from existing data.

The econometric studies reviewed do not unanimously conclude that taxation deters business activities nor do they provide unequivocally strong support for the notion that taxes do not matter.\footnote{Note that the results from econometric studies are not without criticism since there are difficulties in setting up the "correct" model, measuring the dependent and explanatory variables, choosing appropriate explanatory variables without omitting the key ones, and establishing causality. See Zodrow (1994) and Bartik (1991) for elaboration on these econometric problems.} Rather, the results are mixed; however, most studies indicate that at least one measure of business location is affected by taxes, and the more recent and more carefully structured studies tend to show negative tax effects. Thus, the essay concludes that to some extent the small open economy assumption is valid in the sense that a positive factor tax drives the taxed factor out of the economy and hampers business activities.

II. Optimal Source-Based Taxation

This section provides a theoretical survey of literature on the optimal source-based factor taxation. It is divided into two subsections that assume perfectly mobile capital and perfectly immobile capital.

A. Perfectly Mobile Capital and Optimal Taxation

Zero Taxation

An argument for zero capital taxation for a small open economy can be implied from early studies by international trade researchers such as Kemp (1962, 1966) and Jones
(1967). Kemp (1962) uses a very simple model in which each of the two countries maximizes national output (i.e., one good) using capital as the only input that is mobile between countries. The optimal tax on foreign investors' earnings in the capital importing country is found to depend negatively on the elasticity of foreign supply of capital and positively on the ratio of capital exports to total capital owned by the lending country. If the lending country is viewed as a group of several capital exporting countries and the capital importing country is small and takes the rental price as given, perfectly elastic foreign supply of capital suggests that the optimal tax is zero in the limit. Kemp (1966) and Jones (1967) extend the model to a general equilibrium model of two countries, two goods and two factors in which each country maximizes the social welfare function subject to the country's budget constraint. Each country is assumed to import one good and specialize in the production of one good using two factors of which capital is internationally mobile while labor is not.82 Although the optimal tax on foreign investors' earnings in the capital importing country is more complex since commodity goods are included,83 zero taxation is optimal when the country faces a predetermined world rate of capital.

Gordon (1986) and Diamond and Mirrlees (1971) also argue that the optimal source-based tax should equal zero. When capital is perfectly mobile, their argument is that as capital flows freely between countries and a small open economy takes the world rate of return on capital as given, any source-based capital tax imposed by a capital importing country will drive investment out of the country until the domestic rate of return rises enough so that the after-tax rate of return equates with the predetermined world rate of return.84 As a consequence, deadweight losses accrue to the taxing country as it loses

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82 The authors consider two cases: each country specializes in the production of only one good (i.e., complete specialization) and each country produces two goods (i.e., incomplete specialization). Of our interest is the complete-specialization case in which they assume that the rate of return on capital depends on the level of foreign capital, not the world terms to trade. Note the in the other case they assume that the rate of return depends on the world terms of trade, not the level of foreign investment.

83 The optimal tax also depends on the price elasticity of the imported good and marginal propensities to consume the home and the imported goods.

84 Savings are fixed in these models.
investment that would occur in the absence of the capital tax. Because the after-tax rate of return earned by the capital owners remains the same as that before the tax, the tax burden is not borne by capital owners but fully shifted to immobile factors (i.e., labor and land). A direct tax on immobile factors is argued to be more desirable since it does not incur excess burden due to a fall in overall investment.

At the subnational level, the zero source-based income tax is also suggested by Arnott and Grieson (1981) and Gordon (1983). Arnott and Grieson (1981) extend Diamond and Mirrlees's model to examine optimal taxation on goods and factors of a small open jurisdiction (e.g., local or state) under the federal system when the local government raises revenues by taxing various commodities (i.e., goods and factors). Factors are supplied to the jurisdiction by both residents and nonresidents, while goods are produced and purchased by these two groups. In general, the jurisdiction would levy a lower tax on, or even subsidize, commodities that are heavily consumed or supplied by its residents and impose a higher tax on those that are heavily consumed or supplied by nonresidents; the magnitude of a tax depends on the price elasticities. However, their analysis does suggest that the optimal factor tax is zero if the economy faces infinitely elastic capital supply by nonresidents, given that the cross-price elasticities are negligible.

Gordon (1983) analyzes optimal local fiscal decisions in which each unit of government under a federal system is decentralized so that tax rates and expenditure levels are decided independently. In his extreme case where the national supply of capital is fixed and capital is completely mobile between jurisdictions, his result strengthens Arnott and Grieson's result that a state under the federal system should not levy a capital tax, since mobile capital would flow out of the taxing jurisdiction when there is no coordination.

---

85 Stemrod (1988) provides a graphical exposition of the incidence, efficiency, and optimal taxation when the capital importing country imposes a source-based capital tax. His analysis suggests that "a tax that differentiates on the basis of the international location of the capital does generate an efficiency cost in an open economy." (p. 123)

86 Provided that the supply of capital is not infinitely elastic, the optimal tax (subsidy) is warranted if the fraction of the total factor supplied by nonresidents is greater (less) than the ratio of private marginal utility to social marginal utility of the resident's income.
among governments. States would compete with one another for mobile capital until the capital tax of each state is reduced to zero.

*Nonzero Taxation*

In the analyses above, it is explicitly or implicitly assumed that the supply of capital is elastically supplied, there is no role for capital accumulation over time, and all (capital and commodity) markets are perfectly competitive. When one of these assumptions is relaxed, the optimal tax would be nonzero even if the country takes the world rate of return as given.

In a partial equilibrium model in which the domestic supply of capital is positively related to the rate of return and the capital importing country can tax earnings from domestic and foreign capital at different rates, Findlay (1986) finds that the optimal tax on capital flows should not be zero. In his analysis, the country maximizes national output, produced by domestic and foreign capital, by levying a capital tax to pay for a fixed level of government expenditures. Since domestic saving is responsive to the rate of return and capital taxes are the only instrument to raise revenues, optimal taxes are positive even when the world rate of return is predetermined; their magnitudes depend on the ratio of price elasticity of domestic capital demand to that of domestic capital supply. His result suggests that the optimal tax on foreign investment income should be no more than the tax on domestic income. The reason can be explained by examining extreme cases of price elasticities. If the domestic supply is fixed, a tax on savings (\(t_D\)) generates no excess burden while a tax on capital imports (\(t_F\)) drives out foreign capital; thus, \(t_D>0\) and \(t_F=0\) are optimal. In the other extreme, if the domestic demand of capital is infinitely inelastic and both domestic and foreign capital are employed, the tax rates on both types of capital should be equal since a reduction in capital imports due to tax would be augmented by a rise in domestic savings; thus, \(t_F=t_D>0\). Thus, without qualifications on elasticities, these two cases imply \(t_D\geq t_F\).

An another argument for nonzero capital taxation is that the country may have a suboptimal capital stock. The rationale is that a tax or subsidy on capital is justified in order
to move the capital stock to the "golden rule" level, even if the country is faced with a perfectly elastic foreign supply of capital. Hartman (1985) examines optimal capital taxes on domestic (retirees) and foreign investors, using a two-period, overlapping generation model. The young in the first period consume the remainder of national output less savings and gross payments to domestic and foreign capital owners, and then the young in the second period receive the amount saved plus net-of-tax interest income less a lump sum tax. Savings are responsive to interest rate. In the case that the capital importing country can set different tax rates on domestic and foreign investors, he finds a surprising result that the tax rate on foreign investors is equal to the closed-economy tax rate on capital.\footnote{This result is also applicable to another case examined in which the uniform rate is exogenously imposed.} The reason can be explained in two steps.\footnote{This two steps are pointed out by Slemrod (1988, p.146).} First, a tax on foreign investors is set so that the optimal domestic capital stock is obtained. Second, an equal tax results in optimal domestic savings, as savers earn an after-tax rate of return equal to the world rate of interest. In a more restricted case when the country can only vary the tax rate on foreign investors, he finds that the rate may exceed or fall short of the fixed tax rate on domestic investor since the tax on foreign investors is the only means to move the economy to the golden rule level. The tax rate is positively related to the domestic tax rate, to the population growth rate less net-of-tax rate of time preference, and to the elasticity of domestic demand relative to that of domestic supply of capital.

Finally, although the country takes the world rate of return as given, a nonzero tax on capital may be optimal if it has market power in the goods market and there is free trade agreement among countries. Burgess (1988) presents a two-period model in which the country imports capital in the first period and exports the commodity good in the second period. He shows that if the world export demand of the commodity good is less than perfectly elastic, the domestic real rate of return would not be equal to the predetermined world rate of interest. That is, the cost of externally funded capital measured in terms of
domestic output increases with the level of foreign investment since the price of the exported good falls as the quantity exported increases. Since individual firms are assumed to have no power over the export price, there would be too much reliance on external borrowing where marginal social benefit of foreign investment would be equated with the average cost of externally funded capital. A tax on capital income is therefore optimal when the export tax is not feasible (e.g., due to GATT agreement) in order to increase the cost of foreign funds so that the marginal cost equals the marginal benefit of foreign investment. In the case of the additively separable social utility function, the optimal capital tax is inversely related to the price elasticity of world export demand and to the elasticity of substitution between present and future consumption.

B. Immobile Capital and Optimal Taxation

With the small open economy assumption, the theoretical analyses suggest zero capital taxation, except in some cases discussed in the previous section. Nevertheless, almost all countries have some form of the corporation income tax with a rate commonly as high as the top personal income tax rate. A growing body of recent literature questions the assumption that a small open economy faces a perfectly elastic supply of capital. Some controversial empirical evidence, provided by Feldstein and Horioka (1980) and Feldstein and Bacchetta (1991), indicates that there is a high correlation between domestic investment and saving, suggesting that capital may not be perfectly mobile. Moreover, Mishkin (1984) and Cumby and Mishkin (1984) find that the real interest differentials exist across countries, while Adler and Dumas (1983) and French and Poterba (1991) report that there is concentration of domestic security portfolios among investors or lack of international portfolio diversification. All these findings contradict the proposition that

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89 Feldstein and Horioka (1980) examine data from Organization of Economic Cooperation and Development countries between 1960 and 1974 and find that savings tend to stay at home. Feldstein and Bacchetta (1991) update the analysis to cover a longer sample period from 1960 and 1986 and reestimate the regression equation to correct for spurious correlation between domestic saving and investment, the problem criticized by Obstfeld (1986) and other critics. Their result confirms the previous finding suggesting capital is not perfectly mobile.
capital is perfectly mobile. Gordon and others seek explanations for the discrepancy between theoretical forecasts and empirical evidence and thus for nonzero source-based taxation. Several reasons are as follows.

First, a nonzero tax may be called for when the country is large in that it faces less than perfectly elastic supply of capital. The argument is that it should use its size to improve its residents' welfare by manipulating the rate of return in its favor. For a capital importing country, a reduction in capital imports as a result of tax would glut the international market with excess supply of capital and thus reduce the world rate of return for all capital. A positive tax should be set at the rate where the marginal gain from the lowering of the rate of return is equated with the marginal efficient loss due to a reduction in capital imports due to a rise in the before-tax rate of return required by foreign investors. This point can be easily shown in the studies mentioned in the previous section, which suggest optimal zero taxation by relaxing the assumption of a small open economy. Thus, when foreign supply of capital is less than perfectly elastic, those papers, namely Kemp (1962, 1966), Jones (1967), Arnott and Grieson (1981), and Gordon (1983), suggest that the optimal capital tax is nonzero. Moreover, although a nonzero tax is suggested by Hartman (1985) in a two-period overlapping generation model when a small open economy has a suboptimal capital stock, the magnitude of the tax would be even larger when the country could influence the world rate of return. For example, under his three cases examined — different tax rates on domestic and foreign investors, uniform tax rates, and fixed tax rate on domestic investor — the optimal tax rate equals a weighted average of one and the tax rate under the small open economy assumption, and the weight of "one" increases with the elasticity of foreign supply of capital.

Second, when investors are risk-averse and returns are uncertain, domestic and foreign investors are likely to diversify their portfolios. In this situation a small country, however, may no longer be a price taker in the capital market since equities from different
countries may not be perfect substitutes.\textsuperscript{90} In a two-period, capital asset pricing model, Gordon and Varian (1989) incorporate risk and uncertainty and argue that if the country has unique equity investment opportunities that cannot be reproduced by other countries, in maximizing its citizens' welfare, the country should tax foreign ownership of domestic equities by imposing a corporation income tax and dividend withholding tax, and encourage domestic ownership of domestic equities by giving a dividend credit and other tax incentives.

The third explanation of a positive corporation income tax may be due to double taxation convention between countries in which a capital exporting country taxes worldwide income and allows its multinationals to claim credits for foreign taxes paid against domestic income taxes. Gordon (1992) argues that if a dominant capital exporting country is a Stackelberg leader, arguably the U.S. in the 1970s, there will be an equilibrium in which a capital importing country would set a tax rate such that it is at least less than the rate of the capital exporting country. The rationale is that the tax levied by the capital exporting country would not drive investment out of the country since multinationals would be indifferent between investing at home and abroad. As tax convention would reduce the incentive to evade taxes paid to the capital exporting country, a positive corporate tax on foreign source income may even be collected. Moreover, the capital importing country would benefit from the source-based tax on foreign income. In effect, the capital exporting country sets the tax rate worldwide. However, he finds that no equilibrium exists under the situation when the capital importing country acts as the Stackelberg leader.

The fourth justification is that the source-base tax should be nonzero to prevent domestic and cross-border income shifting. Musgrave (1959) argues that the corporation income tax should be levied to eliminate an incentive to reclassify labor income as retained earnings, especially plausible among closed-held firms so that their incomes are taxed at a lower capital gains tax rate. In addition, Gordon and MacKie-Mason (1994) explicitly

\textsuperscript{90} Some risks that an individual faces when investing abroad are exchange rate fluctuation, threat of expropriation, and other country-specific risks.
model domestic income shifting and multinational transfer pricing. They argue that in order to discourage domestic investors from income shifting to reduce tax liability by classifying business earnings as labor income, the corporation income tax should be set equal to the tax on labor income. Moreover, income earned domestically by foreign firms should be taxed to discourage domestic firms from selling ideas to foreign firms, and foreign source income earned by its multinationals should also be taxed to eliminate an incentive to use their ideas overseas. Specifically, elements in the multinational's reported income susceptible to transfer pricing should be taxed at a rate lower than the tax on labor income to reduce incentives for multinationals reporting low earnings and high expenses to the highly taxed subsidiaries and vice versa to the lightly taxed subsidiaries. Gordon and MacKie-Mason (1994, p. 4) state that these results are "consistent with most tax systems in the developed countries (at least for the top tax rates on labor, which presumably apply to those people best able to shift income to the corporate sector)."

The final argument for nonzero taxation is that foreign investors are at a disadvantage relative to domestic investors in obtaining information about domestic firms and market conditions such as reliable suppliers and local consumer tastes. The asymmetric information about investing countries, pointed out by Gordon and Bovenberg (1994), would result in a premium foreign investors pay for foreign acquisitions of domestic firms, costs of inputs, and other costs of doing businesses in the domestic country. Gordon and Bovenberg model capital imports through foreign acquisitions of domestic shares and argue that the capital importing country should subsidize, rather than tax, foreign acquisitions. The intuition is that due to poor investment information foreign investors would be overcharged for the acquisition. Since the country is small relative to the world market, it benefits from marginal foreign acquisition. The government therefore should subsidize in order to lower the domestic rate of return to the world rate prevailing in the market so that the optimal level of investment is obtained. Though the result is counterfactual, their justifications of the presence of a positive tax rate are that the capital importing country's tax
authority may ignore the merits of providing subsidies to the foreign acquirers. In addition, there is concern that domestic investors would disguise investment as foreign investment and that foreign investors may acquire domestic technology through acquisition and later increase investment in their home country rather than in the domestic country, leading to a reduction in domestic comparative advantage.

C. Summary on Optimal Taxation

The small open economy assumption with a standard set of assumptions\(^{91}\) suggests that the optimal source-based capital tax should be zero. Even when capital supply is assumed to be infinitely elastic, some analyses suggest that a positive tax is optimal. These theoretical forecasts based on specific assumptions such as a suboptimal capital stock, a fixed government expenditure requirement financed only through capital taxes, and monopoly in the goods market. Moreover, more recent theoretical studies try to explain why there are not as much movements of capital, pointed out by Feldstein and Horioka (1981) and others, as predicted by the small open economy assumption. Gordon and others justify by arguing that a nonzero tax may be due to largeness of the capital importing country, international double taxation convention, unique investment diversification opportunities, asymmetric information, and domestic and cross-border income shifting.

Although most theoretical analyses that attempt to justify whether a zero or nonzero capital tax is optimal are usually studied in the framework of capital flows between countries, the direct empirical evidence on the effect of taxation on international capital flows is relatively scare. With the voluminous amount of econometric analyses of the effect on industrial location decisions within the U.S. of state and local taxation, the next section will review a large amount on these empirical evidence in addition to those on inter-country evidence. Of interest is to examine whether the small open economy assumption is valid. Note that the explanations that Gordon and others suggest that capital is not perfectly mobile may not be easily justified to directly apply to a state or locality. For example, it

\(^{91}\) For example, capital and good markets are perfectly competitive, and saving is fixed.
seems unlikely that a state under the federal system is sufficiently large to have market
power to influence world prices, provides unique diversification opportunities, or is likely
to impose a state corporation income tax to prevent intrastate and interstate income
shifting. Although the arguments suggesting capital immobility among states or localities
are rather weak, a sizable number of state and local governments, like those among countries
in the world, impose a positive corporation income tax or a tax of the same sort (e.g., capital
franchise tax). This fact contradicts zero optimal capital taxation suggested by theoretical
forecasts that assume that capital is perfect mobile.

Other than the reasons given in the previous section that might in fact be applicable,
two important justifications for a state to impose the corporation income tax stand out. First, the federal government allows businesses to deduct state and local taxes from the
taxable income in calculating the federal income tax liability. In effect, the cost of one dollar
of tax revenues raising through a state corporation income tax is less than the cost of
revenues raising through other taxes that are not allowed for federal tax deductions. On this
ground a state corporation income tax may be more desirable than other nondeductible
taxes. Second, policy makers may base their decisions on the short term while the full
impact of taxation under the small open economy assumption is based on a long run
perspective. Alternatively, they may believe that the small open economy assumption is
faulty and thus that all tax burden would fall on the rich or out-of-state residents or that
businesses benefit from public services more than the tax collected; therefore, the state
corporation income tax is justifiable. As will be shown in a sizable number of econometric

92 An interesting question is whether the region in which there is a concentration of certain industry —
for example, leather goods in Texas (Krugman, 1991a, p.129) — should impose a tax on that particular
industry. Unfortunately, there is no theoretical analysis (to my knowledge) that ties optimal taxation and
economic geography (e.g., industrialized core versus agricultural periphery). Note that major contributions
in this area are done by Krugman (1991a, 1991b) who concludes from a no-tax, two-factor, two-region
analysis that the concentration of certain industry in certain area is as a result of low transportation cost,
large economy of scale, and large share of manufacturing in national income.

93 Several states use some variant of three-factor apportionment formulas — based on sales, payroll, and
property — to collect corporate taxes from multistate firms. Specifically, the state tax liability is calculated
by total multistate firm's income times an average of the ratios of in-state factor value to total factor value of
the multistate firm.

94 For more discussion why a small open state would impose a corporation income tax, see Zodrow
(1994).
studies in the next section, businesses respond negatively to a tax increase and the small open economy to some extent may be a valid proposition for policy makers to take into account when a tax increase is needed to pay for burgeoning public expenditures.

III. Taxation and Business Location: Econometric Evidence

Econometric evidence on the effects of taxes on industrial location decisions is based on two broad measures. The first measure attempts to explain single establishment start-ups and branch openings due to federal, state and local taxes using micro-data at the firm level. The other measure relies on macroeconomic variables such as capital investment, employment, income and output. This review includes several new econometric studies and other studies drawn from surveys done by Wasylkenko (1991), Bartik (1991), Carroll and Wasylkenko (1990), Blair and Premus (1987), Slemrod (1991), and Ondrich and Wasylkenko (1993). The latter two reviews the literature in foreign direct investment in the U.S.

Compared to the above surveys, our review is narrower in scope. Since the essay tries to answer whether the small open economy assumption is valid, it will concentrate primarily on the impact of taxes on business location decisions and therefore ignore other determinants — argued to be more important by some experts — such as wages, energy prices, unionization, agglomeration economy, tax and financial programs, etc. Contrary to the zero optimal capital taxation suggested by the small open market assumption, most jurisdictions impose a positive tax on income earned by businesses. Thus, it can be argued that if taxes have a deleterious effect on business activity measures, this strengthens the argument that the small open economy assumption to some extent is a valid one. Moreover, the essay will carefully explain how tax variables are defined. Analysts, arriving at different findings, use various types of tax variables such as statutory and average tax rates, relative tax based on average tax measures, and tax rate based on marginal effective tax rate concept. The notable findings are a series of papers on domestic business location decisions by Papke (1987, 1990, 1991a, 1990b) and two studies on international investment decisions by Shah and Slemrod (1991), and Slemrod (1991), whose models incorporate the
tax measure that reflects expected tax burden on marginal investment; they seem to strongly support negative tax effects.

This section reviews the tax impact on domestic business location in the first subsection and on international location of investment in the second subsection.

A. State and Local Taxation and Domestic Business Location

This subsection examines empirical evidence that both supports and refutes the importance of taxes in determining start-ups of businesses, capital investment, employment, income and output.

*Individual Firm Data: Start-ups and Openings*

An early analysis using individual firm data to examine single establishment start-ups and new branch openings is done by Carlton (1979, 1983) who finds very little negative tax effects. In the first study, he analyzes single-establishment startups over 1967-1975 and new branch plants over 1967-1971 for three manufacturing industries, including fabricated plastics, communication equipment and electronic components, in a number of the Metropolitan Statistical Areas.

Using the data from Dun and Bradstreet Corporation, his results do not support that taxes are a major factor in business location decisions. The tax variables used in his analysis are the average state corporate and personal income tax rate, the maximum state personal income tax rate, and the property tax rate. The coefficients of these tax variables in the models for single-establishment firms and branches are found to be either of the unexpected sign or statistically insignificant. In particular, none of the tax coefficients are statistically significant except the state income tax coefficients for single establishment

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95 When the tax coefficient in the econometric analysis is significantly different from zero at 5 percent significant level, tax is said to affect business location decisions.

96 It equals a weighted average of personal and corporate tax rates. The personal income tax rate is the ratio of personal income taxes to personal income; the corporate tax rate is the ratio of corporate taxes to corporate profits.

97 He constructs this tax series from the "effective property tax rates" provided by MSA (Metropolitan Statistical Areas).
births in communication and electronics; however, the signs of these two are positive. This contradicts the argument that a fall in the corporation income tax would encourage start-ups of new single-establishment firms.

Carlton (1983) extends his previous models by incorporating the firm's simultaneous decisions to build new branch plants and to employ certain number of employees. Taxes are found to have no influence on openings of new branch plants, using the same data from Dun and Bradstreet, although the model predicts the average number of employees in branch plants quite accurately.

In contrast, Bartik (1985) finds that the state corporation income tax has a negative impact on location of new branch plants, using the Dun and Bradstreet, cross-sectional data of Fortune 500 manufacturing plants in 48 states from 1972 to 1978. Tax variables are the state corporation income tax rate and the property tax rate.\textsuperscript{98} In his three specifications in which two\textsuperscript{99} are controlled for state-specific characteristics, he finds that all three corporation income tax coefficients are significantly and negatively related to the probability of opening a manufacturing plant in a state. Moreover, the elasticities of branch plant births with respect to the corporate tax rate range from -0.2 to -0.3; this suggests that a 10 percent increase in the state corporate tax rate would reduce the number of new branch plants by 2-3 percent. In addition, the coefficients of the property tax are significant but of the unexpected sign; this suggests that property taxes may attract manufacturing plants among states, other things being equal. Furthermore, he shows that raising a certain level of government revenues has a negative tax more through the state corporate tax than through the property tax.

Using the same data of Fortune 500 firms as in Bartik (1985), Schmenner, Huber and Cook (1987) find a rather mixed result of the tax effects on the location of industrial

\textsuperscript{98} The state corporate tax rate is the ratio of actual state corporate income tax collections to total corporate income, data provided by the Advisory Commission on Intergovernmental Relations (ACIR, 1982); the property tax rate equals total property taxes as a percentage of total value of business properties.

\textsuperscript{99} One includes 3 region dummy variables (i.e., Northeast, South, and West) while the other includes 8 dummy variables.
plant sites. Their results show that taxes have only a weak influence, but become pivotal for firms that are characterized as highly mobile and whose managers have strong sentiment for low taxes. The innovation is that the analysis is divided into two stages. The managers in the first stage pick a number of states to evaluate whether to locate new plants and in the second stage select the states from those already considered to invest. Tax variables are the maximum state corporate tax rate and the property tax rate.¹⁰⁰

Unlike Bartik (1985), they do not find any influence of the corporate income tax rate in both stages, even after moderating for the plant-specific characteristics of the firm such as plant size and the degree of mobility of the firm. However, although they cannot find the property tax to be statistically significant in the first stage, they find that the effect of the property tax is significant but positive after moderating for plant-specific characteristics; this implies that an increase in the property tax attracts — rather than deters — the birth of new branch plants. However, after tax variables are moderated for the management sentiments toward low taxes, tax variables become significant. Specifically, the property tax is inversely related to the probability of establishing new branch plants in both stages while the corporation income tax has a negative effect in the second stage.

Deich (1990) examines the impact of state and local taxes on the birth of new plants and single-establishment firms and also provides an inconclusive result. In particular, he studies the business location decision of three manufacturing industry groups — food products, apparel, and printing — as well as the manufacturing sector, using the data obtained from the Census of Manufactures between 1967 and 1982. As in Bartik (1985), tax variables are the average state corporate income tax and the property tax.

For single-establishment firms, all tax coefficients are statistically insignificant. However, he finds roughly half of the tax coefficients to be significant and negative for new branch plants. Specifically, the corporate tax has a negative effect on new branch openings in "all industries" and apparel, while the property tax discourages births in "all industries."

¹⁰⁰ It equals state and local property tax revenues as a percentage of personal income
printing, and apparel but encourages births in apparel. Deich attributes part of the mixed results to two problems. First, many of the location determinant variables used are highly aggregated because the available industry-specific data is limited.\textsuperscript{101} Second, tax variables used are average or statutory tax measures rather than the marginal effective tax rate.

The latter problem is addressed and corrected by Papke (1991a) who studies start-ups of single establishment firms of five manufacturing industry groups. She argues that most econometric analyses on industrial location decisions are flawed since the tax variable is not measured accurately. The tax variable — rather than based on average or statutory tax measures — should be based on the marginal effective tax rate concept.\textsuperscript{102} It is calculated by assuming that the firm maximizes future expected returns of the marginal investment that takes account of federal, state and local taxes paid as well as all pertinent tax provisions, including depreciation allowances, interest expenses, investment tax credits, deductibility of state taxes against federal tax liability, etc. In contrast, average tax measures are calculated from previous tax structures and do not take account of tax differentials that vary across assets and hence across locations. Therefore, she argues that they are not an accurate reflection of the effective tax rates among various industry groups and use of the average tax variables would attribute to measurement error in explaining the dependent variable.

Using the marginal effective tax rate measure as the tax variable, Papke analyzes location choices of single-establishment firms using pooled cross-section time series data of 22 states and five manufacturing industries\textsuperscript{103} — outerwear, communication equipment, furniture, printing and electronic equipment — from 1975 to 1982. She provides a very important finding\textsuperscript{104} that births of single-establishment firms are affected by the marginal

\textsuperscript{101} Aggregated observations could cause estimates to be biased and to have spurious significance. For a more detailed discussion of this problem as well as other difficulties encountered in dealing with econometric analyses of the effect of taxation on industrial location decisions, see Bartik (1991, pp. 30-36).

\textsuperscript{102} For an extensive discussion of the differences between marginal and average tax rates, see King and Fullerton (1984).

\textsuperscript{103} In the analysis, industries that are viewed as relatively mobile are picked. The criteria are that the product demand is determined by the national market and that supplies of inputs can easily be obtained locally.

\textsuperscript{104} Most findings such as Carlton (1979) and Deich (1990) support that taxes have no bearing on single-establishment start-ups.
effective tax rate in certain industries. In her preferred model specification, the tax coefficients in two out of five industry groups are negative and significant. In particular, taxes discourage start-ups in communication equipment and furniture, and their respective tax elasticities are 2.7 and 9.5.

Aggregate Data: Capital Investment

Aggregate measures, including capital investment, employment, income and output are also used to indirectly study the tax effects on industrial business location. This subsection reviews the tax effects on capital expenditures and the following subsections on the rest.

An early econometric analysis on capital investment is given by Plaut and Pluta (1983) who examine the effects of various tax measures on the percentage change in the real capital stock of manufacturing industries in 48 states from 1967 to 1977 and find only scant evidence of tax effect. Tax variables are (1) the state personal income tax rate, (2) "state and local tax effort" or overall tax rate, (3) state corporate income and license taxes as a percentage of payroll, (4) state sales and receipts taxes as a percentage of retail sales, and (5) state and local property taxes as a fraction of the property market values. None of the tax measures influence the real capital stock growth except the property tax of which the coefficient is positive; they argue that the positive correlation between property taxes and capital expenditures suggest that business firms are attracted to regions that rely more heavily on the property tax than on corporate and personal income taxes.

Using the marginal effective tax rate approach, Papke (1987) studies new capital expenditures per worker of 20 manufacturing industries in 20 different states for 1978 and

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105 The state-specific characteristics are controlled. Examples are climate, proximity to water transportation, labor force work ethics, education, and skill level.
106 In addition, she also argues that the tax coefficient for the outerwear industry is negative and significant, and the elasticity is 27.0. She obtains this result from her basic Poisson model in which a test for model misspecification for the outerwear industry cannot be rejected, but Those for communication equipment and furniture are rejected.
107 It equals the ratio of state personal income tax index to a weighted average of state and personal income and progressivity measure. See Plaut and Pluta (1983).
108 It equals the ratio of state and local taxes to the government tax base or tax capacity, which includes such item as the availability of taxable mineral resources in resource-rich states (ACIR, 1982).
finds that taxes have a negative influence on investment decisions. The tax variable is the after-tax rate of return, which accounts for federal, state, and local taxes and other tax provisions affecting marginal investment. She finds that the coefficient of the after-tax rate of return equals 0.515 and is significant and its implied tax elasticity is 2.024. Her findings suggest that a one percent increase in the after-tax rate of return is estimated to increase new investment expenditures per worker by approximately 2 percent or 515 dollars.

Moreover, Papke uses two average tax measures to show that the after-tax rate of return based on the marginal effective tax rate concept is a more accurate measure. Those alternative tax variables are the ratio of state and local taxes that have an initial impact on businesses to total state and local taxes, provided by ACIR, and the ratio of state and local taxes net of sales taxes to business income, used in Wheaton's (1983) analysis. Papke finds that the tax coefficients of these average tax costs are statistically insignificant. Moreover, the point estimate of the Wheaton's tax measure even has the wrong sign. She therefore argues that the findings which suggest that taxes have no effects on industrial investment decisions may be attributed to serious measurement error.

However, Benson and Johnson (1986) use average tax measures and find a negative impact on manufacturing capital outlays in a state. They regress the relative capital outlay on a distributed lag of relative state and income taxes over six years.¹⁰⁹ Using pooled cross-section time series data of per-capita annual capital expenditures for manufacturing plant and equipment in 48 states from 1966 to 1978, they find that the sum of relative tax rate coefficients has a negative and significant influence on capital expenditures within a state. Moreover, the mean lag equals 2.2 years; this suggests that it takes approximately two years for half of the effect of a tax change to have an impact on capital expenditures in plant and equipment investment.

¹⁰⁹ The relative capital outlay is defined as the ratio of state capital expenditures per capita to average U.S. capital expenditures per capita. The tax variable is defined as the ratio of state and local taxes as a percentage of personal income to the national average.
Papke (1991b) reinforces her previous findings that interstate tax differentials do matter by using the marginal effective tax rate as one of her explanatory variables and a panel data of five manufacturing industries — apparel, household furniture, industry book publishing, communication equipment, and electronic components — in 22 states from 1975 to 1982. She finds that taxes affect capital investment decisions in some industries: the tax coefficients in household furniture and electronic component are significant and negative. Their respective elasticities are 8.1 and 5.9.

Aggregate Data: Employment, Income and Output

Most of the econometric evidence uses employment, personal income and output to explain the tax effects on business activities. The findings using these measures are even more mixed than those obtained in the studies of tax effects on firms' openings and capital investment.

An early study on employment growth is done by Plaut and Pluta (1983), who examine the effects of various taxes on the percentage change in the aggregate employment of manufacturing industries in 48 contiguous states from 1967 to 1977 and find a scant tax effect. Of the five tax explanatory variables discussed earlier in the previous subsection, only the overall state and local tax is negative and significant.\textsuperscript{110}

Using a more disaggregated data, Newman (1983) examines the state corporation income tax effects on employment growth in 13 specific manufacturing groups and the manufacturing sector over 1957-1973 and finds that tax has a significant effect only on certain industries. Specifically, the state corporation income tax\textsuperscript{111} influences employment in only four specific industry groups, primarily durable good manufacturers except textiles. He thus suggests that high state corporation tax rate would lead to slow employment growth in capital-intensive industries\textsuperscript{112} — which is consistent with the small open economy

\textsuperscript{110} Note that the property tax coefficient is statistically significant, but is positive.
\textsuperscript{111} The tax variable is defined as a lagged 10-year change in the state corporate tax rates.
\textsuperscript{112} Gyourko (1987) also argues that relatively low property tax cities tend to attract more capital-intensive firms. In particular, he finds that the property tax has a negative and significant effect on the city's labor-capital cost at 10 percent significant level; however, city payroll and corporate taxes are
assumption. Moreover, he finds that the tax has a significant and negative impact on total employment growth in the manufacturing sector and its implied elasticity is -0.136. This suggests that a reduction in the state corporate tax rate by 10 percent would increase employment in the manufacturing sector by roughly 1-2 percent.

Wasylenko and McGuire (1985) analyze various tax effects on total employment growth and employment growth of six industries in 48 states between 1973 and 1980; those industry groups are manufacturing, transportation, wholesale trade, retail trade, service, and finance, insurance and real estate (FIRE). They also find that taxes affect only certain industries. Tax variables include (1) the maximum state corporate tax rate in 1976, (2) nominal personal income tax rate on taxable income of $50,000 in 1976, (3) average state corporate tax rate in 1979 (as a fraction of corporate "tax capacity"\textsuperscript{113}), (4) average personal income tax in 1977 (fraction of personal income), (5) average sales tax rate in 1977 (fraction of state and local tax revenues) and (6) "state and local tax effort" or overall tax rate using data from ACIR between 1967 and 1977.

After testing two separate specifications in which one uses average tax variables and the other uses nominal tax measures, they find tax effects as follows. For average measures, only the overall state and local tax influences total employment growth. Moreover, the overall state and local tax, the state personal income tax and the sales tax affect some industry groups, but the state corporate income tax does not have any impact. In particular, the state personal income tax affects employment growth in wholesale trade, retail trade and FIRE; the overall tax, in manufacturing, retail and services; and the sale tax, in wholesale. In contrast, none of the nominal tax coefficients are significant. Therefore, they suggest businesses do not make employment decisions simply on nominal state tax rate differentials, but would take the average tax costs into account.

\textsuperscript{113} See the definition of the state and local tax effort in Plaut and Pluta (1983).

\textsuperscript{113} See the definition of the state and local tax effort in Plaut and Pluta (1983).
However, McGuire and Wasylenko (1987) could not duplicate the results of their previous study when they analyze the employment growth of the same industries\textsuperscript{114} over two periods, 1973-1977 and 1977-1984. Tax variables include (1) nominal personal income tax rate, (2) per-capita sales taxes, (3) maximum corporate tax rate, and (4) property tax rate. Only the property tax rate coefficient in the service industry over 1973-1977 is negative and statistically significant, and the rest of tax coefficients over the two periods are insignificantly different from zero.

Wasylenko (1988) updates the study by Wasylenko and McGuire (1985) to examine total nonagricultural employment growth as well as employment growth of the same industry groups between 1980 and 1985. Two tax variables are overall state and local taxes (fraction of 1980 income) and the progressivity of state personal tax in 1977. He finds that overall state and local tax dampens employment growth only in nondurable goods manufacturing, and tax progressivity discourages total nonagricultural employment growth and employment growth in transportation and wholesale. Interestingly, while progressivity does not influence employment in manufacturing, it affects employment in the specific manufacturing industries — durable and nondurable goods. Moreover, Wasylenko and Carroll (1989) conduct a similar study from 1981 to 1987 and find that state and local tax taxes have a negative effect on employment growth in manufacturing. Contradicting the Wasylenko's (1988) finding, however, they find that taxes discourage employment growth in durable goods manufacturing, not in nondurable goods.

In a more recent study, Carroll and Wasylenko (1993) analyze the impact of taxes on employment growth of total nonagricultural and specific industries\textsuperscript{115} using pooled cross section time series data over 1967-1988 for 48 states and find that taxes have a negative effect in the 1970s, not in 1980s.\textsuperscript{116} Tax variables include average measures of state and local property taxes, personal income taxes, corporate taxes, user fees and other

\textsuperscript{114} Note that they treat wholesale and retail trade as an industry.
\textsuperscript{115} They are the same as in McGuire and Wasylenko (1987).
\textsuperscript{116} Vedder (1982) also finds that in the 1970s high tax states tended to have lower growth rates in employment and real per-capita income.
taxes. They divided the data into two time periods for each industry since they find that there is a structural change in fiscal policies among states in their deterministic switching regression model. Their results are as follows.

In the 1970s, the results suggest that state and local taxes affect mostly the manufacturing sector. Specifically, the coefficients of all tax variables except the user fees are negative and significant in manufacturing, but the tax coefficients of other industries are statistically insignificant and/or of the wrong sign. In the 1980s, the effects of taxes are minuscule. In particular, only the property tax has a negative influence on the nonagricultural sector and the transportation industry, while the rest of the tax variables in various industries are statistically insignificant and/or of the unexpected sign.

Another indirect measure in explaining industrial business activity is the effects of taxes on state personal income. An often-cited example of this study is Helms (1985), who analyzes the effects of state and local taxes and other explanatory variables on the state personal income growth using pooled cross-section time series data for 48 states over 1965-1979. He finds that state and local taxes affect the growth of state personal income. Tax variables include the property tax, other state and local taxes, and user fees.\textsuperscript{117} The coefficients of the property tax and other state and local taxes are negative and significant, while the coefficient of user fees is not statistically significant.

Note that one important innovation in his analysis is that he includes government budget constraint to link taxes and public expenditures with budget surplus or deficit. His results show that in absolute value terms the tax coefficients are less than the coefficients of public investment — significant and positive — such as education and highway, but are higher than those of transfer payments. Moreover, he finds that raising government revenues by one dollar per thousand-dollar income through the property tax to finance education expenditures would increase personal income by 1.1 percent in the long run, while that to finance transfer payments would decrease personal income by 1.5 percent.

\textsuperscript{117} These tax rates are calculated from proxies divided by state personal income.
Mehay and Solnick (1989) extend Helm's model by including federal defense spending to the list of explanatory variables and correct the model for heteroskedasticity, contemporaneous cross-section correlation and serial correlation of the residuals. Using pooled cross section time series data from 1976 to 1985, they also find that the average aggregate tax rate, the only tax explanatory variable that includes federal, state and local taxes, is negatively related to state employment growth and personal income. However, when he tries to replicate the results using Helm's covariance model, the tax coefficient becomes insignificant; they therefore argue in favor of their model that corrects for aforementioned econometric problems. Moreover, Mehay and Solnick find the deleterious effects on state personal income of raising non-property taxes to finance both transfer payments and education. In particular, they find that raising state and local tax revenues (excluding property taxes) to finance an equal amount of education expenditures would reduce income by 6.0 percent in the long run, and raising taxes to finance welfare transfers would reduce personal income by 13 percent.

Another recent extension of Helms' model is made by Mofidi and Stone (1990) who find negative tax effects on employment and net investment rates when the model is controlled for public expenditures. They analyze pooled cross section time series data of manufacturing employment and investment growth for all fifty states over 1962-1982. Tax variables include overall state and local taxes and other revenues (e.g., user fees and licenses), as a percentage of state personal income. They find that the overall tax and other revenues imposed to finance transfer payments have a significant and negative effect on employment and net investment with tax elasticities of -5.0 and -9.7, respectively, provided that other public expenditures such as health, education, and highway are held constant. In marked contrast to findings by Helm and Mehay and Solnick, taxes imposed to finance public expenditures such as health, education, and highway have little or no effects on net investment and employment, given that transfer payments are held constant. Specifically,
overall taxes have no effects on either economic growth measures while other taxes such as user fees have a significantly negative effect on investment.

Moreover, in a regional study, Quan and Beck (1987) analyze the dynamic response of overall state tax burdens on the levels of state personal income, employment, and average hourly wages. They use pooled cross section time series data from 1964 to 1983 for 32 states, including 17 "Sunbelt" states and 15 "Northeastern" states, and find that taxes are effective only in the Northeastern states. In particular, the sum of lagged state and local tax variables over previous eight years has negative and significant effects on all dependent variables in the Northeastern states, but not in the Sunbelt states, and therefore conclude that taxes may be important to economic growth more in the declining regions (e.g., Northeast) than in the growing regions (e.g., South and Southwest) of the country.

Finally, there are two studies that analyze various tax effects on state output growth. An early study by Plaut and Pluta (1983) does not provide any evidence that taxes have a negative impact, as he regresses the percentage change of real value added of manufacturing industries in 48 states over 1967-1977 on five tax explanatory variables discussed above.

The more recent analysis by Papke (1990), on the other hand, provides strong support that taxes have a negative impact on her analyzed industry groups, as she studies the tax effects on gross state product (GSP) or total value of goods and services of a state, using pooled cross section time series data of five manufacturing groups — apparel, household furniture, book publishing, communication equipment, and electronic component — in 22 states between 1975 and 1982. As in her previous analyses, she uses the marginal effective marginal tax rate, which incorporates incentive effects attributable to federal, state and local tax codes, as the tax variable, and the wage rate as the other explanatory variable. Her results suggest that when the dependent variable is defined as the GSP growth rate, taxes have a negative influence in all industry groups except Book Publishing with

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118 These dependent variables are measured in relative terms; for example, the relative state personal income is the ratio of state personal income per capita to the average personal income in the U.S.
119 This is an average measure expressed as a fraction state personal income.
120 Note that the property tax coefficient is significant but positive.
elasticities ranging from 1.1 to 14.7, and when it is defined as the ratio of industry GSP to
total manufacturing GSP, taxes have a negative impact in all groups with elasticities ranging
from 1.5 to 9.4.

B. Taxation and International Investment Location

Studies on international business location are based on two measures. Following
Hartman (1984), several studies attempt to explain capital flows between countries and
regions using aggregate foreign direct investment data. The other international location
indicator is based on micro-level data of new foreign firms established in the U.S.

Foreign Direct Investment and Taxation

A pioneering empirical evidence on the effect of domestic tax policy on foreign
direct investment has been done by Hartman (1984) using time series data between 1965
and 1979 published by the Bureau of Economic Analysis and tax and rate-of-return data
obtained from Feldstein, Dicks-Mireaux and Poterba (1983). He uses a very simple
regression model in which all non-tax location determinants are ignored and attempts to
explain foreign direct investment, separately through retained earnings by foreign firms in
the U.S. and transfer of funds from parent corporations, using the tax rate on capital owned
by U.S. investors relative to that owned by foreign investors,121 after-tax rate of return
actually realized by foreign investors,122 and after-tax rate of return on U.S. capital earned
by foreign investors.123 His results are very strong, especially for investment through
retained earnings. In all his regressions, tax variables are statistically significant, and the
elasticities of foreign direct investment with respect to the relative tax rate equal
approximately two. For transfer of funds, the regression equations fit the data less well.

121 It is defined as the ratio of net-of-tax return per dollar earned by foreign investors to that earned by
U.S. investors.
122 It equals the relevant amount of foreign investment divided by foreign direct investment position. For
example, foreign investment for the case of retained earnings includes subsidiary reinvested income and
branch earnings.
123 It is assumed to equal the after-tax rate of return on U.S. capital as the whole calculated by multiplying
the overall rate of return and one minus the effective corporate and personal tax rate.
Nevertheless, taxes also found to have a detrimental impact on foreign direct investment financed by transfer of funds from abroad in his preferred logarithmic regression equation, but not in the simple linear equation.

Boskin and Gale (1987) and Young (1988) reestimate Hartman's regression equation by including non-tax explanatory variables such as GNP, increasing sample periods from 1964-79 to 1953-1984, and using revised investment data primarily from the Bureau of Economic Analysis and tax and rate-of-tax rate of return data from Feldstein and Jun (1986). They conclude that Hartman's results are fairly robust. Using revised data and Hartman's regression equation and his time period, Boskin and Gale's tax and rate-of-return estimates are slightly lower in the regression equation for retained-earnings; 124 Young also finds the same result in his estimates except the coefficient for the actual after-tax rate of return on foreigners. Both analyses attribute lower estimates to the use of new data from Feldstein and Jun (1986). Note that since Young also uses the revised data to compute actual after-tax rate of return to foreigners, this results in a higher estimate. As in Hartman, the equation for transfer of funds fits the data more poorly; however, all tax and rate-of-return estimates except that for the after-tax return on U.S. capital are statistically significant.

In their preferred regression equations, they find strong support for Hartman's result that taxes influence foreign investment through retained earnings and quite poor support that taxes affect investment through transfer of funds. That is, for reinvestment equations, Boskin and Gale find that all tax and rate-of-return coefficients are statistically significant while Young also finds that all except that for the after-tax return on U.S. capital are statistically significant. However, their preferred regression equations for transfer of funds fit data much worse than Hartman's equation; for example, Young finds that none of the tax and rate-of-return estimates can explain foreign investment financed by transfer of funds.

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124 They are so close to Hartman's results that none of the point estimates changes by more than one standard deviation.
Shah and Slemrod (1991) also strengthen Hartman's conclusions in their examination Mexican foreign direct investment through reinvestment and transfer of funds using data from the Banco de Mexico and various sources over 1965-77. Tax variables include statutory, average and marginal effective tax rates; non-tax variables include credit rating and regulation index. In the reported results, tax coefficients for foreign reinvestment and transfer of funds are statistically significant, but both types of foreign investment in Mexico are more sensitive to the marginal effective tax rate than to the statutory tax rate. Moreover, the marginal-effective-tax variable in their various specifications shows more consistency in explaining foreign direct investment than statutory and average tax variables.

However, the strong finding of the tax effect on investment through retained earnings is countered by Slemrod (1991), who examines the impact on total foreign direct investment, new transfer of funds, and retained earnings using the Bureau of Economic Analysis sample data over 1956-84 revised by Newlon (1987). Tax variables studied are the relative average tax rate and the marginal U.S. effective tax rate. By using revised longer-period data and his modified model specification, his finding rejects the significance of foreign investment through retained earnings found by Hartman, Boskin and Gale, and Young. In marked contrast, he finds that foreign investment financed by transfer of funds is responsive to relative average tax rate. In addition, total foreign direct investment is found to be responsive to tax. His results are further confirmed when he regresses foreign investment measures on the marginal effective tax rate.

Hartman argues that only the host country tax matters when foreign investment is financed by retained earnings, while the home country tax can only influence transfer of funds from the parent corporations. To test whether the home country tax influences

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125 He also finds that the regression equation for transfer of funds fits the revised data much better than the data used by Hartman.
126 The data for the marginal effective tax rate is obtained from Auerbach and Hines (1988).
127 He also obtains the similar findings in the regression equation that includes other non-tax determinants and lagged taxes.
128 Hartman (1985) argues that mature foreign subsidiaries have sufficient earnings for investment needs while immature firms need more investment funds than earnings they can generate. Thus, foreign investment financed by transfer of funds from the parent corporations is only relevant for immature operations. Because of this distinction, he argues that only the host country tax is relevant in investment decisions for mature
foreign direct investment, Slemrod uses a disaggregated data of six major investing countries of which three exempts foreign source income while the other three taxes foreign income on a worldwide basis. He argues that investing countries that exempt foreign income from tax should be more responsive to higher host country's (U.S.) marginal tax rate than those that taxes worldwide income. His findings do not support this argument; two (one) of the countries from each tax regime show a significant marginal-effective-tax effect on transfer and total foreign direct investment (retained earnings).

Slemrod's argument is supported by Hines (1993). In a more regional level, Hines (1993) analyzes the effect of state tax rate differentials on foreign direct investment across states and concludes that tax rates that vary among states greatly affect the distribution of foreign investment in the United States. He uses the statutory tax rates and the tax rates that adjust for formula apportionment of tax bases among states. Using the cross section data of capital expenditures by foreign-owned U.S. affiliates in 1987 provided by the Bureau of Economic Analysis, he differentiates foreign investment into those from countries that allow a credit of state income taxes (e.g., Japan) and those that do not (e.g., France). His argument is that firms from countries that allows foreign tax credits would be less responsive to high state taxes than those that exempt tax on foreign source income, and his results support this hypothesis. In particular, a one percent increase in state corporate tax is associated with 7-9 percent smaller share of foreign investment by investors that can not claim foreign tax credits than by those that can.

Finally, Moore, Steece and Swenson (1987) examine net foreign investment in gross manufacturing assets by state using data from the U.S. Department of Commerce between 1977 and 1981. Tax variables include Carlton's average corporate tax and worldwide and domestic unitary taxes. Similar to Carton's result, the corporate tax is statistically

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129 Under unitary taxation, the states generally tax all business income earned by the corporate group that has 50 percent or more common ownership or control between the corporation located in state and the
insignificant; they also argue that use of average corporate tax rather than the marginal effective tax may attribute to this result. However, they are early pioneers who find that state unitary taxation deters foreign direct investment. In three out of five regressions for each year over 1977-81, the worldwide and domestic unitary tax coefficients are negative and significant. The rationale is that unitary taxation would deter foreign investment since tax burden and tax compliance costs would be larger in these states than those using nonunitary taxation.

*Locational Choice and Taxation*

The tax impact of foreign direct investment is also studied at the micro level to examine locational decisions of foreign firms. Three studies are reviewed.

Coughlin, Terza, and Arromdee (1991) examine the tax effect on locational choices of foreign manufacturing firms in the U.S. between 1981 and 1983 and find only a limited evidence. They use two overall state and local tax measures of which one is defined in terms of per-capita and another in terms of a fraction of state personal income, and find no support that taxes affect foreign investment. However, when the analyses include only states that use worldwide unitary combination method of taxation, they support the Moore, Streece and Swenson's (1987) finding; they find average state and local taxes inversely and significantly affect locations of foreign firms in two out of four runs.130

Woodward (1992) examines locational choices of 540 Japanese manufacturing plants using firm-level data from the Japan Economic Institute over 1980-1989. Analogous to Schmenner, Huber, and Cook (1987), the analysis is divided into two stages: state selection and then the county choice within the state. Tax variables at the state level include

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130 In particular, taxes are statistically significant in two runs: the variant that controls for the number of airports and the basic variant that does not control for the number of airports, transportation infrastructure and railroad miles. Taxes are statistically insignificant in two runs of which one is controlled for state highway miles and another for railroad miles.
the effective state corporate profit tax\textsuperscript{131} and worldwide or domestic unitary tax, and the variable at the county level includes only property taxes. After controlling for regional effects, Japanese manufacturing plant births are deterred by unitary taxation with the coefficient estimate of worldwide unitary taxation twice as large as that of domestic unitary taxation. However, the coefficients of the corporate and property taxes are not significant.

Finally, Ondrich and Wasylenko (1993) examine location choices of new foreign manufacturing plants using pooled cross-section and time-series data from the International Trade Administration between 1978 and 1987. Tax variables are, as a fraction of state personal income, property tax, sales taxes, individual income tax, user charges, corporate tax, and other taxes. There are two findings that depart from Moore, Steece and Swenson (1987) and above two analyses. First, they find that the corporate tax, user charges, and other taxes have a negative and significant impact on the probability that a state is selected as a location for a new manufacturing plant; their reported elasticities are -0.6 for the corporate tax, -0.3 for user charges, and -0.2 for user charges.\textsuperscript{132} Other tax variables are statistically insignificant. Second, use of worldwide unitary taxation has no significant impact on the selection probability; however, they attribute this weak result to their longer period analysis and to the fact that eight out of thirteen states have repealed a unitary taxation within the period of study. Moreover, as in Helms (1985), he finds that an increase in public investment by lowering corporation income tax would encourage capital investment. Specifically, a 10 percent increase in higher education expenditures financed by individual income taxes would increase investments by 5-19 percent.

\textbf{IV. Conclusions and Policy Implications}

The essay provides a survey of theoretical analyses on optimal source-based taxation and of econometric studies on the impact of taxes on business location decisions.

\textsuperscript{131} It is calculated by dividing average state corporate taxes collected from manufacturing firms by average manufacturing business income over 1977-81.

\textsuperscript{132} In their two models, coefficients are significant at the 1 percent level for the corporate tax and at the 5 percent level for user charges. However, other taxes are significant at the 5 percent level in only one model.
The first section of the essay inquires whether zero taxation is optimal under the small open economy assumption. When an economy is confronted with a perfectly elastic supply of capital, this implies that capital is perfectly mobile and zero taxation is generally the optimal tax rule suggested by most theoretical forecasts. The basic argument is that a positive tax would drive the taxed capital out of the country and the imperfectly mobile factors would bear the tax burden. However, zero taxation under the small open economy assumption may not hold when the economy has a suboptimal capital stock, capital accumulation is not fixed, the country has monopoly power in the goods market, or the government is required to purchase a fixed level of public expenditures financed exclusively by capital taxes.

Although zero taxation is considered optimal under the small open economy assumption, practically all countries and subnational jurisdictions impose some sort of a source-based capital tax such as a corporate income tax. Many researchers question the small open economy assumption suggesting that capital is perfectly mobile. Gordon and others provide some explanations for why capital may not be perfectly mobile and nonzero taxes should be imposed: some country may be sufficiently large in that it can affect the world rate of return, the economy has a unique diversified portfolio that cannot be duplicated by others, a capital exporting country may act as a Stackelberg leader under international double taxation convention, foreign investors have less information about domestic market conditions than local investors, and investors may be able to shift income domestically or internationally.

The second section reviews the empirical econometric evidence of the tax effects on business location decisions to inquire whether the small open economy assumption is valid. Given the fact that this assumption suggests zero taxation while most countries and their jurisdictions impose a tax, the proposition is that if taxes have a deleterious effect on business activity measures, the small open economy assumption is to some extent a valid one.
The findings suggest that not all econometric studies provide a firm support of a negative tax influence, but a sizable number of studies lean toward supporting that taxes do affect business location decisions. A notable result is that nearly all econometric studies except Carlton's provide at least an evidence of a negative tax effect. Among the strong ones are recent studies that tend to be more carefully and intricately done: those that use the marginal effective tax rate approach by Papke (1987, 1990, 1991a, 1990b), Shah and Slemrod (1991), and Slemrod (1991); those that use a lagged average tax variable over several years by Newman (1983), Benson and Johnson (1986) and Quan and Beck (1986); those that use a pooled cross section time series model\textsuperscript{133} such as Helms (1985), Mehay and Solnick (1989), Mofidi and Stone (1990) and Ondrich and Waslenko (1993). The latter three studies are particularly noteworthy for policy makers since their analyses contain the government budget constraint that links taxes and public expenditures; their findings suggest that raising taxes to finance government transfer payments would impede economic growth causing slowdowns in the growth rates of employment, investment and personal income. However, these studies do not unanimously agree on the widely popular idea that raising taxes to finance government investment such as education and highway would be beneficial for the economy.

Although conflicting, the econometric evidence on the tax impact on international investment location — plausibly the most relevant to the small open economy assumption — also provides at least an evidence that taxes do affect business location. Thus, the general point may be established that taxes do affect the level of foreign investment within the country. Nevertheless, it should be taken with a grain of salt since when a specific tax impact on a particular foreign investment measure is analyzed, different analysts provide different conclusions. For example Boskin and Gales (1987) and Young (1988) conclude that taxes affect investment through retained earnings by foreign firms in the U.S. but would not likely to affect transfer of funds from foreign parent corporations, whereas

\textsuperscript{133} This point is pointed out by Carroll and Waslenko (1990)
Slomrod (1991) concludes just the opposite. Another example is that while Moore, Steece, and Swenson (1987) and Coughlin, Terza and Arromdeee (1991) argue that locational choice of foreign manufacturing plants is not responsive to the state corporation income tax but is sensitive to the state unitary taxation, whereas Ondrich and Wasylenko find just the opposite. For the impact of subnational taxation on business location decisions within the U.S., examples of conflicting results are also numerous. Nevertheless, the general conclusion that taxes have a negative impact on domestic and international investment location can not be totally rejected.

The assertion that taxes have a negative impact on business location decision is not unconventional, as the significance of the effect of subnational taxation is reported in most surveys in this area. The strongest supporter appears to be Bartik (1991, p. 43), who concludes that the "recent research suggests a consensus on the likely magnitude of tax effects on business location. The long-run elasticity of business activity with respect to state and local taxes appears to lie in the range of -0.1 to -0.6 for intermetropolitan or interstate business location decisions...", while others such as Wasylenko (1991), Carroll and Wasylenko (1990), and Blair and Premus (1987) have doubts of this proposition but do not totally discount the notion that subnational taxes influence industrial business location. However, the essay does show that econometric studies, especially more recently and intricately done, support the proposition that taxes have a negative tax effect on economic activities. Policy makers on fiscal matters should acknowledge that the economy, especially a state or locality that is small relative to the world market, may face a highly (or perfectly) elastic supply of capital, because of the evidence that taxes do affect business location decisions.
APPENDIX

Derivation of the Cost of Capital Formula and Optimal Financial Equilibrium

This appendix derives the formulas for the cost-of-capital and optimal financial equilibrium. Leechor and Mintz (1991, 1993) have derived in detail the cost of capital and optimal financial equilibrium when the home country allows foreign tax credits; thus, this appendix will only derive the solutions when the home country allows foreign tax deductions and only provide the solutions when it allows foreign tax credits.

A Lagrangian can be formed by maximizing (2.1) subject to (2.5') and (2.7):

$$ (1.1) \quad L = \int_0^\infty e^{-\rho(1-c^*)t} \left\{ \frac{D_t^d}{1-c^*} + (1-\sigma^*) + \lambda_1(t) \left[ e^{\rho t}(\hat{K}_t + \delta K_t) - \alpha^* \hat{K}_t + \hat{K}_t \right] ight. $$

$$ \left. + \lambda_2(t) \left[ e^{\rho t}(\hat{K}_t + \delta K_t) - \alpha^* \hat{K}_t^* - \hat{K}_t^* \right] \right\} $$

where $\lambda_1(t)$ and $\lambda_2(t)$ are the Lagrange multipliers, and the repatriation tax rate can be written as

$$ (1.2) \quad \sigma_t^* = g^c \left( \frac{u^* \Pi_t^* - u \Pi_t x_t}{Y_t^*} \right) + g^d \left( \frac{\theta Y_t^* + u^* \Pi_t d^*}{Y_t^*} \right). $$

where $\Pi_t d^* = \Pi_t^* - \theta D_t^* - u \Pi_t x_t$. The control variables are $\hat{K}_t$, $\hat{K}_t^*$, $K_t$ and $B_t$.

Under the deduction system, $g_d = 1$ and $g_c = 0$. To assist derivation, $D_t^*$, $Y_t^*$ and $\Pi_t d^*$ can be written as

$$ D_t^* = (1-u)e^{\rho t}F(K_t) + (1-u_f)B_t x_t + u_f 3 \alpha^* K_t x_t - (1-u_f_4)e^{\rho t}(\hat{K}_t + \delta K_t), $$

$$ Y_t^* = (1-u)e^{\rho t}F(K_t) - u_f 2 \beta_t x_t - \alpha^* \hat{K}_t x_t + u_f 3 \alpha^* K_t x_t + u_f 4 e^{\rho t}(\hat{K}_t + \delta K_t), $$

$$ \Pi_t d^* = [1-u-\theta(1-u)]e^{\rho t}F(K_t) - [u_f 1 + \theta(1-u_2)]B_t x_t - [1-u_f_2 - \theta(1-u_2)]B_t x_t - \alpha^* \hat{K}_t x_t + [u_f 3 - \theta u_f 3] \alpha^* K_t x_t + [u_f 4 + \theta(1-u_4)]e^{\rho t}(\hat{K}_t + \delta K_t). $$

The cost of capital formula under the deduction method can be found from the Euler equations$^{134}$ by differentiating (1.1) with respect to $\hat{K}_t$, $\hat{K}_t^*$, and $K_t$:

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$^{134}$ An Euler equation, for example for $K_t$, is $\frac{\partial}{\partial t} \left( \frac{\partial L}{\partial K_t} \right) = \frac{\partial L}{\partial K_t}$. 


\( K_t: e^{-\rho/(1-c^*\lambda_1)} = e^{-\rho/(1-c^*)} \{ \frac{1-\sigma^*}{1-c}\alpha x_t - \frac{D_t^*}{(1-c^*)Y_t^*} [\theta u f_3\alpha x_t + u^*(uf_3-\theta u f_3)\alpha x_t - \sigma^* u f_3\alpha x_t] - \lambda_1 \alpha \}, \)

\( K_t^*: e^{-\rho/(1-c^*)} = e^{-\rho/(1-c^*)} \{ \frac{D_t^*}{(1-c^*)Y_t^*} (\theta^* x_t + u^* x_t) - \sigma^* x_t - \lambda_2 \}, \)

\( K_t: e^{-\rho/(1-c^*)} e^{\pi t} \{ \frac{1-\sigma^*}{1-c}(1-u f_4) + \frac{D_t^*}{(1-c^*)Y_t^*} [\theta u f_4 + u^*(u f_4 + \theta(1-u f_4)) - \sigma^* u f_4] + \frac{1}{1-c^*}(1-u f_4) \{ \hat{\lambda}_1 + \hat{\lambda}_2 - \rho/(1-c^*) - \pi \} \} = e^{-\rho/(1-c^*)} e^{\pi t} \{ \frac{1-\sigma^*}{1-c^*} [(1-u)F_k - (1-u f_4)\delta ] - \frac{D_t^*}{(1-c^*)Y_t^*} \theta (1-u)F_k + u f_4 \delta + u^*(1-u-\theta(1-u))F_k + [u f_4 + \theta(1-u f_4)\delta] - \sigma^* [(1-u)F_k + u f_4 \delta] \} + e^{-\rho/(1-c^*)} e^{\pi t} (\lambda_1 \lambda_2 + \lambda_2 \lambda_2), \)

To derive the user cost of capital, three steady-state assumptions used by Leechor and Mintz (1991, 1993) are made. First, there is no growth of new investment in the steady state (i.e., \( \dot{K}_t = 0 \)). This assumption implies that the steady-state undepreciated capital stock in the host country equals \( \hat{K}_t = \delta K t e^{\pi t}/(\alpha^* + \pi) \) and that in the home country equals \( \hat{K}_t^* = \delta K t e^{\pi t}/(\alpha^* + \pi) \). Second, new borrowing in the steady state grows at the inflation rate (i.e., \( \dot{B}_t = \pi B_t \)). This assumption implies that the steady-state undepreciated capital stock in the host country equals \( \hat{K}_t = \delta K t e^{\pi t}/(\alpha^* + \pi) \) and that in the home country equals \( \hat{K}_t^* = \delta K t e^{\pi t}/(\alpha^* + \pi) \). With these three assumptions, the time derivatives of the repatriation tax and "dividend pay-out" ratio equal zero (i.e., \( \dot{\sigma}_t = 0 \) and \( (\theta(\theta))(D_t^*/Y_t^*) = 0 \)). That is,

\[ \dot{\sigma}_t = \frac{1}{e^{\pi t}Y_t^*} \{ \theta ((1-u)F_t) - u v_1 e^{-\pi t}(\dot{B}_t - \pi B_t) - (1-u f_2) i e^{-\pi t}(\dot{B}_t - \pi B_t) - \alpha e^{-\pi t}(\dot{K}_t - \pi K_t^*) + [u f_3 - \theta(1-u f_1)] e^{-\pi t}(\dot{B}_t - \pi B_t) - [u f_4 - \theta(1-u f_2)] e^{-\pi t} i(\dot{B}_t - \pi B_t) - \alpha e^{-\pi t}(\dot{K}_t - \pi K_t^*) + [u f_3 - \theta u f_3] e^{-\pi t} \alpha(\dot{K}_t - \pi K_t^*) + [u f_4 + \theta(1-u f_4)] \delta K_t^* - \sigma^* [(1-u)F_t - u f_1 e^{-\pi t}(\dot{B}_t - \pi B_t)] \]
\(- (1-u\alpha_2)e^{-\pi t} (\dot{B}_1 - \pi B_1) - \alpha e^{-\pi t} (\dot{K}_t - \pi \dot{K}_t) + uf_3 \alpha e^{-\pi t} (\dot{K}_t - \pi \dot{K}_t) + uf_4 \delta \dot{K}_t \} = 0,
\frac{\partial}{\partial t} \left[ \frac{D_t^*}{Y_t} \right] = \frac{1}{e^{-\pi t} Y_t} \left\{ (1-u)F(\dot{K}_t) + (1-u\alpha_1)e^{-\pi t}(\dot{B}_1 - \pi B_1) - (1-u\alpha_2)e^{-\pi t}(\dot{B}_1 - \pi B_1) \right. \\
+ uf_3 \alpha e^{-\pi t}(\dot{K}_t - \pi \dot{K}_t) - (1-u\alpha_2) \delta \dot{K}_t - D_t^*/Y_t \left\{ (1-u)F(\dot{K}_t) - uf_1 \pi e^{-\pi t}(\dot{B}_1 - \pi B_1) \right. \\
- (1-u\alpha_2)e^{-\pi t}(\dot{B}_1 - \pi B_1) - \alpha e^{-\pi t} (\dot{K}_t - \pi \dot{K}_t) + uf_3 \alpha e^{-\pi t} (\dot{K}_t - \pi \dot{K}_t) + uf_4 \delta \dot{K}_t \} = 0.

Third, the marginal values of the Lagrange multipliers are assumed to grow in the steady state at rate \((\pi^*-\pi)\) (i.e., \(\dot{\lambda}_1 = (\pi^*-\pi)\lambda_1 \) and \(\dot{\lambda}_2 = (\pi^*-\pi)\lambda_2 \)). This assumption is valid since two obvious guesses of \(\lambda_1 \) and \(\lambda_2 \) are derived from the Euler equations of \(\dot{K}_t \) and \(\dot{K}_t^* \) as

\[
\lambda_1 = \frac{x_1}{\rho/(1-c^*)+\alpha} \left\{ \frac{1-\sigma^*}{1-c^*} uf_3 \alpha - \frac{D_t^*}{(1-c^*)} \left[ \theta uf_3 \alpha + u^*(uf_3-\theta uf_3) \alpha - \sigma^* uf_3 \alpha \right] \right\},
\lambda_2 = \frac{x_1}{\rho/(1-c^*)+\alpha^*} \left\{ \frac{D_t^*}{(1-c^*)^2} \left[ \theta \alpha^* + u^* \alpha^* - \sigma^* \alpha^* \right] \right\}.
\]

Taking derivative these two guesses with respect to time \(t \) at the steady state shows that \(\dot{\lambda}_1 = (\pi^*-\pi)\lambda_1 \) and \(\dot{\lambda}_2 = (\pi^*-\pi)\lambda_2 \) are satisfied.

With these three assumptions, the cost of capital formula under the deduction system can be written as

\[
\{ 1 - u - d[\theta(1-u)+u^*(1-u-\theta(1-u))-\sigma^*(1-u)] \} F_k
= \left\{ \frac{\rho/(1-c^*)-\pi + \delta}{1 - uf_4 + d[\theta uf_3 \alpha + u^*(uf_4-\theta(1-uf_4)) - \sigma^* uf_4]} \\
- \frac{uf_3 \alpha - d[\theta uf_3 \alpha + u^*(uf_3-\theta uf_3) \alpha - \sigma^* uf_3 \alpha]}{\rho/(1-c^*)+\alpha-\pi} \right\} \left\{ \frac{d[\theta \alpha^* + u^* \alpha^* - \sigma^* \alpha^*]}{\rho/(1-c^*)+\alpha^*-\pi^*+\pi} \right\}.
\]

Set \(f_3=0\) and \(f_4=1\) to obtain the cost of capital when the host country switches to a consumption-based business tax; set \(f_3=1\) and \(f_4=0\) when it is under an income tax.

The formula for optimal financial equilibrium can be obtained by differentiating (I.1) with respect to \(B_t \):

\[
B_t: \quad e^{-\rho/(1-c^*)t} x_1 \left\{ \left[ \frac{\rho/(1-c^*)-\pi + \delta}{1 - uf_4 + d[\theta uf_3 \alpha + u^*(uf_4-\theta(1-uf_4)) - \sigma^* uf_4]} \right. \\
+ \frac{D_t^*}{(1-c^*)} \left[ \theta uf_3 + u^*(uf_1+\theta(1-uf_1)) - \sigma^* uf_3 \right] + \frac{1}{1-c^*} (1-uf_1) [\dot{\sigma}_t^*] \right\}
\]

135 This is derived by assuming \(\dot{\lambda}_1 \) and \(\dot{\lambda}_2 \) to equal zero and isolating \(\lambda_1 \) and \(\lambda_2 \) in (I.3) and (I.4).
- \{\theta_1 + u^*(u_1 + \theta(1-u_1)) - \sigma^* u_1\} \frac{1}{1-c^*} \left[ \frac{\partial D_t^*}{\partial Y_t^*} + \frac{D_t^*}{(1-c^*)Y_t^*} u_1[\sigma_t^*] \right] \\
= e^{-(1-c^*)x_1} \left\{ \frac{1-C_t^*}{1-c^*} (1-u_2) - \frac{D_t^*}{(1-c^*)Y_t^*} [\theta(1-u_2) - u^*(1-u_2-\theta(1-u_2)) + \sigma^*(1-u_2)] \right\}.

After canceling out common terms and using steady-state assumptions, the equilibrium can be written as

\[ \frac{\rho}{(1-c^*)-\pi^*+\pi} \{ 1 - u_2 + d(\theta u_1 + u^*(u_1 + \theta(1-u_1)) - \sigma^* u_1) \} \]

= \{ 1 - u_2 - d[\theta(1-u_2) + u^*[1-u_2-\theta(1-u_2)] - \sigma^*(1-u_2)] \}.

Set \( f_1 = 0 \) and \( f_2 = 1 \) to obtain the equilibrium under an income tax; set \( f_1 = 0 \) and \( f_2 = 0 \) to obtain that under the R-base tax; set \( f_1 = f_2 = 1 \) to obtain that under the R+F-base tax.

A similar exercise can be done to find the user cost of capital and optimal financial equilibrium under a credit system. Since Leechor and Mintz (1991, 1993) have derived this case, only solutions are provided. Solutions can be derived from the same Lagrangian in which the binary variables in (1.2) equal \( g_c = 1 \) and \( g_d = 0 \). Using the same steady-state assumptions, the cost of capital is

\[ \{ 1 - u - d[u^* - \phi - \sigma^*(1-u)] \} F_k = \left[ \frac{\rho}{(1-c^*)-\pi^*+\delta} \{ 1 - u_4 + (\phi u_4 - \sigma^* u_4) \} \right] \frac{uf_3 - d[\phi u_3 \alpha - \sigma^* u_3 \alpha]}{\rho/(1-c^*) + \alpha - \pi^* + \pi} \frac{d[u^* \alpha^* - \sigma^* \alpha^*]}{\rho/(1-c^*) + \alpha - \pi^* + \pi} \].

Under a cash flow tax, set \( f_3 = 0 \) and \( f_4 = 1 \); under an income tax, set \( f_3 = 1 \) and \( f_4 = 0 \). If the home country allows only a partial credit for dividend withholding taxes, set \( \phi = 0 \).

The optimal financial equilibrium is

\[ \left[ \frac{\rho}{(1-c^*)-\pi^*+\pi} \{ 1 - u_1 + d(\phi u_1 + \sigma^* u_1) \} \right] = \{ 1 - u_2 - d[u^* - \phi f_2 - \sigma^*(1-u_2)] \}.

The equilibria under the R-base, the R+F-base and the income tax can be found by defining appropriate binary variables as given above.
Derivation of the Divided Repatriation Tax Rates for Simulation.

As shown in equation (2.9), the dividend repatriation tax equals

\[(II.1) \quad \sigma_t^* = g^c\left(\frac{\phi u(P_t^* - \frac{\phi u(P_t^*)}{\gamma_t^*})}{\beta^* + \pi^*}\right) + g^d(\theta + \frac{u(P_t^*)}{\gamma_t^*}).\]

Using the stead state assumptions discussed in Appendix I, tax bases that define the repatriation tax rate can be written as

\[(II.2) \quad \Pi^* = e^{\pi^*}(F(K) - \frac{\alpha^*}{\alpha^* + \pi^*})\delta - iBe^{-\pi^*}.
\]

\[(II.3) \quad x\Pi = e^{\pi^*}[F(K) + f_{2\Pi}Be^{-\pi^*} - f_{1i}Be^{-\pi^*} - f_{3}\frac{\alpha^*}{\alpha^* + \pi^*}\delta - f_{4\delta}],
\]

\[(II.4) \quad Y^* = \Pi^* - u(x\Pi),
\]

\[(II.5) \quad \Pi^d = \Pi^* - u(x\Pi) - \theta D^*,
\]

\[(II.6) \quad D^* = e^{\pi^*}[F(K) - \delta + f_{2\Pi}Be^{-\pi^*} - f_{1i}Be^{-\pi^*}] - u(x\Pi^*),
\]

where subscript \(t\) is suppressed to denote steady state.

By substituting (II.2)-(II.6) into (II.1), dividing it by \(Ke^{\pi^*}\), and defining \(r = F(K)/K\) and \(b = e^{-\pi^*}B/K\), the steady-state dividend repatriation tax rate\(^{136}\) under a credit method (i.e., \(g^c=1\) and \(g^d=0\)) can be written as

\[(II.7) \quad \sigma^* = \frac{u^*(r - \frac{\alpha^*}{\alpha^* + \pi^*}\delta - ib) - \phi u[r - f_{1i}b + f_{2\Pi}b - f_{3}\frac{\alpha^*}{\alpha^* + \pi^*}\delta] - f_{4\delta]}{r - \frac{\alpha^*}{\alpha^* + \pi^*}\delta - ib - u[r - f_{1i}b + f_{2\Pi}b - f_{3}\frac{\alpha^*}{\alpha^* + \pi^*}\delta] - f_{4\delta}}.
\]

The steady state \(\sigma^*\) under the deduction method (i.e., \(g^c=0\) and \(g^d=1\)) can be written as

\[(II.8) \quad \sigma^* = \theta + u^* - u^*\left(\frac{r - \frac{\alpha^*}{\alpha^* + \pi^*}\delta - ib - u[R - f_{1i}b + f_{2\Pi}b - f_{3}\frac{\alpha}{\alpha + \pi}\delta] - f_{4\delta}]{r - \frac{\alpha^*}{\alpha^* + \pi^*}\delta - ib - u[R - f_{1i}b + f_{2\Pi}b - f_{3}\frac{\alpha}{\alpha + \pi}\delta] - f_{4\delta}}\right),
\]

where the steady state \(\sigma^*\) depends on \(r\) and \(b\) and parameters summarized in Table 2.1.

\(^{136}\) The derivation of this appendix is owed much to Professor Jack M. Mintz, who show us how to derive these results.
The ratio of nominal revenues to capital $r$ is assumed to equal 62 percent.\footnote{Note that the qualitative results of the METRs do not change for other assumed values of $r$.} It is estimated from data of 87 Thai affiliates majority-owned by the nonbank US parents in 1989 Benchmark Survey, Final Results (U.S. Department of Commerce, 1992). The estimated nominal revenues are derived by adding foreign taxes (158 million), depreciation allowances (151), interest expenses (98) and net income (482). All four items used are actual numbers except interest expenses, which are assumed to equal 10 percent of actual long-terms debts (988). $K$ is assumed to equal the historical cost of the net property, plant, and equipment (940) in 1988, adjusted to the current 1989 cost using the index (1.53) provided by Feldstein (1994). Thus, $r$ equals 62 percent (i.e., $482+158+151+98)/(940\times1.53$). For simplicity, $r$ is assumed to be equal under all types of finance.

Under 100 percent parent finance, $b = 0$ is assumed; thus, there is no difference between the R base and R+F-base tax. The steady-state $\sigma^*$ is reported in the table below:

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
Income & Credit & Partial Credit & Deduction \\
\hline
R-base & 11.4 & 55.0 & 44.8 \\
R+F-base & 13.8 & 53.5 & 44.8 \\
\hline
\end{tabular}
\caption{Steady-State Dividend Repatriation tax Rates under 100 Percent Parent Finance.}
\end{table}

$\sigma^*$ under the deduction method are equal since values in the third term of (II.8) under the income or cash flow tax systems are equal (i.e., $\sigma^*$ is roughly equal to $u^*+\theta$). Under the partial credit, the numerator of $\sigma^*$ is the same for all three cases, while the denominator — home tax base less foreign taxes — under the income tax is smaller since host corporate taxes under an income tax would be larger than that under the cash flow tax systems. (Note that there is no local borrowing.) With smaller denominator, $\sigma^*$ under the income tax is larger. Under the full credit method, the numerator is smaller under the income tax since foreign tax credits (i.e., foreign tax liability) would be larger under the income tax than
under the cash flow tax systems. The effects of foreign taxes in the denominator are the same as described for the partial credit case. Although these two effects are not reinforcing, the effect of the numerator dominates and thus $\sigma^*$ under the income tax is smaller.

Under 100 local debt finance, $b=1$ is assumed. The steady-state $\sigma^*$ is reported in Table 2.9. Under the deduction method $\sigma^*$ are equal because the values of the third term in (II.8) are equal. By comparing the income tax with the cash flow tax systems, corporate taxes paid to the host country under the income tax would be smaller. (Note that local borrowing is no longer zero.) The base of $\sigma^*$ under the partial credit method is larger; hence, $\sigma^*$ is smaller under the income tax. Under the full credit method, with smaller foreign tax credits the numerator is larger under the income tax; this contributes to a larger $\sigma^*$.

**Table 2.9. Steady-State Dividend Repatriation tax Rates under 100 Percent Local Debt Finance.**

<table>
<thead>
<tr>
<th>Income</th>
<th>Credit</th>
<th>Partial Credit</th>
<th>Deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-base</td>
<td>$f_1=f_3=1; f_2=f_4=0$</td>
<td>11.3</td>
<td>55.1</td>
</tr>
<tr>
<td>R+F-base</td>
<td>$f_4=1; f_1=f_2=f_3=0$</td>
<td>9.5</td>
<td>56.2</td>
</tr>
<tr>
<td></td>
<td>$f_1=f_2=f_4=1; f_3=0$</td>
<td>5.0</td>
<td>58.9</td>
</tr>
</tbody>
</table>

By comparing the R-base with the R+F-base tax, $\sigma^*$ differ considerably under the credit and partial methods. Since loan proceeds (increasing at rate $\pi$) are lower than interest expenses (increasing at rate $i$) in the steady state, foreign tax liability under the R+F-base is lower than that under the R-base; this contributes to a larger denominator under the R+F-base. Thus, under the partial credit method, $\sigma^*$ is smaller for the R+F base. Under the full credit method, less new borrowing than interest expenses contributes to a larger numerator due to lower foreign tax credits given under the R+F-tax; this results in a higher $\sigma^*$ under the R+F-base, in spite of the offsetting effect in the denominator.
Derive the Value of the Affiliate’s Equity (2.1’)

The present value of the affiliate’s dividends in (1’) is shown to equal

\[ (2.1’) \quad E_0^* = \int_0^\infty e^{-\rho(1-c^*)t} \left[ \frac{D^*_t}{1-c^*} (1-\sigma_t^*) \right] dt, \]

where \( \sigma_t^* = g^c \left( \frac{u^*_\Pi_t^* - \phi u^*_x \Pi_t x_t}{Y_t^*} \right) + g^d (\theta + \frac{u^*_\Pi_t^* - \theta D_t^* - u^* \Pi_t x_t}{Y_t^*}). \)

To derive (2.1’), substituting \( T_t^* \) from (2.5) into (2.1) yields

\[ E_0^* = \int_0^\infty e^{-\rho t} \left[ D_t^*(1-\sigma_t^*) - c^* \hat{E}_t^* \right] dt. \]

Rewrite in terms of \( E_t, \)

\[ E_t^* = \int_t^\infty e^{-\rho(s-t)} \left[ D_s^*(1-\sigma_s^*) - c^* \hat{E}_s \right] ds. \]

Take derivative with respect to time \( t \) [use Leibnitz's Rule (Kamien and Schwartz, 1981, p. 254)].

\[ \hat{E}_t^* = \rho E_t^* - [D_t^*(1-\sigma_t^*) - c^* \hat{E}_t^*]. \]

Rearrange both sides by (1-c) and multiply both sides by \( e^{-\rho(1-c^*)t}, \)

\[ e^{-\rho(1-c^*)t} [\hat{E}_t^* - \rho(1-c^*) E_t^*] = - e^{-\rho(1-c^*)t} [D_t^*(1-\sigma_t^*)/(1-c^*)], \]

\[ \frac{d}{dt} [e^{-\rho(1-c^*)t} E_t^*] = - e^{-\rho(1-c^*)t} [D_t^*(1-\sigma_t^*)/(1-c^*)]. \]

Integrate both sides from time \( t \) to \( \infty \) and rearrange,

\[ E_t^* = \int_t^\infty e^{-\rho(1-c^*)(s-t)} \left[ \frac{D_s^*}{1-c^*} (1-\sigma_s^*) \right] ds. \]

Rewrite in terms of \( E_0 \) shown in (1'),

\[ E_0^* = \int_0^\infty e^{-\rho(1-c^*)t} \left[ \frac{D_t^*}{1-c^*} (1-\sigma_t^*) \right] dt. \]

This completes the derivation.
Incidence of the Classified Property Tax When Each Resident Receives Equal Benefits

The change in real income of each income group would not be equal across communities when each resident in the taxing community benefits equally from the commercial property tax. The reason is that the excess of the wage differential over an equal benefit results in a negative (positive) local-specific effect on land rents in the taxing community (nontaxing communities), in addition to the global effect on land rents. Thus, the change in housing prices can be divided into the global effect and the local-specific effect. The former effect, which reduces the housing price, can be computed from the weighted average of the reduction in capital rental return and the global effect on land rents. The latter effect on housing price equals the land share times the negative (positive) local-specific effect on land rents. Thus, the housing price would unambiguously be decreased (is indeterminate).

With these changes, the utility changes of different income groups in the taxing community are indeterminate. However, in the rest of the economy, the welfare is ambiguous for workers, but deteriorates for capitalists and improves for landlord unambiguously if $E^h>\sigma^h(1-b^l)$.

For the taxing community, substituting price changes into (3.26) yields

\[(III.1) \quad \frac{dV^L}{Y^L} = -\frac{\frac{g_k}{g_L} (\tau_1 + d^s)}{n\Omega} + \frac{\frac{b^l}{b^L} (k^x\sigma^x/g_L) f_k \sigma^h}{n\Omega} t_1 + \frac{n-1}{n} (\frac{g_k}{g_L} \tau_1 - d^L), \]

\[(III.2) \quad \frac{dV^K}{Y^K} = -\frac{(k^x\sigma^x/g_L)(f_k \sigma^h + f^h E^h)}{n\Omega} + \frac{b^K}{b^L} \frac{n-1}{n} (\frac{g_k}{g_L} \tau_1 - d^L), \]

\[(III.3) \quad \frac{dV^l}{Y^l} = -\frac{[f_k(E^h, \sigma^h)(k^x\sigma^x/g_L)]_1}{n\Omega} - \frac{1}{f^h b^L} \frac{n-1}{n} (\frac{g_k}{g_L} \tau_1 - d^L) + \frac{b^l}{b^L} \frac{n-1}{n} (\frac{g_k}{g_L} \tau_1 - d^L). \]
In comparing to the case in which only workers receive an equal benefit, there are three important changes. First, the housing price falls much more since the negative local-specific effect (fourth term in III.1-III.3) reinforces with the negative global effect on housing price (third term). Second, land rents are indeterminate because the global effect is positive (if \( E^b > \sigma^b \)) and the local-specific effect is negative (second and third terms in III.3). Third, all residents benefit equally from the tax (i.e., \( d\phi_1 = (K_1^x / N) \tau_1 \)). With these changes, the welfare for workers and capitalists is indeterminate since they suffer from lower return but benefit from an equal benefit and lower housing prices (these terms do not cancel out). Finally, although landlords gain from the latter two items, land rents are indeterminate; thus, their welfare is ambiguous.

In the rest of the economy, their utility changes are as follows.

\[
\text{(III.4)} \quad \frac{dV^L_Y}{Y} = \frac{g_k}{g_L} (ds^*) + b_k \left( \frac{k^x \sigma^x / g_L}{n \Omega} \right) \frac{f_k \sigma^h}{n} \frac{1}{n} \frac{g_k}{g_L} \tau_1 - \frac{1}{n} \left( \frac{g_k}{g_L} \tau_1 - d\phi^L \right),
\]

\[
\text{(III.5)} \quad \frac{dV^K_Y}{Y^K} = - \frac{(k^x \sigma^x / g_L)(f_k \sigma^h + f_k E^h)}{n \Omega} + b_k \left( \frac{k^x \sigma^x / g_L}{n \Omega} \right) \frac{f_k \sigma^h}{n} \frac{1}{n} \left( \frac{g_k}{g_L} \tau_1 - d\phi^L \right),
\]

\[
\text{(III.6)} \quad \frac{dV^L_Y}{Y^L} = \frac{f_k (E^h \sigma^h)(k^x \sigma^x / g_L) \tau_1}{n \Omega} + \frac{1}{n} \left( \frac{b^l}{b^L} \frac{g_k}{g_L} \tau_1 - d\phi^L \right) + \frac{b^l}{n} \left( \frac{k^x \sigma^x / g_L}{n \Omega} \right) \frac{f_k \sigma^h}{n} \frac{1}{n} \left( \frac{g_k}{g_L} \tau_1 - d\phi^L \right).
\]

The results are that the welfare is indeterminate for workers, but worsens for capitalists and improves for landlords if \( E^b > \sigma^b (1 - b^l) \). The utility change for workers is indeterminate since an increase in real income due to wage rise and the negative global effect on housing prices may or may not exceed a reduction in real income due to the positive local-specific effect on housing prices (terms do not cancel out). For capitalists, a decrease in the rental return is much larger than an increase in real income caused by the negative global effect on housing prices; when combined with real income decline caused by the positive local-specific effect on housing price, capitalists are worse off. For landlords, the welfare can be disaggregated into the "global" effects and the "local-specific" effects. In the former effects, the landlord
welfare improves since an increase in land rent (first term in III.6) reinforces a rise in real income caused by the negative global effect on housing prices. In the latter effects, an increase in land rent (second term) is much larger than a decrease in real income caused by a positive local-specific effect on housing prices.
Derivation of the Community housing demand (3.7)

Following Lin (1986), since individuals' preferences are homothetic, the community housing demand function can be written as a function of price and community income $Y_i$, where

$$Y_i = s_iK + w_iL_i + r_l + t_{ip_i}H_i + \tau_isK_i^x,$$

(IV.1) $H_i = D(p_i, sK + w_iL_i + r_l + t_{ip_i}H_i + \tau_isK_i^x)$.

By choice of units, assume a capitalist owns one unit of capital and a landlord owns one unit of land. Since land and capital owners are immobile (i.e. $dK=0$ and $dl=0$) and prices are initially equal to unity, total differentiating (IV.1) yields

(IV.2) $dH_i = \frac{\partial D}{\partial p_i} dp_i + \frac{\partial D}{Y_i} \{Kds + dL_i + L_idw_i + ldr_i + t_{i}H_i + \tau_{i}K_i^x\},^{138}$

where $\partial D/\partial p_i$ is the change in housing demand with respect to its own price and $\partial D/\partial Y_i$ is the change in $H_i$ with respect to community income.

From the model,

(IV.3) $dK_i = dK_i^h + dK_i^h,$

(IV.4) $\tau_{i}dK_i^x + K_i^xds_i + L_idw_i = 0,$

derived by total differentiating the zero profit function of the nonhousing sector, and

(IV.5) $K_i^hds + \lambda_i d\tau_i + t_{i}dH_i = H_i dp_i,$

derived by total differentiating the zero profit function of the housing sector. Substituting (IV.3)-(IV.5) into (IV.2) yields

(IV.6) $dH_i^* = E^h dp_i + MdL_i^*,$

---

138 Note that for notation convenience, $d\lambda_i$ and $d\tau_i$ are written as $\tau_i$ and $\tau_i$. 
where $E^h = - (\partial D/\partial p_i)/H_i + \partial D/\partial Y_i$ is negative of the own-price income-compensated elasticity of housing demand and $M = (m/H_i)L_i$ is the elasticity of community housing demand with respect to labor population.
Derivation of the Change in Social Welfare Function

Total differentiating $V_i = V(p_i, Y_i)$ yields

$$dV_i = \frac{\partial V}{\partial p_i} dp_i + \frac{\partial V}{Y_i} \left( Kds_i + dL_d + L_d dw_i + ldr_i + t_i H_i + \tau_i K_i^x \right)$$

where $\frac{\partial V}{\partial p_i}$ is the change in aggregate welfare with respect to housing price and $\frac{\partial V}{Y_i}$ is the marginal utility of community income. Let $\lambda = \frac{\partial V}{Y_i}$. Using Roy’s identity (i.e., $\frac{\partial V}{\partial p_i} = -\lambda H_i$) and (IV.3)-(IV.5), (IV.7) can be simplified as

$$\frac{dV_i}{\lambda} = L_i^* [dL_i^*].$$
**Derivation of the General Equilibrium Model**

A system of four equations and four unknowns can be formed using equations (3.1)-(3.5), (3.7), (3.8) and (3.10)-(3.13). These seventeen equations yield solutions for seventeen unknowns: \( L_i, K_i, K_i^h, K_i^s, H_i, p_i, w_i, r_i, s. \)

The four equations in the system used to find \( dr_1^*, dr_2^*, ds^* \) and \( dL_1^* \) can be found as follows. The first equation is derived by total differentiating the labor demand function, and the other three equations are derived from factor and housing market equilibrium conditions.

Total differentiating labor demand function \( L_1 = z(V_1, V_2) \) where \( V_i = V(p_i, w_i + \phi^L + \delta^L) \) yields

\[
(V.1) \quad dL_1 = \frac{\partial z}{\partial V_1} dV_1 + \frac{\partial z}{\partial V_2} dV_2,
\]

where \( \partial z/\partial V_1 = \infty \) suggesting labor mobility and \( \partial z/\partial V_2 = 0 \) suggesting labor immobility, and

\[
(V.2) \quad dV_i = \frac{\partial V}{\partial p_i} dp_i + \frac{\partial V}{\partial \phi^L} (dw^* + d\phi^L + d\delta^L).
\]

Equation (V.2) can be rewritten as follows. First, rewriting (3.5) in terms of \( dw_i^* \) yields

\[
(V.3) \quad dw_i^* = g_k/\delta L ds^* + g_k/\delta L t_i.
\]

Roy's Identity and the symmetry assumption implies

\[
(V.4) \quad -\partial V/\partial p_i = b^L (\partial V/\partial L^L) = b^L Y^L.
\]

Substituting (V.3), (V.4), and \( dp_i^* \) in (3.4) into (V.2) yields

\[
(V.5) \quad dV_i = -b Y^L (t_i + f_k ds_i^* + f_k dr_j^*) - Y^L \frac{g_k}{\delta L} ds_i^* + d\phi^L + d\delta^L).
\]
Since $\partial z/\partial V_1 = -\partial z/\partial V_2$ and $ds_1^* = ds_2^* = ds^*$ in (3.6), substituting (V.5) into (V.1) results in the first equation of the system:

(V.6)  \[ dL_1 = -bfL \left( dr_1^* - dr_2^* \right) + \varepsilon^L (b - t_1 - d\delta_1^2) + \varepsilon^L \left( \frac{b_k}{gL} \tau_1 - d\phi_1^L \right). \]

The second equation is derived from capital and labor market equilibrium conditions. First, Substituting (3.11) into (3.10) yields

(V.7)  \[ k^h dK_1^h * + (n-1)k^h dK_2^h * + \kappa^x dK_1^x * + (n-1)k^x dK_2^x * = 0, \]

where $dK_i^h *$ and $dK_i^x$ in (3.1) and (3.2) can be written as

(V.8)  \[ dK_i^h * = \sigma^h d\tau_i^* - \sigma^h ds^*, \]

(V.9)  \[ dK_i^x * = dL_1^* - \frac{\sigma^x}{gL} ds^* - \frac{\sigma^x}{gL} \tau_i, \]

by substituting $dw_i^*$ in (V.3) into (3.2).

Substituting the above two conditions into (V.7) and using full employment condition for the labor market (3.12) yields the second equation of the system:

(V.10)  \[ cdr_1^* + c(n-1)dr_2^* - nFds^* = (k^x \sigma^x /gL)(\tau_1/n), \]

where \( c = k^h \sigma^h, \)
\[ F = k^h \sigma^h + k^x \sigma^x /gL, \]
\[ \tau_{AV} = \tau_1/n. \]

The third and fourth equations of the system can be found by the housing market equilibrium conditions of community 1 and 2. Setting housing supply (3.3) equal to housing demand, (VI.1) yields

(V.11)  \[ f_k dK_i^h * + f_d i = -E^h dp_i^* + Md_{L_1}^*. \]

Substituting $dK_i^h *$ in (V.8) and $dp_i^*$ in (3.4) into (V.11) yields
(V.12) \( Adr_1^* + Bds^* - MdL_1^* = -E^h dt_1 \),

where \( A = f_k \sigma^h + f_l E^h \),
\[
B = f_k E^h - f_k \sigma^h.
\]

From (V.12), the housing equilibrium condition for community 1 yields the third equation of the system:

(V.13) \( Adr_1^* + Bds^* - MdL_1^* = -E^h dt_1 \).

Using full labor employment condition (3.12) implying \( L_2 = -L_1/(n-1) \), the housing equilibrium condition for community 2 yields the fourth equation of the system:

(V.12) \( Adr_2^* + Bds^* - M \frac{dL_1^*}{n-1} = 0 \).

The system of four equations and four unknowns in (V.6), (V.10), (V.13) and (V.14), where (V.13) is divided by \( n \), can be written as

\[
\begin{bmatrix}
  b^l f_i e^L - b^l f_i e^L & 0 & 1 \\
  c & (n-1)c & -nF & 0 \\
  A/n & 0 & B/n & -M/n \\
  0 & A & B & M/(n-1)
\end{bmatrix}
\begin{bmatrix}
  dr_1^* \\
  dr_2^* \\
  ds^* \\
  dL_1^*
\end{bmatrix}
=
\begin{bmatrix}
  e^L(b^l t_i - d\delta^L) + e^L((g_k / g_L)\tau_i - d\phi^L) \\
  (k^x \sigma^h / g_L)(\tau_i / n) \\
  -E^h t_i / n \\
  0
\end{bmatrix}.
\]

The determinant of the system equals

\[
|D| = (bf_i e^L - M \frac{n}{n-1} + A)\Omega,
\]

where \( \Omega = k^h E^h \sigma^h + (k^x \sigma^h / g_L)[f_k \sigma^h + f_l E^h] \) is positive. Note that in the case of wasteful government, \( d\delta^L = d\phi^L = 0 \).

\( dr_1^*, dr_2^*, ds^*, \) and \( dL_1^* \) are derived from the system by Cramer's Rule. The remaining variable changes are derived from equations (3.1)-(3.13).
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