

The Differential Effects of Bilateral Tax Treaties[†]

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Bilateral tax treaties (BTTs) are intended to promote foreign direct investment through double-taxation relief. Using BEA firm-level data, we find a positive effect of BTTs on FDI, which is larger for firms that use differentiated inputs. BTTs allow multinational firms to request assistance from treaty partners' governments if they have a grievance about how tax liabilities are determined. These provisions disproportionately benefit firms that use inputs for which an arm's-length price is difficult to observe, since allocation of earnings across countries is more complex. We find differential BTT effects for both sales by existing affiliates and entry of new affiliates. (JEL F23, H25, H87)

Foreign direct investment (FDI) and related foreign affiliate activities by multinational firms play a primary role in the 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 percent of all US 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 and foreign affiliate activity subject to the provisions of these treaties, previous studies have not found significant evidence that they affect such activity between member nations.

Previous empirical work examining the relationship between BTTs and multinational activity has primarily analyzed data on aggregate bilateral FDI flows or stocks across countries, and has found little evidence for any significant

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relationship.¹ di Giovanni (2005) examines bilateral cross-border merger and acquisition activity, the principle mode by which FDI occurs, and also finds no robust impact of BTTs. Davies, Norbäck, and Tekin-Koru (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 foreign affiliate activity (intensive margin).

There are a number of reasons why prior studies may generally find little evidence for a significant effect of BTTs. First, provisions of BTTs may be truly inconsequential for cross-border investment and production decisions. This would be somewhat surprising since there is substantial evidence that tax rates have a significant impact on international capital mobility.² Second, there may be substantial heterogeneity in the effects of BTTs across sectors of the economy, which offset one another in the aggregate. Also, failing to account for the differential effects of BTTs across different sectors of an economy may lead standard empirical models used to estimate the effects of BTTs to be incorrectly specified, with a bias toward finding no effect.

In this paper, we look more closely at the provisions for information sharing and coordinated tax treatment that are commonly included within treaties, and examine how they may differentially affect foreign affiliate behavior across different types of industries and firms. In particular, BTTs put into place cooperative procedures for tax authorities to examine circumstances in which firms are being double taxed because of differing treatments of tax base definitions or procedures across countries, especially with respect to transfer pricing. These provisions are generally known as Mutual Agreement Procedures (MAP) or, alternatively, Competent Authority Requests. Almost invariably, a MAP ruling is requested because the firm believes that differing transfer pricing rules and definitions across the two countries is leading to reported income that is inconsistent with their actual economic activities, subjecting the firm to a form of double taxation.³

The potential for distinct rules to be applied across different countries leads to the key hypothesis in our analysis. The access to MAP once a BTT is in place is more advantageous to firms trading relatively differentiated inputs with their foreign affiliates than for firms trading homogenous inputs. In the United States and most countries, the key principle used to determine the appropriate transfer price between related parties is the price of the product if it were transacted between unrelated (or arm's-length) parties. This is straightforward for homogeneous goods that are traded on organized exchanges or have reference prices. As a result, the transfer

¹Examples of such studies include Blonigen and Davies (2004) and Louie and Rousslang (2008). To circumvent empirical difficulties associated with using aggregate data to estimate the effects of potentially endogenous treaty formation, Egger et al. (2006) use numerical simulations and find results that new treaties may reduce aggregate outbound FDI stocks. For a thorough review of both the theoretical and empirical literatures on international tax treaties, see Davies (2004).

²See 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.

³As we document in more detail below, there are well over 500 ongoing MAP investigations in the United States in any given year to examine possible double taxation of a US-based firm due to differing tax treatment between the United States and a BTT partner, as well as a large and growing staff in the US tax authority (the Internal Revenue Service) to process these requests. Ackerman and Hobster (2001) cite reports that multinationals view differences in the applications of tax rules as the primary cause of the incidence of double taxation.

pricing rules applied across different countries are likely to be similar, limiting the exposure of the firm to double taxation. However, it can be very difficult to establish the appropriate transfer price for differentiated products, opening up a wide range of possible rules to be applied by different countries. Thus, firms trading differentiated inputs with their foreign affiliates are more likely to experience double taxation due to differing tax practices between countries and, therefore, should realize more benefit from the establishment of MAP once a BTT is in place.

We use firm-level data from the US Bureau of Economic Analysis (BEA) to examine our hypothesis that greater use of differentiated inputs will increase the potential benefits of BTTs, and increase foreign affiliate activity primarily for corresponding industries and firms. Identification of our hypothesis requires data at the industry level at the very least in order to distinguish the intensity with which industries use differentiated or homogeneous inputs. Firm-level data brings even further advantages. First, the likelihood that firms will request assistance from the competent authority may differ according to, say, their scale of production. If the typical scale of production (and hence the propensity of multinational firms to file for a MAP ruling) differs across firms, failing to account for firm-level characteristics may lead us to misattribute the industry-specific effects of BTTs. Second, the BEA firm-level data have information on the trade of inputs between US parents and their foreign affiliates. This allows us to further verify the mechanism described above, as we would not expect the BTT to affect activity when there are no flows of inputs between the US parent and its affiliate in the BTT-partner country. The BEA data coverage extends across 174 country-pairs (all including the United States) and 73 industries (three-digit BEA International Surveys Industries (ISI), which are based on three-digit SIC codes in nonservice sectors).

To identify the effects of BTTs on foreign affiliate activities using these data we implement a triple-difference empirical strategy that exploits differences in (i) US treaty status with other foreign countries, (ii) over time, and (iii) across sectors that use homogenous versus differentiated inputs with varying intensity. With over two decades of observations, we are able to compare affiliate activity well before and well after the signing of a treaty, and to verify that our results are not due to preexisting trends in affiliate activities across sectors and countries.

We find strong evidence for our hypothesis that US multinational firms using differentiated inputs see increased foreign affiliate activity (measured by affiliate sales) once the United States has a BTT in place with the country hosting the affiliate. In contrast, US multinationals transacting more homogeneous inputs on average are less likely to see any significant effects. For a firm requiring a 10 percent larger share of differentiated inputs, a BTT increases foreign affiliate sales by approximately \$10 million more per year. Aggregating across all affiliates, these effects of BTTs, and their differential benefits across sectors, are economically substantial. BTTs impact foreign affiliate activities not only at the intensive margin (greater sales for existing affiliates), but also at the extensive margin (i.e., FDI). A US BTT with a foreign country is associated with subsequent new US foreign affiliates into that foreign country in industries where firms typically use differentiated inputs. The estimated effect of BTTs correspond to approximately doubling the entry rate for the average sector.

By accommodating differences in foreign affiliate activities across sectors, our analysis also rectifies a specification error common throughout the prior literature studying BTTs. Recent work by Keller and Yeaple (2013) demonstrates that the incentives for firms to engage in FDI depends on the types of inputs (differentiated versus homogeneous) they would send to their affiliates. Thus, omitting information about the use of homogeneous and differentiated inputs among the sample fails to account for the propensity of FDI activity to occur in the first place. And since the benefits of BTTs are concentrated in sectors that use differentiated inputs intensively, where FDI activity is less likely to occur, omitting information about the composition of input use biases the estimated effects of BTTs toward zero. As we show, allowing for differential effects across sectors is essential to identify the positive economic impact of BTTs.

The next section provides more information about BTTs and the MAP that becomes available once the BTT is in place. Sections II and III provide details on our estimation strategy, variable construction, and data sources. Section IV presents the key results and we conclude in Section V.

I. Background Information on BTTs and MAP

BTTs signed by the United States (and most countries) 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.⁴

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. If a multinational firm has a grievance about the allocation of its taxable earnings to either jurisdiction, a tax treaty explicitly provides a mechanism for the firm to challenge its due tax liability. Specifically, Article 25 of the OECD model treaty stipulates that “The competent authorities of the Contracting States shall endeavour to resolve by mutual agreement any difficulties or doubts arising as to the interpretation or application of the Convention. They may also consult together for the elimination of double taxation in cases not provided for in the Convention.” This statement regarding the MAP highlights the fact that tax agencies recognize that many of the complex operations of multinational firms may not conform to the stated rules and provisions of BTTs in a straightforward manner. Thus,

⁴There is some literature to suggest that BTTs may have positive effects in other ways than the issues we focus on here. Davies (2003) shows that by simply prohibiting the use of deductions for foreign taxes paid, the OECD model treaty will lead to larger incentives to invest abroad. Thus, even without explicit coordination in tax rates between nations, tax competition under a BTT leads to reduced tax liabilities for multinational firms. In addition, Chisik and Davies (2004) provide direct evidence that BTTs reduce withholding rates by the foreign jurisdiction on repatriated income, which should increase incentives for FDI and foreign affiliate activity. In contrast to our analysis, these arguments do not suggest any differing impact of BTTs across sectors.

MAP grants firms with unique tax circumstances the opportunity to interact with both national tax agencies directly. Moreover, it is important to note that the MAP is available only with regard to activities that take place within a treaty partner.⁵

A primary issue in determining the proper allocation of earned income across jurisdictions (and therefore a likely motivation for MAP) is transfer pricing—the price charged between related parties for goods, services, and/or use of assets. A chosen transfer price will significantly affect the allocation of profits across the two related parties (which we will term affiliates in this context). Multinational firms have incentives to use such prices to allocate profits to affiliates in low-tax jurisdictions. At the same time, however, governments and their tax authorities will have incentives to impose transfer pricing rules that allocate more profit to their jurisdictions. Thus, a firm may be held to different transfer pricing rules across tax jurisdictions, which artificially inflates the profitability of both affiliates above actual economic activity, and subjects the firm to a form of double taxation. Ackerman and Hobster (2001) note that over 80 percent of multinational firms responding to Ernst and Young surveys in the late 1990s reported that such transfer pricing issues across tax jurisdictions were leading to their double taxation.⁶

BTTs provide explicit guidelines about how transfer prices should be calculated for related parties operating between treaty partners. A common principle for determining appropriate transfer prices, which is also endorsed by the OECD, is the arm's-length principle; namely that prices between related parties should be equivalent to the price that would be charged between unrelated parties.⁷ Many national governments also state this as a primary transfer pricing rule to be used by multinational firms operating in their jurisdictions. While clear in its logic, the practical application of the arm's-length transfer pricing rule depends directly on the type of product being transacted. In the case where related parties are exchanging homogeneous products that are traded on organized exchanges, or for which there are available reference prices, determination of an arm's-length price is trivial. In this case, there is little reason to think that the BTT would have a substantial impact on the determination of tax liabilities in both locations.

However, the determination of the appropriate transfer price under the arm's-length principle becomes more difficult and ambiguous as one moves away from homogeneous products, and must assign appropriate values to more differentiated products. As a result, there is a range of possible ways to estimate arm's-length prices for differentiated products. For sectors of the economy where differentiated products are used intensively as inputs, the creation of MAP with the competent authority through the signing of a BTT may be crucial for multinational firms. A MAP ruling will determine a common approach to transfer pricing for a given

⁵The availability of the MAP only with countries for which a tax treaty is in place is clearly stated in US IRS documents; e.g., see <http://www.irs.gov/Individuals/International-Taxpayers/Competent-Authority-Assistance>. Moreover, Article 23 of the OECD model treaty details the Limitation of Benefits provision, which explicitly prohibits a multinational firm from claiming treaty benefits by routing foreign affiliate activity that took place in a nontreaty country through an affiliate in a treaty partner (i.e., Treaty Shopping).

⁶Rooney and Suit (1996, 676) provides more details about the ways in which the interests of the taxpayer and those of the sovereign may, and usually will, diverge, most particularly with respect to application of transfer pricing rules.

⁷See OECD Transfer (2010 edition) pricing guidelines for multinational enterprise and tax administrations.

taxpayer's situation between two tax authorities that have a BTT in place, potentially alleviating significant double taxation for the taxpayer.⁸ Moreover, MAP provisions within BTTs will also give the firm more certainty about future tax liabilities. It is also common that the competent authority works on-site with a multinational firm to establish appropriate transfer pricing rules, effectively reducing compliance costs in addition to reducing actual tax liabilities.

Of course, the potential for our empirical strategy to find significant effects also depends on the extent to which firms use MAP once a BTT enters into force. The evidence suggests that it is an important tool for multinationals around the world. The United States held an inventory of roughly 700 pending requests as of 2011.⁹ In addition, an Ernst and Young report notes that the US Internal Revenue Service has approximately 700 international examiners and 120 economists working with these international examiners on areas of international taxation, particularly transfer pricing.¹⁰ There is similar evidence of significant MAP activity looking across the OECD, with Canada, France, and Germany having several hundreds MAP requests under consideration in 2010, and other countries such as the United Kingdom, Sweden, the Netherlands, and Spain had approximately 100 MAP requests under consideration. Reports published by the competent authorities across countries indicate that an overwhelming majority of MAP cases lead to at least some relief in the incidence of double taxation; in the United States for example, between 2007 and 2011 on average over 90 percent of requested adjustments resulted in some amount of relief, with similar levels of success in other countries. The extent to which firms seek adjustments through MAP, as well as the extent to which such requests are observed to lead to adjustments in tax liabilities, suggest that MAP provisions can have a substantial impact on foreign affiliate activities.

II. Estimation Strategy

Our goal is to identify the impact of BTTs on foreign affiliate activity, allowing for differential effects across sectors. Towards this aim, we implement a triple-difference strategy that considers difference in foreign affiliate activity (i) across US treaty status with foreign countries, (ii) over time, and (iii) across sectors that use homogeneous versus differentiated inputs with varying intensity. We also 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 foreign affiliate 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,

⁸See 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 United States, Canada, and Japan, which also serves as model documentation for multinationals operating in other countries.

⁹Since 2006, the OECD has collected and reported statistics on MAP activity by its member countries, which can be found at: <http://www.oecd.org/unitedstates/countrymutualagreementprocedurestatistics2006-2010.htm>.

¹⁰This report can be found at: [http://www.ey.com/Publication/vwLUAssets/2012-Global-TP-Tax-Authority-Survey/\\$FILE/2012-Global-TP-Tax-Authority-Survey.pdf](http://www.ey.com/Publication/vwLUAssets/2012-Global-TP-Tax-Authority-Survey/$FILE/2012-Global-TP-Tax-Authority-Survey.pdf).

and the potential endogeneity of treaty formation at the country-level, we introduce several additional industry- and firm-level characteristics.¹¹

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

$$(1) \quad ForAffAct_{pdt} = f(Treaty_{dt}, \ln Diff_Input_i, [\ln Diff_Input \times Treaty]_{dit}, \mathbf{X}_{dt}, \psi_p, \lambda_d).$$

The variable $Treaty_{dt}$ is an indicator that equals one if the destination country has a treaty in force with the United States at time t . Our second key regressor, $\ln Diff_Input_i$, indicates how intensively firms in an industry use differentiated inputs to generate a single dollar amount of output. We measure differentiated inputs as the fraction of required intermediates that are not available on an organized exchange, nor 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 $\ln Diff_Input$ indicate that a relatively larger cost share of production is due to the use the differentiated intermediate inputs that do not have easily verifiable prices. Values of $\ln Diff_Input$ are weighted by total factor usages. We note that we log this variable due to significant skewness in the $Diff_Input$ variable, but get qualitatively identical results regardless of whether we log the variable or not. Keller and Yeaple (2013) find evidence 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. Thus the predicted sign on $\ln Diff_Input$ is negative reflecting the difficulty of using foreign affiliates to manufacture differentiated inputs.

The interaction between the $Treaty$ variable and $\ln Diff_Input$ captures the differential effect of a BTT across industries, where there is varying potential to exploit the benefits of competent authority assistance created by BTTs. Firms which use intensively differentiated inputs supplied by their foreign affiliates are more likely to benefit from the opportunity to obtain assistance from the competent authority. Hence, a new treaty is predicted to increase foreign affiliate activity relatively less in sectors which use inputs available on organized exchanges or with reference prices available; we expect to find a positive coefficient on the interaction term between the $Treaty$ variable and $\ln Diff_Input$.

By now it is well known that firms adopt different strategies for international participation based on differences in their productivity and size.¹² Transfer pricing

¹¹ Evidence in support of the knowledge-capital model is provided by Carr, Markusen, and Maskus (2001) and Markusen and Maskus (2001, 2002). One purpose of this analysis is to highlight the opposing effects of different provisions in BTTs that confound 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.

¹² 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

behavior also varies across firms of different size; see, Bernard, Jensen, and Schott (2006). Furthermore, Desai, Foley, and Hines Jr. (2006) show that larger firms are more likely to source intermediates from tax haven countries. Keuschnigg and Devereux (2013) argue that firm-level credit constraints can influence transfer pricing behavior. It is also plausible that firms may differ in their propensity to file MAP requests once a BTTs is in force. To accommodate each of these sources of firm-level variation, we include the term ψ_p , which is a parent firm fixed effect. We estimate the impact of BTTs separately for the sample of incumbent firms and new entrants to elucidate the impact at both the intensive and extensive margins.

We primarily rely on the empirical knowledge-capital model introduced by Carr, Markusen, and Maskus (2001) to specify the control variables in the vector \mathbf{X}_{dt} . These include *SumGDP* and *RGDPdiff*² which measure (in logs) the sum and squared differences in real GDP between the destination country and the United States. Larger markets motivate firms to engage in horizontal foreign affiliate activity, allowing them to bypass trade costs when serving foreign consumers. While greater incomes promote foreign affiliate 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 foreign affiliate activity.

Higher costs to import goods from the foreign country ($TCost_{dt}$) 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.¹³ To account for other unobserved country-level characteristics we include destination country fixed effects, λ_d . Since all observations are from the United States, the term λ_d is tantamount to country-pair fixed effects.

III. 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 foreign affiliate activity, since it is a measure of real economic

(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.

¹³The issue of endogenous treaty formation is examined by Hines Jr. and Willard (1992) and Egger et al. (2006).

activity by foreign affiliates. Firm-level data has two distinct advantages for our purpose. First, BEA firm-level data indicate if there is trade of inputs between US parents and their foreign affiliates. Transfer pricing issues arise only for related party transactions, and thus the benefits of MAP within BTTs are relevant only for multinational firms that engage in vertical trade. Restricting our attention to firms with related party transactions allows us to further verify the mechanism described above. Second, the likelihood of requesting assistance from the competent authority may differ across firms. Failing to account for such unobserved firm-level characteristics may lead us to misidentify the effects of BTTs. 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 three-digit Standard Industrial Classification (SIC) system. We focus on nonservice sectors, giving us a set of firms spanning 73 three-digit industries and operating in 174 countries from 1987 to 2007.

Information about international tax treaties signed by the United States come from Internal Revenue Service and Treasury Department publications.¹⁴ The text of each treaty provides the signature date, ratification date, the general effective date, and the date of revisions if applicable. Treaties are often signed in years previous to when they become effective and several country-pairs have also renegotiated their BTT over time. 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 us finding a significant impact on foreign affiliate if there is anticipated FDI into a treaty partner prior to the effective date of a new BTT.¹⁵ Table 1 provides a list of countries that have a new BTT with the United States during our sample, and the corresponding year it became effective. The set of new treaties signed by the United States covers many regions of the world, with nations that differ substantially in size and volumes of foreign affiliate activities.

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 four-digit SITC revision two classification system, which we convert to three-digit SIC-based ISI codes using correspondences available from the US Bureau of Economic Analysis. When the three-digit level spans observations for several four-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 United States for a single year, and so we must treat them as constant

¹⁴ See IRS.gov, United States Income Tax Treaties A-Z.

¹⁵ Davies (2003) considers revisions to tax treaties and, similar to previous studies, finds no impact on foreign investment activity.

TABLE 1—COUNTRIES WITH NEW TREATIES IN EFFECT

Country	Date	Country	Date
Bangladesh	2007	Russia	1993
Estonia	1999	Slovenia	2001
India	1990	Spain	1990
Indonesia	1990	Sri Lanka	2004
Israel	1994	Thailand	1997
Latvia	1994	Tunisia	1990
Lithuania	1994	Turkey	1997
Mexico	1993	Ukraine	2000
Portugal	1995	Venezuela	1999

across all countries and years. After aggregating we have coverage for 73 separate industries concentrated in nonservice sectors.¹⁶

Country-level data are compiled from several sources. Information regarding real GDP and trade barriers comes 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 United States 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 2 provides summary statistics for each variable used to estimate the impact of BTTs.

IV. Results

Our empirical strategy identifies the effects of BTTs by considering differences in foreign affiliate activities (i) across US treaty status with foreign countries, (ii) over time, and (iii) across sectors that use homogenous versus differentiated inputs with varying intensity. Before turning to the regression results it is worthwhile to examine patterns in the raw data. Figure 1 illustrates relative foreign affiliate activities in homogeneous versus differentiated sectors separately for countries that enter a new BTT with the United States (solid line), and for countries that do not (dashed line), across the time horizon four years prior to—and four years after—the date treaties enter into force, which we denote $t0$.¹⁷ We delineate homogeneous and

¹⁶The use of aggregated sector data is driven completely by data constraints. It is worth noting that this aggregation limits the variation in the measures of inputs traded on organized exchanges, in addition to generating substantial measurement error surrounding firm-level use of differentiated inputs supplied by affiliates. However, each of these features only work against obtaining significant estimates of the impacts of treaties across industries.

¹⁷Several countries entered new treaties in years early in our sample, limiting the number of observations available for any dates five years prior to new treaties (i.e., $t - 5$).

TABLE 2—SUMMARY STATISTICS

	Observations	Mean	SD	Min.	Max.
Affiliate sales	109,102	160.77	744.08	(confidential)	
BTT	109,102	0.784	0.411	0	1
Differentiated inputs	109,102	0.551	0.204	0.169	0.947
Sum GDP (log)	109,097	9.283	0.216	8.866	10.093
GDP diff ²	109,097	18.093	0.501	14.841	18.933
Skill diff	108,505	1.129	0.720	-2.767	2.485
Trade costs	109,097	2.893	2.221	-3.068	4.594
BIT	109,102	0.030	0.171	0	1
Exchange rate	107,469	120.422	672.977	0	16,105.1
FTA	109,102	0.142	0.349	0	1
Number of new affiliates (1988)	97	3.237	7.209	(confidential)	
Number of new affiliates (2006)	115	5.157	11.270	(confidential)	

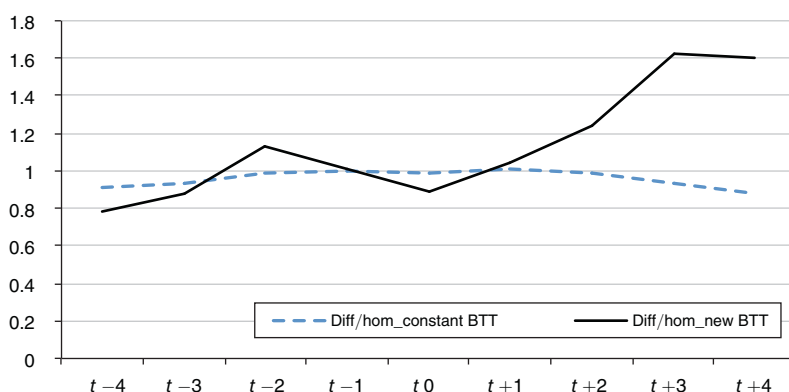


FIGURE 1. RELATIVE FOREIGN AFFILIATE ACTIVITIES ACROSS TREATY STATUS AND TIME

differentiated sectors according to the median observation in the sample; note that for confidentiality reasons with regard to the BEA data, we cannot illustrate relative foreign affiliate activities across industries at more disaggregate levels.

There are two important features of Figure 1. First, for countries that enter new treaties, relative foreign affiliate activities in differentiated sectors do not increase until after the treaties become effective; i.e., until after the period t_0 . This fact assuages concerns about the presence of preexisting trends in activity *across sectors* spuriously driving our regression results.¹⁸ Secondly, relative foreign affiliate activities in countries that do not enter a new BTT are stable across the entire sample period, similar to the flat trend in countries with new treaties prior to their entry into force. This fact mitigates concerns about differential trends *across countries* leading to spurious estimates of the impact of BTTs.

In the following sections, we turn to the regression results from the model specified in (1). We first consider the average impact of BTTs to demonstrate that, as found by previous studies, tax treaties appear ineffective if we do not correctly

¹⁸We also note that the fact that the entirety of the literature on the effects of BTT has found no positive effect, which also suggests that there are no pre-trends in foreign affiliate activities that lead to spuriously positive estimated effects of BTTs.

TABLE 3—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	-1.211 (3.291)	-0.717 (3.230)	-1.609 (2.079)	24.561 (37.270)	20.634 (37.122)	7.020 (30.119)
Sum GDP (log)		-193.454 (145.913)	-187.387 (138.985)		1,085.518** (477.198)	1,126.698** (474.024)
GDP diff ² (log)		-35.575** (16.518)	-35.017** (15.604)		97.757** (46.743)	100.707** (47.180)
Skill diff (log)		-10.806** (4.533)	-10.519** (4.655)		10.263 (13.436)	8.426 (13.011)
Trade costs		0.145 (0.501)	0.097 (0.494)		-2.017 (6.121)	-5.435 (6.356)
BIT			-7.130*** (2.152)			-24.584 (19.123)
FTA			20.949* (10.917)			46.680*** (21.221)
Exchange rate			-0.001*** (0.000)			-0.020*** (0.005)
Constant	159.887*** (3.141)	2,521.382 (1,593.91)	2,443.680 (1,516.68)	176.644*** (39.976)	-11,260.99** (5,084.63)	-11,679.4** (5,059.74)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	YES	YES	YES
R ²	0.882	0.888	0.897	0.01	0.01	0.01
Observations	2,185	1,944	1,914	123,262	121,016	119,293

Note: Standard errors clustered by country in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

account for the sector-level characteristics, and the differential effect of BTTs across industries. We then provide results when estimating the differential effects of BTTs. New treaties lead to increases in firm-level foreign affiliate activity, which differ in magnitude across industries.

A. Baseline Estimates—The Average Effects of BTTs

Previous studies of BTTs concentrated on aggregate investment flows and found little evidence that they were effective. In Table 3, we aggregate our data across sectors to see if the average effect of BTTs also appears insignificant in our sample when we do not account for sector-level characteristics. Each regression in Table 3 includes country fixed effects so that the effect of BTTs is identified within countries that switch treaty status over time.¹⁹ We report standard errors clustered at the country-level. Column 1 is consistent with previous studies which find that new treaties have no discernible effect on foreign affiliate activity between member nations.

A key advantage of our data is that we observe foreign affiliate activity for each parent firm. When estimating the firm-level impact of BTTs, the endogeneity of BTTs with respect to foreign affiliate activity is much less of an issue when using

¹⁹This simple difference-in-differences specification corresponds to the strategies typically employed in prior studies.

firm-level data; the signing of a BTT is plausibly an exogenous shock to any single firm within a country. Information at the firm-level also provides a greater number of observations per year within each country-pair that signs a new treaty, and allows us to account for heterogeneity among firms headquartered in the same country.

Columns 4–6 of Table 3 report the coefficient estimates when estimating the average effect of BTTs on foreign affiliate activity using firm-level foreign affiliate activity. Each specification includes both country and parent-firm fixed effects. At the more disaggregated firm-level, we still find that the average effect of BTTs on foreign affiliate activity between countries appears to be insignificant. Hence, the apparent lack of impact cannot be attributed to weak statistical power available at the country-level, nor heterogeneity at the firm-level. In summary, our data indicate the same puzzling ineffectiveness of BTTs as found in previous studies when estimating an average effect on foreign affiliate activity.

B. The Differential Effects of BTTs on Foreign Affiliate Activity

Table 4 presents the coefficients obtained when implementing the triple-difference strategy in (1), allowing for heterogeneous responses across firms from industries that differ in their use of differentiated inputs. In Table 4, we introduce sector-level measures of the (log) requirement of differentiated inputs. Each specification includes country and parent-firm fixed effects. We continue to report standard errors clustered by country.²⁰

Our results provide strong evidence that there are differential effects of BTTs on foreign affiliate sales across sectors. There is an estimated positive coefficient on the interaction between BTT and the sectoral use of differentiated inputs, which is statistically significant at the 5 percent level, indicating that the potential for BTTs to increase foreign affiliate activity is larger for firms operating in industries using larger shares of differentiated inputs. This latter effect is consistent with our hypothesis that the benefits of MAP to multinational firms are stronger for circumstances in which there is ambiguity in how appropriate transfer prices should be determined. The estimates from our preferred specification in column 6 indicates that a firm with a 10 percent greater use of differentiated inputs supplied by their affiliates will realize a \$10.4 million dollar larger increase in annual affiliate sales than average. Thus, the differential benefits of MAP across sectors are economically sizable.

In Table 4, we also find a positive average impact of tax treaties on foreign affiliate activities for firms that acquire only differentiated inputs from their affiliates, as indicated by the positive coefficient on the BTT variable, which is significant at the 10 percent level in our preferred specifications.²¹ For the average firm across sectors requiring a fraction 0.55 of differentiated inputs, the estimated increase in total sales following a BTT is approximately \$20.2 million. At first, it may be surprising

²⁰We note that our estimates are robust across clustering methods. For example, one may be concerned that, because the industry-specific measure of the use of differentiated inputs does not vary by country or time, clustering at only the country-level will under estimate standard errors. Yet, clustering at the country-year level yields similar quantitative results.

²¹For a multinational firm that acquires differentiated inputs from a foreign affiliate, the corresponding value of *Diff_Input* is one, so that $\ln Diff_Input$ is zero.

TABLE 4—IDENTIFYING THE DIFFERENTIAL EFFECTS OF BILATERAL TAX TREATIES

	Foreign affiliate sales					
	(1)	(2)	(3)	(4)	(5)	(6)
BTT	98.61* (56.04)	96.09* (55.21)	80.19 (48.81)	100.78* (55.34)	98.03* (54.50)	82.14* (48.05)
BTT × ln Diff_Input	97.42** (43.04)	98.54** (44.39)	102.35** (46.87)	100.25** (42.98)	101.05** (44.26)	104.82** (46.73)
ln Diff_Input	−147.99*** (35.89)	−148.09*** (37.14)	−153.42*** (39.65)	−38.21 (89.44)	−41.11 (93.85)	−53.75 (96.43)
Sum GDP (log)		1,573.57*** (582.93)	1,567.21*** (565.91)		1,572.57*** (582.95)	1,566.48*** (565.90)
GDP diff ² (log)		134.42** (56.27)	132.44** (56.34)		134.16** (56.29)	132.22** (56.36)
Skill diff (log)		−8.25 (15.29)	−10.11 (13.98)		−8.12 (15.26)	−9.99 (13.94)
Trade costs		−5.24 (7.18)	−9.10 (7.55)		−5.18 (7.21)	−9.02 (7.58)
BIT			−28.67* (16.78)			−28.48* (17.07)
FTA			62.10*** (17.19)			61.94*** (17.13)
Exchange rate			−0.02*** (0.01)			−0.02*** (0.01)
Constant	56.28 (50.64)	−16,363.1*** (6200.02)	−16,274.1*** (6041.32)	273.22 (177.47)	−16,138.9** (6224.18)	−16,067.3*** (6052.14)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Ind-year FE	NO	NO	NO	YES	YES	YES
R ²	0.009	0.009	0.009	0.008	0.008	0.008
Observations	109,102	108,502	106,879	109,102	108,502	106,879

Note: Standard errors clustered by country in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

that we obtain a positive effect of BTTs on foreign affiliate sales only after controlling for industry-specific requirements for differentiated inputs. In many previous studies, as well as in our sample, the effects of new treaties were consistently estimated to be zero using an empirical specification that only controlled for country-level characteristics (see Table 3). However it is important to recognize that the use of differentiated inputs informs us both about the benefits of MAP provisions for engaging in foreign affiliate activities, and the ease of offshoring production within each industry in the first place. It is worth noting that the estimated independent effect of *ln Diff_Input* also has a highly significant relationship with foreign affiliate sales in each specification.²² The negative coefficient on the *ln Diff_Input* variable

²²In columns 4–6 of Table 4, the reported coefficient on *ln Diff_Input* appears insignificant. However, these specifications include (unreported) industry-by-year fixed effects. Overall, these industry characteristics have a strong influence on foreign affiliate activities.

is consistent with the notion in Keller and Yeaple (2013) that offshore production is impeded by the requirement for differentiated inputs. As a result, omitting information about the use of differentiated inputs biases estimates of the net impact of BTTs toward zero. We are able to detect the increase in activity here because in each specification we allow industry-specific features to interact with treaty status at the national level.

Figure 1 demonstrates that there appears to be no preexisting trends across sectors or countries that are driving the results in Table 4. As a further robustness check, we also perform a falsification test using bilateral investment treaties (BITs), which contain no provisions regarding the tax liabilities. In fact, Article 21 of the latest US Model Bilateral Investment Treaty (2012) explicitly states that the provisions of the treaty “shall not impose any obligations with regard to taxation measures,” or “affect the rights and obligations of either Party under any tax convention.” Without MAP provisions that benefit firms in differentiated sectors, a new BIT entering into force between countries should not have any positive impact on the incentive to operate an affiliate in a new treaty partner within differentiated sectors. The results of this falsification test indeed reveal that there is no positive impact of BITs for any value of required differentiated inputs.²³ Note that the number of BITs in force between countries has also been growing over time, with no cancelled investment treaties observed in the data. Thus, if one were concerned that our results were driven spuriously by differential trends in foreign affiliate activities across sectors, we should also find positive effects of BITs in sectors with greater requirements for differentiated inputs. The fact that we do not find such positive effects further supports the conclusion that BTTs and associated MAP raise the incentives of firms to engage in foreign affiliate activities.

C. BTTs and New Entry

Our results above show that BTTs have effects at the intensive margin when accounting for the sectoral use of differentiated inputs. In this section, we turn to the extensive margin and measure changes in FDI activities by considering firm entry rates. The effects of BTTs on entry rates can have far reaching consequences as domestic firms respond to changes in the number of foreign competitors.²⁴ Specifically, we estimate the effect of tax treaties on the number of new foreign affiliate entrants into a partner country per year.²⁵

For each specification in Table 5 we continue to include country fixed effects, but cannot include parent-firm fixed effects since we are examining new firm entry. We continue to report standard errors clustered at the country-level. As with the intensive margin, we find that the effect of BTTs on entry rates appears insignificant when

²³ We have estimated the BIT effects simultaneously with our main BTT regressors and find virtually no quantitative differences in the effects of BTTs across sectors.

²⁴ 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 United States, Keller and Yeaple (2013) find additional evidence of spillovers from the entry of new multinationals.

²⁵ The entry of new firms is a count variable, and so we have also estimated the effects of BTTs at the extensive margin using a Poisson regression. Using the Poisson specification we obtain qualitatively similar results to the standard linear model.

TABLE 5—THE EFFECTS OF BILATERAL TAX TREATIES ON ENTRY RATES

	Number of new affiliates					
	(1)	(2)	(3)	(4)	(5)	(6)
BTT	0.034 (0.032)	0.035 (0.030)	0.036 (0.028)	0.207*** (0.058)	0.204*** (0.058)	0.209*** (0.057)
BTT × ln (Diff_Input)				0.225*** (0.064)	0.219*** (0.065)	0.225*** (0.065)
ln (Diff_Input)				0.057*** (0.017)	0.063*** (0.017)	0.057*** (0.017)
Sum GDP (log)		3.575 (2.216)	3.774* (2.138)		3.587 (2.262)	3.783* (2.190)
GDP diff ² (log)		0.296 (0.232)	0.317 (0.223)		0.293 (0.236)	0.314 (0.228)
Skill diff (log)		-0.081*** (0.027)	-0.083*** (0.027)		-0.081*** (0.028)	-0.083*** (0.028)
Trade costs		-0.003 (0.005)	-0.004 (0.006)		-0.003 (0.005)	-0.003 (0.006)
BIT			0.014 (0.031)			0.019 (0.031)
FTA			-0.002 (0.052)			-0.001 (0.053)
Exchange rate			0.000 (0.000)			0.000 (0.000)
Constant	0.646*** (0.076)	-36.475 (23.875)	-41.304* (25.577)	0.694*** (0.075)	-36.495 (24.363)	-41.291 (25.165)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO	NO
R ²	0.189	0.189	0.190	0.197	0.198	0.198
Observations	33,405	32,868	32,135	33,405	32,868	32,135

Notes: OLS regressions. Standard errors clustered by country in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

we specify the model using only country-level characteristics. See columns 1–3. However, when we again control for the differential incentives across sectors, we find significant increases in entry rates once a treaty is in force. Results in columns 4–6 of Table 5 demonstrate that the effect of a BTT on entry rates is much larger for firms that acquire differentiated inputs from a new affiliate relative to the average. Using the preferred estimates in column 6, there is an additional 0.02 firms per year per sector as the requirement for differentiated inputs increases by 10 percent. The rationale for these effects is the same as that for our estimates of the BTT effects on the intensive margin: BTTs are more likely to encourage new firms to invest in a partner country in sectors that require differentiated inputs, since MAP provisions provide additional resolution possibilities in the incidence of double taxation.

For the average sector using a fraction 0.55 of differentiated inputs during production, a new BTT adds approximately 0.076 additional firms per year. At the beginning of our sample in 1988, the average number of new entrants within a sector per country was 0.06 and by the end of our sample in 2006, entry rates had increased

steadily to 0.07 new firms. Thus, the estimated effect of BTTs in our sample correspond to approximately doubling the entry rate for the average sector.²⁶

V. Conclusion

Previous studies of BTT have found little evidence that they have a significant effect on foreign affiliate 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 United Nations 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 paper, we take a closer look at the information sharing provisions in BTTs, and particularly the Mutual Agreement Procedures (MAP) that becomes available to firms once a BTT is in place. MAP allows multinational firms to request tax authorities to coordinate common tax base and tax definitions that can significantly eliminate double taxation on multinational firms. Varying methods across tax authorities for determining an arm's-length price for transactions between affiliates is a substantial issue for multinational firms, and a MAP request for tax authorities to agree on a common method for transfer price determination can lead to significant elimination of double taxation. Since transfer pricing is only a salient issue for differentiated inputs (versus homogeneous inputs where external reference prices are readily available), we hypothesize that multinational firms in sectors where the share of differentiated inputs is larger, will be more likely to see positive effects of BTTs through the new availability of MAP.

We find strong support for this hypothesis using detailed US firm-level data from 1987 through 2007 available through the US Bureau of Economic Analysis. We find that this differential effect of BTTs on foreign affiliate activity, depending on use of differentiated inputs, operates at both the intensive margin (volume of foreign affiliate sales) and the extensive margin (net new entry). We also verify in our data, that there is no robust evidence of an average positive effect of BTTs on foreign affiliate activity and FDI if one does account for the use of differentiated inputs, which is consistent with prior studies. There is likely more work to be done in the future to fully understand the ramifications of information sharing provisions in BTTs, as well as exploring other dimensions in which BTTs may have heterogenous effects across multinational firms.

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²⁶Although they do not account for the different effects of BTTs across sectors, Davies, Norbäck, and Tekin-Koru (2009) also find evidence of increased firm entry rates in their analysis.

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