NBER WORKING PAPER SERIES

CONSUMPTION AND CASH-FLOW TAXES IN AN INTERNATIONAL SETTING

Alan J. Auerbach
Michael P. Devereux

Working Paper 19579
http://www.nber.org/papers/w19579

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2013

We would like to thank Steve Bond and seminar participants at the Centre for Business Taxation, the Oxford University Economics department, the IFS-STICERD public economics seminar, and Goethe University for helpful discussion and comments. Devereux acknowledges the financial support of the ESRC under grant RES-060-25-0033. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

At least one co-author has disclosed a financial relationship of potential relevance for this research. Further information is available online at http://www.nber.org/papers/w19579.ack

Consumption and Cash-Flow Taxes in an International Setting
Alan J. Auerbach and Michael P. Devereux
NBER Working Paper No. 19579
October 2013
JEL No. F23,H25

ABSTRACT

We model the effects of consumption-type taxes which differ according to the base and location of the tax. Our model incorporates a multinational producing and selling in two countries with three sources of rent, each in a different location: a fixed basic production factor (located with initial production), mobile managerial skill, and a fixed final production factor (located with consumption). In the general case, we show that for national governments, there are trade-offs in choosing between alternative taxes. In particular, a cash-flow tax on a source basis creates welfare-impairing distortions to production and consumption, but is partially incident on the owners of domestic production who may be non-resident. By contrast, a destination-based cash-flow tax does not distort behavior, but is incident only on domestic residents. In the alternative case with the returns to the fixed factors accruing to domestic residents, the only distortion from the source-based tax is through the allocation of the mobile managerial skill. In this case, the source-based tax is also incident only on domestic residents, and is dominated by an equivalent tax on a destination basis.

Alan J. Auerbach
Department of Economics
530 Evans Hall, #3880
University of California, Berkeley
Berkeley, CA 94720-3880
and NBER
auerbach@econ.berkeley.edu

Michael P. Devereux
Centre for Business Taxation
Saïd Business School
Oxford University
Park End Street
Oxford OX1 1HP
United Kingdom
Michael.Devereux@sbs.ox.ac.uk

1. Introduction

It is generally understood that the distortionary effects of capital income taxation are magnified in open economies. For example, the standard theoretical model suggests that the optimal effective marginal tax rate of a source-based capital income tax in a small open economy is zero (see Gordon, 1986). Raising this tax rate increases the required pre-tax rate of return in that location; this reduces the quantity of capital located there, which in turn creates an excess burden which could be avoided by taxing immobile factors directly.

One alternative to income taxation is consumption-type taxation. This paper investigates the effects of different types of consumption-type taxation on factor allocation, production and consumption in a two-country framework. Our particular interest is in three versions of the business cash-flow tax levied on business profit.[1] These differ in how the profit is allocated across the two countries. We analyze the case where aggregate profit is allocated by an apportionment factor based on the location of sales; a "destination" tax akin to VAT where exports are tax exempt, but imports are taxed; and a conventional source-based tax. We explore and compare the efficiency properties of each of these forms of taxation. We show that there are many potential distortions even when capital income is excluded from the tax base, so that the tax is based only on profit or economic rent. We also examine a game played between the two countries to consider what the non-cooperative outcome would be if the two countries chose their tax systems independently. In particular, starting from the most common form of taxation, the source-based tax, we analyze whether

[1] These three can be thought of, for example, as variants of the R-based tax of Meade et al. (1978), although since we do not include debt in our model , this would be equivalent to the R+F based tax.

countries have an incentive to switch at least part of their tax system to one of the other forms.

We model a representative multinational company which takes all prices as given, and which is owned equally by two representative consumers, one in each country. The company has a production plant in each country that supplies either or both consumers. The final good differs between countries depending on local conditions – for example, a car must be prepared as right- or left-hand drive. The company exports an intermediate product between the two countries, and completes the final product in the country in which it is sold and consumed.

The company generates profit in three ways. First, it has the use of a fixed factor in each production location of the intermediate good, which implies that there are decreasing returns to scale in the other two factors, capital and managerial skill. The existence of the fixed factor generates profit in the country of production. This factor can be thought of, for example, as a local supply network that has been built up in each country, and which is available to the multinational to support production. Second, we also assume that there is a fixed factor in process of adjusting the intermediate good for the local market, which generates profit in the country of consumption. Third, the company owns a fixed supply of managerial skill, which it can move freely between the two countries. The profit generated from access to managerial skill is therefore mobile between the two countries.

Within this framework, even taxes on business profits can affect economic behavior. For example, consider the effects of a source-based cash-flow tax applied to the company in each country, where the home country has a higher tax rate. Other things being equal, and even in the absence of manipulating the transfer price of the intermediate good for tax reasons, the company would prefer to shift production of the intermediate good to the lower-taxed country, and export the intermediate good back to the home country to serve the domestic market. In addition, the company will have an incentive to inflate the transfer price at which the intermediate good is sold, since this will raise taxable profit in the foreign country and reduce it in the home country. This in turn creates a further incentive to shift production to the foreign country. So even under a cash-flow tax, the company will have an incentive to shift production to the foreign country, where the tax rate is lower.[2]

By contrast, a destination-based tax implemented in both countries along the lines of a VAT (but with labor costs deductible) would be efficient, equivalent to a lump-sum tax. This stems from the assumption that the representative consumer is immobile. A tax based solely on the revenue generated in each market cannot be avoided by switching factors of production (and trade flows) between countries.

A source-based cash-flow tax does have an attractive property, even though it causes distortions, including to the location of production. The incidence of such a tax falls to some extent on the owners of the company. As long as the company is at least partly owned by non-residents, then the source-based tax is partly incident on those non-residents. In a non-cooperative setting, then, there is generally a trade-off for governments in setting a source-based tax rate. On the one hand, a higher tax rate induces a deadweight cost due to distortions induced by a switch of production between countries; on the other hand the country benefits since part of the incidence of the tax falls on non-residents.

[2] Note that this depends on production taking place in both countries. If the company chooses to produce in only one country, then its discrete choice of which country to choose will depend on the tax rate. Bond and Devereux (2002) compare the properties of source- and destination-based taxes in this framework.

Beginning with the standard case in practice of only a source-based tax in each country, we ask whether the home government has an incentive to switch part of its tax base away from the source base to either a destination base or a sales tax on the good produced by the multinational. In the general case, it is not possible to identify whether the government should do this or not. The reason is the tradeoff just mentioned between the benefit of taxing non-residents as against the deadweight loss imposed by the source-based tax.

However, this benefit of the source-based tax is not present in an alternative framework which we model. In this framework, the rent earned by the fixed factors (associated with initial production and final production) accrue to domestic residents rather than to the multinational. This generates a direct benefit to the representative residents from attracting each element of production activity, in that the prices of the fixed factors are bid up. In this case, the only source of measured company profits (which we continue to assume are shared equally between jurisdictions) is the returns to managerial skill. In this setting, it is possible to show that a switch to the destination based tax would be beneficial.

This result appears to be at odds with several claims in the literature regarding the equivalence of destination and source-based taxes. In the last model, the only remaining distortion is the choice of where to locate managerial skill. That implicitly reflects a transfer pricing decision, since in our model this factor can be allocated freely, and hence in effect the transfer price is zero. If instead, we assumed that the factor was wholly owned in one country, and that its transfer to the other country was appropriately priced, then even this distortion would disappear, and the source-based tax, like the destination-based tax, would be equivalent to a lump-sum tax. This is implicitly the framework underlying the contributions of Auerbach (1997), Bradford (2003) and others, resulting in the claim that destination-based and source-based consumption taxes are equivalent.[3] We show in this paper the nature of the assumptions that need to be made for such an equivalence to hold.

In that respect, this paper relates closely to the literature investigating the comparison between VAT levied on a destination or origin (i.e. source) basis. A comprehensive analysis of alternative locations of the VAT base was provided by Lockwood (2001), who synthesized a number of earlier contributions. Our model differs substantially, focusing particularly on firm-level decisions and several variations in tax structure as opposed to modeling the consumption side in more detail. Nevertheless, the results are broadly consistent: Lockwood finds that destination and origin bases are only equivalent in the presence of perfect competition and factor immobility. This would also be true in our model, though as noted above, mobile managerial skill would not overturn this result under appropriate transfer pricing. Beyond this, Lockwood (building on Lockwood, 1993, and Keen and Lahiri, 1998) also finds that the introduction of imperfect competition destroys this equivalence. We do not model imperfect competition in this paper.

The remainder of the paper is organized as follows. Section 2 sets up the base case model, and analyzes the impact of the four taxes (a domestic sales tax on one good only, and a cash-flow corporation tax based on formula apportionment, a destination base, and a source base) when both countries adopt the same form of taxation. To set the scene, and for the purposes of comparison, this section also considers a lump-sum tax, and a domestic sales tax on all goods, which also amounts to a lump-sum tax in our model. Given that

[3] See also Avi-Yonah (2000), and Grubert and Newlon (1997).

source-based taxes are dominant in practice, Section 3 addresses the question of whether, starting from the case in which both countries impose a source-based tax, the home country has an incentive to switch part of its tax base to either a destination basis or a sales tax on one good only. Section 4 extends the framework of the model by considering the case in which the returns to the fixed factors accrue only to domestic residents, and not to the company. Section 5 concludes.

2. Properties of common tax regimes

There are two countries. Each country has a representative agent with a utility function of the form

$$(2.1) \qquad U = u(c_1) + c_2 + v(g); \qquad U^* = u^*(c_1) + c_2^* + v(g^*)$$

where c_1 and c_2 represent consumption of goods 1 and 2 respectively, g is a local public good, and the asterisk denotes the foreign country. To make the model tractable, we assume that there are no income effects in the demand for good 1. In general, we allow the shape of the utility function for good 1 to differ between the two countries, although we also study the symmetric case in which the utility functions are the same.

In each country there is one unit of an endowment good. Production of one unit of good 2 in each country uses one unit of endowment. The production of good 2 is therefore characterized by constant returns to scale, and is assumed to be perfectly competitive, so that there are no profits. Good 2 can be used as a public good (g) or as consumption (c_2), with the remainder supplied as capital to the world capital market. Hence, the total world supply of capital (K) is

(2.2) $$K = (1 - c_2 - g) + (1 - c_2^* - g^*) = k + k^*$$

where k is the amount of capital used in the home country and k^* is the amount used abroad.

Good 1 is produced by a single representative multinational, which takes all prices as given. It produces the basic good in both countries, and in its production has access to two additional factors, both in fixed supply. One factor is a local supply network that has been built up in each country, and which is available to the multinational to support production. The second is access to managerial skill (m), the overall stock of which is assumed to be in fixed supply, M, and which can be used for production in either location. Thus,

(2.3) $$M = m + m^*$$

where m is the amount of capital used in the home country and m^* is the amount used abroad. Also, the total amount of capital used by the multinational, *K,* is shared between the two sites of production as shown in (2.2).

We assume that the basic production function used by the multinational is the same in both countries, $f(k, m)$, and that there are decreasing returns to scale because of the fixed factor representing the local supply network. There are no transportation costs, so without taxes the locations of production and consumption are unrelated. Hence

(2.4) $$x_1 + x_1^* = f(k, m) + f(k^*, m^*)$$

where x_1 and x_1^* are the output from the production processes consumed in the home and foreign country respectively. The locations of capital production and capital use are also unrelated.

The final product must be prepared for sale in each country due to local tastes. For example, cars must be adjusted to be left-hand or right-hand drive, depending on local law. This links consumption of good 1 in each country with the basic output sold in that country, according to a common second stage production function, $h(\cdot)$,

(2.5) $$c_1 = h(x_1)\ ;\ c_1^* = h(x_1^*)$$

where c_1 and c_1^* are the quantity of sales of the multinational in each country, and $h(\cdot)$ is assumed to be decreasing returns to scale.

Although we model a representative company, we assume that there are many such companies which determine the price in equilibrium. Any single company therefore takes the output price as given. Conditional on the consumer price in each country, decreasing returns to scale of $h(\cdot)$ leads to different values associated with x in the two countries. If, for example, there is a stronger demand for good-1 consumption in country 1, then this will lead to more consumption, and higher consumption rents in that country.

Ownership of the multinational, and hence profit (π), is shared equally between the two countries' representative agents. The profits have three components: returns to the fixed factor in basic production, returns to managerial skill, and returns to the fixed factor in final production. The effective locations of these components differ. The return to the fixed factor in basic production is located in the country hosting that fixed factor;[4] the

[4] Here we assume that the fixed factor is owned directly by the multinational.

return to managerial skill is mobile, and depends on the location of the managerial skill itself; and the return to the fixed factor in final production is located in the country of consumption. The differences in location for these components of profits are important in modeling the impact of alternative taxes.

We now consider the effects of using different types of taxes to raise revenue to finance public goods. Initially, we consider only cases in which both governments adopt the same tax base; in Section 3 we consider the incentives to deviate from a common tax base.

2.1. Lump sum tax

To set the stage, consider first the case of lump sum taxes (T and T^*) levied on the consumer in each country, and equal to government spending, $T = g$; $T^* = g^*$. Individuals choose consumption of goods 1 and 2 to maximize utility, U or U^*, subject to a budget constraint:

(2.6) $$p_1 c_1 + p_2 c_2 = 1 + \frac{\pi}{2} + T; \qquad p_1^* c_1^* + p_2^* c_2^* = 1 + \frac{\pi}{2} + T^*.$$

Without income effects and assuming that the price of good 2 ≡ 1, this implies

(2.7) $$u'(c_1) = p_1; \qquad u^{*\prime}(c_1^*) = p_1^*.$$

The profit of the multinational is:

(2.8) $$\pi = p_1 c_1 + p_1^* c_1^* - K = p_1 h(x_1) + p_1^* h\{f(k,m) + f(K-k, M-m) - x_1\} - K.$$

Maximizing profit with respect to k, m, K, and x_1, and yields the following first-order conditions for profit maximization of the multinational:

(2.9) $$f_1(k,m) = f_1(k^*,m^*)$$

(2.10) $$f_2(k,m) = f_2(k^*,m^*)$$

(2.11) $$p_1^*h'(x_1^*) = \frac{1}{f_1(k^*,m^*)}$$

(2.12) $$p_1h'(x_1) = p_1^*h'(x_1^*)$$

Conditions (2.9) and (2.10) call for production efficiency, with the marginal product of capital equal across the two countries, and also the marginal product of managerial skill equal across the two countries. Condition (2.11) calls for setting marginal revenue equal to marginal cost. Condition (2.12) implies that marginal revenues should be independent of consumption location.

Given that production functions are the same in the two countries, then (2.9) and (2.10) imply that $k = k^* = K/2$ and $m = m^* = M/2$. In turn, this implies that these four first-order conditions imply:

(2.13) $$p_1h'(x_1) = p_1^*h'(x_1^*) = 1/f_1\left(\frac{K}{2},\frac{M}{2}\right).$$

The home government chooses the lump sum tax T to maximize utility, U, subject to its budget constraint, $T = g$. The foreign government faces the equivalent problem. This yields:

(2.14) $$u'(c_1)\frac{\partial c_1}{\partial T} + \frac{\partial c_2}{\partial T} + v'(g) = 0.$$

With no income effects in the demand for good 1, $\partial c_1/\partial T = \partial c_1^*/\partial T^* = 0$. Given the household budget constraints (2.6), this implies that $\partial c_2/\partial T = \partial c_2^*/\partial T^* = 1$. Thus,

$v'(g) = v^{*'}(g^*) = 1$, which implies that the optimal value of the public goods, $\bar{g}$ *and* $\bar{g}^*$, are given by:

$$\bar{g} = v'^{-1}(1);\ \bar{g}^* = v^{*'^{-1}}(1). \tag{2.15}$$

Note that the consumer budget constraints can be rewritten as

$$u'(c_1)c_1 + c_2 = 1 + \frac{(u'(c_1)c_1 + u^{*'}(c_1^*)c_1^* - K)}{2} - \bar{g} \tag{2.16}$$

with the equivalent for the foreign country. These two constraints represent only one new equation, given Walras' law. Equation (2.2), combined with (2.4), (2.5), (2.13) and (2.16) represent seven equations in seven unknowns, the four consumption levels, the two levels of output, and the capital stock, *K*, that can be solved for their equilibrium values.

Having summarized the equilibrium conditions when both countries use lump-sum taxes, we now consider the effects of using other tax systems.

2.2. Uniform domestic consumption tax

Suppose that the home country imposes a tax at tax-inclusive rate t on consumption of goods 1 and 2, and the foreign country imposes a tax of the same form, at rate t^*. Define p_1 and p_2 to be the home-country consumer prices, inclusive of tax, of goods 1 and 2 respectively with the same notation convention abroad. Taxes are therefore

$$T = t\{p_1c_1 + p_2c_2\};\quad T^* = t^*\{p_1^*c_1^* + p_2^*c_2^*\} \tag{2.17}$$

As there are no taxes on production, the producer price of the numeraire good 2 remains equal to 1 in both countries. This implies that the consumer prices of good 2 become

$1/(1-t)$ and $1/(1-t^*)$. With these prices, the conditions for utility maximization become:

$$(2.18) \qquad u'(c_1) = \frac{p_1}{p_2} = (1-t)p_1; \quad u^{*'}(c_1^*) = \frac{p_1^*}{p_2^*} = (1-t)p_1^*,$$

and after-tax profits of the multinational are:

$$(2.19) \qquad \pi = p_1(1-t)c_1 + p_1^*(1-t^*)c_1^* - K$$

Combining (2.18) and (2.19) yields the same expression for profits as above, (2.8). Thus the conditions for profit-maximization, (2.9)-(2.12), are also the same as in the case of the lump-sum tax. Finally, the household budget constraint becomes

$$(2.20) \qquad u'(c_1)c_1 + c_2 = (1-t)\left(1 + \frac{(u'(c_1)c_1 + u^{*'}(c_1^*)c_1^* - K)}{2}\right),$$

with the equivalent for the foreign country.

Since the choice of tax rate t amounts to a lump-sum tax on endowment and profits, both of which are unaffected by the tax rate, it amounts to a lump-sum tax on domestic residents. As a consequence, $g = \overline{g}$ and $g^* = \overline{g}^*$: the equilibrium is unchanged.

2.3. Domestic sales tax on good 1 only

It is useful to consider good 2 to be an untaxed good, such as leisure, so that the sales tax will have some distortionary impact, as would be realistic.[5] With no tax on good 2 in either country, individual maximization yields the same expressions as for the lump-sum tax, (2.7).

---

[5] One might also think of good 2 as local production by small producers below a taxpaying threshold.

After-tax profits are therefore:

(2.21) $$\pi = (1-t)p_1c_1 + (1-t^*)p_1^*c_1^* - K$$
$$= (1-t)p_1h(x_1) + (1-t^*)p_1^*h\{f(k,m) + f(K-k, M-m) - x_1\} - K$$

Maximization with respect to k and m will still yield production efficiency, since all the terms in k and m are multiplied by (1-t^*). However, conditions (2.11) and (2.12) become

(2.22) $$(1-t^*)p_1^*h^{'}(x_1^*) = \frac{1}{f_1(k^*,m^*)}$$, and

(2.23) $$(1-t)p_1h^{'}(x_1) = (1-t^*)p_1^*h^{'}(x_1^*)$$

implying that condition (2.13) becomes:

(2.24) $$(1-t)p_1h^{'}(x_1) = (1-t^*)p_1^*h^{'}(x_1^*) = 1/f_1\left(\frac{K}{2},\frac{M}{2}\right).$$

The consumer choice of good 1 is therefore distorted in each country.

The government now faces a more complicated decision since increasing the tax will have substitution effects as well as income effects. The government chooses the tax rate t, again to maximize U, subject to the consumer's budget constraint,

(2.25) $$p_1c_1 + c_2 = 1 + \frac{\pi}{2} = 1 + \{(1-t)p_1c_1 + (1-t^*)p_1^*c_1^* - K\}/2$$

and the government's budget constraint,

(2.26) $$g = T = tp_1c_1.$$

Substituting (2.25) into the expression for U, and maximizing with respect to t, implies:

(2.27) $$\frac{dY}{dt}+v^{'}(g)\frac{dT}{dt}=0\Rightarrow g=v^{'-1}\left(-\frac{dY/dt}{dT/dt}\right)$$

where

(2.28) $$\frac{dY}{dt}=\frac{1}{2}\frac{d\pi}{dt}-c_1\frac{dp_1}{dt}=\frac{1}{2}\frac{d\pi}{dt}-u''(c_1)c_1\frac{dc_1}{dt}$$

is the change in real income due to an increase in t, resulting from the direct change in nominal income through π, plus the change in purchasing power due to price changes.

To take this further, consider $d\pi/dt$:

(2.29) $$\frac{d\pi}{dt}=-p_1c_1+(1-t)c_1\frac{dp_1}{dt}+(1-t^*)c_1^*\frac{dp_1^*}{dt}-p_1^*c_1^*\frac{dt^*}{dt}$$
$$\left[+(1-t)p_1h^{'}(x_1)\frac{dx_1}{dt}+(1-t^*)p_1^*h^{'}(x_1^*)\frac{dx_1^*}{dt}-\frac{dK}{dt}\right]$$

The first line reflects the impact on post-tax profit of an increase in the tax rate holding everything else constant, plus the effects through changes in the output prices in the two countries, which are not taken into consideration by the multinational, plus the effect on post-tax profit through a possible reaction in the foreign tax rate. The second line is equal to zero from the multinational's first-order condition for profit maximization.

Noting that $\frac{dp_1}{dt}=u^{''}(c_1)\frac{dc_1}{dt}$ and the equivalent for the foreign price, we can combine (2.28) and (2.29) to yield an expression for the effect on real income:

(2.30) $$\frac{dY}{dt}=-\frac{1}{2}\left\{u'(c_1)c_1+u^{*'}(c_1^*)c_1^*\frac{dt^*}{dt}+(1+t)c_1u''(c_1)\frac{dc_1}{dt}-\frac{(1-t^*)c_1^*u^{*''}(c_1^*)(dc_1^*)}{dt}\right\}$$

For the effect on revenues, we have:

(2.31) $$\frac{dT}{dt}=u^{'}(c_1)c_1+t\left[c_1u^{''}(c_1)+u^{'}(c_1)\right]\frac{dc_1}{dt}.$$

Comparing these two expressions yields:

(2.32) $$\frac{dY}{dt} = -\frac{dT}{dt} + tu'(c_1)\frac{dc_1}{dt}$$

$$+\frac{1}{2}\left\{u'(c_1)c_1 - (1-t)c_1u''(c_1)\frac{dc_1}{dt} + (1-t^*)c_1^*u^{*''}(c_1^*)\frac{dc_1^*}{dt} - u^{*'}(c_1^*)c_1^*\frac{dt^*}{dt}\right\}$$

$$= -\frac{dT}{dt} + tu'(c_1)\frac{dc_1}{dt} - \frac{1}{2}\frac{d\pi^1}{dt} + \frac{1}{2}\frac{d\pi^2}{dt}$$

where $d\pi^1/dt$ is the sum of the first two components of $d\pi/dt$ in the first line of expression (2.29) and $d\pi^2/dt$ is the sum of the last two components. There are three sources of deviation from equality of $|dY/dt|$ and dT/dt on the right-hand side of this expression:

- The first, $\left[tu^{'}(c_1)\frac{dc_1}{dt}\right]$, represents the first-order deadweight cost from worsening the pre-existing tax distortion, $tu^{'}$, which is equal to zero for $t = 0$. This will reduce g.
- The second and third terms, $\left[-\frac{1}{2}\frac{d\pi^1}{dt}\right]$ and $\left[+\frac{1}{2}\frac{d\pi^2}{dt}\right]$, account for tax exporting. The second (which will be positive for an increase in t) reflects the fact that only half of the reduction in profits from home country taxes shows up in home country income, even though *all* of it shows up in home-country taxes; this will increase g. The third term has the opposite sign, reflecting the fact that half of the tax-induced change in profits due to foreign country taxes shows up in home country income, even though *none* of it shows up in home country-taxes; this will reduce g, assuming that foreign-country tax revenues rise.

2.4. Business profits tax with apportionment by sales

Formula apportionment has often been considered as a solution to the difficulty of determining the location of the tax base, and has recently been proposed by the European Commission as a replacement for existing corporation taxes in Europe. Its properties have been analyzed by Gordon and Wilson (1986), who demonstrated that for a standard corporate income tax, a three-factor formula based on the location of property, payroll and sales could be examined as, in effect, three forms of distortionary taxation. It is clear that a formula based on property or payroll would affect location incentives. We therefore focus on the case where the apportionment factor is solely the destination of sales – that is, where the consumer resides, as proposed by Avi-Yonah and Clausing (2008). We further consider the case in which the tax base itself is a business cash-flow tax.[6]

We assume here that the apportionment factor is based on the location of the consumption of good 1 only, rather than on goods 1 and 2. This would follow naturally if the multinational does not also produce good 2, or if good 2 represents leisure. This assumption implies that sales of good 2 in either country have no impact on the firm's tax payments.[7] Consequently, the equilibrium competitive price for good 2 will still be 1, and the utility maximization conditions for the lump-sum tax in (2.7) still hold. Also, the condition for pre-tax profits given in (2.8) holds. Post-tax profits are:

---

[6] We abstract from issues concerning debt and the treatment of interest, by implicitly assuming the multinational is equity financed.

[7] If sales of good 2 were included in the apportionment formula, for example if the multinational were an integrated producer of goods 1 and 2, this would lead to an additional distortion. The firm would be encouraged to shift sales of low-margin products, in this model good 2, from the high-tax country to the low-tax country, to reduce the share of its overall sales in the high-tax country. In a more general model with sales of intermediate production inputs (absent from our model because the two stages of good-1 production occur within the same firm), there would be a second additional distortion, through the implicit taxation of intermediate sales along the lines of the implicit taxation of final goods sales described in expression (2.34). See Auerbach (2011) for further discussion of these distortions.

(2.33) $\pi^n = \pi[1 - ta - t^*(1 - a)]$;

where $a = \frac{p_1 h(x_1)}{p_1 h(x_1) + p_1^* h(x_1^*)} = \frac{p_1 c_1}{p_1 c_1 + p_1^* c_1^*}$.

Using (2.8) and (2.33), we can derive the firm's optimal conditions with respect to *k*, *m*, *K*, and x_1. For the condition with respect to *k*, we have:

(2.34) $$[1 - ta - t^*(1 - a) + \frac{a(t - t^*)\pi}{p_1 c_1 + p_1^* c_1^*}] p_1^* h'(x_1^*)[f_1(k, m) - f_1(k^*, m^*)] = 0$$

Hence, the term $\left(f_1 - f_1^*\right)$ must equal 0 and (2.9) still holds; likewise, so does condition (2.10), so there is still production efficiency.

The remaining two conditions, with respect to *K* and c_1, imply

(2.35) $$\left[1 + \frac{a(t - t^*)\pi}{(1 - t)p_1 c_1 + (1 - t^*)p_1^* c_1^*}\right] p_1^* h'(x_1^*) = \frac{1}{f_1(\frac{K}{2}, \frac{M}{2})}$$

where we have here used the conditions for production efficiency. Expression (2.35) indicates that there will be an effective tax or a subsidy on consumption according to whether the home tax rate is higher or lower than the tax rate abroad. So if $t > t^*$, for example, sales are discouraged at home and encouraged abroad by the incentive to shift the location of profits for tax purposes.

As to the choice of public goods, we again have $g = v'^{-1}\left(-\frac{dY/dt}{dT/dt}\right)$, with the numerator again reflecting the changes in π^n and p_1. Following the same approach as above, and again using the production efficiency conditions then, after some algebra, it is possible to show that

(2.36) $\frac{dY}{dt} = -c_1 \frac{dp_1}{dt} - \frac{\pi}{2}\left(a + (1-a)\frac{dt^*}{dt}\right) + \frac{1}{2}\left[(1 - at - (1-a)t^*)\frac{d\pi}{dt} + \pi(t^* - t)\frac{da}{dt}\right]$

$$= -c_1 \frac{dp_1}{dt} - \frac{\pi}{2}\left(a + (1-a)\frac{dt^*}{dt}\right)$$

$$+\frac{1}{2}\left[(1 - at - (1-a)t^*)\left[c_1 \frac{dp_1}{dt} + c_1^* \frac{dp_1^*}{dt}\right] + \frac{(t^*-t)\pi}{p_1 c_1 + p_1^* c_1^*}\left\{(1-a)c_1 \frac{dp_1}{dt} - a c_1^* \frac{dp_1^*}{dt}\right\}\right]$$

$$= -c_1 \frac{dp_1}{dt} - \frac{\pi}{2}\left(a + (1-a)\frac{dt^*}{dt}\right)$$

$$+\frac{1}{2}\left[c_1 \frac{dp_1}{dt}\left\{1 - t + \frac{(1-a)(t^*-t)K}{p_1 c_1 + p_1^* c_1^*}\right\} - c_1^* \frac{dp_1^*}{dt}\left\{1 - t^* + \frac{a(t^*-t)K}{p_1 c_1 + p_1^* c_1^*}\right\}\right]$$

where π is pre-tax profits, and the envelope theorem implies that only terms in dp_1 and dp_1^* enter this expression from changing either pre-tax profit or the effective tax rate. Also, we have:

(2.37) $\frac{dT}{dt} = a\pi + t\pi \frac{da}{dt} + ta \frac{d\pi}{dt}$

Comparing these two expressions yields:

(2.38) $\frac{dY}{dt} + \frac{dT}{dt} = -c_1 \frac{dp_1}{dt} - \frac{\pi}{2}\left(a + (1-a)\frac{dt^*}{dt}\right)$

$$+\frac{1}{2}\left[(1 - at - (1-a)t^*)\frac{d\pi}{dt} + \pi(t^* - t)\frac{da}{dt}\right] + a\pi + t\pi \frac{da}{dt} + ta \frac{d\pi}{dt}$$

$$= -c_1 \frac{dp_1}{dt} + \frac{\pi}{2}\left(a - (1-a)\frac{dt^*}{dt}\right) + \frac{1}{2}\left[(1 + at - (1-a)t^*)\frac{d\pi}{dt} + \pi(t^* + t)\frac{da}{dt}\right]$$

As in the case of the domestic sales tax on good 1 only, there is a deadweight loss term and fiscal externality terms in addition to *dT/dt*. In summary, although a cash-flow tax in a domestic context is equivalent to a non-distortionary lump-sum tax, apportioning a cash-flow tax internationally based on the destination of sales will generally distort consumption in both countries, although it will not distort production in this particular set-up with intermediate inputs not involved in the tax computation. It thus has impacts similar to sales taxes in our model. Since sales taxes are more straightforward to analyze, we focus on those in Section 3 of the paper.

2.5. Destination-based cash-flow tax

We now consider a tax with the same cash-flow base, but with the tax base determined directly by the destination of sales using border adjustments, as under a VAT.

Consider first the tax treatment of sector 2. In the absence of any trade in good 2, profits are zero and tax from this sector is zero. But with trade then an import of good 2 would be subject to the import tax at rate t or t^*. The price of the domestically produced good 2 must be the same as for imported goods. Further, if the sector is a net exporter, then its tax will be negative. The tax liability in sector 2 and on imports together is:

$$T_2 = t\{p_2(c_2 + k + g) - w\} \tag{2.39}$$

where w is the producer price of the endowment. If $(c_2 + k + g) < 1$ then the home country exports good 2 (or capital) and $T_2 < 0$. If $(c_2 + k + g) > 1$ then $T_2 > 0$ is a tax on imports. The opposite holds for the foreign country. If $(c_2 + k + g) < 1$, the post-tax zero-profits condition is:

$$\pi_2 = (1 - t)\{p_2(c_2 + k - g) - w\} + (1 - t^*)p_2^*(1 - c_2 + k - g) = 0 \tag{2.40}$$

which is solved by $p_2 = w = 1/(1 - t)$ and $p_2^* = 1/(1 - t^*)$. That is, the prices of good 2 and the endowment good are grossed up by $(1 - t)$ in the home country and $(1 - t^*)$ in the foreign country. The goods exported to the foreign country are taxed at rate t^*, and so are the same price as domestically produced goods in that country. Condition (2.18) therefore holds, as for the uniform domestic consumption tax. If $c_2 + k + g > 1$, post-tax profit is zero, but the price of good 2 must reflect the import tax and so is again grossed up.

After tax profits in sector 1 are:

(2.41) $\pi = (1-t)\{p_1 c_1 - p_2 k\} + (1-t^*)\{p_1^* c_1^* - p_2^*(K-k)\} = u'(c_1)c_1 + u^{*'}(c_1^*)c_1^* - K$

This is identical to the expression for lump-sum taxes. Since the tax is all spent on g, all the results for lump-sum taxes continue to hold, though with all prices (including wages and those for government purchases) grossed up by $1-t$ in the home country and $1-t^*$ in the foreign country.

The household budget constraint is:

(2.42) $$p_1 c_1 + p_2 c_2 = w + \left(1 + \frac{u'(c_1)c_1 + u^{*'}(c_1^*)c_1^* - K}{2}\right)$$

$$\Rightarrow u'(c_1)c_1 + c_2 = 1 + (1-t)\left(\frac{u'(c_1)c_1 + u^{*'}(c_1^*)c_1^* - K}{2}\right)$$

with an equivalent condition for the foreign country.

This expression makes it clear that the destination-based tax is equivalent to a tax on the pure profits received by domestic residents. As this is a lump-sum tax on domestic residents, it has no impact on government spending, i.e., $g = \bar{g}$ and $g^* = \bar{g}^*$. In summary, a destination-based cash-flow tax acts as a lump-sum tax.

This result differs from the analysis of a destination-based VAT in Keen and Lahiri (1998) and Lockwood (2001). Keen and Lahiri assume that the tax is levied only on the imperfectly competitive sector; like a sales tax only on good 1 (or the sales-apportioned cash-flow tax), this would clearly would distort consumption choices in our model.[8] Lockwood assumes that consumers are internationally mobile, which would introduce a new, and distorted, margin of consumer choice under the destination-based tax.

2.6. Source-based cash-flow tax

We now consider a third version of the cash-flow tax, in this case one allocated using the source principle.

For this tax, there would be no taxes in the competitive sector 2, so $p_2 = 1$. Hence, the prices of good 1 in the two countries are governed by expression (2.7). We assume that the final level of production, turning x into the final good 1, takes place in the country of consumption.[9] Define e to be exports of the unfinished good 1 (i.e. x) from the home country plant to the foreign country plant at price q and e^* to be exports of good 1 from the foreign country plant to the home country plant at price q^*. Then profit earned by the home country plant is $\pi_1 = (1-t)\{p_1 h(f(k,m) - e + e^*) + qe - q^*e^* - k\}$ and that earned by the foreign plant is: $\pi_1^* = (1-t^*)\{p_1^* h(f(k^*,m^*) - e^* + e) + q^*e^* - qe - k^*\}$. Total profit after tax is:

$$(2.43) \qquad \pi = (p_1 c_1 - k)(1-t) + (p_1^* c_1^* - k^*)(1-t^*) + (q^*e^* - qe)(t - t^*).$$

Conditional on production and consumption in the two countries, $(e - e^*)$ is determined, but not the individual gross exports. This arises because there are no

[8] Note that, if one thinks of good 2 as leisure, then the lack of distortion in our model can also be thought of a relating to the fact that our destination-based cash-flow tax excludes labor from the tax base, unlike a standard VAT. With a labor-leisure trade-off, of course, a uniform VAT on market consumption expenditures would distort labor supply.

[9] In addition to customization for local markets, one can think of this final production stage as including advertising, distribution, and other activities that take place in the proximity of consumption.

transportation costs, which implies that the firm can choose where to produce for each market. With production and consumption in each country given, unit increases in both e and e^* lead to a net increase in after-tax profits of $(q^* - q)(t - t^*)$.

The prices q and q^* are internal transfer prices of the multinational company. Since there are no observable arms' length prices, it may be open to the company to manipulate these internal prices to reduce its tax liability. But it is useful first to consider a benchmark price. A natural benchmark arises if we treat the multinational as having four independent plants, two in each country, each of which takes prices as given. In each case plant A uses k to produce x and plant B uses x to produce the final good c. Consider the case where there are no exports, in which case the profits of the two home country plants are $\pi_A = (1 - t)\{qf(k,m) - k\}$ and $\pi_B = (1 - t)\{p_1 h(x_1) - qx_1\}$. Plant A chooses k to maximize its profit and plant B chooses $x_1 = f(k,m)$ to maximize its profit. What value of q would yield the same outputs as in the case where these two plants were combined, i.e., the value of $k = \hat{k}$ for which $p_1 h'(x_1) f_1(\hat{k},m) = 1$? The answer is $q = 1/f_1(k,m)$, the marginal cost of producing x. That is, if the transfer price is set equal to the marginal cost of plant A, then outputs would not be affected by splitting the home plant into two parts. The same applies to the case in which the intermediate good is exported, and holds even in the presence of the two cash flow taxes analyzed here, so in addition we have $q^* = 1/f_1(K - k, M - m)$.

We discuss below the possibility that the multinational can exploit the absence of an arms' length price to manipulate its transfer prices in order to shift profit between the two countries. But while we allow the firm considerable latitude in its choice of transfer prices q and q^*, we assume that it cannot choose different values for the two, for example exporting at a high price from the low-tax country and then exporting back from the high-tax country at a low price. This means that, even in the absence of transportation costs, the firm can gain no benefit from cross-hauling.

With $q = q^*$ in expression (2.43), there are four possible regimes:

Case A: $e^* = 0$ and $e = f(k,m) - x_1 = x_1^* - f(k^*,m^*) > 0$ and $t < t^*$

Case B: $e = 0$ and $e^* = f(k^*,m^*) - x_1^* = x_1 - f(k,m) > 0$ and $t > t^*$

Case C: $e^* = 0$ and $e = f(k,m) - x_1 = x_1^* - f(k^*,m^*) > 0$ and $t > t^*$

Case D: $e = 0$ and $e^* = f(k^*,m^*) - x_1^* = x_1 - f(k,m) > 0$ and $t < t^*$

In the first two cases, the high-tax country is importing, so the firm will wish to maximize q. In the last two cases, the high-tax country is exporting, and the firm will wish to minimize q.

In all four of these cases, $e^* - e = x_1 - f(k,m)$. Making this substitution in (2.43) generates general first order conditions as follows:

(2.44) x_1: $(1-t)\left(p_1 h' - q\right) - (1-t^*)(p_1^* h^{*\prime} - q) = 0$

(2.45) K: $p_1^* h^{*\prime} = \frac{1}{f_1^*}$

(2.46) k: $p_1^* h^{*\prime}(f_1 - f_1^*)(1-t^*) + (1 - qf_1)(t - t^*) = 0$

(2.47) m: $p_1^* h^{*\prime}(f_2 - f_2^*)(1-t^*) - qf_2(t - t^*) = 0$

With marginal cost pricing, $q = \frac{1}{f_1^*} = \frac{1}{f_1}$, these conditions simplify to:

(2.44’) $p_1 h' = \frac{1}{f_1}$,

(2.45’) $p_1^* h^{*\prime} = \frac{1}{f_1^*}$

(2.46’) $f_1 = f_1^*$

(2.47’) $f_2(1-t) = f_2^*(1-t^*)$

In this case, there is no distortion to the allocation of capital, but there is to the allocation of managerial skill.

More generally, consider first Case A, with $t < t^*$, where the home plant is exporting, and where the firm wishes to maximize q. From the k condition $q > \frac{1}{f_1}$ implies that $f_1 < f_1^*$. That is, with transfer pricing manipulation, production is shifted from the foreign country to the home country, reducing f_1 and increasing f_1^*, increasing exports from the home country. Relative to the marginal cost pricing case, in this case $q > \frac{1}{f_1}$ would also increase $f_2^* - f_2 > 0$, also pushing more intellectual property to the home country. By symmetry, the same result, that exports from the low-tax country increase, will hold for Case B. Now consider Case C, with $t > t^*$, where again the home firm is exporting, but now the firm wishes to minimize q. From the k condition $q < \frac{1}{f_1}$ again implies that $f_1 < f_1^*$. That is, with transfer pricing manipulation, production is again shifted from the foreign country to the home country, reducing f_1 and increasing f_1^*, increasing exports from the home country. Relative to the marginal cost pricing case, in this case $q < \frac{1}{f_1}$ would reduce $f_2 - f_2^* > 0$, again pushing more intellectual property to the home country. By symmetry, the same result, that exports from the high-tax country increase, will hold for Case D.

Thus, we have the interesting result that, regardless of whether the high-tax or low-tax country exports, the ability to manipulate transfer prices makes export activity more attractive and causes the firm to adjust the location of production accordingly. Thus, the ability of the firm to manipulate transfer prices does not necessarily lead the firm to shift *production* to the low-tax country, unless it also leads the firm to *export* from the low-tax country in the absence of transfer pricing manipulation. Certainly, by expression (2.47'), the firm already will have the tendency to locate intellectual property in the low-tax country, making that country more likely to export. On the other hand, the low-tax country might also have a stronger demand for good 1, increasing the likelihood that it would import.

For Cases A and B, where the firm would like to maximize q, in the extreme where the firm can raise q arbitrarily, a profit constraint that binds the choice of q. That is, the firm raises q to the point at which there are zero profits in the importing, high-tax country. This assumption alters the first-order conditions, because it makes q endogenous with respect to production decisions. In fact, things become very simple, because all profits now appear in the low-tax country. For example, for Case A, in which $t < t^*$ and $e > 0$, profits are:

$$\pi = [(p_1 h(f(k, m) - e) - k) + (p_1^* h(f(K - k, M - m) + e) - (K - k))](1 - t).$$

This leads to first-order conditions:

(2.44A) e: $\quad p_1 h' = p_1^* h^{*'}$

(2.45A) K: $\quad p_1^* h^{*'} = \frac{1}{f_1^*}$

(2.46A) k: $\quad \left(p_1 h' f_1 - 1\right) - (p_1^* h^{*\prime} f_1^* - 1) = 0$

(2.47A) m: $\quad f_2 = f_2^*$

That is, all tax distortions disappear, since all profits are effectively taxed at the low-tax country's tax rate. Comparing this for the more general case discussed above, an initial rise in q above $\frac{1}{f_1}$ shifts production to the exporting country and drives an increasing wedge between f_1 and f_1^*. However, eventually as a smaller and smaller share of profit is taxed in the high tax country, the wedge falls, until it reaches zero where all profit is taxed in the low tax country.

For Cases C and D, an obvious natural lower bound for q is $q = 0$. Whether this is feasible depends not only on the respective governments' enforcement and information, but also on whether setting q this low drives profits below zero in the exporting country. If we assume not, i.e., that the constraint that the exporting country's profits are non-negative is not binding at $q = 0$, then the first-order conditions imply that:

(2.44C) $$p_1 h' = \frac{1}{f_1}$$

(2.45C) $$p_1^* h^{*'} = \frac{1}{f_1^*}$$

(2.46C) $$\frac{f_1}{1-t} = \frac{f_1^*}{1-t^*}$$

(2.47C) $$f_2 = f_2^*$$

Condition (2.46C) indicates that the country with the lower tax rate, which is the importing country, has a higher marginal product of capital. The shift of capital to the exporting country occurs because it gives the firm an opportunity to export more and shift more profits to the low-tax importing country. Condition (2.47C) indicates that the marginal product of intellectual capital is no longer lower in the low-tax country; so much intellectual capital is shifted to the exporting country that the initial bias in the location of intellectual capital disappears.

Because of the complexity of the analysis for source-based taxation, in particular the four cases and the need to specify how transfer prices might be manipulated, we will not, at this point, analyze the choice of government spending. However, the nature of the distortions present, which we have seen influence the choice of government spending, will be discussed in the next session.

3. Would Countries Choose to Deviate from a Source-Based Tax?

Since source-based taxes are a standard form of taxation, it is worth asking whether an individual country would have an incentive to move to a different tax base, starting from an equilibrium in which each country relies only on a source-based tax.

Because of the complexity of the question, we begin by assuming in analyzing it that the two countries have the same utility functions, so that there will be a symmetric equilibrium under the initial source-based tax, with the same initial tax rate and no net exports.[10] We then go on to consider the more complex case without symmetry.

We also assume a Nash equilibrium, that is, that each country chooses its tax policy assuming that the policy of the other country is fixed. In this environment, we ask whether the home country would wish to deviate from the equilibrium by introducing either a small destination-based tax cash-flow tax or a small sales tax on good 1, which we showed to have similar effects to a cash-flow tax with formula apportionment. By the envelope theorem, we can ignore the benefits of changes in the level of government spending, assuming that the government always sets spending at its optimal level. Thus, we consider

[10] When symmetric equilibria exist we limit our attention to these and do not consider other possible equilibria.

in each case the substitution of the new tax for the old, keeping the level of public goods fixed.

3.1. Would the home country adopt a destination-based cash-flow tax?

3.1.1. Symmetric case

Suppose that we start with a symmetric equilibrium in which both countries have equal source-based taxes, levied at rates $s = s^*$ and no other taxes. So that we do not have to keep track of associated prices changes, we assume for simplicity that the destination-based tax is implemented in its equivalent form of a lump-sum tax, at rate z, on the home country's share of profits. Let ε be the experiment. Then the change in welfare with respect to ε equals $dY/d\varepsilon$, since government spending g is unchanged and hence $dT/d\varepsilon = 0$. To keep revenue the same, the changes in s and z must satisfy:

(3.1) $$\frac{ds/d\varepsilon}{dz/d\varepsilon} = \frac{dT/dz}{dT/ds},$$

from which it follows that $dY/d\varepsilon > 0$ if and only if

(3.2) $$\frac{dY/dz}{dT/dz} > \frac{dY/ds}{dT/ds}.$$

From (2.28), the effects of a change in the tax rate on real income are:

(3.3) $$\frac{dY}{dz} = \frac{1}{2}\frac{d\pi}{dz} - c_1\frac{dp_1}{dz} \; ; \quad \text{and} \quad \frac{dY}{ds} = \frac{1}{2}\frac{d\pi}{ds} - c_1\frac{dp_1}{ds}$$

In this case, $p_1 = u'(c_1)$ and at the symmetric equilibrium

(3.4) $$\pi = (1 - z)\{(p_1 c_1 - k)(1 - s) + (p_1^* c_1^* - k^*)(1 - s^*)\},$$

We evaluate this at $z = 0$.

Since an increase in z is a lump-sum tax, its only behavioral impact will be to reduce g and c_2; prices, consumption of good 1 and capital are all unaffected. As a result,

(3.5) $$\frac{dY}{dz} = -\frac{\pi}{2} = -\frac{dT}{dz}$$

This is true for any of the regimes for the source-based tax, and so condition (3.2) therefore reduces to ${}^{dY}/_{ds} + {}^{dT}/_{ds} < 0$; that is, the increase in real income from reducing the source-based tax is larger than the decline in revenue.

With respect to the effects of a change in the source-based tax, the effect on real income is :

(3.6) $$\frac{dY}{ds} = \frac{1}{2}\frac{d\pi}{ds} - c_1\frac{dp_1}{ds} = \frac{1}{2}\left\{-(p_1c_1 - k) + (1-s)c_1\frac{dp_1}{ds} + (1-s^*)c_1^*\frac{dp_1^*}{ds}\right\} - c_1\frac{dp_1}{ds},$$

where other terms in $d\pi/ds$ are zero by the envelope theorem.

Total tax levied is

(3.7) $$T = z\frac{\pi}{2} + s(p_1c_1 - k - q^*e^* + qe)$$

Before differentiating this expression with respect to s, we must consider which of the four regimes applies, since even though e and e^* will be zero in the initial symmetric equilibrium, this will not be the case once s and z change. By expression (2.47'), the reduction in s would shift production to the home country, absent any adjustment in q. And, as noted above, manipulating transfer pricing will only serve to increase exports from the home country. Given that a reduction in s implies that $s < s^*$ and that the home country will export, this implies that case A must hold, i.e., that $e^* = 0$ and $e = f(k,m) - x_1$.[11] In this case,

(3.8) $$T = s\big(p_1 c_1 - k - q x_1 + q f(k,m)\big).$$

and so, (using $c_1 = h(x_1)$ and $\frac{df}{ds} = f_1 \frac{dk}{ds} + f_2 \frac{dm}{ds}$):

(3.9) $$\frac{dT}{ds} = p_1 c_1 - k - q x_1 + q f(k,m)$$
$$+ s\left(c_1 \frac{dp_1}{ds} + \left(p_1 h' - q\right)\frac{dx_1}{ds} - (1 - q f_1)\frac{dk}{ds} + q f_2 \frac{dm}{ds} + \left(f(k,m) - x_1\right)\frac{dq}{ds}\right)$$

In the initial symmetric equilibrium, $f(k,m) = x_1$. Also, because in this equilibrium the firm wishes neither to overstate nor understate its transfer price, we may assume that $q = 1/f_1$. Hence, (by (2.44')), $p_1 h' = q$. With these taken into account, (3.9) becomes:

(3.9') $$\frac{dT}{ds} = p_1 c_1 - k + s\left(c_1 \frac{dp_1}{ds} + \frac{f_2}{f_1}\frac{dm}{ds}\right)$$

Combining (3.6) with (3.9') generates the following condition for an increase in welfare under a switch to the destination-based tax, i.e.: ${}^{dY}/_{ds} + {}^{dT}/_{ds} < 0$:

(3.10) $$-s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1 c_1 - k}{2} + \frac{(1-s)c_1}{2}\left(\frac{dp_1^*}{ds} - \frac{dp_1}{ds}\right)$$

We can solve for $\left(\frac{dp_1^*}{ds} - \frac{dp_1}{ds}\right)$ from equations (2.44)-(2.47) using comparative statics, again assuming that we start at a symmetric equilibrium with marginal cost transfer pricing. From these four equations, we obtain:

[11] We show below that the pattern of production and consumption is consistent with this assumption.

(3.11) $\frac{d(p_1 h')}{ds} = \frac{d(p_1^* h^{*\prime})}{ds}$

(3.12) $\frac{d\left(p_1^* h^{*\prime} f_1^*\right)}{ds} = 0$

(3.13) $\frac{d(p_1 h' f_1)}{ds} = \frac{d\left(p_1^* h^{*\prime} f_1^*\right)}{ds}$

(3.14) $\frac{df_2}{ds} - \frac{df_2^*}{ds} = \frac{f_2}{(1-s)}$

where the right-hand side of the last expression uses the fact that $p_1^* h^{*\prime} = \frac{1}{f_1^*}$ from (2.45). Combining the first three of these expressions implies that

(3.15) $\frac{df_1}{ds} - \frac{df_1^*}{ds} = 0$

That is, starting from marginal-cost transfer pricing, there is no distortion of capital allocation because of the cash-flow tax base, even under source-based taxation. From (3.11), we have:

(3.16) $\frac{dp_1^*}{ds} - \frac{dp_1}{ds} = -\frac{h''}{h'} p_1 \left(\frac{dx_1^*}{ds} - \frac{dx_1}{ds}\right)$

However, given that marginal utility equals the price in each country, it also is the case that

(3.17) $\frac{dp_1^*}{ds} - \frac{dp_1}{ds} = u'' h' \left(\frac{dx_1^*}{ds} - \frac{dx_1}{ds}\right)$

Since $-\frac{h''}{h'} p_1 > 0$ and $u'' h' < 0$, these two equations can hold simultaneously only if $\left(\frac{dx_1^*}{ds} - \frac{dx_1}{ds}\right) = 0$. Hence, $\frac{dp_1^*}{ds} - \frac{dp_1}{ds} = 0$ and expression (3.10) becomes

(3.10') $-s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1 c_1 - k}{2}$

The left-hand side of this expression, which will be positive, represents the increased revenue generated from attracting managerial capital by reducing the source-based tax. This term reflects the efficiency gain from reducing the tax on a mobile factor. The right-hand side of the expression, equals the net tax exporting that is given up by switching to the destination-based tax. We do not have a definitive result about whether the inequality holds, although, *ceteris paribus*, a higher initial value of s would make the result more likely.

Note that, even though relative consumption doesn't change, production does shift. Combining (3.14) and (3.15), we obtain:

(3.18) $$\frac{dm^*}{ds} - \frac{dm}{ds} = -\frac{f_{11}}{D}\frac{f_2}{(1-s)} > 0$$

(3.19) $$\frac{dk^*}{ds} - \frac{dk}{ds} = \frac{f_{12}}{D}\frac{f_2}{(1-s)} > 0$$

where $D = f_{11}f_{22} - f_{12}f_{21} > 0$ is the determinant of the Hessian of the production function. Since both m and k shift abroad with an increase in s, it is obvious that the first stage of production shifts abroad. Put another way, as the home country *lowers* its source based tax, production shifts to the home country and the home country begins exporting, consistent with the assumption that Case A applies.

3.1.2. Asymmetric case

Now consider the more general case without imposing symmetry. Then the transfer price would affect the tradeoff in (3.10). Begin with the general expression for profit,

(3.20) $$\pi = (1-z)(p_1c_1 - k)(1-s) + (p_1^*c_1^* - k^*)(1-s^*) - q(f(k,m) - x_1)(s - s^*)$$

evaluated at z = 0. We now have

$$(3.21)\ \frac{dY}{ds} = \frac{1}{2}\begin{Bmatrix} -p_1c_1 + k - q(f(k,m) - x_1) - s(f(k,m) - x_1)\frac{dq}{ds} \\ +(1-s)c_1\frac{dp_1}{ds} + (1-s^*)c_1^*\frac{dp_1^*}{ds} \end{Bmatrix} - c_1\frac{dp_1}{ds}$$

while dT/ds is the same as in (3.9). Combining, these expressions, rearranging and using $p_1h' = 1/f_1$ (from (2.45)[12]), we can write the condition for welfare improvement as:

$$(3.22)\qquad -s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1c_1+q(e-e^*)-k}{2} + \frac{1}{2}\left[(1-s^*)c_1^*\frac{dp_1^*}{ds} - (1-s)c_1\frac{dp_1}{ds}\right]$$
$$+s(q-1/f_1)\left\{\frac{d(f(k,m)-x_1)}{ds}\right\} + s\frac{(f(k,m)-x_1)}{2}\frac{dq}{ds}$$

The first line of this expression is similar to that in (3.10). Compared to (3.10), the first term on the right-hand side is adjusted simply to reflect the fact that profits based on domestic production must now incorporate the difference between domestic consumption and domestic production. The only other difference in the first line is that we do not use the assumption of symmetry in combining the effects on the two output prices (and cannot generally show that these two price changes are equal). However, the interpretation of this line is similar to that above.

The introduction of asymmetry also introduces the second line. There are two new terms, both relating to the transfer prices associated with exports, and both reflecting the change in home country tax revenue. The first element reflects the effect on net exports from the home country of a change in *s*; this term is zero with marginal cost pricing. The second term reflects effect of the tax on net profits, and is thus divided by 2, since half of

[12] While this expression refers to the foreign country, the symmetry of the analysis implies that it holds for the home country as well.

the profit accrues to non-residents. This term reflects the effect of a change in tax on the value of exports through a change in the transfer price, again in response to a change in s. To interpret the impact of these new terms in this expression, it is useful to distinguish the effects of asymmetry per se and the separate effects of the deviations from marginal cost transfer pricing that arise as a result of cross-border trade and differences in tax rates.

In an asymmetric equilibrium with marginal cost pricing, expressions (3.11)-(3.13) still hold (although (3.14) is different because s and s^* need not be equal). Thus, it will still be the case that $\frac{dp_1^*}{ds} - \frac{dp_1}{ds} = 0$, so the second term on the right-hand side of (3.22) reduces to $\frac{1}{2}[(1-s^*)c_1^* - (1-s)c_1]\frac{dp_1}{ds}$. The third term on the right-hand side vanishes with marginal cost pricing, since $q = 1/f_1$. The final term equals $\frac{(f(k,m)-x_1)}{2} s \frac{dq}{ds}$ (where q changes with s only because of a change in f_1). So, we may rewrite (3.22) as

$$(3.22') \qquad -s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1c_1 + q(e-e^*) - k}{2} + \frac{1}{2}[(1-s^*)c_1^* - (1-s)c_1]\frac{dp_1}{ds} + \frac{s}{2}(e-e^*)\frac{d(\frac{1}{f_1})}{ds}$$

Compared to (3.10'), the first term on the right-hand side is adjusted simply to reflect the presence of exports. The second and third terms, which each equal zero starting in a symmetric equilibrium, no longer do so here, even though it is still the case that $\frac{dp_1^*}{ds} = \frac{dp_1}{ds}$. These two terms pick up further effects on after-tax profits occurring indirectly through price changes.

The net effect of these terms relating to changes in p_1 and q will generally be indeterminate. For example, consider the case in which preferences are the same in the two countries, so that equal prices for good 1 translate into equal consumption of good 1 and the term in square brackets simplifies to $(s - s^*)c_1$. In this case (with equal preferences), the exporting country will be that with a lower tax rate. Thus, $(s - s^*)$ and $(e - e^*)$ will be of the opposite sign. Assuming that prices move in the same direction (i.e., an increase in input prices induces an increase in output prices), the second and third terms on the right-hand side of (3.22') will have the opposite sign regardless of which country starts with a lower tax rate.

For the more general case with transfer-pricing manipulation expression (3.22) may be rewritten as:

$$(3.22'') \quad -s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1c_1+q(e-e^*)-k}{2} + \frac{1}{2}\left[(1-s^*)c_1^*\frac{dp_1^*}{ds} - (1-s)c_1\frac{dp_1}{ds}\right] + \frac{s}{2}(e-e^*)\frac{d(\frac{1}{f_1})}{ds}$$

$$+s(q - 1/f_1)\left\{\frac{d(e-e^*)}{ds}\right\} + s\,\frac{(e-e^*)}{2}\frac{d(q-1/f_1)}{ds}$$

Compared to the case where marginal cost transfer pricing was assumed, we now have two new terms, in the second line. To assess the signs of these, we have to consider the effects on the volume of exports and the transfer price separately the four cases described above. In general, a rise in s has both direct and indirect effects on the volume of exports and the transfer price.

Case A. Here $s < s^*$, the firm is exporting from the home country so that $f(k,m) > x_1$ and the firm is consequently maximizing the transfer price, so that $q > 1/f_1$. Given a transfer price, the reduction in the tax rate differential would have a direct impact on the incentive to export, leading to a reduction in exports over and above the reduction we would expect to arise even with marginal cost pricing due to the higher domestic tax rate. And given the volume of exports, the reduction in the tax rate differential would also directly reduce the incentive to overstate the transfer price, so that q would fall relative to

$1/f_1$. In addition to these direct effects would be interactions: a lower volume of exports would reduce the gains from manipulating the transfer price, which would tend to reduce q still further. And the direct effect on the transfer price would reduce the benefit of exporting, which would tend to reduce exports still further.

Combined, therefore, these effects reinforce each other, so that both the volume of exports, and the transfer price, fall. As a consequence both the new terms should be negative, increasing the chance of the reform being undertaken. Lowering the source-based tax would increase the benefits derived by the low-tax home country from transfer-pricing manipulation.

Case B. In this case the home country is the net importer, so that $f(k, m) < x_1$; $s > s^*$, and the firm is consequently maximizing the transfer price, so that, again, $q > 1/f_1$. A rise in s would increase the tax rate differential. An increase in the differential would have the direct effect of inducing more production to take place abroad (both because of the incentive to shift production abroad due to a higher tax at home and the greater payoff to trade-based transfer pricing manipulation), raising imports. It would also probably have a direct effect by raising the transfer price further. These two effects are again self-reinforcing. The higher volume of imports would induce a further rise in the transfer price, and the rise in transfer price would further increase imports. These effects again imply that both terms are unambiguously negative, making the condition more likely to hold. Here, lowering the source-based tax limits the damage that the high-tax home country suffers from transfer-pricing manipulation.

Case C. This is a case where the firm is exporting from the home country, so that $f(k, m) > x_1$. But, unlike in Case A, $s > s^*$, and the firm is consequently *minimizing* the transfer price, so that $q < 1/f_1$. A rise in s would now increase the tax rate differential between the two countries. For a given transfer price, a rise in the tax differential would have an ambiguous direct effect on exports from the home country, since the transfer-pricing gain from exporting is increased, but the increase in domestic production costs discourages domestic production and exports. Conditional on the volume of exports, a rise in s would also probably directly induce a reduction in the transfer price, to take advantage of the increased tax differential. As to interaction effects, the direct reduction in the transfer price would increase the value of exports, and so would lead indirectly to higher exports, but the direction of the effect of exports on the transfer price is uncertain because of the uncertain direct impact on exports. The net effects on both the volume of exports and the transfer price are therefore ambiguous. Neither of the additional terms can therefore be signed.

Case D. The home country is the net importer, so that $f(k, m) < x_1$. Now $s < s^*$, and the firm is consequently minimizing the transfer price, so that $q < 1/f_1$. As with case C, the effects on the volume of imports and the transfer price of a rise in s are ambiguous. The direct effect of a reduction in the tax rate differential would be to reduce imports because of a lower transfer-pricing benefit of trade, but to increase imports because of higher home production costs. Thus, the direct effect on imports is ambiguous, for the same reason given in Case C. Also, the direct effect of the smaller tax rate differential would be to raise the transfer price, and this would have the indirect effect of encouraging more imports. But, as in Case C, the first term is still of ambiguous sign, and hence so is its indirect effect on the second term. Hence, both terms are of ambiguous sign, as in Case C.

In sum, transfer pricing manipulation increases the incentive to move away from the source-based tax in Cases A and B. We might consider these the "normal" cases, where the lower-tax country is exporting. The reasoning is different in the two cases, though, with the low-tax country in Case A lowering its tax rate to benefit more from the multinational's transfer pricing manipulation, and the high-tax country in Case B lowering its rate to reduce the damage that it suffers from transfer pricing manipulation. In the other two cases, though, the picture is less clear, because the high-tax country is also the exporting country. These cases would arise only where the high-tax country also has a stronger demand for the good produced by the multinational, given that the initial move away from a symmetric equilibrium leads the higher-tax country to import.

3.2. Would the home country adopt a sales tax on good 1?

Suppose now that we start with a symmetric equilibrium in which both countries have equal source-based taxes ($s = s^*$) and the home country considers introducing a sales tax on good 1 at rate *t*, as an equal-yield replacement for *s*. As in the previous case, welfare will increase if and only if

$$(3.23) \qquad \frac{dY/dt}{dT/dt} > \frac{dY/ds}{dT/ds}.$$

Because we are starting from the same equilibrium, the changes in Y and T with respect to s are the same as in (3.6) with (3.9'), and the discussion relating to these expressions holds as well. Now, consider the corresponding terms for *t*. Since

$$(3.24) \quad \pi = (1-s)\big((1-t)p_1c_1 - k\big) + (1-s^*)\big((1-t^*)p_1^*c_1^* - k^*\big) + q(e^* - e)(s - s^*),$$

the effect of a change in t on real income, starting at t = 0 in the symmetric equilibrium, is therefore (following the same approach as in (2.29)):

(3.25) $$\frac{dY}{dt} = \frac{1}{2}\frac{d\pi}{dt} - c_1\frac{dp_1}{dt} = -\frac{1}{2}\left((1-s)p_1c_1 + (1+s)c_1\frac{dp_1}{dt} - (1-s^*)c_1^*\frac{dp_1^*}{dt}\right)$$

Now consider the changes in T. We again may assume that case A holds, and so we have:

(3.26) $$T = tp_1c_1 + s\big((1-t)p_1c_1 - k - qx_1 + qf(k,m)\big)$$

Therefore, following the logic used in deriving (3.9'), we obtain

(3.27) $$\frac{dT}{dt} = (1-s)p_1c_1 + s\left(c_1\frac{dp_1}{dt} + qf_2\frac{dm}{dt}\right) = (1-s)p_1c_1 + sc_1\frac{dp_1}{dt},$$

where the last equality comes from the fact that the sales tax does not distort the location of intangible assets, as discussed above. We therefore may express condition (3.23) as:

(3.23') $$\frac{-\frac{1}{2}\left((1-s)p_1c_1+(1+s)c_1\frac{dp_1}{dt}-(1-s^*)c_1^*\frac{dp_1^*}{dt}\right)}{(1-s)p_1c_1+sc_1\frac{dp_1}{dt}} > \frac{-\frac{1}{2}\left\{(p_1c_1-k)+(1+s)c_1\frac{dp_1}{ds}-(1-s^*)c_1^*\frac{dp_1^*}{ds}\right\}}{p_1c_1-k+s\left(c_1\frac{dp_1}{ds}+\frac{f_2}{f_1}\frac{dm}{ds}\right)}$$

Using the fact that we are initially in a symmetric equilibrium and $\frac{dp_1}{ds} = \frac{dp_1^*}{ds}$, this further simplifies to:

(3.23") $$\frac{-\frac{1}{2}\left((1-s)p_1c_1+(1+s)c_1\frac{dp_1}{dt}-(1-s^*)c_1^*\frac{dp_1^*}{dt}\right)}{(1-s)p_1c_1+sc_1\frac{dp_1}{dt}} > \frac{-\frac{1}{2}(p_1c_1-k)-sc_1\frac{dp_1}{ds}}{p_1c_1-k+s\left(c_1\frac{dp_1}{ds}+\frac{f_2}{f_1}\frac{dm}{ds}\right)}$$

Note, from expression (2.24), that

$$-p_1h' + \frac{d(p_1h')}{dt} = \frac{d(p_1^*h^{*'})}{dt}$$

Consider first the special case where there are no consumption rents, so that h' is constant and equal across the two countries. Then this expression becomes:

$$-p_1 + \frac{dp_1}{dt} = \frac{dp_1^*}{dt}$$

and (3.23") becomes:

$$(3.23''') \qquad -1 > \frac{-\frac{1}{2}(p_1c_1 - k) - sc_1\frac{dp_1}{ds}}{p_1c_1 - k + s\left(c_1\frac{dp_1}{ds} + \frac{f_2}{f_1}\frac{dm}{ds}\right)}$$

The left-hand side of (3.23''') equals 1 because *dY/dt = -dT/dt* in this case – there is neither a production distortion nor tax exporting. This expression is satisfied if

$$-s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > \frac{p_1c_1 - k}{2}$$

which is the same expression as (3.10'); when there is no tax exporting under the sales tax, the decision is the same as under the destination-based tax.[13] However, if there are consumption rents, then

$$-p_1 + \frac{dp_1}{dt} < \frac{dp_1^*}{dt}$$

since some of the sales tax wedge will show up in a reduced producer price. This reduces in absolute value the numerator of the left-hand side of (3.23"), making it more likely that the condition will be met (since the overall term is negative); with consumption rents, some of

[13] One might have expected the condition to differ from (3.10') even in this special case, since the sales tax introduces a consumption distortion that is not present under the destination-based tax. However, our experiment here considers the introduction of a small sales tax, starting from an initial value of zero, for which there is no first-order deadweight loss. For a larger tax change, the adoption of a sales tax would presumably be less attractive because of the associated consumption distortion, although the analysis would also be more complicated.

the burden of the sales tax is shifted onto producers, and some of this burden on producers is borne by owners in the other country.

4. Local ownership of fixed factors

We now modify the model, assuming that the rents to the fixed factors accrue to domestic residents instead of to the multinational. There are two fixed factors implicit in the two production functions $f(k,m)$ and $h(x_1)$. Assuming these factors are owned by domestic residents is equivalent, in our model where there is a representative consumer in each country, to modifying our assumption about the sharing of profits to one where domestic profits attributable to these two factors are received by domestic residents.

With this modification, consider again the issue of whether the home country will wish to shift from a source-based tax to a destination-based tax, starting again from the assumption that the initial equilibrium is symmetric. In place of equation (3.4), the definition of overall profits, we now have profits of domestic residents, say $\hat{\pi}$:

$$(3.4')\quad \hat{\pi} = (1-z)\left((1-s)\left\{(p_1c_1 - k + qe - qe^*) - \frac{p_1h'f_2m}{2}\right\} + (1-s^*)\frac{p_1^*{h^*}'f_2^*(M-m)}{2}\right)$$

where the terms divided by 2 represent the domestic and foreign components of the multinational's remaining profits, from managerial capital.[14]

Based on (3.4'), the change in domestic income with respect to s is now (as we are assumed to be in Regime A):

[14] Note that the domestic term is subtracted to account for the fact that only half of this component of domestic earnings goes to the domestic resident.

(3.6’) $\frac{dY}{ds} = \frac{d\hat{\pi}}{ds} - c_1 \frac{dp_1}{ds} = \left\{-(p_1 c_1 - k) + (1-s)\left(c_1 \frac{dp_1}{ds} + p_1 \frac{dc_1}{ds} - \frac{dk}{ds} + q\frac{de}{ds}\right)\right\} - c_1 \frac{dp_1}{ds}$

$$-(1-s)p_1 h' f_2 \frac{dm}{ds} + \frac{p_1 h' f_2 m}{2} + (1-s)\frac{m}{2} p_1 h' \left(\frac{df_2^*}{ds} - \frac{df_2}{ds}\right)$$

$$= -(p_1 c_1 - k) - s c_1 \frac{dp_1}{ds} + (1-s)\left(p_1 \frac{dc_1}{ds} - \frac{dk}{ds} + q\frac{de}{ds}\right)$$

$$-(1-s)p_1 h' f_2 \frac{dm}{ds} + \frac{p_1 h' f_2 m}{2} + (1-s)\frac{m}{2} p_1 h' \left(\frac{df_2^*}{ds} - \frac{df_2}{ds}\right)$$

Given marginal cost transfer pricing, $p_1^* h^{*'} = q = 1/f_1$, and from (3.14), we have:

$$\left(\frac{df_2}{ds} - \frac{df_2^*}{ds}\right) = \frac{f_2}{(1-s)}$$

and the last line in expression (*3.6*’) becomes:

(4.1) $-(1-s)\frac{f_2}{f_1}\frac{dm}{ds} + \frac{f_2 m}{2f_1} - \frac{f_2 m}{2f_1} = -(1-s)\frac{f_2}{f_1}\frac{dm}{ds}$

Substituting this into (3.6’) and adding the resulting expression for dY/ds to dT/ds as defined in (3.9’) yields the following condition in place of (3.10):

(3.10”) $-s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > (1-s)\left(p_1 \frac{dc_1}{ds} - \frac{dk}{ds} - \frac{f_2}{f_1}\frac{dm}{ds} + q\frac{de}{ds}\right)$

One may interpret the right-hand side of (3.10”) as the change in “pure” profits resulting from the shift in domestic production spurred by the change in *s*, with the marginal cost of managerial skill taken into account. This will be zero for the optimizing firm, as we see by expanding this term:

(4.2) $p_1 \frac{dc_1}{ds} - \frac{dk}{ds} - \frac{f_2}{f_1}\frac{dm}{ds} + q\frac{de}{ds} = p_1 h'\left(f_1 \frac{dk}{ds} + f_2 \frac{dm}{ds} - \frac{de}{ds}\right) - \frac{dk}{ds} - \frac{f_2}{f_1}\frac{dm}{ds} + q\frac{de}{ds}$

$$= \left(p_1 h' f_1 - 1\right)\frac{dk}{ds} + \left(q - p_1 h'\right)\frac{de}{ds} = 0$$

where the last equality follows from the assumption of marginal cost transfer pricing. Thus, expression (3.10”) reduces to the simple inequality condition,

(4.3) $$-s\left(\frac{f_2}{f_1}\frac{dm}{ds}\right) > 0$$

Compared to expression (3.10’), there is no positive term on the right-hand side, because there is no tax exporting when domestic rents are owned by domestic factors. Thus, the home country will not wish to distort production.

5. Conclusions

This paper models the effects of alternative forms of consumption-type taxes in a two-country model with trade of semi-finished goods and mobile factors of production.

In our base case, we consider a representative multinational that produces and sells in each of the two countries and allocates capital and managerial skill between the two countries for production. There are three sources of rents for the multinational: a fixed factor in each country of basic production; managerial skill, owned by the company, and mobile between the two countries; and a fixed factor in the country of consumption, associated with preparing the semi-finished good for the local market. We consider three main forms of cash-flow taxation, all of which would be equivalent in a closed economy: a cash-flow tax levied on the multinational on a source basis, the equivalent tax levied on a destination basis, and one whose base is allocated using sales-only formula apportionment (the effects of which can be studied by analyzing a sales tax levied on the good produced by the multinational.) We describe the forms of distortion to production and consumption generated by these taxes.

We investigate whether there is an incentive for a national government to move away from an equilibrium in which both countries use only the source-based tax. We show that the government faces a trade-off. One the one hand, movement away from a source-based tax to a destination-based tax reduces distortions and improves welfare. This result may be reinforced by the presence of transfer-pricing manipulation by firms, either by pushing a high-tax country to lower its tax to reduce the incentives for such manipulation (from which it suffers), or by leading a low-tax country to lower its tax still further to encourage an expansion of such manipulation (from which it benefits). On the other hand, the source-based tax is partially incident on the owners of the multinational; since some of them may be non-residents, the tax can improve the welfare of domestic residents, if its distortions are small relative to this shifting. For a shift to the sales-apportioned tax, the calculus is somewhat more complicated, as the apportioned tax may also partially be shifted to non-residents, but also introduces various distortions (not all of which are incorporated in our analysis) absent under the destination-based tax.

However, the potential attractiveness of the source-based tax evaporates if the returns to fixed production factors in each country are captured by domestic residents, so that the rent of the multinational is due solely to its ownership of managerial skill. In this case, the source-based tax is incident only on domestic residents, and so its main potential benefit for the national government is no longer present. This tax does, however, continue to distort the choice of where to locate mobile managerial skill. This distortion reduces welfare, and can be reduced by a substitution away from the source-based tax in the direction of the destination-based tax, or a sales (or sales-apportioned) tax.

REFERENCES

Auerbach, A.J. (1997) "The Future of Fundamental Tax Reform", *American Economic Review* 87, 143-146.

Auerbach, A.J. (2011) "Consumption Tax Options for California", Technical Appendix, Public Policy Institute of California Report, June.

Avi-Yonah, R. (2000) "Globalization, Tax Competition, and the Fiscal Crisis of the Welfare State", *Harvard Law Review*, 113, 1573-1676.

Avi-Yonah, R. and K. Clausing (2008) "Reforming Corporate Taxation in a Global Economy: A Proposal to Adopt Formulary Apportionment" in Jason Furman and Jason E. Bordoff, eds. *Path to Prosperity: Hamilton Project Ideas on Income Security, Education, and Taxes*, 319-344.

Bradford, D. (2003) "The X Tax in the World Economy", *CEPS Working Paper 93*, Princeton.

Devereux, M.P. and S.R. Bond (2002) "Cash Flow Taxes in an Open Economy", *CEPR Discussion Paper 3401*.

Gordon, R.H. (1986) "Taxation of Investment and Savings in a World Economy", *American Economic Review* 76, 1086-1102.

Gordon, R.H. and J.D. Wilson (1986) "An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment", *Econometrica* 54, 1357-1373.

Grubert, H. and T. S. Newlon (1997) "Taxing Consumption in a Global Economy", Washington D.C.: American Enterprise Institute.

Keen, M. and S Lahiri (1998) "The Comparison between Destination and Origin Principles under Imperfect Competition," *Journal of International Economics* 45, 323-350.

Lockwood, B. (1993) "Commodity Tax Competition Under Destination and Origin Principles" *Journal of Public Economics* 53, 141-162.

Lockwood, B. (2001) "Tax Competition and Tax Co-ordination under Destination and Origin Principles: a Synthesis", *Journal of Public Economics* 81, 279-319.

Meade, J. et al. (1978) *The Structure and Reform of Direct Taxation*, London: Allen and Unwin.