International Capital Mobility and Tax Evasion

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Economic Development Institute of the World Bank
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1. Introduction

In an open economy, foreign investment is often used as a means of evading taxes on wealth, or on capital assets' income. The purchase of foreign assets makes it easy to avoid taxes because—on general—ownership of foreign assets by domestic residents cannot always be verified and tracked by tax authorities, because some governments (like the US government currently) do not levy withholding taxes on income from domestic securities accruing to foreign residents, and because in many countries it is possible to defer the payment of taxes on foreign assets' income, by deferring the repatriation of such income.

This paper presents the simple analytics of tax evasion through international capital mobility. It discusses the general-equilibrium effects of tax evasion and evaluates its impact on domestic welfare, under the assumption that the distortionary taxes on capital income cannot be removed.

* This paper is part of a project on "Capital Controls and Liberalization: Costs and Benefits," financed by a World Bank McNamara Fellowship. I am grateful to Michael Gavin and Michael Salinger for discussions.
International capital mobility and the constraints it imposes on macroeconomic policies are the central issues of theoretical and empirical research in international economics. Surprisingly, however, few papers have analyzed the repercussions of changes in taxes on international capital flows, and, as a consequence, on the domestic economy. Among the recent examples, Aizenman [1985] studies the optimal combination of the inflation tax, capital controls, and tariffs, for the purpose of raising a given amount of government revenue, in an economy without production; Stockman and Hernandez [1985] discuss taxes on the purchase of foreign currency in a general-equilibrium asset pricing model, while Gordon and Varian [1986] consider the optimal structure of capital-asset taxes in an international capital asset pricing model; Frenkel and Razin [1987] analyze the effects of tax reforms on international borrowing and lending in a two-country world; Tornell [1987] and Velasco [1987] argue that capital controls might be desirable as second-best devices in the presence of distortionary taxation.

International capital flows to avoid domestic wealth and capital-income taxes are likely to be a widespread phenomenon, especially among developing countries. Tanzi [1983], reviewing the structure of tax revenues in developing countries, notes that (i) income tax revenue is accounted for almost exclusively by taxation of wages; (ii) in poor countries the revenue from corporate income taxes is very low; (iii) wealth taxes account for an almost insignificant

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1 For a recent survey on international capital mobility, see Obstfeld [1986].

2 See, for example, Walter [1986].
fraction of total tax revenue. These facts are in principle consistent with the view that international capital mobility imposes severe constraints on fiscal authorities. Dornbusch [1987] argues that the repeal of withholding taxes on US government securities must have been an important determinant of capital flight from Latin American countries. Giovannini [1987], discussing the interwar experience in Italy, indicates that, during those years, international capital flows to evade wealth taxes were possibly very large.

Section 2 of this paper presents a two-period model of savings, investment, and the current account, where government spending can be financed only by levying distortionary taxes. The welfare effects of international investment for tax evasion are discussed in section 3. Section 4 endogenizes government spending, showing the open-economy effects of dynamic inconsistency and "discretionary" equilibria studied by Fischer [1980] and Kydland and Prescott [1980] in closed-economy models. Section 5 contains some concluding remarks. An appendix proves the equivalence between quantitative controls on international investment and a regime of uniform taxation of income from domestic and foreign assets.
2. The Model

I consider a one-good, two-period model of an open economy. Domestic residents consume in period 1 and period 2, and can transfer wealth intertemporally by investing in domestic capital or by purchasing (or selling) foreign bonds. The government taxes only income from domestic investments. Tax revenues are used to finance "infrastructures" that provide a positive externality to domestic residents. The government does not spend in the first period: thus there is no government debt. Taxes, however, are known by domestic residents at the time investment decisions are made.

In this paper I study a small country, and assume that the foreign interest rate is given. This case is both a useful theoretical benchmark, since it helps to highlight all the basic effects that are at work also in a two-country world and a reasonable empirical paradigm, since in many countries the size of international capital flows is too small to affect the world rate of interest. Assuming a given world interest rate is equivalent to assuming that foreign residents do not pay taxes to the home government on interest income earned from domestic residents. Domestic residents, however, are taxed on the value of their investment income, and can borrow the investment capital at the world interest rate.

---

3 This model is also used by Obstfeld [1987].

4 Foreign residents do not have direct access to the home investment technology. In these cases, the tax regime of a small country can differ from that in the rest of the world.
The consumers' problem is:

\[
\text{MAX } U(C_1, C_2) + v(G) \tag{1}
\]
\[
\text{s.t. } K_2 + C_1 + A = K \tag{2}
\]
\[
C_2 = A(l+r^*) + f(K_2)(1-r) \tag{3}
\]

Where \(C_1\) and \(C_2\) stand for consumption in the two periods; \(G\) is government spending; \(A\) represents the stock of foreign assets accumulated in period 1, i.e. the current account surplus in period 1; \(K_2\) is the stock of productive capital in period 2, which equals the rate of investment in period 1, and \(K\) is the exogenous initial allocation of resources. \(f(K_2)\) is a decreasing-returns-to-scale production technology, yielding output in period 2. In the production process, the capital stock depreciates completely. \(r\) is the tax rate; \(r^*\) the world interest rate. In this section and in section 3 I analyze the effects of tax evasion by assuming that \(r\) is exogenously given, and \(G\) is determined by the solution of the model. As equations (1)-(3) suggest, the government could clearly optimize tax collection and spending: the exogeneity of \(r\) is relaxed in section 4, where I study equilibria in the presence of a maximizing government.

Equations (4)-(5) and (2)-(3) are the first order conditions for the consumption-savings and portfolio-allocation problem of the consumer:

\[
f'(K_2)(1-r) = 1+r^* \tag{4}
\]
\[
U_1(C_1, C_2) - (1+r^*)U_2(C_1, C_2) \tag{5}
\]

Equation (4) determines domestic investment: the domestic capital stock is such
that its after-tax marginal productivity equals the world interest factor, \(1+r^*\). This portfolio allocation rule insures that the net return on savings is always equal to the world interest rate. Equation (5) is the standard Euler equation, setting the marginal rate of substitution between present and future consumption equal to the marginal rate of transformation, \(1+r^*\). Given domestic investment, equation (5), together with (2) and (3), determine consumption, savings and the current account.

Figure 1 shows the determination of equilibrium with \(r=0\). The bowed-out production-possibility frontier characterizes the domestic technology. Maximum consumption at time 1 equals the stock of available resources, \(K\), plus the present discounted value (at the world rate of interest) of future investment income. The investment in domestic capital is determined by the equality of the marginal return on domestic and on foreign investment, i.e. the tangency of the production possibility frontier with the world intertemporal terms of trade—the BB line with slope \(-(1+r^*)\). Savings, the current account, and consumption in the two periods are determined by the tangency of the consumption indifference curve and the BB line.

Figure 2 illustrates the effects of distortionary taxes in the presence of tax evasion. Equalization of the after-tax return on domestic investment with the world (tax-free) interest rate decreases the domestic capital stock and domestic production: the fall in \(K_2\) is caused by tax evasion, which takes place because domestic residents can substitute home capital with foreign securities. The production distortion originating from the tax, however, does not affect the marginal rate of substitution between present and future consumption, since the fall in domestic investment insures that the net return on savings is \(r^*\). The
budget line shifts further down and to the left, from B'B' to B"B", since tax revenue is not rebated in a lump sum fashion to consumers, but is used to provide for utility-generating "infrastructures." At the consumption point c', the vertical distance between the lines B'B' and B"B" is equal to tax revenue and government spending. Consumption at time 2 is accordingly decreased, for every level of investment. What is the effect of the distortionary tax on savings? If present and future consumption are normal goods, an increase in r increases savings, whereas savings decreases if future consumption is an inferior good. Since portfolio substitution insures that the rate of return on savings is unchanged, savings is here affected exclusively by the income effect of the tax increase.

The effects of tax evasion can be evaluated by studying the case where residents cannot avoid domestic taxes by purchasing foreign securities: income from all assets, domestic and foreign, is taxed at the same rate. When tax evasion is not possible, the intertemporal budget constraint has to be changed. Equation (3) becomes:

\[ C_2 = (1-r)[A(l+r^*) + f(K_2)] \]  

Equation (3') implies that domestic residents can deduct foreign interest payments—when A is negative—from taxable income. The first-order condition for the consumption and portfolio-allocation problem are:

\[ f'(K_2) = 1+r^* \]  

(4')
Figure 3 illustrates the effects of the tax distortions in this case. Investment and the domestic capital stock are now unaffected by changes in \( r \). Thus international capital mobility now prevents capital income taxes from distorting the production side of the economy.\(^5\) By contrast, as indicated by (5'), the relevant rate of interest for savings is now the after-tax world interest rate.

The BB" line shows the consumption possibilities of domestic residents. At point B, first-period consumption equals the sum of the present discounted value (at world interest rates) of second-period output and the initial endowment \( K \), second-period consumption equals zero, the revenue from taxation of domestic production identically offsets the tax rebates on foreign interest payments, and government spending is zero. The vertical distance between the BB" line and the production point \( P \) is the revenue from taxation of domestic production. Equilibrium consumption, government spending, and the structure of tax revenues can be easily characterized as indicated in the figure. Line B'B' shows the consumption possibilities of domestic residents before taxation of foreign assets' income. The vertical distance between \( BB \) and \( B'B' \) is the revenue from the tax on domestic income, while the distance between \( BB" \) and \( B'B' \) is the revenue (or outlay) from foreign interest income (or payments). What is the response of savings to an increase in taxes? In the absence of tax evasion.

\(^5\) Notice that this would not happen in a closed economy, see, for example, Diamond [1970].
FIGURE 1
Figure 2
FIGURE 3
intertemporal substitutability in consumption tends to decrease savings, while
the income effect—if both periods' consumption levels are normal goods—
increases savings. Thus the response of savings to an increase in the tax rate
is ambiguous, because of conflicting income and substitution effects, just like
in the standard partial-equilibrium exercise.


A comparison of two regimes described in section 2. allows to determine
whether tax evasion through international capital mobility lowers national
welfare. The literature on optimal taxation provides the framework for this
comparison. The problem studied by the optimal taxation literature is finding
the structure of taxes that minimizes the deviation (in terms of welfare) from
the nondistorted, pre-tax equilibrium. We can consider the two regimes
described in this paper as two special cases: tax evasion is the case where the
tax rate on foreign assets' income equals zero, uniform taxation is the case
where both assets are taxed at the same rate. The common prescription of the
optimal taxation literature is to tax those goods with a smaller demand
elasticity: this criterion insures that the after-tax allocation of resources is
closest to the pre-tax, nondistorted optimum.

To carry out the welfare comparison of the two regimes, it is convenient to

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6 For surveys of the optimal taxation literature, see Sandmo [1976], and
Atkinson and Stiglitz [1980].

7 The same question can be asked with the model in this paper, since the utility
function is assumed to be separable in consumption and government spending.
assume that both taxes on savings and capital income are available. The budget
constraint can be rewritten after solving out the current account in the first
period:

\[
C_1 + \frac{C_2}{(1-r_2)(1+r^*)} = K + \frac{(1-r_1-r_2)f(K_2)}{(1-r_2)(1+r^*)} - K_2
\]  

(6)

The tax rate on income from domestic investment is \( r_1 \), while the savings tax
rate is \( r_2 \). Equation (6) comprises the two extreme cases studied above. In the
presence of tax evasion, \( r_2 = 0 \) and \( r_1 \neq 0 \). With uniform taxation, \( r_1 = 0 \) and
\( r_2 = 0 \). As above, the required rate of return on domestic investment is
determined by the international arbitrage condition:

\[
f'(K_2)(1-r_1-r_2) = (1+r^*)(1-r_2)
\]  

(7)

Maximization of (1), subject to (6) and (7), leads to the following indirect
utility function:

\[
W((1-r_2)(1+r^*), K+Y)
\]  

(8)

where \( Y \) is the net present value of domestic investment projects—i.e. the last
two terms on the right-hand side of equation (6)—a function of \( r_1, r_2 \) and \( r^* \).
An application of the envelope theorem shows:

\[
dY/dr_1 = -\frac{1}{[(1-r_2)(1+r^*)]}^{-1}, \quad dY/dr_2 = -r_1/[(1+r^*)(1-r_2)^2]
\]  

(9)
Since G is exogenous, the welfare effects of tax evasion can be analyzed by minimizing the welfare loss of raising a given tax revenue. The solution to this problem, the optimal levels of $r_1$ and $r_2$, are determined by the parameters of the model. In general, neither of the regimes studied above is optimal according to the criterion just outlined. However, tax evasion is welfare-inferior when the optimal level of $r_1$ is much smaller than $r_2$. The problem is formally stated as follows:

$$\text{MAX } W((1-r_2)(1+r^*), K+Y)$$

s.t. $r_2[A(1+r^*) + f(K^2)] + r_1f(K_2) = G$ \hfill (11)

(10)-(11) can be solved using (7) and (9). The first order conditions are:

\begin{align*}
W_1 + \frac{W_2r_1}{(1-r_2)^2(1+r^*)} &= \lambda \left[ A(1+r^*) + f(K^2) + r_2[(1+r^*)\frac{dA}{dr_2} + \frac{df(K_2)}{dr_2}] + r_1 \frac{df(K_2)}{dr_2} \right] \hfill (12) \\
\frac{W_1}{(1-r_2)(1+r^*)} &= \lambda \left[ r_2[(1+r^*)\frac{dA}{dr_1} + \frac{df(K_2)}{dr_1}] + f(K_2) + r_1 \frac{df(K_2)}{dr_1} \right] \hfill (13)
\end{align*}

And equation (11). $W_1$ and $W_2$ are the partial derivatives of the $W$ function with respect to its first and second argument, respectively. $\lambda$ is the Lagrange multiplier associated with the revenue constraint (11). Equations (12) and (13) do not have a closed-form solution, even assuming special functional forms for $W$. 
and f. However, the structure of the problem, and in particular the determinants of tax revenue, provide some intuition for the conditions that make $r_1 = 0$ and $r_2 = 0$ (no tax evasion) preferable to $r_1 < 0$ and $r_2 = 0$ (the tax evasion case). The left hand side of equations (12) and (13) are affected by the parameters of the indirect utility function. Notice that the larger the intertemporal substitution elasticity, the larger is the (positive) effect of an increase in the after-tax world interest rate on indirect utility (the larger is $W_1$), and consequently the smaller is the optimal level of the savings tax. The right-hand side of (12) and (13) are affected by the marginal tax revenue. In the presence of tax evasion, an increase in taxes generates a fall in the domestic capital stock that is larger, the closer is the production technology to constant returns to scale. Differentiating equation (7) when $r_1 = 0$ and $r_2 = 0$, we obtain:

$$\frac{dK_2}{dr_1} = \frac{f'(K_2)}{(1-r_1) f''(K_2)}$$  

(14)

The closer the production technology to constant returns the smaller (in absolute value) the denominator on the right-hand side of (14), and therefore the larger the fall in the domestic capital stock after an increase in taxes. The intuition for this result is straightforward: the alternative available technology to shift resources from the present to the future is foreign borrowing and lending, and is a constant-returns-to-scale technology. The closer to constant returns gets the domestic technology, the closer a "substitute" for foreign assets becomes the domestic capital stock: thus a
small change in rates of return differential generates a large portfolio shift, and a large change in domestic production. Here the term "substitutability" is used to mean the similarity of the investment technologies. Since there is no uncertainty in the model, after-tax returns on foreign assets and the domestic capital stock are always equal: this last feature is normally referred to as "perfect substitutability" in the international finance literature.

In a regime of uniform taxation ($r_1 = 0$ and $r_2 = 0$), by contrast, a change in the tax rate does not affect the domestic capital stock, but gives rise to a large deviation from the initial allocation of resources if the intertemporal substitution elasticity is large. An increase in the tax rate decreases the rate of return on savings. With a positive interest elasticity of savings, domestic residents decrease future consumption and increase current consumption. Since the domestic capital stock is given, the increase in current consumption decreases foreign asset holdings (worsens the current account), and thus reduces the second period's total tax bill. The response is larger, the larger the elasticity of intertemporal substitution in consumption. Therefore, a regime of uniform taxation should be preferable if domestic capital and foreign assets are "close substitutes," and the interest elasticity of savings is relatively small. For small $G$, this proposition can be rigorously proved by differentiating equations (12) and (13).

Since, for finite values of $G$, closed-form solutions to (12) and (13) cannot be obtained, I perform some numerical simulations that illustrate the effects of intertemporal substitutability and the substitutability between domestic and foreign assets. I assume a constant-elasticity-of-intertemporal-substitution utility function ($1/\theta$ is the elasticity of intertemporal
substitution); the production function has constant elasticity of returns to scale, equal to $\alpha$. In the tables, the column on the left reports the given levels of government spending. Columns "(1)" contain the values of the endogenous tax rates, domestic output, and foreign-asset accumulation, in the presence of tax evasion. Columns "(2)" contain the values of the same variables, in the uniform taxation case. The welfare costs of tax evasion are measured in terms of period-1 consumption: a positive number indicates that tax evasion reduces national welfare, relative to a regime of uniform taxation. Finally, the two columns on the right report the tax rates that would prevail if both $r_1$ and $r_2$ were allowed to be nonzero.

Tables 1 and 2 illustrate the effects of differences in the elasticity of returns to scale, given an intertemporal substitution elasticity equal to 0.5 ($\theta=2$). Table 1 shows that with "low" intertemporal substitution and nearly constant returns to scale in domestic investment, tax evasion through international capital mobility is always inferior. In fact, in the presence of tax evasion the ability of the government to raise revenue is severely limited: the maximum tax revenue is only 0.031. Since $G=0.05$ is about 10 percent of second-period consumption, these results suggest that the distortions due to tax evasion can be quite large. In table 2, where the elasticity of returns to scale is halved to 0.4, the welfare costs of tax evasion decreases substantially. Both in table 1 and in table 2 foreign assets increase with an increase in tax revenue. With uniform taxation foreign assets increase since the capital stock

---

$8$ $dU$ is equal to $U(C_1,C_2)$ (uniform taxation) - $U(C_1,C_2)$ (tax evasion), scaled by the marginal utility of first-period consumption.
is given, and \( \theta = 2 \) implies a negative interest elasticity of savings. In columns (2) foreign assets increase because domestic capital is substituted away with an increase in the tax rate. Tables 3 and 4 show that, with low returns-to-scale elasticity and high intertemporal elasticity, tax evasion is welfare-superior to uniform taxation of domestic and foreign assets.\(^9\)

4. The Inconsistency of Optimal Plans: Capital Levies and Capital Flight

In this section I make the tax rate endogenous, and discuss optimal fiscal policies. The government maximizes the representative individual's utility function, taking the optimal responses to taxation as given. As Kydland and Prescott [1980] and Fischer [1980] show, in this type of problem the optimal plans of the government are in general reneged as time goes by, since the ex-ante price elasticity of the demand for capital goods differs from the ex-post elasticity.

What are the government's incentives to impose a capital levy and their effects on investors' behavior? I consider here the case where foreign assets are not taxable. The government's problem at time 1 is:

\[
\text{MAX } W(1+r^*, Y+K) + v(G)
\]

\(^9\) The relative ranking of the two regimes does not depend on whether the interest elasticity of savings is positive or negative. For example, assuming \( \alpha = 0.8 \) and \( \theta = 0.8 \) (positive but small interest elasticity of savings) the values of the utility function corresponding to a tax revenue of 0.012 and 0.031 are: 3.121 and 8.098 in the uniform taxation regime, and 8.119 and 8.047 in the presence of tax evasion, respectively.
the first-order conditions are:

\[
v'(G) \left[ 1 - \frac{f'(K_2)}{f(K_2)} \frac{f'(K_2)}{f''(K_2)} \frac{r}{1-r} \right] = \frac{W_2}{1+r^*}
\]

and equations (16), (4) and (17). The solution of the problem yields a value of \( r \) that investors would use in their portfolio and savings decisions. At time 2 the government might want to renege on the announced tax rate. The problem at time 2 is:

\[
\text{MAX } U(C_1, C_2) + v(G)
\]

s.t. \( C_1 = K - A - K_2 \)
\( C_2 = A(1+r^*) + (1-r)f(K_2) \)
\( rf(K_2) = G \)

At time 2 both A and \( K_2 \) are given, hence \( C_1 \) and \( f(K_2) \) are given as well. Therefore, the first order conditions are:

\[
v'(G) = \frac{\partial U}{\partial C_2}
\]

and equations (2), (3) and (16). (18) and (19) are unlikely to give rise to the same value of \( r \). In the first period, the marginal government revenue from an
increase in taxes—the second term on the left-hand side of (18)—times the marginal utility of government spending, has to equal the welfare cost of the tax distortion. In the second period, by contrast, the tax rate is such that the marginal utility of consumption is equal to the marginal utility of government spending.

Are the optimal ex-post taxes higher than ex-ante? The right-hand side of equation (18) equals \( U_1/(1+r^*) \), since the derivative of the indirect utility function with respect to the present discounted value of available resources equals the Lagrange multiplier associated with the present-value budget constraint, and in turn, the marginal utility of period-one consumption. Therefore, given the consumption Euler equation (5), the right-hand side expressions in equations (18) and (19) are identical. Thus, a comparison of the left-hand sides of the two equations shows that ex-post government spending and taxes are always greater than ex-ante, if the marginal utility of government expenditure is decreasing.

Equations (18) and (19) also reveal that the government's incentive to raise higher taxes ex-post is stronger, the larger the response of international capital flows to future taxes, i.e. the more "similar" the domestic and foreign investment technologies: in this case the marginal tax revenue term in equation (18) is relatively small, thus driving a larger wedge between the ex-ante and ex-post marginal utility of government spending.

By a similar argument it is possible to show that, in the uniform taxation case, the government's incentives to raise higher taxes ex-post are positively related to the response of the current account to the savings tax rate: the higher the intertemporal elasticity of substitution the larger is the difference
between ex-post and ex-ante taxes.

Historically, examples of extraordinary taxation, like capital levies, debt repudiation, or exchange-rate "maxi" devaluations, are numerous. For this reason, and since the "fooling" equilibrium just described is unlikely to be self-replicating, it is plausible to study equilibria where the public anticipates the government's actions. Define a discretionary equilibrium as one where the public perfectly anticipates future taxes, and the government has no incentives to renege on previous commitments.\(^\text{10}\) In the government's problem at time 2, the values of \(C_1\), \(A\), and \(K_2\)--that the government takes as given--are functions of taxes expected at time 1. To make sure that the government will have no incentives to change the announced tax rate, the public has to choose \(A\), \(C_1\), and \(K_2\) conditional on a value of \(r\) consistent with the solution of the problem (1)-(3) and (16) above. Since ex-post taxes are always greater than their ex-ante optimal values, the discretionary equilibrium is characterized by "over-accumulation" of foreign assets.\(^\text{11}\) The accumulation of foreign assets in the discretionary equilibrium is larger, the more similar are the domestic and foreign investment technologies. Therefore, the arguments for preventing international capital flows for tax evasion are the same even when the

\(^{10}\) See Fischer [1986] for the a complete discussion of the welfare ranking of "first best," "time inconsistent" and "discretionary" equilibria.

\(^{11}\) An interesting historical example of this phenomenon is provided by the Italian experience in 1919. A capital levy was passed by the Italian government in November, and was publicly debated since the beginning of the year. The dollar price of lire in New York fell by 52% from December 1918 to December 1919, and many contemporary observers argued that capital flight for fear of the capital levy reached serious proportions in that year. See Giovannini [1987].
endogeneity of government spending, and the effects of dynamic inconsistency, are explicitly accounted for: if the substitutability between domestic and foreign investments is large relative to the intertemporal substitutability of consumption, tax evasion lowers national welfare relative to a regime where domestic and foreign investment income are taxed at the same rate.

5. Concluding Remarks

This paper has studied the simple analytics of tax evasion through international capital flows. The main result is that the welfare costs of international capital outflows to evade domestic taxes are larger, the more substitutable are domestic and foreign investments, relative to present and future consumption. Thus the relative importance of portfolio substitution and intertemporal substitution provide a simple criterion to evaluate the welfare effects of international tax evasion from an individual country’s perspective: this general criterion should not be overturned in more complicated models that account for many assets (and imperfect substitutability in the traditional sense) and a much richer menu of taxes, including taxes on labor income, and differential tax schedules on the various capital assets.

The analysis of this paper has implications for the question of the desirability of “capital controls.” Capital controls decrease welfare in

12 Since the logical structure of the proof of this proposition—as well as its intuition—are clearly the same as in section 3, I omit it for brevity’s sake.

13 Taking the rest of the world as exogenously given.
economies that are free of distortions, but can be desirable when some distortions are unavoidable. Empirically, taxes are one of the most important distortions that cannot be eliminated. This paper suggests that the application of the "public finance" approach to normative questions like the optimal design of "controls" or taxation of international capital flows might prove fruitful.

14 The effects of capital controls on equilibrium prices and quantities in an open economy are studied by Greenwood and Kimbrough [1984, 1985], Adams and Greenwood [1985], and van Wijnbergen [1985].

15 See Atkinson and Stiglitz [1980] for a review of the arguments demonstrating the impossibility of achieving lump-sum taxation.
Appendix:

Quantitative Capital Controls Can Achieve the Uniform Taxation Solution

A regime of uniform taxation like the one described in section 2 might be difficult to achieve, since, for many governments, monitoring international trade in assets and evaluating foreign assets holdings of domestic residents is too costly. Traditionally, outright prohibitions of purchases of foreign assets are a frequently-used form of capital controls. Below I show that appropriately-set quantitative controls achieve the same allocation of resources as a regime of uniform taxation. Consider the following problem:

\[
\begin{align*}
\text{MAX} & \quad U(C_1, C_2) + v(G) \\
\text{s.t.} & \quad K_2 + C_1 + A - K \\
& \quad C_2 = A(1+r^*) + f(K_2)(1-r) \\
& \quad A \leq \bar{A}
\end{align*}
\]

Equation (a4) represents the quantitative controls on purchases of foreign assets. The first-order conditions for the problem (a1)-(a3) plus (a4) are:

\[
\begin{align*}
U_1(C_1, C_2) &= U_2(C_1, C_2)f'(K_2)(1-r) \\
U_1(C_1, C_2) &= U_2(C_1, C_2)(1+r^*) - \mu
\end{align*}
\]

and the intertemporal budget constraint (2)-(3), together with the "complementary slackness" condition:
In this problem, $\hat{A}$ can in fact be set at a level such that distortions on the production side of the economy are avoided. Let $rf'(K_2)U_2(C_1,C_2) = \mu$: from equations (a5) and (a6), it follows that $f'(K_2) = 1+r^*$, as in equation (4') in section 2, and $\mu = r(1+r^*)U_2(C_1,C_2)$. Substituting into equation (a6) yields equation (5') of section 2, the other first-order condition from the uniform taxation problem. Solution of (4')-(5') and the two budget constraints (a2)-(a3) produces the values for consumption, savings, and foreign asset accumulation that are obtained in the uniform-taxation problem. Furthermore, given the value of $\mu$, auctioning the rights to purchase foreign assets generates the same revenue as in the case where foreign assets' income is taxed. Therefore, even when foreign assets' income cannot be taxed, appropriately-set quantitative restrictions can achieve an allocation of resources identical to that obtainable with a system of uniform taxation.
References


Table 1: 
\( \alpha = .8 \quad \theta = 2 \)

<table>
<thead>
<tr>
<th>G</th>
<th>( r )</th>
<th>( f(K_2) )</th>
<th>A</th>
<th>dU</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>.01</td>
<td>.017</td>
<td>.025</td>
<td>.438</td>
<td>.395</td>
<td>.134</td>
</tr>
<tr>
<td>.05</td>
<td>.031*</td>
<td>.080</td>
<td>.438</td>
<td>.099</td>
<td>.144</td>
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<tr>
<td>.10</td>
<td>.157</td>
<td>na</td>
<td>.438</td>
<td>na</td>
<td>.155</td>
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</table>

Table 2: 
\( \alpha = .4 \quad \theta = 2 \)

<table>
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<tr>
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<th>( r )</th>
<th>( f(K_2) )</th>
<th>A</th>
<th>dU</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.01</td>
<td>.009</td>
<td>.005</td>
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<td>2.092</td>
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<tr>
<td>.05</td>
<td>.045</td>
<td>.025</td>
<td>2.098</td>
<td>2.064</td>
<td>-.737</td>
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<tr>
<td>.10</td>
<td>.087</td>
<td>.049</td>
<td>2.098</td>
<td>2.029</td>
<td>-.726</td>
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Table 3:
\( \alpha = .4 \quad \theta = .5 \)

<table>
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<th>( r ) (2)</th>
<th>( f(K_2) ) (1)</th>
<th>( f(K_2) ) (2)</th>
<th>( A ) (1)</th>
<th>( A ) (2)</th>
<th>( dU ) (1)</th>
<th>( dU ) (2)</th>
<th>( % \text{ of } C_1 )</th>
<th>( \tau_1 ) and ( \tau_2 )</th>
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<td>2.092</td>
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<td>.002</td>
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<tr>
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<td>.044</td>
<td>.024</td>
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<td>2.064</td>
<td>-.742</td>
<td>-.673</td>
<td>-.060</td>
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<td>-.626</td>
<td>-.300</td>
<td>.035</td>
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Table 4:
\( \alpha = .2 \quad \theta = .2 \)

<table>
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<th>( r ) (2)</th>
<th>( f(K_2) ) (1)</th>
<th>( f(K_2) ) (2)</th>
<th>( A ) (1)</th>
<th>( A ) (2)</th>
<th>( dU ) (1)</th>
<th>( dU ) (2)</th>
<th>( % \text{ of } C_1 )</th>
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<td>.002</td>
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<td>4.680</td>
<td>-1.742</td>
<td>-1.720</td>
<td>-.006</td>
<td>.002</td>
<td>.0002</td>
<td></td>
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<tr>
<td>.05</td>
<td>.022</td>
<td>.011</td>
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<td>4.670</td>
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<td>-1.696</td>
<td>-.110</td>
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<td>.001</td>
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<tr>
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<td>.045</td>
<td>.021</td>
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* Maximum government revenue attainable, given the parameters.
The utility function and production function used in the simulations are:

\[
U(C_1, C_2) = \left[ C_1^{1-\theta} + C_2^{1-\theta} / (1+\delta) \right] / (1-\theta)
\]

\[
f(K_2) = (1/\alpha)K_2^\alpha
\]

The exogenous first-period endowment and the fixed parameters are:

- \(K = 1.00\)
- \(r^* = 0.30\)
- \(\delta = 0.25\)