Asymmetric FDI and Tax-Treaty Bargaining:

Theory and Evidence

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Abstract: Tax treaties are often viewed as a mechanism for eliminating tax competition, however this approach ignores the need for bargaining over the treaty's terms. This paper focuses on how bargaining can affect the withholding taxes set under the treaty. In a simple framework, we develop hypotheses about patterns in treaty tax rates. A key determinant for these patterns is the relative size of bilateral foreign direct investment (FDI) activity. In plausible situations, more asymmetric countries will negotiate treaties with higher tax rates. This theory is then tested using 1992 data from U.S. bilateral tax treaties. Overall, the data supports the prediction that greater asymmetric FDI activity increases the negotiated tax rates.

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I. Introduction

Tax treaties are often viewed as a remedy for tax competition. Under bilateral tax treaties, withholding taxes, tax definitions, and relief methods are chosen jointly by the treaty partners.[1] In the rubric of game theory, tax treaties move taxation from non-cooperative tax competition to a cooperative setting. Because these policies are now set cooperatively, it is tempting to believe that they eliminate tax competition. This presumption, however, is misleading since the terms of the treaty (and the distribution of the gains from treaty formation) must be bargained over. If countries differ in their preferred treaties, then there is conflict within treaty formation itself. In particular, if countries differ in their desired treaty-specified tax rates, there is a kind of tax competition as each country pushes for its preferred tax rate.[2] Recognizing the patterns of this bargaining has important implications for understanding the potential of tax treaties.

This paper makes a first attempt at modeling the conflicting goals in treaty formation by presenting a simple bargaining framework. The implications of the model are then tested using 1992 data from bilateral tax treaties with the United States and within the OECD. We find that treaty-specified withholding taxes vary in a systematic way which is consistent with our simple bargaining model. In particular, our results highlight the importance of differences in bilateral FDI activity between the two countries. As the size of this asymmetry grows the scope for cooperation is decreased and negotiated tax rates are higher. We find similar results for relative country size. These findings indicate that it may be difficult for highly asymmetric countries to negotiate a treaty, and in fact, our analysis suggests that countries with highly asymmetric FDI activity are also the least likely to have a treaty.

While tax treaties are rarely discussed in this literature, when they are, they are typically presented as a mechanism of eliminating the inefficiencies created by tax competition. In fact, in the OECD's (1997) model treaty, the claim is made that their goal is to reduce the inefficiencies caused by

[1] For an excellent discussion of the workings of the OECD model tax treaty, see Baker (1994). For additional discussion on some of the primary goals and issues of tax treaties, see Blonigen and Davies (2002).

[2] This type of tax competition differs considerably from the standard sorts in which governments strategically set taxes to influence foreign direct investment (FDI). Wilson (1999) and Gresik (2001) provide excellent surveys of this literature.

tax competition and double taxation. In a model of unilateral capital flows, Janeba (1995) shows that when taxes are uniform and either foreign tax credits or an exemption is used to combat double taxation, there exists a set of mutually beneficial, harmonized tax rates. Since this is a common provision in tax treaties, Janeba suggests that this provides a role for treaties. Davies (2003) demonstrates that a similar set of mutually beneficial, harmonized taxes exists when FDI flows are bilateral. Neither author, however, discusses how a particular rate is chosen from this set of mutually beneficial taxes. This is the first goal of the present paper.

In addition to the small economic literature on tax treaties, there also exists work by international tax lawyers. These writings often portray treaties in a less-hopeful light than the economic studies do. Dagan (2000), for example, pans the FDI efficiency gains as a myth. Instead, she argues that in U.S. treaty formation two other aspects dominate policy development: reductions in tax losses overseas and alleviation of administration costs. Radaelli (1997) also suggests that U.S. treaty policy is not driven by a desire to improve efficiency, but rather to reduce tax evasion through mechanisms such as transfer pricing. Other gains from treaty formation include information sharing between governments, dispute resolution mechanisms, and coordinated policies on items such as transfer pricing and expense allocation. With these arguments in mind, we assume that a country can benefit from the treaty in two ways. First, by negotiating a lower withholding tax, a country can lower what its investors pay in overseas taxes. Note that this gain for one country is a loss to the other country. Thus, it can easily be the case that under the treaty one country's net tax payment falls while the other's rises. This is the source of contention Dagan focused on. Second, each country experiences an additional gain unrelated to the withholding tax level which arises from reductions in administrative and enforcement costs. In this way, the treaty represents an increase in total surplus for the two countries and they must agree how to split these gains between them.

One way to transfer surplus between the countries is through the appropriate choice of a common withholding tax rate.[3] Using a non-symmetric bargaining solution (see, for example,

[3] When a firm invests overseas, it typically does so through a subsidiary that repatriates profits to its parent through dividends, interest, and royalty payments. Since these payments are a cost to the subsidiary, they are not taxable by the host country as part of the subsidiary's income. Nevertheless,

Myerson, p.390, 1991), we solve for the jointly chosen tax rate as a function of relative bargaining strength, relative FDI activity, and non-treaty tax policies. Our second goal is to then test the implications of this solution using 1992 U.S. and OECD data. We perform this estimation using affiliate sales data, FDI stock data, and instruments developed from recent work by Carr, Markusen, and Maskus (2001). We find strongly significant results for the effect of asymmetry in FDI activity on the negotiated tax rates. Our results suggest that as sales from overseas affiliates become unbalanced, the negotiated tax will rise. The signs of the coefficients are consistent with a situation in which changes in tax revenues are highly important to countries. Our proxies for bargaining size do not perform as expected, but do reinforce the idea that more asymmetric countries negotiate higher tax rates. These results are robust across our data sets and under both Tobit estimation and the use of instrumental variables. Finally, since treaty-negotiated rates are only observed for countries with treaties, we test whether sample selection is driving our results. Using Heckman's (1979) two-step method, we find that our results hold even after controlling for sample selection.

The remainder of the paper is as follows. Section II presents the bargaining model and develops some hypotheses for our estimation. Section III discusses our data and estimation procedure. Results are found in Section IV. Section V concludes.

II. Bargaining in Tax Treaties

In order to develop testable hypotheses, in this section we develop a model of bargaining over the treaty-specified withholding tax rates. While this model is admittedly stylized, we use it to explore the conflicts likely to arise in treaty formation and to anticipate what results might be found in the data.

Since the treaties in question are bilateral, consider a setting with two countries, home and foreign. Mirroring the data, each country's investors produce at home and abroad. Home's domestic production is $h(K-Z)$ and its overseas production function is $h^s(Z)$ where K is home's capital stock and Z are its capital outflows. Similarly, foreign's domestic production is $f(K^*-Z^*)$ and its overseas

most host governments capture part of this parent income through withholding taxes levied on these repatriations. Tax treaties reduce withholding taxes by specifying maximum allowable tax rates.

production is $f^s(Z^*)$. The price of output is constant and equal to one for all four types of production. In this one period model, all overseas profits are repatriated. Upon repatriation, home investors must pay a withholding tax to the foreign country just as foreign investors must pay the home withholding tax. Without a treaty, the home withholding tax is $\bar{t}$ and the foreign withholding tax is $\bar{t}^*$. Since these non-treaty rates remain the same for non-treaty countries, we treat them as exogenous parameters.[4] Following the treaty convention, under a treaty each country chooses the same withholding tax t.[5] It is also useful to note that among U.S. treaties, t is no greater than either country's non-treaty rate.

Although we do not explicitly model it, we take the "new" view on the effect of withholding taxes which was initiated by Hartman (1985). This theory posits that withholding taxes will have no effect on the size of overseas operations by a mature subsidiary.[6] This occurs because, given the initial parental capital injection, retained earnings present a less expensive source of investment than repatriated and re-exported funds. Sinn (1993) formalized this result and also found that while withholding taxes do not affect the size of a mature subsidiary, they can impact the initial parental injection of equity. However, as shown by Weichenrieder (1996), even this effect on the initial equity injection need not influence FDI activity if there exist passive investment options in the host country. Grubert (1998) extended the Hartman-Sinn result to a setting in which profits can be repatriated through dividends, royalties, and interest payments and found results similar to Sinn's. Furthermore, as demonstrated by Altshuler and Grubert (1996), there exist costly "triangular" strategies which enable firms to achieve the equivalent repatriation without actually repatriating funds from the host country. Both Grubert (1998) and Grubert and Mutti (1999) provide empirical results consistent with

[4] Our model could easily be extended to include both home and foreign corporate income taxes. Since these do not change under tax treaties, they would cancel out in the bargaining solution. Thus, their inclusion would not alter the model's predictions.

[5] If instead of a common tax rate each country chooses its own treaty-specified tax, then under the Hartman-Sinn analysis there exist a continuum of home and foreign taxes which achieve the same distribution of rents as any given common tax.

[6] It is important to note that the Hartman/Sinn result indicates that *withholding* taxes should be irrelevant for the size of overseas operations, not that other taxes such as corporate income taxes should be irrelevant. A wealth of evidence, such as that provided by Grubert and Mutti (1999), suggests that these other taxes do affect FDI activity while withholding taxes do not.

the Hartman/Sinn result. In light of this work, we operate under the assumption that the size of overseas operations (and the Z and Z^*) are exogenous to the withholding tax and are therefore determined outside the model.[7] Note that under this assumption, in equilibrium, one would expect the non-treaty rates to equal one since countries can increase their share of the inbound FDI tax base without affecting the size of that base. This result can be eliminated by extending the model to a setting in which, due to non-tax base costs of taxation such as costly enforcement, equilibrium withholding tax rates would be less than one even under the Hartman-Sinn result. Since our goal is to describe the treaty-negotiated taxes rather than the non-treaty rates, we set this issue aside and use the current, more direct model. Without loss of generality we label our countries such that home has relatively more overseas output:

$$h^s(Z) > f^s(Z^*) \tag{1}$$

In this sense, the home country is large relative to foreign. Note that this does not correspond with the standard trade definition of "large". We define $h^s(Z) - f^s(Z^*)$ as the degree of asymmetry, so that an increase in $h^s(Z)$ or a decrease in $f^s(Z^*)$ increases the asymmetry of FDI.

Although Z and Z^* are equilibrium levels of FDI, given the Hartman/Sinn assumption they are determined exogenously to the environment we consider. An alternative interpretation of our model is that it captures only a single-period snapshot of a more general dynamic environment. In this way, the FDI levels constitute an optimal response to the previous tax levels as well as to the expected current and future reductions from the tax treaties. We concentrate, here, on the negotiated tax for these given FDI levels. We explore this richer dynamic environment, whereby FDI levels gradually increase and treaty-tax rates gradually decrease over time, in a companion paper (Chisik and Davies, forthcoming).[8] There, we derive the same asymmetry effects as we note here. We present the simpler snapshot

[7] Since the Hartman/Sinn result arises in part because of the firm's ability to defer domestic taxes until repatriation, it may be unwarranted to impose it in a one period model. However, if the present setting is thought of as a single period of a longer, intertemporal interaction, then it is not unreasonable to assume their result within that period. As our goal is to develop some testable predictions for a cross-section of data rather than to restate the Hartman/Sinn analysis, we proceed with the current formulation.

[8] For example, the original draft of the U.S.-Canadian treaty lowered the royalty withholding tax to 15%. Renegotiations in the late 1970s reduced this to 10% and according to Price-Waterhouse's

version in the current paper, in order to leave room for the empirical verification, and we direct the interested reader to that work.

In line with Bond and Samuelson (1989), Janeba (1995), and others, we assume that governments maximize national income. In our bilateral context, a country's national income is the sum of the home-controlled production and net tax revenue. Thus, home's national income without a tax treaty is:

$$\overline{Y} = h + h^s - \overline{t}^* h^s + \overline{t} f^s. \tag{2}$$

Under the tax treaty, two changes occur to home national income. First, with movement to a common withholding tax t, net tax revenue can change. Second, there is an additional non-revenue gain simply from being part of a treaty. This non-revenue gain can represent reductions in enforcement costs due to increased inter-governmental cooperation, reductions in the wasteful triangulation activities described by Altshuler and Grubert (1996), or Dagan's (2000) administrative savings. In order to keep this effect as general as possible, we simply represent these gains by $\Phi(h^s, f^s)$ for home and $\Phi^*(h^s, f^s)$ for foreign. Both of these functions are non-decreasing in both of their arguments, such that greater FDI activity (either outbound or inbound) can lead to greater non-revenue gains from the treaty. To ease the development of the intuition for our main result, for the moment we assume that the inbound effect is zero, i.e. that $\Phi^*_{h^s} = \Phi_{f^s} = 0$. This would be the case if each country is only concerned with saving administrative and enforcement costs and reducing the transfer pricing losses associated with its own outbound FDI. Not surprisingly, when this assumption is relaxed additional interactions are introduced which lead to less clear-cut results. However, as is shown below, under plausible conditions similar results can be found even in this more general case.

Incorporating these changes under the treaty, home income can be written as:

$$Y = h + h^s - t(h^s - f^s) + \Phi(h^s, f^s) \tag{3}$$

Corporate Taxes: A Worldwide Summary, it was eliminated entirely in 1997. Additionally, the parental dividend tax fell from 15 to 10 to 5 percent over the same period. See our companion paper for further examples of treaties that exhibit falling withholding taxes over time, often as a result of renegotiations.

which is again the sum of worldwide sales and net tax revenue with the addition of the non-tax revenue gains from being part of the treaty. Since home is the large country, note that under the treaty it collects negative net tax revenues. Combining equations (2) and (3), home's gain from the treaty is:

$$Y - \overline{Y} = \bar{t}^{*} h^{s} - \bar{t} f^{s} - t(h^{s} - f^{s}) + \Phi(h^{s}, f^{s}) \tag{4}$$

which is the change in net tax revenue plus the non-tax gains from the treaty. This mirrors Dagan's (2000) belief that reductions in net tax losses and administrative costs are the primary concerns for the (relatively large) U.S..

Similar to home, foreign's gain from the treaty is:

$$Y^{*} - \overline{Y}^{*} = \bar{t} f^{s} - \bar{t}^{*} h^{s} + t(h^{s} - f^{s}) + \Phi^{*}(f^{s}, h^{s}) \tag{5}$$

From the third term in equations (4) and (5), we can see the conflict between countries over the treaty-specified tax rate t, since increasing t shifts gains from the large home country to the small foreign country. Because of this, home prefers a lower t while foreign prefers higher tax rates. Since the treaty constitutes a Pareto improvement it must be individually rational for both countries, therefore, t is constrained to the set

$$\left[\frac{\bar{t}^{*} h^{s} - \bar{t} f^{s} - \Phi^{*}}{h^{s} - f^{s}}, \frac{\bar{t}^{*} h^{s} - \bar{t} f^{s} + \Phi}{h^{s} - f^{s}} \right],$$

with the two countries preferring the opposite ends of this interval.[9] Anecdotally, the necessity of a mutually-beneficial treaty is illustrated by the U.S. treaty with Honduras which eliminated all withholding taxes. Honduras felt that, since nearly all FDI flowed from the U.S. to Honduras, the treaty only benefited the U.S., which is akin to a t outside of this range. This led Honduras to cancel the treaty in 1966, ten years after its implementation (Diamond and Diamond, 1998).

[9] This set of mutually-agreeable tax rates is comparable to those found in Janeba's (1995) unilateral FDI model and in Davies' (2003) bilateral FDI model. In those papers, they discard the Hartman/Sinn assumption and assume endogenous capital flows. By harmonizing tax rates under a treaty, surplus is created by improving capital market efficiency, which can also be represented by our F and F^{*}. They find that there is a range of tax rates which achieve this result and that the two countries prefer opposite ends of this range. Neither author, however, discusses the method by which a treaty arrives at a particular tax rate from the range.

We appeal to the generalized Nash bargaining solution to derive the result from the bargaining process. This technique indicates that the solution can be found by choosing a t which maximizes a weighted product of the two countries' gains from treaty formation. Thus, t must satisfy:

$$t(a) \quad \in \quad \text{argmax} \quad \left[(Y - \overline{Y})^a (Y^* - \overline{Y}^*)^{1-a} \right] \tag{6}$$

where a represents the relative bargaining power of the home country.[10] The first order condition for this problem can be written as:

$$a\left(Y^* - \overline{Y}^*\right)(f^s - h^s) + (1-a)\left(Y - \overline{Y}\right)(h^s - f^s) = 0, \tag{7}$$

in which the first term is negative. The maximizing t is unique. After some simplification the negotiated tax can be written as:

$$t = \frac{\overline{t}^* h^s - \overline{t} f^s + (1-a)\Phi - a\Phi^*}{h^s - f^s} \tag{8}$$

Note that when a = 1 home has all of the bargaining power and the chosen tax is equal to home's most preferred tax rate. Similarly, as a approaches zero, the tax approaches foreign's optimal tax rate. Substituting the treaty tax rate into equations (4) and (5) we see that the solution distributes income between the countries in the following way:

$$Y - \overline{Y} = a(\Phi + \Phi^*) \tag{9a}$$

and

$$Y^* - \overline{Y}^* = (1-a)(\Phi + \Phi^*). \tag{9b}$$

Hence, the non-revenue gains are split according to each country's bargaining power. By choosing the appropriate tax rate, income is shifted from one country to another such that both are willing to agree to the treaty. In this fashion, a side payment is built into the treaty itself and is reflected in the agreed upon tax rate. Note that if there are no non-revenue gains from treaty formation, then there is no scope for treaty formation.

From equation (8), we can derive the following set of comparative statics as well as our main results.

[10] Hence, unless a = ½ we are abandoning Nash's (1953) symmetry axiom.

Proposition 1: *If* $\Phi^*_{h^s} = \Phi_{f^s} = 0$, *then the negotiated tax rate is increasing in the asymmetry of outbound FDI levels. Furthermore, the comparative static effects of* $\bar{t}, \bar{t}^*$, a, h^s, *and* f^s *on t are:*

$$\frac{\partial t}{\partial \bar{t}} = \frac{-f^s}{h^s - f^s} < 0 \tag{10a}$$

$$\frac{\partial t}{\partial \bar{t}^*} = \frac{h^s}{h^s - f^s} > 0 \tag{10b}$$

$$\frac{\partial t}{\partial a} = \frac{-\Phi - \Phi^*}{h^s - f^s} < 0 \tag{10c}$$

$$\frac{\partial t}{\partial h^s} = \frac{\bar{t}^* - t + (1-a)\Phi_{h^s}}{h^s - f^s} > 0 \tag{10d}$$

$$\frac{\partial t}{\partial f^s} = -\frac{\bar{t} - t + a\Phi_{f^s}}{h^s - f^s} < 0 \tag{10e}$$

Proof: First remember that without loss of generality we label the countries so that $h^s > f^s$. The comparative statics then follow from manipulation of the partial derivatives of equation (8). Furthermore, if $h^s > f^s$, then an increase in the asymmetry of FDI levels corresponds to an increase in h^s and/or a decrease in f^s and, therefore, from equations (10d) and (10e), t is increasing along with this asymmetry. •

The intuition behind Proposition 1 is as follows. An increase in the home non-treaty rate means that the foreign country saves more in tax payments for a given treaty tax rate. This foreign windfall is a cost for the home country. To return to the bargaining solution it is, therefore, necessary to transfer surplus from foreign to home, which is achieved by lowering t. The intuition for a change in $\bar{t}^*$ is similar. As noted above, when home has more bargaining power, it is able to push more strenuously for its desired low tax rate, yielding a negative derivative.

The comparative static effect of FDI activity on t can be described as follows. The first two terms in equation (10d) show the difference between foreign's non-treaty and treaty tax rate. As

home's overseas investment rises, this increases home's gain from a tax reduction. At the same time, this lowers foreign's gain from the treaty. This necessitates transferring income from home to foreign to return to the bargaining solution, a result which is achieved by raising t. This effect is reinforced by the second term, which represents changes in the non-tax gains from treaty formation. An increase in non-tax gains for the home country generates a larger total surplus from the treaty, (1-a) percent of which must be transferred to foreign. Equation (10e) indicates that an increase in f^S has the opposite effect. Since $h^s > f^s$, an increase in the asymmetry of FDI levels is generated by an increase in h^S and/or a decrease in f^S. This increased asymmetry in FDI levels affects the threat point in the bargaining problem and as these threat points become more asymmetric the negotiated tax rate must increase.

Under the more general formulation for F and F^*, equations (10d) and (10e) become:

$$\frac{\partial t}{\partial h^s} = \frac{\bar{t}^* - t + (1-a)\Phi_{h^s} - a\Phi^*_{h^s}}{h^s - f^s} \tag{11a}$$

and

$$\frac{\partial t}{\partial f^s} = -\frac{\bar{t} - t + a\Phi^*_{f^s} - (1-a)\Phi_{f^s}}{h^s - f^s} \tag{11b}$$

Here, both the third and fourth terms represent changes in the non-tax gains from treaty formation. When h^s rises, this increases total surplus from the treaty by $\Phi_{h^s} + \Phi^*_{h^s}$, a percent of which will go to home. Since Φ_{h^s} arises in home directly, to again satisfy the Nash bargaining solution home must transfer the difference between this amount and home's share of the total rise in surplus to foreign. Note that if Φ^* is sufficiently sensitive to h^S or if home's bargaining power is sufficiently large, then a rise in h^S may require a transfer to home, i.e. a reduction in t. In this case, the comparative statics in (11) are ambiguous. An alternative way of recognizing this ambiguity is that a rise in h^S increases both $Y^* - \bar{Y}^*$ and $Y - \bar{Y}$ through the non-revenue treaty gains in equation (7). Since these move in the same direction, to determine whether it is necessary to move income to home or to foreign it is necessary to

compare the relative magnitudes of these changes, i.e. compare Φ_{h^s} with $\Phi^*_{h^s}$. This leaves us with two situations in which we can unambiguously sign these comparative statics: when revenue changes are larger than the non-revenue changes or when a rise in a country's outbound investment increases the non-revenue gains generated within its borders by more than it increases that country's share of total non-revenue gains. These conditions are summarized by Proposition 2.

Proposition 2: *Sufficient conditions for an increase in the asymmetry of FDI levels to generate an increase in the treaty tax rate are that:*

a) revenue effects are larger than non-revenue effects,

or

b) that $\frac{\Phi_{h^s}}{\Phi^*_{h^s}} > \frac{a}{1-a}$ *and that* $\frac{\Phi^*_{f^s}}{\Phi_{f^s}} > \frac{1-a}{a}$.

An interesting extension of the above theory is to allow the non-revenue gains from treaty formation to depend on the treaty specified tax rate. If the non-revenue gains partly reflect reductions in wasteful tax evasion or enforcement, then we might expect that lower taxes would correspond to less waste and greater gains from the treaty so that both Φ_t and Φ^*_t are negative. Under this modification, we can write the first order condition from the bargaining problem as:

$$a\left(Y^* - \overline{Y}^*\right)(f^s - h^s + \Phi_t) + (1-a)\left(Y - \overline{Y}\right)(h^s - f^s + \Phi^*_t) = 0. \qquad (12)$$

Equation (12) is the counterpart of equation (7) with one key difference, the introduction of two new terms, $a(Y^* - \overline{Y}^*)\Phi_t$ and $(1-a)(Y - \overline{Y})\Phi^*_t$ which are both negative. These new terms demonstrate that when lower taxes increase the non-revenue gains from the treaty, additional downward pressure is placed on the tax rate. To solve for the comparative statics in (12), note that since $a \in (0,1)$, $Y^* - \overline{Y}^* > 0$, $Y - \overline{Y} > 0$, and $f^s - h^s + \Phi_t < 0$, it must be the case that $h^s - f^s + \Phi^*_t > 0$. Using this, it is

straightforward to verify that although the expressions for $\frac{\partial t}{\partial \bar{t}}$, $\frac{\partial t}{\partial \bar{t}^*}$, $\frac{\partial t}{\partial a}$ are now more complicated, they match the signs of those given in Proposition 1.

Unfortunately, without imposing further restrictions, it is impossible to sign the marginal effects of FDI. As with Proposition 2, part of this difficulty arises from comparing the relative changes in F and F^* with respect to FDI. An additional problem, however, is that these changes are also affected by the treaty tax. In particular, the sign of $\frac{\P t}{\P h^s}$, depends on the size of the cross-derivatives Φ_{t,h^s} and Φ^*_{t,h^s} relative to each other. A comparable difficulty exists for signing the comparative static effect of foreign FDI. Nevertheless, if these additional effects are relatively small, then the results of Proposition 2 carry through, that is, increases in FDI asymmetries increase treaty-specified tax rates.

With these predictions in hand, we now turn to data on U.S. bilateral treaties to test their plausibility.

III. Empirical Methodology and Data

To test the predictions of our theory, we use two data sets, both from 1992.[11] The first data set considers the U.S. and its bilateral tax treaty partners. We form two subsamples of the U.S. data, one that uses affiliate sales and one that uses FDI stock as the measure of FDI activity. Our second data set uses the FDI stock between OECD member countries.[12] Since treaties affect four different withholding taxes, for each country pair we consider four different tax rates: that on dividends paid to the parent, that on non-affiliated dividends, that on non-financial interest payments, and that on industrial royalty payments. Although we believe the above model describes the tradeoffs in treaty formation, we can only solve for an explicit functional form under the most restrictive assumptions. Therefore, rather

[11] An earlier draft of the paper also used 1997 affiliate sales data for the U.S. and its treaty partners. This data set included more treaties than the 1992 version, however, it lacked the necessary controls for IV estimation. Since the results from that data match the presented results, we omit them for space. These additional results are available upon request.

[12] Affiliates sales information was not available for a reasonably large number of OECD countries.

than estimate a variant of the structural equation (8), for our baseline results we estimate the following reduced-form equation:

$$t_{ijk} = t\,(h_{ij}^{s},\, f_{ij}^{s}, \overline{t_{ik}}, \overline{t^{*}_{jk}}, a_{ij}, D_{k}) \tag{13}$$

where i is the home country, j is the foreign country, and k is the type of withholding tax. The first five right hand side variables are defined as in the theory, that is, h^s is the value of overseas FDI production by the relatively large country, f^s is the value of overseas FDI production by the relatively small country, etc.. The final term, D_k, is a constant plus a set of dummy variables for the parental dividend tax, the unrelated dividend tax, and the royalty tax. Note that since we are using all four taxes simultaneously, our coefficients are best interpreted as the relation between the independent variables and the overall level of treaty taxes rather than specific types of withholding taxes.[13]

For measures of h^s and f^s, we use data drawn from two sources. For the U.S. data set, we use either affiliate sales of non-financial institutions in the host country or the stock of FDI in the host country, both of which can be obtained from the Bureau of Economic Analysis' website.[14] We use two measures because of potential problems with using affiliate sales. First, withholding taxes are not applied to sales but to repatriations, therefore, sales may not closely approximate the repatriated value of FDI. While stocks are susceptible to the same criticism, we hope that using two measures that yield similar results alleviates concerns. Second, sales are a flow value of investment and may reflect short-run variation that does not correspond to the longer run considerations of treaty formation. Since the

[13] In results not reported here, we also ran separate regressions for each of the four tax types. With the exception of the regressions using the withholding tax on non-parental dividends, this procedure yielded estimates similar in sign and magnitude to those reported for the asymmetry variables, the foreign tax rate, and our bargaining power measure. For the interest and royalty withholding tax regressions, these estimates were generally significant when using either affiliate sales or FDI stocks. For the parental dividend regression, the stock measure gave us signficance at the standard levels whereas sales yielded significance only in the 20 to 30% range. Since the stock measure increased the number of observations from 21 to 28, this suggests that combining the tax rates into a single regression improves the estimates significance while not dramatically altering their signs or magnitudes. To check this, we also did pairwise combinations of the parental dividend, interest, and royalty taxes. This yielded similar coefficients but increased significance. The non-parental dividend tax regression yielded a sign reversal for home's FDI. However, none of the coefficients from this regression even approached significance. Additionally, the estimated coefficients on the asymmetry variables were an order of magnitude smaller than those from the other regressions. Since this tax most likely applies to portfolio investments and not FDI, this is not especially surprising. These alternative results are available upon request.

[14] As of the time of this paper, this website is http://www.bea.doc.gov/bea/di1.htm.

FDI stock is a stock measure of FDI activity, it sidesteps this problem. For the OECD data set, we use the stock of FDI as reported in the OECD's *International Direct Investment Statistics Yearbook*. Note that since this only reports outward FDI for OECD members, it is only possible to construct the necessary bilateral FDI measures when both countries are OECD members. Because of this, the U.S. data presents a broader selection of countries while the OECD data includes observations for which the U.S. is not one of the two treaty partners. On the other hand, since the OECD data is between only developed economies, it is possibly a better fit for the mature FDI story of Hartman/Sinn. It should also be noted that due to cross-country variation in definitions and reporting requirements, the OECD measures of FDI stock are possibly noisier than the BEA's measures. The year 1992 is used because it is the most recent year for which both the OECD data and many of our control variables are available. It should be noted that if the sales or stock measures report the actions of a single firm, then the BEA censors this data, deleting some treaty partners from our sample. This is a greater problem for sales than the stock data, allowing us to increase our observations by one-third in the stock regressions.

In order to classify countries as home or foreign, we compare the relative FDI activity of the two countries for each year that bilateral data was available and designated the one which had higher activity in the most number of years "home". In the U.S. data, with a few exceptions, this coding means that the U.S. plays the part of the home country. Similarly, in both the U.S. and the OECD data sets Japan was always a home country which is not surprising given Japan's traditional barriers to inbound FDI. To test the sensitivity of our results to this coding, we also use a "gravity" specification in which, rather than using the home and foreign FDI measures separately, we use the sum of FDI activity and the squared difference between home and foreign FDI. This gravity method of dealing with asymmetries is common in the empirical literature on trade and FDI.[15]

Data on non-treaty rates are obtained from the Price-Waterhouse *Corporate Taxes - A Worldwide Summary* (1992). This source was also used to determine whether a country uses credits or exemptions to relieve the double taxation of foreign earned profits. For the U.S. data set, since the U.S. is almost always the home country and all U.S. non-treaty withholding tax rates were 30%, the

[15] Recent examples include Feenstra, Markusen, and Rose (2001), Bougheas, Demetriades, and Morgenroth (1999), and Brainard (1997).

home non-treaty tax is nearly constant for the U.S. regressions. The information on the treaty-specified tax rates is drawn from the treaties themselves as reprinted in Diamond and Diamond (1998). We also obtain information on the initial year of treaty enforcement from this source. This is used to create a treaty age variable which is defined as the number of years since the first treaty was formed between two countries as of 1992.[16] Note that the tax rate information we use is for the treaty in force as of 1992, these rates may differ from the initial version of the treaty that forms our treaty age variable.

As a measure of the home country's bargaining power, we use the home country's share of the total gross domestic product (GDP) of the two countries.[17] This proxy is based on the idea that a country with a larger economy will have more sway in the negotiations. One rationale for this presumption is that a small country might choose to appease a large one in the hopes of future concessions on other international agreements such as trade pacts. Data on real GDP come from the Penn-World Tables, which are detailed in Summers and Heston (1991). In the gravity specification, we replace this measure with the sum of GDP and the difference in GDP squared.

In the theory, we make great use of the Hartman/Sinn result that overseas affiliate sales are unresponsive to the withholding taxes. This assumption need not hold in the data and we therefore use a Hausman test for endogeneity. While gravity models such as Brainard (1997) have been popular specifications for affiliate sales, they were developed more in response to the data than to the theory of the multinational enterprise (MNE). Instead we develop our instruments using recent work by Carr, Markusen, and Maskus (2001) and Markusen and Maskus (2001), both of whom establish empirical specifications of FDI activity that are arguably more grounded in the formal theories of multinational firms. As noted by Blonigen, Davies, and Head (2002) there is a misspecification in this framework regarding skill variables and we therefore use their alternative absolute-value specification. Carr, Markusen and Maskus use their empirical model to examine affiliate sales of U.S. firms in other

[16] Although Diamond and Diamond (1998) do not list a bilateral treaty of FDI between France and Japan, Price-Waterhouse (1992) does list treaty tax rates. Therefore, this country pair is not included in our OECD regressions using treaty age. If this treaty is eliminated from all OECD regressions, our results remain nearly identical.

[17] Earlier drafts of the paper also used the home relative GDP and the home and foreign GDP as two separate, independent variables as measures of bargaining power. These alternatives yielded similar results for our other independent variables and are available upon request.

countries and foreign affiliate sales in the U.S. over the period 1986-1994 and find that their unrestricted specification fits their data quite well. Blonigen, Davies, and Head show that this specification also performs well using both U.S. FDI stock and OECD FDI stock data. Details of our instrumental variables estimation are found in the appendix. Here, we merely note that the modified Carr, Markusen and Maskus specification does reasonably well in capturing the variation in affiliate sales with R^2s for home and foreign affiliate sales of .9740 and .9196 respectively. Summary statistics for our data are found in Table A1 of the appendix. Table A2 lists the treaty partners used in our estimation.

In addition to the variables in (13), in some specifications we consider two additional explanatory variables: treaty age and double tax rules. By using a cross-sectional approach, we are testing for systematic variation in the long-run equilibrium of the bargaining game between countries rather than the marginal effect of changes in our explanatory variables. Because of this, in the baseline specification, we may miss out on long-run effects of our variables on the treaty-specified tax rates. Specifically, there are two concerns that one might have relating to treaty age. First, the relative FDI activity in 1992 may not reflect the situation when the treaty was originally signed. If this is the case, we would expect no significant relationship between FDI in 1992 and treaty-specified taxes. This concern is mitigated somewhat by the fact that treaties can and do get renegotiated.[18] Thus, if the current situation differs highly from when the treaty was initially formed, one would expect that this would lead to a renegotiation. Therefore, we expect that the current version of the treaty should be at least partially reflective of the current FDI situation. Another possible influence of treaty age is that when countries have a long history of cooperation, this may impact their tax treaty negotiations since they may feel more "integrated". If this is the case, the large country may be more willing to implement a treaty with lower tax rates regardless of FDI asymmetries since it may gain concessions on other fronts. Alternatively, there may exist inertia between countries with long histories that makes

[18] See footnote 8 for an example of a treaty that has been renegotiated over time. See our companion paper (Chisik and Davies, forthcoming) for a further explanation of the sources of this renegotiation and for several other examples of renegotiated treaties. As we develop there, and explain briefly in section II of this paper, the renegotiation takes place in response to changes in FDI so that the currently specified treaty tax rates can be considered as an optimal response to the 1992 FDI levels.

them less likely to renegotiate an existing treaty even if one country could reap greater rewards from renegotiation. To investigate these possibilities, we will examine the effect of treaty age, both by itself and interacted with other variables, on the treaty-specified tax rates.

In addition to considering treaty age effects, we also control for double tax rules. When a payment is received by a parent firm, it may face parent country taxes in addition to the host's corporate and withholding taxes. The burden of this parent country tax depends both upon statutory rates and the double tax rule. In our sample, all treaty partners offer either a limited foreign tax credit or exempt foreign earned profits from domestic taxation. If the parent country offers a credit for host taxes, then if the combined host taxes lie below the domestic corporate income tax, the firm's marginal effective tax rate is driven by the parent country tax, not host taxes.[19] Regardless of the relative tax burdens, this is not case when the parent country offers exemptions. Because of this, firms' tax avoidance strategies may be more responsive to the withholding tax when it operates under exemptions. As such, these firms may have a greater incentive to avoid host taxes, imposing greater enforcement and monitoring costs on governments. This implies that, all else equal, treaty gains may be more sensitive to the treaty tax when one or both signatories uses exemptions. While this implies greater gains from lower negotiated taxes, this effect may be tempered depending on whether the additional gains tend to accrue to the home or foreign country. To investigate these potential effects, we create an exemptions dummy variable equal to one if a parent country uses exemptions and zero otherwise. We use this to estimate a version of (13) that includes both the exemptions dummy and its interactions with the FDI measures.

Before turning to our estimation results, three issues deserve mention. First, since these data are available for more than one year, it is tempting to use a panel data specification. Unfortunately, during the period for which bilateral FDI data is available, there is insufficient within-treaty variation in the treaty-specified tax rates for this approach to be useful. Second, although the treaty tax rates do vary across types of withholding taxes within a country pair our other variables do not vary within our single year sample. This precludes the use of country-specific fixed effects for the U.S. data sets. It

[19] This statement is only approximate since it ignores other host taxes and additional credit determination issues such as income baskets.

can also cause clustering effects, as discussed by Kloek (1981), which can lead to understated standard errors. Therefore, we correct for clustering on country pairs when calculating our standard errors. Finally, treaty tax rates are only observed for countries with treaties. Therefore, it is necessary to ask how this sample selection impacts our results. We do this using Heckman's (1979) two-step process that estimates treaty-specified tax rates conditional on the existence of a treaty. Note that this is only possible for the U.S. data set since there are treaties in place for all of the OECD country pairs with available bilateral FDI data.

IV. Results

Tables 1 through 3 present our baseline results using the U.S. sales, U.S. stock, and OECD stock measures of FDI activity respectively. In each table, Column 1 presents OLS estimates using the actual FDI data while Column 2 presents the results using the instruments for FDI. Since there are no negative withholding taxes, Column 3 of each table reports results using the Tobit estimation procedure that corrects for a dependent variable restricted to non-negative values. Column 4 of each table reports the results from the gravity specification. Finally, since it is possible to use a fixed effects approach in the OECD data set, Column 5 of Table 3 also reports the results when using country-specific dummy variables. In addition to the reported independent variables, each of these regressions includes a constant as well as dummy variables for the parental dividend, unrelated dividend, and royalty tax. These estimates are omitted for space and are available upon request. Finally, all standard errors are calculated using White's (1980) consistent method. The non-Tobit errors are also corrected for clustering on country pairs using the method described by Rodgers (1993).

Regardless of which sample we use, we find very similar results. For both the U.S. and the OECD data sets, home FDI is positively correlated with the treaty tax while foreign FDI is negatively correlated with the treaty tax. These results are always significant for affiliate sales and usually significant for the FDI stock measures. Since the treaties in our sample lower tax rates, these results are consistent with two situations: revenue effects dominate or, as described in Proposition 2, the parent's marginal non-revenue gain is larger than the host's. Since these variables' coefficients have

opposite signs, our estimates imply that a rise in FDI asymmetry leads to higher negotiated tax rates. We find comparable results when using the instrumented FDI measures. Furthermore, Hausman tests reject the hypothesis that there are systematic differences between the regressions using the actual FDI data and their constructed counterparts. This suggests that endogeneity is not driving our results.[20] The Tobit results find similar effects of asymmetries, indicating that truncation of tax rates is not responsible for our findings. In fact, for the U.S. stock specification, the Tobit estimation increases the overall significance of the FDI measures relative to the OLS specification. These results hold up even after introducing country-specific fixed effects into the OECD specification, although standard errors rise so that only the home FDI stock has a significant coefficient.[21] In any case, even here we find that FDI asymmetries between treaty partners play a role in treaty negotiations.

The result that FDI asymmetries increase taxes is confirmed by the U.S. gravity specifications where we find a positive, strongly significant coefficient on squared FDI differences. This indicates that at least for the U.S. our results are not contingent on our coding of the small and large countries. In the OECD data set, we do not find significant coefficients on our FDI measures in the gravity specification. However, since the OECD non-gravity results mirror the U.S. non-gravity results, the differences between the U.S. and OECD gravity results may be due to the gravity transformation exaggerating the additional noise in the OECD data.

For affiliate sales, the magnitudes of the coefficients on home and foreign affiliate sales center around .0000629 and -.0000939 respectively. This indicates that an increase in home affiliate sales of $1 billion would increase the level of the negotiated tax by .0629 percentage points (i.e. an increase from 5% to 5.0629%). An equivalent increase in foreign affiliate sales would lower the level of the negotiated tax by .0939 percentage points. While these magnitudes seem small, consider them in the following light. The U.S. had roughly the same level of affiliate sales in Canada and the U.K. in 1992, however, Canada had only half the sales in the U.S. that the U.K. did. If Canadian sales rose to those of the U.K., our estimates predict a drop in the Canadian treaty tax applied to dividends paid to the

[20] In an additional battery of tests in which FDI was the dependant variable, we found that FDI was not driven by treaty-specified withholding taxes. These are available on request.
[21] Note that in this specification, since the only Icelandic treaty for which FDI data was available was its treaty with the U.S., our sample size is reduced by four.

parent of approximately 6.5 percentage points. Noting that this tax rate is 10% in the Canadian treaty but only 5% in the U.K. treaty, this suggests economic meaningful effects from asymmetric FDI flows.

In most of our specifications, the home share of GDP is significantly and positively correlated with the treaty-specified rate, that is, as home gets relatively large, tax rates rise. This is the opposite of our predictions for home bargaining power. One explanation for this is that our expectation that larger countries hold more bargaining power is incorrect. For example, since relatively small countries do not support large international military operations, they are far more likely to host a U.S. military base than the U.S. is to host one of their bases. The threat of expulsion might tip the balance in favor of the small country resulting in higher tax rates. However, when using the gravity specification, we consistently find a negative coefficient on squared GDP differences. Thus, in the gravity specification, a rise in the home GDP relative to foreign reduces treaty-specified tax rates. Since this conflicts with the home share of GDP result, we feel that the more likely explanation is that we simply have poor proxies of bargaining power, highlighting the need for additional research on the determinants of bargaining power in international agreements. In any case, these estimates suggest that, similar to FDI asymmetries, higher GDP asymmetries are linked to higher negotiated taxes.

Turning our attention to the non-treaty tax rates, we find that the foreign non-treaty tax has a positive coefficient in all the regressions and is generally significant. This mirrors our theory's prediction that when the foreign country has an initially high tax rate, the average negotiated tax is also higher. Contrary to the theory, the coefficient on the home non-treaty tax is also positive although primarily significant only in the U.S. regressions. One possible reason for this is that all the variation in the U.S. regressions comes from those few cases in which the U.S. is the small, foreign country. As such, this variable may simply be capturing other variables specific to those few countries that have greater FDI in the U.S. than the U.S. does in them. One factor that argues against this is that in the OECD results, the home non-treaty tax is only significant when country-specific dummies are included. An alternative explanation is that a high non-treaty tax indicates a country with a preference for government revenues relative to firm profits regardless of its relative size. Thus, large countries

that desire large tax revenues may push for treaties with high taxes, even at the cost of efficiency or transferring additional surplus to the relatively small country. Such a rationale would also be consistent with the coefficient on the foreign non-treaty tax.

Treaty Age Effects

We now modify the basic specification by including treaty age, both on its own and interacted with our FDI variables. When we include both FDI and interactions between FDI and treaty age, we only find significant coefficients when using U.S. affiliate sales. Here, the interaction terms mirror the above results, that is increases in FDI asymmetries increase tax rates. At the same time, however, the coefficients on home and foreign FDI reverse signs, although only the home FDI coefficient is significant. These sign reversals and overall insignificance are likely due to collinearity between our interacted and non-interacted variables with FDI measures. To test this, in the even numbered columns, we drop the basic FDI terms and use only the interacted FDI terms. Now we find significant results that match those from Tables 1 through 3, that is, FDI asymmetries significantly increase tax rates with a stronger effect for older treaties. The treaty age variable itself is always negative, but never significant. This is true even if we exclude all interaction terms suggesting that while older treaties may involve lower tax rates, this link is tenuous. In any case, when including treaty age effects, we again find that greater FDI asymmetries are linked to higher treaty-specified tax rates.

Double Tax Relief Effects

In Table 5, we turn our attention towards the possible effects of a country's double tax rules. To examine this, we include our exemptions dummy both alone and interacted with the FDI variables.[22] In the U.S. data, the home country always offers credits. Because of this, we only use a foreign exemption dummy. Note that since only the foreign country's FDI is operating under exemptions, we expect an insignificant coefficient on the interaction between exemptions and home FDI. For the OECD data, we interact a parent country's exemption dummy with its outbound FDI and

[22] The coefficients for other exemption interactions were always insignificant and are therefore omitted from the reported specifications.

with the host's non-treaty tax. Across the board, we find that when the small foreign country uses exemptions, this implies an even stronger negative correlation between its outbound FDI and the treaty-specified tax. Similarly, in the OECD regression, when the large country offers exemptions, this also reduces the positive impact of its outbound FDI on the treaty-specified rate. Since this effect is similar for both small and large countries, this suggests that the use of exemptions by either country is correlated with lower treaty taxes. This is consistent with the idea that when a treaty partner offers exemptions, all else equal, there are additional efficiency gains from lower withholding taxes and that this effect works irrespective of the redistributive problem. As before, we find significantly opposite signs for the non-interacted FDI terms. This suggests that FDI asymmetries still matter, although they may be less important when one or both treaty partners uses exemptions.

As expected, the interaction of foreign exemptions and home FDI is insignificant in the U.S. stock regression. Surprisingly, this interaction is significant in the U.S. affiliate sales regression. In results not reported here, we find that the opposite is found in the OECD data.[23] We therefore attach no special interpretation to this significance. The U.S. affiliate sales regression is also the only case in which the exemption dummy itself is significant. Finally, the home share of GDP and non-treaty tax rates perform similar to the baseline regressions.

Sample Selection

As a final robustness test, we investigate the impact of sample selection since treaty-specified tax rates are only observed for countries which actually have treaties. To examine the impact this may have, we turn to Heckman's (1979) two-step procedure. This process first estimates the likelihood of the dependent variable (a treaty-specified tax rate) being observed using Probit estimation. Then, a second step estimates the impact of our independent variables conditional on the results from the first step. To carry out this estimation, we expand our U.S. data set to cover all countries for which the necessary variables were available from the above-cited sources.[24] For the sales data, this results in forty countries, twenty-one of which had treaties. For the stock data, this yielded fifty-five countries,

[23] When all interactions are included, collinearity inflates standard errors and eliminates significance.
[24] Recall that in the OECD data set, all countries for which we had bilateral FDI data had treaties.

twenty-eight of which had treaties. The results from the sales data are in Columns 1 and 2 of Table 6. As that table shows, the sales data suggest that asymmetries are important for the simple existence of a treaty, regardless of its actual terms. Specifically, as the small foreign country's affiliate sales rise, this increases the probability of a treaty. The negative coefficient on home sales tells the same story. Therefore, the sales data suggest that as the difference between the countries FDI levels shrinks, the probability of a treaty grows. Turning to the second column, we once again find that, even conditional on the existence of a treaty, greater FDI asymmetries are linked to higher treaty taxes. While the non-treaty rates are not significant in the first stage results, they are positive which lends some weak credence to the idea that countries may seek out treaties in order to reduce the taxes paid to the overseas government. Finally, as before, the bargaining proxy performs poorly and is not significant in either stage.

Turning to the stock results in Columns 3 and 4, we find a story for FDI stocks that is similar to that of affiliate sales although the significance of the estimates drops below the standard levels. As with the sales data, we find positive coefficients on all the non-treaty taxes. In fact, here we find significant effects from the foreign tax. Contrary to the sales results, we estimate a negative effect for the home share of total GDP in the selection stage which suggests that asymmetries in country size may also lower the probability of a treaty. While there are certainly many other factors related to treaty formation, these first-stage results are intriguing and, to our knowledge, present the first empirical findings regarding the patterns of treaty formation. While our results on treaty formation are by no means exhaustive, they do indicate that asymmetries are important both for treaty formation and treaty terms. Overall, the data suggests that not only are dissimilar countries less likely to form a treaty, but even those that do reach the negotiating table may find themselves with directly opposing goals.

V. Conclusion

In this paper, we have made a first attempt at modeling the bargaining process behind bilateral tax treaty development. Following the work in international tax law, the theory highlights two main areas of conflict: changes in tax revenue and sharing the non-revenue gains from treaty creation. The

predictions from this theory were then tested with data from both U.S. and OECD treaties. The data indicate that asymmetries in FDI play an important role in treaty negotiations since coordinated tax rate changes transfer income between partners. Additionally, the data suggest that GDP asymmetries may also be associated with higher negotiated taxes. While our approach has been admittedly simple, we believe it makes three key points. First, although tax treaties can benefit both signatories, there still exist conflicting interests in treaty formation. As such, there exists an element of competition even in tax rate coordination although this type of tax competition differs considerably from that discussed by Wilson (1999). Second, the terms of tax treaties vary in a systematic way across countries. Third, asymmetries in FDI levels affect the threat point in the bargaining problem. As these asymmetries rise, the scope of possible cooperative outcomes is diminished which in turn can either increase the negotiated tax rates or put a stop to treaty formation altogether. This can reduce the gains from treaty formation if these gains are decreasing in the negotiated tax rate. Similar problems may arise as governments butt heads over other treaty provisions such as jurisdiction, tax definitions, and the like. Our results indicate that these issues may be a particular concern for highly asymmetric countries. Recognizing how these treaty policies are determined in this "cooperative" setting is therefore important in maximizing the potential gains from tax coordination. Additionally, if treaty-specified tax policy has efficiency implications beyond FDI, then understanding treaty formation is necessary in order to effectively use them to mitigate the effects of decentralized tax decisions.

While our work points to some key factors in treaty formation, there remain unanswered questions about treaty formation. First, there are many facets of tax treaties beyond withholding taxes. The way in which these issues are settled, as well as their possible effects on FDI, is something we have not dealt with here. Second, there is the issue of how to best approximate the relative bargaining strength between countries. Relative bargaining strength has been an area of study in the trade negotiation literature and determining what factors isolated there do and do not matter for tax negotiations is worth considering. Third, what other factors influence the formation of treaties apart from the terms of the treaties? While we find some evidence that asymmetries matter, treaty formation is a rich issue in and of itself. Finally, there is the question of why do we not see multilateral tax

agreements. This is a particularly intriguing matter when compared to the abundance of multilateral trade agreements.[25] While these items are beyond the scope of the present paper, we hope that our results serve as a catalyst for research in this direction.

[25] Graham (2001) provides a very interesting dissection of the failure of the Multilateral Agreement on Investment.

Table 1: Treaty-specified Withholding Taxes using 1992 U.S. Affiliate Sales

	OLS	Instruments	Tobit	Gravity
Home sales	.0000554*** (3.304)	.0000454** (2.268)	.000088*** (2.800)	
Foreign sales	-.0000863*** (3.841)	-.0000618* (1.810)	-.0001336*** (2.907)	
Sum of sales				-.0000286** (2.635)
Sales difference squared				7.58e-10*** (2.963)
Home share of total GDP	3.001545* (1.768)	2.475572 (1.609)	3.939629 (1.590)	
Sum of GDP				-.0000533** (2.084)
GDP difference squared				-7.53e-12** (2.181)
Foreign non-treaty tax	.1377366* (1.759)	.0891628 (1.406)	.2417758** (2.365)	.0460867 (0.850)
Home non-treaty tax	.1051999** (2.230)	.0776175* (1.866)	.2905498 (1.314)	.1098275** (2.500)
N	84	72	84	84
Adjusted R^2	0.5052	0.5691		0.5983
Pseudo-R^2			0.1216	
Hausman Chi^2	358			

All equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
White-corrected t- values in parenthesis. Non-tobit t-values are also corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 2: Treaty-specified Withholding Taxes using 1992 U.S. Stock of FDI

	OLS	Instruments	Tobit	Gravity
Home stock	.0000529 (1.372)	.0000876** (1.937)	.0001227** (2.219)	
Foreign stock	-.0001169** (2.518)	-.0001773** (2.278)	-.0002149*** (3.259)	
Sum of stock				-.0000768*** (2.805)
Stock difference squared				3.07e-09*** (2.893)
Home share of total GDP	4.973936*** (2.965)	5.199193*** (2.873)	5.651452** (2.489)	
Sum of GDP				-.000027 4 (1.058)
GDP difference squared				-3.85e-12 (1.088)
Foreign non-treaty tax	.2499824** (3.152)	.2272345** (2.631)	.3305822*** (5.118)	.2261205** (2.742)
Home non-treaty tax	.0928323 (1.436)	.0948969 (1.659)	.333948 (1.396)	.2266958** (2.632)
N	112	100	112	112
Adjusted R^2	0.5229	0.528		0.5168
Pseudo-R^2			0.1242	
Hausman Chi^2	10.87			

All equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
White-corrected t- values in parenthesis. Non-tobit t-values are also corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 3: Treaty-specified Withholding Taxes using 1992 OECD Stock of FDI

	OLS	Instruments	Tobit	Gravity	OLS with Country Dummies
Home stock	.0000216*** (3.161)	.0000101 (0.145)	.0000358 (1.462)		.0000222* (1.785)
Foreign stock	-.0000568** (2.086)	-.000214 (1.547)	-.0000876* (1.839)		-8.72e-06 (0.342)
Sum of stock				-.0000224 (1.444)	
Stock difference squared				-1.61e-11 (0.118)	
Home share of total GDP	4.104279** (2.296)	5.550202** (2.244)	6.088562*** (3.695)		-.0776843 (0.049)
Sum of GDP				1.77e-06** (2.492)	
GDP difference squared				-4.61e-13*** (3.334)	
Foreign non-treaty tax	.1186111** (2.618)	.1198662** (2.545)	.1802494*** (3.388)	.047443 (1.028)	.1123722** (2.090)
Home non-treaty tax	.0297828 (0.661)	.0405006 (0.884)	.0625101 (0.983)	.0748667 (1.652)	.168794*** (2.848)
N	240	192	240	240	236
Adjusted R^2	0.3852	0.3979		0.3834	0.5622
Pseudo-R^2			0.0793		
Hausman Chi^2	8.9				

All equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
White-corrected t- values in parenthesis. Non-tobit t-values are also corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 4: OLS Including Treaty Age Effects

	U.S. Affiliate Sales		U.S. FDI Stock		OECD FDI Stock	
Home FDI	-.003749*** (3.651)		-.0007268 (1.295)		.0001372 (.0942)	
Foreign FDI	.0003261 (1.579)		.0010556 (0.933)		-.0003286 (1.036)	
Home FDI * Treaty Age	.0000113*** (4.690)	1.46e-06*** (3.319)	.0000192 (1.399)	1.56e-06 (1.630)	-2.95e-06 (0.742)	5.42e-07*** (2.896)
Foreign FDI * Treaty Age	-.0000106** (2.415)	-1.81e-06*** (3.972)	-.0000269 (1.036)	-2.79e-06* (1.976)	6.39e-06 (0.932)	-1.26e-06** (2.400)
Home share of total GDP	4.325696 (0.503)	-6.386146 (0.443)	-6.474949 (0.558)	-6.204578 (0.593)	-2.753757 (0.475)	-.8874639 (0.188)
Home share * Treaty Age	-.0458619 (0.245)	.20533 (0.613)	.2519541 (0.952)	.2452521 (1.002)	.1629337 (1.366)	.1281752 (1.285)
Foreign non-treaty tax	.1570663** (2.281)	.1359165** (2.130)	.2657602*** (3.399)	.256789*** (3.236)	.1186297** (2.402)	.1225498** (2.475)
Home non-treaty tax	.0754266 (1.584)	.0981246* (1.940)	.0469126 (0.627)	.0755146 (1.250)	.0467478 (0.975)	.0431517 (0.914)
Treaty Age	-.2023498 (1.186)	-.2965155 (1.169)	-.3580139 (1.602)	-.3133476 (1.508)	-.1209685 (1.285)	-.0950155 (1.200)
N	84	84	112	112	236	236
Adjusted R^2	0.6995	0.5977	0.5889	0.5698	0.3946	0.3912

All equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
White-corrected t- values in parenthesis. T-values are also corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 5: OLS Including Exemption Effects

	U.S. Affiliate Sales	U.S. FDI Stock	OECD FDI Stock
Home FDI	.0000505*** (2.847)	.0000514 (1.400)	.0000186** (2.640)
Foreign FDI	-.0000796*** (3.498)	-.0001038** (2.262)	-.0000466* (1.709)
Home FDI * Foreign Exemptions	.0003665*** (11.025)	.0001687 (0.646)	
Foreign FDI * Foreign Exemptions	-.0003564*** (10.890)	-.000529*** (3.555)	-.0001509*** (2.151)
Home FDI * Home Exemptions			-.0001122*** (3.563)
Home share of total GDP	3.012185 (1.495)	4.84183*** (2.750)	4.88428*** (2.785)
Foreign non-treaty tax	.1288513 (1.468)	.2740375*** (3.704)	.1398857*** (3.072)
Home non-treaty tax	.0993932* (2.045)	.1018341 (1.583)	.0409828 (0.856)
Foreign Exemptions	-5.57564*** (4.145)	1.78253 (0.656)	-.7327034 (0.687)
Home Exemptions			.9399076 (1.232)
N	84	112	240
Adjusted R^2	0.5285	0.5445	0.4015

All equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
White-corrected t- values in parenthesis. T-values are also corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 6: Testing for Sample Selection using Heckman's Two-Step Procedure

	Affiliate Sales		FDI Stocks	
	Is there a Treaty?	Tax Rates if there is a Treaty	Is there a Treaty?	Tax Rates if there is a Treaty
Home FDI	-.000013 (0.988)	.0000559** (2.348)	.0000171 (0.467)	.0000652 (1.478)
Foreign FDI	.0002688*** (3.693)	-.0000777** (2.232)	.0001757 (1.380)	-.0000818 (1.297)
Foreign non-treaty tax	.0151765 (1.209)	.1490292 (1.275)	.0160522* (1.860)	.276206*** (3.426)
Home non-treaty tax	.0018499 (0.051)	.1043242 (0.683)	.0288341 (0.779)	.1119696 (0.771)
Home share of GDP	.160058 (0.354)	2.83274 (1.084)	-.9028458* (1.884)	3.807063 (1.530)
N (N with treaty)	160 (84)		220 (112)	
Pseudo-R^2	0.3528		0.1917	
Mills Ratio	1.341979 (0.653)		2.560707 (0.803)	

The estimated equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
Heckman's consistent Z- values in parenthesis are corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Appendix

Our instrumental variables are constructed using the empirical framework described by Carr, Markusen, and Maskus (2001) and Markusen and Maskus (2001). This framework is derived from the knowledge-capital model of FDI that incorporates both horizontal and vertical motivations for investment. This specification includes gravity-type variables and skill variables that capture relative factor differences. This specification is:

$$FDI_{ij} = f\,(SUMGDP_{ij},\ GDPDIFSQ_{ij},\ SKDIFF_{ij},\ SKDIFF_{ij} * GDPDIFF_{ij},\ (SKDIFF_{ij})^2 * T\_OPEN_j,\ Z_{ij})$$

The dependent variable, FDI_{ij} is a measure of FDI activity from a parent country (i) to a host country (j). The first two terms are gravity-type measures with SUMGDP defined as the sum of the two countries' real GDPs, and GDPDIFSQ defined as the squared difference between the two countries' real GDP. The next three terms deal attempt to capture differences in the countries relative endowments of skilled and unskilled labor. The SKDIFF variable is the absolute value of the parent country's skilled labor abundance minus the host country's skilled labor abundance. The fourth term is an interaction term between SKDIFF and GDPDIFF, the parent country's GDP minus the host country's GDP. The fifth term interacts the square of SKDIFF with the trade openness in the host country. Additional control variables in Z_{ij} include distance ($DISTANCE_{ij}$) the home share of combined GDP, non-treaty tax rates, and trade and investment openness measures for the two countries. Trade openness for both the parent and host countries are denoted by T_OPEN_i and T_OPEN_j while investment openness measures are denoted by F_OPEN_i and F_OPEN_j.

The GDP and trade openness information comes from the Penn-World Tables.[26] Trade openness is measured as exports plus imports relative to GDP. For our measures of investment barriers, we use the composite score reported by Business Environment Risk Intelligence, S.A. (BERI). This measure includes information of political risk, financial risk, and other economic indicators. Distance data comes from the Bali Online Corporation (1999) and is measured as the

[26] We use version 5.6 of the Penn-World Tables, which are available online at http://datacentre.chass.utoronto.ca:5680/pwt/. For details on the Penn-World Tables, see Summers and Heston (1991).

distance between capital cities.[27] For skill information, we rely on a relatively new database constructed by the World Bank on total mean years of education across countries from 1950-1990 and extrapolate this to 1992.[28] We use the difference in total mean years of education between the parent and host country as our measure of skilled-labor abundance differences. Summary statistics for these data are found in Table A1.

As Table A3 shows, the modified Carr, Markusen, Maskus specification does reasonably well in capturing the variation in affiliate sales. Although some coefficients such as that for squared GDP differences do not match any of the models of MNE activity, on the whole the data supports either the horizontal or knowledge-capital model of FDI. This is comparable to the findings of Carr, Markusen, and Maskus (2001), Markusen and Maskus (2001), and Blonigen and Davies (2001).

[27] This distance calculator can be found at http://www.indo.com.
[28] Our education variable is the mean years of education for both males and females. This data is published by the World Bank and is discussed by Nehru and Dhareshwar (1993).

Table A1: Summary Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum	Observations
1992 U.S. Data					
All Countries					
Foreign non-treaty tax	21.94419	10.93684	0	50	220
Home non-treaty tax	29.67742	3.668552	0	40	220
Foreign Affiliate Sales	17455.98	36303.72	0	157708.7	160
Home Affiliate Sales	23113.6	48451.02	3.9265	263873.3	160
Foreign FDI Stock	4473.481	12485.01	-7.0677	67996.77	220
Home FDI Stock	6510.973	14610.62	-0.7853	76777.99	220
Foreign GDP	634673.2	1342633	3293.298	4575975	220
Home GDP	4173908	1247433	60564	4575975	220
Treaty Partners					
Treaty Tax	9.55	7.127707	0	30	112
Foreign non-treaty tax	24.04422	10.60883	0	50	112
Home non-treaty tax	29.20833	4.348081	0	35	112
Foreign Affiliate Sales	31617.71	45147.68	96.5919	157708.7	84
Home Affiliate Sales	41971.31	64005.93	81.6712	263873.3	84
Foreign FDI Stock	8463.44	16568.89	-6.2824	67996.77	100
Home FDI Stock	11535.85	19549.15	18.8472	76777.99	100
Foreign GDP	931159.2	1517942	3293.298	4575975	100
Home GDP	4038000	1405912	60564	4575975	100
Foreign F_OPEN	0.1305225	0.0964986	0.0207835	0.4055	100
Home F_OPEN	7.043884	1.876148	0.6046884	14.47015	100
Foreign T_OPEN	62.60138	36.86545	21.43	181.26	100
Home T_OPEN	25.41733	11.28892	17.97	68.48	100
Foreign Average Education	7.9987	2.702833	2.109	12.578	100
Home Average Education	11.3197	0.9323243	6.957	11.615	100
Treaty Age	29.46667	16.99972	1	52	112
Exemptions	0.2	0.4016772	0	1	112
Distance	5188	2187.76	455	10163	100
OECD Data					
Treaty Tax	9.981538	6.94829	0	32.4	240
Foreign non-treaty tax	24.71527	9.992279	0	45	240

Home non-treaty tax	24.84662	8.383326	0	45	240
Foreign FDI Stock	6826.146	14738.99	-6.934597	92733.8	240
Home FDI Stock	12675.55	27010.62	32.66195	176780.6	240
Foreign GDP	793356.9	1162007	3293.298	4575975	240
Home GDP	1276269	1390160	60564	4575975	240
Foreign F_OPEN	12.59447	8.612199	2.078349	27.44144	192
Home F_OPEN	7.601404	7.451177	0.6046884	27.44144	192
Foreign T_OPEN	55.02274	20.06177	21.9	100.11	192
Home T_OPEN	45.47587	21.1126	17.97	100.11	192
Foreign Average Education	9.007785	1.115905	7.599	11.615	192
Home Average Education	9.722862	1.230624	7.721	11.615	192
Treaty Age	35.74603	15.02398	9	69	236
Home Exemptions	0.076923	0.2669833	0	1	240
Foreign Exemptions	0.3538462	0.4790844	0	1	240
Distance	5503.831	4927.123	235	17004	192

Table A3: Sample Countries with Treaties

U.S. data					
Australia*	Austria*	Belgium*	Canada*	China*	Cyprus
Denmark*	Egypt	France*	Germany*	Iceland	India*
Indonesia*	Ireland*	Italy*	Luxembourg*	Morocco	Netherlands*
New Zealand	Norway*	Pakistan	Spain*	U.K.*	Finland*#
Japan*#	Sweden*#	Switzerland*#			
OECD data					
Australia	Austria	Canada	Finland	France	Germany
Italy	Japan	Netherlands	Norway	Sweden	U.K.
U.S.	Iceland				

* Indicates affiliates sales data was available.
# Denotes home country in the U.S. data set.

Table A4: Results from Instrumenting FDI Variables

	U.S. Affiliate Sales		U.S. FDI Stock		OECD FDI Stock	
	Foreign	Home	Foreign	Home	Foreign	Home
Home share of GDP	1021261*** (17.945)	555611.7*** (3.866)	227203*** (3.231)	115884*** (3.425)	-1212.064 (1.317)	162.9612 (0.091)
Foreign non-treaty tax	-89.98173 (0.821)	-266.7037 (0.996)	-16.82855 (0.153)	93.33982* (1.763)	-3.301958 (0.155)	-12.22218 (0.295)
Home non-treaty tax	-11.86293 (0.081)	-20.77544 (0.056)	-24.30629 (0.096)	2.268298 (0.019)	-4.690342 (0.201)	-80.64405* (1.778)
SUMGDP	.7001995*** (9.800)	.3600394* (1.995)	-.0234795 (0.395)	.006684 (0.234)	.0054494*** (11.284)	.0108119*** (11.515)
GDPDIFSQ	3.37e-08*** (4.485)	-2.58e-09 (0.136)	-1.61e-08** (2.573)	-8.75e-09*** (2.897)	-2.19e-09*** (3.824)	-4.94e-09*** (4.428)
SKDIFF	-214606.5*** (30.566)	-221303.8*** (12.482)	-56225.01*** (7.337)	-58181.24*** (15.779)	-6685.549*** (5.722)	-16763.9*** (7.379)
SKDIFF* GDPDIFF	.0455645*** (24.247)	.0480322*** (10.122)	.0116374*** (5.442)	.0095283*** (9.259)	.0019655*** (3.247)	.0075252*** (6.394)
Foreign T_OPEN	-590.7096*** (7.482)	-332.4069 (1.667)	31.10368 (0.316)	-341.8776*** (7.227)	24.76365 (1.240)	120.1819*** (3.096)
Home T_OPEN	30351.76*** (18.400)	16623.04*** (3.991)	6563.034*** (3.278)	2649.799*** (2.750)	.4528649 (0.024)	-102.0351*** (2.780)
Foreign F_OPEN	219996.1*** (20.623)	198218.1*** (7.358)	101248.1*** (6.459)	80363.6*** (10.654)	38.84303 (1.551)	493.851*** (10.144)
Home F_OPEN	-22376.74*** (10.417)	-10225.82* (1.885)	-8264.58** (2.410)	-2422.279 (1.468)	490.6766*** (14.964)	303.6418*** (4.763)
Distance	-.3000287 (0.535)	-2.661217* (1.878)	-1.644561** (2.404)	-.9928406*** (3.016)	-.1445276** (2.529)	-.5891856*** (5.302)
$(SKDIFF_{ij})^2$*Foreign T_OPEN	83.98833*** (14.286)	41.10465*** (2.769)	5.593966 (0.925)	14.94229*** (5.137)	6.752201 (1.586)	-12.36193 (1.493)
$(SKDIFF_{ij})^2$*Home T_OPEN	-186.7023*** (12.890)	-94.47349** (2.583)	4.283381 (0.385)	23.41329*** (4.375)	30.41418*** (3.858)	121.6641*** (7.938)
N	72	72	100	100	192	192
Adjusted R^2	0.9856	0.958	0.6793	0.9465	0.7789	0.7195

The estimated equations also have a constant and dummy variables for the parental dividend, unrelated dividend, and interest tax.
Heckman's consistent Z- values in parenthesis are corrected for clustering around country pair.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

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