CHAPTER 4: EQUIVALENCE RELATIONS IN TAXATION*

4.1 Introduction

This chapter is about equivalence relations among different combinations of fiscal instruments. Taxes themselves may vary in many apparently significant respects, such as who pays them, what country collects them, when the taxes are collected, and whether the fiscal instruments are even thought of as taxes. Yet many of these differences vanish with the households and firms. The resulting equivalences have an important bearing on the design and effectiveness of tax policy. They suggest that a given objective may be accomplished in a variety of different ways, some perhaps more feasible or politically acceptable than others. Another implications, however, is that a tax policy may be subverted by the failure to coordinate such equivalent channels. These implications can be of considerable economic significance, and there is ample evidence that they, as well as the equivalences themselves, are of prime relevance for policymaking.

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* Based on Alan Auerbach, Jacob Frenkel, and Assaf Razin, "Notes on International Taxation," February 1989. We are indebted to Alan Auerbach for agreeing to include this chapter in the book.

For example, one fundamental equivalence discussed below is of combinations of trade-based (border) taxes on exports and imports and domestic taxes on production and consumption. A second equivalence concerns direct and indirect taxation. As Anthony Atkinson (1977) puts it, direct taxes are taxes that can be based on specific characteristics of individuals and households (e.g., marital status, number of dependents, age, etc.) or businesses (e.g., type of industry). The main forms of direct taxes are personal and corporate income taxes, wealth taxes and inheritance taxes. Indirect taxes are taxes based on transactions such as consumption, exports or imports. As we argue below, the relevance of these equivalences can be demonstrated using the economic integration of the countries of the European Community (EC).

Among the goals of the 1992 process of economic integration in Europe is a harmonization of national tax systems, aimed at eliminating the adverse incentives for the movement of capital, goods and production activity that may derive from the conflicting national objectives of independently designed national tax systems.

Economic integration obviously requires limits on the ability of countries to tax or subsidize exports or imports within the integrated community. In addition, in recognition of the relevance of domestic taxation to export and import incentives, two types of domestic indirect taxation are dealt with in the harmonization provisions. As indicated in Chapter 2, an important indirect tax used in the EC is the value-added tax (VAT) that applies to the domestic consumption of goods and services. As demonstrated in Table 2.2, the coverage, rates and method of calculation

of such taxes vary extensively among the member countries. The difference in tax rates gives rise to incentives to move reported sales from high-tax to low-tax countries. Because of differences in tax base definition, some sales across national borders may be taxed in more than one country. The harmonization proposals would attack these problems by reducing the extent of tax rate variation and standardizing the tax base definition. In addition, the excise duties currently levied at very different rates among countries on specific commodities such as alcoholic beverages, cigarettes and gasoline would be entirely harmonized at uniform rates of tax for each commodity.

The apparent motivation for these provisions is that they will facilitate the elimination of fiscal frontiers within the EC. This exclusive focus on indirect taxation is also found in the provisions of GATT which restrict tax-based trade barriers. The discussion in this chapter implies, however, that there is little theoretical basis for such an approach. Just as domestic and trade-based indirect taxes have similar effects that require coordination, so too do direct and indirect taxes.

To provide the intuition for certain tax equivalences, we begin with a simple model in which many different types of tax policy are assumed to be the same and then show the conditions under which some of these very basic equivalences carry over to much more refined models which are better suited for guiding policy actions.

4.2 One-Period Model

Consider a one-period model of a small open economy with a single representative consumer. The country produces two goods in domestically-owned industries and both goods are consumed domestically. One good, X, is exported, as well as being domestically consumed. The other good, M, is imported, as well as being domestically produced. Each good is produced using two factors of production, labor, L, and capital, K. Let C_i be the domestic consumption of good i; L_i and K_i the levels of labor and capital allocated to industry i, respectively; w and r the factor returns of labor and capital, respectively; and B_i the pure profits generated for the household sector by industry i, $(i=X,M)$. Let the world price of the export good be normalized to unity, with the relative world price of the imported good equal to p_M. In the absence of taxes, the household's budget constraint is:

$$C_X + p_M C_M = wL_X + wL_M + rK_X + rK_M + B_X + B_M. \qquad (4.1)$$

Equation (4.1) states, simply, that spending equals income.

This household's budget constraint may be derived in an alternative way via the production and trade sectors of the economy. Starting with the production sector accounts, which require that production, in sector i, Z_i, equal factor payments plus profits, we obtain:

$$p_i Z_i = wL_i + rK_i + B_i \ , \qquad (i = X, M). \qquad (4.2)$$

To this, we add the requirement that trade must be balanced; that is, exports must equal imports:

$$p_M(C_M - Z_M) = Z_X - C_X. \qquad (4.3)$$

Equation (4.3) is a requirement imposed by the model's single period assumption. No country will be willing to "lend" goods to the rest of the world by running a trade surplus, since there will be no subsequent period in which the debt can be repaid via a trade deficit. Using equation (4.2) in equation (4.3) yields equation (4.1), which can be then viewed as the overall budget constraint of the economy.

Let us now introduce to this model, a variety of taxes including consumption taxes, income taxes and trade taxes. In practice, consumption taxes may take a variety of forms, including retail sales taxes and value-added taxes on consumption goods. In this simple model, with no intermediate production, the two types of taxes are identical. One could also impose a direct consumption tax at the household level. Although there has been considerable theoretical discussion of personal consumption taxes, no country has yet adopted such a tax.

4.2.1 Simple Equivalences

Let the tax on good i be expressed as a fraction J_i of the producer price. (A basic and familiar feature concerning excise taxes is that it is irrelevant whether the tax is paid by the producer or the consumer.) The tax appears on the left-hand side of the budget constraint

(4.1), with the export good's domestic consumer price becoming $1 + J_X$ and the import good's domestic consumer price becoming $(1+J_M)p_M)$; the producer domestic prices are $p_X \equiv 1$ and p_M, respectively.

The first very simple equivalence to note is that the taxes could also be expressed as fractions $(J'_i, i = X, M)$ of the consumer prices, in which case the consumer prices would become $p_i/(1-J'_i)$. This distinction is between a tax, J, that has a tax-exclusive base and one, J', that has a tax-inclusive base. If $r' = J/(1+J)$, then the two taxes have identical effects on the consumer and producer and provide the same revenue to the government. Yet, when tax rates get reasonably high, the nominal difference between tax-exclusive and tax-inclusive rates becomes quite substantial. A tax-inclusive rate of 50 percent, for example, is equivalent to a tax-exclusive rate of 100 percent.

Consider now income taxes on profits and returns to labor and capital. Rather than raising consumer prices, these taxes reduce the resources available to consume. In practice, such taxes are assessed both directly and indirectly. There are individual and business income taxes, but also payroll taxes, for example. By the national income identity, a uniform value-added tax on all production is simply an indirect tax on domestic factor incomes, both payrolls and returns to capital and profits.

One may note, as in the case of consumption taxes, that it does not matter whether the supplier of a factor, in this case the household, or the user, in this case the firm, must actually remit the tax. A factor tax introduced in equation (4.2) or (4.1) has the same effect. The same point holds in regard to tax-exclusive versus tax-inclusive tax bases.

One also may observe from inspection of (4.1) that a uniform tax on income is equivalent to uniform tax on consumption. Each tax reduces real income. Imposition of tax-inclusive consumption tax at rate J divides the left-hand side of (4.1) by the factor $(1-J)$ while a tax-inclusive income tax (the way an income tax base is normally defined) at the same rate multiplies the right-hand side of (4.1) by $(1-J)$. Since dividing one side of an equation by a certain factor is equivalent to multiplying the other side of the same factor, the equivalence between a uniform consumption tax and a uniform income tax is established in a one-period model.

Despite their simplicity, these basic equivalences are useful in understanding the potential effects of various policies. For example, the EC tax harmonization provisions discussed above would narrow differences in rates of VAT among member countries, but these provisions say nothing about income taxes. Yet our results suggest that a uniform consumption tax or any type of uniform income tax would be equivalent to a uniform VAT. Thus, a country with a VAT deemed too high could accede to the provisions of the harmonization process by lowering its VAT and raising other domestic taxes, with no resulting impact on its own citizens and, a fortiori, on the citizens of other countries either. One must conclude that either these proposals have not taken adequate account of simple equivalences or that the simple equivalences may break down in more complicated situations, a possibility we explore below.

4.2.2. International Trade Equivalences

We turn now to taxes explicitly related to international trade. We say explicitly, of course, because an obvious theme of this chapter is that one must recognize the equivalences that make some policies, not specifically targeted at trade, perfect substitutes for others that are.

Tax-based trade policies may involve border taxes, such as tariffs on imports or export subsidies, but may also be industry-specific taxes aimed, for example, at making trade-sensitive industries more competitive. It is well known that quantity restrictions may in some cases be used to replicate the effects on trade-based taxes. The most familiar case is the use of import quotas instead of tariffs. Other alternatives to explicit tax policies are discussed further below.

The first equivalence we note among trade-based tax policies is between taxes on exports and taxes on imports. One might imagine that these policies would work in opposite directions, since the first appears to encourage a trade deficit (a decline in exports not of imports) while the second to discourage one. However, it must be remembered that this one-period model requires balanced trade. Hence, there can be no trade deficit or surplus; only the level of balanced trade may be influenced. Once this is recognized, the equivalence of these two policies can be more rapidly understood; each policy discourages trade by driving a wedge between the buyer's and seller's prices of one of the traded goods. This is the well-known Lerner's Symmetry Proposition.

Algebraically, the equivalence is straightforward. An import tax at a tax-exclusive rate of J causes the domestic price of the imported

good to equal the world price, p_M, multiplied by the factor $1 + J$. Note that since the import tax does not apply to the domestic producer, then $p_M(1 + J)$ is the domestic price not only for the consumer but rather also for the domestic producer. Denoting by w and r the equilibrium factor returns to labor and capital, respectively, the 4-tuple $(p_M(1 + J), 1, w, r)$ is an equilibrium domestic price vector with an import tax at a tax-exclusive rate of J. On the other hand, an export tax at the same tax-exclusive rate of J causes the exporting firm to receive only $1/(1 + J)$ for every unit of the export good sold at the export price of one. The rest, $J/(1 + J)$, equals the tax exporters must pay, which is the tax rate times the net price received, $1/(1 + J)$. Note that $1/(1 + J)$ becomes also the domestic price of the export good, as an exporter can either sell domestically or abroad and must therefore receive the same net price at home and abroad. Multiplying the price vector (4.4) by $1/(1 + J)$, we obtain another price vector

$$(p_M, 1/(1 + J), w', r') \qquad (4.5)$$

where $w' = w/(1 + J)$ and $r' = r/(1 + J)$. Notice that the price vectors (4.4) and (4.5) represent the same relative prices. As only relative prices matter for economic behavior, the two price vectors, (4.4) and (4.5), support the same equilibrium allocation. Put it differently, multiplying p_M on the left-hand side of the household's budget constraint by $1 + J$ (an import tax) is equivalent to multiplying all other prices in that equation (and the profits B_M and B_X) by $1/(1 + J)$ (an export tax).

Thus, the equivalence between an import tax at a tax-exclusive rate of J (which generates the equilibrium price vector (4.4)) and an export tax at the same tax-exclusive rate of J (which generates the equilibrium price vector (4.5)) is established.

It is important to point out that this symmetry of trade taxes makes no assumption about whether the taxing country is small or large, i.e., whether its policies can affect the relative world price of the two goods. The equivalence indicates that these two policies are really one.

4.2.3. Equivalences Between Trade and Domestic Policies

The next class of policy equivalences we note is between trade policies and combinations of domestic policies. We have already shown that an import tariff at a tax-exclusive rate J causes the domestic price of the imported good to equal the world price, p_M, multiplied by the factor $1 + J$. We also noted that $p_M(1 + J)$ is the domestic price for both the consumer and the producer. If, instead of an import tax at a tax-exclusive rate of J the government imposes an excise (consumption) tax at the same tax-exclusive rate of J, then the consumer price of the import good becomes $p_M(1 + J)$, but the producer price remains the world price of p_M. However, the producer will be indifferent between the import tax which generates a producer price of $p_M(1 + J)$ and the excise tax (which generates a producer price of only p_M), if the excise tax is accompanied by a subsidy at a rate J to domestic production which raises the price for him back to $p_M(1 + J)$. An immediate implication is that one cannot control

tax-based trade barriers without also controlling domestic taxes, and that controlling only domestic sales or consumption taxes alone is still not enough. It is possible to convert a perfectly domestic sales tax into an import tariff by subsidizing domestic production of the commodity in question at the rate of consumption tax already in place.

4.3 Multiperiod Model

Many of the equivalences just demonstrated hold in very general models. Even those that do not may "break down" in much more limited ways than one might think. Furthermore, the conditions under which such equivalences do fail provide insight into the channels through which different tax policies operate. Perhaps the most important extension of the simple model we have used in the addition of several periods during which households may produce and consume. This permits the appearance of saving, investment and imbalances of both the government and trade accounts, the "two deficits."

In fact, one may go quite far toward such a model simply by reinterpreting the previous one. Consider, once again, the basic model of equations (4.1)-(4.3). We originally interpreted this as a one-period model, with capital and labor as primary factors supplied to the production process and p_M, w, and r the one-period relative prices of imports, labor and capital. Suppose, instead, that we wished to consider a multiperiod economy. What would the budget constraint of a household choosing consumption and labor supply over several periods look like? From Chapter 3, we know that the household planning no bequests would equate the present value of its lifetime consumption to the present value of its

lifetime labor income plus the initial value of its tangible wealth. What is this initial wealth? It equals the present value of all future profits plus the value of the initial capital stock. The value of the initial capital stock, in turn, may also be expressed as the present value of all future earnings on that capital. Thus, we may replace expression (4.1) with

$$PV(C_X + P_M C_M) = PV(wL_X + wL_M) + PV(rK_X + rK_M) + PV(B_X + B_M), \quad (4.6)$$

where PV( ) represents the present value of a future stream rather than a single period quantity, K_i is the initial capital stock of industry i, and L_i and B_i are the flows of industry i's labor input and profits in period i.

In (4.6), we have made the transition to a multiperiod budget constraint. Note that this budget constraint no longer implies that income equal consumption in any given period, only that lifetime income (from labor plus initial wealth) equal lifetime consumption, in present value. Thus, there may be saving in some periods and dissaving in others.

Similar adjustments are needed to equations (4.2) and (4.3) to complete the transition to a multiperiod model. Just as a household need not balance its budget in any given year, a country need not have balanced trade in any given year. Over the entire horizon of the model, however, trade must be balanced in present value, following the argument used above for balance in the one-period model. That is, each country will give up no more goods and services, in present value, than it receives. The dates of these matching exports and imports may be different, of course, and this is what gives rise to single-period trade deficits and surpluses. Thus, equation (4.3) becomes:

$$PV[p_M[C_M - Z_M)] = PV[Z_X - C_X] \ . \qquad (4.7)$$

The last equation in need of reinterpretation is (4.2). The natural analogue in the multiperiod context is:

$$PV(p_iZ_i) = PV(wL_i) + PV(rK_i) + PV(B_i) \qquad i = X, M, \qquad (4.8)$$

which says that the present value of output in each industry equals the present value of the streams of payments to labor and profits plus the payments to the initial capital stock. However, this condition requires further explanation, since one might expect returns to all capital over time, and not just the initial capital stock, to appear on the right-hand side of the expression.

The explanation is that new investment and its returns are subsumed by the "final form" relationship between final outputs and primary inputs given in (4.8). Put it differently, Z_i is interpreted as the output that is available for final uses outside the production sector, i.e., Z_i is output that is available for either domestic consumption or exports. One may think of capital goods produced after the initial date and then used in production as intermediate goods. Normal production relations represent each stage of production. In a two-period model, for example, we would depict first-period capital and consumption as being produced by initial capital and first-period labor, and second-period consumption as being produced by initial capital plus capital produced during the first period, and second-period labor. Inserting the first-period production relation into the

second-period production relation allows us to eliminate first-period capital from the equation, giving us a single "final form" relating each period's consumption to each period's labor input and the initial stock of capital. This approach may be applied recursively in the same manner for multiperiod models, leading to the type of relationship given in (4.8). In fact, if the capital goods produced in one industry are used in the other, then (4.8) does not hold for each industry separately; only when the two conditions are summed together. This is still consistent with conditions (4.6) and (4.7).

Given the similarity of the multiperiod model (4.6)-(4.8) and the single-period model (4.1)-(4.3), it is not surprising that several of the one-period equivalences carry over to the multiperiod model. First, a permanent tax on consumption is equivalent to a permanent tax on labor income plus profits plus the returns to the initial capital stock. A permanent consumption tax at a tax-exclusive rate of J causes expression (4.6) to become

$$PV[(1+J)(C_X+p_MC_M)] = PV(wL_X+wL_M) + PV(rK_X+rK_M) + PV(B_X+B_M) \ . \qquad (4.9)$$

Multiplying this equation by $1\text{-}J' \equiv 1/(1+J)$, we obtain:

$$PV(C_X+P_MC_M) = PV[(wL_X+wL_M)(1-J')] + PV[(rK_K+rK_M)(1-J')] + PV[(B_M + B_X)(1-J')]. \qquad (4.10)$$

Equation (4.10) is obtained from (4.6) when a permanent tax at a tax-inclusive rate of J' is imposed on labor income plus profits plus the returns to the initial stock of capital. Thus, the equivalence between the latter tax and a consumption tax is established. Clearly, this equivalence holds only if the tax rates are constant over time, so that the tax terms can be taken outside the present value operators PV ( ). One may be tempted to interpret this result as showing that consumption taxes and income taxes are equivalent in multiperiod models with saving, but it is important to recognize that the type of income tax imposed here is not the income tax as normally conceived. The tax here is on wage income plus capital income attributable to initial wealth. It excludes from the tax base the income attributable to capital generated by saving done during the model's periods. Were such income also taxed, there would be an additional change to both sides of (4.6): the present value operator, PV( ), which aggregates future streams of income and consumption, would now be based on the after-tax interest rate, $r(1-J')$, rather than on the market interest rate r. Transferring resources from one period to a subsequent one would now increase the household's tax burden. Indeed, this double taxation of saving has traditionally been emphasized in distinguishing income taxation from consumption taxation.

On the other hand, it is also no longer true that labor income taxation and consumption taxation are equivalent. The equivalence we have uncovered is between consumption taxation, on one hand, and labor income taxation plus taxes on profits and the returns to the initial capital stock. This distinction between consumption taxes and labor income taxes has been

misleadingly termed a "transition" issue by some, since only the capital income from initial assets is concerned. However, such income is large, even in present value. For example, if the economy's capital-output ratio is 3 and the ratio of output to consumption is 1.5 (realistic values for the United States), then a permanent consumption tax of, say, 20 percent, which attaches 20 percent of these assets' flows and hence 20 percent of their value, will raise additional revenue equal to 90 percent (.2 x 3 x 1.5) of one year's consumption.

The equivalence between export and import taxes also carries over to the multiperiod case. Inspection of (4.7) shows that the imposition of a permanent import tariff at rate J multiplies the terms inside the present value operator on the left-hand side by $(1+J)$, while an export tax divides each of the terms inside the present value operator on the right-hand side by $(1+J)$. Again, if the tax rates are constant over time, one may take them outside the present value operators, and the logic of the one-period model then applies. Clearly, the equivalence would not hold for time-varying tax rates. For example, a single-period import tax would be expected to discourage trade overall but also to shift imports to other periods. Likewise, an export tax would not only discourage trade, but also shift exports to other periods. Thus, one would expect the first policy to lead to a greater trade surplus <u>in the period of taxation</u> than the second.

A similar outcome for temporary taxation would hold in the previous case of consumption taxes and taxes on labor income plus returns to initial assets. It has been argued that a VAT should be more favorable to the development of trade surpluses because of its use of the destination

principle rather than the origin principle of taxation. Indeed, for a one-period tax, this will be so, since a one-period consumption tax (destination-based VAT) will shift consumption to other periods, while a one-period income tax will shift production to other periods.

Thus, the primary requirements for the basic one-period equivalences to carry over to the multiperiod context are that rates be permanent and the returns to savings not be taxed. (Even the basic equivalences depend on our implicit assumption that there are no additional nominal constraints on the system; for example, that it is just as easy for a real wage reduction to be accomplished through a fall in the nominal wage as a rise in the price level.) Yet it is unrealistic to assume that governments wish to keep taxes constant over time or that, even if they did, they could bind themselves to do so. Likewise, the taxation of new saving and investment plays an extremely important role not only in the domestic policy context but also increasingly in the international area, as world capital markets become more integrated and the transactions and information costs to investment abroad decline. It is important that we go beyond the previous analysis to consider the effects of changing tax rates and the taxation of saving and investment.

4.4 Tax Equivalences in a Two-Period Model and Cash Flow Taxation

To allow a tractable treatment of more general tax policies and yet maintain the dynamic aspect of the multiperiod model, we consider a two-period model with a single consumption good, no pure profits and fixed labor supply, with the above input in each period normalized to unity. In such a

model, there can no longer be exports and imports in the same period, but issues of trade can still be discussed because there can be exports in one period and imports in another. Because we wish to consider time-varying tax policies and capital income taxation, we must explicitly treat capital accumulation, including foreign as well as domestic investment. This is most easily exposited by representing separately the budget constraints the household faces in each of the two periods, taking account of first-period savings decisions.

In the absence of taxes, the household's budget constraints in periods zero and one for this model are:

$$C_0 = w_0 + D_0K_{D0} + D^*_0K_{F0} - K_{D1} - K_{F1} \tag{4.11}$$

$$C_1 = w_1 + D_1K_{D1} + D^*_1K_{F1} \tag{4.12}$$

where C_i is period i consumption, w_i is the wage in period i, D_i is the return to capital in the home country in period i, D^*_i is the return to capital in the foreign country in period i, K_{Di} is the stock of domestic capital owned by the household in period i, and K_{Fi} is the stock of foreign capital owned by the household in period i. In terms of the multiperiod model considered above, K_{D1} and K_{F1} are stocks of initial capital. Capital fully depreciates in each period. There are no costs of adjustment of investment. The only savings decisions involve the levels of second-period capital purchased.

Now let us introduce taxes to this model. In addition to the consumption taxes and labor income taxes, discussed above, we consider several taxes on capital income. We make three important distinctions with respect to these capital income taxes: whether they are assessed at home or abroad, on the firm or the household, and whether they apply to capital investment or capital income. These three binary distinctions give rise to eight types of capital-income tax. Although such a number of tax instruments may seem excessive, each of these taxes has different economic effects and all have significant real-world representations. Indeed, there are still important restrictions implicit in this characterization.

The eight instruments are denoted J_{RD}, J_{B}, J_{RF}, J^{*}_{NB}, J_{HS}, J_{I}, J_{RFC}, and J^{*}_{I}. The first four apply to capital income, and may be different in periods zero and one. The last four apply to capital investment, and hence are only relevant in period zero. We now define each of these taxes and offer real world examples:

J_{RD} = household level domestic tax on income from domestic investment; taxes on interest and dividend income from domestic sources;

J_{B} = firm level domestic tax on income from domestic investment; domestic corporate income taxes;

J_{RF} = household level domestic tax on income from foreign investment; taxes on interest and dividend income from foreign sources (net of foreign tax credits);

J^{*}_{NB} = firm level foreign tax on income from foreign investment; foreign corporate income taxes;

J_{HS} = household level domestic rate of deduction for domestic investment;

J_I = firm level domestic rate of deduction for domestic investment; domestic investment tax credit;

J_{RFC} = household level domestic rate of deduction for foreign investment; tax-deductible pension saving abroad;

J^*_I = firm level foreign rate of deduction for foreign investment; foreign investment tax credit;

Note that two of these tax instruments, denoted by *"*"s*, are applied by foreign governments to investment and capital income in their countries owned by the domestic household. This tax classification scheme does not include domestic taxes on foreign corporate income. For simplicity, we assume that all investment abroad is portfolio investment by domestic households rather than foreign direct investment by corporations. We adopt this restriction not because foreign direct investment is unimportant empirically (for this is not the case), but because the effects of taxation on foreign investment can be described adequately using the instruments already specified. Likewise, we ignore the fact that such portfolio income might, in some countries, be taxed by the host country at the individual as well as firm levels before being repatriated.

In any particular country, several of these eight capital tax instruments might be absent. For example, if a country integrated its personal and corporate income tax systems, a policy often recommended but never fully adopted, all separate firm level taxes would vanish. If a country's tax rules called for taxation of foreign source capital income,

the tax rate J_{RF} could be low or even zero if the home country credited foreign taxes on such income. In such a scheme, the tax on foreign source income equals:

$$J_{RF} = (J-J^*)/(1-J^*),$$

where J and J^* are the statutory rates of income tax in the home and foreign countries, respectively. Thus, if $J = J^*$, $J_{RF} = 0$.

To introduce these taxes into the budget constraints (4.11) and (4.12) in a realistic manner, one additional element of notation is necessary. Most countries that tax household capital income emanating from firms do so only on a realization basis. Households are taxed on dividends and interest received, but not on corporate retained earnings. This has important implications concerning the cost of capital and the market value of corporate assets. To represent the fact that retained earnings are not taxed at the household level, we let R_0 and R_0^* be earnings retained in period 0 by domestic and foreign corporations owned by domestic households, and assume that household level taxes on corporate income are levied on earnings net of these values.

Letting J_{ci} be the tax-exclusive consumption tax and J_{Li} the labor income tax in period i, we may rewrite the budget constraints (4.11) and (4.12) to account for the capital income tax treatment just considered:

$$(1+J_{C0})C_0=(1-J_{L0})w_0 \qquad (4.13)$$

$$+ (1-J_{RD0})[(1-J_{B0})D_0K_{D0}-R_0]$$

$$+ (1-J_{RF0})[(1-J^*_{NB0})D^*_0K_{F0}-R^*_0]$$

$$- (1-J_{HS})[(1-J_I)K_{D1}-R_0] - (1-J_{RFC})[(1-J^*_I)K_{F1}- R^*_0]$$

and

$$(1+J_{C1})C_1 = (1-J_{L1})w_1+ (1-J_{RD1})(1-J_{B1})D_1K_{D1} \qquad (4.14)$$

$$+(1-J_{RF1})(1-J^*_{NB1})D^*_1K_{F1} \quad .$$

Despite its apparent complexity, this system is useful in demonstrating a variety of tax equivalences.

We begin with a special case. Suppose there are no taxes at the firm level, and that tax rates that apply to deductions for investment at home and abroad, J_{HS} and J_{RFC}, equal the corresponding taxes on investment income, J_{RD} and J_{RF}, respectively. Then the budget constraints (4.13) and (4.14) become:

$$(1+J_{C0})C_0= (1-J_{L0})w_0 + (1-J_{RD0})(D_0K_{D0} - K_{D1}) \qquad (4.15)$$

$$+ (1-J_{RF0})(D^*_0K_{F0} - K_{F1})$$

and

$$(1+J_{C1})C_1 = (1-J_{L1})w_1 + (1-J_{RD1})D_1K_{D1} + (1-J_{RF1})D^*_1K_{F1}. \qquad (4.16)$$

Note that in this case the consumption tax in each period is equivalent to a combination of taxes in the same period at the same rate on labor income, domestic capital income and foreign capital income, net of domestic and foreign investment. This is a new result, but it is closely related to one derived in the previous section. If, in addition, we assume that the tax rates are constant over time and the rates of return D_1 and D_1^* are equal (as would be the case if foreign and domestic investments were taxed at the same rate and investors chose to hold each), we may combine (4.15) and (4.16) to obtain:

$$(1+J_C)(C_0+C_1/D_1) = (1-J_L)(w_0+ w_1/D_1) \qquad (4.17)$$

$$+ (1-J_{RD})D_0K_{D0} + (1-J_{RF})D_0^* K_{F0} \quad ,$$

which gives the previous multiperiod result confirming the equivalence of a constant consumption tax to taxes at the same rate on labor income and the income the income from initial assets.

Even when tax rates differ across periods, we have identified an important period-by-period equivalence between consumption and income taxes. A consumption tax can be replicated by a tax on labor income plus taxes on domestic plus foreign capital income, net of new investment. This is in no way inconsistent with our previous intuition that a consumption tax does not impose a tax on new savings: a constant tax on capital income, net of investment, imposes no tax, in present value, on the income from new investment. Though the entire return from such investment is taxed, its

entire cost is deducted at the same rate. Thus, the government is simply a fair partner in the enterprise (though because of its passive role in the actual operation of the firm, sometimes called a "sleeping" partner). Only income from capital already in place at the beginning of period 1 is subject to a true tax, and this tax was seen above to be part of the income-tax-equivalent scheme.

These foreign and domestic taxes on capital income less investment are sometimes called cash flow taxes, since they are based on net flows from the firm. In the case of the foreign tax, the cash-flow tax is a tax on net capital inflows. In this sense, it is equivalent to a policy of taxing foreign borrowing and interest receipts and subsidizing foreign lending and payments of interest. In the domestic literature on taxation, much has been made of the equivalence between labor income taxes plus business cash flow taxes and consumption taxes. But in an open economy, this equivalence also requires the taxation of cash flows from abroad. For otherwise, the destination-based consumption tax will include an extra piece that is absent from the tax on labor and domestic capital income net of domestic investment.

We turn next to issues related to the level of capital income taxation, business versus household. In the real world, some payments by firms to suppliers of capital are taxed only at the investor level, without being subject to a business-level tax. These are interest payments, which are treated as tax-deductible business expenses. Other payments, dividends, are typically either partially deductible or not deductible at all. One may think of the tax rates J_B and J^*_{NB} as representing weighted average tax

rates of the positive tax rate on dividends and the zero tax rate on interest. (Again, it is typical that the individual tax rates on these two forms of capital income differ, but not as significantly. We ignore such differences in our model.)

One would expect these tax provisions to affect firms' incentives with respect to retained earnings, R and R^*. Indeed, it is clear from the budget constraint (4.13) that the optimal policy will be to maximize (minimize) R if $J_{RD} >(<) J_{HS}$: likewise, for foreign investment, R^* should be maximized (minimized) if $J_{RF} >(<) J_{RFC}$. In the "normal" case that savers do not receive a full immediate deduction for funds supplied to the firm, firms will retain earnings until constrained from doing so. This would presumably be when they had financed all their investment, $(1-J_I)K_{D1}$, or exhausted all available internal funds, $(1-J_B)D_0K_{D0}$. Were $J_{RD} = J_{HS}$, households would be indifferent: payments made to them by the firm and then immediately sent back would have no tax consequences. Following the same logic, a more generous rate of savings deduction would lead firms to distribute as much as possible to allow savers the opportunity to return the funds and reduce their net taxes. The lower limit on retentions would be zero, as dividends cannot be negative.

We thus have three cases domestically (and analogous three cases with respect to foreign savings):

(a) $J_{RD} > J_{HS}$ and $R = \min[(1-J_I)K_{D1}, (1-J_B)D_0K_{D0}]$;

(b) $J_{RD} = J_{HS}$ and $\min[(1-J_I)K_{D1}, (1-J_B)D_0K_{D0}] > R > 0$;

(c) $J_{RD} < J_{HS}$ and $R = 0$.

For each of these cases, we may substitute the optimal value of *R* into equation (4.13) to obtain a budget constraint in which *R* does not explicitly appear. In the normal case (a), and the intermediate case (b), this procedure yields:

$$(1+t_{C0})C_0 = (1-J_{L0})w_0 \qquad (4.13')$$

$$+ (1-J_{DS0})[1-J_{B0})D_0K_{D0} - (1-J_I)K_{D1}]$$

$$+ (1-J_{FL0})[1-J^*_{NB})D^*_0K_{F0} - (1-J^*_I)K_{F1}] \quad ,$$

where

$$J_{DS} = J_{HS} \text{ if } (1-J_{B0})D_0K_{D0} < (1-J_I)K_{D1}$$

$$J_{RD} \text{ if } (1-J_{B0})D_0K_{D0} > (1-J_I)K_{D1}$$

$$J_{FL} = J_{RFC} \text{ if } (1-J^*_{NB})D^*_0K_{F0} < (1-J^*_I)K_{F1}$$

$$J_{RF} \text{ if } (1-J^*_{NB})D^*_0K_{F0} > (1-J^*_I)K_{F1}.$$

The value of J_{DS} depends on whether the firm is in a regime in which it is paying dividends at the margin and hence financing marginal investment from retained earnings (J_{RD}) or not paying dividends and financing new investment through issues of new shares (J_{HS}). In either case, however, the behavior of the optimizing firm induces a household level cash flow tax. This implies that the economy may be closer to cash-flow taxation than might appear from the statutory tax treatment of household capital income. In particular, the <u>effective</u> tax burden on capital income at the household level is zero in present value, even if there are dividends and $J_{RD} > J_{HS}$. This is another equivalence, of existing systems of household capital income taxation to household cash-flow taxation.

A final equivalence involving the two levels of capital income taxation is <u>between</u> taxes at the two levels. In a variety of situations, a tax at the firm level is equivalent to one at the household level. Consider, for example, the case in which all capital income taxes are cash flow taxes. This is like the situation considered in equation (4.15), but with cash-flow business taxes added. In this case, the first-period budget constraint is:

$$(1+J_{C0})C_0 = (1-J_{L0})w_0 + (1-J_{RD0})(1-J_{B0})(D_0K_{D0}-K_{D1}) \qquad (4.13")$$

$$+ (1-J_{RF0})(1-J^*_{B0})(D^*_0K_{F0} - K_{F1})$$

(The second-period budget constraint (4.14) is unaffected.) It is clear from this equation that it is irrelevant from the household's viewpoint whether taxes are collected from firms or individuals. The tax rate J_B is a perfect substitute for J_{RD} and J^*_B is one for J_{RF}. In the first

case, with both taxes collected by the same government, the equivalence is complete; government is indifferent as well. In the second case, this would not be so, unless a tax treaty existed that directed capital income taxes collected on specific assets to specific countries regardless of who actually collect the taxes.

Even in the domestic case, the taxes might appear to have different effects due to their different collection points. For example, measured rates of return from the corporate sector would be net of tax were the taxes collected from firms, but gross of tax were they collected from households.

4.5. Present Value Equivalences

In discussing cash flow taxation, we have made a point that has a more general application: that tax policies may change the timing of tax collections without changing their burden, in present value. A constant-rate cash flow tax exerts no net tax on the returns to marginal investment, giving investors an initial deduction equal in present value to the ultimate tax on positive cash flows the investment generates.

In our two-period model, a cash-flow tax at a constant rate collects revenue equal in present value only to the cash flows from the first-period capital stock. Thus, an initial wealth tax on that stock would be equivalent from the viewpoint of both household and government. For example, consider the simple case with no firm-level taxes and constant tax rates examined above. This is the example in which the first-period and second-period budget constraints can be combined as in the multiperiod model of the previous section. These three budget constraints (first-period,

second-period and combined) are under cash-flow taxation (assuming that $D = D^*$):

$$(1+J_C)C_0 = (1-J_L)w_0 + (1-J_{RD})(D_0K_{D0}-K_{D1}) + (1-J_{RF})(D^*_0K_{F0}-K_{F1}), \qquad (4.15')$$

$$(1+J_C)C_1 = (1-J_L)w_1 + (1-J_{RD})D_1K_{D1}+(1-J_{RF})D^*K_{F1}\ , \qquad (4.16')$$

and

$$(1+J_C)(C_0+ C_1/D_1) = (1-J_L)(w_0+ w_1/D_1) \qquad (4.17')$$

$$+ (1-J_{RD})D_0K_{D0} + (1-J_{RF})D^*_0K_{F0}$$

Here, if the terms K_{D1} and K_{F1} appearing in the first and second-period budget constraints were no longer multiperiod by $1-J_{RD}$, and $1-J_{RF}$, respectively, cash-flow tax would be replaced by a first-period tax on the returns to existing capital, a wealth tax, yet there would be no impact at all on the household's combined budget constraint. Its measured saving would be affected, but not its consumption.

Just as measured household saving would be affected, there would also be apparent differences between the levels of government debt in the two cases. In the cash-flow tax case, the government's revenue would be higher in the first and lower in the second period. It would have a bigger first-period budget deficit. At the same time, firm values would be lower, to account for the larger impending second-period cash-flow tax payments. Indeed, these differences exactly offset each other. One could imagine the cash-flow tax policy as being a combination of the wealth tax policy plus a

decision by the government to borrow in the first-period and force firms to accept loans of equal value at the market interest rate, to be repaid in the same period. Firms would require less funds from the household sector, leaving households just enough extra money to purchase the bonds floated by the government.

Thus, the explicitly measured government debt is not an accurate indicator of policy, since it may vary considerably between the two equivalent situations. One may think of the "forced loans" of the cash-flow tax system as being off-budget assets that cause the deficit to be overstated, assets that can be brought on budget by recalling the loans, paying back the debt, and shifting to the wealth tax.

One can imagine many similar examples of present value equivalences, none of which go beyond the bounds of the realistic tax policies we have already considered. The government can arbitrarily change the measured composition of a household's wealth between government debt and tangible capital (and indeed between government debt and human capital, through changes in the time pattern of labor income taxation) simply by introducing offsetting levels of debt and "forced loans" attached to these other assets. This is true whether or not the asset owners are domestic residents or not. Foreign owners of a domestic corporation that is suddenly hit with a cash-flow tax on <u>new</u> investment (i.e., excluding the wealth tax effect on preexisting capital) will spend less of their funds on the domestic firms and the remainder on other assets, quit possibly the government debt, but not in the country's external debt, i.e., the aggregate value of domestic assets owned by foreigners.

It is noteworthy that the government's ability to shift such asset values of foreigners is more circumscribed than its ability with respect to domestic residents. It cannot, for example, cause a reduction in the value of a foreigner's human capital offset by a loan to the foreigner (by cutting labor income taxes today and raising them in the future) because it cannot tax the foreigner's labor income. All adjustments with respect to external debt must be through the tax treatment of foreign-owned domestic assets.