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Abstract

Neutrality has been a dominant theme in scholarly and policy debates on international taxation for fifty years. This paper questions whether the concept of tax neutrality is adequately specified for analyzing the efficiency properties of international tax systems. As distinct from the closed economy setting, in the open economy setting, tax incentive effects include the redirection of both capital and tax revenues from one jurisdiction to another. Because tax revenues finance infrastructure and other productivity-enhancing goods – so-called "tax amenities" – and because capital burdens infrastructure, one consequence of the reallocation of tax revenues and assets is the adjustment of non-tax-affected rates of return in both home and host jurisdictions. As a result, what are viewed as tax incentive effects, or distortions, improve productivity in some cases. Neutrality as a value, however, rests on the idea that tax incentive effects reduce efficiency by causing resources to be allocated away from some optimum non-tax-affected baseline; this idea is what justifies referring to tax-influenced allocations as distortions. The implication of the argument is that the baseline is normatively arbitrary in the open-economy setting.

The paper suggests that in light of these considerations, an analysis focusing on the allocative, distributive and competitive properties of international tax rules would be more helpful than one focused on their neutrality properties. In this spirit, a simple model relating tax revenue and population to productivity is offered.

Tax Neutrality and Tax Amenities

Introduction

     In the economic analysis of international taxation, few policy goals loom larger than the promotion of tax neutrality, or the idea that tax considerations should not drive the economic decisions of private actors

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engaged, or potentially engaged, in cross-border activity.[1] Talk of neutrality animates official policy discourse,[2] while scholarly literature on the subject has become something of a cottage industry.[3] Many papers are devoted to promoting a particular conception of neutrality over one or more rival conceptions;[4] others develop or test various empirical claims about neutrality.[5] It is safe to say that the disagreements are substantive and the debates robust.[6]

Operating as part of background consensus are the assumptions that international tax neutrality is a well-defined concept and an ideal the pursuit of which, when properly conceived, is normatively appropriate. This paper argues that the assumptions are incorrect. The public finance model in which the concept of tax neutrality originally was developed applies to the closed economy setting. In that setting, it is possible to formulate the concept of a non-tax-affected world with sufficient rigor to specify a baseline of non-tax-distorted economic activity. The baseline, in turn, serves as the yardstick by which one can measure the distorting effects of taxes. As explained below, a centerpiece of the framework is the assumption that one may take levels of tax-financed infrastructure and other goods that contribute to productivity – "tax amenities," as I refer to them – as exogenously given.

In contrast to the domestic setting, in a system of open economies, the problem of non-neutrality arises because any system of rules for taxing cross-border arrangements induces flows of capital, labor or both across national boundaries and affects patterns of ownership as well.[7] It is well understood that these responses affect the productivity both of the assets that are somehow shifted in reaction to the rules and of all factors of production to the extent the relative supply of and demand for them are shifted through the first effect. But

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[1] Michael S. Knoll, *Reconsidering International Tax Neutrality*, __, at [draft at p. 1].

[2] *See, e.g.*, Testimony of R. Glenn Hubbard before U.S. House Subcommittee on Select Revenue Measures, June 22, 2006.

[3] A Westlaw search returned 212 results for articles in law journals having the terms "international" and "tax neutrality" in the same sentence. A JSTOR search of the same terms in economics journals returned 100 results.

[4] *E.g.*, Desai & Hines, *Old Rules and New Realities*, 57 NAT'L TAX J. 937 (2004).

[5] *See, e.g.*, *id.*, at 946-50 (citing studies).

[6] [CITE.]

[7] See Hines, *Reconsidering*, for a statement of the basic neutrality problem.

these responses have a third effect as well. They alter the quantity of tax revenue in every jurisdiction that is a part of the system. Because of the relationship, over the long term, between tax revenues and the supply of tax amenities, tax incentives circle back to affect both the pre-tax and the after-tax rates of return that function as baselines to start with, thereby upending their status as baselines.

Several conclusions would appear to follow. First, it is not clear that the concepts of tax neutrality and tax distortion in the international setting are meaningful. If it is impossible to articulate a neutral baseline, it would seem impossible to justify normative claims about the value of minimizing actual departures, that is, "distortions," from whatever is taken as the baseline. Second, any effort to model the impact of tax rules on capital flows or ownership patterns must account for the relationship between the provision of tax-financed amenities and the productive capacity of labor and capital. (Similar problems would apply to the analysis of tax-induced individual migration, but, following most of the literature,[8] I assume that individual migration is much less sensitive to tax rules, and I therefore disregard it.) It is not sufficient to account merely for the effects of tax rules on the supply of and demand for either capital or its owners, taking pre-tax rates of return as given. And third, it seems that a more useful mode of analysis would dispense with considerations of neutrality in favor of a focus on other significant properties of tax regimes, informed by an idea of how tax revenues affect productivity.

The paper develops these points as follows. Part I sets up the analysis by describing the traditional framing of the problem of tax distortions in cross-border investment. Part II describes the basic model of tax neutrality as developed in the closed economy setting and as it has been applied in the international setting. Part III offers criticisms of the application of the model to the evaluation of the basic methods of double tax relief – worldwide taxation and territorial taxation. Part IV defends the view that a productive framework for analysis would eschew neutrality considerations and take its bearings instead from the allocative, distributional and competitive properties of systems for taxing cross-border income.

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[8] *See e.g.*, Michael S. Kirsch, *Taxing Citizens in a Global Economy*, 82 N.Y.U. L. REV. 443, 493 (2007) (noting that few Americans change residence in response to tax rates). To the extent labor location is sensitive to taxes, the effects analyzed in this paper would be compounded. See Ruth Mason, *Tax Expenditures and Global Labor Mobility*, 84 N.Y.U. L. REV. 1540 (2009) for an extension of neutrality analysis to labor as a tax-sensitive factor of production.

I. The Problem of International Double Taxation

Tax non-neutrality in the international setting arises from the fact that at least two jurisdictions plausibly have a claim to tax income earned from cross-border arrangements: the jurisdiction of the place of investment (the "source" or "host") and the jurisdiction where its owner resides (the "residence" or "home"). By contrast, in the domestic setting there is generally only one plausible candidate to asses tax, as source and residence (host and home) are identical.

States, recognizing the magnitude of the bias toward domestic investment that would result if both home and host exercised their full prerogative to tax, have regularly sought to alleviate the high tax burden that otherwise would fall on cross-border income.[9] The general solution has been for residence states to cede all or a portion of their taxing power, whether by treaty, unilateral action, or combination of the two, so that the total rate faced by a taxpayer in the cross-border setting approximates the rate of one of the two states involved.[10] Where the effort is successful, exactly one tax (or an amount of tax exactly equal to the tax imposed by one of the states on its residents' domestic income) applies to all income whether earned domestically or abroad. So-called "double taxation" is eliminated.

The widely recognized difficulty with these solutions is that they address only partially the problem of non-neutrality, which persists because: (a) the location of capital, the location of its owners and, in more recent treatments, the identity of its owners all are somewhat elastic, (b) different jurisdictions impose different rates of tax, and (c) different jurisdictions adopt different methods of double tax relief.[11] In particular, because capital or its owner may seek the lowest possible tax, locational or ownership decisions continue to be driven by tax considerations, even though one or the other of the location or ownership decisions may be tax-neutral. The question then becomes which type of neutrality is least distorting, over all.[12]

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[9] [CITE.]

[10] *See generally* Adam Rosenzweig, *Why Are There Tax Havens?*, __ WILLIAM & MARY L. REV. __ (2010).

[11] Michael Graetz , *The David R. Tillinghast Lecture, Taxing International Income: Inadequate Principles, Outdated Concepts, and Unsatisfactory Policies*, 54 TAX L. REV. 261, 272 n.36 (2001).

[12] See Desai & Hines, at 955-75, for an example of this type of analysis.

A. The Basic Problem

To illustrate these points, consider the following three-stage analysis as applied to a simple system consisting of two states, State A and State B, in which a resident of State A has $100 to invest. Assume in the first stage that no taxes apply. If the State A resident has an investment opportunity that is expected to yield 9 percent if made in State A, but 10 percent if made in State B, the economically efficient decision is for the resident to make the investment in State B. Because no taxes apply, the State A resident realizes $10 of income after one year, and total wealth has concomitantly increased by $10. (In a dynamic model, investors from both states would continue to favor investment in State B until the after-tax return there converged with the after-tax return in State A, but for present purposes it is sufficient to use a static model.)[13]

Now, in the second stage, assume the same situation except that State A adopts a 35 percent rate of tax for all the income of its residents as well as for income produced domestically by non-residents, and State B adopts a 25 percent rate on an analogous basis. In the absence of any relief for double taxation, a resident of either state will face a tax rate at the level imposed solely by its residence for purely domestic investments, but a rate equal to the sum of the two states' rates, or 60 percent, for cross-border investments. (It is possible that a state would treat foreign taxes paid as a deductible business expense, but deductibility would merely alleviate the disparity between domestic and cross-border investment, not eliminate it. For the sake of simplicity, I omit discussion of the deduction model here.) Accordingly, even though the pretax yield and therefore total wealth is greater if the State A resident makes the investment in State B, the State A resident will make it domestically, because the after-tax yield there is greater: 5.85 percent versus 4 percent.[14] Without relief from double taxation, after one year, $9 of total wealth will be produced instead of $10, meaning that $1 of "deadweight loss" arises in the system. Again, although it can be expected that after-tax rates of return will equalize over time as capital investment responds to tax rates, the resulting allocations of capital and labor will be inefficient when compared with the allocations that would result in the absence of taxes, taking as a given in the latter case that tax revenues would be provided for in some fashion.[15]

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[13] *See, e.g.*, Fadi Shaheen, __.

[14] 5.85 percent is 9 percent reduced by 35 percent, and 4 percent is 10 percent reduced by 60 percent.

[15] *See, e.g.*, Knoll, at __.

As described above, the general solution to this problem is to eliminate one level of tax or an amount of tax equal to that imposed by one of the states. Thus, consider, in a third stage, two common alternative methods for achieving a single rate of tax: providing residents a credit against their domestic tax liability for foreign income taxes paid (a "foreign tax credit," or "FTC"), and exempting residents' foreign-source income, loss and expense from tax. Under either method, the problem of non-neutrality is alleviated but not eliminated. More generally, under any solution to the problem of double taxation where rates differ across jurisdictions, non-neutrality arises across some margin of possible taxpayer behavior.

1. First Variation: Worldwide Taxation with an Unlimited FTC

To see how tax distortion persists, assume in the first variation that both states tax the income earned in the source but that residence states provide an unlimited FTC to their residents for income foreign taxes paid. This model is generally referred to as residency-based, worldwide taxation.[16] Under the residency-based model, foreign taxes paid by the state's residents reduce domestic tax liability on a dollar-for-dollar basis. Further, since, in the base case, the credit is "unlimited," the resident's tax rate is fixed regardless of the rate in the source, because the resident state will reimburse its resident any excess of foreign taxes paid over domestic taxes due. Such an excess arises when the average tax rate in the source jurisdiction exceeds the average rate in the residence jurisdiction.

In this setting, the problem of double taxation is eliminated in the sense that each individual pays the same, domestic rate of tax regardless of where the investment is made. Moreover, taking the location of the resident and the identities of the owners of capital as fixed, tax neutrality is preserved, because the FTC regime eliminates the only remaining tax-based incentive, which is to adjust the location of the investment in response to taxes. That is, the resident of State A will face a 35 percent rate of tax whether the investment is made in State A or in State B: if in State A, State B has no basis to tax and the rate is 35 percent; if in State B, the State A resident pays a 25 percent tax to State B and receives a credit in the same amount to be applied against State A's 35 percent tax, leaving a 10 percent tax to be collected by State A, for a total tax of 35 percent. Analogous treatment will apply to an investor situated in State B, who will face a 25 percent rate no matter where the investment is made. (If it is made in State A, the State B investor pays $3.50 in tax but gets $1 from State B.) An unlimited foreign tax credit system thus results in neutrality over the location of capital investment. Under these assumptions,

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[16] [CITE.]

$10 of wealth is created after one year, just as in the non-tax world, but $3.50 in net tax revenue is collected if the investor resides in State A ($2.50 to State A and $1.00 to State B), and $2.50 if in State B ($3.50 to State A and -$1.00 to State B). This type of neutrality is referred to as capital export neutrality, or CEN.[17] CEN also is sometimes referred to as production neutrality to reflect the idea that productive activity is based on identical pre-tax returns to all investment, meaning that the worldwide distribution of capital and the resulting productivity of capital are unaffected by taxes.[18]

Universal residence-based taxation also preserves so-called capital ownership neutrality ("CON"), a benchmark recently introduced into the legal literature by Desai and Hines.[19] A tax system preserves CON when it does not affect patterns of ownership. The importance of CON becomes apparent if one considers the fact that ownership patterns, like investment patterns and savings decisions, though perhaps to an even greater degree, are elastic to taxes. In any developed market, firms can buy or dispose of business assets with relative ease, and the transaction and personal costs of doing so are likely to be lower than those of either capital or individual locational shifts. Indeed, Desai and Hines argue that for modern economies, ownership considerations dominate locational decisions because so much of international trade consists of the development and distribution of intellectual property as well as the exploitation of different capabilities sourced in different jurisdictions; it does not primarily involve movements of capital.[20] On this view, the typical form of cross-border investment is not the transfer of physical capital or the movement of its owners, but the shift in ownership of stationary capital from one country's nationals to another's. Concomitantly, when ownership moves out of the jurisdiction, it is more commonly replaced by an offsetting ownership shift elsewhere than by a net movement of capital. New owners step in to fill the void created when property changes hands. In short, cross-border transactions are mostly about

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[17] James R. Hines Jr., *Reconsidering the Taxation of Foreign Income*, 62 TAX L. REV. 269, 272 (2009).

[18] Hines, *Reconsidering*, at __.

[19] Desai & Hines. They also have introduced the cognate benchmark of national ownership neutrality to reflect national rather than worldwide welfare maximization where ownership is elastic to taxes. *Id.*, at 956. The discussion here is confined to the examination of worldwide welfare-maximizing benchmarks.

[20] Desai & Hines, at 956.

aligning competencies to manage fixed-base capital, not about moving capital into or out of productive jurisdictions.[21]

Thus, in the simplest case, suppose that the locations of all capital and all taxpayers are fixed but that taxpayers can acquire capital at home or abroad. In a first-best world without taxes, some optimal pattern of ownership of the fixed supply of worldwide capital will emerge, reflecting on one hand synergies of combined ownership of different productive activities, the advantages of vertical over horizontal integration, and other factors weighing in favor of combination, and on the other hand the advantages of specialized ownership of specialized industries, the limitations of hierarchical organizations to manage large or heterogeneous sets of assets and business opportunities, competitive price pressures, and other factors weighing in favor of dispersed ownership.[22] If the introduction of taxes differentially affects the tax burden on prospective owners, then tax considerations are apt to alter this optimal pre-tax pattern of ownership, resulting in efficiency losses.

2. Second Variation: Territorial Taxation

Although a pure residence-based FTC system eliminates capital location incentives, it does not preserve neutrality along a number of other margins, including uniformity in savings versus consumption decision, uniformity in ownership considerations (in the case of a world of mixed systems for tax relief), and uniformity in investor location; it also does not preserve "competitive neutrality," which functions less as a genuine neutrality benchmark than as a plea for equal treatment. When sensitivity to taxes along these margins is large, distortions may result from pursuing CEN that are no less harmful than distortions in patterns of home- and host-country investment that worldwide taxation is designed to eliminate.

The other major (and by far more widely adopted) method of double tax relief, foreign income exemption, or so-called territorial taxation, addresses these problems.[23] Under a pure form of territorial taxation, states exempt residents' foreign-source income, loss and expense from the tax base entirely.[24]

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[21] *Id.* ("[M]ost FDI [(foreign direct investment)] represents transfers of control and ownership, and need not involve transfers of net savings.").

[22] *See* Hines, *Reconsidering*, at 275-77.

[23] [CITE to figures on numbers of jurisdictions.]

[24] In practice, most territorial systems adopt some worldwide features (and vice-versa) to prevent tax avoidance. Kleinbard, *Lessons of Stateless Income*, at __. As an example, the opportunity to shift profits earned in high-tax jurisdictions to low-

In this setting, double taxation is eliminated because the only tax investors face on cross-border investment is foreign-source tax. Returning to the example above, the resident of State A will face a 25 percent rate of tax if the investment is made in State B, with State A ceding its right to tax entirely, and a 35 percent rate if it is made at home. Analogously, a resident of State B will face the same rates on investment in State A and State B that the State A resident does.

A world of territorial systems has the following distinctive properties. First, the after-tax rather than the pre-tax rate is everywhere the same, as investment flows out of low-return jurisdictions and into high-return ones until the worldwide rate equalizes.[25] Although capital is not optimally allocated (since its allocation is affected by tax considerations), there is a tradeoff in that the decision about whether to save or consume, which is based on after-tax rather than pre-tax rates of return, is no longer differentially affected by taxes. This state of affairs is referred to as "savings neutrality"[26] and, by some scholars, as "capital import neutrality" ("CIN").[27] Second, universal territoriality preserves what is sometimes termed competitive neutrality, or the idea that all investors face the same tax burden on investment in a given source, regardless of their residence. Perhaps unfortunately, competitive neutrality also often goes by the name CIN.[28] Although, as explained below, competitive neutrality sounds more in considerations of national than worldwide welfare, it has been particularly influential as a driver of international tax policy in a number of countries, including the U.S.[29] Third, universal territorial taxation, like universal worldwide taxation, preserves CON, as the after-tax return to the owner of a fixed-base investment is the same regardless of who owns it. And finally, and perhaps most obviously, territorial systems eliminate the incentive to alter the location of the owner of capital in response to taxes, since tax rates

tax jurisdictions has caused some territorial jurisdictions, such as Japan, to impose floors on the rate applied to certain foreign-source income. *Id.*

[25] Hines, *Reconsidering*, at __.

[26] Altshuler, at __.

[27] *Id.*, at __.

[28] Musgrave; Knoll, at __. Knoll notes that lawyers have tended to interpret CIN as a competitiveness benchmark (explained in the text below), while economists have interpreted it as a savings benchmark, and that the two groups have not always recognized they are talking about different benchmarks in using the term "CIN."

[29] Kleinbard, *Lessons*, at __.

do not vary with the location of the owner, taking the location of the investment as fixed.

B. Neutrality Tradeoffs

The framework of international taxation and relief of double taxation described in Subpart A sets the parameters for scholarly debate on international tax neutrality. This Subpart provides an overview of the tradeoffs that the various neutrality benchmarks present and canvasses some of the recent literature on international tax neutrality.

1. Homogeneous Systems

The efficiency question in evaluating any proposed tax system is which of the available arrangements minimizes total deadweight loss for the relevant population.[30] here assumed to be countries worldwide, though in some analyses it is national welfare.[31] Most scholars have agreed that in the comparison of worlds consisting solely of pure versions of either territorial or worldwide systems, the latter is superior in promoting worldwide welfare.[32] Another way of stating the point is that it is believed that promoting productive neutrality and accepting the associated savings, competitive and investor location distortions produces less deadweight loss than the converse. As a general matter, this conclusion seems correct.

Begin with tax-induced locational shifts. As a factual matter, it seems that owner location response to tax incentives is likely to be relatively minor.[33] And under the stylized assumptions here, the failure to preserve locational neutrality of capital owners would not seem to merit concern anyway, since the location of the owner ought to have little impact on worldwide productivity. Thus, suppose that the quantity of capital and the identity of its owners as fixed, so that the sole tax-based incentive that arises under a pure worldwide system is for an owner in a high-tax jurisdiction to move to a low-tax jurisdiction, leaving capital where it is. The owner then would enjoy the low-tax jurisdiction's crediting of foreign tax paid in excess of source tax due when it makes economic sense to locate the investment in the higher-tax jurisdiction. As a result, total worldwide output would continue to be maximized despite the tax-induced decision to change the residence of the owner. Under these

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[30] Daniel Shaviro, *Why Worldwide Welfare as a Normative Standard in U.S. Tax Policy?*, 60 TAX L. REV. 155 (2007).

[31] *See id.*, at 157.

[32] Hines, *Reconsidering*, at __.

[33] Kirsch, at __.

stylized circumstances, it is unclear what inefficiency arises. Rather, the effects, if any, will be distributive and on administrative costs, as tax revenues will be eroded in low-tax source jurisdictions while administrative costs are shifted to them.

These considerations become somewhat less decisive if one relaxes the unrealistic assumption that the quantity of capital available for investment is fixed. Treating this margin as somewhat tax-elastic, the fact that worldwide systems preserve production neutrality must be weighed against the fact that they do not preserve savings neutrality.[34]. If one assumes there is a single, optimal worldwide rate of return to savings, then worldwide taxation introduces distortions in the decision to save or invest. Investors located in high-tax jurisdictions will have a greater incentive to consume currently than will investors who face a better after-tax return to savings. A territorial system avoids this distortion because the after-tax return to all investments worldwide will converge to a single worldwide rate, for, if there were differences in the after-tax rate of return in two jurisdictions, capital would flow to the one providing the higher rate (even though the allocation would not be desirable in terms of production efficiency) until rates were equalized.[35]

Although territorial systems preserve savings neutrality, the proposition that savings neutrality is a proper subject of efficiency analysis when the focus is on worldwide welfare is debatable.[36] Differing incentives to save or consume across jurisdictions would appear more a reflection of differing policy choices about the optimal mix of private and public returns to savings than an inefficiency traceable to tax-motivated incentives for cross-border investment.[37] Further, it is not clear that savings decisions are as responsive as capital location decisions to taxes;[38] higher taxes may induce both income and substitution effects among savers, meaning that some taxpayers may save more (on a pre-tax basis) in the presence of the tax than in its absence in order to ensure they have adequate savings in light of a greater

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[34] Altshuler, at 257; Horst, at __.

[35] *Id.*

[36] Hines, *Reconsidering*, at __.

[37] *See* Hines, *Reconsidering*, at 274 ("As a practical matter, since many national policies influence the return to savers, CIN is often dismissed as a policy objective . . . ."). *See also* Knoll, at __.

[38] *See* DOES ATLAS SHRUG? THE ECONOMIC CONSEQUENCES OF TAXING THE RICH (Slemrod ed., 2000) (presenting research on the sensitivity of savings decisions to tax rates).

loss of returns to taxes.[39] Nevertheless, the view that the inefficiency resulting from non-uniformity in returns to savers has equal status with production inefficiency has had a significant influence in the literature,[40] and a number of scholars have framed the question of optimal tax design in terms of the relative efficiency losses arising from pursuing either efficiency benchmark – production versus savings.[41]

Finally, consider competitive neutrality, or the idea that some form of neutrality exists when investors meet on an equal tax footing in a given jurisdiction.[42] Returning again to the discussion example, if States A and B each tax on a territorial basis, then investors from either jurisdiction face the same rate on income from the source that an investor located in the source faces on its source-based investment, regardless of the rates that States A and B impose on domestic income. This arrangement is competitively "neutral" in the sense that home-country rules do not disadvantage home residents in their competition with other taxpayers for investment in the host. However, as contrasted with CEN and, at least arguably, with savings neutrality, CIN as competitive neutrality does not promote worldwide welfare; indeed, it does not appear directly to promote the welfare of any constituency other than host-country multinationals resident in high-tax jurisdictions, for the benefits to them are offset by detriments to those against whom they compete for investment. (And serving even this benchmark assumes that other jurisdictions do not retaliate against the residence jurisdiction's decision to pursue competitive neutrality).[43] Consequently, competitive neutrality has been

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[39] For an explanation of income effects, see ROSEN, at __.

[40] Altshuler, at 256 ("The standard result [in the analysis of the efficiency properties of residence- and source-based taxation] is that a pure residence system ensures efficiency in investment location decisions whereas a pure source system preserves efficiency in savings decisions."). Knoll, at 14.

[41] Althsuler, at 258. *See generally* Knoll, at 13-14; Horst, at __. It also has been observed that the availability of deferral in worldwide systems such as the United States', coupled with the formality of corporate residence for U.S. tax purposes, makes it easier for taxpayers to shift the location of capital owners to lower-tax jurisdictions, thereby moving toward savings neutrality. Altshuler, at 257.

[42] Musgrave, at 8.

[43] *See, e.g.*, Kimberly A. Clausing, *The Role of U.S. Policy in Offshoring*, BROOKINGS TRADE FORUM 457, 473 (2006). ("Thus, capital import neutrality [in the competitiveness sense] generally puts the international competitiveness of a country's multinational firms ahead of considerations regarding optimal investment location or government revenue. For example, capital may be allocated inefficiently toward low-tax locations because after-tax rates of return in such locations are higher.")

characterized as "rooting for the home team"[44] rather than a genuine neutrality benchmark, though it might more aptly be characterized as trickle-down neutrality for home-country residents who, in theory, could benefit from home-country multinationals' prosperity. Perhaps the best one can say about competitive neutrality is that it sounds in some theory of investor equality.[45]

The final neutrality benchmark, CON, does not come into play in the comparison of pure, homogeneous systems. Both the universal adoption of pure worldwide tax systems and the universal adoption of pure territorial systems preserve CON.[46] The result is easier to see for the latter case, because under territorial systems all investors face the same tax with regard to any investment having a fixed situs. However, because worldwide systems cause all investors to place the same relative after-tax value on all investments that they would place on them in the absence of taxes, ownership shifts resulting from taxes will not result in that setting, either.[47] Consequently, it is fair to say that CON advocates do not have a dog in the fight between homogeneous pure worldwide systems and homogeneous pure territorial systems.

2. Mixed and Limited Systems

More realistic difficulties with promoting CEN arise if the idealized assumptions of the preceding section are relaxed. In the actual world, no residence-based system provides an unlimited FTC, heterogeneity of methods of double-tax relief obtains, and some amount of deferral of foreign-source income is available under worldwide systems. Each of these real-world features introduces tax distortions for states seeking to promote CEN. Begin with the case of the limitation on FTCs. As a practical matter, a country that provided an unlimited FTC would suffer dramatic erosion of its tax base, as net capital importing countries could raise taxes arbitrarily high with no adverse effect on levels of inbound investment from countries using the FTC regime. Consequently, no country has permitted FTCs in excess of the taxpayer's erstwhile domestic tax liability.[48] The limitation means that residents of FTC jurisdictions with lower rates face higher taxes on investments in high-tax jurisdictions than on investments at home or in other jurisdictions having rates

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[44] Kleinbard, at __; Shaviro, at __;

[45] Shaheen, at 210.

[46] Desai & Hines, *Evaluating International Tax Reform*, at 495.

[47] *See* Knoll, at [draft pages 22-23] for a numerical example; *see also* Hines, *Reconsideration*, at 276-77.

[48] *See, e.g.*, 26 U.S.C. § 904()().

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not in excess of the home rate. Residents of high-tax FTC jurisdictions, however, will face the same rate on investments wherever located. In addition, residents of high-tax FTC jurisdictions have an incentive to locate both themselves and capital in low-tax jurisdictions, since then, but only then, can they secure the lower tax rate they would otherwise obtain just by relocating themselves and leaving capital where it was in a system of unlimited FTCs.[49] The net effect of both phenomena is to create a worldwide bias towards investment in lower-taxed jurisdictions, which effectively moves the world in the direction of territorial taxation. Depending on the magnitude of the effects, a formal switch to territoriality could actually be welfare enhancing, since it eliminates tax-induced shifts of ownership that arise under an incomplete implementation of worldwide taxation while preserving savings neutrality and, more importantly, ownership neutrality.

Heterogeneity of tax systems has a similar effect. In a multi-state world in which one or more jurisdictions adopt territorial taxation, residents of countries employing a residence-based FTC system are at a tax disadvantage when compared with residents in territorial jurisdictions with respect to investment opportunities in low-tax jurisdictions. To illustrate, consider a world composed of States X, Y and Z. X and Y each impose tax at a flat 35 percent rate, but whereas X adopts worldwide taxation with an FTC for its residents and nationals, Y adopts a territorial system under which neither foreign-source income nor foreign-source expense is accounted for. Z is a net capital importing country that has adopted a flat 10 percent rate on Z-sourced income.[50] (Z's method of taxing non-Z-sourced income is immaterial for the example.) Now, when compared to Y residents, X residents face a tax disadvantage with respect to the Z-sourced investment, because X residents cannot respond to the tax advantage of the Z-sourced investment, while Y residents can. The difficulty that this type of situation creates forms the basis for regular pleas from U.S. industry for the U.S. to move to a territorial system, as most industrialized nations have done.[51]

More importantly, the tax-insensitivity to ownership considerations that arises in a world of residence-based systems disappears in a world of

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[49] Hines, *Reconsidering*, at 273; Peggy B. Musgrave, "Capital Import Neutrality," *in* Joseph J. Cordes et al., eds. Encyclopedia of Taxation and Tax Policy 50, 50 (2005).

[50] *See* Kleinbard, *Lessons of Stateless Income*, __, __ at 15ff., for a discussion of this problem.

[51] Kleinbard, *Lessons of Stateless Income*, at __. Kleinbard describes these pleas as demands that the U.S. move to "cartoon territoriality."

mixed systems.[52]   In the mixed setting, the incentives that residents of worldwide tax jurisdictions face differ from the incentives that residents of territorial jurisdictions face, as illustrated in the example in the preceding paragraph. In particular, residents of high-tax, residence-based jurisdictions will be at a disadvantage compared to residents of high-tax territorial jurisdictions when it comes to investment opportunities in low-tax jurisdictions, because they lack the incentive that residents of territorial jurisdictions have to invest in the low-tax jurisdiction. Especially if the factual contention is true that most cross-border transactions involve shifting ownership of fixed-base capital, the tax disadvantage to a country employing a high-tax worldwide system becomes very large, while the tax loss of shifting to a territorial system becomes very small.[53]

Finally, consider the problem of deferral, as exemplified by the U.S. case. Formally, the U.S. pursues CEN through worldwide taxation of its citizens and residents together with the provision of a limited FTC.[54] Consistent with the standard assumptions discussed in Section 1, the costs to individuals of escaping U.S. tax on income directly owned by the taxpayer are relatively high, because doing so generally requires the individual to leave the U.S., something most residents are reluctant to do. Consequently, it would appear that the U.S.'s promotion of CEN increases worldwide welfare more than would its promotion of (either version of) CIN. The difficulty with this analysis is that under U.S. law, the cost of shifting the identity of the immediate owner of capital to a non-U.S. person is quite low, because corporate residency for U.S tax purposes is almost entirely a formal matter. It depends upon the place of incorporation, not the location of significant managerial, production or other operations, or on ultimate beneficial ownership of corporate capital.[55] When coupled with the fact that most active business income of foreign corporations that are owned by U.S. persons is not taxed until it is repatriated,[56]

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[52] *Id.*, at 276.

[53] Desai and Hines derive $50 billion (in 2004) as a rough estimate of the dollar value of the annual efficiency losses to U.S. multinationals from the U.S. system of quasi-worldwide taxation (i.e., worldwide taxation with significant deferral opportunities). Desai & Hines, at 955.

[54] *See* 26 C.F.R. §1.1-1(b) (U.S. citizens and residents are subject to tax on their worldwide income.); 26 U.S.C. §901 (foreign tax credit).

[55] 26 U.S.C. §7701(a)(4).

[56] The U.S. system requires immediate inclusion by certain U.S. persons of corporate profits earned through certain controlled foreign corporations and passive foreign investment companies. *See* 26 U.S.C. §§ 951-959 ("Subpart F") & 1291

the result is a tax system that approaches territoriality because of deferral and the ability of taxpayers to time inclusions with offsetting losses.[57] As a consequence, the neutrality question in the U.S. setting has to some extent devolved into a question of determining the appropriate limits on deferral.[58] If the ultimate U.S. owners of non-U.S.-source income can defer inclusion for U.S. tax purposes for long enough, the fact that the income ultimately is subject to tax at U.S. rates will not deter taxpayers from shifting formal ownership from domestic to foreign entities. This shifting is completely at odds with CEN, because the incentive arises to move capital to the low-tax jurisdiction based on the after-tax, not pre-tax, rate of return there. In effect, deferral pushes the system closer to territoriality.[59] However, it comes with the further disadvantage that a substantial efficiency loss arises from the tax cost on repatriation of foreign profits under the U.S. system. Because the U.S. continues to tax foreign-source income when it is repatriated, the large incentive to earn income offshore is coupled with a large disincentive to bring it into the U.S. This disincentive has regularly given rise to pleas from U.S. multinationals, occasionally successful,[60] for both short-run relief in the form of tax holidays and the transition to a full-blown territorial system.[61]

3. Conclusion on tradeoffs

Against the backdrop of the considerations outlined above, a lively debate in the U.S. context has emerged on the relative merits of worldwide and territorial taxation, principally on the question of whether the U.S. should move

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(PFICs). Neither of these regimes, however, currently taxes most earnings of actively conducted foreign businesses.

[57] *See* Kleinbard, *Stateless Income*, for a comprehensive analysis of the problem.

[58] *See, e.g.*, Roseanne Altshuler, *Recent Developments in the Debate on Deferral*, 20 TAX NOTES INT'L 1579 (Apr. 3, 2000). If, for example, the discount rate is 5 percent, then ten-year deferral of tax reduces the effective rate by approximately 39 percent; twenty-year deferral reduces it by 62 percent.

[59] *E.g.*, Hines, __; Shaviro, at 160.

[60] *See,.e.g.*, American Jobs Creation Act of 2004 (Pub. L. No. 108-357) § 422 (enacting 26 U.S.C. § 965, which provided for a temporary reduction in rate, to 5.25 percent, on certain foreign income repatriated to the United States).

[61] *See* Kleinbard, *Lessons of Stateless Income*, at __. Kleinbard notes that most of these pleas are for systems that he terms "cartoon territoriality," that is, systems so generous as effectively to permit full tax exemption for U.S. multinationals. *Id.*

to shore up its worldwide system or instead move to more full-blown territoriality. Those taking the latter position have argued that substantial deadweight loss arises when the residence or owner of capital changes in response to taxes, as it must when the system is heterogeneous or the FTC is limited.[62] That is, they have argued that there is no reason to bear the efficiency losses associated with tax-induced changes in ownership and savings non-neutrality, or the losses from competition with investors located in territorial jurisdictions, when the benefits from doing so – limited neutrality with respect to the location of capital, or CEN – have been lost anyway. On top of these losses are additional ones resulting from the tremendous incentive to keep offshore earnings offshore unless and until they can be repatriated on a tax-favored basis.[63] A territorial system would remove this incentive (as would a purer worldwide one.) Others have argued that territorial taxation is not inferior to residence-based taxation even on first-best grounds and that it is much preferable given the much wider use of territorial systems today.[64] For example, from the perspective of CON, the adoption of territoriality would be superior to remaining with a residence-based system in light of the wide use of territoriality by other countries and the contention that most of the losses associated with taxing cross-border transactions arise from inefficient ownership of fixed-location capital.[65]

On the other side, a number of commentators have argued that the solution to the problem of corporate residence-shifting is to tighten up the rules on deferral, thereby moving closer to a true worldwide system, and not to abandon the ideal of CEN.[66] In response to the Desai and Hines argument that the dominant margin of tax-induced behavior is ownership, some have argued that ownership is, at best, one of a number of relevant margins of response to tax rules and that no evidence has yet been offered to show that tax-induced

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[62] A prominent example is the proposal that President George W. Bush's tax reform panel made to move to an exemption system. President's Advisory Panel on Federal Tax Reform, *Simple, Fair & Pro-Growth: Proposals to Fix America's Tax System* 103-07 (2005). For a critique of the Panel's proposal, see J. Clifton Fleming Jr. & Robert J. Peroni, *Exploring the Contours of a Proposed U.S. Exemption (Territorial) Tax System*, 109 TAX NOTES 1557 (2005).

[63] See Desai & Hines, at __, and Kleinbard, *Lessons of Stateless Income*, at __, for discussions of this problem.

[64] *E.g.*, Shaheen.

[65] Hines, *Reconsidering*, at 282.

[66] *See, e.g.*, Fleming & Peroni.

ownership effects swamp capital location effects.[67] And against the view that worldwide taxation is inadvisable on competitive grounds when most jurisdictions pursue territorial taxation, it has been noted that even territorial jurisdictions tend to adopt worldwide tax features for foreign-source income that is subject to exceptionally low rates, that most industrialized countries tend to have rates roughly comparable to each other (so that tax considerations may be minimized as long as it is not possible to exploit tax havens), and that if the U.S. moved closer to true worldwide taxation, other countries might follow suit.[68]

Which of these positions is correct depends in some measure on who is right about the economic facts – where the margins are more elastic, and what the efficiency costs are of responding to tax incentives along one or another of them. But the assumption that there are answers to these questions depends on the more basic assumption that neutrality is a well-formulated concept, for if it is not, then it is not clear what it means to say that one set of tax rules is more distorting than another and consequently is associated with greater efficiency losses. The next part makes the case that neutrality is not well defined in the international context; in the parts following I offer an alternative way to consider the relationship between tax rules and productivity and an argument for applying different policy criteria in evaluating international tax rules.

II. Neutrality Generally

The discussion in Part I was designed to explicate the problem that double taxation of cross-border income poses for efficiency analysis and to give a flavor for the debates surrounding the relative merits of various methods of double-tax relief. In what follows, I offer a criticism of the supposition that the relevant baselines for the evaluation of tax distortions are well specified. As contrasted with narrower inquiries into whether one or another local legal change is likely to increase or reduce efficiency system-wide, the global question of which international tax regime is closest to an ideal of neutrality is not well formulated. In the former case, one can make a meaningful evaluation of the effects of a new rule in light of reasonably fixed background conditions; in the latter case, one cannot make sense of the ideal against which the actual world is to be measured, because the ideal turns out to be affected by the world for which it is supposed to operate as an ideal.

This feedback effect materializes because any system for taxing cross-border arrangements causes economic actors to make decisions that affect not

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[67] *E.g.*, Kane.

[68] Kleinbard, *Lessons of Stateless Income*.

only the amount of tax paid, but who gets it. When economic decisions cause tax revenue streams to be redirected from one jurisdiction to another, they affect the absolute productivity of the factors of production in both jurisdictions because of the relationship between tax revenues and tax amenities. As productivity rates diverge from prior levels, the rate of return that was supposed to remain uniform across jurisdictions under the relevant benchmark (e.g., pre-tax for production neutrality, after-tax for savings neutrality) diverges as well, meaning that the benchmark is not maintained.

One can frame the point as follows. There are not two but at least three moving parts to the analysis of the effects on rates of return of any regime for taxing cross-border income: the flow of capital (and possibly labor or investors) in response to taxes, the adjustments in both net importing and net exporting countries to the relative prices of factors of production that result from these flows, and the effects of these two effects on tax revenues. The first two items are part of the standard fare of neutrality analysis,[69] but the third, which is not, is no less important to a comprehensive analysis of a tax system's neutrality properties. Because levels of funding for tax amenities affect the absolute rate of return to factors of production in each jurisdiction, tax-induced adjustments to tax revenues, no less than changes in the relative supply of and demand for factors of production, will affect the productivity of those factors, and indeed in ways that diverge between the affected jurisdictions. This divergence means that neutrality by definition is not satisfied, because preservation of the relevant rate of return is the criterion of tax neutrality.

This Part illustrates the problem by examining the development of the neutrality model in the domestic setting and the difficulties that arise when the model is appropriated for use in the international setting. Subpart A explicates the concept of tax neutrality in general terms. Subpart B examines the question of how to articulate the problem of non-neutrality in the international setting, concluding that the most cogent statement of the problem is one that analyzes the effects of moving from a system of closed to one of open economies. Because this statement also subverts the idea of the single-tax-affected baseline that underwrites the analysis of tax distortions, it seems that the concept of neutrality in the international setting cannot be well formulated.

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[69] *See, e.g.*, Desai & Hines, Hines, Knoll, Shaheen.

A. Tax Neutrality Generally

Under the standard public finance model, a tax is optimally efficient when it does not change relative prices.[70] A tax that has this property is said to be neutral. Correlatively, if taxes do change relative prices, then prices are said to be "distorted" and, when the change alters the decisions of economic actors, the decisions are said to be distorted as well.[71] The reason it is considered appropriate to characterize such tax-affected decisions as distortions is that they produce less total social wealth than would result in their absence. This conclusion follows if one accepts the assumptions commonly applied to describe the behavior of rational actors in free markets – namely, that they have ordered preferences, that they are free to deploy their resources to satisfy those preferences and that there are no externalities.[72] In this setting, total social wealth is maximized.[73] Consequently, when decisions are affected by tax-induced changes to relative prices, the resulting arrangements do not maximize total social wealth, because individuals have substituted less-efficient outcomes for more-efficient ones as a means to maximize their after-tax welfare. The reduction in total social wealth that arises through these substitution effects is referred to as the deadweight loss, or excess burden, of taxes.[74]

The following simple example illustrates these ideas. Suppose that a taxpayer faces two investment opportunities, one of which, Opportunity A, has an expected value of $X and the other of which, Opportunity B, has an expected value of 0.9*$X, in both cases on a pre-tax basis. In the absence of tax considerations, and disregarding the possibility that risk preferences might

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[70] *See, e.g.*, HOWARD ROSEN, PUBLIC FINANCE __ (20__). Tax-induced changes in relative prices are to be distinguished from tax-induced changes in absolute prices, which also may cause taxpayers to alter the composition of goods and services they consume or the labor they supply. *Id.*, at __. To the extent a tax-induced price change is absolute, the alteration in behavior is said to result from so-called income effects, or the fact that the taxpayer is poorer in absolute terms by reason of paying the tax and, consequently, may have a lower budget line. *Id.*, at __. Income effects are not inefficient, though they may be problematic for other reasons, such as, for example, that they reduce the wealth of the wrong person.

[71] *Id.*, at __.

[72] [Econ. textbook.]

[73] This is simply a statement of the first fundamental theorem of welfare economics, which itself can be considered a formal version of Adam Smith's theory of the invisible hand. *See*, "Welfare Economics," *in* Eatwell et al., eds., 4 THE NEW PALGRAVE DICTIONARY OF ECONOMICS 889 (1987).

[74] ROSEN, at __.

affect the investment decision, the taxpayer would choose Opportunity A. If, however, Opportunity A is sufficiently less favorably taxed than Opportunity B, the taxpayer will choose Opportunity B, other things equal. In such a case, the decision is distorted by taxes as compared to a baseline of the efficiency-maximizing non-tax world. In the example, $0.9X rather than $X of total social wealth is created, simply because the ultimate value to the taxpayer is greater if the non-wealth-maximizing choice is made.

The "non-tax" world is a standard heuristic employed to get at the idea that taxes create the kinds of inefficiencies described above.[75] However, the non-tax world cannot function as a true baseline for the simple reason that taxes are necessary to fund infrastructure and other goods that make possible a system of competitive markets in which rational actors satisfy their ordered preferences. In other words, the non-tax world would seem to require taxes in order to function as the baseline against which to measure the effect of taxes. This difficulty, however, can be largely gotten around if one bears in mind that the problem is not, strictly speaking, the existence of taxes but the fact that most real-world taxes create substitution effects because tax liability is determined, in part, by economic decisions. Stated otherwise, real-world taxes alter the relative prices of goods. For example, even a broad-based income tax creates an incentive to work less if leisure goes untaxed, because the tax alters the relative prices of work and leisure. Consequently, we can expect leisure to be over-supplied and labor to be under-supplied even under a broad-based, low-rate income tax system, when compared to a system in which tax revenue is raised in some way that does not affect the decision about how much labor to supply.

The question, then, is whether it is possible for revenue in fact to be supplied in a way that does not affect behavior. In general, a tax imposed without regard to what the taxpayer does – generally referred to as a lump-sum tax – would have this property.[76] A head tax is the simplest example of such a tax. Although a head tax may affect taxpayer behavior simply because taxpayers have fewer resources, and may be objectionable on distributive or other grounds, the absolute reduction in wealth it effects does not lead to inefficient substitutions, but only to less consumption (or more production) as a

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[75] *Id.*, at __.

[76] The statement should be qualified because lump-sum taxes have a distorting effect if it is assumed that labor supplied solely to satisfy a lump-sum tax burden creates additional social costs that must be internalized. *See*, David M. Hasen, *Liberalism and Ability Taxation*, 85 TEX. L. REV. 1057, 1108-13 (2007). The complication is disregarded here.

way to compensate for the reduced wealth. Relative prices remain unaffected and, as a result, resources continue to be allocated optimally.[77] Distributive concerns can, theoretically, be addressed either through government redistribution or by tailoring the lump-sum tax liability to whatever non-behavior-affected metric is deemed appropriate.[78]

If one begins with the idea of a lump-sum-tax financed, non-tax affected world as the baseline, it becomes possible to sketch a model of tax neutrality in the closed economy setting. A revenue target is exogenously set based upon some procedure by which relevant preferences are aggregated and sorted. This exercise is part of the larger procedure for identifying and implementing what is commonly termed the "social welfare function,:[79] or the societal determination about how to weight individual utilities and other tradeoffs among conflicting values. For example, in a democratic polity, voters might express their preferences about levels of tax-financed amenities through a referendum in which the majority prevails, or the choice might be mediated through the election of representatives empowered to make decisions about such matters.[80] The level having been set, a base and rate schedule are then adopted. The latter decisions would, it is hoped, be based on efficiency considerations and take into account as well the various additional costs of administering the tax system. Although the base is unlikely to include, much less to consist solely of, lump-sum taxes, it is at least possible to have in view the economy that would result if the desired levels of tax-financed amenities were funded with lump-sum taxes. That economy represents the "non-tax world," or more accurately, the non-tax-affected world, and deviations from that world that result from tax-induced substitution effects represent tax

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[77] ROSEN, at __.

[78] Thus, the standard assumption in the public finance literature is that the optimal theoretical tax would be a lump-sum tax assessed on the basis of wage rate, or ability (not actual wages). An ability base would seem to combine the tax neutrality properties sought from an efficiency perspective with the desired utility-maximizing distributive properties, assuming the declining marginal utility of ability. *See id.*, at __. A large literature addresses the philosophical cogency of this view. *See* Linda Sugin, *A Philosophical Objection to the Optimal Tax Model*, 64 TAX L. REV. 229 (2011) (reviewing the literature).

[79] *See, e.g.*, ROSEN, at __.

[80] See Sarah B. Lawsky, *On the Edge: Declining Marginal Utility and Tax Policy*, 95 MINN. L. REV. 904, 913-14 (2011), for a discussion of social welfare functions.

distortions. The world has its own distributive and productive properties, including a pre-tax rate of return.

It is important to be clear about the conceptual price that employment of the idea of the non-tax affected world exacts on the theory of tax distortions. Initially, the observation that the existence of a rate of return requires tax-financed amenities vitiated the notion of a non-tax-world that would operate as a baseline to measure tax distortions. The basic idea of that model, however, is not that there are no taxes but that taxes do not affect decision making by causing taxpayers to substitute more favorably-taxed goods or services for those less favorably taxed. It was then recognized that if taxes were conceptualized as imposed on a lump-sum basis, the link would be severed between the funding of goods paid for with tax revenues and the avoidance behavior of the individuals that pay for them. The resulting model mostly solves the problem of establishing the conditions under which a non-tax distorted rate of return is possible even though taxes must somehow be collected, but it is not complete.[81] Since different quantities of tax-financed goods supplied correspond to different quantities of tax-financed amenities and, in consequence, different rates of return,[82] one cannot establish the rate of return in the non-tax affected world without a specification of the revenue target. The target itself, however, cannot be derived from the conditions imposed by the model but, rather, must be taken as an exogenously given amount based on a normative judgment – for instance, by ascertaining and applying the applicable social welfare function. The model itself does not specify the target, and it cannot be read off as a fact about the world.

B. Adapting Neutrality to the International Setting

The question on the table is whether the closed-economy model can be adapted to the international setting without loss of normative or analytic power. In the international setting, the analog of the non-tax-affected world is the non-double-tax-affected world.[83] That is, one level of real tax (together with its

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[81] The statement is qualified as "mostly," because the model assumes that additional work undertaken solely to satisfy a tax burden does not itself create additional costs that must be paid for with additional tax revenues.

[82] *See, e.g.*, Lawrence J. Lau et al., *Efficiency in the Optimum Supply of Public Goods*, 46 ECONOMETRICA 269, 269 (1978) (noting "the dependence of private consumption, and hence of tax revenue, on the supply of public goods").

[83] Technically, it would be more accurate to refer to the analog of the non-tax-affected world as the "single-tax-affected world," since double non-taxation creates problems analogous to those of double taxation. As it is commonly framed, however, the problem is one of double taxation arising from the joint rights of source and

distortions) is taken as given, and the question is how that level will be maintained in light of the rights of both home and host countries to tax cross-border transactions.[84]

The trouble is that, as will be developed below, no matter the starting point, tax-motivated behavior that results from the chosen neutrality regime fails to preserve the relevant rate of non-tax-affected return (pre-tax or after-tax) over all affected jurisdictions. As capital flows respond to the tax incentives created under the rules for cross-border transactions, tax revenues are redirected between affected jurisdictions. Over the long term, levels of tax-financed amenities and of productivity diverge as well, causing real rates of return to move in opposite directions in the affected jurisdictions. Any benchmark defined with reference to the preservation of a rate of return therefore is not met and neutrality is not preserved. This result implies that the non-double-tax affected world cannot be specified for any system of independent jurisdictions in which tax rules create incentives that cause tax revenues to be redirected from one jurisdiction to another.

The following discussion develops these ideas by examining three possible non-double-tax-affected starting points and evolutions to the real-world case: a tax-free world to which taxes are added on; a world of open economies, each of which initially has the same tax rate in which rates are then made to differ across jurisdictions; and a world of single-taxed, closed economies that become open economies. It will be seen that only the last of the starting points actually states the problem in a coherent way. But that way of formulating the problem demonstrates both that "neutrality" is violated as soon as cross-border trade is introduced, and that the resulting tax-motivated decisions are as likely to improve as to harm overall productivity.

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residence to tax; double non-taxation generally arises because of tax base inconsistencies or strategic efforts to avoid tax, both topics that fall outside the scope of the present discussion.

[84] Thus, tax treaties typically describe the elimination of double taxation as a or the central objective of the treaty. *See, e.g.*, UNITED NATIONS MODEL DOUBLE TAXATION CONVENTION BETWEEN DEVELOPED AND DEVELOPING COUNTRIES, Introduction, ¶ A.2 ("Broadly, the general objectives of bilateral tax conventions may today be seen to include the full protection of taxpayers against double taxation (whether direct or indirect) . . . .") (available at: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan002084.pdf).

1. First Possible Approach: From Non-Tax to Single-Tax World

The first approach posits as a baseline a tax-free world and an associated tax-free rate of return to capital.[85] In this setting, the question becomes what happens to rates of return and capital allocations when different jurisdictions impose different rates of tax and adopt different methods of double tax relief.

For the reasons stated above, this approach never really gets off the ground. Because taxes are necessary to finance various goods needed for well functioning markets to exist, a genuinely tax-free world would be one that lacked the features of a market economy; it would be one of rudimentary trade. As the preceding subpart explained, this problem arises in the closed economy setting as well, but it can be solved for the most part by substituting, with only minor loss of explanatory power, the concept of the non-tax-affected world. The non-tax-affected world is operationalized (ideally) through lump-sum taxation. However, the concept of the non-tax-affected world requires an exogenously specified decision about the amount of tax revenue to be raised, since this target, together with other factors, determines the "pre-tax" rate of return. Without such a specification, the non-tax affected world is indeterminate, because different levels of exogenously given (via lump-sum taxation) funding result in different rates of return in the non-tax affected world. Consider, for example, the absolute productivity differences of capital (human and physical) between two countries of roughly equal population but dramatically different levels of development and taxation: Algeria and Canada. Taking GDP per capita as a proxy for capital productivity, capital in Canada is approximately 550 percent more productive than in Algeria.[86] Undoubtedly many factors contribute to this difference, but among them are the relative differences in transportation infrastructure, educational opportunities, a well-functioning and reliable administrative state, and other features of industrialization that are paid for with taxes and that contribute to the capacity of private parties to develop and diversify human capital and native resources. Notably, the percentage of GDP that goes to taxes in Canada is higher than the percentage in Algeria by approximately the same ratio: 32.2 percent versus 8 percent.[87]

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[85] *See, e.g.*, Shaheen, at __.

[86] Canada's GDP per capita in 2010 was $39,057, and Algeria's was $6,950, in each case in purchasing power parity dollars. Figures are IMF estimates, available at: http://tinyurl.com/6e6acpx.

[87] Heritage Foundation 2011 Index of Economic Freedom, available at: http://www.heritage.org/index/explore?view=by-variables.

2. Second Possible Approach: From Single Rate to Divergent Rates

A second approach would begin from a world in which all states imposed the same level of tax and adopted some form of double tax relief, and then examine the efficiency consequences, under alternative methods of double tax relief, if tax rates are then made to diverge. Since in the initial state all jurisdictions impose tax at the same rate, it would appear that under any method or methods of double tax relief, the initial state of the world would be non-double tax distorted. Thus, the results under worldwide taxation with an unlimited FTC would be the same as under pure territorial taxation. Each taxpayer would face one rate of tax that is the same across jurisdictions, paid in every case to the source. The single rate also would apply in a world of mixed jurisdictions, in which some states adopted territorial taxation and the others worldwide taxation with an FTC. Again, each taxpayer would face a single rate of tax paid exclusively to the source. However counterfactual as a practical matter, this world at least would provide a theoretical articulation of the standard against which to measure tax distortions: a single-tax-affected world in which all individuals face the same rate of tax regardless of location of individual or capital and regardless of ownership. The system of double-tax relief under varying tax rates that created the least distortion from the baseline of the system under identical tax rates then would be the most efficient.

This method of conceptualizing the non-tax distorted world is somewhat better than the first, but fundamentally it does not address the problem. It requires the same decision on initial tax rates that individual states operating as closed economies face in setting a revenue target. Since heterogeneity on this decision is what characterizes the essential nature of the problem – as well as the actual world – it is not possible to pick a fixed rate that represents a non-distorted baseline without making a normative decision about appropriate levels of tax-financed amenities. Therefore, even though it is possible to model the actual world as a set of variations from any particular, arbitrarily chosen baseline, one would not be entitled to conclude that the efficiency costs associated with the variations represented distortions.

One might counter that, at least within a plausible range, all states would choose to impose taxes at a rate that approximately maximizes the return to privately held capital. On this view, heterogeneity outside of the range would not be the product of divergent national tastes on levels of tax-financed amenities; rather it would result from political, technical or other constraints on the capacities of different jurisdictions to impose taxes at ideal rates. One then could identify a rate within the range as a neutral target (assuming it could be identified), acknowledging that the target rate functions as a proxy for the range itself.

As an initial matter, it should be noted that the assumption that variations in tax burdens are due to technical or other factors appears to be inconsistent with reality, as widely varying tax burdens measured as a percentage of GDP obtain among countries not apparently under external or technical constraints to tax. As examples, the U.S. burden is approximately 26.9 percent, while larger Western European countries tend to impose levels nearer to 40 percent; Scandinavian countries hover in the mid- to high 40-percent range.[88] Further, the assumption that states would, if they could, seek to maximize the returns to privately held capital within a range faces the technical difficulty that the optimal ratio of public to private investment for such a purpose is likely to depend on a variety of country-specific factors. Therefore it cannot be specified as a uniform world rate. As examples, different countries may face different requirements for defense spending per capita; for state-funded roads, waterways and other infrastructure; and for educational outlays in order to optimize the exploitation of local resources. Therefore uniformity in initial starting point will have to be absent unless one assumes that the initial rate is set to meet a worldwide optimal revenue target and that extra collections in some jurisdictions are transferred to other jurisdictions in order to ensure that adequate tax amenities are financed everywhere.

Neither of these solutions solves the problem of identifying a non-double-tax affected world. If initial uniformity is lacking, then the non-double-tax affected world will have to have different after-tax returns in different jurisdictions in order to preserve the single pre-tax rate of return worldwide. But investors seek to maximize after-tax, not pre-tax, returns, assuming they have the capacity to adjust their investments in response to tax variation. (If they lack the capacity, then the problem of tax non-neutrality doesn't exist anyway.) Consequently, they will adjust their arrangements to maximize their after-tax revenue, replicating the problem that the solution is designed to address.

If, instead, a single rate with transfer payments is assumed, then a well-formulated model of the non-double-tax affected world results (if one is willing to accept the imprecision arising from the fact that states may have different tastes for tax-financed amenities within a range). However, this approach assumes away the problem, since it is the existence of distinct, autonomous jurisdictions that gives rise to the actual problem that analyses of neutrality are designed to address. That is, the problem is how to move towards tax

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[88] Figures are from OECD tax database and are for 2008, available at: http://www.oecd.org/document/60/0,3746,en_2649_34533_1942460_1_1_1_1,00.html.

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neutrality in a system of sovereign nations that, if they cooperate at all, tend to do so through quite limited means, such as bilateral treaties that are not enforceable through any supra-national authority. The assumption of tax transfer payments coordinated worldwide in effect reformulates the problem as one for a single, closed economy.

Finally, even if one assumes both that states generally agree that optimal tax rates are those that maximize the return to privately-held capital and that a single rate for all countries could reasonably approximate that optimal rate, it turns out that what is meant by tax neutrality cannot be specified without also articulating an optimal rate. From this perspective, distortions would not be measured by the extent to which patterns of investment in the actual world differ from those that would obtain if some version of territoriality or worldwide taxation were implemented, without absolute adjustments in rates. Rather, distortions would have to include a measure of the departure of tax revenue in any particular jurisdiction from what would be necessary to maximize the return to privately-held capital there. As an example, if it turned out that the optimal rate were uniform but, say, 45 percent, then even if every jurisdiction imposed tax at the same rate, there would be tax distortions unless that rate happened to be 45 percent. Such an approach is inconsistent with the idea that the non-double-tax-affected world is the world of existing pre-tax returns, coupled with a single level of tax.

3. Third Possible Approach: From Closed to Open Economies

A third approach would begin from the well-defined case of a set of closed economies in each of which income taxes are levied at a rate based upon a prior decision about desired levels of tax-financed amenities. Within the framework of the problem as traditionally posed – how to preserve the neutrality associated with a single level of tax in the cross-border setting – this approach is superior to the prior two because the starting point is well-defined and tax-neutral; it is in fact the same starting point that is used for the analysis of closed economies. In addition, it enjoys a greater consonance with historical practice, as domestic economies historically have dwarfed international economies in size.[89]

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[89] According to the director general of the World Trade Organization, between 1950 and 2010, world trade grew from approximately 5.5 percent to approximately 29 percent of world GDP. Pascal Lamy, "Facts and Fictions in International Trade Economics," p. 3. Speech given at Conference on Trade and Inclusive Organization, Apr. 12, 2010 (available at:

In this setting, the question becomes whether and how one can preserve the initial neutrality when borders are opened. It will be seen that what is properly called neutrality – namely, the removal of tax effects across some specified margin – is vitiated once cross-border trade is introduced, unless elasticity along the margin of behavior is not associated with redirection of tax revenues from one jurisdiction to another. In particular, as capital moves in response to taxes, tax revenues in each affected jurisdiction diverge from the target that was set initially and was associated with a prior decision about desired productivity levels prior to the introduction of cross-border trade. Because the effect of changes in tax revenue on capital productivity can be large, the divergence from the closed-economy baseline that results has a significant impact on both pre- and post-tax rates of return and consequently on the level of taxes necessary to maintain the previously set baseline. The feedback effect of tax-induced capital flows on tax revenues and, ultimately, on the productivity of factors of production makes it impossible to articulate a neutrality standard compatible with cross-border trade among distinct, sovereign tax jurisdictions.

Thus, consider a system of two states, A and B, in which the economies initially are closed. Pursuant to their own internal political processes, each state selects a level of tax amenities and a tax base and rate designed to supply those amenities in a reasonably efficient manner. State A taxes at a high average rate, devotes much of its tax revenue to building institutions and infrastructure and, in consequence, has a high level of productivity, expressed as GDP per capita. State B taxes at a low rate and has a correspondingly lower level of productivity. The question is what happens when borders are opened and capital flows from one jurisdiction to the other.

(i) Non-Preservation of Savings Neutrality

Suppose that A and B adopt systems of territorial taxation on the basis that they wish to promote savings neutrality. Savings neutrality, it will be recalled, holds when all investors face the same after-tax return to savings. When that criterion is met, it is not possible for total global welfare to be improved by reallocating some savings from investors in low-tax jurisdictions

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http://unstats.un.org/unsd/trade/s_geneva2011/refdocs/IADs/Facts%20and%20Fictions%20in%20International%20Trade%20Economics%20(WTO%20-%20Apr%202010).pdf

to investors in high-tax jurisdictions.[90]   Worldwide allocations of goods to savings and consumption are asserted to be Pareto-optimal.[91]

By the terms of the standard analysis,[92] universal territorial systems satisfy savings neutrality because they cause capital to flow from high- to low-tax jurisdictions until the after-tax return to savings is the same everywhere. In the stylized world under consideration here, when borders are opened, capital is expected to flow from A to B as investors reap the benefits of lower taxes there, which make the after-tax rate of return higher. As capital flows out of A and into B, its relative supply in the former drops and in the latter rises, causing, respectively, an increase and a decline in after-tax rates of return to capital in the two jurisdictions relative to the rates that obtained immediately prior to the opening of borders. The flow continues until after-tax rates equalize, at which point equilibrium is reached and the economic return on the decision to save or invest is the same in A and B. Savings neutrality, under this view, is preserved.

The standard analysis disregards the fact that if capital begins to flow from A to B, then under territorial taxation A's tax revenues will drop, and, over time, the level of tax-financed amenities in A will drop as well. The drop in amenities will lower the pre- and after-tax rates of return to investment in A apart from any effect caused by changes in the relative supplies of factors of production there. That is, the drop in amenities will lower the value of A-sited assets in real terms. (Note that if A raises its rates to compensate for the reduction in tax revenue, the incentive to move capital out of A to B becomes greater, undermining the effectiveness of the revenue-raising measure.) B's tax revenues will rise, with parallel but opposite effects.

In this setting, it is not clear what significance there is to the resulting neutrality in savings decisions. The asserted efficiency property of savings neutrality is that it prevents taxes from influencing investors' decisions to allocate more or less than they would to savings in the absence of taxes,[93] or, more accurately, in the absence of lump-sum taxes. The result qualifies as efficient on the standard assumption that non-tax-affected decisions maximize productivity, because they are based on real market prices, not tax-affected prices.[94]   The conclusion does not hold, however, if real, (pre-tax) market

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[90] Altshuler, at 257.

[91] [CITE to standard text on Pareto-optimality.]

[92] *See, e.g.*, Shaheen.

[93] Altshuler, at 257.

[94] *See* Part II.A.

prices depend on inputs that are supplied with taxes. Stated in the converse, if tax amenities contribute to productivity, then real market prices are not given by pre-tax prices, but by those prices plus some portion of assessed taxes, which means that the payment of taxes contributes to the value, not just the price, of the good purchased.

In the closed economy setting, this truth was implicitly acknowledged in the recognition that taxes were necessary, but it could be safely disregarded on the basis that tax revenues were supplied through lump-sum taxation. With lump-sum taxation, neither the real tax price of goods (the cost of providing tax amenities) nor the real tax benefit to goods (the value received for that tax price in the form of enhanced productivity) is impounded into prices; taxes are determined and assessed separately from the economic activity that gives rise to the need for tax revenues. In the closed economy setting, where the demand for tax benefits may be taken as fixed, this separation poses little difficulty.[95] In the real-world, open economy setting where goods and taxes flow across borders, things are different. Neither the supply of tax payments nor the demand for tax benefits can be taken as fixed. The supply of tax payments is not fixed because taxes are not assessed on a lump-sum basis. The demand for tax benefits is not fixed because the flow of capital and labor across borders changes the burden on infrastructure in each jurisdiction and thereby alters the productivity of factors of production there. Each of these effects poses problems for efficiency analysis, because they cause actual revenue received to diverge from the revenue target required to maintain a given rate of (pre-tax) return. Indeed, the fact that the demand for tax benefits adjusts in response to economic activity means that distortions would arise as borders were opened even in a world in which all taxes were of the lump-sum variety.

Returning to the case at hand, once it is acknowledged that taxes purchase part of the return to savings – that is, that taxes are not merely a cost added on to savings – it is not possible to maintain that identity of after-tax returns to savings is efficient if tax revenues or the burdens on infrastructure have been redirected from one jurisdiction to another along the way. The efficiency produced by ensuring that investment decisions do not differ on substitution grounds from what they would be in pre-tax terms holds only when it is possible to assume that tax benefits will be separately supplied at the level necessary to support the pre-tax rate of return. It is that assumption that makes what are called non-tax-affected decisions efficient, because it is that

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[95] The problem is not completely solved even in the closed economy setting, because there may be infrastructure costs created by activity undertaken solely to satisfy a lump-sum tax burden. *See* Hasen, *Liberalism and Ability Taxation*, at __.

assumption that authorizes backing out the tax cost of goods and the tax benefit purchased for them from their market prices. The redirection of tax revenues and burdens on infrastructure from one jurisdiction to another in the open economy setting violates the assumption. In order to assess the efficiency properties in that setting, one can no longer assume that the non-tax-affected world provides a benchmark of efficiency, because, as demonstrated above, their efficiency properties depend upon a fixed demand for tax benefits. It is that assumption that ensures the Pareto-optimality of non-tax affected decision making.

Thus, consider what happens as capital flows and tax revenues adjust in the example. The real return to savings will be enhanced in B, the low-tax jurisdiction, as increased tax revenues improve the pre-tax rate of return there, causing increased investment. Thus we have the seemingly odd result that tax-induced behavior causes an increase in productivity, not a reduction. The result is odd if one assumes that taxes are a pure cost, but perfectly sensible if one assumes that taxes buy something. For a resident of A, the net exporter, capital becomes less productive, which means the same physical quantity of capital drops in value compared to the value it had in the pre-trade world. The resident of A nominally gets the same return on investment as the resident of B, but A has less to invest in real terms. The opposite effect on B, however, should be larger if B started with a lower level of tax amenities and lower productivity.[96]

On balance, it is not clear whether savings decisions in the resulting, post-trade world are superior to the decisions that would be made if savings neutrality did not hold. To see this, assume the same facts, except that A and B satisfy all revenue requirements via lump-sum taxation. When borders are opened, capital will flow from B to A because of the superior return there. If that were the sole effect, optimum savings decisions would result when rates equalized. But the inflow of capital to A will impose an additional burden on A's infrastructure, causing the revenue target to fall short of what is needed to maintain its higher productivity. The opposite effect will occur in B. If revenue targets are not adjusted, then in real terms asset prices in A will drop and in B will increase. After-tax rates of return, however, will be identical in both jurisdictions. If some tax revenue were allocated from B to A (or if some capital were reallocated from A back to B), greater over all productivity would result, meaning that the world of lump-sum taxes is not Pareto-optimal. This implies that the non-tax-affected world is inferior to the tax-affected world.

Such an allocation in fact is what occurs under territorial taxation. When capital moves from A to B in the original example, tax revenue is

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[96] *See* Part III., below.

redirected from A to B. Productivity in B is increased, resulting in a tax-affected world that is superior to the non-tax-affected world given that B began with fewer tax amenities than A.

(ii) Non-Preservation of Production Neutrality

Similar conceptual difficulties arise if A instead pursues CEN, or identity of pre-tax returns, through a system of residence-based taxation with a FTC. In this case, as capital flows from A to B, A initially will retain some revenue on its residents' B-sited investments, and there may be only slight adjustments to the levels of tax-financed amenities in A in consequence; indeed, the adjustments could go either way depending on the relative reductions in A's tax revenue and the demand for it to pay for tax amenities in A at the rate that was chosen before borders were opened. However, the indifference of A's investors to tax rates in B (at least up to A's rate) gives B an incentive to raise rates and improve its tax amenities, thereby increasing the pre-tax rate of return in B and, in consequence, attracting more capital to B. The increase in B's productivity will then reduce the residual tax revenue available in A to finance tax amenities there – especially since more capital also will be attracted to B as a result of its improved productivity. Again, the result is reduced productivity in A. And, just as in the territorial case, despite the fact that the relevant benchmark is satisfied (here, CEN, or identity on pre-tax rates of return), it is clear that tax rules have caused locational adjustments that affect pre-tax rates of return in absolute terms, which were supposed to be preserved under CEN. Therefore, it again is not clear what the normative significance is of satisfying the benchmark. Nor, conversely, is it clear why the fact that the tax law has induced locational adjustments means that the resulting state of affairs is distorted: The pre-tax rate of return in A and B, which was supposed to function as a baseline to measure tax distortions, has itself been shifted in both jurisdictions, while the effect of tax-induced capital flows has been to increase productivity overall. One again is left with the odd result that tax-induced flows of capital – that is, "distortions" – have resulted in greater rather than less productivity. Indeed, tax-induced flows even have resulted in greater rather than less efficiency over all, when the latter is understood to include the realization of latent productive power available to capital and labor.

(iii) Comparison With Ownership and Competitive Neutralities

Capital ownership neutrality offers a useful contrast to savings neutrality and production neutrality on the question of the effects of taxation on productivity. The case for pursuing CON over other benchmarks rests in large part on the contention that tax-induced ownership effects dominate capital

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location and savings-spending decision effects.[97]   To the extent the facts support this contention, the feedback effects just discussed are muted, because tax rules generally do not redirect tax revenues into or out of jurisdictions if capital doesn't move. There may, however, be adjustments on the demand side for tax amenities even if the location of factors of production is fixed, meaning that some feedback effect may occur.

Thus, consider again the example of States A and B as borders open, but assume that the only tax-sensitive margin is ownership. In the first scenario, both A and B adopt territorial systems. One would expect ownership shifts to occur as borders are opened, and, if one supposes that better tax amenities reliably produce greater competencies, it seems that in an initial stage there will be a net shift of ownership of B-sited assets to A residents. Because gains from non-tax-affected trade can be expected to increase output over all, one would expect tax revenue increases in B as B-sited assets become more profitable. However, as long as there is not a net reduction in productivity of assets remaining in A (by whoever held), tax revenue should not decline in A either.

Whether A-sited assets remain as productive as before depends on what happens when A residents acquire more-profitable assets in B. The CON story plausibly holds that when resident investors acquire foreign-sited assets, new owners enter to fill the void created by the investor's decision to sell property at home in order to finance the foreign acquisition.[98]   It does not follow that the new investors of the residence-sited assets will be as effective owners as the old owners, but a guess based purely on intuition is that the long-run tax revenue differences would not be large. If, however, intuition fails and there is a material net reduction, then tax revenue would decline, much as in the case where it is assumed that capital is mobile and ownership is fixed.

If A and B each adopt a worldwide FTC system, it would appear that the effect would be more muted still, because residual residence-based tax remains when ownership shifts from low-tax to high-tax residents.

These considerations suggest that it is an empirical question whether tax revenue streams or burdens on tax-financed infrastructure will be dramatically affected by tax rules. As indicated above, there is wide

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[97] Desai & Hines, at __.

[98] Hines, *Reconsidering*, at 277-78.

disagreement on the question of which margins of investor behavior, if any, dominate in response to tax rules.[99]

Finally, a word on competitive neutrality. As discussed in Part I, treating "competitive neutrality" as a genuine neutrality benchmark seems mistaken because there are no efficiency losses other than those associated with savings non-neutrality that result from failure to ensure that home and host residents face identical tax burdens on host-sited investment. Not surprisingly, there are no implications for competitive neutrality from the fact that capital will move in response to lower rates (assuming capital location is responsive to tax considerations). Competitive neutrality says nothing explicitly or implicitly about relative productivity in home and host.

III. Neutrality as a Combination of Rates and Amenities

This Part attempts to quantify the conceptual point described in Part II.B. The extent of the effect of tax rules on productivity depends on the relationship between tax revenues and tax amenities. This Part accordingly attempts to provide measures of that relationship and of the magnitude of the effect on tax revenues from tax-induced capital flows. It begins with a simple model and then explores the consequences for productivity under the model when capital enters or leaves the jurisdiction in response to taxes.

A. Estimating the Value of Tax Amenities

Technically the question of interest is the quantity of those tax-financed governmental goods and services that contribute to productivity that are needed to support a given level of productivity. I have been referring to these goods as "tax amenities." Redistributive taxation and taxation for the provision of what might be called pure consumption benefits, such as public parks for enjoyment, are not relevant.

The precise relationship between tax amenities and productivity is, undoubtedly, quite complex and certainly varies depending on such factors as the size of the jurisdiction, its available resources, social and political views about various matters, and other variables. Rather than seek to tease out the relationships among these factors and productivity, I proceed with a more tractable, if less precise, model. The object here is to specify the general nature of the relationship between taxation and productivity, not to model particular jurisdictions.

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[99] *See, e.g.*, Kane, at __; Stephen E. Shay, *Commentary Ownership Neutrality and Practical Complications*, 62 TAX L. REV. 317, 319-24 (2009).

It is helpful to begin with the observation that most tax amenities exhibit characteristics somewhere between those of "pure private goods" and "pure public goods." A pure private good is one whose unit price can be determined under a standard model of supply and demand; it exhibits no externalities and its owner bears all associated costs and enjoys all associated benefits.[100] Pure private goods also exhibit the characteristics of "excludability" and "rivalry," meaning, respectively, that the good's availability can be limited to those who pay for it and that one person's consumption of the supply of the good reduces its availability for consumption by another.

A pure public good, by contrast, would be entirely non-rival and non-excludable.[101] National defense is close to a pure public good because militias provide a benefit to all residents without regard to the amounts of tax they pay that support national defense and, within limits, without regard to population size. Clean air is a similar example. For these goods, it is impossible to exclude those who do not pay for it from enjoying it, and the enjoyment of it by anyone (whether paying or not) does not reduce the quantity available for others to enjoy.

In practice, most state-provided goods exhibit some aspects of non-rivalry and non-excludability, but they are not "pure."[102] (The converse similarly holds: few market-supplied goods are pure private goods.[103]) Locally provided amenities such as street cleaning or schools exhibit less of these characteristics, since ordinary market forces, such as the cost of housing, may determine who gets to enjoy the benefits. A public school may be open only to community residents (excludability), and there are limits to the number of attendees (rivalry).

It has been noted that public goods cannot be priced under the standard model applicable to private goods because of endemic market failure, which takes the form of positive externalities.[104] In particular, non-excludability creates a free-rider problem in that the goods are enjoyed by non-purchasers,

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[100] Samuelson, __.

[101] *Id.*

[102] *Id.*

[103] [CITE.]

[104] *See generally*, Barbara Fried, __ CHAPMAN L. REV., __, for a discussion of the problem.

and non-rivalry means that pricing presents a collective action problem.[105] As a consequence, the use of market mechanisms to supply public goods will result in a systematic undersupply unless there is someone who so values the good that it is worthwhile for that person to provide it even if no compensation from other beneficiaries is forthcoming. A large literature explores the problem of funding public goods in a manner to get around these difficulties.[106]

Although the pricing of public goods is relevant to the problem of their supply, here the concern is not so much with setting prices but with determining the value they add to factors of production via tax amenities. What, in general, does it cost to supply a given level of productivity, and how is that cost related to the quantity of capital in the jurisdiction, assuming that all tax amenities are financed with tax revenues?

If tax amenities were pure private goods, the feedback problem of tax-induced capital flows on tax revenues and, consequently, on tax amenities would disappear. In that case, each unit of capital would be ticketed with just the taxes that it requires in order to be as productive as it is for a given rate of tax, and not more. Net capital exports would reduce total taxes collected and, concomitantly, total tax amenities supplied by exactly the amount no longer needed in the jurisdiction to maintain the same level of capital productivity, while net capital imports would increase them analogously. But tax amenities, even though narrowly construed to include solely those tax-purchased goods that contribute to the productivity of capital, are not pure private goods, and the cost of providing them cannot be assumed to be linearly impounded into taxes assessed on capital. Many tax amenities, such as national defense or the broadcast spectrum, have costs that are not systematically related to the quantity of capital in the jurisdiction. Other tax amenities, such as a court system, public safety or transportation infrastructure, have costs that are partly related and partly unrelated to the quantity of capital present in the jurisdiction. More generally, it seems reasonable to suppose that for a given level of capital productivity, tax amenities will be supplied partly from public goods financed with fixed costs and partly from public goods the cost of which varies in (some) proportion to the amount of capital in the jurisdiction.

Equation (1) attempts to capture these intuitions in a simple, stylized model that relates GDP per capita, a proxy for capital productivity, to the

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[105] *Id.*

[106] The seminal paper is Samuelson's *The Pure Theory of Public Expenditure*, 36 REV. OF ECON. & STATISTICS, 37 (1954). *See* John Hudson & Philip Jones, *"Public goods": An exercise in calibration*, 124 PUBLIC CHOICE 267, 267 (2005). ([Samuelson's] definition has become a 'standard' textbook description.").

product of the logarithms of total taxes collected per capita and country population, backing out, however, taxes paid for pension contributions. The underlying intuitions may be summarized as follows:

(i) over the range of reasonable possible tax burdens, taxes are positively correlated with capital productivity because taxes pay for infrastructure;

(ii) by backing out the largest single item (retirement) that is largely unrelated to productivity and using a log function, a reasonable approximation of taxes used to fund productive activity is employed;[107]

(iii) especially in the case of public goods, there are returns to scale for larger countries so that, all else equal, the same quantity of tax revenue per capita will fund more infrastructure in a country with a larger population than with a smaller one; and

(iv) the use of logarithm functions is appropriate because both the benefit from greater tax burdens and the benefit from greater population exhibit the property common to many economic inputs of being constantly declining, so that the next dollar of tax revenue or the next person is not as valuable as the last in improving GDP per capita.

Thus:

$$GDP_i = \log_n(T_i + C_1) * \log_n(P_i + C_2), \tag{1}$$

where GDP_i is gross domestic product per capita as a share of a reference GDP per capita, T_i is tax revenue per capita as a share of reference tax revenue per capita, and P_i is population as a share of reference population, in each case in jurisdiction i. The C-terms are constants. Reference rates are used to avoid the problem of expressing relative productivity levels and tax burdens in dollars or other units.

Because the model under consideration attempts to derive the consequences of international tax rules on productivity as economies move from relatively closed to more open status, an older data set is a better candidate than a newer one for an approximation of the relationship between tax revenue and population on one hand and productivity on the other for a closed economy. The earliest year for which data are readily available is 1980.

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[107] Additional outlays that could have been backed out include unemployment insurance; public consumption goods such as parks; and transfer payments from high-income to low-income persons. The first and third of these items plausibly contribute materially to productivity, while the second is generally inconsequential in amount. [CITE.]

At that time, world trade accounted for approximately 16 percent of world GDP (as contrasted with approximately 29 percent by 2010).[108] Expressing total taxes in Country i as a fraction of U.S. total taxes and population in Country i as a fraction of U.S. population, a regression for then-member OECD countries against the exponent of GDP per capita (expressed as a fraction of U.S. GDP per capita) was run for 1980.[109] The parameters derived for the regression are: C_1 = 1.3228, and C_2 = 2.4750. The two independent variables appear to account for approximately 75 percent of the variation in GDP/capita, although tax revenue per capita alone accounts for nearly 65 percent of total variation.[110]

Substituting these values into Equation (1) yields:

$$GDP/cap_i = \log_n(T_i + 1.2899)*\log_n(P_i + 2.9285), \quad (1')$$

where *GDP/cap* is expressed in terms of the fraction of U.S. GDP per capita, T_i is expressed as the fraction of total U.S. tax revenue, and P_i is expressed as a fraction of U.S. population, all in 1980. Total tax revenue includes both income and other taxes and includes sub-national tax revenue. Table 1 lists predicted productivity levels under Equation (1') associated with different levels of tax revenue for selected population and tax revenue values.

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[108] United Nations figures, available at __.

[109] The data set consisted of all OECD member countries in 1980 except Iceland, Luxembourg and Sweden. Iceland and Luxembourg were excluded because they were judged too small in population to be representative, while Switzerland was excluded because it was judged to be a tax haven and, therefore, unlikely to exhibit the properties of a relatively closed economy funding its infrastructure primarily with taxes from domestic productive activity. Additional attributes of the data set and results for statistical significance are provided in the Appendix.

[110] R^2 is 0.7979. *See* Appendix.

Table 1: Productivity at Selected Tax Revenues and Populations

a. Population equal to U.S. population (1980)

	Tax rev. per capita as percent U.S. tax rev. per capita	GDP per capita as percent U.S. GDP per capita
1.	200	162.91
2.	180	154.33
3.	160	145.16
4.	140	135.36
5.	120	124.79
6.	100	113.34
7.	80	100.84
8.	60	87.08
9.	40	71.77
10.	20	54.54

b. Population equal to one-half U.S. population (1980)

	Tax rev. per capita as percent U.S. tax rev. per capita	GDP per capita as percent U.S. GDP per capita
1.	200	139.19
2.	180	131.86
3.	160	124.04
4.	140	115.65
5.	120	106.62
6.	100	96.83
7.	80	86.15
8.	60	74.40
9.	40	61.32
10.	20	46.60

c. Population equal to one-twentieth U.S. population (1980)

	Tax rev. per capita as percent U.S. tax rev. per capita	GDP per capita as percent U.S. GDP per capita
1.	200	121.25
2.	180	114.87
3.	160	108.05
4.	140	100.75
5.	120	92.88
6.	100	84.36
7.	80	75.05
8.	60	64.81
9.	40	53.42
10.	20	40.60

B. Productivity Consequences of Capital Flows Under the Model

Whether and how capital will flow as the world moves from a system of closed economies to one of open economies (i.e., capital flow consequences) are topics developed in Part IV, but it is worth considering in a general way the revenue and productivity consequences that the model predicts assuming that significant amounts of capital do flow into or out of a representative jurisdiction. In order to simplify the analysis, the following assumes that all countries derive one-half of their tax revenues from a flat-rate income tax, with the balance derived from taxes and fees not dependent upon the presence of capital in the jurisdiction. It also assumes that one-half of world income is derived from labor and one-half from capital. This assumption is one possible approximation of the generally accepted view that labor accounts for between 40 and 60 percent of GDP, and capital the balance.[111] Thus, under these assumptions, one-quarter of world tax revenue derives from income taxes laid on capital. Finally, it is assumed that tax rates are not adjusted to reflect increases or reductions in tax revenues resulting from capital movements.

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[111] OECD.

1. Territorial Systems

In a system of universal territoriality, the flow of capital out of a jurisdiction is associated in the short term with the elimination of all income tax revenues generated by the capital from the resident jurisdiction and the generation of new tax revenue in the source jurisdiction (at the source rate). It also is associated with the elimination of tax revenue from labor supplied in conjunction with the operation of that capital in the residence to the extent the labor is not reabsorbed into the residence economy; additional tax revenue resulting from the inflow of capital in the source arises on an analogous basis.[112] Based upon the assumptions described above and in light of the associated revenue losses and gains resulting from capital movements, the exodus of one percent of capital from a jurisdiction leads to a minimum 0.25 percent reduction in total tax revenues there. Thus, the transfer of 20 percent of the capital from the residence to a source jurisdiction is associated with at least a five percent reduction in residence tax revenues.

Consider a country having a population one-twentieth of the U.S. 1980 population whose initial tax revenues per capita are 1.6 times that of the U.S. in 1980. This would be approximately the situation of a small Western European country such as Belgium. Assume that, after borders are lifted, over time the country experiences 25 percent net capital outflow and an associated eight percent reduction in tax revenues, factoring in lost productivity from the sub-optimal reallocation of labor to other activities in the residence. Although residents would continue to own income generated by off-shore capital, the residence would experience a reduction in productivity of approximately 4.5 percent due solely to reductions in tax revenues, from 108 percent of U.S. productivity to about 103.5 percent.[113] This drop may not appear to be large, but even an economy five percent of the size of the U.S. economy would have approximately $729 billion in annual GDP,[114] meaning that a four percent

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[112] [CITE to text on production functions.]

[113] An eight percent reduction in tax revenue per capital from 1.6 times the U.S. level is 1.472 times the U.S. level. Under Equation (1'), the resulting productivity is given by: $\log_n(1.472 + 1.2899)*\log_n(0.05 + 2.71828) = 1.034$, or 103.4 percent of U.S. productivity, a drop of approximately four-and-one-half percent from the level for tax revenue per capita equal to 1.6 times that of the U.S. *See* Table 1.c., line 3.

[114] For 2010, the OECD estimated U.S. GDP as $14.58 trillion. OECD Data, available at:
http://www.oecd-ilibrary.org/economics/gross-domestic-product-in-us-dollars_2074384x-table3.
According to Equation (1'), a country one-twentieth the size of the U.S. with a per capita tax burden equal to 1.6 times that of the U.S. would have GDP per capita of 99

reduction in productivity is associated with approximately $29 billion in lost productivity, or more than $1,800 per person per year.

Perhaps more importantly, a further effect of a reduction in in-country capital productivity is to make foreign investment still more attractive to home-country residents, leading to a cycle of capital exodus that continues for as long as the reduction in productivity associated with lower tax revenues exceeds the increase in capital productivity associated with greater scarcity of capital in the jurisdiction.[115] And if, as is commonly the case,[116] the residence responds to falling productivity by reducing tax rates, the problem is likely to get worse unless the drop in rates encourages capital inflows. (Whether it does depends upon the tradeoff to foreign investors between lower productivity in the residence and lower taxes there. This subject is addressed in Part IV.) Unless and until the drop in rates encourages net capital inflows, residence productivity will decline further still. When equilibrium is reached, in-country GDP will have declined substantially below the optimum level that existed before borders were opened. Whether the drop represents a worldwide productivity loss depends, however, on the capital productivity increase, if any, associated with the movement of capital into source jurisdictions and the associated infrastructure improvements resulting from additional tax revenues there. Of importance for the neutrality question is that, however that analysis plays out, one cannot read off from the fact that capital flows into or out of the jurisdiction that neutrality either has been "maintained" or has not according to the benchmarks applicable to CIN – savings neutrality and competitive neutrality.

In the case of a net capital importer, the situation is roughly reversed. A net 25 percent increase in capital inflow will be associated with a 25 percent increase in tax revenues and rising productivity. Of course, this result presupposes that tax rates remain generally constant. As discussed in Part IV, below, this expectation is not reasonable in a world of territorial states divided into net capital exporting countries and net capital importing countries.

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percent of that of the U.S., resulting in an economy approximately five percent of the size of the U.S. economy.

[115] To be clear, the upward pressure on the price of capital remaining in the jurisdiction resulting from tax-induced outflows is a consistent theme of neutrality analysis. *See, e.g.*, Hines, Knoll, Shaheen. The claim here is that the focus equally needs to be on the downward pressure on the price of capital remaining in the jurisdiction (relative to the price of capital in other jurisdictions) that results from the reduced productivity of capital as tax amenities go unsupplied.

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2. Worldwide Systems

In worldwide systems, the productivity consequences of a net inflow of capital, without more, do not differ from those in territorial systems, while the consequences of a net outflow of capital may or may not differ markedly from those in territorial systems. (As explained in Part IV, the incentives giving rise to capital flows do differ dramatically.) As under a territorial system, in a worldwide system all tax revenue imposed by the source on imported capital flows to the source, and the associated benefits to tax amenities all arise there. The productivity consequences in the residence, however, depend upon relative tax rates. If capital moves to a higher-taxed jurisdiction, the result is the same as in a territorial system, assuming the FTC is limited: The residence experiences a net reduction in tax revenues equal to all tax on the departed capital, giving rise to the same reduction in productivity that arises under a territorial system. (If the FTC is unlimited, there is an additional reduction in residence tax revenue equal to the difference between the tax on income at the source rate and the tax on income at the residence rate, resulting in even greater degradation of residence productivity. However, as noted earlier no system provides or is likely to provide an unlimited FTC.[117])

If the source taxes at a lower rate than the residence, the residence retains residual tax revenue equal to the difference between the home- and host-country rates applied to net source-based investment income. The productivity consequences of the retention are ambiguous. The model of productivity developed in this Part is based on the theory that over the range of reasonably possible tax rates, tax revenues significantly drive the rate of return to privately-held capital. The model further supposes that, for a variety of reasons, the increase or reduction in taxes on capital will be related to the logarithm of the pre-tax rate of return. In other words, if, as capital leaves the jurisdiction, all the associated tax revenues leave the jurisdiction, the resultant reduction in tax revenues has a downward effect on productivity that exceeds the upward effect from having to supply fewer tax amenities by reason of the reduced quantity of capital present there. By the same token, however, the departure of capital from a jurisdiction does imply that the burden on infrastructure, and consequently the cost of tax amenities, drops to some extent. Consequently, in a worldwide system where capital leaves a high-tax residence for a low-tax source, the effect on residence productivity from reduced tax revenues depends on whether the residual tax revenue in the residence covers the cost of maintaining the reduced need for tax amenities there. This is an empirical question that is a function of a number of variables, including the

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[117] *See* Part I.B., above.

initial quantity of tax revenue per capita in the residence (a higher amount associated with less reduction in productivity as capital leaves), the difference between the source and resident rates (a greater difference associated with less reduction in productivity as capital leaves) and the size of the residence (a larger population associated with less reduction in productivity as capital leaves).

C. Conclusion on Neutrality and Amenities

The discussion in this Part has developed the thesis, backed by evidence, that the presence in a jurisdiction of what I have termed "tax amenities" – infrastructure and other public or quasi-public goods that are paid for with tax revenues – plays a significant role in the productivity of capital there. The ramifications of the thesis, if true, are reasonably far-reaching. Part II developed the argument that any system for taxing cross-border transactions creates tax incentives that alter the absolute productivity of capital in any jurisdiction, assuming that capital moves in response to tax rules. (Similar consequences follow if labor moves, a question not treated here.) Changes in absolute productivity in the jurisdiction, no less than tax-induced movements of assets or changes to the relative supplies of labor and capital, have an effect on the "pre-tax rate of return" and indicate that productivity enhancements may result from tax what would count as tax distortions under the standard view of the effects of taxation on productivity. One consequence of these observations is that it becomes hard to say what international tax neutrality is.

This Part suggests that predictions about how capital will flow and the productivity consequences of capital flows as borders become more open differ markedly from predictions of the standard models. Under those models, productivity is not made to depend on tax revenues, and tax rules accordingly are expected to have effects on productivity largely because of tax-induced changes allocations of resources to the wrong person or place and resulting misallocations of the relative supplies of and demands for factors of production in affected jurisdictions.

Thus, if, when borders are lifted, the world consists of a system of territorial regimes, under the standard model capital can be expected to flow to the lowest-tax jurisdictions until after-tax rates of return there reach after-tax rates in the next-lowest-taxed jurisdictions, then to those latter jurisdictions, finally reaching a single worldwide after-tax rate with some significant amount of distortion in capital location once all tax benefits have been capitalized.[118] This pattern follows if one assumes that taxes generally represent a cost laid on

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[118] *See, e.g.*, Rosenzweig for a standard statement of the thesis.

top of other costs to investment. Similarly, if ownership is the dominant margin along which behavior is elastic to taxes and a mixed system of worldwide and territorial regimes is in effect as borders become open, one can expect the identity of owners of capital to shift in similar ways until a single after-tax rate of return is reached with an associated (inefficient) pattern of ownership.[119]

By contrast, under the approach developed here, it is unclear whether under a territorial regime capital will flow into low-tax jurisdictions or ownership will shift from high- to low-tax investors: On one hand, for a high-tax jurisdiction resident, the tax burden of investment is lower in a low-tax jurisdiction; but on the other hand, the absolute rate of return to capital in the low-tax jurisdiction is likely to be lower than it is in a high-tax jurisdiction. Whether it makes sense to move capital or change ownership to enjoy those lower tax rates depends on the tradeoff between them and the lower productivity associated with them – an empirical question the answer to which depends on actual productivity levels and rates in both jurisdictions.

It is perhaps worth noting that the low levels of capital inflow into low-tax jurisdictions suggested by a focus on tax amenities is consistent with observation.[120] The theory that generates them also helps to explain the so-called "Lucas Paradox," which states that despite the fact that (standard) theory predicts net capital flows to low-cost jurisdictions, observed flows tend to run in the opposite direction – to high-cost jurisdictions.[121] It would appear that the

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[119] *See, e.g.*, Hines, *Reconsidering*, at __, for a description of how ownership changes result from tax rules.

[120] As explained in the next note, capital does not uniformly flow from high- to low-cost jurisdictions, contrary to theoretical prediction.

[121] Robert Lucas, *Why Doesn't Capital Flow from Rich to Poor Countries?*, 80 AM. ECON. REV. 92 (1990). The Lucas Paradox is more of a puzzle than it is a paradox. Lucas attempted to explain the fact that capital flowed into the U.S. much more readily than into India in 1988, despite the fact that theory predicted the marginal productivity of capital in India would be 58 times higher than in the U.S. *Id*. Lucas offered two possible explanations: differences in "fundamentals," or country-specific factors affecting productivity, and market failure.

Alfaro et al. examine a larger data set for the period 1971-2000 and conclude that fundamentals are the key determinant. In particular, they state: "[L]ow institutional quality is the leading explanation for the Lucas Paradox." Alfaro *et al.*, *Why doesn't Capital Flow from Rich to Poor Countries? An Empirical Investigation*, 90 REV. ECON. & STATISTICS 347, 347 (2008). The explanation offered in this Article is consistent with Alfaro et al. inasmuch as many fundamentals, including those affecting institutional quality, tend to be financed with tax amenities.

puzzle can be partly explained, or at least better understood, once the role that taxes play in establishing productivity is taken into account. In particular, a jurisdiction's after-tax return to higher taxes will often, perhaps typically, exceed the after-tax return to lower taxes. For example, consider a country one-twentieth the size of the U.S. in population having an initial tax amenity rate equal to 80 percent of the U.S. tax amenity rate in 1980. Such a country would have an amenity tax rate of 20.62 percent[122] and a model-predicted GDP per capita of 75.05 percent of U.S. GDP per capita.[123] If the tax rate were cut in half, model-predicted GDP per capita as a fraction of U.S. GDP per capita drops to 53.42 percent. Thus, while an investment earning $100 at the higher productivity rate would yield in $79.38 after-tax, the same investment at the lower productivity rate would yield approximately five-sevenths the return on a pre-tax basis, or $71.18. The after-tax return would be $63.28. A rational investor therefore would favor investment in the high-tax jurisdiction.[124]

Finally, there are dramatic welfare consequences to tax-induced capital flows that have gone largely unnoticed in the literature. The link between tax revenues and productivity means that the flow of capital in response to taxes has a multiplier effect on increases in productivity in the source and, at least in the case of territorial systems, on reductions in productivity in the residence. For the source, if statutory rates of tax remain constant (which they rarely do in a territorial world) the news generally would be good regardless whether the system is territorial or worldwide, as the source gets all the additional tax revenue associated with the net inflow of capital. The additional tax revenue improves the rate of return in the source, thereby making it more attractive for additional investment. This virtuous circle continues until the improvement in the rate of return is balanced by a reduction resulting from the increased relative supply of capital in the source as a factor of production.

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[122] In 1980, the U.S. tax rate (national and sub-national) as a percentage of GDP per capita was 26.40 percent, of which 78.1 percent, or 20.62 percent of GDP, was devoted to spending on tax amenities. OECD.

[123] *See* Table 1.c., Line 7.

[124] Other tax explanations for the Lucas Paradox have been offered. For example, Kleinbard notes that the capacity of multinational firms to divert income economically earned in high-tax jurisdictions to low-tax jurisdictions for tax purposes removes the added cost of investing in high-tax jurisdictions while enabling the investor to reap the greater productivity benefits there. Kleinbard, *Lessons of Stateless Income*, at __. Kleinbard's explanation is entirely consistent with the theory of tax amenities offered here, since it presupposes that the absolute pre-tax return to investment in high-tax jurisdictions is superior to that in low-tax ones.

By contrast, for the residence, the news is likely to be bad – especially in a territorial system. In a territorial system, as capital leaves the residence, productivity declines because of the decline in tax revenues. The decline in productivity makes the residence still less attractive to capital, meaning that still more capital can be expected to depart. This "rats from a sinking ship" phenomenon continues until the increased scarcity of capital relative to other factors of production in the residence counterbalances any additional reduction in the rate of return to capital resulting from reductions in tax revenues. The point at which equilibrium is reached, however, is likely to be one at which productivity is markedly lower than it would have been if tax revenues were kept at a level sufficient to maintain capital productivity in the residence. Whether there is an overall reduction in productivity – that is, a worldwide reduction – depends upon the consequences in the source. It seems safe to say, however, that residence reductions in productivity are less likely in a system of worldwide taxation, as high-tax resident jurisdictions retain some tax revenue after the departure of capital to lower-tax jurisdictions. Where the revenue retained is sufficient to maintain productivity levels (as it may be given the reduced burden to finance tax amenities resulting from the net departure of capital), no hollowing out occurs.

IV. Allocative, Distributional and Competitive Effects

Part II laid out the case against the traditional understanding of international tax neutrality, arguing that the effects of capital flows on pre-tax rates of return render the idea that there exists a worldwide baseline against which one can measure return problematic. Part III developed a model for thinking about cross-border taxation that takes account of the relationship between tax revenues and the pre-tax rate of return – the effect of so-called tax amenities on productivity. Part III also detailed some of the productivity consequences of capital flows for home and host jurisdictions, assuming that capital moves in response to taxes.

This Part briefly examines the circumstances under which such capital flows are likely to occur in light of the model and compares predictions of the model with observation. It also surveys the likely allocative, distributional and competitive properties of international tax systems under the model. If the case for pursuing some global form of neutrality fails, these effects loom larger.

A. After-Tax Returns

A range of average effective tax rates and levels of development obtains in the actual world,[125] but in broad brush the world consists mostly of a set of industrialized, developed countries and a set of relatively non-industrialized, undeveloped countries.[126] Here I consider the situations of a developed and an undeveloped country under alternative worldwide tax regimes as the world moves from closed to open economies, taking into account that under any system, investors generally seek to maximize their after-tax returns.

In general, after-tax investment return is given by:

$$q_i = (1 - t_i)*r_i, \tag{2}$$

where q_i is after-tax rate of return, t_i is tax rate (expressed as a decimal), and r_i is pre-tax rate of return (also expressed as a decimal), all in Country i. In making investment decisions, investors seek a combination of tax rate and rate of return that provides the maximum value for q.

Many factors are responsible for r_i, but for present purposes I bracket all those except taxes and population, which Part II suggests are highly correlated with productivity. Using Equation (1'), it is possible to derive an expression for r_i in terms of t_i and population for a world in which all taxes are income taxes levied at a flat rate. Recall that Equation (1') relates pre-tax rate of return (expressed as the ratio of GDP per capita to that of the U.S. in 1980) to tax rate and country population (also as fractions of the respective U.S. values for 1980) as follows:

$$GDP_i = \log_n(T_i + 1.2899)*\log_n(P_i + 2.9285). \tag{1'}$$

Taking population as fixed for any particular Country i, the second logarithm term becomes a constant and for that country (1') simplifies to:

$$GDP_i = A_i*\log_n(T_i + 1.2899), \tag{1''}$$

where A_i is the constant derived by applying the logarithm function to the argument of the second logarithm term in Equation (1'), taking as P_i the ratio of Country i population to U.S. population in 1980.

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[125] *See* Heritage Foundation 2011 Index of World Economic Freedom for a list of all countries and tax rates. It is possible to compute tax revenue per capita using the Heritage data.

[126] [CITE.]

If GDP per capita is taken as a proxy for pre-tax rate of return, then one can rewrite r_i as the product of GDP_i and some constant, K. However, it is not necessary to derive this constant if one expresses the after-tax rate of return not directly as a rate but as the ratio of the Country i GDP per capita to the same reference GDP per capita that was used in Equation (1), U.S. GDP per capita in 1980, multiplied by one minus the tax rate in Country i. (Under this procedure, the K term appears in both the numerator and the denominator of the ratio.)

Therefore, let Q_i be the ratio of q_i to q_{US-80}, U.S. GDP per capita in 1980. Then:

$$Q_i = (1 - t_i)*R_i, \qquad\qquad (2')$$

where R_i is simply Country i productivity measured against 1980 U.S. productivity, or the expression given on the right side of Equation (1'). For a fixed population in Country i, that expression is given by Equation (1''), so that:

$$R_i = A_i*\log_n(T_i + 1.2899). \qquad\qquad (1''')$$

Since T_i is just the ratio of t_i to the reference tax rate, U.S. amenity taxes in 1980 (expressed as the ratio of all U.S. tax revenue to U.S. GDP for the year), or 0.206, Equation (1''') can be rewritten as:

$$R_i = A_i*\log_n((t_i/0.206) + 1.2899), \qquad\qquad (1'''')$$

and Equation (2') becomes:

$$Q_i = (1 - t_i)*A_i*\log_n((t_i/0.206) + 1.2899). \qquad\qquad (2'')$$

Equation (2'') relates the after-tax return in Country i to its average amenity tax rate and population, which latter it treats as fixed. For any population size, after-tax return reaches a maximum at a value for t_i of approximately 0.34, or 34 percent,[127] though what this maximum value is depends slightly upon population.[128] Table 2 provides figures for a country having one-quarter the population of the United States in 1980. For such a country, A is 1.156, and at $t = .34$, Q_i has a value of 0.633. In other words, the after-tax maximum rate of return in Country i, assuming it is one-fourth the

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[127] The derivative of Equation (2'') with respect to t_i is:
$dQ_i/dt_i = (1 - t_i)*(A_i*4.854/(4.854*t_i + 1.2899)) - A_i*\log_n(4.854*t_i + 1.2899)$,
which reaches a value of zero when t_i is approximately 0.340. The second-order derivative is negative at this value of t_i.

[128] Note that Equation (1') is much less sensitive to variations in population size than tax rate.

size of the U.S. in 1980 population, is approximately 82.3 percent of the pre-tax rate of return in the U.S. in 1980, which translates into approximately 103.7 percent of the after-tax rate of return in the U.S. in 1980.[129] Table 2 shows that the "sweet spot" for maximum after-tax returns runs from tax rates of about 30 percent to about 40 percent, which reflects average tax rates (expressed as the ratio of total tax revenues to GDP) in developed countries, not developing countries.[130]

Equation (2'') suggests, contrary to the usual assumptions about the effects of tax rates on investment, that as trade restrictions are lifted, capital is more likely to flow into high-tax jurisdictions than into low-tax ones. The evidence is consistent with this hypothesis.[131] The vast majority of international trade takes place among developed countries.[132] Alfaro et al. (Alfaro), summarizing data from the IMF and other sources, report that for a sample consisting of 23 developed and 75 undeveloped countries over the period 1971 to 2000, capital inflows per capita to developed countries exceeded those to undeveloped countries by a factor of approximately five.[133]

Table 2: Selected predicted after-tax rates of return for a country having
25 percent of U.S. population (1980)

Tax rate (fraction)	After-tax return as fraction of 1980 U.S. pre-tax return	After-tax return as fraction of 1980 U.S. after-tax return
0.1	0.597364416	75.23481315
0.2	0.754596793	95.03737951
0.3	0.817721901	102.9876450
0.4	0.813837148	102.4983814
0.5	0.759112991	95.60617013
0.6	0.664065935	83.63550823
0.7	0.535971298	67.50268242
0.8	0.380102232	47.87181768

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[129] Fraction of U.S. after-tax return in 1980 is given by the ratio to the pre-tax return, divided by one minus the 1980 U.S. tax rate (expressed as a fraction), or 0.264. Data from OECD.

[130] [CITE.]

[131] Alfaro, at __.

[132] IMF, __.

[133] Alfaro, at 352.

0.9	0.200422488	25.24212698

The bias in favor of capital movements among developed countries does not imply, of course, that there will be no capital flows from developed to undeveloped countries; it implies only that those flows will be dwarfed by flows among developed countries, as indeed they are. In general, the quantity of capital inflows into developing countries appears to have grown steadily over the last fifty years.[134] In Alfaro's sample, from 1970 to 1974, net inflows per capita to developing countries were less than $1,000 per year; in the five-year period from 1990 to 1994 they had risen to approximately $2,500 per year; and by 1995 they had more than doubled again, to more than $5,000 per year.[135] Flows per capita into developed countries in Alfaro's sample grew more quickly still, moving from approximately $1,000 per year in 1975-79 to more than $25,000 per year from 1995 to 2000.[136]

B. Comparisons of Systemic Effects

1. Territorial Systems

Even in a territorial system, investors will not automatically invest in low-tax jurisdictions once borders are lifted, for the reason just discussed that low taxes are highly correlated with lower productivity and lower after-tax returns, and investors seek the highest after-tax return, not the lowest tax rate.[137] The relationship between tax rate and population on one hand and productivity rates on the other illuminates the choices that countries face as borders become more open. In a world of territorial tax systems, the opening of borders would not be expected to result in massive net capital flows either in or out of a developed country, as most trading will occur with similarly situated partners and tax advantages of low-tax jurisdictions would seem to be swamped by productive weakness. Rather, the uneven distribution of resources, capabilities and factors of production worldwide (commonly referred to as "comparative advantage"[138]) means that supra-normal returns become available in all countries as borders are opened or, stated otherwise, that new opportunities for gains from trade are as likely to appear in one

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[134] *Id.*

[135] *Id.*

[136] *Id.*

[137] *See* Part III.

[138] Paul A. Samuelson, *Where Ricardo and Mill Rebut and Confirm Articles of Mainstream Economists Supporting Globalization*, 18 J. ECON. PERSPECTIVES 135 (2004).

country as in another.[139] The opportunities that emerge in developed countries, however, are more likely to be attractive than those emerging in developing countries (because of the higher productivity baseline). For a developed country, then, the optimal tax policy would be simply to ensure that neither double taxation nor opportunities for substantial tax avoidance materialize for investors. In the case of trade between developed countries, a territorial system ought not produce tax consequences much different from a worldwide system, as investments should, on balance, be as likely to flow in as out, and, since rates across developed jurisdictions are likely to be similar, forgone tax revenue (on outbound investment) should approximately equal new tax revenue on inbound investment.[140]

For a developing country, the situation is dramatically different. Developing countries will have trouble attracting capital, since productivity rates tend to be much lower. Lower productivity rates lead foreign investors to discount investment opportunities offering supra-marginal returns (discount, that is, relative to the value that host-country investors place on those opportunities as compared with other opportunities in the host). In a system of worldwide territorial taxation, developing countries have two ways to deal with the resulting disincentive to inbound investment. They can increase taxes in order to develop infrastructure and improve the pre-tax rate of return, or they can cut taxes to reduce the after-tax cost of investment more directly. Table 2 demonstrates why the former method ought to be vastly preferable. Over the range of average tax rates running from ten percent to 30 percent, a one-percent increase in average tax rates (measured as a fraction of GDP) is associated with approximately a 0.75 percent increase, on average, in after-tax return.

The difficulty with raising rates to improve infrastructure, of course, is that it is a long-term solution to the problem of low productivity. Higher rates do not directly translate to higher productivity but promote it when governments make effective use of tax revenues to build infrastructure – a

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[139] See, e.g., *id.*, for an analysis of comparative advantage in the international setting. Samuelson notes that the comparative advantage story may be too rosy in some settings, but he does not question the basic theory. *See also* Hines & Desai, at __.

[140] *See, e.g.*, Kleinbard, *Lessons of Stateless Income*, at __ (noting that taxes should have a minimal impact on choices between domestic and cross-border investment where rates are comparable and opportunities for earnings stripping and other tax avoidance strategies are unavailable).

time-consuming process.[141]   Where net capital exporters adopt territorial systems, developing countries do not have the luxury of attracting capital by improving infrastructure with the aid of higher rates, because countries must compete on tax rate to attract capital. Lower tax rates offer investors the opportunity for an immediately improved rate of return, a more attractive option than the prospect of greater productivity commencing at some point in the distant future (often beyond the projected time-horizon of a contemplated investment).   The result is a prisoner's dilemma among underdeveloped countries: The option of competing on tax rates means that developing countries cannot compete on tax amenities, because investors will move their capital immediately to low-tax jurisdictions.   From the perspective of an individual developing country that seeks to attract foreign capital, tax competition becomes the only rational strategy, but it leaves developing countries as a group worse off than if all could cooperate to increase rates.[142] Instead of improved infrastructure leading to greater capital investment (and still more improved infrastructure as taxes per capita rise), the result is stagnating levels of development in countries that lacked adequate infrastructure in the first place, as under-financed tax amenities continue to go under-financed – another widely observed phenomenon.[143]

The overall picture that emerges is not pretty. On one hand, developed countries as a group can expect to experience enhanced growth compared to the closed-economy world they leave behind as borders become more open and group members reap gains from trade. On the other hand, developing countries that participate in the sweepstakes to attract foreign capital are likely to be mostly unsuccessful and to remain relatively infrastructure-poor to the extent they rely on international trade to fund growth.   Because seeking foreign capital means keeping tax rates low or lowering them compared with the rates they adopted in the system of closed economies, they do in fact increase reliance on foreign investment to fund growth.   The result is that these countries all become less able to fund infrastructure from native economic

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[141] See Alfaro, at 353-54, for a statement of the point as it relates to institutional quality (noting that the explanatory variables of institutional quality "are slowly changing over time.").

[142] The Stanford Encyclopedia of Philosophy has an extended discussion of the prisoner's dilemma, available at: http://plato.stanford.edu/entries/prisoner-dilemma/.

[143] *See, e.g.*, Eugene B. Gallagher, *Sociological Studies of Third World Health and Health Care: Introduction*, 30 J. HEALTH & SOC. BEHAVIOR 345, 345 (1989) ("[The 'Third World'] is a world characterized economic underdevelopment.").

activity and, consequently, more dependent on the vagaries of worldwide patterns of investment and trade to fund tax amenities. In some cases – the most likely candidates would seem to be developing countries that begin with relatively high tax revenues and GDPs per capita and then seek to attract additional capital by lowering rates – tax competition will prove ruinous and economic collapse will follow.

Again, these predictions are largely borne out by the facts. As contrasted with growth in OECD countries, growth in developing countries tends to be sporadic, volatile and marked by periods of contraction.[144] Over the long run, it is only about half as large as growth in developed countries.[145] The lesson for developing economies in a world of tax competition would seem to be that it is better to stay out of the tax-driven competition to attract capital entirely and rely instead on domestic production and, perhaps, other sources of capital (such as foreign aid) to develop infrastructure.

2. Worldwide Systems

A universal worldwide system with a limited foreign tax credit differs from a territorial system most significantly in that tax rate competition over capital is largely eliminated. As economies become open, investors continue to have the choice to invest in low- or high-tax jurisdictions, but investors in capital exporting nations, who typically face high domestic rates, will derive no tax advantage from investment in low-tax jurisdictions because of the residual home-country tax liability on low-taxed foreign earnings.

This point is well understood;[146] it is simply a feature of worldwide systems. What has not been as appreciated is the generally salutary relationship between the absence of tax competition and developing country productivity. Developing countries compete for capital by offering the best after-tax return to foreign investors. In a territorial world, they theoretically can compete by improving the pre-tax rate of return or by lowering the actual tax rate. For the reasons explored in the last section, the former is superior over the long run, but as a practical matter only the latter is available, leading to a cycle of under-taxation and chronic underdevelopment among countries that enter the worldwide system with developing rather than developed economies. By contrast, in a worldwide system, residual taxation by the home

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[144] Lant Pritchett, *Understanding Patterns of Economic Growth: Searching for Hills Among Plateaus, Mountains, and Plains*, 14 THE WORLD BANK ECON. REV. 221, 222 (2000).

[145] *Id.*, at 225.

[146] *See, e.g.*, Kleinbard, *Stateless Income*; Rosenzweig.

country makes direct competition on rates impossible. Consequently, if states compete for foreign capital, they can be expected to do so by competing to provide better tax amenities, that is, by raising rates and improving infrastructure.

The residual character of an FTC system makes competition to provide tax amenities particularly attractive to developing countries, because it empowers home-country investors to finance the host-country fisc at the expense of the home fisc, rather than of the investors themselves. That is, because home-country residents are reimbursed by the home-country government via the FTC, foreign taxes paid by home residents constitute a wealth transfer from home country to host country where the party in control of the amount of the transfer does not bear its cost. Consequently, host countries have access to a source of funding that is to some extent free. In practice, both nondiscrimination rules[147] and limits on residence jurisdictions' FTC largess[148] prevent source rates on foreign investors from going too high, but these limits merely blunt the effect; they do not eliminate it, especially since host jurisdictions can return some of the benefits of high rates on their own residents in the form of tax benefits or even direct transfer payments.

From a worldwide welfare perspective, it is hard to see how this incentive structure does not improve things, despite the apparent departure from "neutrality" – namely, tax-induced changes on the pre-tax rate of return in each jurisdiction. On one hand, as investment moves among jurisdictions having comparable tax rates, tax revenues should generally rise uniformly because of rising productivity or the reciprocal exploitation of comparative advantage. And, on the other, as investment that moves from developed to developing countries the siphoning of tax revenues to developing countries improves rates of productivity there and may or may not damage productivity in the home jurisdiction. (Recall that the effect on home country productivity is ambiguous when both capital and some of the associated tax revenue leave the jurisdiction, since some of the tax amenities that the departing revenue finances were needed only to pay for amenities for the capital that has now left.) Indeed, even if developing countries respond to the opening of borders

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[147] *See, e.g.*, Art. I-4 of the Treaty Establishing a Constitution for Europe (establishing the "four freedoms," which, together, have been applied by the European Court of Justice to prevent member states of the EU from engaging in income tax discrimination). *See* Michael J. Graetz & Alvin C. Warren, Jr., *Income Tax Discrimination and the Political and Economic Integration of Europe*, 115 YALE L.J. 1186, 1194 (2006).

[148] [CITE to U.S. limits on creditability.]

by raising their rates to the levels in developed countries, so that all tax revenue associated with exported capital goes to the developing country, worldwide productivity should increase, since the benefit from a marginal dollar of tax revenue in a low-tax jurisdiction will exceed the detriment from the loss of that dollar of revenue in the high-tax jurisdiction.[149]

3. Mixed Systems

The world in fact is populated mostly by jurisdictions that employ some version of territoriality and a handful of jurisdictions that employ some variant of worldwide taxation – the U.S. being the most prominent example.[150] A world of mixed regimes can change the calculation for any individual jurisdiction about which system it should adopt. For example, as discussed earlier, a proponent of CON should be indifferent between a world of worldwide taxation and one of territorial taxation, because the relative prices of all investments will be the same for all residents in every jurisdiction in either world.[151] However, the competitive or neutrality properties of pursuing a worldwide regime will not necessarily be preserved if other countries are territorial, or vice-versa.[152] Also as previously discussed,[153] under the standard mode of neutrality analysis, residents of high-tax worldwide jurisdictions are at both an ownership neutrality and a competitive disadvantage when compared with residents of territorial jurisdictions. Further, if the most important comparative advantage stemming from international trade derives from the opportunity to allocate ownership to non-residents, the efficiency losses from tax-induced ownership changes (or non-changes) for residents of high-tax worldwide jurisdictions are likely to be quite high given the ease with which ownership can be transferred from one person to another.[154]

Most of these worries would appear to be overstated if the theory offered here is accurate. The worry on competitive neutrality is that residents of high-tax worldwide systems will be unable to compete with investors in

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[149] This result follows from the logarithmic property of Equation (1).

[150] Kleinbard, *Stateless Income*, at __. In light of opportunities for deferral and the use of disregarded entities, the U.S. system is more accurately characterized as worldwide lite or even quasi-territorial than as a true territorial system. Kleinbard, *Lessons of Stateless Income*, at __.

[151] Hines, *Reconsidering*, at __.

[152] [CITES.]

[153] Part I.B.3.

[154] Hines, *Reconsidering*, at __.

territorial jurisdictions for favorable investment opportunities in low-tax jurisdictions.[155] Tax competition among low-tax jurisdictions to attract foreign capital then will exacerbate the problem. The story rests on the view, implicitly ratified under the traditional mode of neutrality analysis, that advantageous investment opportunities in low-tax jurisdictions are likely to be prevalent as borders open because of the reduced tax burden. Under the tax amenity theory, this worry would seem to be overstated because low-tax jurisdictions are unlikely to offer many favorable investment opportunities for the same reason – the reduced tax burden. And, as reported earlier in this Part, the evidence seems to support the theory. Capital moving across borders overwhelmingly flows into high-tax jurisdictions, not low-tax ones.

The story is similar even if the dominant margin along which investors respond to cross-border tax incentives is ownership identity. Nothing about the CON story suggests that if ownership identity in fact is more tax-elastic and of greater import than the capital location or savings margins, favorable investment opportunities are more likely to arise in low-tax jurisdictions. Productivity still seems to require substantial infrastructure, a point that Desai and Hines themselves suggest:

> [M]odern scholars view [foreign direct investment, or FDI] as arising from differential capabilities, and consequently differential productivity, among firms, and the extension of intangible assets across borders. This intuition squares well with empirical FDI patterns, which include the fact that most of the world's FDI represents investment from one high-income country into another, and the fact that a very high fraction of such investment takes the form of acquiring existing businesses.[156]

Desai and Hines frame their observation in terms of the movement of investment among high-income rather than high-tax jurisdictions, but the correlation between incomes and taxation is, as noted previously, itself quite high. Apart from tax havens, there are not many high-income jurisdictions that do not have high taxes.[157]

Conclusion

Taking their cue from the theory of neutrality as developed in the domestic setting, the traditional modes of analyzing international tax neutrality

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[155] Kleinbard, *Lessons of Stateless Income*, at __.

[156] Desai & Hines, at 956.

[157] [CITE.]

downplay or disregard the link between tax revenues and productivity. In the domestic setting, one need not subscribe to the view that there exists a natural productivity level, or pre-tax rate of return, in order to be justified in that enterprise, because the object of neutrality analysis is to ascertain the extent to which various possible tax rules alter the relative prices of goods in ways that create deadweight loss. No assumption need be made of the unavailability of tax revenues, which, after all, are necessary in some measure to make significant rates of return possible, in order to make the inquiry. Rather, what is required is an assumption that tax revenues theoretically could be supplied on some basis that does not affect, and is not affected by, relative prices.

That assumption is possible in the domestic setting, but it is not available even as a theoretical ideal in the international setting, where tax rules inevitably affect both the magnitude of tax revenues and the identities of their recipients. In the domestic setting, the idea of a productivity level or pre-tax rate of return is implicitly built into the decision about the level of tax amenities to be supplied, or the revenue target. In the international setting, the only way to make sense of the pre-tax rate of return is to suppose that states begin from a world of closed economies and then move to more open ones. But tax incentives that arise as that movement takes place redirect tax revenues, causing the revenue raised to diverge from the target and thereby to affect the supply of tax amenities. Over time, as tax amenities exceed or fall short of the original target, the pre-tax rate of return that was supposed to be taken as the baseline against which to measure the distorting effects of tax rules is adjusted. As a result, what appeared to be a baseline turns out to be no baseline at all. In a final twist, the alterations themselves may well be productivity and even efficiency-enhancing, even though they are "tax-motivated." Where, for example, tax rules encourage low-productivity, low-tax source jurisdictions to compete on the supply of tax amenities (rather than on tax rate), the net effect over time would seem to be a slight lowering of productivity in high-tax residence jurisdictions and a much larger increase in the productivity of the sources. On a worldwide basis, that would count as tax-motivated capital shifts leading to arrangements that are welfare-enhancing, not welfare-reducing.

One inference that may be drawn is that a more fruitful lens than neutrality through which to view the effects of international tax rules is the competitive, allocative and distributional properties of various possible tax regimes. From a global welfare perspective, the object of designing a tax regime is not to maximize neutrality but to promote overall welfare, which may require promoting tax "distortions" that improve total productivity.

A second inference is that sensitivity to the relationship between tax revenue and productivity suggests that the consequences of adopting various

possible methods of double tax relief are likely to be quite different from those assumed under the traditional view. In particular, worldwide regimes are more likely than territorial regimes to promote welfare-enhancing improvements to infrastructure in low-tax jurisdictions, while the competitive and savings benefits to high-tax jurisdictions of territorial regimes are overstated.

Data for the regression on Equation 1:

p1 is country population 1980 as fraction U.S. 1980
p2 is country tax revenue 1980 as percentage U.S. tax revenue 1980, backing
out all social security contributions

$Y = \ln(p1+x1)*\ln(p2 + x2)$

Country	x1	x2	Y	yc	Y-yc	SEest	YcLo	YcHi
Australia	0.0643	0.9621	0.8350	0.8899	-0.0549	0.0363	0.8145	0.9654
Austria	0.0332	1.1771	0.9191	0.9805	-0.0614	0.0430	0.8911	1.0699
Belgium	0.0433	1.1685	0.8925	0.9797	-0.0872	0.0425	0.8914	1.0681
Canada	0.1082	0.9807	0.9591	0.9109	0.0482	0.0361	0.8359	0.9859
Denmark	0.0225	1.7977	1.2836	1.2200	0.0636	0.0618	1.0915	1.3486
Finland	0.0210	0.8249	0.8514	0.8101	0.0413	0.0336	0.7402	0.8800
France	0.2425	0.8207	0.9032	0.8620	0.0412	0.0318	0.7960	0.9281
Germany	0.2713	1.0417	0.9105	0.9847	-0.0742	0.0351	0.9116	1.0577
Greece	0.0416	0.0444	0.5374	0.3139	0.2235	0.0540	0.2016	0.4263
Ireland	0.0150	0.4406	0.6190	0.5920	0.0270	0.0324	0.5247	0.6594
Italy	0.2484	0.2869	0.7960	0.5264	0.2696	0.0421	0.4388	0.6139
Japan	0.5141	0.5188	0.7947	0.7326	0.0621	0.0365	0.6568	0.8084
Korea	0.1678	0.0888	0.1685	0.3629	-0.1944	0.0535	0.2518	0.4741
Mexico	0.3008	0.1332	0.2382	0.4136	-0.1754	0.0531	0.3033	0.5240
Netherlands	0.0622	1.3235	0.9602	1.0524	-0.0922	0.0467	0.9553	1.1496
New Zealand	0.0140	0.7253	0.6463	0.7562	-0.1099	0.0319	0.6899	0.8225
Norway	0.0180	1.6240	1.4941	1.1557	0.3384	0.0569	1.0373	1.2741
Portugal	0.0430	0.0560	0.3748	0.3235	0.0513	0.0531	0.2131	0.4339
Spain	0.1650	0.1302	0.5679	0.3961	0.1718	0.0502	0.2916	0.5005
Sweden	0.0366	1.6330	0.9717	1.1658	-0.1941	0.0567	1.0480	1.2836
Turkey	0.1983	0.0564	0.1021	0.3390	-0.2369	0.0568	0.2208	0.4571
United Kingdom	0.2478	0.8674	0.8299	0.8886	-0.0587	0.0323	0.8214	0.9558
United States	1.0000	0.7810	1.0000	0.9961	0.0039	0.0345	0.9243	1.0678

Corr. Coeff. = 0.893230; r*r = 0.797861
RMS Error = 0.152746; d.f = 21; SSq = 0.489961
AIC = -82.525261; AIC(corrected) = -81.262104

Parameter Estimates...
p1= 2.928549 +/- 0.216125; p= 0.0000
p2= 1.289874 +/- 0.084655; p= 0.0000

Covariance Matrix Terms and Error-Correlations...
B(1,1)= 0.0467100944052148; r= 1.0000
B(1,2)=B(2,1)= -0.014457683649219772; r=-0.7902
B(2,2)= 0.0071664996260828034; r= 1.0000