On capital income tax policies under uncertainty

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Abstract

This paper investigates corporate income and dividend taxation in a multi-country world, where production is subject to country-specific productivity shocks. Single-country non-cooperative tax policy is shown to imply a tax on foreign-source dividends and a subsidy to domestic-source dividends. The optimal corporate tax may be negative, if international portfolios are little diversified at the outset. Finally, each country in a coordinating region should subsidize rather than tax domestic citizen's investment in equity in partner countries. © 1998 Elsevier Science B.V. All rights reserved.

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1. Introduction

This paper examines non-cooperative capital income taxation under uncertainty and regional coordination of tax policies. The major stimulus to writing the paper has been a glaring contrast between, on one side, ongoing debates on coordination of capital income tax policies in Europe and in the OECD as a whole and, on the other, some striking results in the theoretical literature on international taxation.

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Quite frequently, the following types of questions have been posed in academic and political discussions: What is the scope for regional coordination of capital income taxes in a group of countries in the world economy? How should these countries adjust their taxes on capital income to take into account the implications for partner countries? (Selected references are OECD (1991), Ruding Report (1992), Keen (1993) and Sørensen (1993).) However, recent theoretical contributions by Razin and Sadka (1991) as well as Bucovetsky and Wilson (1991) almost convey the impression that coordination of national capital income tax policies is a non-issue.

Razin and Sadka (1991) investigate harmonization of capital income taxes in a group of small countries. Their main result is that when small countries harmonize their capital income tax policies, the act of harmonization will not lead to any change in their tax rates, since the tax policy of a small country has no bearing whatsoever on conditions in any other country. Hence, Razin and Sadka claim that there is no scope for coordination within a group of small countries. Bucovetsky and Wilson (1991) derive a similar and in a sense stronger result. They demonstrate that there is no scope for global coordination of residence- and source-based capital income taxes, if individual countries have access to both types of tax; this is so, even if they believe they can to some extent affect the world interest rate.¹

A notable feature of these twin contributions is that they consider a world of certainty in which all assets are perfect substitutes. Reality does not quite match these assumptions, but unfortunately the literature on international taxation under uncertainty is extremely sparse. The main contribution is the pioneering article by Gordon and Varian (1989) which examines the taxation of asset income in the presence of a world securities market, focusing on how uncertainty influences optimal taxation in single countries. They point out that even countries that consider themselves too small to affect the international rate of interest or investment in capital stocks in other countries may still possess some ability to influence international security prices, if the securities in the world are characterized by idiosyncratic (country-specific) risk. This recognition will then shape their tax policy.

In the light of these remarks it seems worthwhile to investigate the implications of uncertainty and less than perfect substitution between national securities for single country and coordinated taxation of capital income. A reasonable conjecture is that under conditions of uncertainty in the form of country-specific shocks, even small countries will wish to employ capital income taxes and will also modify their policies once they embark on regional policy coordination.

¹ Bucovetsky and Wilson (1991) do identify, though, a need for coordination, when residence-based taxes are not available to authorities because of, e.g., tax evasion.
To examine these issues we use a two-period multi-country model, following the pioneering article by Gordon and Varian rather closely. We do, however, depart from their framework in a number of ways. In particular, Gordon and Varian somewhat disturbingly assume that all revenue from taxing capital income is rebated to the same firms or individuals who paid the taxes in question. Instead, we introduce the more realistic assumption of governments distributing proceeds from capital income taxation solely to domestic residents. On one hand, this leads to rather different rules for, in particular, corporate income taxation. On the other, it complicates the single-country optimal tax problem considerably as compared to the Gordon–Varian study. Moreover, the corporate income tax in our paper incorporates flexibility as regards the treatment of depreciation and so may be a cash flow tax or a more conventional corporate income tax. Finally, our model enables an analysis of regional coordination of tax policy and of non-enforceability of foreign-source income taxation.

The outline of the paper is as follows. Section 2 derives optimal consumption and investment rules for individuals and firms as well as market values for relevant investment opportunities. On the basis of this, Section 3 considers Nash capital income tax policy in an individual country under the assumption that every country in the world believes it is too small to influence the international risk-free interest rate or capital investment in other countries, but large enough to affect international asset prices. We focus on a symmetric equilibrium, in which all firms and individuals are identical across countries, save for the country-specific productivity disturbances.

We find that taxation of interest will not be part of an optimal tax policy package. Taxation of dividends/capital gains will tend to encourage investment in domestic firms while penalizing placement in equity abroad. And perhaps most interestingly, the optimal corporate tax may be negative, its sign depending on the initial pattern of international asset holdings and the associated amount of equity trade desired by individuals at home and abroad. Finally, the optimal corporate tax never takes the form of a pure cash flow tax; in the non-cooperative environment, a ‘dirty’, distortionary corporate tax is called for.

In Section 4 we move on to coordination of policy in two countries, the ‘home country’ and the ‘partner country’. Specifically, we optimize the sum of welfare in the two countries, maintaining the assumption of Nash behaviour in the countries in the rest of the world. We are primarily interested in the way regional coordination modifies the taxation of corporate income and dividends, when due respect is given to the repercussions from national tax policy in the partner country.

It turns out that the most significant modification of tax policy concerns investment in equity in partner countries. We derive that such investment should be supported rather than discouraged, and that all investors residing in
the ‘union’ of coordinating countries should be treated alike when they invest in securities issued in a given member country (implying intra-union capital import neutrality).

Section 5 briefly takes up a major problem facing governments, namely the lack of enforceability of foreign-source capital income taxation. It shows that countries should still coordinate remaining capital income taxes, when income from abroad cannot be taxed. Finally, Section 6 is devoted to discussion and interpretation of our results.

2. The model

2.1. General remarks

We imagine a world consisting of \( N + 2 \) countries: a home country, a potential partner country, and an \( N \)-country region comprising the rest of the world. Each country in the world economy contains a large number of identical consumers and a large number of identical firms that are engaged in perfect competition. All firms in the world produce the same composite good, while the production process as such is subject to country-specific productivity shocks. These shocks constitute the only source of uncertainty in the model. For analytical convenience, the national productivity disturbances are supposed to be independent of each other.\(^2\)

The idiosyncratic productivity shocks give rise to a motive on the part of individual investors for diversifying their portfolios and for acquiring equity in not only domestic firms, but also foreign firms. In addition, internationally traded bonds may be part of these portfolios.

Individuals live for two periods. In the first period they divide their initial resources, consisting of endowments plus ownership shares in domestic or foreign companies, into consumption, physical investment in those companies, and acquisition of shares and bonds. In the second period, they consume the return from the investments undertaken in the preceding period.

Firms undertake capital investment so as to maximize their value in the market (or, more correctly, the net value correcting for the cost of investment). Physical capital depreciates fully after the lapse of one period, so what firms are able to pay out to their owners is the value of production, net of possible corporate income taxes.

Governments have three capital income tax instruments at their disposal: (i) an interest tax on the return to bond holdings; (ii) a corporate tax on

\(^2\) Alternatively, a symmetric correlation structure might be applied; this alternative does not seem to affect qualitative results, but it does add to complexity.
income generated in firms; and (iii) a tax on dividends/capital gains accruing to shareholders. While the interest tax and the dividend/capital gains tax are levied on domestic citizens and thus are residence-based taxes, the corporate income tax is levied on domestic firms, regardless of ownership structure, and accordingly is a source-based tax. The rate of dividend tax will be allowed to vary across countries of origin.

Whatever revenue is collected from these taxes is distributed to domestic citizens. This assumption seems the more realistic one, absent, of course, is public expenditure on goods and services. The rebating assumption employed by Gordon and Varian (1989), according to which revenue is paid back to whoever paid the tax in the first place, seems less realistic, although it did serve in their article to highlight substitution effects associated with taxes as opposed to redistribution effects. Comparing the model and the computations below with the Gordon–Varian article it becomes clear that the assumption of tax revenue being distributed solely to domestic agents complicates matters considerably. This is because the corporate tax assumes a double role: On one hand it controls the rate of domestic physical investment. On the other, it controls the redistribution of income from foreign shareholders in domestic firms to domestic citizens.

With reference to the symmetry assumption, we concentrate on a description of the home country in the following two subsections.

2.2. Firms, households and the government in the home country

The representative firm in the home country uses capital as an input to produce its output according to the production structure

\[ Y_h = y_hF(K_h). \] (2.1)

\( Y_h \) denotes output, resulting from the production function \( F(K_h) \) and the multiplicative productivity disturbance \( y_h \). \( F(\cdot) \) possesses the usual properties of concavity, etc. The productivity disturbance is assumed to be normally distributed, and \( F(\cdot) \) is normalized so that \( y_h \) has a unitary mean.

The representative individual consumes and invests so as to maximize expected utility. The latter is equal to

\[ U_h = - \exp (- bC_h^1) - \rho E(\exp(- bC_h^2)) \]

or

\[ U_h = - \exp (- bC_h^1) - \rho \exp (- b[EC_h^2 - (b/2) \text{var}(C_h^2)]). \] (2.2)

Here, \( C_h^1 \) and \( C_h^2 \) denote the individual’s consumption in the first and second periods, respectively. \( E \) is the expected value operator, and \( \rho \) is a time preference,
parameter. While $C_1^h$ is certain, $C_2^h$ is not, as it depends on the risky return to the investments which the individual undertakes in the first period.\(^3\)

Entering the first period, the individual has an endowment of $W_h$ and shares in domestic or foreign firms $s_h^m$ were the ‘$m$’ stands for the location of the firm; if $m$ is equal to $h$, the financial investment is done in domestic equity. Qua his initial ownership of shares in domestic or foreign firms, the individual participates in physical investment in the amount $K_m$ in the representative firm in country $m$. Having accomplished the capital investment, the firm ‘goes public’; shares are traded at a price equal to the value of the firm $V_m$, and the individual in question decides on the extent of ownership in the firm. Denoting this share $s_h^m$, it will in general vary from the initial ownership share $s_h^m$, in which case the individual will have to sell or purchase shares.\(^4\)

At the same time as he invests in shares, he may invest in risk-free bonds in the amount $B_h$. These bonds yield a risk-free interest rate $\tau$ and are internationally traded. The (net) holdings of the bonds are interpreted as international borrowing or lending.

The following taxes are levied in the home country: $t_h$ is the interest tax rate, $u_h$ is the domestic corporate tax rate, while $v_h^m$ is the dividend/capital gains tax rate applied to the net payments on the part of firms in country $m$ to a domestic citizen. Taxes in foreign countries are defined analogously; hence, $u_m$ denotes the corporate tax rate in country $m$.

When the firms in country $h$ invest $K_h$ in the first period, they can expense part of it (receive a tax credit) at a rate of $e_h$;\(^5\) hence, the net outlays for investment are $K_h(1 - e_h u_h)$. The book value of the capital stock, $K_h(1 - e_h)$, is then deducted from revenue in the second period to generate taxable corporate income $Y_h - K_h(1 - e_h)$ and thereby net corporate income, denoted $R_h$,

$$R_h = Y_h - u_h Y_h - (1 - e_h)K_h.$$  \hfill (2.3)

The individual in country $h$ pays dividend/capital gains tax on the excess of net corporate income over the original share price, yielding a net return of $R_m - v_h^m (R_m - V_m)$ on the investment in country $m$ shares.

The government borrows at the international interest rate to finance the tax credit in the first period. The net revenue of the government in the second period then becomes

$$T_h = t_h r B_h + \sum_m S_h^m v_h^m (R_m - V_m) + u_h (Y_h - \lfloor 1 + e_h r \rfloor K_h).$$  \hfill (2.4)

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\(^3\) It will be clear below that $C_1^h$ is normally distributed. This property has, in fact, already been utilized in the last equality of Eq. (2.2).

\(^4\) The shares $s_h^m$, respectively $s_h^h$, sum to one over countries of ownership, $n$.

\(^5\) The parameter $e_h$ defines the extent to which the corporate tax is a cash flow tax, a pure cash flow tax corresponding to $e_h = 1$ and a conventional corporate tax with economic depreciation to $e_h = 0$. 
This revenue is distributed to domestic consumers in a lump sum fashion. To the extent that equity in domestic firms is owned by foreigners, the corporate tax accordingly functions as a redistributive tax.

2.3. Consumer optimization

The first-period budget constraint on the part of the representative domestic consumer becomes

\[ C_1^h + B_h + \sum_m s_h^m V_m = W_h + \sum_m \bar{s}_h^m (V_m - [1 - e_m u_m] K_m) \] (2.5)

while the second period’s consumption is given by

\[ C_2^h = [1 + (1 - t_h) r] B_h + \sum_m s_h^m [R_m - v_h^m (R_m - V_m)] + T_h . \] (2.6)

The consumer takes the following as given: the international interest rate, the tax rates, the investment undertaken by firms, the share prices, the return on shares, and the transfer from the government (including the stochastic properties of the latter two items). On the basis of this and the budget constraints, he maximizes his expected utility with respect to first-period consumption, asset shares and bond holdings; the latter may, however, conveniently be substituted out of the expression for second-period consumption by the use of the first-period budget constraint.

The first-order condition related to consumption in the first period is

\[ \exp (-b C_1^h) = \rho [1 + (1 - t_h) r] E (\exp (-b C_2^h)). \] (2.7)

The first-order conditions corresponding to the choice of asset shares can be written as

\[ \bar{R}_m = [1 + a^m_h r] V_m + b \text{cov} (R_m, C_2^h) \] (2.8)

in which \( \bar{R}_m \) is the expected value of \( R_m \), and the tax factor \( a^m_h \) expresses the relative severity of interest and dividend taxation at the personal level,

\[ a^m_h = (1 - t_h)/(1 - v_h^m). \]

Eq. (2.8) in effect balances the covariance between the income, after corporate taxes, from investing in firms in country \( m \) and second-period consumption, with the value of these firms and the expected return to capital in the firms. The balance obviously is affected by possible asymmetries in taxation at the household level. Note that while the share \( s_h^m \) does not explicitly appear in the equation, it enters in an indirect way, since it influences \( C_2^h \) and thereby the covariance term.
2.4. Market pricing and investment decisions of firms

Formulas similar to Eq. (2.8) hold for individual share choices in all the other countries in the world. Aggregating over these for each type of firm (each \( m \)) we derive

\[
\bar{R}_m = [1 + a^m r] V_m + b \, \text{cov} (R_m, R)/(N + 2)
\]  

(2.9)

where \( a^m \) is a tax factor expressing the average asymmetry across countries in their tax treatment of interest and dividends, while \( R \) denotes total world income or consumption in the second period,

\[
a^m = \sum_n a^m_n/(N + 2), \quad R = \sum_n C^2_n.
\]

Eq. (2.9) is a version of the familiar CAPM equation with taxes, expressing a relation between the after-corporate-tax return to investment in equity in country \( m \), the price of that equity, and the covariance of its return with the market portfolio. The latter includes the transfers from governments; indeed, the promise of the transfer in each country can be considered an asset which the individual in the country is ‘forced to hold’.

The representative firm in country \( m \) regards Eq. (2.9) as the formula for the relationship between the market value of the firm and its investment activity. It wishes to maximize the difference between its value and the effective cost of physical investment, i.e. \( V_m - (1 - e_m u_m) K_m \). Qua its investment it influences the after-corporate-tax return to investors, the covariance of the return with the market portfolio, and thereby its market value. Differentiation of Eq. (2.9) with respect to the capital stock yields

\[
\frac{\partial \bar{R}_m}{\partial K_m} = [1 + a^m r] \frac{\partial V_m}{\partial K_m} + b \frac{F'}{F} \frac{\text{cov} (R_m, R)}{(N + 2)}
\]

where a necessary condition for optimality of investment is \( \frac{\partial V_m}{\partial K_m} = 1 - e_m u_m \).

Inserting this and using the definition of \( R_m \) as well as Eq. (2.9) once more (so as to substitute out the covariance term) we obtain our final expression

\[
V_m F'/F = 1 - e_m u_m - \frac{u_m (1 - e_m)}{(1 + a^m r)} \left( 1 - \frac{K_m F'}{F} \right).
\]  

(2.10)

Optimizing investment behaviour on the part of the representative firm in country \( m \) accordingly must see to it that this equation is satisfied. The formula

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\(^6\) That this is indeed in the interest of initial owners of the firm is shown in a similar context in Gordon (1985).
relates the value of the firm to, most importantly, the relevant country’s corporate income tax rate and the average personal tax factor for investment in country-$m$ shares. Changes in such tax parameters generally lead to changes in physical investment of firms located in country $m$. Finally notice that in the absence of corporate taxation in country $m$, $V_m F'/F = 1$.

2.5. The smallness of countries

The ‘smallness’ of a country is defined by which international economic variables it counts on being able to influence. Here we shall adopt the assumption that every country believes it is unable to affect the world interest rate and capital investment on the part of foreign firms. On the other hand, via its tax policy it believes it is able to change domestic consumption, capital investment in domestic firms and asset holdings on the part of domestic citizens, and that all this will result in an ability to influence international security prices.\footnote{This particular way of defining or implementing the concept of ‘smallness’ can, of course, be debated. One may alternatively assume that each country perceives itself as able to influence capital formation abroad, too. The qualitative conclusions below for optimal non-cooperative tax policy can be shown to be robust to selecting this alternative.}

To see how the home country $h$ may impact international equity prices, aggregate the asset holding equations, Eq. (2.8), over all $N + 1$ foreign countries to derive the following pricing relation for firms in country $m$:

$$ R_m = [1 + a^m_{-h}] V_m + b \text{ cov } (R_m, R - C^2_h)/(N + 1). \quad (2.11) $$

In this expression, the security price for equity in country $m$ is related to tax policy in foreign countries via the tax factor

$$ a^m_{-h} \equiv \sum_{n \neq h} a^n_m/(N + 1). $$

It is also related to the expected return as well as to world income less domestic consumption in the second period, i.e. to the sum of consumption in all other countries. In the formula, the home country government takes $R_m$, $R$ and $a^m_{-h}$ as exogenous, while it believes it can influence $V_m$ via changing second period consumption domestically and thereby the covariance term.

In the special case of $h = m$, the domestic authorities are in addition able to affect the return to capital $R_m$ primarily through corporate tax policy, both directly and via the choice of physical investment in domestic firms.

In the appendix we investigate in more detail how the value of domestic equity is related, directly and indirectly, to domestic tax policy. We also discuss the determination of the investment on the part of domestic citizens in domestic equity.
2.6. The consequences of dividend and corporate taxation for capital formation

Investment policy on the part of domestic firms is characterized by the condition $\frac{\partial V_h}{\partial K_h} = 1 - e_h u_h$ always being satisfied. Hence, should the government change the corporate income tax rate, then firms will respond by changing the capital stock so as to still fulfill this condition. This implies, using Eqs. (2.9) and (2.10), that

$$\frac{\partial K_h}{\partial u_h} = \frac{F'}{F''} \frac{d^h r (1 - e_h)}{(1 - u_h) [1 + d^h r (1 - e_h u_h) - u_h]}.$$ (2.12)

The formula states that the response of corporate investment to a change in the corporate income tax rate generally is linked to the curvature of the production function $F(.)$, to the tax policy worldwide regarding dividends from home country firms and to the level of the corporate income tax itself. With a concave production structure $F'' < 0$, and the expression in Eq. (2.12) is negative as expected, as long as $e_h < 1$. However, for $e_h = 1$, i.e. when the corporate tax is actually a cash flow tax, Eq. (2.12) demonstrates that it is indeed neutral vis-a-vis physical investment activity.

Similarly, we derive the response of physical investment to a change in the dividend tax rate $v_h$:

$$\frac{\partial K_h}{\partial v_h} = \frac{F'}{F''} \frac{r d^h (1 - e_h u_h) / (N + 2)}{(1 - v_h) [1 + d^h r (1 - e_h u_h) - u_h]}.$$ (2.13)

The effect of the dividend tax on the capital stock at home is thus likewise negative. It is evident, though, that it becomes increasingly small relative to the effect from the corporate tax as the number of countries in the world increases, reflecting that with many countries, domestic citizens become less important as potential suppliers of finance for physical investment at home.

The effect of an increase in the cash flow parameter $e_h$ on the capital stock is,

$$\frac{\partial K_h}{\partial e_h} = -\frac{F'}{F''} \frac{u_h r d^h}{(1 - u_h) [1 + d^h r (1 - e_h u_h) - u_h]}.$$ (2.14)

As expected, the effect is positive iff the corporate tax rate is positive. In this case, raising the cash flow parameter makes the corporate tax more neutral and alleviates the investment distortion associated with the tax.

3. Non-cooperative tax policy

3.1. The policy problem

We now suppose that the government in each country applies tax policy so as to maximize domestic welfare, taken to be the utility of the representative agent.
This occurs under the conventional Nash assumptions of unchanged policy in other countries. It will be seen that three sets of considerations determine optimal tax policy. First, the country as a whole will be able to manipulate the prices of international securities. However, this ability is ignored by the single investor in the country. Second, tax policy is able to redistribute income from foreign investors to domestic citizens. Third, the government at the same time aims for production efficiency in the sense of minimizing distortions to capital formation.\footnote{The trade-off between the latter two considerations is also emphasized in an interesting paper by Wildasin and Wilson (1994) focusing on land and property taxation and diversification of risk in a multi-region setting.}

The first step in our analysis is to insert the expression for public tax revenue (transfers) into the equation for second-period consumption. Then apply the individual’s resource constraint for the first period to write second-period consumption as

$$C_h^2 = (1 + r) \left[ W_h + \sum_m s_h^m (V_m - [1 - e_m u_m] K_m) - C_h^1 - \sum_m s_h^m V_m \right]$$

$$+ \sum_m s_h^m R_m + u_h \left[ Y_h - (1 + e_h r) K_h \right]. \quad (3.1)$$

Note here that the stochastic component of income from domestic production is $s_h^d (1 - u_h) y_h f(K_h) + u_h y_h F(K_h)$, with variance equal to $\text{var}(R_h) [s_h^d + u_h (1 - u_h)]^2$.

The optimization problem on the part of the domestic government is to maximize the welfare function Eq. (2.2) with Eq. (3.1) inserted, taking into account the market value equations, Eq. (2.11), the household first-order conditions, Eqs. (2.7) and (2.8), and the condition for optimal physical investment in firms, Eq. (2.10). This leads to a desire to control portfolio investment of domestic citizens, domestic capital formation, and the redistribution of income from foreign holders of domestic equity to citizens at home.

The instruments at the disposal of domestic authorities are: (i) the interest tax, $t_h$; (ii) the dividend taxes on foreign-source incomes, $v_m^f$; (iii) the dividend tax on domestic-source income, $v_h^d$; (iv) the corporate income tax, $u_h$; and finally, (v) the cash flow parameter, $e_h$. We first consider the interest tax and the foreign-source dividend taxes and then move on to the joint determination of the remaining three rates.

### 3.2. Optimal taxation of interest and dividends from abroad

The only instrument directly affecting first-period consumption is the interest tax. At the same time, the interest tax governs the investment in foreign equity
together with the dividend tax on foreign income (cf. the tax factor \( a_{mh} \)). Moreover, it influences domestic demand for home country equity and physical investment at home (via tax factors \( a_{hh} \) and \( a_h \)), in both places together with the dividend tax on domestic income. Since the only thing accomplished by the interest tax which cannot be taken care of by other, more specialized taxes\(^9\) is the control of first-period consumption, we derive the optimality rule for this:

\[
\exp (- bC_h) = \rho (1 + r) E (\exp (- bC_h^2)).
\]

Referring to the similar first-order condition for households, Eq. (2.7), it becomes clear that the interest tax can safely be set equal to zero. Consequently, in line with our assumption of the country being too small to affect the international rate of interest it should simply accept the intertemporal terms of trade offered by the rest of the world.

Next, consider dividend taxes on foreign-source income. Without interest taxation, only the dividend taxes affect placements in equity abroad, while these taxes have no further effect on other policy targets. Hence, the dividend tax \( \nu_{mh} \) can unambiguously be assigned to the share variable \( s_{mh} \).

The optimal share of equity in a foreign country \( m \) is determined by the first-order condition

\[
\left[ (s_{mh}^m - s_{h}^m) \frac{\partial V_m}{\partial s_{h}^m} - V_m \right] (1 + r) + \bar{R}_m - b \ \text{cov} (R_m, C_h^2) = 0.
\]

The following effects should offset each other at the optimal share level \( s_{mh}^m \): A larger (final) share in country \( m \) implies less revenue \( V_m \) from net selling the equity in the first period. Purchasing the equity may affect its price; it is advantageous if the price is negatively affected when the country is a net buyer \( (s_{mh}^m < s_{h}^m) \), and vice versa. Furthermore, a larger share implies higher expected return from physical capital in country \( m \) \( (\bar{R}_m) \). Finally, more uncertain dividends from that country contributes to period two consumption uncertainty, which is welfare reducing.

It is interesting to compare Eq. (3.3) to the corresponding individual first-order condition, Eq. (2.8). The individual does not take the effect of a higher share on the price of equity into account. Moreover, the dividend tax drives a wedge between the private and social required return to placement in country \( m \) shares. Subtracting Eq. (2.8) from Eq. (3.3) yields

\[
r (a_{h}^m - 1)V_m + (1 + r) (s_{h}^m - s_{h}^m) \frac{\partial V_m}{\partial s_{h}^m} = 0.
\]

\(^9\) Observe that the dividend taxes only appear via the ‘\( a \)’ tax factors.
From Eq. (2.11) for the market value of equity in country $m$ (as perceived by the government) we obtain the response of the market price to a change in the share holding in the home country:

$$\frac{\partial V_m}{\partial S_h} = \text{var}(R_m)b/[(N + 1)(1 + a^m_s r)]$$

which we insert in the above to get

$$r(a^m_h - 1)V_m + (\bar{s}^m_h - s^m_h) \text{var}(R_m) \frac{b(1 + r)}{(N + 1)(1 + a^m_s r)} = 0. \quad (3.4)$$

Thus, when the private sector decides to increase its share of foreign equity, i.e., when the relevant $(\bar{s}^m_h - s^m_h) < 0$, then $a^m_h$ should be greater than one, and there should be a positive dividend/capital gains tax. We sum up our first insights in

Proposition 1. The home country should set the interest tax equal to zero. Further, if domestic citizens own few foreign shares initially, then optimal foreign-source dividend tax policy will tend to limit capital flows to the rest of the world by taxing dividends from there.

The content of Proposition 1 corresponds to results in Gordon and Varian (1989). But because of the redistributive character of the corporate tax in this paper the results in the next subsection are new.

3.3. The determination of remaining instruments

The characterization of optimality rules for the remaining instruments, $v^h_h$, $u_h$, and $e_h$, unfortunately is more cumbersome. As evidenced by the calculations in Section 2.6 and in Appendix A, all three instruments generally affect domestic capital formation as well as the holdings on the part of domestic citizens of home country equity. On top of this, the corporate tax and the cash flow parameter more directly affect welfare, in particular via the redistribution from foreign owners of domestic equity to domestic citizens.\(^{10}\)

The full first-order conditions for the three instruments can be written as follows:\(^{11}\)

$$\frac{dU_h}{dv^h_h} = \frac{\partial U_h}{\partial S_h} \frac{\partial S_h}{\partial v^h_h} + \frac{\partial U_h}{\partial K_h} \frac{\partial K_h}{\partial v^h_h} = 0, \quad (3.5)$$

\(^{10}\)This redistribution is given by the term $u_d(1 - s^h_k)[Y_h - (1 + e_h r)K_k]$ (see Eq. (3.1)).

\(^{11}\)The expressions may require some explanation. For instance, the total derivative $dU_h/dv^h_h$ captures both direct and indirect effects on utility of an increase in the corporate tax. The first term on the right-hand side in Eq. (3.6) represents the indirect effect via $s^h_k$, holding $K_k$ constant. The second terms instead holds $s^h_k$ constant, reflecting the effect via $K_k$. Finally, the third term represents the direct effect, with both $s^h_k$ and $K_k$ kept constant. Note also that while individuals perceive $\partial U_h/\partial s^h_k$ equal to zero, the government may not (see below).
\[
\frac{dU_h}{du_h} = \frac{\partial U_h}{\partial s^h_h} \frac{\partial s^h_h}{\partial u_h} + \frac{\partial U_h}{\partial K_h} \frac{\partial K_h}{\partial u_h} + \frac{\partial U_h}{\partial e_h} = 0, \tag{3.6}
\]

\[
\frac{dU_h}{de_h} = \frac{\partial U_h}{\partial s^h_h} \frac{\partial s^h_h}{\partial e_h} + \frac{\partial U_h}{\partial K_h} \frac{\partial K_h}{\partial e_h} + \frac{\partial U_h}{\partial e_h} = 0. \tag{3.7}
\]

In these expressions, the derivatives \(\partial K_h / \partial v^h_h\), \(\partial K_h / \partial u_h\) and \(\partial K_h / \partial e_h\) were derived in Section 2.6 above. Furthermore, \(\partial s^h_h / \partial v^h_h\), \(\partial s^h_h / \partial u_h\) and \(\partial s^h_h / \partial e_h\) can be derived along the lines suggested in Appendix A. This leaves the effects of welfare changes in either the asset share \(s^h_h\) or in the capital stock \(K_h\), and the direct welfare effects of changes in the corporate tax \(u_h\) and in the cash flow parameter \(e_h\). We compute these in turn.

First, going through steps similar to those leading to Eq. (3.4) we find,\(^{12}\)

\[
\frac{\partial U_h}{\partial s^h_h} \propto r (d^h_h - 1)V_h + (s^h_h - s^h_h) \var (R_h) \frac{b(1 + r)}{(N + 1)(1 + d^h_h r)} = X_h. \tag{3.8}
\]

If domestic authorities subsidize the ownership of home equity,\(^{13}\) then \(d^h_h < 1\) and the first term in Eq. (3.8) negative. The subsidy drives a wedge between the private and social values of equity investment at home, implying that increased investment hurts welfare. The second term is positive if domestic citizens own relatively many shares in home firms to begin with and wish to sell some of those. Then a larger placement at home increases the share price which is advantageous given the seller position. The derivative comprises the net effect of these two mechanisms.

Next, to compute the effect on welfare of a higher capital stock we use Eq. (2.11) to get

\[
\frac{\partial V_h}{\partial K_h} = \frac{V_h F'}{F} + \frac{u_h(1 - e_h)}{1 + d^h_h r} \left( 1 - \frac{K_h F'}{F} \right) + \frac{F'}{F} \left( s^h_h + \frac{u_h}{1 - u_h} \right) \frac{b \var (R_h)}{(N + 1)(1 + d^h_h r)}. \tag{3.9}
\]

A higher capital stock first of all raises production and thus foreigners’ income from domestic firms, and this tends to increase the value of domestic equity. The expression represents how the government perceives the relation between the capital stock and the value of domestic shares. It is interesting to compare it with a rewritten Eq. (2.10), showing how domestic firms perceive this relation:

\[
(1 - e_h u_h) = \frac{\partial V_h}{\partial K_h} = \frac{V_h F'}{F} + \frac{u_h(1 - e_h)}{1 + d^h_h r} \left( 1 - \frac{K_h F'}{F} \right). \tag{2.10a}
\]

\(^{12}\)The symbol \(\propto\) means ‘proportional to’, the factor of proportionality being the term \(b p(E(\exp(-C^2))).\)

\(^{13}\)A subsidy turns out to be optimal, see below.
The private sector tends to overlook the effect on share prices via the influence on the variance of second-period consumption at home. Further, it takes the domestic dividend tax as given, whereas to the government it is a policy instrument (hence the appearance of \( \alpha_{-h} \) rather than \( \alpha_h \) in Eq. (3.9)).

Applying Eq. (3.8) to substitute out the variance term in Eq. (3.9) and further using Eq. (2.8), the expression for the effect of the capital stock on welfare becomes

\[
\frac{\partial U_h}{\partial K_h} \propto \left( V_h \frac{F'}{F} - [1 - \epsilon_h u_h] \right) (1 + r) \left( \tilde{s}_h + \frac{u_h}{1 - u_h} \right)
+ \left( 1 - \frac{K_h F'}{F} \right) u_h (1 - \epsilon_h) \left[ s_h + \frac{u_h}{1 - u_h} \left( \frac{1 + r}{(1 + \alpha_{-h} r)} \right) \right]
+ \frac{u_h}{1 - u_h} (1 - \epsilon_h) r + X_h \frac{F'}{F} \left( s_h + \frac{u_h}{1 - u_h} \right).
\] (3.10)

Note that if the corporate tax \( u_h \) and the term \( X_h \) are both zero, then \( \frac{\partial U_h}{\partial K_h} \) is likewise zero (apply Eq. (2.10a)); in this situation, there would be no reason for moving the corporate tax away from zero with reference to potential welfare effects of changes in the capital stock.

To prepare for computing the direct welfare effect of the corporate tax we find the effect of the tax on the domestic share price from Eq. (2.11):

\[
\frac{\partial V_h}{\partial u_h} = [1 + \alpha_{-h} r]^{-1} (1 - u_h)^{-1} [K_h (1 - \epsilon_h) - V_h (1 + \alpha_{-h} r)]
+ \text{var} (R_h) (1 - s_h)^2 \text{/}(N + 1)
\] (3.11)

A higher corporate tax lowers foreigners’ income from domestic firms, leading to a lower value of home country equity. On the other hand, the variance of consumption abroad will be reduced, tending to raise the value of the equity. The net effect will in general be negative. Again, Eq. (3.8) is utilized to substitute out the variance term, after which additional use of Eq. (2.8) produces

\[
\frac{\partial U_h}{\partial u_h} \propto \frac{V_h}{(1 - u_h)} (1 + r) \left( 1 - \tilde{s}_h + X_h \frac{1 - s_h}{(1 - u_h)} \right)
- \frac{K_h}{(1 - u_h)} \left[ (1 - \epsilon_h) \left[ 1 - s_h - (\tilde{s}_h - s_h) \frac{1 + r}{(1 + \alpha_{-h} r)} \right] \right]
+ \epsilon_h (1 - u_h) (1 + r) (1 - \tilde{s}_h^h) \] (3.12)

In general, the formula contains the trade-off between the detrimental reduction of the value of domestic equity (as in Eq. (3.11)) and the beneficial transfer of
income from foreign investors to domestic citizens following an increase in the corporate tax rate. We shall return to the sign of (3.12) in special cases below.

Finally, we consider how the cash flow parameter influences welfare:

$$\frac{\partial U_h}{\partial e_h} \propto (1 + a_{h-k}r)^{-1}u_hK_h[\bar{s}_h^h - s_h^h(\alpha_{h-k}-1)r - (1 - \bar{s}_h^h) (1 + a_{h-k}r)]. \quad (3.13)$$

With a positive corporate tax rate, an increase in the expensing parameter lowers the present value of the revenue from the corporate tax. To the extent that foreigners initially own domestic equity, this hurts welfare (the last term). At the same time, the reduction in depreciation deductions in the second period decreases the value of equity sold to foreigners, but with $a_{h-k}$ greater than unity this fall is less than the associated increase in tax revenue from these foreigners (the first term). The net effect depends on, in particular, the magnitude of $\bar{s}_h^h$.

To attempt to extract more information on the qualitative features of optimal tax policy from the first-order conditions, Eqs. (3.5), (3.6) and (3.7), and the subsequent formulas, let us consider a few special cases.

**Case A: Complete diversification initially.** The first case we consider is the one where to begin with all shares are distributed evenly among investors in the world economy, i.e., $\bar{s}_m^n = 1/(N + 2)$ for all countries $m, n$. We seek to characterize optimal tax policy in this situation.\(^{14}\)

Assume for a start that no taxes are levied (while $e_h$ can take on any value). Then $a_{n}^m = 1, u_m = 0$ for all $m, n$. Firms will respond by setting the capital stock so that $V_m F'/ F = 1$, and individuals will react by keeping $s_{n}^m = \bar{s}_m^m = 1/(N + 2)$. Accordingly, no assets will be traded.

In this situation it is easily seen that $\partial U_h / \partial s_m^n = \partial U_h / \partial \bar{s}_h^h = X_h = \partial U_h / \partial K_h = \partial U_h / e_h = 0$. There is no incentive to introduce taxes so as to alter domestic citizens' placements in foreign or domestic equity, or domestic firms' investment in physical capital. However, the direct effect of a change in the corporate income tax is non-zero. Specifically,

$$\text{Case A (with } X_h = 0): \quad \frac{\partial U_h}{\partial u_h} \propto \frac{(1 - \bar{s}_h^h)}{(1 - u_h)} [V_h(1 + r) - K_h(1 + e_h r)]. \quad (3.14)$$

This expression is clearly positive,\(^{15}\) suggesting an increase in the corporate tax rate beyond zero. The dominant theme in tax policy in this special case is the desire to extract income from foreigners.

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\(^{14}\)This case can be interpreted as the breakdown of global coordination which would have excluded capital income taxes altogether and allowed complete international diversification of portfolios.

\(^{15}\)This is because investment will be carried to the point where the (declining) derivative of $V_h$ w.r.t. $K_h$ equals one.
What happens when the corporate tax becomes positive? For one, this has the effect of providing the public at home with an asset corresponding to the expected transfer from the government of corporate tax revenue. As the return to this ‘asset’ is perfectly correlated with the return to individuals’ own explicit investment in domestic firms, they will wish to cut the latter, reducing \( s_h^h \) below \( \tilde{s}_h^h \) (cf. Eq. (A.8) in Appendix A). This renders \( \partial U_h / \partial s_h^h \) positive in Eq. (3.8); the government at home is induced to subsidize investment in home country equity to bring the share \( s_h^h \) back up again.

Furthermore, a positive corporate tax renders \( \partial U_h / \partial e_h \) negative which points in the direction of a small cash-flow parameter. At the same time, the introduction of the corporate tax generally implies a decline in the domestic capital stock,\(^{16}\) whereas according to Eq. (3.10) an increase in the stock would be welfare improving given \( u_h > 0 \). This fact limits the increase in the corporate tax; in addition, a not too low cash flow parameter and the domestic-source dividend subsidy also limit the fall in the capital stock (cf. Eqs. (2.13) and (2.14)).

Summing up, starting from a perfectly balanced equity ownership pattern gives rise to imposition of a positive corporate tax, positive taxes on returns from investment abroad, and a subsidy to equity investment at home. Moreover, the optimal corporate income tax is a conventional, distortionary one rather than a cash flow tax.

**Case B: No asset diversification initially.** Suppose alternatively that all firms are initially completely owned by national residents in the respective countries, i.e., \( s_h^h = 1, s_h^m = 0, m \neq n \), etc.\(^{17}\)

Assume to begin with that all taxes as well as the expensing parameter are set equal to zero. From the individual first-order constraints, Eq. (2.8), it is again clear that households will want to spread their risky investments evenly over all \( (N + 2) \) assets, rendering \( s_h^m = 1/(N + 2) \) for all \( m \). And at the firm level, physical investment will be carried to the point where \( V_h F / F = 1 \).

Introducing taxes, foreign-source dividend taxes will in line with Eq. (3.4) be shaped so as to penalize investment in foreign shares. Similarly, with \( \partial U_h / \partial s_h^h > 0 \) in the absence of taxes, the home country would like to raise the share \( s_h^h \) back up again so as to increase the value of domestic assets for sale. This can be accomplished by a subsidy to domestic-source dividends, \( v_h^h < 0 \). Unless the corporate tax is moved away from zero, bringing down \( X_h \) to zero is perfectly sensible in the light of Eq. (3.5), as also \( \partial U_h / \partial K_h \) is kept at zero in Eq. (3.10).

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\(^{16}\)This is strictly not the case if \( e_n = 1 \), see Eq. (2.13). However, we just noted a desire to lower \( e_n \), whence the optimal cash flow parameter must be below unity.

\(^{17}\)This case depicts the removal of informational, economic or political barriers which previously precluded international mobility of capital.
However, judging from Eq. (3.12) with \( s^h = 1 \) inserted, there will generally be a slight incentive to alter the corporate tax (unless \( e_h = 1 \), see below). In fact, \( \partial U_h / \partial u_h \) is negative for \( s^h = 1 \) and \( u_h = 0 \), as evidenced by Eq. (3.15):

\[
\text{Case B (with } X_h = 0): \quad \frac{\partial U_h}{\partial u_h} \propto - (1 - s^h) \frac{K_h(1 - e_h)(a^{h^\prime} - 1)r}{(1 - u_h)(1 + a^{h^\prime} r)}
\]  

(3.15)
suggesting the introduction of a corporate subsidy. With a slightly negative \( u_h \), the derivative in Eq. (3.13) becomes negative, again suggesting a reduction in the cash flow parameter. The final adjustment of the instruments \( v^h, u_h \) and \( e_h \) will modify the expansionary effect of the corporate subsidy on the domestic capital stock; the derivative in Eq. (3.10) has become negative, suggesting that some offsetting reduction in the capital stock is desirable.

The 'fine-tuning' of instruments should not affect the qualitative conclusion: If all shares in domestic companies are owned domestically at the start, the response of tax policy will be to levy foreign-source dividend taxes, yield a domestic-source dividend subsidy, and concede a negative corporate tax of the conventional distortionary type (as opposed to a cash flow tax).

In our arguments we started out with \( e_h \) at zero. If instead \( e_h \) was put at unity, both Eqs. (3.13) and (3.15) would in fact be zero. However, \((u_h, e_h) = (0, 1)\) can be seen to be a saddlepoint for Eqs. (3.13) and (3.15) and discrete joint decreases in \( u_h \) and \( e_h \) from \( (0, 1) \), to be welfare improving.

Now what is the reason for the desirability of the negative corporate tax in Case B? To find out, we take another look at Eq. (3.15) which contains the effects on welfare other than those working through the capital stock \( K_h \) and domestic citizens' share of domestic equity \( s^h \). These effects can be split up into those that work through the value of home country equity \( V_h \), and remaining direct effects. The former can be written as

\[
(1 - s^h) \left[ \frac{(1 + r)}{1 + a^{h^\prime}} K_h - V_h(1 + a^{h^\prime} r) \right]
\]

while the latter are

\[
(1 - s^h) \left[ V_h(1 + a^{h^\prime} r) - K_h \right].
\]

Because foreign countries impose dividend taxes on their citizens' income from domestic firms, \( a^{h^\prime} > 1 \). Hence, the fall in the value of domestic equity induced by a marginal increase in the corporate tax from zero will reduce welfare by more than the direct redistribution of income from foreigners is able to raise it. Therefore, it is optimal to go the other way and install a 'countervailing subsidy' to offset foreign dividend taxation.

We summarize our results for non-cooperative domestic-source dividend and corporate income taxes in
Proposition 2. When ownership of assets is rather evenly distributed among citizens in all countries at the outset, a positive corporate income tax will be levied. Conversely, when domestic citizens possess almost all the equity in domestic firms to begin with, the corporate income tax will be negative, i.e., will turn into a subsidy. In both cases, the corporate tax will distort investment and not be in the form of a cash flow tax. Furthermore, domestic citizens’ placement in home country equity will be subsidized.

4. Regional coordination of capital income taxes

4.1. The policy problem

Suppose the home country (h) and its partner country (to be denoted by ‘p’ in what follows) wish to coordinate their capital income tax policies. What adjustments would that lead them to undertake? The policy objective on the part of the two coordinating countries (the ‘union’) will be specified as the maximization of the sum of utilities on the part of the representative individuals in the two countries. The authorities in the union countries still believe they are unable to affect the world rate of interest as well as investment in countries outside the region. But of course they count on affecting international security prices and union-wide capital formation via their tax policy. The countries outside the region will be labelled ‘non-union countries’ and referred to by ‘n’. Finally, the letter ‘m’ is as before used to denote any country in the world economy.

Considerations similar to those in the preceding section result in the following equation for the price of securities issued in country m:

\[ \bar{R}_m = (1 + a^m_u)R_m + \text{cov}(R_m, R - C^2_u) b/N \]  

in which the symbol ‘u’ refers to the union, and accordingly,

\[ a^m_u = \sum_n a^m_n/N, \quad C^2_u = C^2_h + C^2_p. \]

Acting together, the union countries perceive the price of equity of country m to be determined by the expected after-corporate-tax return to capital in that country, the covariance of the return with consumption in the rest of the world, and the average tax factor summarizing household taxation in the non-union countries. Intuitively, joint action on the part of the home and partner countries ought to increase their influence over international share prices, and this is captured by the fact that in Eq. (4.1) total union consumption is subtracted.

When country m lies outside the union, the union countries are solely able to alter (the stochastic properties of ) \( R - C^2_u \). On the other hand, when m signifies
either $h$ or $p$, the union can additionally affect the expected return $\bar{R}_m$ and the stochastic properties of the return via the corporate tax rate of the country in question, and via both countries’ dividend taxes.

4.2. Coordinated foreign-source dividend taxes

First, since the union as a whole also assumes it is too small to have a bearing on the world rate of interest, both $t_h$ and $t_p$ will be set equal to zero; like in the single country, the optimal interest tax in the union is no tax.

Second, the optimal shares of countries $h$ and $p$ in a non-region country, i.e., $s^h_n$ and $s^p_n$ for some $n$, will have to fulfill (when stated for $s^h_n$)

$$(1 + r) \left[ \frac{\partial V_n}{\partial s^h_n} (\bar{s}^n_u - s^h_n) - V_n \right] + \bar{R}_n - b \text{cov} (R_m, C^2_h) = 0$$

in which $s^u_n = s^h_n + s^p_n$. The new aspect of this formula as compared to Eq. (3.3) is that the home country will wish to take into account how raising its share of country-$n$ equity will impact the price at which the partner country sells or purchases the foreign shares.

Invoking the individual’s first-order condition, Eq. (2.8), together with Eq. (4.1), we obtain

$$r (a^n_h - 1)V_n + (\bar{s}^n_u - s^n_u) \text{var} (R_u) b (1 + r) \left[ N(1 + a^n_u r) \right] = 0.$$  (4.3)

The second term in Eq. (4.3) is bound to exceed the analogous term in Eq. (3.4), on account of the presence of the difference $\bar{s}^n_u - s^n_u$ which should be about twice as large as the corresponding difference for the home country alone. Thus, we altogether conclude that coordination entails substantial strengthening of taxation of dividends originating in countries outside the union.\(^{18}\)

4.3. Optimal corporate and intra-union dividend tax policy

It remains to determine rules for $v^h_{hh}$, $u_h$, $e_h$, and also $v^p_h$ under coordination. The optimality conditions for the first three rates are formally identical to Eqs. (3.5), (3.6) and (3.7) with union welfare $U_u = U_h + U_p$ substituting for $U_h$. Instead of considering the choice of $v^h_k$ it may be more illuminating to look at how the

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\(^{18}\) To be exact, the formation of the union will lead other countries to marginally change their tax rates $a^n_u$ for investment in country $n$, whence the tax factor $a^n_u$ would deviate slightly from $a^n_{-h}$ in Eq. (3.4). At the same time, Eq. (4.3) features $N$ in the denominator instead of $N + 1$. With $N$ not very small, all this should be unimportant.
symmetric tax \( v_p^h \), i.e., the partner country tax on home country dividends, is determined. We here find

$$
\frac{\partial U_u}{\partial s_p^h} = r(a_p^h - 1)V_h + (\tilde{s}_u^h - s_u^h) \text{ var } (R_h) \frac{b(1 + r)}{N(1 + a_{urr})} \equiv X_p^h
$$

(4.4)

Analogous to Eq. (3.8), the second term is positive if citizens in the union own relatively many shares in home firms to begin with and wish to sell some of these. A higher investment on the part of partner country individuals then raises the share price which is advantageous for the union as a whole. At the same time, the extra investment by residents in the partner country can be triggered by a subsidy there, \( a_p^h < 1 \), and the wedge between private and social values of domestic equity so created will lower union welfare, as captured by the first term in Eq. (4.4).

The formula for \( \frac{\partial U_u}{\partial s_p^h} \) is identical to Eq. (4.4), when the two dividend tax rates \( v_p^h \) and \( v_h^h \) are equal. Under the same condition, the derivatives \( \frac{\partial K_h}{\partial v_p^h} \) and \( \frac{\partial K_h}{\partial v_h^h} \) will be identical, too. This implies that the two union countries will apply exactly the same rate of tax on dividends from the home country. A similar conclusion holds, of course, for investment in equity in the partner country. So intra-union placements in equity should be taxed (subsidized) to the same extent, regardless of whether the investor resides in the home country or in the partner country.

As regards the corporate income tax in the home country, the implications for expected utility in the partner country, directly and indirectly via especially the home country capital stock, will now be taken into account. It turns out that going through the same steps as in Section 3 we end up with formulas for the effects on welfare of a change in the corporate tax rate and in the home capital stock that look like Eqs. (3.12) and (3.10), respectively, with the important exception that \( s_{hh}^h \) and \( s_{hu}^h \) are substituted by \( s_{hu}^h \) and \( s_{hu}^h \). Since the partner country will end up owning shares in home country firms, may have some shares to start with, but will likely be a net buyer of these shares, we have \( s_{hu}^h > s_{hu}^h; \tilde{s}_{u}^h \geq \tilde{s}_{u}^h \text{ and } (\tilde{s}_{u}^h - \tilde{s}_{u}^h) < (s_{hu}^h - s_{hu}^h) \). Utilizing these inequalities, close examination of the formulas corresponding to Eqs. (3.12) and (3.10) yields the following conclusions:

When portfolios are well diversified at the outset, coordination will have the effect of reducing the corporate tax. The explanation is that part of the tax falls on partner country citizens, and there is little perspective in using a distortionary tax to shift income from the partner country. Hence, the domestic authorities will be induced to lower the rate of corporate tax. When the revenue from the corporate tax is handed over to residents in the home country, they will demand fewer domestic shares, depressing the price of the shares. This is detrimental to union welfare and will be limited by authorities in both countries giving a subsidy to dividends from investment in home country equity. Parallel
remarks pertain to the tax treatment of dividends from equity in the partner country.

When, on the contrary, almost all equity in home-country firms is in the hands of home country citizens initially, tax policy coordination will have the consequence of reducing the corporate subsidy. The reason is that when partner country citizens receive a dividend subsidy (rather than being taxed) when demanding home country shares, the need for domestic authorities to support the sale of domestic equity via a negative corporate tax is reduced. As home country citizens will tend to sell many of their own shares, they – and partner country citizens – again will receive a dividend subsidy to dampen the negative effect on the price of domestic equity.

We sum up our insights as to intra-union dividend and corporate income tax policy in the region as

Proposition 3. Coordination of tax policy in the home and partner countries will imply heavier taxation of dividends accruing to residents within the union from placements in countries outside the union. Furthermore, each member of the region will want to stimulate rather than discourage domestic citizens’ investment in equity in the other country in the union. Indeed, the subsidy offered by the two union countries to dividends from equity in the home country will be equal.19

Coordination of tax policies likely entails a diminished role for the corporate tax. The rate of tax is bound to decline, when individual portfolios are well diversified initially, respectively become less negative, when national assets are held domestically to begin with.20

Instead of merely adjusting their taxes to take into account effects on partner countries, one might imagine the two coordinating countries going one step further by also sharing their tax revenues between them.

At least when the union countries are taken to be completely symmetric, this extra step can, however, be seen to be inconsequential. It would make the two countries share the risk associated with the transfers of revenue from corporate taxation to the public sector as opposed to the situation described above, where only domestic citizens bear the risk on transfers from domestic authorities. Individuals can, however, completely undo the extra risk by selling off relatively many shares in domestic equity.

19 Whether this subsidy is greater or less than the subsidy to domestic investment under non-cooperative tax policy is unclear.
20 If anything, coordinated corporate taxes may be closer to cash flow taxes than non-cooperative taxes.
5. When taxation of foreign-source income is unenforceable

Up to this point, an implicit assumption has been that taxation of all capital income, domestic as well as foreign source, is fully enforceable. Unfortunately, authorities often find it close to impossible to monitor foreign-source income. We therefore in this section briefly discuss how capital income tax policy in individual countries will change when the taxation of foreign-source capital income is unenforceable.

In the case of single-country non-cooperative tax policy, \(v^m_h = 0\) for all \(m \neq h\), whence the government can only use the instruments \(v_h^h\), the tax rate on dividends paid from domestic firms, and \(u_h\), the corporate tax rate.\(^{21}\) Under coordination, we shall assume that it is possible to obtain the necessary information about capital income originating in the partner country and accruing to domestic residents, so that this income can be subjected to dividend taxation at home. In other words, in addition to the two instruments mentioned above, the dividend tax \(v_h^h\) would be feasible for home country tax authorities. Anyway, the conclusions as to the implications of lack of enforceability for coordination are completely parallel to those for non-cooperative tax policy.

Note first that enforceability problems associated with taxation in foreign countries of dividends originating in the home country imply that the tax factor \(a_{h-h} = 1\), simplifying Eq. (3.8). Since with enforceability \(a_{h-h} > 1\), the effect of a higher \(s_h^h\) on the value of domestic equity and thereby utility increases with unenforceability of foreign-source income taxation (see Eq. (A.1) in Appendix), pointing towards a larger dividend subsidy to the holdings of domestic equity.

Concerning the implications for corporate income taxation, first note that the expression for its direct effect on utility in Eq. (3.12) increases, ceteris paribus.\(^{22}\) In fact, Eq. (3.12) degenerates to

\[
\frac{\partial U_h}{\partial u_h} \propto \frac{1 - s_h^h}{1 - u_h} \left[ V_h (1 + r) - K_h (1 - e_h + e_h (1 - u_h)(1 + r)) \right] + X_h \frac{(1 - s_h^h)}{(1 - u_h)}. \tag{3.12a}
\]

Inspection of the formula for the welfare effect of an increase in the stock of capital reveals that there is no similar tendency to rise for the negative welfare effect of a positive corporate income tax through the capital stock. This suggests

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\(^{21}\) One might even argue that a tax on the dividends domestic residents receive from domestic firms becomes infeasible in this setting, since domestic residents might be able to channel their investments through a foreign intermediary and appear to be a foreign national for tax purposes. We ignore this in what follows, though.

\(^{22}\) The term \(K_h (1 - e_h) (s_h^h - s_h^h) (1 + r) / [(1 - u_h) (1 + a_{h-h} r)]\) increases as \(a_{h-h}\) falls.
that the corporate tax rate in the case of unenforceable foreign-source income will exceed the rate under enforceability.

Let us briefly study the two special cases in Section 3. First, with complete diversification initially, starting with no taxes there again is no incentive to introduce dividend taxes. However, on the basis of Eq. (3.12a) a corporate tax should be levied. Once the corporate tax is introduced, it becomes optimal to restrain the sale of domestic assets through a dividend subsidy to domestic citizens.

Second, with no asset diversification initially and consequently a desire to sell domestic assets, there is still an incentive to limit this asset trade by imposing a dividend subsidy to domestic residents. However, there is no longer any incentive to grant a corporate subsidy; indeed, with $s_h^h = 1$ inserted into Eq. (3.12a) and with $X_h$ at zero (this is ensured by the dividend subsidy, cf. Eq. (3.8)), the direct effect on utility from moving the corporate tax away from zero is nil. Hence, when foreign-source income taxation is impossible and all domestic assets are held at home to start with, the corporate tax rate will be set equal to zero.

In intermediate cases with some asset diversification to begin with we infer that the optimal tax policy package will consist of a negative dividend tax on domestic equity holdings and a positive corporate tax. As stated previously, the conclusions for the case of coordination are completely parallel. In sum,

**Proposition 4.** Even though the government in a single country (the union) is not able to enforce taxation of foreign-source income, it will generally want to employ as well the corporate tax as the dividend tax on holdings of domestic (union) equity. Both the corporate tax rate and dividend subsidy are likely to be larger than in the case of enforceable foreign-source income taxation.

6. Concluding remarks

The purpose of the paper was to study non-cooperative as well as coordinated capital income tax policy in a context of uncertainty. Regional coordination of tax policy is a subject that is frequently debated in Europe at the moment. Unfortunately, the literature on tax policy coordination in the capital income tax area is sparse and in a sense not very helpful. One of the classical results in the literature, derived by Razin and Sadka (1989), states that small countries stand to gain nothing from coordination of their capital income tax policies. However, an underlying assumption is that countries have no influence on rates of return on and prices of securities.

In this article, we have attempted to lend more realism to the study of regional coordination of capital income tax policy by incorporating uncertainty together
with the reasonable assumption that equity issued in each country is characterized by idiosyncratic risk. In this way, countries which consider themselves too small to affect the international interest rate may nevertheless believe they can influence the prices at which domestic and foreign shares are traded internationally by altering their capital income tax policy.

On the basis of this presumption we found that when acting non-cooperatively, countries will generally aim at limiting trade in assets by taxing foreign-source dividends and subsidizing domestic-source dividends. Furthermore, unless almost all domestic equity is held at home at the outset, the corporate income tax will be used to transfer income from foreign owners of this equity to domestic citizens. Under coordination, participating countries wish to alter these policies, at least to some extent. A central finding is that each country in the union will find it desirable to subsidize rather than tax domestic citizens’ investment in equity in partner countries. Another conclusion is that the act of coordination of tax policies will tend to diminish the role of corporate taxation. Third, whether coordinating or not, countries will still want to apply the corporate income tax as well as subsidies to domestic holdings of domestic equity, when taxation of foreign-source income is non-enforceable. Finally, from a global perspective the first best policy clearly abstains from the use of tax instruments. Therefore, there is a scope for global coordination to eliminate the attempts at redistribution between countries and at manipulation of international asset prices.\(^{23}\)

Many interesting issues and institutions related to direct taxation in open economies have been left out of the analysis in the previous sections. First, the tax systems of many countries offer credits against taxes paid abroad. It would be interesting to explore the role of such credits under uncertainty. The results of this paper do not point in the direction of crediting being beneficial for single countries; instead, individual countries decide to tax foreign-source dividends, even when corporate taxes have already been paid abroad to foreign authorities. In line with this, both Bond and Samuelson (1989) and Gordon (1992) find that no (non-degenerate) Nash equilibrium exists between countries that tax capital income while offering foreign tax credits. Tax credits can, however, be rationalized by appeal to the existence of a capital-exporting Stackelberg leader as in Gordon (1992) or to the ability of capital exporting countries to only monitor foreign investment at a cost as in Bruce (1992).

Second, our analysis did not incorporate a genuine revenue motive on the part of the government. In reality, taxation of capital income (at least corporate income) contributes to the finance of provision of public goods. It would be desirable to extend our analysis to the case of a given revenue requirement or to

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\(^{23}\) Huizinga and Nielsen (1996) also find a scope for global coordination of capital income tax policies in a setting with incomplete taxation of pure profits and cross-ownership of firms.
optimal provision of some public good. Such a framework could be used to investigate how the burden of financing would be split between taxes on capital and taxes on other production factors like labour; still the mechanisms we identified in this paper should be important in a more general framework along these lines.

Third, the simple two-period framework we chose above obviates the confrontation of problems related to time consistency of tax policies. Indeed, it is perfectly legitimate to ask where the initial shareholdings \( \tilde{s}_m \) come from. What were the expectations as to future tax policy that led domestic and foreign citizens to select these initial holdings of equity? An extension of our model to a truly multiperiod model would be desirable and necessary in order to properly deal with the time consistency issue. As it stands, however, the analysis does shed light on the incentives faced by tax policy authorities, stemming from the initial distribution of asset holdings.

Finally, referring to the work of Zhu (1992), Hartman (1993) and others, the best non-cooperative tax policy in our setting might involve stochastic (state-contingent) tax rates. But such taxes bear so little resemblance to conventional capital income taxes that we have chosen to bypass them.

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Appendix A

This appendix investigates in some detail how tax policy impacts the value of domestic equity and the investment on the part of domestic citizens in domestic shares.

First, on the basis of Eq. (2.11) for \( m = h \) we derive

\[
\frac{\partial V_h}{\partial s^h} = \frac{b \text{ var } (R^h)}{(1 + d^h_{-h}) (N + 1)}, \tag{A.1}
\]

\[
\frac{\partial V_h}{\partial K_h} = (1 + d^h_{-h})^{-1} \left[ \frac{F'}{F} (1 - u_h) \bar{Y}_h + u_h (1 - e_h) ight. \\
- \left. \frac{b}{N + 1} \frac{F'}{F} \text{ cov } (R_h, R - C^h_h) - \text{ var } (R_h) (s^h_h (1 - u_h) + u_h) \right]. \tag{A.2}
\]
A higher domestic demand for domestic equity increases its value, as does a higher domestic capital stock. The likely effect of an increase in the corporate tax rate on the value of domestic equity is negative, whereas the sign of the effect from the cash flow parameter is the opposite of the sign of the rate of corporate tax. With a positive corporate tax, the increase in the cash flow parameter lowers the value of depreciation deductions in the second period. Using Eq. (2.11) once more, Eq. (A.2) and Eq. (A.3) can be reduced to Eq. (3.9) and Eq. (3.11), respectively, in the text.

Turning next to investments in domestic equity, we obtain from Eq. (2.8),

\[
\frac{\partial s_h^h}{\partial V_h} = - \frac{(1 + d_h^h)}{b \text{ var } (R_h)}, \\
\frac{\partial s_h^h}{\partial v_h} = - \frac{V_h'(a_h^h)^2}{b \text{ var } (R_h)}, \\
\frac{\partial s_h^h}{\partial K_h} = \frac{1}{b \text{ var } (R_h)} \left[ \frac{F'Y_h(1 - u_h) + u_h(1 - e_h) - 2F' b \text{ cov } (R_h, C_h^h)}{F} \right], \\
\frac{\partial s_h^h}{\partial u_h} = \frac{1}{b \text{ var } (R_h)} \left[ - Y_h(1 - u_h) + K_h(1 - e_h) - [2(1 - s_h^h)(1 - u_h) - 1] b \text{ var } (R_h) \right], \\
\frac{\partial s_h^h}{\partial e_h} = - \frac{u_hK_h}{b \text{ var } (R_h)}. 
\]
References

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