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SEPARATING THE OPPOSING EFFECTS OF BILATERAL TAX TREATIES

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**ABSTRACT**

Bilateral tax treaties (BTT) are intended to promote foreign direct investment and foreign affiliate activity through double taxation relief. However, BTTs also typically contain provisions that facilitate sharing of tax information between countries intended to curtail tax avoidance by multinational firms. These provisions should disproportionately affect firms that intensively use inputs for which an arms-length price is easily observed, since strategic transfer practices that manipulate tax liabilities are no longer effective with information sharing between countries. Using BEA firm-level data we are able to separately estimate the impacts of double-taxation relief and sharing of tax information on investment behavior of US multinational firms. We find a significant positive effect of new tax treaties on foreign affiliate activity between member nations that is offset (and even reversed) the more a firm relies on inputs traded on an organized exchange (i.e., inputs for which the arms-length price is easily observed). We find these opposing BTT effects for both the intensive margin (sales of existing affiliates) and the extensive margin (entry of new affiliates).

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# 1 Introduction

Foreign direct investment (FDI) is among the largest economic activities in an increasingly global economy. Growth in foreign affiliate sales worldwide has exceeded growth in exports in recent decades (See Markusen (2002).) Moreover, the US Census Bureau reports that in 2009 over 40% of all imports were between related parties. The main policy tool used to promote efficient flows of capital across borders is a bilateral tax treaty (BTT). The provisions of these treaties include rules to coordinate double-taxation relief, to share information between national tax agencies, and agreements on definitions of the tax base. Despite the substantial amount of FDI activity subject to the provisions of these treaties, previous studies have not found significant evidence that they affect FDI activity between member nations.

Previous empirical work on BTTs and FDI activity has primarily used data on aggregate bilateral investment activity across countries and has found little evidence for any significant relationship.<sup>1</sup> In addition to aggregate FDI flows, di Giovanni (2005) finds no robust impact of BTTs on cross-border merger and acquisition activity. Davies et al. (2009) is the only prior study of which we are aware to use firm-level data to examine the impact of BTTs on FDI activity. Their study using data on Swedish multinationals finds that, while BTTs have a positive impact on the likelihood of FDI into a host country (extensive margin), there is no evidence that it affects the volume of activity (intensive margin).

There are two potential reasons that the previous literature has found little evidence for a significant effect of BTTs on FDI activity. First, BTTs may not impact tax rules in a way that alters investment activity.<sup>2</sup> Second, the many provisions within tax treaties may generate opposing incentives for investment between treaty partners. In particular, it has been suggested (e.g., Davies (2004)) that information sharing between governments reduces the ability of multinationals to surreptitiously allocate profits toward low tax rate countries. Thus, provisions for information sharing may reduce investment, while double-taxation relief stimulates FDI activity, making BTTs appear ineffective on net.

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<sup>1</sup>Examples of such studies include Blonigen and Davies (2004), Egger et al. (2006), and Louie and Rousslang (2008). For a thorough review of both the theoretical and empirical literatures on international tax treaties see Davies (2004).

<sup>2</sup>There is substantial evidence that tax rates have a significant impact on international capital mobility. See Wilson and Wildasin (2004) for a review of this literature. The well-documented relationship between FDI and tax competition stands at odds with the possibility that bilateral tax treaties do not affect FDI patterns.

Our objective in this paper is to separately identify the opposing effects of tax relief and information sharing on FDI activity. In the absence of information sharing agreements within a BTT, tax authorities have little ability to verify the reported income of the foreign affiliates, much less the internal transfer prices that would justify such reported income. Thus, there is a significant degree of implicit transfer pricing that can be employed by multinational firms when reporting foreign-affiliate activity, regardless of the types of inputs that are being traded between the parent firm and its foreign affiliates.<sup>3</sup>

Once a BTT is signed, provisions for information sharing substantially increase the information that domestic tax authorities can obtain regarding foreign affiliate activity.<sup>4</sup> For example, through information-sharing arrangements the Internal Revenue Service can ask the foreign government of a treaty partner to obtain information from foreign affiliates about the (transfer) prices they charge to their parent firm, thus justifying the tax liabilities that a U.S. multinational parent firm claims in each country. When foreign affiliates produce and sell relatively-homogeneous inputs to their parent company, the introduction of a BTT severely limits any ability to shift income through transfer pricing, due to the easy verification of market prices for such inputs by tax authorities. On the other hand, foreign affiliates producing and selling more differentiated products will continue to have flexibility in their strategic transfer pricing behavior with a BTT in place, due to the much greater ambiguity involved in determining the true market price of differentiated inputs.

Nearly every nation implements the Arms-Length Principle to govern tax liabilities when there are intra-firm transactions; the price for a transaction between related parties should correspond to a price that would be paid to a third-party. In some industries, production requires several inputs that are either traded on organized exchanges or have public listed reference prices. Our empirical strategy exploits the fact that the arms-length price for intermediate goods is easily verified in these industries and, hence, there is less ability to manipulate transfer prices to avoid taxation once a BTT is in force. As a result, provisions for information sharing within tax treaties should have

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<sup>3</sup>Using transaction-level data for U.S. multinationals, Clausing (2003) finds evidence of strategic transfer pricing behavior on a wide array of intermediate goods. Furthermore, Clausing (2009) shows there are several methods by which multinationals can mitigate their tax liabilities, highlighting financial means such as strategic transfer pricing and real means of avoiding taxation by shifting employment.

<sup>4</sup>See the *Transfer Pricing Compliance Directive* at IRS.gov for details regarding the principal and background documentation that firms must provide upon request. Also see the *PATA Documentation Package* for the uniform transfer pricing documents used by Australia, the U.S., Canada, and Japan, which also serves as model documentation for multinationals operating in other countries.

a much greater negative impact on firms in industries where inputs transferred within the firm have observable arms-length prices. Bernard et al. (2006) provide direct evidence in support of this identification strategy. They show that intra-firm prices for differentiated products exhibit higher price mark-ups than non-differentiated products (e.g., those available on an organized exchange). Feenstra and Hanson (2004) find similar evidence for entrepôt traders.

Estimating these separate (and opposing) effects of BTTs, requires detailed information about FDI activity at the sectoral level. We use firm-level data from the U.S. Bureau of Economic Analysis (BEA) and incorporate industry-specific characteristics about the necessity of differentiated inputs, which captures the ability of foreign affiliates to engage in strategic transfer pricing. The data coverage extends across 174 country-pairs (all including the United States) and 73 industries (3-digit BEA International Surveys Industries (ISI), which are based on 3-digit SIC codes in non-service sectors). With over two decades of observations we are able to compare affiliate activity well before and well after the signing of a treaty. In practice tax treaties are negotiated, signed and then put into force through a process lasting several years. The long time horizon in the data allows us to bypass the potential confounding effects of anticipated treaty enforcement within a short span of years.<sup>5</sup> Furthermore, the panel of establishment-level data on foreign activity allows us to circumvent any bias due to endogenous treaty formation, as it is unlikely that any single firm can significantly impact the country-level decisions to form treaties.

We find strong evidence for both of these effects when looking at the intensive margin (volume of activity for firms already in the host country prior to the BTT), as well as the extensive margin (likelihood of new entry into the host country after a BTT is signed). There is a significant independent positive effect of BTTs on foreign affiliate activity for US multinationals, but a significant countervailing negative effect that grows with the firm's share of inputs that are purchased with observable arms-length prices. Once a BTT is signed, firms which use inputs intensively either from an organized exchange, or with publicly available reference prices, can no longer engage in strategic transfer pricing on these types of inputs, as governments can share and verify tax information. Comparing the opposing effects of BTTs, we find that they have a significant and positive net impact on FDI activity for the average firm in our sample. The estimated impacts of BTTs

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<sup>5</sup>Baier and Bergstrand (2007) used a similar strategy to estimate the impact of free-trade agreements on trade flows between member countries. They show that panel studies, combined with an analysis across long differences, revealed significant impacts of trade agreements on international commerce.

are robust to controls for country-specific motives to engage in FDI, measures of trade openness, changes to provisions within specific treaties, and time specific effects.

The next section provides some information about tax treaties that is relevant to our estimation strategy. Sections 3 and 4 provide details on our estimation strategy, variable construction and data sources. Section 5 presents the key results and we conclude in section 6.

## 2 Background on Bilateral Tax Treaties

Most recently signed BTTs conform to the model treaties proposed by the OECD or the United Nations. The stated goal in the preamble of the OECD model treaty is to provide common solutions to the incidence of double-taxation. It is important to note that double-taxation relief is achieved via provisions about tax *rules*, and not tax *rates*. The degree of coordination is limited to the definitions of the tax base and the requirement that countries offer either exemptions or credits for foreign taxes paid. Capital income tax rates remain under the sovereign authority of each nation. Still, Davies (2003) shows that, by prohibiting the use of deductions for foreign taxes paid, the OECD model treaty will lead to larger incentives to invest abroad. Even without explicit coordination in tax rates between nations, tax competition under a BTT leads to reduced tax liabilities for multinational firms. Chisik and Davies (2004) provide direct evidence that BTTs reduce withholding rates.

Besides coordinating definitions of the tax base and double-taxation relief methods, each model tax treaty includes special provisions about cooperation between national tax agencies. First, BTTs require member nations to share pertinent information. Member countries cannot simply state a willingness to share information in good faith. Information sharing is compulsory at the request of the tax agency in either nation. *Article 26* of the OECD model treaty stipulates that each nation must assist in the gathering of tax information, "...even though that other State may not need such information for its own tax purposes." Transfer pricing documents for foreign affiliate sales are one example of such information that may be requested. *Article 27* further requires that member nations assist with the collection of revenues if a taxable agent is in non-compliance. The United States has a history of acting on treaty violations by foreign nations, leading to the suspension or

cancelation of treaties when tax agencies refuse to share information or enforce treaty rules.<sup>6</sup> In short, international tax treaties include several provisions that are intended to curb the use of tax havens and strategic transfer pricing behavior.<sup>7</sup>

On a final note, BTTs typically require that member nations levy taxes on foreign-owned permanent establishments and domestic firms equally. (See *Article 24* of the OECD model treaty.) These provisions are useful here because our measure of foreign direct investment is affiliate sales by foreign permanent establishments. Provisions for non-discrimination ensure that BTTs offer relief from double-taxation, without additional costs attributable to foreign ownership classifications.

### 3 Estimation Strategy

Our goal is to measure the impact of BTTs on FDI activity, separate from the other determinants of such activity. Thus we require an estimation framework that incorporates the motives for firms to operate foreign affiliates. We first incorporate country-level features derived from the knowledge-capital model of FDI activity developed by Markusen (2002). Furthermore, di Giovanni (2005) shows that the estimated effects of BTTs are sensitive to the incidence of trade agreements between countries; we add country-level controls for other trade and investment treaties. To account for the opposing effects of BTTs and potential endogeneity issues we include additional industry- and firm- level characteristics.<sup>8</sup>

Denote FDI activity for US parent firm  $p$ , in destination country  $d$ , within industry  $i$ , during year  $t$  as  $FDIAct_{pdit}$ . Then our baseline specification is

$$FDIAct_{pdit} = f\left(Treaty_{dt}, Hom\_Input_i, [Hom\_Input \times Treaty]_{dit}, \mathbf{X}_{dt}, \psi_p, \lambda_d\right) \quad (1)$$

The variable  $Treaty_{dt}$  is an indicator that equals one if the destination country has a treaty in

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<sup>6</sup>See Papke (2000) for a detailed analysis of "treaty shopping" that occurred in the Netherlands Antilles, Aruba. The US subsequently cancelled its BTT for failure to enforce rules that would limit tax evasion.

<sup>7</sup>Some of the older US treaties in our sample have looser requirements on provisions for tax sharing. When information exchange is voluntary, the degree of cooperation can be used as an endogenous policy instrument to influence tax competition outcomes. (See, e.g., Bacchetta and Espinosa (1995) and Dhillon et al. (1999).) This will work against us finding negative effects of BTTs due to information sharing.

<sup>8</sup>Evidence in support of the knowledge-capital model is provided by Carr et al. (2001) and Markusen and Maskus (2001, 2002). One purpose of this analysis is to highlight the opposing effects of different provisions in BTTs that confounded previous studies. Hence our use of the knowledge-capital model also corresponds to previous work. See Blonigen and Davies (2004, 2005). Also, di Giovanni (2005) estimated the effect of BTTs on cross-border M&A activity using similar country-level controls.

force with the US at time  $t$ . Treaties are often signed in years previous to when they become effective. Several country-pairs have also renegotiated their BTT over time. In any case we use the effective date of the original signing to indicate when countries have a treaty in place. Measuring the presence of a treaty this way works against finding a significant impact on foreign investment.<sup>9</sup>

Our second key regressor,  $Hom\_Input_i$ , indicates how intensively firms in an industry use homogeneous inputs. We measure homogeneous inputs as the fraction of required intermediates that are available on an organized exchange, or have publicly quoted reference prices. For example, corn, wheat, and petroleum can be purchased on an organized exchange with a publicly observed price. However photographic processing materials and air compressor equipment require specific designs, and as result their prices are determined primarily in specific contracts. Higher levels of the variable  $Hom\_Input$  indicate that relatively more of the intermediate goods required within an industry are homogeneous inputs that have easily verifiable prices. Values of  $Hom\_Input$  are weighted by factor usages so that a value of 0.5 indicates that half of the inputs needed to generate a single unit of output in industry  $i$  can be purchased on an organized exchange or has a public reference price. Keller and Yeaple (2009) find evidence of gravity effects within multinational firms such that the costs to offshore production are increasing faster in technology intensive sectors; i.e., where differentiated inputs are likely to be used more intensively. The predicted sign of  $Hom\_Input$  is positive reflecting the ease of using foreign affiliates to manufacture homogeneous inputs.

The interaction between the treaty variable and  $Hom\_Input$  measures the differential effect of a BTT across industries with varying potential to avoid tax liabilities. This interaction term captures the impact of BTT provisions for sharing tax information. Strategic transfer pricing is relatively more difficult in industries that require homogeneous inputs with observable third-party prices, which limits the incentives to operate foreign affiliates for tax avoidance purposes once a BTT is in force. Thus, a new treaty is predicted to increase FDI activity relatively less in sectors which use inputs available on organized exchanges or with reference prices available.

By now it is well-known that firms adopt different strategies for international participation based on differences in their productivity and size.<sup>10</sup> Information sharing provisions may also have

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<sup>9</sup> Davies (2003) considers revisions to tax treaties and finds no impact on foreign investment activity.

<sup>10</sup>Bernard and Jensen (1999) show that more productive firms select into exporting. Yeaple (2009) provides evidence that firms which operate foreign affiliates are on average more productive than exporters. Nocke and Yeaple (2007, 2008) further show that multinationals which adopt greenfield strategies and those that use cross-border M&A as investment mechanisms differ systematically in terms of productivity.



varying effects on firms of different size. Desai et al. (2006) show that larger firms are more likely to source intermediates from tax haven countries. Furthermore, Bernard et al. (2006) find that the price of intra-firm transactions is increasing in the size of U.S. parent companies, consistent with larger firms engaging in tax avoidance through strategic transfer pricing more intensively. The term  $\psi_p$  is a parent firm fixed effect which captures, among other things, the size of the firm without introducing a bias as most common measures of size (e.g. sales or employment) are clearly correlated with affiliate sales. We estimate the impact of BTTs separately for the sample of incumbent firms and new entrants.

We primarily rely on the empirical knowledge-capital model introduced by Carr et al. (2001) to specify the control variables in the vector  $\mathbf{X}_{dt}$ . These include *SumGDP* and *RGDPdiff*<sup>2</sup> which measure (in logs) the sum and squared differences in real GDP between the destination country and the US. Larger markets motivate firms to engage in horizontal FDI activity, allowing them to bypass trade costs when serving foreign consumers. While greater incomes promote FDI activity, differences between national incomes are a deterrent. The variable *ASkillDiff* measures differences in human capital between countries, in absolute terms. Large skill differences, which may lead to wage differences, capture the incentives of firms to engage in vertical FDI activity.

Higher costs to import goods from the foreign country (*TCost<sub>dt</sub>*) reduce the incentives to acquire foreign production facilities, as intermediates inputs are more expensive to acquire. On the other hand, higher costs to export to a foreign country promote investment activity as firms can avoid trade costs by serving foreign consumers with foreign production facilities. We also include annual measures of the exchange rate between countries. As suggested by di Giovanni (2005) other trade and investment opportunities can mitigate the impact of BTTs. We add indicator variables for country pairs that equal unity if they have a free trade agreement (FTA) or bilateral investment treaty (BIT) in place. It is plausible that nations pursue treaties only with their most preferred investment destinations, or with nations most likely to act as tax havens.

Also, BTTs require several years of deliberation, suggesting that the proliferation of treaties may proceed according to the political ease with which they can be negotiated.<sup>11</sup> To account for other unobserved country-level characteristics we include destination country fixed effects,  $\lambda_d$ . Since all observations are from the US, the term  $\lambda_d$  is tantamount to country-pair fixed effects.

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<sup>11</sup>The issue of endogenous treaty formation is examined by Hines Jr. and Willard (1992) and Egger et al. (2006).

## 4 Data

The Bureau of Economic Analysis (BEA) collects firm-level data on US multinational company operations in its annual surveys of US direct investment abroad. We use data on total sales by foreign affiliates of US owned firms from these surveys as our measure of FDI activity, since it is a measure of real economic activity by foreign affiliates. Each affiliate is assigned an industry classification based on its primary activity according to the BEA International Surveys Industry (ISI) system, which closely follows the 3-digit Standard Industrial Classification (SIC) system. We focus on non-service sectors, giving us a set of firms spanning 73 3-digit industries and operating in 174 countries from 1987 to 2007.

Information about international tax treaties signed by the US come from Internal Revenue Service and Treasury Department publications.<sup>12</sup> The text of each treaty provides the signature date, ratification date, the general effective date, and the date of revisions if applicable. For all countries we use the general effective date to measure when a BTT is in force. Treaties vary in the extent to which information sharing is compulsory, and in the responsibilities of member nations to gather relevant information from resident affiliates. We do not distinguish treaties by the intensity with which they try to limit tax avoidance, nor the changes in provisions over time; this may lead to substantial heterogeneity in the effect of BTTs across countries and years. To account for these potential sources of variation in impacts when we evaluate the statistical significance of BTT effects we cluster standard errors by country-year.

Our key industry characteristic is the share of inputs traded on an organized exchange or with a published reference price. There are two components to these data. First, Rauch (1999) documented which goods are traded on an organized exchange, are exchanged through specific contracts, and which are offered at referenced prices. Products are classified at a highly disaggregated level. Second, Nunn (2007) uses US input-output tables to measure the intensity with which each input is used in the industry-specific production process. These data provide detailed information about the variation factor usages by their level of product differentiation.

The original industry-level data on factor usages correspond to the 4-digit SITC revision 2 classification system, which we convert to 3-digit SIC-based ISI codes using correspondences available

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<sup>12</sup>See IRS.gov, *United States Income Tax Treaties A-Z*.

from the *US Bureau of Economic Analysis*. When the 3-digit level spans observations for several 4-digit industries, we use the average fraction of inputs traded on an organized exchange or with an available reference price. Data on industry-level characteristics are limited to observations from the US for a single year, and so we must treat them as constant across all countries and years. After aggregating we have coverage for 73 separate industries concentrated in non-service sectors.<sup>13</sup>

Country-level data are compiled from several sources. Information regarding real GDP and trade barriers come from the Penn-World tables. National incomes are expressed in trillions of US dollars. Trade costs are measured using standard definitions of openness: 100 minus the trade share of total GDP. Skill differences across country-pairs are measured using estimates of average educational attainment by Barro and Lee (2010). Observations of educational attainment in each country are available every five years; we interpolate data for years between observations on a linear scale. Our country-level data contain observations for 137 countries.

We also control for other factors that may influence foreign affiliate sales. Data indicating whether the US has a bilateral investment treaty with the destination country are from the United Nations Conference on Trade and Development (UNCTAD). The incidence of free trade agreements across countries are available from the US Trade Representative. Annual exchange rate data are from the World Bank. Table 1 provides summary statistics for each variable used to estimate the impact of BTTs.

(Insert Table 1 here)

## 5 Results

In this section, we first consider the aggregate impact of BTTs to demonstrate that, as found by previous studies, tax treaties appear ineffective if we do not correctly specify the roles of double taxation relief and information sharing between nations. We then provide results from estimating the separate and opposing effects of BTTs. New treaties lead to significant changes in firm-level FDI activity which differ across industries, and on average increase foreign affiliate activity.

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<sup>13</sup>The use of aggregated sector data is driven completely by data constraints. But it is worth noting that this aggregation limits the variation in the measures of inputs traded on organized exchanges, working against obtaining significant estimates of the impacts of treaties across industries.

## 5.1 The Aggregate Effects of BTTs

Previous studies of BTTs concentrated on aggregate investment flows and found little evidence that they were effective. In Table 2 we aggregate our data to see if the net effect of BTTs also appears insignificant in our sample. Each regression in Table 2 includes country fixed effects so that the effect of BTTs is identified within countries that switch treaty status over time. With our identifying variation being within countries over time, we report clustered standard errors by country-year. Column (1) is consistent with previous studies which find that new treaties have no discernible effect on FDI activity between member nations. In fact, once we have accounted for time trends, country characteristics and relative trading opportunities through FTAs or exchange rate movements in columns (2) and (3), the country-level evidences suggests that BTTs may have a negative impact on FDI activity.<sup>14</sup>

A key advantage of our data is that we observe foreign affiliate activity for each parent firm. This means, first of all, that the endogeneity of BTTs with FDI activity is much less of an issue than with country-level analysis - the signing of a BTT is plausibly an exogenous shock to any single firm within a country. In addition, firm-level information provides a greater number of observations per year within each country-pair that signs a new treaty and allows us to account for heterogeneity in responses of firms headquartered in the same country.

Columns (4)-(6) of Table 2 report the coefficient estimates using firm-level FDI activity, where the endogeneity of treaty formation is much less of a concern. Each specification includes both country and parent firm fixed effects. At the more disaggregated firm-level, we still find that the net effect of BTTs on FDI activity between countries is insignificant. The apparent lack of impact cannot be attributed to a bias from endogenous treaty formation as the shock of a new treaty does not increase affiliate activity for individual firms, nor is the apparent ineffectiveness of BTTs simply a result of weak statistical power available at the country-level. In summary, our data indicate the same ineffectiveness of BTTs as found in previous studies. The next step is to disentangle the opposing effect of different provisions within BTTs.

(Insert Table 2 here.)

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<sup>14</sup>The apparent negative effects of BTTs are similar to the results of Blonigen and Davies (2004), who found weak evidence of reductions in FDI activity looking at the country-level over a shorter time span than in our sample.

## 5.2 Separating Two Opposing Effects of BTTs on FDI Activity

The necessity of homogeneous or differentiated inputs is an exogenous characteristic of the production process for firms in each industry. As a result we can use cross-sectional variation in requirements for homogeneous inputs to identify the differential impacts of tax treaties where the potential for strategic transfer pricing varies. Table 3 presents the coefficients obtained when estimating (1) allowing for differential impacts across firms from different industries. Each specification in Table 3 includes country and parent firm fixed effects, with all standard errors clustered by country-year.

(Insert Table 3 here)

Our results provide strong evidence that there are two opposing effects of BTTs on foreign affiliate sales. There is now an estimated positive coefficient on the BTT variable that is statistically significant at the 1% level. The positive effect of BTTs is consistent with provisions for double taxation relief increasing firm incentives to invest in new treaty partners. In addition to the other benefits to investment within BTTs, evidence that they lower withholding tax rates is available from Chisik and Davies (2004).

The evidence in Table 3 also suggests that the positive effect of BTTs is mitigated for firms operating in industries where a high fraction of required inputs are homogeneous intermediate goods, as indicated by the statistically significant negative coefficient on the interaction between BTT and the fraction of required inputs from organized exchanges or with public reference prices. This latter effect is consistent with our hypothesis that the ability of firms to mitigate tax liabilities via strategic transfer price is reduced more by BTTs for firms from industries that use homogeneous inputs intensively. It is worth noting that the estimated independent effect of *Hom.Input* also has a highly significant relationship with foreign affiliate sales in each specification. The positive coefficient on the *Hom.Input* variable is consistent with the notion by Keller and Yeaple (2009) that offshore production is facilitated by the use of homogeneous inputs.

While several countries entered a new BTT with the US during our sample, no treaty was canceled or suspended. Since we only observe the addition of new treaty partners over time we must also check that our results are not driven by a general time trend. In columns (4)-(6) of Table 3 we estimate the impact of a BTT on the deviation from trends in FDI activity. Foreign affiliate sales do appear to rise independently over time. Also, the growth in foreign affiliate sales is slower

in industries that use homogeneous inputs, consistent with countries increasing enforcement of tax rules over time. Looking beyond the trends in foreign affiliate sales we still find significant gross reductions in foreign affiliate sales where treaties make transfer pricing strategies less viable.<sup>15</sup>

The marginal effects of our coefficient estimates suggest that these effects are economically significant as well. First, we can use the estimated coefficient on the interaction term from our preferred specification in column (6) to estimate the average negative effect on foreign affiliate activity from the deterrence of strategic transfer pricing due to the information-sharing provisions of BTTs. For the average industry, about 45% of required inputs are homogeneous intermediates with easily verified arms-length prices. Using this value together with the estimated coefficient on the interaction term of -58.59 from our estimates in column (6), we calculate a gross reduction of approximately \$US 26 million in foreign affiliate sales for a firm in the average industry due to strategic transfer pricing deterrence of BTTs. Adding this up across all firms and industries and BTTs in our sample, this means a gross reduction in US outbound FDI activity to each treaty partner by \$US 2.29 billion per year.

These estimated reductions in affiliate activity as national tax agencies cooperate to reduce strategic transfer pricing practices are quite large, although previous evidence has also shown that strategic transfer pricing behavior by multinational firms is quite pervasive. Clausing (2003) examines comprehensive transaction-level data for US multinationals and finds that goods shipped from affiliates in low tax countries typically occur at higher prices. Similarly Feenstra and Hanson (2004) find that highly disaggregated goods shipped from Hong Kong intermediaries exhibit greater markups when sent to high tax countries. These strategies shift taxable earnings from parent firms in high tax locations toward affiliates in low tax countries.

We can also use our estimates to examine the net effect of BTTs on foreign affiliate sales within new treaty partners - summing both the positive effect estimated by the coefficient on the BTT variable and the negative effect estimated by the negative coefficient on the interaction term. For a firm in an industry using the sample average share of homogeneous inputs (45%), the net effect of a treaty is positive and approximately \$16 million. Aggregating across all firms and industries, the net increase in affiliate sales is approximately \$1.48 billion after a new BTT is signed. An F-test

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<sup>15</sup>There may be other non-linear time effects that influence FDI activity that are not captured by a simple trend. Estimating the model with year fixed effects yields quantitatively similar estimated effects, with no loss in statistical significance.

also finds this net effect to be statistically significant at the 1% level. Clearly, firms using less than the average share of inputs with observable arms-length prices experience a positive and significant net effect of a BTT on foreign affiliate sales as well. But there are also firms in our sample for which the estimated net effect of the BTTs is negative. The estimated effect of a BTT effect is zero when the share of homogeneous inputs required during production is 73%, and we have firms from sectors in our sample where this share is up to 85%.

In summary, the estimated coefficient for the interaction term between a treaty and the requirement of homogeneous inputs in Table 3 is consistent with a negative gross effect due to information sharing. On the other hand, the positive coefficient on the *Treaty* variable demonstrates that reductions in the incidence of double taxation promote FDI activity. Controlling for the opposing effects of tax relief and information sharing, we find a net positive tax treaty effect on the foreign affiliate sales of a firm using the average percentage of inputs with observable arms-length prices.

At first it may be surprising that we obtain a positive and significant net effect of BTTs on foreign affiliate sales only after controlling for industry-specific requirements for homogeneous inputs. In many previous studies, as well as in our sample, the net effects of new treaties were consistently estimated to be zero using an empirical specification that only controlled for country-level characteristics. However it is important to recognize that the use of homogeneous inputs informs about both the ability to use foreign affiliates for tax avoidance, and the ease of offshoring production within each industry. As a result, omitting information about the use of differentiated inputs biases estimates of the net impact of BTTs toward zero.<sup>16</sup> We are able to detect a net increase in activity here because in each specification we allow industry-specific features to interact with treaty status at the national level.

### 5.3 BTTs and New Entry

The previous section showed that double taxation relief and reduced transfer pricing opportunities both lead to a significant impact of BTTs on foreign affiliate activity for firms with existing foreign affiliate sales - i.e., BTTs have effects at the intensive margin. In this section we turn to the

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<sup>16</sup>Note that the coefficient on *Hom.Input* is highly significant in each specification, and the coefficient on the treaty variable is sensitive to its inclusion in the estimation, suggesting an omitted variable bias. Comparing the results for firm-level regressions across tables (2) and (3), the estimated coefficient on the treaty variable is larger by more than an order of magnitude when controlling for the use of homogeneous inputs.

extensive margin. The effects of BTTs on firm entry rates can have far reaching consequences as domestic firms respond to changes in the number of foreign competitors.<sup>17</sup> Also, even if the net change in entry rates are small at the country-level, the large differences in the impacts of BTTs across sectors can have significant consequences across domestic industries.

We estimate the effect of tax treaties on the number of new foreign affiliate entrants into a partner country per year. For each specification in Table 4 we continue to include country firm fixed effects, but cannot include parent-firm fixed effects since we are examining entry. We continue to report standard errors clustered by country-year.

As with the intensive margin, we find that the net effect of BTTs on entry rates appears insignificant when we specify the model using only country-level characteristics (e.g., see columns (2) and (3) of table 4). However, when we again control for the opposing incentives within treaties, we find significant changes in entry rates once a treaty is in force. Results in columns (4)-(6) demonstrate that a BTT leads to a gross increase of about 0.80 to 0.93 new affiliates that enter each year into sectors that use no homogeneous inputs, depending on specification. However, the coefficient on the interaction term between *BTT* and the *Hom\_Input* variables is negative and significant, indicating that this positive effect on sectoral entry from a BTT declines the more a sector relies on inputs with observable arms-length prices. The rationale for these effects is the same as that for our estimates of the BTT effects on the intensive margin. BTTs are less likely to encourage new firms to invest in a partner country in sectors that require homogeneous inputs, since strategic transfer pricing is difficult when tax authorities have information-sharing arrangements.

For firms in an average sector (with 45% of intermediates being homogeneous goods) the increase in the net entry rate is about 0.15 new firms per sector per year once a BTT is in force, which is statistically significant at the 1% level. With 73 sectors, the total effect on a country level is then about 11 new entrants a year, which is quite sizable. At the beginning of our sample in 1988 the average number of new entrants per country was 4.8 and by the end of our sample in 2006, entry rates had increased steadily to 6.1 new firms per nation.<sup>18</sup> Thus our estimate of approximately 11

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<sup>17</sup> Aghion et al. (2004) estimate the effects of new multinational entrants on domestic incumbent firms. They find significant increases in firm-level efficiency that contributed substantially to aggregate productivity growth. In the US, Keller and Yeaple (2009) find additional evidence of spillovers from the entry of new multinationals.

<sup>18</sup>The threshold cutoff for firms included in BEA surveys varies across year due to, among other things, budget concerns. With the exception of BEA benchmark years, the average rate of entry is near five to six firms. Since we can control for the annual differences in the composition of firms reporting to the BEA in our regression analysis, it is easiest to simply compare our findings to entry rates at various points of time in our sample.



new affiliates per year where a BTT is in force is about twice the average rate of entry for any given year in our sample.<sup>19</sup>

## 6 Conclusion

Previous studies of BTT have found little evidence that they have a significant effect on FDI activity between member nations. There are several reasons why this is surprising. To begin, nearly half of all US trade is within firms. The amount of economic activity that is subject to the provisions of tax treaties is quite large, which should lead to large consequences when new BTTs are signed. Model treaties from the OECD and UN state their primary goal as the elimination of double-taxation on foreign capital income. It is curious then that the actual tax rates and tax competition between states has been shown to impact capital flows, but tax treaties do not.

In this analysis we found that small net changes in foreign investment between countries mask large reallocations of economic activity after a tax treaty is signed. Separating the opposing impacts of double-taxation relief and information sharing demonstrates that bilateral tax treaties generate sector-specific shocks in the incentives to offshore production. The gross effects of these different provisions are large: at the intensive margin a BTT increases US outbound FDI activity to treaty members by \$US 3.77 billion per year via double-taxation relief, and simultaneously decreases foreign affiliate activity by \$US 2.29 billion through the increased cooperation between national tax agencies.

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<sup>19</sup>Although they do not account for the different effects of BTTs, Davies et al. (2009) also find evidence of increased entry rates in their analysis as well.

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Table 1: Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Affiliate Sales	253747	94.39	532.00	(confidential)	
BTT	253747	0.793	0.405	0	1
Homogeneous Inputs	253747	0.451	0.228	0.053	0.831
Sum GDP (log)	253747	9.336	0.213	8.866	10.09
GDP Diff <sup>2</sup>	253747	18.19	0.536	14.84	18.93
Skill Diff	253747	1.132	0.752	-2.767	2.494
Trade Costs	253747	2.777	2.291	-3.203	4.489
BIT	253747	0.056	0.229	0	1
Exchange Rate	253747	182.2	1020.9	0	16105.1
FTA	253747	0.130	0.336	0	1
No. New Affiliates (1988)	109	4.817	10.12	(confidential)	
No. New Affiliates (2006)	149	6.10	14.56	(confidential)	

Table 2: Effects of Bilateral Tax Treaties at Aggregate Levels

	Affiliate Sales by Country (\$US Billions)			Affiliate Sales by Firm (\$US Millions)		
	(1)	(2)	(3)	(4)	(5)	(6)
BTT	-1.307 (1.398)	-3.030* (1.446)	-3.234** (1.104)	2.297 (3.889)	3.150 (3.956)	-1.742 (3.073)
Trend	0.816** (0.066)	0.357 (0.542)	0.246 (0.544)	2.934** (0.270)	7.279** (1.593)	7.199** (1.578)
Sum GDP (log)		46.852** (13.448)	50.950** (13.341)		-57.934 (40.705)	-63.226 (39.892)
GDP Diff <sup>2</sup> (log)		-17.780** (2.076)	-17.066** (2.063)		-41.849** (13.141)	-42.499** (13.019)
Skill Diff (log)		-13.741** (2.849)	-13.127** (2.858)		4.737 (3.633)	4.769 (4.434)
Trade Costs		-0.204 (0.240)	-0.246 (0.242)		-1.549 (1.445)	-1.953 (1.520)
BIT			-9.434** (1.095)			-3.904 (3.496)
FTA			29.652** (6.930)			27.347** (3.889)
Exchange Rate			-0.002** (0.000)			-0.004** (0.001)
Constant	261.391** (18.863)	165.084 (137.949)	95.663 (135.715)	119.547** (5.087)	1369.344** (418.416)	1417.564** (411.581)
Country FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	YES	YES	YES
R-sq	0.887	0.891	0.897	0.01	0.01	0.01
No. Obs	3397	2553	2499	424421	412052	407096

Note: Standard errors clustered by country-year in parentheses:  $p < 0.05 = *$ ,  $p < 0.01 = **$

Table 3: Separating the Opposing Effects of Bilateral Tax Treaties

	Foreign Affiliate Sales					
	(1)	(2)	(3)	(4)	(5)	(6)
BTT	54.735** (13.093)	54.553** (13.293)	43.525** (11.603)	54.371** (12.789)	53.902** (12.962)	42.748** (11.329)
BTT x Hom. Input	-67.338** (13.740)	-64.946** (13.960)	-60.969** (14.479)	-65.295** (13.401)	-62.633** (13.577)	-58.588** (14.066)
Hom. Input	194.932** (12.414)	193.848** (12.560)	191.692** (12.985)	241.124** (21.171)	240.926** (21.629)	237.554** (22.062)
Trend	4.652** (0.363)	3.541 (1.958)	3.334 (1.895)	6.518** (0.969)	5.253* (2.151)	5.015* (2.109)
Sum GDP (log)		89.328 (49.589)	83.452 (47.461)		95.433 (49.355)	88.743 (47.192)
GDP Diff <sup>2</sup> (log)		-32.453* (13.757)	-33.825* (13.712)		-31.881* (13.829)	-33.316* (13.774)
Skill Diff (log)		-4.352 (4.574)	-4.783 (4.269)		-3.451 (4.560)	-3.982 (4.271)
Trade Costs		-2.163 (1.842)	-3.306 (1.956)		-2.141 (1.824)	-3.326 (1.936)
BIT			-1.438 (4.945)			0.830 (4.736)
FTA			43.022** (5.143)			42.949** (5.127)
Exchange Rate			-0.006** (0.001)			-0.006** (0.001)
Year x Hom. Input				-3.887* (1.543)	-3.983* (1.568)	-3.889* (1.586)
Constant	25.594* (12.619)	-190.343 (521.971)	-124.187 (503.013)	1.973 (16.109)	-279.531 (522.026)	-203.874 (502.630)
Country FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
R-sq	0.018	0.018	0.018	0.018	0.018	0.018
No. Obs.	260466	257231	253747	260466	257231	253747

Note: Standard errors clustered by country-year in parentheses: p<0.05=\*, p<0.01=\*\*

Table 4: The Effects of Bilateral Tax Treaties on Entry Rates

	No. New Affiliates					
	(1)	(2)	(3)	(4)	(5)	(6)
BTT	0.179 (0.176)	0.084 (0.171)	0.060 (0.163)	0.927** (0.224)	0.804** (0.214)	0.796** (0.206)
BTT x Hom. Input				-1.496** (0.253)	-1.442** (0.256)	-1.475** (0.256)
Hom. Input				-0.262** (0.097)	-0.335** (0.103)	-0.305** (0.104)
Trend	0.015* (0.007)	-0.566** (0.088)	-0.574** (0.091)	0.014* (0.007)	-0.568** (0.089)	-0.576** (0.091)
Sum GDP (log)		14.746** (2.338)	14.942** (2.392)		14.778** (2.341)	14.979** (2.395)
GDP Diff <sup>2</sup> (log)		1.846** (0.358)	1.867** (0.362)		1.847** (0.358)	1.869** (0.362)
Skill Diff (log)		-0.158 (0.206)	-0.142 (0.208)		-0.160 (0.206)	-0.144 (0.208)
Trade Costs		0.029 (0.027)	0.027 (0.029)		0.029 (0.027)	0.027 (0.029)
BIT			-0.132 (0.108)			-0.147 (0.109)
FTA			0.272 (0.366)			0.282 (0.366)
Exchange Rate			0.000 (0.000)			0.000 (0.000)
Constant	1.565* (0.634)	-162.012** (24.985)	-164.297** (25.578)	1.708** (0.638)	-162.147** (25.011)	-164.499** (25.605)
Country FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO
R-sq	0.044	0.062	0.062	0.054	0.072	0.073
No. Obs	45622	44431	43487	45622	44431	43487

Note: Standard errors clustered by country-year in parentheses:  $p < 0.05 = *$ ,  $p < 0.01 = **$