

THE LABOR MARKET EFFECTS OF OFFSHORING BY U.S. MULTINATIONAL FIRMS

Brian K. Kovak, Lindsay Oldenski, and Nicholas Sly*

Abstract—We use firm-level data on U.S. multinationals to show how offshoring affects domestic employment within and across firms. We introduce a new instrument for offshoring, bilateral tax treaties, which reduce the cost of offshore activities. We find substantial heterogeneity in effects. A 10% increase in affiliate employment drives a 1.3% increase in employment at the U.S. parent firm, with smaller effects at the industry and regional levels. In contrast, offshoring by vertical multinationals drives declining employment among nonmultinationals in the same industry, and firms opening new affiliates exhibit smaller domestic employment growth than those expanding existing affiliates.

I. Introduction

IN recent years, the question of how offshoring affects domestic employment has been at the forefront of political and popular discussions of international economic policy. In spite of the salience of this question, there is little agreement among academic economists regarding the sign of offshoring's effects on domestic labor market outcomes, let alone the magnitude.¹ This is in large part because the term *offshoring* comprises many different activities. Offshoring may take place within a multinational firm or at arm's length. Firms may relocate U.S. production to new plants in other countries, or they may increase their output at existing offshore locations. The work performed in the United States may

differ from the work performed offshore. These different dimensions of offshoring decisions could have different effects not only on the workers at the firm doing the offshoring, but also on workers at competing firms within the same industry or in supporting industries within the same geographic location.

We present a consistent framework to study the effects of offshoring on employment within U.S. multinational firms, at all firms in a given U.S. industry, and for all workers in a given region, with changes in effective tax rates of foreign affiliates serving as an instrument for offshore employment. We combine data on U.S. multinational enterprises (MNEs) from the U.S. Bureau of Economic Analysis (BEA) and broader industry employment within County Business Patterns data to highlight differences in the effects of offshoring across industries (with high versus low reliance on royalties, interest, and dividends), due to various offshoring margins (extensive versus intensive), and between organizational forms (domestic versus multinational). Our results show that these distinctions matter. A 10% increase in affiliate employment drives a 1.3% increase in employment at the U.S. parent firm, with smaller effects at the industry and regional levels. In contrast, increased foreign affiliate activity in vertically oriented multinational firms drives declining employment among non-multinationals in the same industry, and multinational firms opening new affiliates exhibit smaller domestic employment growth than those expanding existing affiliates. Overall, our results indicate that greater offshore activity modestly raises net employment by U.S. firms, albeit with substantial job loss and employment reallocation.

Any empirical analysis of the labor market effects of offshoring is complicated by the fact that offshore activity and domestic employment both reflect choices made by firms, making it difficult to disentangle the causal relationships between the two phenomena. To overcome this inherent simultaneity between domestic and offshore employment, we exploit a policy instrument that alters the relative costs of offshore activity and is exogenous to firm choices: bilateral tax treaties (BTTs). These treaties allow U.S. firms to avoid double taxation, in which foreign affiliate income is taxed in two jurisdictions due to constraints on the size of the foreign tax credit available to U.S.-owned firms. BTTs make this constraint less likely to bind, lowering the average effective tax rate on income from foreign affiliates, hence lowering the overall cost of offshore activity. During our sample period of 1987 to 2007, countries accounting for 23% of total foreign affiliate employment of U.S. multinational firms received new BTTs with the United States. We leverage variation in the timing of these treaties, the preexisting country mix of multinational firms' affiliates, and the incidence of double taxation across industries to infer the causal effect

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*Kovak: Carnegie Mellon University NBER and IZA; Oldenski: Georgetown University; Sly: Federal Reserve Bank of Kansas City and CESifo.

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¹For example, Desai, Foley, and Hines (2009) find a positive relationship between domestic labor market outcomes and offshoring activities of U.S. multinationals, while Muendler and Becker (2010) find negative effects for German multinational firms, and Monarch, Park, and Sivadasan (2014) find negative employment effects of offshoring for U.S. firms participating in the Trade Adjustment Assistance program. Harrison and McMillan (2011) provide evidence from the United States that the association between offshore and domestic employment may depend on the type of offshoring activity. The destination of offshore activities may also alter the relationship between domestic and foreign employment; see Brainard and Riker (1997). Rather than positive or negative effects, several studies find null impacts of offshoring on domestic labor market outcomes, for example, Slaughter (2000, 2001), Ottaviano, Peri, and Wright (2013), and Antràs, Fort, and Tintelnot (2017).

of BTT-induced changes in foreign affiliate employment on changes in U.S. domestic employment.

To motivate our empirical analysis we use the model of multinational firm organization developed by Antràs and Helpman (2004).² This framework (a) demonstrates the simultaneity of employment decisions at a domestic parent and its foreign affiliates; (b) characterizes the division of revenue between multinational parents and affiliates, which is necessary to address double-taxation; (c) characterizes sourcing decisions within and across both country and firm boundaries, dimensions of offshoring that have different implications for U.S. employment; and (d) yields a panel difference-in-differences estimation strategy, with changes in effective tax rates of foreign affiliates serving as an instrument for off-shore employment.

We rule out the presence of confounding pretrends using an event-study framework demonstrating similar employment trends for affected and unaffected firms prior to BTT implementation. This analysis also documents positive (reduced-form) effects of BTTs on domestic employment in multinational firms, with results concentrated in industries with relatively high royalty, interest, and dividend payments (RID) to the parent. This is to be expected since the pretreaty incidence of double-taxation, and thus the benefit of a BTT, is larger for firms in high-RID industries.³ RID payments are subject to foreign withholding taxes, which often place total foreign tax payments above the maximum level of the U.S. foreign tax credit, resulting in double taxation. We also find a strong, positive (first-stage) effect of BTTs on foreign-affiliate employment, but only in high-RID industries. The absence of effects in low-RID industries helps rule out identification concerns regarding other policy reforms that might have occurred simultaneously with BTTs.

For our exclusion restriction to hold, it must be the case that BTTs affect the domestic hiring decisions of U.S. firms only through their effect on foreign affiliates. We offer several pieces of evidence supporting this assumption. First, BTTs reduce the tax burden on foreign affiliate activities, leaving the taxation of domestic activity unchanged. Second, the vast majority of double-taxation cases involving U.S.-owned firms are raised in the foreign affiliate's country, suggesting that this is where the costs of double taxation are incurred (Ernst & Young, 2015). Third, we show that firms in industries that are less likely to be subject to double taxation exhibit no reduced-form relationship between BTTs and U.S. employment, nor do they have significant first-stage results linking BTTs with foreign affiliate employment. These re-

lationships exist only for the sample of firms in industries with relatively large royalty, interest, and dividend payments to the parent, payments that are the source of double taxation, again supporting the exclusion assumption (Angrist & Pischke, 2009). Finally, our IV estimates are significantly smaller than the corresponding OLS results and are less than one-third the magnitude of estimates in the most closely related prior literature (Desai et al., 2009), which suggests that our instrument substantially ameliorates upward simultaneity bias.

In addition to our firm-level analysis, we use County Business Patterns data to study employment outcomes for overall national industries and regional labor markets. The industry perspective allows us to capture two margins that are absent in the analysis of multinational firms alone. First, changes in employment at multinational parents may be partly offset by equilibrium employment adjustment at other domestic firms in the same industry. Second, declining costs of offshore activity will likely motivate some firms to become multinational firms by opening new affiliates. Both margins predict smaller effects at the industry level than at the multinational parent level, and this is what we find. The effect within multinational parents is much smaller than the overall industry employment effect, and employment at nonmultinational firms significantly declines in response to increased offshore activity at vertically oriented multinational firms in the same industry, suggesting substitution of intermediate input purchases from domestic suppliers to foreign affiliates adversely affects domestic employment. Finally, we examine effects at the regional level, capturing potential spillovers across industries in the same metropolitan area. We generate a regional measure of offshoring exposure as a weighted average of industry-level foreign affiliate employment, with weights reflecting the market's initial industry mix, using a procedure similar to Topalova (2010), Autor, Dorn, and Hanson (2013), and Kovak (2013). As before, we instrument for observed affiliate employment using BTTs. The metro-area estimates are somewhat larger in magnitude than the industry results, consistent with the presence of cross-industry spillovers at the regional level.

Our paper contributes in a variety of ways to the literature on the labor market effects of offshoring. We introduce bilateral tax treaties as a new source of identifying policy variation in the effective cost of offshore activity.⁴ Although BTTs have been extensively studied in prior work, to our knowledge they have not been used to examine the domestic labor market effects of offshoring.⁵

²See Feenstra and Hanson (2005) and Defever and Toubal (2013) for empirical support of the property rights/incomplete contracts theory of multinational firms.

³Blonigen, Oldenski, and Sly (2014) provide evidence that the effects of BTTs vary across U.S. industries according to the use of differentiated inputs. Highly differentiated products tend to have higher markups and so more revenue that is exposed to double taxation. Rather than use a proxy for the degree to which income is subject to double taxation, here we use initial royalty, interest, and dividend payments at the industry level to assess directly the exposure to treatment from BTTs.

⁴Closely related prior work uses variation based at least partly on year-to-year changes in affiliate-country GDP (Desai et al., 2009) or wages (Brainard & Riker, 1997; Slaughter, 2000; Muendler & Becker, 2010; Harrison & McMillan, 2011). Permanent reductions in the cost of offshore activity following a BTT more closely parallel the secular declines in offshoring costs during recent decades.

⁵See, for example, Blonigen and Davies (2004), Davies (2004), di Giovanni (2005), Egger et al. (2006), Louie and Roushlang (2008), Davies, Norback, and Tekin-Koru (2009), and Blonigen et al. (2014).

Other work has documented that the relationship between offshore and domestic employment varies according to the affiliate country (Brainard & Riker, 1997) and the type of offshoring activity (Harrison & McMillan, 2011). By examining outcomes at different levels of aggregation and for different subsamples, we are also able to capture heterogeneity in the effects of offshoring across firms with different organizational forms and different offshoring margins. For example, our parent-level analysis suggests that extensive-margin offshoring (opening new affiliates in response to cost reductions) does not significantly affect domestic employment within multinationals, while intensive-margin adjustments (increasing employment at existing affiliates) increase domestic employment. These findings suggest that there is not a single effect of increased offshore activity on domestic employment, but that the effects vary depending on the circumstances, potentially explaining differences in empirical findings across research papers.⁶

This observation also has important implications for relating our findings to others in the broader literature on the effects of increased imports, which tends to find negative effects of total imports on labor market outcomes (Autor et al., 2013, and Hummels et al., 2014). Total imports include final goods, inputs purchased abroad at arm's length, and inputs purchased from foreign affiliates of domestic multinationals. Each of these trade flows may have a different effect on domestic labor market outcomes and is subject to different policy interventions. We focus on the effects of increased employment at foreign affiliates of U.S. multinational firms, both to take advantage of a compelling policy-based identification strategy and because the potential effects of offshoring by multinational firms have been the topic of much attention in political debates and the popular press, distinct from discussions of trade more broadly. Moreover, the U.S. Census Bureau reports that about 50% of U.S. imports are between related parties, and Slaughter (2009) discusses evidence that MNEs account for approximately 20% of total employment in the United States. Hence, the type of offshoring we consider here is of first-order importance to U.S. labor market outcomes.

Our research design explicitly measures the overall effects of declining costs of offshore activity, including potential substitution and scale effects. This approach is distinct from that in papers estimating substitution parameters in multinational firm-level cost functions, which explicitly hold firm output

fixed to isolate substitution effects.⁷ In our framework, the key mechanism driving the positive relationship between domestic and offshore affiliate employment is that firms may expand output, and thus employment, as offshoring costs fall. Hence, our positive estimates are entirely consistent with prior work finding that foreign and domestic employment are substitutes, since our estimates reflect a combination of substitution and scale effects. Moreover, we find independent evidence for the quantitative importance of substitution effects by showing smaller employment growth in firms opening new affiliates in BTT countries, a margin in which substitution effects are most important.

The following section describes bilateral tax treaties and the data we utilize to study their effects. Section III estimates the reduced-form effect of BTTs on domestic employment in multinational firms, emphasizing that the appearance of BTTs was uncorrelated with preexisting firm employment growth. Section IV presents our main analysis, studying how increased offshore employment affects domestic employment. This includes the theoretical framework, analysis of how BTTs affect foreign affiliate employment, and results for the effects of offshoring at the multinational parent, industry, and regional levels. Section V concludes.

II. Background and Data

This paper identifies the effects of offshore employment on domestic employment using variation in offshore activity driven by bilateral tax treaties (BTTs). BTTs resolve a problem called "double taxation" in which limits on the amount of foreign tax credits available to U.S. MNEs result in the same income being taxed in two jurisdictions, potentially raising the effective tax rate for foreign affiliates well above the statutory level in either jurisdiction.

In particular, during our sample period, the U.S. corporate tax applied to worldwide profits, meaning that profits resulting from a U.S. multinational firm's activities both at home and abroad were subject to the U.S. corporate tax. This is in contrast to territorial systems, in which foreign affiliate activity is taxed only by the country in which the affiliate is located.⁸ Under the U.S. worldwide system, any foreign tax on foreign affiliate activity would subject the firm to double taxation in the absence of some compensation. In an effort to limit this possibility, the U.S. government offers a foreign tax credit to U.S. firms to offset their foreign tax liabilities.⁹ However, a U.S. multinational firm may not claim a foreign tax credit that exceeds the U.S. tax on foreign taxable

⁶For example, we find positive net effects on domestic employment while Boehm, Flaaen, and Pandalai-Nayar (2017) find declining domestic employment in response to offshoring. Their analysis restricts attention to U.S. manufacturing establishments, omitting the headquarters establishments where positive scale effects are most likely to emerge. They also observe offshoring at arm's length and extensive margin offshoring at newly formed multinationals. Both of these margins likely contribute to domestic employment declines but are unobservable in the BEA data. In contrast, Suárez Serrato (2018) examines the effects of an effective tax increase on firms with existing affiliates, in which scale effects are most likely to dominate, finding domestic employment effects consistent with ours.

⁷Slaughter (2000) and Muendler and Becker (2010). Harrison and McMillan (2011) control for output by assuming that firm output depends only upon domestic and foreign prices and then empirically proxying for those prices using industry sales.

⁸With the Tax Cuts and Jobs Act of 2017, the United States adopted a more territorial corporate tax system so our identification strategy does not apply after 2017.

⁹See Desai et al. (2001) for an introduction to the U.S. foreign tax credit and Doernberg (2016) and Misy and Schädewald (2015) for detailed treatments.

TABLE 1.—COUNTRIES WITH NEW TREATIES IN EFFECT DURING SAMPLE PERIOD (1987–2007)

Treaty Partner	Year BTT Entered into Force	Pretreaty Rates			Posttreaty Rates		
		Dividends	Interest	Royalties	Dividends	Interest	Royalties
India	1990	25	25	30	15	15	20
Indonesia	1990	20	20	20	15	0, 15	10, 15
Spain	1990	25	25	25	10, 15	10	5–10
Tunisia ^a	1990	–	–	–	–	–	–
Mexico	1993	0	15–35	15–35	5–15	10, 15	10
Russia	1993	15	15	20	5, 10	0	0
Israel	1994	25	25	25	12.5–25	10, 17.5	10, 15
Portugal	1995	25, 30	20	15	15	10	10
Thailand	1997	10	15	15	10	10, 15	5, 8, 15
Turkey	1997	20, 22	13.2	22	15, 20	15	5, 10
Estonia	1999	26	26	15	0, 5, 15	10	5, 10
Latvia	1999	10	0, 5, 10	5, 15	10	0, 5, 10	2, 5, 10
Lithuania	1999	29	24–29	24–29	15	10	10
Venezuela ^b	1999	–	–	–	5, 15	0, 4.95, 10	0, 5, 10
Ukraine	2000	15	0, 15	0	5, 15	0	10
Slovenia ^a	2001	25	–	–	5, 15	5	5
Sri Lanka	2004	10	15	15	15	10	5, 10
Bangladesh ^a	2007	–	–	–	–	–	–

Year BTT entered into force determined from tax treaty text, available from *IRS United States Income Tax Treaties—A to Z*. Note that Russia had been covered by a preexisting tax treaty between the United States and U.S.S.R., but this treaty did not include standard measures to reduce double taxation, so we count the 1993 treaty with Russia as a new treaty. Tax rates from Price Waterhouse Coopers (PwC) publications, *Corporate Taxes: A Worldwide Summary*, across various years. When multiple rates apply in different circumstances, each rate or a range is reported. Pre- and posttreaty data are from publications in the following years for each country: India (1990, 1991), Indonesia (1990, 1991), Spain (1990, 1991), Mexico (1993, 1994), Russia (1993, 1994), Israel (1995, 1995), Portugal (1995, 1996), Thailand (1997, 1999–2000), Turkey (1999–2000, 1999–2000), Estonia (1997, 2001–2002), Latvia (1999–2000, 2003–2004), Lithuania (1999–2000, 2001–2002), Venezuela (1999–2000, 2004), Ukraine (1999–2000, 2001–2002), Slovenia (2000–2001, 2004), Sri Lanka (2004, 2005). Note that Israel reports 1995 nontreaty rate for the pretreaty period (doesn't appear in prior issues), and Turkey reports 1991–2000 nontreaty rate for the pretreaty period.

^aTunisia and Bangladesh are omitted from the PwC publications, as are Slovenia's pretreaty withholding tax rates for interest and royalties.

^bVenezuela's pretreaty withholding tax structure is too complex to report with a simple set of rates.

income; otherwise, the U.S. IRS would implicitly subsidize the foreign tax authority. When the foreign tax liability exceeds this limit, a portion of the firm's income is taxed by both the United States and foreign taxing authorities without an offsetting credit.

Double taxation of this kind is most likely to arise when the foreign jurisdiction imposes a substantial tax on royalties, interest, or dividends, known as a "withholding tax." These rates can be quite high, so that the combined corporate income tax and withholding tax in many foreign jurisdictions can exceed the relatively high U.S. corporate tax rate. In this circumstance, the firm owes withholding taxes to the foreign tax authority without receiving a fully offsetting credit, resulting in double taxation and imposing additional costs on the foreign activities of the firm.

To see how lowering withholding tax rates helps avoid double taxation, consider a hypothetical situation in which a U.S. multinational firm has an affiliate in Mexico that earns \$100 of taxable income, \$60 of which is paid to the U.S. parent in the form of royalties. Before a BTT is in place, the Mexican tax authority levies a 25% withholding tax on the \$60 of royalty payments plus a 35% tax on the \$40 earned in its jurisdiction. In this scenario the foreign tax authority collects \$29 ($= 0.25 \times 60 + 0.35 \times 40$) from the foreign affiliate. Yet the U.S. foreign tax credit limit is \$14 ($= 0.35 \times 40$), reflecting the 35% U.S. corporate tax rate applied to the value of Mexican activity. As a result, the foreign affiliate is left with \$15 in uncredited foreign tax liabilities, subjecting the multinational enterprise to double taxation. If signing a BTT were to eliminate the withholding tax, then the U.S. foreign tax credit would be sufficient to fully offset the taxes paid to the foreign tax authority. Albeit an overly simplified example, this sce-

nario demonstrates how limits on foreign tax credits can lead to double taxation and how BTTs can mitigate the problem by reducing withholding tax rates on royalty, interest, and dividend income.¹⁰

Table 1 provides information on each of the U.S. BTTs that entered into force during our sample period, 1987 to 2007.¹¹ These treaty partner countries account for approximately 23% of total foreign affiliate employment of U.S. MNEs during our sample period.¹² Table 1 also reports withholding tax rates on royalty, interest, and dividend income facing U.S. multinational firms just before and just after the relevant BTT entered into force. Note that the withholding rates under the treaty are often substantially lower than they were prior to the treaty. By reducing these withholding rates, BTTs reduce the probability of double taxation, lowering the effective tax rate that multinational firms face and incentivizing offshore activity in treaty countries.

Even though BTTs apply to all industries, the effects of BTTs on effective tax rates may vary by industry because

¹⁰Note that the prospect of double taxation arising from withholding taxes may deter firms from making royalty, interest, or dividend payments (Desai et al., 2001). Even in this case, lowering withholding taxes through a BTT lowers effective costs, since it allows the firm to allocate resources with less distortion.

¹¹Treaties are often signed in years prior to when they become effective, and several BTTs have been renegotiated over time. We use the date in which the original signing entered into force to indicate when countries have a treaty in place. See IRS.gov, *United States Income Tax Treaties A-Z*, for treaty text, including relevant dates. Our event-study analysis in figure 1 below shows no sign of anticipatory effects, supporting this timing definition. See appendix A.1 for a visualization of our sample's time coverage relative to BTT dates.

¹²Authors' calculations using the BEA Surveys of U.S. Direct Investment Abroad.

of differences in the initial incidence of double taxation. For multinational firms in industries where royalties, interest, and dividends (RID) are higher, the amount of withholding tax levied on foreign affiliate activity is also higher, and double taxation is more likely. In contrast, industries that rely minimally on royalty, interest, and dividend payments are much less likely to face double taxation. Hence, we expect the effects of BTTs to be larger in industries with relatively high RID payments. Appendix A.2 describes in detail our categorization of industries with high or low RID payments.

Our empirical analyses examine the effects of BTTs on employment in U.S. multinational firms, their foreign affiliates, and the broader labor market. Information on multinational firms comes from the 1987–2007 Surveys of U.S. Direct Investment Abroad, collected by the Bureau of Economic Analysis (BEA). These data provide a quasi-exhaustive sample of U.S. multinational firms and their affiliates in foreign countries. Our analysis utilizes information on domestic employment at the U.S. parent firm and employment in each of its majority-owned foreign affiliates, along with information on each parent firm's three-digit primary industry.¹³ Firm-level data are ideal in this context, as they allow us to control for time-invariant unobservable firm or affiliate characteristics and to investigate heterogeneity in effects based on offshoring margin and firm organizational structure. Our sample includes 5,715 firms with 46,498 foreign affiliates spanning 121 three-digit industries and operating in 130 countries from 1987 to 2007. Note that our sample includes all multinational firms, including those outside manufacturing.

After examining outcomes within multinational firms, we consider employment effects at the industry and regional levels using data on employment by industry and metropolitan statistical area (MSA) from the U.S. Census Bureau's County Business Patterns (CBP). These data report total employment at private business establishments in covered industries by industry and county.¹⁴ We aggregate industries to match the three-digit classification used in the BEA data and aggregate counties to construct 304 time-consistent metropolitan areas spanning our sample period.

Throughout our analyses, we present specifications controlling for a standard set of time-varying, country-level determinants of offshoring, using data compiled from several sources.¹⁵ Control variable names appear in brackets. To capture the regularities that greater national incomes promote foreign affiliate activity, while large differences in national income reduce it, we control for the log of the sum of U.S. and affiliate country's real GDP [$\ln(GDP_{us} + GDP_d)$]

and the log of the squared difference in the two countries' GDPs [$\ln((GDP_{us} - GDP_d)^2)$]. Information regarding real GDP and trade costs come from the Penn World Tables, with national incomes expressed in trillions of U.S. dollars. Trade costs are measured using a standard definition of openness: the log of 100 minus the trade share of total GDP [$\ln(\text{Trade Costs})$]. The skill difference between the United States and a foreign affiliate country is measured as the log of the difference in average educational attainment [$\ln(\text{Skill Difference})$] from Barro and Lee (2010). Educational attainment measures are available every five years, so we linearly interpolate data for years between observations. Data indicating whether the United States has a bilateral investment treaty [BIT] with the destination country are from the United Nations Conference on Trade and Development. The presence of free trade agreements [FTA] across countries is available from the U.S. Trade Representative. Annual exchange rate data [Exchange Rate] are from the World Bank.

Table 2 reports summary statistics for all foreign affiliates in our sample and the U.S. parent firms that own them. The average firm in our sample has roughly nine foreign affiliates with total foreign employment of 3,513 workers and total U.S. employment of 7,906 workers.

III. Effects of BTTs at U.S. Multinationals

Before moving on to our theoretically motivated IV estimates of the effects of offshoring on U.S. employment, we begin our empirical analyses by estimating the effect of BTTs on U.S. parent firm employment. This analysis is the reduced form of the simultaneous equations framework introduced in section IVA, and serves two purposes. First, the effect of BTTs on multinational firm hiring in the United States is of independent interest, as tax treaties are among the most commonly implemented policy tools affecting the incentives to engage in cross-border production, and they help inform us about the broader consequences of changes in effective tax rates for multinational firms. Second, this analysis allows us to rule out the presence of confounding trends, in which faster-growing multinational firms are systematically more or less likely to have affiliates in countries signing new BTTs with the United States.

We estimate the effect of BTTs on parent employment using a panel difference-in-differences research design (Bertrand, Duflo, & Mullainathan, 2004). In order to have a single well-defined treatment period for each parent firm, here we focus on the first BTT received by one of the parent's affiliates during our sample period. A parent firm is treated when at least one of the countries hosting its affiliates has enacted a new BTT with the United States during our sample period. Define \tilde{t}_f as the first year in which an affiliate of firm f receives a BTT, so the firm is treated when $t \geq \tilde{t}_f$. To account for differences in the relative importance of the first affiliate receiving a BTT, we scale the treatment indicator by

¹³We classify affiliates based on their parent's primary industry. The BEA uses three-digit SIC-based ISI codes prior to 1999 and four-digit NAICS-based ISI codes afterward. For consistency, we convert NAICS-based codes to three-digit SIC-based codes for the relevant years.

¹⁴The CBP data provide full coverage in all industries except crop and animal production; rail transportation; National Postal Service; pension, health, welfare, and vacation funds; trusts, estates, and agency accounts; private households; and public administration.

¹⁵See Carr, Markusen, and Maskus (2001), di Giovanni (2005), and Blonigen et al. (2014) for papers motivating these controls.

TABLE 2.—SUMMARY STATISTICS.

	Mean	SD	Min	Max
Foreign affiliates (342,239 observations)				
Employment	474.30	2,394.8		(confidential)
ln(Employment)	4.3788	1.9213		(confidential)
Av. Annual Emp Growth (%)	0.0909	0.7876		(confidential)
BTT	0.8099	0.3924	0	1
High RID Indicator	0.5763	0.4941	0	1
ln($GDP_{us} + GDP_d$)	9.3112	0.2040	8.8665	10.093
ln($GDP_{us} - GDP_d$) ²	18.184	0.4946	14.841	18.933
ln(Skill Difference)	1.0984	0.7194	0	2.494
ln(Trade Cost)	2.6727	2.3737	0	4.5940
BIT	0.0516	0.2212	0	1
FTA	0.1216	0.3269	0	1
Exchange Rate	140.50	819.37	0	16,105
Parent-Sibling BTTs ^a	0.5645	0.2053	0	1
Affiliate-Sibling BTTs ^b	0.2944	0.3888	0	1
U.S. parent firms (43,233 observations)				
Foreign Affiliate Employment	3,513.2	16,010		(confidential)
ln(Aff Emp)	5.6966	2.3485		(confidential)
Av Annual Aff Emp Growth (%)	0.1090	0.7911		(confidential)
Parent Firm Employment	7,906.7	28,649		(confidential)
ln(Parent Emp)	7.2009	2.0656		(confidential)
Number of Affiliates	8,6924	18.445		(confidential)
ln($GDP_{us} + GDP_d$) ^c	4.5246	3.610	0	29.618
ln($GDP_{us} - GDP_d$) ^{2 c}	8.8243	7.0513	0	58.087
ln(Skill Difference) ^c	0.4759	0.5094	0	4.240
ln(Trade Cost) ^c	1.4748	1.6564	0	10.940
BIT ^c	0.0178	0.0717	0	1
FTA ^c	0.1538	0.3261	0	1
Exchange Rate ^c	21.485	217.81	0	23,573

Authors' calculations from BEA Annual Surveys of U.S. Direct Investment Abroad 1987–2007 and various other data sources, described in section II.

^aWeighted average share of total sibling employment covered by a BTT with the United States, using fixed affiliate employment shares.

^bWeighted average share of total sibling employment covered by a BTT with the affiliate's country, using fixed affiliate employment shares.

^cParent-level versions of affiliate country controls are aggregated from the country to the parent firm level using a weighted average, using fixed affiliate employment shares as weights.

that affiliate's pre-BTT share of the parent firm's total affiliate employment, $\tilde{\varphi}_f$ and estimate the following:¹⁶

$$\ln s_{ft} = \beta^{RF} [\tilde{\varphi}_f \mathbf{1}(t \geq \tilde{t}_f)] + \Gamma X_{ft} + \lambda_f + v_{it} + \epsilon_{ft}, \quad (1)$$

where s_{ft} is U.S. employment at parent firm f in year t ; $\mathbf{1}(t \geq \tilde{t}_f)$ is a treatment indicator for years in which at least one of firm f 's affiliates has received a BTT; this treatment indicator is scaled by that affiliate's initial employment share, $\tilde{\varphi}_f$; X_{ft} is the vector of standard offshoring controls described in section II; λ_f are parent firm fixed effects; v_{it} are industry-year fixed effects; and ϵ_{ft} is an error term. Because equation (1) includes fixed effects for each parent firm and for each industry-year combination, β^{RF} measures the (reduced-form) difference in employment growth for parent firms in the same industry whose affiliates do and do not receive BTTs. We calculate two-way cluster-robust standard errors, clustering by parent firm and by year.

The results appear in table 3. The first column includes firms from all industries, while columns 2 and 3 separately

estimate the effects of BTTs in industries with high and low levels of royalty, interest, and dividend (RID) payments. A positive point estimate for the BTT indicator's coefficient implies that parent firms whose affiliates receive BTTs expand employment on average in comparison to parents whose affiliates do not. The effect on all parents in column 1 is statistically insignificant.¹⁷ However, when restricting the sample to parents in high-RID industries, BTTs have large and statistically significant effects. This is expected since double taxation is more likely in these industries prior to BTT implementation. In contrast, the estimates for low-RID industries are much smaller and statistically indistinguishable from 0. Introducing additional controls in columns 4 to 6 yields similar results. The coefficient in column 5 implies that a BTT for a multinational firm with single affiliate in high-RID industries increases domestic employment by 6.6%.¹⁸

In order to interpret the estimates from equation (1) as the causal effect of BTTs on MNE parent firm employment, it must be true that parents whose affiliates did and did not receive BTTs would have experienced equal average employment growth in the absence of new BTTs. We test for

t . We scale by the pre-BTT affiliate employment to avoid including any endogenous employment adjustments.

¹⁷Di Giovanni (2005), Blonigen and Davies (2005), and Davies et al. (2009) also find no robust relationship between BTTs and FDI activity at an aggregate level.

¹⁸ $100 \times (\exp(0.064) - 1) = 6.6$.

¹⁶To be precise, let t_c be the year in which country c enacts a BTT with the United States, and $t_c = \infty$ if the country does not enact a BTT. C_f is the set of countries in which firm f initially has affiliates. Then $\tilde{t}_f \equiv \min_{c \in C_f} \{t_c\}$. Note that $\tilde{t}_f = \infty$ if none of f 's affiliates have a BTT during our sample period, so $\mathbf{1}(t \geq \tilde{t}_f) = 0$, and f is not treated. Let $\tilde{c}_f \equiv \arg\min_{c \in C_f} \{t_c\}$ be the first of firm f 's affiliate countries to receive a BTT. Affiliate \tilde{c}_f 's pre-BTT share of affiliate employment is then $\tilde{\varphi}_f \equiv (m_{f,\tilde{c}_f,\tilde{t}_f-1}) / (\sum_{c \in C_f} m_{f,c,\tilde{t}_f-1})$, where $m_{f,c,t}$ is employment at parent firm f 's affiliate in country c in year

TABLE 3.—REDUCED-FORM-DIFFERENCE-IN-DIFFERENCES ANALYSIS: THE EFFECT OF BTTs ON PARENT EMPLOYMENT

Sample	Dependent Variable: Log Parent Employment— $\ln(s_{ft})$					
	(1) All	(2) High RID	(3) Low RID	(4) All	(5) High RID	(6) Low RID
BTT $[\tilde{\varphi}_f \mathbf{1}(t \geq \tilde{t}_f)]$	0.027 (0.007)	0.055*** (0.014)	-0.009 (0.013)	0.012 (0.090)	0.064*** (0.023)	-0.027 (0.018)
$\ln(GDP_{us} + GDP_d)$				0.025 (0.123)	-0.076 (0.147)	0.196 (0.189)
$\ln(GDP_{us} - GDP_d)^2$				-0.054 (0.061)	-0.006 (0.072)	-0.135 (0.094)
$\ln(\text{Skill Difference})$				-0.077 (0.050)	-0.084 (0.059)	-0.066 (0.095)
$\ln(\text{Trade Costs})$				0.003 (0.015)	0.012 (0.017)	0.003 (0.030)
BIT				-0.287 (0.177)	-0.242 (0.244)	-0.259 (0.23)
FTA				-0.008 (0.062)	-0.08 (0.088)	0.02 (0.079)
Exchange Rate				-0.0001 (0.000)	-0.0001 (0.000)	0.0001 (0.000)
Parent FE	YES	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES	YES
<i>N</i>	43,233	29,765	13,468	43,233	29,765	13,468
<i>R</i> -squared	0.0021	0.0033	0.0002	0.0573	0.0644	0.0431

Documents the effects of newly signed bilateral tax treaties (BTTs) on parent employment at multinational firms. "High RID" and "Low RID" refer to firms within industries that exhibit ratios of total payments in royalties, interest, and dividends relative to total industry sales that are above and below the median sector (see appendix A.2 for details). Sample covers 1987 to 2007. Standard errors clustered by both parent firm and year are in parentheses. Significant at *10%, **5%, and ***1%.

preexisting differences in employment trends using the event-study framework of Jacobson, LaLonde, and Sullivan (1993), in which we examine the employment effect of a parent's first new BTT in each year before and after it enters into force. The estimation equation, which strictly generalizes the difference-in-differences specification in equation (1), is

$$\ln s_{ft} = \sum_{j=-6}^{+6} \beta_j^{RF} [\tilde{\varphi}_f \mathbf{1}(t - \tilde{t}_f = j)] + \Gamma X_{ft} + \lambda_f + v_{it} + \epsilon_{ft}. \quad (2)$$

The estimates of β_j^{RF} measure the difference in employment growth for parent firms in the same industry whose affiliates do and do not receive new BTTs, in year j before or after the BTT was implemented. To rule out potentially confounding pre-BTT trends in parent firm employment growth, we expect $\beta_j^{RF} \approx 0 \forall j < 0$. We focus on high-RID industries, since they exhibited substantial responses to BTTs in table 3. Figure 1 plots the estimated coefficients along with their 95% confidence intervals, with the year before BTT implementation ($j = -1$) as the omitted category, equal to 0. The coefficients on the pre-BTT $\hat{\beta}_j^{RF}$ are flat and nearly identical to 0, and there is no sign of pre-BTT differences in employment growth for firms that would and would not later be treated. Only in the period of BTT implementation and later do treated and nontreated firms' employment growth rates diverge, as indicated by the jump in period 0, in which the BTT was implemented, and growth in the effects over the subsequent years. These results are consistent with prior evidence that increased multinational activity occurs only after BTTs enter

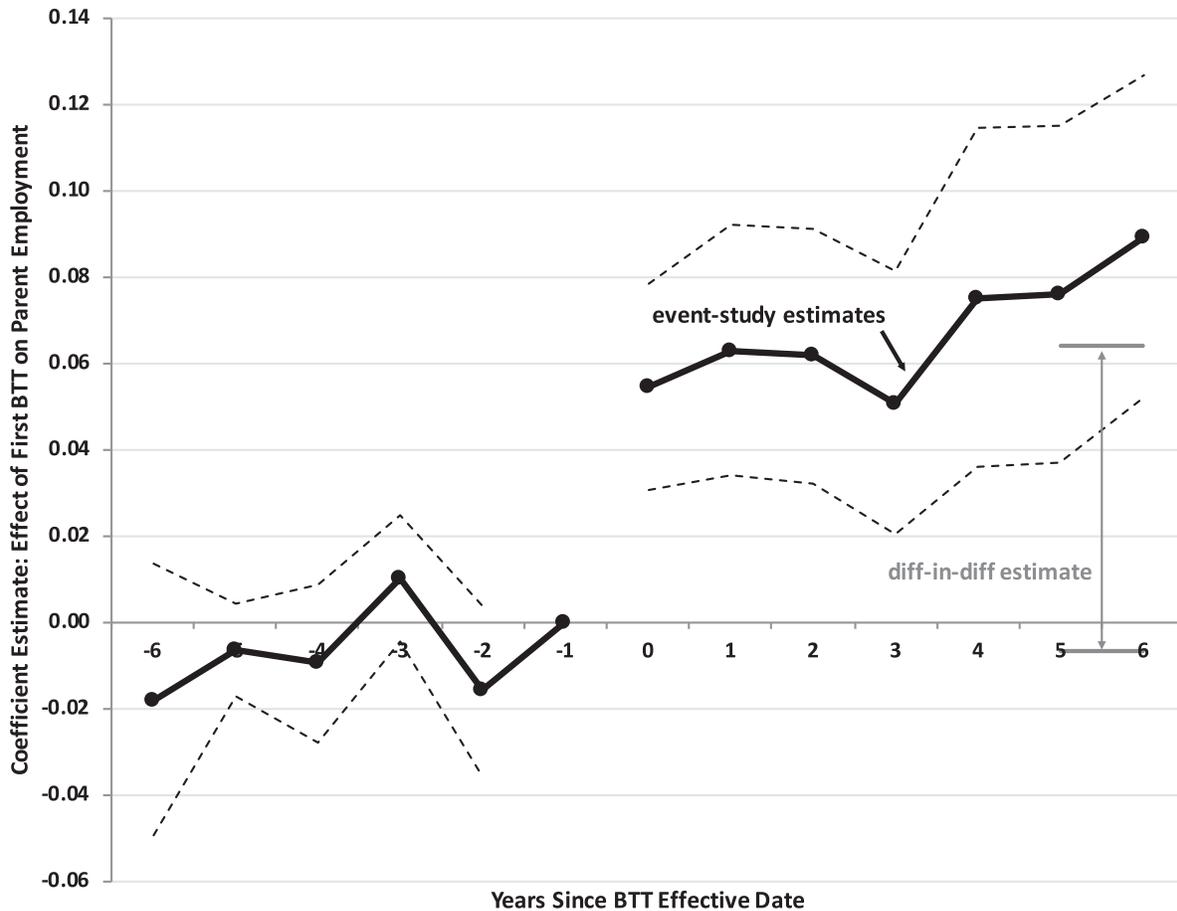
into force (Blonigen et al., 2014) and show that BTT assignment is uncorrelated with preexisting firm performance.¹⁹

Together, the results in this section show that decreasing effective tax rates on foreign affiliate activity by enacting a BTT increases employment at the U.S. parent firm. As we discuss in detail below, these positive estimates suggest that scale effects, in which lower costs drive increases in overall firm activity, outweigh substitution effects, in which firms shift activity toward the newly cheaper affiliate activities. Statistically and economically significant results appear for parents in high-RID industries, which benefit most from removing double taxation, while the effects in low-RID industries are indistinguishable from 0.

These findings support the notion that BTTs are exogenous to counterfactual firm employment growth in a variety of ways. The lack of confounding pre-BTT trends in parent employment rules out concerns in which firms that were experiencing stronger employment growth were systematically more likely to have affiliates receiving BTTs. Another potential concern is the presence of other time-varying confounders that are correlated with BTTs. A potential example is that some countries listed in table 1 (e.g., India) implemented other market-based policy reforms around the time their BTT entered into force, potentially confounding the effects of BTTs on employment growth. Unlike BTTs, broader market reforms should affect both high- and low-RID

¹⁹In appendix A.3 we implement two alternative versions of this parent-level reduced-form analysis. First, we remove the affiliate employment scaling factor, $\tilde{\varphi}_f$ and examine the effect of an average BTT irrespective of the relative size of the affected affiliate. Second, we utilize information on all new BTTs experienced by a parent firm's affiliates, not just the first one. In each case, we find results consistent with our preferred specification.

FIGURE 1.—EFFECT OF BTTs ON U.S. MULTINATIONAL FIRM EMPLOYMENT IN HIGH ROYALTY, INTEREST, AND DIVIDEND INDUSTRIES



Authors' calculations based on BEA Annual Surveys of U.S. Direct Investment Abroad 1987–2007. Sample restricted to firms in industries with high-RID payments to U.S. parent firms. Each point on the black line represents a coefficient estimate from the event study specification in equation (2). Dashed lines reflect 95% confidence intervals for these event-study estimates when clustering standard errors by both parent firm and year. Gray lines reflect the diff-in-diff estimate described in equation (1), located so the lower line corresponds to the average of pre-BTT event study coefficients. Both specifications include firm and industry \times time fixed effects and a full set of controls, as in column 5 of table 3.

industries, so the lack of any observed effect of BTTs in low-RID industries rules out substantial confounding from simultaneous policy reforms. In the following section, we similarly find that BTTs have no effect on affiliate employment in low-RID industries. As Angrist and Pischke (2009) argue, the lack of reduced-form (parent) effect in a subsample with no first-stage (affiliate) effect helps reinforce the idea that BTTs satisfy the exclusion restriction required for the IV analysis in the following section.

IV. Effects of Offshoring on Domestic Employment

We now turn to studying the more general question of how changes in foreign affiliate hiring affect domestic employment at multinational parent firms and in the broader U.S. labor market. Although this question has been the subject of prior research and is of interest to policymakers, it is difficult to answer credibly due to the inherent simultaneity between offshore and domestic activity.

A. Theoretical Framework

We utilize the Antràs and Helpman (2004) global sourcing model to motivate an estimation strategy using BTTs to resolve this simultaneity problem. This particular model suits our context for three reasons. First, it defines the boundary of the firm in an environment with incomplete contracts, allowing us to characterize how the effects of offshoring vary across firms with different organizational forms. Since BTTs only influence effective tax rates for integrated multinationals (not those transacting at arm's length), the firm boundary distinction is essential. Second, by specifying each agent's bargaining position, the framework describes the economic division of revenue across tax jurisdictions, thereby characterizing the respective tax liabilities, and subsequently the potential for double taxation. Finally, the model explicitly characterizes the simultaneity of parent and offshore affiliate employment, yielding a system of linear simultaneous equations justifying a panel difference-in-differences research design using variation in BTTs as an instrument for affiliate employment.

Fundamentals. The world economy consists of one home country and C foreign countries. Consumers in all countries are laborers with identical quasi-linear preferences over a homogeneous good, x_{i0} , and a series of composite goods, X_{ti} , across industries $i = 1, \dots, I$, given by $U_i = x_{i0} + \frac{1}{\mu} \sum_{i=1}^I X_{ti}^\mu$, with $0 < \mu < 1$. Consumers have constant elasticity of substitution preferences over unique varieties, f , among the set F_{ti} of varieties available in industry i and period t specified as $X_{ti} = [\int_{f \in F_{ti}} x_{ti}(f)^{\alpha_i} df]^{1/\alpha_i}$, with $0 < \alpha_i < 1$. It follows that within each period, monopolistically competitive firms, each producing a unique variety, f , face an inverse demand function $p_{ti}(f) = X_{ti}^{\mu-\alpha_i} x_{ti}(f)^{\alpha_i-1}$.

Labor is the only factor of production, with a perfectly elastic supply in all countries. Let ω be the wage in the home country and w_c be the wage in each foreign country with $\omega > w_c$. Workers may either perform headquarters services, s , or assembly, m , in producing the variety of the final good sold by the firm. Each worker can provide a single unit of headquarters services or assembly services, and the final product for each firm is delivered to consumers by combining headquarters services and assembly according to

$$x_{ti}(f) = \theta(f) \left[\frac{s_t(f)}{\eta_i} \right]^{\eta_i} \left[\frac{m_{ct}(f)}{1-\eta_i} \right]^{1-\eta_i}, \quad (3)$$

where $\theta(f)$ is a firm-level productivity parameter. Headquarters services, $s_t(f)$, can only be performed domestically, while assembly can take place domestically or at factories in any country $c \in C$.²⁰ Regardless of where assembly occurs, the process is firm specific.

Offshoring and double taxation in integrated multinationals. Firms face an inability to write ex ante enforceable contracts over the delivery of specialized inputs like R&D, design, marketing, or the specific processes used during assembly at the factory. Instead, the parent firm and affiliate engage in Nash bargaining over the surplus from their relationship after goods are sold. A multinational enterprise comprises a parent firm that supplies headquarters services and integrates with its offshore assembly factory, giving the parent the right to seize outputs from the affiliate after they are produced. However, in the case of seizure, the parent loses a share $(1 - \delta_c) \in (0, 1)$ of final output, which can vary by the location of offshore assembly c . The parent's outside option is therefore to seize the goods produced and sell them directly, receiving only a proportion $\delta_c^{\alpha_i}$ of the revenue that would result had the parent not exercised its rights to claim the assembled output. Thus, the surplus generated by cooperation between the parent and affiliate is a fraction $(1 - \delta_c^{\alpha_i})$ of total revenue. The parent company receives a fraction β of this surplus, with the remainder going to the foreign affiliate supplier.

The parent's problem is therefore to choose its employment, equivalent to choosing its production of headquarters services $s_t(f)$, in order to maximize its profits:

$$\max_{s_t(f)} [\delta_c^{\alpha_i} + \beta(1 - \delta_c^{\alpha_i})] r_{ti}(f) - \omega s_t(f), \quad (4)$$

where revenue is $r_{ti}(f) = \theta(f)^{\alpha_i} X_{ti}^{\mu-\alpha_i} \left[\frac{s_t(f)}{\eta_i} \right]^{\alpha_i \eta_i} \left[\frac{m_{ct}(f)}{1-\eta_i} \right]^{\alpha_i(1-\eta_i)}$. The corresponding problem for the affiliate performing assembly in foreign location c is

$$\max_{m_{ct}(f)} [(1 - \beta)(1 - \delta_c^{\alpha_i})] r_{ti}(f) - \tau_{cti} w_c m_{ct}(f). \quad (5)$$

The term $\tau_{cti} \geq 1$ is our addition to the Antràs and Helpman (2004) model, reflecting the possibility that the multinational firm faces double taxation. We model double taxation such that the affiliate must hire $\tau_{cti} > 1$ workers to provide one unit of assembly services. The next section discusses the motivation for and implications of assuming that the incidence of double taxation falls on the affiliate while leaving the parent's problem unchanged. Note that τ_{cti} may vary by affiliate country, year, and industry, capturing variation in the timing and presence of BTTs with particular countries, and the fact that the incidence of double taxation is greater in industries with more reliance on royalties, interest, and dividend payments.

Labor demand within multinational firms. A parent firm solves equation (4) by choosing its employment, $s_t(f)$, given its affiliate's employment, $m_{ct}(f)$. This yields the following best-response function for the parent:

$$\ln s_t(f) = \ln \eta_i + \frac{\left(\ln [\delta_c^{\alpha_i} + \beta(1 - \delta_c^{\alpha_i})] + \ln \alpha_i - \ln \omega \right) + \alpha_i [\ln \theta(f) - (1 - \eta_i) \ln(1 - \eta_i)]}{1 - \alpha_i \eta_i} - \frac{\alpha_i - \mu}{1 - \alpha_i \eta_i} \ln X_{ti} + \frac{\alpha_i(1 - \eta_i)}{1 - \alpha_i \eta_i} \ln m_{ct}(f). \quad (6)$$

Similarly, an affiliate in country c solves equation (5) by choosing its employment, $m_{ct}(f)$, given its parent's employment, $s_t(f)$, yielding its best-response function:

$$\ln m_{ct}(f) = \ln(1 - \eta_i) + \frac{\left(\alpha_i [\ln \theta(f) - \eta_i \ln \eta_i] + \ln(1 - \delta_c^{\alpha_i}) \right) + \ln(1 - \beta) + \ln \alpha_i - \ln w_c}{1 - \alpha_i(1 - \eta_i)} - \frac{\alpha_i - \mu}{1 - \alpha_i(1 - \eta_i)} \ln X_{ti} + \frac{\alpha_i \eta_i}{1 - \alpha_i(1 - \eta_i)} \ln s_t(f) - \frac{1}{1 - \alpha_i(1 - \eta_i)} \ln \tau_{cti}. \quad (7)$$

We can more concisely express these two best-response functions by grouping terms together into firm-industry-country fixed effects, ψ_{fci} and ϕ_{fci} , and industry-year fixed effects,

²⁰For simplicity, we assume that domestic and offshore labor inputs are perfect substitutes in performing assembly. Muendler and Becker (2010) find that in the German context, they are substitutes, but imperfect ones.

ϑ_{ti} and ϕ_{ti} , yielding the following expressions:

$$\ln s_t(f) = \psi_{fci} + \vartheta_{ti} + \gamma \ln m_{ct}(f), \quad (8)$$

$$\ln m_{ct}(f) = \varphi_{fci} + \phi_{ti} + \zeta \ln s_t(f) - \nu \ln \tau_{cti}. \quad (9)$$

Equations (8) and (9) form a set of linear simultaneous equations for parent and affiliate employment, making clear the inherent challenge in estimating γ , the effect of affiliate employment on parent employment.²¹ Estimating equation (8) by OLS overstates the effect of affiliate employment on parent employment because of the simultaneity induced by equation (9), in which $\zeta > 0$.²² However, equations (8) and (9) also provide a solution to the simultaneity problem. Reductions in effective tax rates on offshore activity, τ_{cti} , shift out the affiliate employment profile in equation (9) while leaving the parent profile in equation (8) unchanged. Therefore, when analyzing the effect of affiliate employment on multinational parent employment, we utilize a panel difference-in-differences research design based upon equation (8) in which we instrument for affiliate employment using BTTs.²³

For this approach to succeed, τ_{cti} must be excluded from the parent's best-response function. In appendix B.1 we explicitly model BTT-induced reductions in withholding tax rates in the context of the U.S. corporate tax system. There, we show that if multinational parents insulate themselves from changes in double taxation by adjusting transfers between themselves and their affiliates, then the implementation of a new BTT satisfies the exclusion restriction. If instead new BTTs reduce the costs that both parents and affiliates face, the IV estimates will not entirely resolve the simultaneity issue. In that case, some portion of the upward bias will remain, and our estimates will reflect an upper bound on the true effect of affiliate employment on domestic employment. As discussed below, our results are less than one-third the magnitude of the most closely related estimates in the literature (Desai et al., 2009). Therefore, in spite of the potential theoretical concern regarding exclusion, our approach appears to substantially ameliorate the simultaneity issue in practice.

Industry labor demand. Total industry employment in the home country includes hiring for headquarters services s_t across all firms, along with domestic labor used in assembly, m_t , either in-house or at arm's length. Let O_{ti} be the set of firms in industry i that choose to offshore assembly within an affiliate in a foreign country during period t , while A_{ti} is

the set of firms that source assembly services from an arm's-length provider in a foreign country. Likewise, let I_{ti} denote the set of nonmultinational firms that hire local workers in the home country to assemble output in-house, while U_{ti} is the set of firms that source assembly from local arm's-length providers in the home country. In total, domestic employment for industry i is given by

$$\begin{aligned} L_{ti} \equiv & \int_{f \in O_{ti} \subset F_{ti}} s_t(f) df + \int_{f \in A_{ti} \subset F_{ti}} s_t(f) df \\ & + \int_{f \in I_{ti} \subset F_{ti}} [m_{ct}(f) + s_t(f)] df \\ & + \int_{f \in U_{ti} \subset F_{ti}} [m_{ct}(f) + s_t(f)] df. \end{aligned} \quad (10)$$

Equation (10) shows that a decline in the effective cost of offshore activity resulting from a BTT ($d\tau_{cti} < 0$) may affect total industry employment, L_{ti} , in a variety of ways. First, existing integrated multinational firms (O_{ti}) will increase offshore employment with the decline in its effective cost, and this change will affect headquarters employment based on γ in equation (9). Based on the positive reduced-form results for continuing multinational firms discussed in section III, this intensive margin effect is likely to increase domestic employment. Other firms will change organizational form to become new integrated multinationals. If these firms had previously assembled goods domestically (I_{ti} or U_{ti}), this extensive margin shift will lower domestic employment (Boehm et al., 2017). We therefore expect to find more negative (less positive) domestic employment effects of increased offshore activity among firms opening new affiliates in BTT countries than among firms maintaining continuing affiliates. Finally, because the costs of production for integrated multinationals fall, other firms face stiffer competition in product markets and may contract as a result (Groizard, Ranjan, & Rodriguez-Lopez, 2015). Given the various positive and negative components, the overall effect on industry employment may be positive or negative. We therefore empirically examine both the overall effect on industry employment along with separate effects for existing multinationals, for firms opening new affiliates in BTT countries, and for nonmultinationals, confirming the heterogeneity in effects just described.

B. Empirical Analysis

The effect of BTTs on foreign affiliate employment. Solving the system in equations (9) and (8) yields a first-stage estimating equation for the effect of BTTs on foreign affiliate employment:

$$\ln m_{at} = \beta^A BTT_{ct} + \Gamma X_{at} + a_a + b_{ti} + \epsilon_{at}. \quad (11)$$

Affiliates are defined by their parent f , in country c , and industry i , which we consolidate with one subscript a

²¹Given a Cobb-Douglas production function, $\gamma = \alpha_i(1 - \eta_i)/(1 - \alpha_i\eta_i) > 0$. In appendix B.2, we examine a more general model in which production is CES and show that γ can generally be positive or negative.

²²The sign of additive simultaneity bias is given by the sign of ζ as long as condition $\gamma\zeta < 1$ is satisfied. This condition is necessary for the existence of equilibrium and is satisfied in our context, since $0 < \alpha_i, \eta_i < 1$.

²³An alternative approach to our empirical strategy is to exploit the variation in the changes in individual tax rates across countries shown in table 1. We prefer the binary treatment indicator as it is the most conservative and transparent approach, but the results (available in appendix A.4) are unaffected when we scale the BTT indicator according to country-specific changes in withholding tax rates.

TABLE 4.—FOREIGN AFFILIATE-LEVEL ANALYSIS: THE EFFECT OF BTTs ON OFFSHORE EMPLOYMENT

Sample	Dependent Variable: Log Affiliate Employment— $\ln(m_{at})$					
	(1) All	(2) High RID	(3) Low RID	(4) All	(5) High RID	(6) Low RID
BTT	0.232*** (0.066)	0.461*** (0.077)	−0.022 (0.086)	0.132* (0.072)	0.338*** (0.083)	−0.089 (0.088)
$\ln(GDP_{us} + GDP_d)$				7.062** (3.129)	6.658* (3.451)	7.331*** (2.800)
$\ln(GDP_{us} - GDP_d)^2$				0.480* (0.264)	0.512* (0.286)	0.416* (0.244)
$\ln(\text{Skill Difference})$				−0.185* (0.095)	−0.173* (0.102)	−0.195** (0.087)
$\ln(\text{Trade Costs})$				0.031 (0.034)	0.029 (0.036)	0.033 (0.032)
BIT				−0.548** (0.258)	−0.528* (0.279)	−0.566** (0.240)
FTA				0.016 (0.105)	0.075 (0.099)	−0.05 (0.112)
Exchange Rate				−0.00002 (0.000)	−0.00003 (0.000)	−0.00001 (0.000)
Parent-Sibling BTTs				−0.044* (0.026)	−0.046** (0.021)	−0.044 (0.033)
Affiliate-Sibling BTTs				0.133* (0.075)	0.173** (0.081)	0.083 (0.090)
Affiliate FE	YES	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES	YES
<i>N</i>	342,239	197,116	145,123	342,239	197,116	145,123
<i>R</i> -squared	0.0014	0.0047	0.0001	0.0131	0.015	0.0145
<i>F</i> -Statistic	12.47	35.58	0.06	7.31	24.31	4.12

Documents the effect of newly signed bilateral tax treaties (BTTs) on foreign affiliate employment. “High RID” and “Low RID” refer to firms within industries that exhibit ratios of total payments in royalties, interest, and dividends relative to total industry sales that are above and below the median sector (see appendix A.2 for details). Sample covers 1987 to 2007. Standard errors clustered by both affiliate country and year are in parentheses. Significant at *10%, **5%, and ***1%.

indicating an individual affiliate.²⁴ The term m_{at} is employment for affiliate a , BTT_{ct} is an indicator for the presence of a BTT between the United States and affiliate country c in year t , and X_{at} is a vector of controls. Affiliate and industry-year fixed effects are given by a_a and b_{ti} , respectively, and ϵ_{at} is an error term. We two-way-cluster standard errors by affiliate country and by year. The coefficient of interest is β^A , reflecting the difference in employment growth for affiliates in the same industry, located in countries that do and do not receive BTTs during our sample period. BTTs lower the effective cost of offshore activity for MNEs, so we expect $\beta^A > 0$ with effects appearing primarily in industries with high RID payments from foreign affiliates to parent firms.

Table 4 reports the results of estimating equation (11). In column 1, we include all affiliates and find a positive and statistically significant point estimate, indicating that affiliates in countries receiving a BTT expanded their employment more than other affiliates in the same industry. Columns 2 and 3 show that this positive effect is entirely driven by affiliates in high-RID industries, where BTTs are most likely to resolve double taxation. The effect in low-RID industries in column 3 is statistically indistinguishable from 0 and is economically small. Columns 4 to 6 introduce the standard controls discussed in section II, along with controls for BTTs in sibling

affiliate countries to control for potential spillovers across siblings. We define “Parent-Sibling BTTs” as the share of initial sibling affiliate employment covered by a BTT with the United States in year t and “Affiliate-Sibling BTT” as the share of initial sibling affiliate employment covered by a BTT between country c and the countries in which affiliate a has siblings. In both cases, using the initial shares of employment observed for each firm avoids allowing endogenous shifts in the affiliate weights to affect these controls. These controls have minimal effects on the coefficients of interest. The coefficient estimate of 0.338 in column 5 indicates that in high-RID industries, receiving a BTT increased affiliate employment by 40.2%, on average.²⁵

The results in table 4 imply that BTTs substantially increase affiliate employment by resolving double taxation, thereby lowering the effective tax rate on affiliate activity. This effect is only present in high-RID industries in which double taxation is most prevalent. Specification (11) represents the first stage of the instrumental-variables analysis in the following sections, and the first-stage partial F -statistics are large enough to rule out weak instruments concerns only in high-RID industries.²⁶ This means that BTTs provide a policy experiment for evaluating the effects of foreign affiliate employment on domestic employment, but only in

²⁵ $100 \times (\exp(0.338) - 1) = 40.2$

²⁴The BEA survey allows firms the option of aggregating sibling affiliates in the same industry and country when reporting, so we apply this aggregation to all firms for consistency.

²⁶Stock and Yogo (2005) report that in order to reject the null hypothesis that the actual size of a 5% test is greater than 10%, the first stage F -statistic must be greater than 16.38 in columns 1 to 3 and 22.30 in columns 4 to 6.

industries with high RID. For this reason, we focus on high-RID industries in the instrumental-variables analyses in the following sections. We also note that for the subsample of low-RID industries in which we have no first-stage relationship in table 4, we also have no reduced-form relationship in table 3. The fact that the reduced-form relationship is absent precisely when the first-stage relationship is absent helps rule out potential concerns regarding violations of the exclusion restriction when using BTTs as an instrument for foreign affiliate employment (Angrist & Pischke, 2009).

The effect of offshoring on multinational firm employment. We now utilize BTT-induced variation in foreign affiliate employment to measure its effect on domestic employment within U.S. multinational firms. Our objective is to estimate the following parent-level specification corresponding to equation (8),

$$\ln s_{ft} = \beta^P \ln M_{ft} + \Gamma X_{ft} + c_f + d_{it} + \epsilon_{ft}, \quad (12)$$

where s_{ft} is parent employment and $M_{ft} \equiv \sum_{a \in f} m_{at}$ is total affiliate employment for firm f .²⁷ X_{ft} is a vector of parent-level controls (described below), and c_f and d_{it} are firm and industry-year fixed effects. We two-way-cluster standard errors by parent and by year. The coefficient of interest, β^P , may be positive or negative, depending on whether scale effects or substitution effects dominate.

Because many parent firms have multiple affiliates, and the first-stage regression in equation (11) is at the affiliate level, we must aggregate the first-stage predicted values for affiliate employment up to the parent level. Aggregating the predicted values for $\ln m_{at}$ to predict $\ln M_{ft}$ involves a nonlinear transformation of random variables, and we perform the aggregation accounting for the sampling distribution of the affiliate-level predicted values.²⁸ This nonlinearity also implies that simply plugging the estimate $\widehat{\ln M_{ft}}$ into the second-stage regression in equation (12) is inappropriate. This would be an example of the so-called forbidden regression in which a nonlinear first-stage estimate is plugged into a linear second stage (Wooldridge, 2002; Angrist & Pischke, 2009). We follow Wooldridge (2002), procedure 18.1, estimating an IV regression for equation (12), with the predicted $\widehat{\ln M_{ft}}$ as an instrument for the observed $\ln M_{ft}$.²⁹ We must similarly aggregate the controls, X_{at} in equation (11), from the affiliate

to the parent level. We generate employment-weighted averages of the affiliate-level controls, using affiliate employment weights from the year before the parent's first affiliate receives a BTT ($\bar{i}_f - 1$).

Table 5 presents OLS and IV estimates of equation (12), measuring how changes in foreign affiliate employment affect employment at U.S. parent firms. Table 5 reports the first-stage partial F -statistics associated with Wooldridge (2002), procedure 18.1, but the appropriate F -statistics to consider when evaluating weak instruments concerns are those for the affiliate-level first stage in table 4.³⁰ Because we have a strong first-stage relationship between BTTs and foreign affiliate employment only within certain industries, we restrict our sample of parents in table 5 to those in high-RID industries.

Columns 1 and 2 of table 5 implement naive OLS regressions of domestic parent employment on total foreign affiliate employment. The very large positive correlation between parent and affiliate employment likely reflects upward simultaneity bias, as discussed in section IVA. The IV results in columns 3 and 4 confirm this point, finding much smaller point estimates and rejecting the equality of OLS and IV results at conventional levels. The IV coefficient on $\ln M_{ft}$ in column 4 is positive and statistically significant, suggesting that a 10% increase in foreign affiliate employment drives a 1.3% increase in domestic employment at the U.S. parent firm. As shown in column 5 of table 4, a new BTT increases employment at affected affiliates in high-RID industries by approximately 40.2%. Using the estimate from column 4 of table 5, this corresponds to about a 5.2% increase in domestic employment, or about 413 new U.S. workers for the average parent firm. The coefficients of interest in columns 3 and 4 are quite similar, indicating that our results are robust to including or excluding the controls, X_{ft} .

As mentioned in section IVA, our instrumental variables strategy requires that BTTs shift affiliates' best response functions while leaving those of parents unchanged. If this assumption is violated, the IV results in table 5 may retain some upward bias. Yet even in that case, the estimates remain informative. First, the IV estimates in columns 3 and 4 are significantly smaller than the OLS estimates in columns 1 and 2, implying that our IV strategy is substantively addressing the simultaneity between parent and affiliate employment. Second, the most closely related result in the prior literature is found in Desai et al. (2009), which reports an effect that is five times larger than our estimates in column 4 of table 5.³¹ Our estimates reflect an upper bound on the true effect of affiliate employment on parent employment, yet they are significantly below the OLS estimates and imply a much less positive effect than one would expect based upon prior work.

As discussed in section IVA, we expect the expansion of existing affiliates to increase domestic employment because parent firms benefit from scale effects when the effective

²⁷Recent work by Antràs et al. (2017) argues that the number of affiliates comprising a parent firm's total offshore employment likely influences the effects of offshore activity on parent firm productivity, which can subsequently affect the employment effects we estimate here. We are abstracting from this mechanism.

²⁸This procedure is known as "smearing" and addresses issues similar to Jensen's inequality. Our main results use a parametric smearing approach assuming normally distributed errors (see appendix B.3), but a nonparametric version based on Duan (1983) and a naive plug-in estimate both yield similar results.

²⁹Note that the parent-level IV standard errors are accurate in spite of the affiliate-level instrument generation procedure that precedes it (Wooldridge, 2002).

³⁰Large F -statistics are common when implementing Wooldridge (2002), procedure 18.1.

³¹See table 5, column 4 in Desai et al. (2009).

TABLE 5.—U.S. PARENT-LEVEL ANALYSIS: THE EFFECT OF OFFSHORE EMPLOYMENT ON DOMESTIC MNE EMPLOYMENT

Specification Sample	Dependent Variable: Log Parent Employment— $\ln(s_{ft})$					
	(1) OLS All	(2) OLS All	(3) IV All	(4) IV All	(5) IV New Aff	(6) IV Cont Aff
log affiliate employment: ($\ln M_{it}$)	0.289*** (0.017)	0.263*** (0.017)	0.174*** (0.017)	0.130*** (0.015)	0.103 (0.116)	0.139*** (0.016)
$\ln(GDP_{us} + GDP_d)$		-0.039 (0.126)		0.006 (0.092)	-0.331 (0.366)	-0.004 (0.088)
$\ln(GDP_{us} - GDP_d)^2$		-0.006 (0.064)		-0.007 (0.047)	0.148 (0.189)	-0.001 (0.045)
$\ln(\text{Skill Difference})$		-0.167*** (0.057)		-0.097** (0.044)	0.093 (0.106)	-0.118** (0.047)
$\ln(\text{Trade Costs})$		0.005 (0.018)		-0.017 (0.013)	0.017 (0.035)	-0.02 (0.014)
BIT		-0.473* (0.25)		-0.432** (0.167)	-0.335 (0.208)	-0.460** (0.201)
FTA		-0.016 (0.082)		-0.004 (0.048)	0.083 (0.125)	-0.009 (0.053)
Exchange Rate		-0.000 (0.000)		-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Parent FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
N	29,765	29,765	29,765	29,765	6,077	23,688
R -squared	0.1865	0.2189	0.1406	0.1581	0.3536	0.1663
First-Stage F -Statistic	—	—	508.14	413.36	117.5	402.53
Endogenous Test p -Value	—	—	0.0017	0.0019	0.0022	0.0015

Documents the effects of BTT-induced changes in foreign-affiliate employment on domestic employment of multinational firms in industries that exhibit high ratios of royalty, interest, and dividend payments relative to total industry sales. Columns 5 and 6 respectively restrict the sample to parent firms that did and did not open new affiliates in countries newly receiving a BTT. First-stage F -statistics are large for all IV specifications, though the relevant F -statistics for weak-instrument concerns appear in columns 2 and 5 of table 4 (see text for discussion). In all IV specifications, the equality of OLS and IV is rejected. Sample covers 1987–2007. Standard errors clustered by parent firm and year are in parentheses. Significant at *10%, **5%, and ***1%.

cost of their offshore activity falls with a BTT. However, extensive margin effects, in which firms shift activity from domestic to offshore locations, may decrease domestic employment within the U.S. parent firm. Although we cannot observe employment for newly formed multinational firms before they begin offshoring, we can examine effects for continuing multinationals that open or acquire new affiliates in BTT countries during our sample period. We expect the domestic employment growth to be less positive for these firms exhibiting extensive margin offshoring. This is precisely what we find in columns 5 and 6 of table 5. When restricting attention to multinationals opening new affiliates in BTT countries (column 5), the effect on domestic employment is not statistically significant, while larger statistically significant effects appear for multinationals that exhibit only intensive margin behavior (column 6).

Industry-level effects of offshoring. We now address the employment effects of offshoring on overall industry employment in the United States. This broader analysis allows us to capture two margins that are absent when examining multinational firms alone. First, the changes in employment at multinational parents may be partly offset by equilibrium employment adjustment at other domestic firms in the industry. Second, declining costs of offshore activity will likely motivate some firms to become multinational firms by opening new affiliates. Both of these margins contribute to industry-level employment responses. We measure U.S. industry employment using County Business Patterns data at the three-

digit SIC level and link to the BEA International Surveys Industry (ISI) classification, resulting in 61 consistently identifiable high-RID industries. Even though we only consider industries with high RID payments, these industries employ an average of about 111 million U.S. workers annually in our sample.

We study the relationship between log domestic employment and log total affiliate employment at the industry level using the following specification,

$$\ln L_{it} = \beta^I \ln M_{it} + \Gamma X_{it} + f_i + g_t + \epsilon_{it}, \quad (13)$$

where L_{it} is total domestic employment in industry i in year t , M_{it} is total foreign affiliate employment in the industry, and f_i and g_t are industry and year fixed effects, respectively. We calculate two-way clustered standard errors by industry and year. As with the parent-level regressions, we aggregate from the affiliate level to the industry level, taking care to address the nonlinearity of the aggregation. We then instrument for observed log industry affiliate employment $\ln M_{it}$, using predicted log industry affiliate employment $\widehat{\ln M_{it}}$. Because the increases in employment within continuing multinational firms may be partly or entirely offset by reductions in employment at newly offshoring firms or competing domestic firms, the estimate of β^I may be positive or negative.

Table 6 shows the relationship between U.S. employment and offshore affiliate employment at the industry level. Columns 1 and 2 present the OLS results, and columns 3 and 4 show the instrumental variables results. As in the multinational parent-level analysis, the estimates are positive,

TABLE 6.—U.S. INDUSTRY-LEVEL ANALYSIS: THE EFFECT OF OFFSHORE EMPLOYMENT ON U.S. INDUSTRY EMPLOYMENT

Specification	Dependent Variable: Log Industry Employment— $\ln(L_{it})$			
	(1) OLS	(2) OLS	(3) IV	(4) IV
log affiliate employment: ($\ln M_{it}$)	0.013*** (0.005)	0.011** (0.005)	0.006** (0.003)	0.006** (0.003)
$\ln(GDP_{us} + GDP_d)$		-0.062 (0.094)		-0.017 (0.06)
$\ln(GDP_{us} - GDP_d)^2$		0.023 (0.048)		0.006 (0.018)
$\ln(\text{Skill Difference})$		0.029 (0.046)		0.01 (0.017)
$\ln(\text{Trade Costs})$		0.031** (0.014)		0.011** (0.005)
BIT		-0.019 (0.056)		-0.006 (0.021)
FTA		0.036 (0.043)		0.013 (0.016)
Exchange Rate		-0.000 (0.000)		-0.000 (0.000)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	1,268	1,268	1,268	1,268
R -squared	0.4836	0.5309	0.4821	0.5292
First-Stage F -Statistic	—	—	234.99	208.2
Endogenous Test p -Value	—	—	0.0213	0.0225

Documents the effects of BTT-induced changes in foreign-affiliate employment at the industry level for industries that exhibit high ratios of royalty, interest, and dividend payments relative to total industry sales. First-stage F -statistics are large for all IV specifications, though the relevant F -statistics for weak-instrument concerns appear in columns 2 and 5 of table 4 (see text for discussion). In all IV specifications, the equality of OLS and IV is rejected. Sample covers 1987–2007. Standard errors clustered by industry and year are in parentheses. Significant at *10%, **5%, and ***1%.

implying that the various margins just discussed combine to yield modest increases in domestic industry employment when affiliates of multinational firms in that industry experience BTT-induced reductions in the cost of foreign affiliate activity. The IV estimates are approximately half the size of the corresponding OLS estimates, confirming the importance of appropriately addressing the simultaneity issue. The IV estimates are small in magnitude and significant at the 5% level, suggesting that the negative effects from equilibrium adjustments to employment and any offshoring by new multinationals at the industry level offset much, but not all, of the gain in domestic employment within existing multinationals.

We observe total multinational employment in the BEA data, and then calculate nonmultinational employment as a residual, subtracting multinational employment from total industry employment measured using County Business Patterns data. Table 7, columns 1 and 2, show that domestic employment in multinational firms increases in response to growth in affiliate employment. This is simply the industry-level analogue of the parent-level effect in table 5. In contrast, the effects on industry-level nonmultinational employment in columns 3 and 4 are extremely small and statistically indistinguishable from 0, implying that nonmultinational firms do not share in the employment growth of multinational firms when the costs of offshore employment fall.

Table 8 adds nuance to these findings by considering the effects of increased foreign affiliate employment only for vertically oriented foreign affiliates—those with sales to their

TABLE 7.—U.S. INDUSTRY LEVEL ANALYSIS: THE EFFECT OF OFFSHORE EMPLOYMENT ON U.S. MNE VERSUS NON-MNE EMPLOYMENT

Specification Sample	Dependent Variable: Log Industry Employment— $\ln(L_{it})$			
	(1) IV MNE	(2) IV MNE	(3) IV non-MNE	(4) IV non-MNE
industry log affiliate employment: ($\ln M_{it}$)	0.042*** (0.005)	0.043*** (0.005)	0.0009 (0.004)	-0.001 (0.005)
$\ln(GDP_{us} + GDP_d)$		0.097 (0.093)		-0.036 (0.046)
$\ln(GDP_{us} - GDP_d)^2$		-0.048 (0.048)		0.015 (0.024)
$\ln(\text{Skill Difference})$		-0.06 (0.037)		0.015 (0.022)
$\ln(\text{Trade Costs})$		-0.006 (0.007)		0.011 (0.009)
BIT		0.047 (0.066)		-0.009 (0.026)
FTA		0.06 (0.036)		0.015 (0.016)
Exchange Rate		-0.00002 (0.000)		-0.00001 (0.000)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	1,268	1,268	1,268	1,268
R -squared	0.2678	0.3086	0.4244	0.4702
First-Stage F -Statistic	276.32	205.84	214.75	189.12
Endogenous Test p -Value	0.0089	0.0052	0.0198	0.0187

Documents the effects of BTT-induced changes in foreign-affiliate employment at the industry level for industries that exhibit high ratios of royalty, interest, and dividend payments relative to total industry sales. Columns 1 and 2 examine employment for multinational parents in the U.S. industry, while columns 3 and 4 examine all other employment in each industry. First-stage F -statistics are large for all IV specifications, though the relevant F -statistics for weak-instrument concerns appear in columns 2 and 5 of table 4 (see text for discussion). In all IV specifications, the equality of OLS and IV is rejected. Sample covers 1987–2007. Standard errors clustered by industry and year are in parentheses. Significant at *10%, **5%, and ***1%.

U.S. parent firm.³² We expect increased activity at vertically oriented affiliates to have more negative effects on domestic employment, since their activities are more likely to replace those of domestic suppliers of intermediate inputs. The effects on domestic employment in multinational firms, shown in columns 1 and 2, remain positive and statistically significant. However, increases in foreign affiliate employment among vertically oriented affiliates drive decreases in domestic employment among nonmultinational firms in the same industry. Although small, these employment decreases likely reflect a combination of shifts in sourcing away from domestic suppliers and competition from multinational firms enjoying decreased costs of affiliate activity following the implementation of a BTT.

Regional effects of offshoring. Finally, we measure the domestic employment effects of offshoring at the regional level. This perspective adds yet another margin of labor market adjustment to the analysis by including potential employment spillovers across industries in the same region. Our unit of analysis is the metropolitan area, and we use 304 time-consistent metro areas, constructed from underlying

³²Tables 7 and 8 show the only case in which the results for vertical affiliates qualitatively differ from those for all affiliates. Appendix A.5 reports all other results in the paper, restricting attention to vertically oriented foreign affiliates.

TABLE 8.—U.S. INDUSTRY-LEVEL ANALYSIS: THE EFFECT OF OFFSHORE EMPLOYMENT AT VERTICALLY ORIENTED AFFILIATES ON U.S. MNE VERSUS NON-MNE EMPLOYMENT

Dependent Variable: Log Industry Employment—ln(L_{it})				
Specification Sample	(1)	(2)	(3)	(4)
	IV V-MNE	IV V-MNE	IV Non-MNE	IV Non-MNE
industry log affiliate employment: ln(M_{it})	0.144*** (0.022)	0.143*** (0.022)	-0.016** (0.007)	-0.023*** (0.008)
ln($GDP_{us} + GDP_d$)		-0.373 (0.676)		-0.297 (0.299)
ln($GDP_{us} - GDP_d$) ²		0.207 (0.341)		0.143 (0.15)
ln(Skill Difference)		-0.416*** (0.135)		0.059 (0.117)
ln(Trade Costs)		-0.006 (0.034)		-0.001 (0.017)
BIT		-0.036 (0.257)		0.447*** (0.17)
FTA		-0.013 (0.151)		0.14 (0.090)
Exchange Rate		0.000 (0.000)		0.000 (0.000)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	1,217	1,217	1,217	1,217
R -squared	0.1535	0.1769	0.4529	0.5009
First-Stage F -Statistic	249.75	214.42	274.63	223.05
Endogenous Test p -Value	0.0093	0.0069	0.0194	0.0178

Documents the effects of BTT-induced changes in foreign-affiliate employment at foreign affiliates that have nonzero sales to their U.S. parent on domestic employment at the industry level for industries that exhibit high ratios of royalty, interest, and dividend payments relative to total industry sales. Columns 1 and 2 examine employment for multinational parents in the U.S. industry while columns 3 and 4 examine all other employment in each industry. First-stage F -statistics are large for all IV specifications, though the relevant F -statistics for weak-instrument concerns appear in columns 2 and 5 of table 4 (see text for discussion). In all IV specifications, the equality of OLS and IV is rejected. Sample covers 1987–2007. Standard errors clustered by industry and year are in parentheses. Significant at *10%, **5%, and ***1%.

county-level employment in the County Business Patterns data.³³ Our metro-area estimation equation is

$$\ln L_{mt} = \beta^M \ln M_{mt} + h_m + k_t + \epsilon_{mt}, \quad (14)$$

where L_{mt} is metro-area m employment in year t , and h_m and k_t are metro-area and year fixed effects. Standard errors are two-way clustered by metro area and year. Our regional measure of offshoring exposure, M_{mt} , is a weighted average of industry-level foreign affiliate employment. We construct industry-level foreign affiliate employment as described above, and the industry weights reflect the distribution of employment across covered industries in 1986, just before the start of our main analysis sample: $M_{mt} \equiv \sum_i \sigma_{mi}^{1986} M_{it}$ where $\sigma_{mi}^{1986} \equiv L_{mi}^{1986} / \sum_i L_{mi}^{1986}$. This measure captures each metro area m 's exposure to foreign affiliate employment, following a procedure similar to Topalova (2010), Autor et al. (2013), Kovak (2013), and others. We generate an instrument for $\ln M_{mt}$ by constructing an otherwise identical measure that replaces observed industry affiliate employment, M_{it} , with predicted industry affiliate employment, \hat{M}_{it} , as in the industry-level analysis.

³³In order to maintain confidentiality, in small counties the CBP data report employment ranges rather than precise employment counts. Appendix A.6 describes our approach to imputing these values and presents similar results treating suppressed values as zeros.

TABLE 9.—U.S. METRO-AREA-LEVEL ANALYSIS: THE EFFECT OF OFFSHORE EMPLOYMENT ON U.S. REGIONAL EMPLOYMENT

Dependent Variable: Log Regional Employment—ln(L_{mt})				
Specification	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
regional log affiliate employment: ln(M_{mt})	0.035*** (0.008)	0.033*** (0.008)	0.018*** (0.004)	0.017*** (0.004)
ln($GDP_{us} + GDP_d$)		-0.756** (0.343)		-0.326** (0.152)
ln($GDP_{us} - GDP_d$) ²		0.365** (0.173)		0.158** (0.077)
ln(Skill Difference)		0.209 (0.129)		0.094 (0.057)
ln(Trade Costs)		0.058 (0.060)		0.022 (0.026)
BIT		0.077 (0.289)		0.030 (0.127)
FTA		0.010 (0.091)		0.003 (0.040)
Exchange Rate		-0.0009 (0.001)		-0.0004 (0.000)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	6,080	6,080	6,080	6,080
R -squared	0.7312	0.7377	0.7308	0.7374
First-Stage F -Statistic	—	—	165.96	171.84
Endogenous Test p -Value	—	—	0.0205	0.0249

Documents the effects of BTT-induced changes in foreign-affiliate employment on domestic employment at the region level. First-stage F -statistics are large for all IV specifications, though the relevant F -statistics for weak-instrument concerns appear in columns 2 and 5 of table 4 (see text for discussion). In all IV specifications, the equality of OLS and IV is rejected. Sample covers 1987 to 2007. Standard errors clustered by parent firm and year are in parentheses. Significant at *10%, **5%, and ***1%.

Table 9 shows the region-level results, with OLS estimates in columns 1 and 2 and IV estimates in columns 3 and 4. As with the aggregate industry-level results, the relationship between offshoring and employment is positive, and the IV estimates are smaller than the OLS results. The estimate in column 4 implies that a metro area whose industries experience on average a 10% increase in affiliate employment exhibit a 0.17% increase in metro-area employment. While this is a modest positive effect, it is larger in magnitude than the industry-level results in table 6, suggesting the possibility of cross-industry spillovers between industries directly affected by offshoring and other industries in the region that are indirectly affected by changes in local economic conditions.

V. Conclusion

The consequences of ever rising levels of offshoring activity by U.S. multinational firms are consistently a source of debate for both the public and policymakers. However, among other challenges, the fact that offshore hiring and domestic employment are determined simultaneously has made it difficult for economists to provide clear answers about the relationship between the two. We contribute to this discussion by providing estimates that rely on relevant and exogenous variation in offshoring costs, allowing us to infer the causal implications of greater offshore employment for U.S. labor market outcomes. We provide clear evidence that changes in the global tax structure influence the hiring activity of U.S. multinational firms both domestically and abroad,

with spillover effects to regional U.S. employment outcomes. These changes in hiring activity demonstrate how shifts in global tax structure can alter the geographic distribution of economic activity both across and within national borders.

Our results also highlight important nuances in the effects of various international economic activities, demonstrating that the effects of offshoring differ across firms' organizational structures and across different margins of offshoring activities. Within existing multinationals, a fall in the cost of offshoring has a net positive effect on U.S. hiring. However, when the costs of offshore activity fall, some firms may alter their global sourcing strategies and begin to substitute offshore facilities for activities that had previously been completed locally. This substitution can adversely affect employment outcomes for U.S. workers. Among multinational firms that open new affiliates in countries that realize lower offshoring costs, we find that domestic employment responds only modestly to BTTs, suggesting that positive scale effects are largely offset by negative substitution effects in these firms.

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