

Domestic Effects of the Foreign Activities of U.S. Multinationals

Mihir A. Desai
Harvard University and NBER

C. Fritz Foley
Harvard University and NBER

James R. Hines Jr.
University of Michigan and NBER

May 2008

The statistical analysis of firm-level data on U.S. multinational companies was conducted at the International Investment Division, Bureau of Economic Analysis, U.S. Department of Commerce under arrangements that maintain legal confidentiality requirements. The views expressed are those of the authors and do not reflect official positions of the U.S. Department of Commerce. The authors thank Alan Auerbach, Kevin Hassett, Bill Zeile, the referees, and various seminar participants for helpful comments, and the Division of Research at Harvard Business School for financial support.

Domestic Effects of the Foreign Activities of U.S. Multinationals

ABSTRACT

Do firms investing abroad simultaneously reduce their domestic activity? This paper analyzes the relationship between the domestic and foreign operations of American manufacturing firms between 1982 and 2004 by instrumenting for changes in foreign operations with GDP growth rates of the foreign countries in which they invest. Estimates produced using this instrument indicate that 10% greater foreign investment is associated with 2.6% greater domestic investment, and 10% greater foreign employee compensation is associated with 3.7% greater domestic employee compensation. These results do not support the popular notion that expansions abroad reduce a firm's domestic activity, instead suggesting the opposite.

JEL Classifications: F230, F210, H250.

Mihir A. Desai
Harvard Business School
Baker 265
Soldiers Field
Boston, MA 02163
mdesai@hbs.edu

C. Fritz Foley
Harvard Business School
Baker 235
Soldiers Field
Boston, MA 02163
ffoley@hbs.edu

James R. Hines Jr.
Department of Economics
University of Michigan
611 Tappan Street
Ann Arbor, MI 48109-1220
jrhines@umich.edu

1. Introduction

There is considerable debate over the likely domestic effects of the rapidly increasing foreign activity by U.S. multinational firms. In particular, flows of foreign direct investment (FDI) to rapidly growing foreign markets generate fears that such investment displaces domestic employment, capital investment, and tax revenue. An alternative perspective suggests that growing foreign investment may instead increase levels of domestic activity by improving the profitability and competitiveness of domestic operations as firms expand globally. Very little empirical evidence is currently available with which to distinguish these views.

The effect of increased foreign activity by U.S. multinational firms on their own domestic operations turns on production and cost considerations that might take any of a number of forms.¹ One possibility is that a multinational firm's total worldwide production level is approximately fixed, being determined by resource limits, capacity constraints, or market competition. Given that foreign and domestic factors of production are conditional substitutes, any additional foreign production then necessarily reduces domestic production, hence foreign and domestic investment levels will be negatively correlated. Alternatively, the level of total production might not be fixed, but it instead may be responsive to profit opportunities that are influenced by economic growth rates. In such a framework it is possible that increases in FDI raise the return to domestic production, stimulating domestic factor demand and domestic output. Firms might, for example, find that foreign operations provide valuable intermediate inputs at low cost, or that foreign affiliates serve as ready buyers of tangible and intangible property produced in the United States.

This paper evaluates the extent to which increased foreign activity by U.S. manufacturing firms influenced their domestic activities between 1982 and 2004. This exercise employs confidential affiliate-level information on the activities of U.S. manufacturing firms collected by the Bureau of Economic Analysis (BEA). These data permit individual foreign operations to be matched to the domestic activities of the same firms; as a result, it is possible to measure the extent to which expansions in foreign business activity coincide with changes in domestic

¹ The text uses "domestic" to refer to the U.S. activities of U.S. multinational firms, and "foreign" to refer to the non-U.S. activities of the same companies.

activity. The evidence indicates that there is a strong positive correlation between the domestic and foreign activity levels of multinational firms.

The fact that foreign and domestic operations are jointly determined makes this evidence difficult to interpret. Investment and desired output are functions of many variables that influence firm profitability, some of which are inevitably omitted from any empirical analysis, and these omissions may themselves induce positive or negative correlations between foreign and domestic activities. For example, the discovery of a new drug by a pharmaceutical company may be manifest in coincident positive growth of activity both abroad and at home. Alternatively, real exchange rate movements may make it more profitable for an American firm to produce in foreign locations and less profitable to produce in the United States, thereby encouraging the firm to expand its foreign activities and reduce its domestic activities more or less simultaneously, even though the foreign activities and domestic activities are unrelated.

Since the locations of foreign investments differ significantly between firms, it is possible to construct firm-specific weighted averages of foreign GDP growth. These firm-specific foreign economic growth rates can be used to generate predicted growth rates of foreign activity that are then employed to explain changes in domestic activity. This empirical procedure effectively compares two U.S. firms, one whose foreign investments in 1982 were, for example, concentrated in Britain, and another whose foreign investments were concentrated in France. As the British economy subsequently grew more rapidly than the French economy, the firm with British operations should exhibit more rapid growth of foreign investment than would the firm with French operations. If the domestic activities of the firm with British operations grow at different rates than the domestic activities of the firm with French operations, it may then be appropriate to interpret the difference as reflecting the impact of changes in foreign operations.

Weighted foreign economic growth rates are strong predictors of subsequent foreign investment by U.S. firms. Foreign growth rates predict increases in foreign investment by firms with foreign operations that are focused on serving host country markets and also by firms with foreign operations that are export oriented. This second pattern suggests that foreign economic growth rates do not merely capture changes in host country demand but also reflect changing economic opportunities from movements in real input costs due to productivity gains or other

changes. As such, the instrumental variables analysis is relevant not only for studying foreign investment directed at serving host country markets but also for studying foreign investment that produces output for other markets.

Second stage equations based on predictions that use foreign economic growth rates to instrument for changes in foreign activity imply that 10 percent greater foreign capital investment triggers 2.6 percent of additional domestic capital investment, and that 10 percent greater foreign employee compensation is associated with 3.7 percent greater domestic employee compensation. There are similar positive relationships between foreign and domestic changes in assets, and numbers of employees.²

There are several channels through which foreign activities can influence the scope of domestic operations, including cases in which foreign production requires inputs of tangible or intellectual property produced in the home country. The same instrumental variables method used to identify the effect of foreign investment on domestic investment can also be used to identify the effect of foreign investment on other types of domestic activity. The estimates indicate that greater foreign activity is associated with higher exports from U.S. parent companies to their foreign affiliates and is also associated with greater domestic R&D spending.

The positive association between changes in foreign and domestic activities persists in supplemental specifications designed to address alternative interpretations of the main results. The use of weighted foreign economic growth rates as instruments for changes in foreign investment has the potential to produce misleading results if the foreign investments of firms planning rapid expansion of domestic investment are disproportionately attracted to economies expected to grow rapidly. To address this possibility, the residuals from regressing foreign GDP growth against lagged GDP growth can be used instead of actual GDP growth in explaining foreign investment; this substitution produces very similar results.

² The example of one large American multinational firm illustrates the relationships manifest in the large-sample evidence. Between 2000 and 2006, Caterpillar increased its foreign employment by 49%, to the point that foreign employment constituted half of its total global employment. Over this period, Caterpillar's U.S. exports, a fraction of which were sent to its foreign affiliates, grew by 104%, and its U.S. employment grew by 29%. While it is difficult to draw causal inferences from the experiences of individual companies, this example illustrates that foreign operations need not divert domestic activity.

In order to avoid the possibility that industry-specific shocks might produce a correlation of foreign and domestic investment growth rates, the regressions reported in the paper include fixed effects for each two-digit parent industry in each year. BEA industry classifications are similar in scope to SIC industry classifications. Furthermore, the use of a larger set of year-specific three-digit industry fixed effects does not change the results. Alternatively, if firms export to unaffiliated customers, and invest in, the same countries, foreign economic growth rates might directly stimulate export-oriented domestic activity. This can be controlled for by including an additional variable equal to export-weighted foreign economic growth, which again does not alter the results. Finally, there are circumstances in which real exchange rate movements that are correlated with economic growth rates might independently influence both foreign and domestic activity, but replicating the analysis with controls for firm-specific changes in foreign exchange rates yields similar answers.

These results carry implications for U.S. policies that influence the attractiveness of foreign investment to U.S. firms. A number of policies are based on the premise that greater foreign business activity, whatever its source, comes at the cost of reduced domestic activity. For example, recent proposals requiring U.S. firms to abide by U.S. labor and regulatory standards when operating abroad would increase costs of certain foreign activities in the hopes of making domestic operations more competitive. Those who advocate greater U.S. taxation of active foreign business income often do so in the belief that subjecting foreign business income to high rates of tax will stimulate demand for domestic factors of production. While plausible, and perhaps intuitive, the premise motivating these policies appears to be inconsistent with the evidence presented in this paper. This, in turn, suggests that the conceptual framework used to evaluate policies might be due for revision, as discussed by Desai and Hines (2003) in the context of tax policy.

Previous studies report mixed results in analyzing the impact of foreign operations on domestic economic activity. Lipsey (1995) analyzes a cross-section of U.S. multinational firms, reporting a mild positive correlation between foreign production and domestic employment levels. Stevens and Lipsey (1992) analyze the investment behavior of seven multinational firms, concluding that investments in different locations substitute for each other due to costly external financing. The absence of compelling instruments that satisfy the necessary exclusion

restrictions complicate the interpretation of this evidence, a problem that likewise appears in studies of aggregate FDI and domestic investment. Feldstein (1995) analyzes decade-long averages of aggregate FDI and domestic investment in OECD economies, reporting evidence that direct investment abroad reduces domestic investment levels. Devereux and Freeman (1995) come to a different conclusion in their study of bilateral flows of aggregate investment funds between seven OECD countries, finding no evidence of tax-induced substitution between domestic and foreign investment, and Desai, Foley and Hines (2005a) report time series evidence that foreign and domestic investment are positively correlated for U.S. firms. Blonigen (2001) investigates the related question of whether foreign production by multinationals is a substitute or complement for exports, finding evidence for both effects. The effect of foreign operations on the domestic activities of multinational firms therefore remains an open question.³

Much of the recent theoretical and empirical work on multinational firms emphasizes alternative motivations for foreign direct investment⁴ or the reasons why alternative productive arrangements⁵ are employed. Specifically, Hummels, Ishii and Yi (2001), Yi (2003) and Hanson, Mataloni and Slaughter (2005) emphasize the importance of vertical specialization to international trade patterns and the expansion strategies of multinational firms. The findings of this research – that multinational firms exhibit high degrees of integrated production – are consistent with sizeable effects of foreign operations on domestic activity.

Section 2 of the paper sketches a simple framework for the analysis of growth-driven FDI on the domestic operations of multinational firms. Section 3 describes the available data on U.S. direct investment abroad. Section 4 presents empirical evidence of the determinants of foreign investment levels by U.S. firms, and the impact of foreign investment on economic activity in the United States. Section 5 is the conclusion.

³ Several studies, including Brainard and Riker (1997), Riker and Brainard (1997), Slaughter (2000), Feenstra and Hanson (1996, 1999) and Harrison and McMillan (2004) have emphasized the link between foreign activities and domestic wages and employment. Additionally, Blonigen and Wilson (1999) investigate the role of demand by multinational firms in determining variations in the measured substitutability of foreign and domestic goods.

⁴ Investments are often characterized as being vertical or horizontal. The horizontal FDI view represents FDI as the replication of capacity in multiple locations in response to factors such as trade costs, as in Markusen (1984, 2002). The vertical FDI view represents FDI as the geographic distribution of production globally in response to the opportunities afforded by different markets, as in Helpman (1984).

⁵ Antràs (2003), Antràs and Helpman (2004), Desai, Foley and Hines (2004), Helpman, Melitz and Yeaple (2004) and Feenstra and Hanson (2005) analyze the determinants of alternative foreign production arrangements.

2. *Foreign Economic Growth and the Operations of Multinationals Firms*

The first stages of the regressions that follow use the fact that firms differ in their initial distributions of foreign economic activity to predict different growth rates of subsequent activity, based on differences in the average GDP growth rates of the countries in which their activities were initially concentrated. These predicted growth rates then become the independent variables in second stage equations used to explain changes in domestic business operations. This empirical strategy takes a firm's initial distribution of activity among foreign countries to be exogenous from the standpoint of subsequent changes in domestic business activity. In order to consider the merits of this strategy, it is useful to formalize the way in which foreign economic growth influences domestic and foreign investment through production considerations and demand conditions.

Consider a multinational firm that produces output with a production function $Q(k, k^*)$, in which k represents inputs of domestic factors and k^* represents inputs of foreign factors; output is taken to be a concave function of each of these inputs. The firm faces costs of c per unit of k and c^* per unit of k^* . Revenue is given by $R(Q, y^*)$ (the usual demand properties imply that $\frac{\partial R}{\partial Q} > 0$ and $\frac{\partial^2 R}{\partial Q^2} \leq 0$) and y^* denotes foreign economic conditions. R is a function of y^* only insofar as foreign economic conditions affect sales revenue for a given output level, presumably through affecting the prices that output can command in local foreign markets.

The firm maximizes $R(Q, y^*) - (ck + c^*k^*)$, and the first order conditions for profit maximization are:

$$(1) \quad \frac{\partial R}{\partial Q} \frac{\partial Q}{\partial k} = c$$

$$(2) \quad \frac{\partial R}{\partial Q} \frac{\partial Q}{\partial k^*} = c^*.$$

In this setting a change in foreign costs (c^*) affects domestic economic activity by influencing k^* , which in turn affects $\frac{\partial Q}{\partial k}$. This can be seen by totally differentiating (1), denoting the induced change in foreign inputs by dk^* , and the resulting change in domestic inputs by dk :

$$(3) \quad \frac{\partial Q}{\partial k} \frac{\partial^2 R}{\partial Q^2} \left[\frac{\partial Q}{\partial k} dk + \frac{\partial Q}{\partial k^*} dk^* \right] + \frac{\partial R}{\partial Q} \left[\frac{\partial^2 Q}{\partial k^2} dk + \frac{\partial^2 Q}{\partial k \partial k^*} dk^* \right] + \frac{\partial Q}{\partial k} \frac{\partial^2 R}{\partial Q \partial y^*} dy^* = dc.$$

Since $dc = 0$, equation (3) implies that:

$$(4) \quad dk = \frac{\left[\frac{\partial Q}{\partial k} \frac{\partial Q}{\partial k^*} \frac{\partial^2 R}{\partial Q^2} + \frac{\partial R}{\partial Q} \frac{\partial^2 Q}{\partial k \partial k^*} \right] dk^* + \frac{\partial Q}{\partial k} \frac{\partial^2 R}{\partial Q \partial y^*} dy^*}{-\left[\left(\frac{\partial Q}{\partial k} \right)^2 \frac{\partial^2 R}{\partial Q^2} + \frac{\partial R}{\partial Q} \frac{\partial^2 Q}{\partial k^2} \right]}.$$

Since $\frac{\partial^2 R}{\partial Q^2} \leq 0$ and $\frac{\partial^2 Q}{\partial k^2} < 0$, it follows that the denominator of the right side of equation (4) is positive.

The first term in the numerator of equation (4) is positive only if $\frac{\partial^2 Q}{\partial k \partial k^*} > 0$ and is of sufficient magnitude to offset the negative sign of the term that includes $\frac{\partial^2 R}{\partial Q^2}$. This will be the case if foreign and domestic inputs exhibit significant complementarity in production. The second term in the numerator of equation (4) is a demand effect: if $\frac{\partial R}{\partial Q}$ increases with y^* , then higher values of y^* will be associated with increased demand for k . This reflects the possibility that the change in foreign economic conditions also directly affects $\frac{\partial R}{\partial Q}$ by influencing final output demand, as captured by $\frac{\partial^2 R}{\partial Q \partial y^*}$. If foreign affiliates or parent companies sell significant portions of their output in markets where affiliates are located, and local demand influences the prices that output commands, then if y^* is per capita income in countries where affiliates are

located it may be the case that $\frac{\partial^2 R}{\partial Q \partial y^*} > 0$. As such, the two terms in the numerator of equation (4) reveal that foreign economic growth can influence domestic factor demand through production and demand considerations.

Equation (4) suggests that it is possible to estimate the impact of foreign input changes on domestic factor demands by using changes to foreign economic conditions as instruments. From equation (2) it is clear that reduced values of c^* are associated with higher levels of k^* . Real values of c^* are difficult to observe, but to the extent that national economic growth is associated with productivity gains that correspond to declining real input costs, then changes in foreign income levels can serve as y^* , and therefore proxies for changes in c^* . For example, a shock to foreign technology might reduce real foreign factor costs and simultaneously promote foreign GDP growth. In such a case, the change in foreign GDP can be used to predict changes in foreign factor demand by U.S. firms.

The second term in the numerator of equation (4) is a reminder that changes in foreign income have the potential to affect the demand for domestic factors via output demand effects. In particular, it is possible that $\frac{\partial R}{\partial Q}$ is itself a function of y^* , since firms with foreign operations concentrated in rapidly growing countries may find that foreign demand for their output grows faster than do firms without strong presences in hot foreign markets. If $\frac{\partial R}{\partial Q}$ is an increasing function of y^* , then a change in y^* will be positively correlated with changes in domestic factor demands even if there is no production spillover, that is, even if $\frac{\partial^2 Q}{\partial k \partial k^*} = 0$. Since some of the policy questions raised by these demand effects differ from those triggered by production effects, it is useful to consider the importance of the demand channel.

How might one distinguish production effects from demand effects in estimating the impact of foreign GDP growth on domestic factor demands? One method of doing so is to distinguish firms based on the extent to which their sales are likely to be influenced by conditions in foreign markets. Firms whose foreign affiliates sell relatively little in their host markets may be affected by local income growth, but these effects are likely to reflect changes in

real factor costs rather than new selling opportunities. If the second term in the numerator of equation (4) is plausibly zero for such firms, then one is left with production effects being responsible for the impact of foreign income growth on domestic factor demands. The evidence analyzed below is indeed consistent with this interpretation.

The possibility that foreign GDP growth influences foreign factor use because it is correlated with sales by foreign affiliates is an issue for the interpretation of the instrument, not its validity. In order to serve as a valid instrument it is necessary that the average GDP growth rate of foreign countries in which a firm invests is conditionally uncorrelated with the residual in the second stage equation explaining the firm's domestic economic activity. This condition requires that foreign economic growth affects its domestic operations only by influencing the level and character of its foreign operations. This restriction cannot be directly tested, but reasonable specifications of production processes within multinational firms imply that by far the most likely channel by which foreign economic prosperity affects firms with local operations is by affecting local operations.

While the preceding establishes how foreign economic growth can give rise to production and demand effects, it also offers guidance on the validity of the instrument. There are three important scenarios in which the instrument would be invalid, and each is considered in the empirical tests below. First, specific industrial activity might be concentrated in certain countries, and domestic and foreign operations might experience common shocks. For example, if most of the foreign operations of electronic component manufacturing parents were located in Taiwan, a productivity shock to the industry could be associated with high growth in Taiwan while the productivity shock also has a direct effect on the growth of parent firms in the industry. The resulting possible misattribution of cause and effect can be largely prevented by including fixed effects that are specific to individual industries and time periods. Second, firms might export to unaffiliated customers in the same foreign countries in which they invest, in which case foreign economic growth might stimulate exports and thereby domestic operations directly. This consideration suggests that it is useful to control for export-driven changes in domestic activity by including an independent variable equal to export-weighted foreign economic growth. Third, parent firms that are trying to grow quickly may invest in countries whose economies are

expected to grow rapidly in the future. This scenario implies that only the unanticipated component of foreign economic growth would be a valid instrument.

Finally, it is also possible that foreign investment by U.S. firms affects local GDP growth rates, making foreign GDP growth rates inadmissible as instruments in explaining foreign investment. This effect is, however, likely to be very small in magnitude except for a certain number of small countries, principally tax havens, that draw disproportionate volumes of U.S. investment.⁶ Since the empirical work presented in the paper uses average foreign GDP growth rates weighted by investment levels, this consideration is very unlikely to contaminate the estimated results.

3. *Data and descriptive statistics*

The empirical work presented in section 4 is based on the most comprehensive and reliable available data on the activities of U.S. multinational firms. The BEA Benchmark Surveys of U.S. Direct Investment Abroad in 1982, 1989, 1994, 1999, and 2004 provide a panel of data on the financial and operating characteristics of U.S. multinational firms.⁷ In order to limit the heterogeneity of the sample, observations are restricted to U.S. firms with parent companies in manufacturing industries (as defined in the BEA survey using a classification that corresponds almost exactly to SIC codes 20-39).⁸ In each of the four benchmark years, all affiliates with sales, assets, or net income in excess of certain size cutoffs of no more than \$10 million in absolute value, and their parents, were required to file reports. Measures of aggregate foreign activity of individual firms are obtained by summing measures of activity across the firm's foreign affiliates. The surveys collect sufficient information to quantify domestic and foreign sales, assets, net property, plant and equipment, employment compensation, and employment, as well as R&D spending by parents and exports from parents to affiliates.⁹

⁶ For an analysis of the effect of foreign direct investment on GDP growth rates of small tax havens, see Hines (2005).

⁷ The International Investment and Trade in Services Survey Act governs the collection of the data and the Act ensures that "use of an individual company's data for tax, investigative, or regulatory purposes is prohibited." Willful noncompliance with the Act can result in penalties of up to \$10,000 or a prison term of one year. As a result of these assurances and penalties, BEA believes that coverage is close to complete and levels of accuracy are high.

⁸ Manufacturing firms have 56% of the employee compensation and 56% of the property plant and equipment of all U.S. multinational firms in the BEA data for these years.

⁹ Only a limited number of firms reported U.S. exports from parents to affiliates in 2004 due to a change in reporting requirements. Therefore, the sample used to analyze intercompany exports does not include observations for 2004.

The BEA collects identifiers linking parents and affiliates through time, thereby permitting the calculation of changes in domestic and foreign input use. Growth rates are computed as ratios of changes in activity between benchmark years to averages of beginning and ending period levels of activity.¹⁰ Since the data include five benchmark survey years – 1982, 1989, 1994, 1999, and 2004 – it is possible to calculate changes in this normalized measure for at most four periods. As the analysis considers changes only, observations of firms that initiate or terminate global activities between benchmark years are not part of the analysis for that period.¹¹

Table 1 presents means, medians, and standard deviations of variables used in the regressions that follow. The instrumental variables procedure uses foreign GDP growth rates, which are calculated by dividing changes (between benchmark years) in the gross domestic product per capita of affiliate host countries by the average of beginning and ending period values.¹² These country growth rates are aggregated using weights equal to a firm's beginning of period affiliate net property, plant and equipment in each country. To control for the possibility that GDP growth rates affect domestic levels of activity by influencing parent exports to final consumers abroad, some regressions include as an independent variable GDP growth rates weighted by a parent company's beginning of period exports to unrelated parties. Some regressions also include changes in real exchange rates, which are computed using nominal exchange rates taken from Heston, Summers, and Aten (2006) and measures of inflation from the IMF's International Financial Statistics database; the real exchange rate movement is defined to equal the ratio of the change in the dollar-equivalent real exchange rate to the average of this rate at the beginning and end of period. Firm-specific exchange rate changes equal the product of these real exchange rate changes and weights equal to beginning of period affiliate net property plant and equipment in each country.

¹⁰ Construction of growth rates around averages of start and end of period values has become standard procedure in the analysis of firm-level job flows, as in Davis, Faberman, and Haltiwanger (2006). Tornqvist, Vartia, and Vartia (1985), and the appendix to Davis, Haltiwanger and Schuh (1996), compare the properties of this growth rate measure to alternatives including log changes and growth rates calculated relative to initial values.

¹¹ The change in foreign activity attributable to the growth of surviving parents is considerably larger than is the change due to net entry and exit of parents in each of the four periods covered by the data. Appendix Table 1 of Desai, Foley, and Hines (2005) provides a description of changes in net foreign property, plant and equipment investment of U.S. multinationals, decomposing these changes into the growth of surviving firms, entry by new firms, and capital reductions due to exit by firms that were previously part of the sample.

¹² Per capita gross domestic product is the CGDP variable reported by Heston, Summers and Aten (2006), representing incomes adjusted for purchasing power and reported in current dollars.

4. *The Relationship Between Foreign and Domestic Activity*

The simple correlation of changes in foreign and domestic activity is evident from Figure 1, which presents a scatter plot of foreign and domestic sales growth rates for multinational firms in the sample.¹³ As in the regression analysis, foreign growth rates are defined as the ratio of the change in a measure of foreign activity between benchmark years to the average of its values in these years; and domestic growth rates are similarly defined. The upward sloping relationship between foreign and domestic sales growth in Figure 1 suggests a positive correlation between growth rates of foreign and domestic economic activity that is investigated further below.

4.1. *OLS Specifications*

Table 2 presents estimated coefficients from OLS specifications explaining changes in the domestic activities of parent companies as functions of changes in their foreign activities. All specifications include fixed effects for two-digit parent industries in each period, and the standard errors correct for clustering at the parent company level.¹⁴ The 0.2018 coefficient reported in column one of Table 2 indicates that 10 percent higher foreign net property, plant and equipment growth is associated with 2.0 percent higher domestic net property, plant and equipment growth by parent companies. Asset accumulation displays a similar pattern, the 0.3241 coefficient reported in column two implying that 10 percent foreign asset growth is associated with 3.2 percent domestic asset growth. The regressions reported in columns three and four consider changes in labor demand. The 0.2454 coefficient reported in column three indicates that 10 percent higher foreign employment compensation is associated with a 2.5 percent greater domestic employment compensation. And the 0.2263 coefficient reported in column four similarly implies that 10 percent higher numbers of foreign employees is associated with 2.3 percent higher numbers of domestic employees. Across all of these measures of multinational firm activity, the OLS analysis suggests that increased foreign activity is associated with greater domestic activity.

4.2. *Instrumental Variables Specifications*

¹³ Foreign sales refers to the sales of a firm's foreign affiliates, regardless of the destination of those sales, and domestic sales refers to the sales of a firm's domestic operations, regardless of the destination of those sales.

¹⁴ Information is missing for some firms in certain years, which is why sample sizes vary between specifications in Table 2.

The instrumental variables approach outlined above relies on the ability of foreign economic growth rates to explain changes in foreign activity levels of U.S. multinational firms. Table 3 presents the results of regressions of growth rates of foreign activity on firm-specific weighted averages of foreign economic growth rates, the weights corresponding to beginning of period distributions of foreign property, plant, and equipment. Growth rates are defined as in Table 2, all specifications include period-industry fixed effects, and the standard errors correct for clustering at the parent level.

The results indicate that the economic performance of foreign economies significantly influences the foreign activity of U.S. multinational firms. The 1.4755 coefficient reported in column one indicates that 2 percent faster annual average GDP growth in countries in which a firm invests is associated with 3.0 percent faster growth of affiliate net property, plant and equipment. Similar results appear in the regressions reported in columns two through four, whose coefficients imply that 2 percent faster annual GDP growth is associated with 2.3 percent greater foreign asset accumulation, 2.3 percent greater foreign employee compensation growth, and 1.3 percent greater foreign employment growth.

As discussed above, foreign economic growth is associated with greater levels of foreign activity by U.S. firms either because economic growth increases the value of the foreign output of U.S. firms or because foreign economic growth coincides with reduced real input costs due to productivity gains or other changes. In order to consider these distinct channels, it is useful to identify the impact of foreign GDP growth on export sales by foreign affiliates, as such sales presumably are little, if at all, affected by output demand in the affiliates' host countries. Such an exploration addresses concerns that the instrumental variables analysis is only relevant for certain types of foreign investments – for example, those that serve local markets.

Table 4 builds on the regressions reported in Table 3 by adding a variable equal to the average fraction of affiliate sales directed outside their own home markets; this variable is measured as of the beginning of the period. The interaction of this variable and weighted GDP growth indicates whether parent companies whose affiliates sell their output outside their host markets are more or less sensitive than others to changes in foreign economic growth rates. There are two notable features of the results presented in this table. First, and perhaps

unsurprisingly, the coefficient on the uninteracted GDP growth variable is positive and significant in all of the specifications other than that explaining foreign employment growth. This implies that capital investment and labor demand by firms whose affiliates do not export respond positively to foreign GDP growth, which is consistent either with cost or demand effects of foreign economic conditions. Second, and more tellingly, the estimated coefficients on the interaction term are positive in all four equations, albeit not statistically significant, suggesting that there is no indication that the foreign operations of firms whose affiliates sell predominantly to host country markets are the most sensitive to foreign economic conditions; if anything, the reverse may be true. As such, it appears that cost considerations are important mechanisms by which foreign economic growth influences foreign factor demand.

Table 5 presents estimated coefficients from instrumental variables regressions in which predicted values of changes in foreign activity (based on coefficients drawn from the regressions presented in Table 3) are used to explain changes in domestic capital and labor demand. All specifications include complete sets of period-industry fixed effects for two-digit parent industries in each period, and the standard errors allow for clustering at the parent level. The 0.2578 coefficient in column one of Table 5 indicates that 10 percent greater accumulation of foreign property plant and equipment, as predicted by host country GDP growth, is associated with 2.6 percent growth of domestic net property plant and equipment. This estimated effect is quite similar to that implied by the OLS regression reported in column 1 of Table 2. The 0.2387 coefficient in column two indicates that 10 percent greater foreign asset accumulation is associated with 2.4 percent growth of domestic assets, though this effect is of marginal statistical significance. There is no indication that firms accumulating capital assets in their foreign affiliates do so at the expense of domestic capital accumulation; instead, greater use of foreign capital appears to stimulate greater use of domestic capital.

The dependent variable in the regression reported in the third column of Table 5 is the growth rate of domestic employee compensation; the 0.3692 coefficient indicates that greater total foreign labor compensation is associated with greater demand for domestic labor. This estimated effect is somewhat larger than that implied by the 0.2454 OLS coefficient presented in column three of Table 2, though the two are statistically indistinguishable. Similarly, the 0.6550 coefficient in the fourth column of Table 5 implies that greater foreign employment is associated

with greater domestic employment.¹⁵ Further regressions (not reported) indicate that growth-induced changes in foreign employment compensation per employee are unrelated to changes in domestic employment compensation per employee. This evidence is consistent with a model of complementarity in which foreign employment compensation affects domestic employment compensation through changes in employment levels and not through changes in compensation per employee.

4.3. *Sources of Domestic Growth*

There are several channels through which foreign activities can influence the scope of domestic operations, including cases in which foreign production requires inputs of tangible or intellectual property produced in the home country. The regressions presented in Table 6 consider the effects of greater foreign sales on domestic research and development (R&D) and domestic exports to affiliates located abroad. Columns one and two report estimated coefficients from regressions in which the dependent variable is the change in domestic R&D.¹⁶ The 0.3225 estimated coefficient in the OLS regression reported in column one indicates that 10 percent faster foreign sales growth is associated with 3.2 percent more rapid growth of domestic R&D spending. In order to avoid bias that might arise due to the joint determination of domestic R&D growth and foreign affiliate sales growth, the specification in column two instruments for foreign sales growth using foreign GDP growth rates.¹⁷ The 0.4991 estimated coefficient in this specification implies a slightly larger effect, 10 percent faster foreign sales growth being associated with 5.0 percent greater domestic R&D spending. Since foreign operations stand to benefit from intangible assets developed by R&D spending, it is not surprising that greater foreign investment might stimulate additional spending on R&D in the United States.

Columns three and four report estimated coefficients from regressions in which the dependent variable is the growth in a parent company's exports to its affiliates. The estimated

¹⁵ Reliable inference from instrumental variables estimation requires strong first stage instruments. The Cragg-Donald (1993) statistics for the instruments used in columns 1-4 are, respectively, 37.27, 37.61, 28.58, and 9.58. Critical values computed in Stock and Yogo (2005) imply that conventional 5% level Wald tests based on IV statistics have actual sizes that exceed thresholds of 10% for the first three specifications and 15% for the fourth. Consequently, there is no evidence of critical weakness in the first stage instruments.

¹⁶ Growth rates that serve as dependent variables in Table 6 are computed in the same way as other growth rates: they are ratios of changes between benchmark years to averages of beginning and end of period values.

0.6642 coefficient reported in column three indicates that 10 percent higher growth of foreign sales is associated with 6.6 percent greater exports from U.S. parent companies to their foreign affiliates. The corresponding instrumental variables coefficient of 0.6473, reported in column four, indicates that firms whose initial investments were concentrated in economies that subsequently grew rapidly tend to expand their exports from the United States to affiliates abroad. These results are consistent with those presented in Table 5, in which domestic investment and employment growth respond positively to changes in their foreign counterparts.

4.4. *Robustness Checks*

As noted earlier, there exist scenarios that raise potential questions about the validity of the instrument. For example, firms with considerable foreign direct investment in a country might also export significant amounts of its final product from the U.S. to unaffiliated customers in the same country. If this were the case, local GDP growth would be an invalid instrument, since high foreign economic growth would directly stimulate domestic investment to meet U.S. export demand. The first two regressions presented in Table 7 address this possibility by including as an independent variable a measure of foreign GDP growth weighted by beginning of period firm exports to unrelated parties, constructed from BEA data that identify the destination of each firm's U.S. exports to unrelated parties.¹⁸ It is also possible that real exchange rate movements that are associated with differences in GDP growth rates might influence relative prices in a way that directly affects factor demands by multinational firms. The first two regressions of Table 7 also address this concern by including measures of real exchange rate changes weighted by a firm's distribution of property, plant and equipment at the beginning of each period.

Since not all parents are exporters, the use of trade share data reduces sample sizes somewhat, but, as the regressions reported in columns one and two of Table 7 illustrate, the inclusion of trade-weighted GDP growth rates and exchange rates has very little impact on the estimated effects of foreign capital accumulation and employment compensation growth. Ten percent faster foreign capital accumulation is associated with 2.7 percent faster domestic capital

¹⁷ The first stage results of this IV specification and the one presented in column 4 indicate that Parent Weighted GDP Growth Rates are significant in predicting foreign sales growth rates.

accumulation in the regression reported in column one, and 10 percent faster foreign employment compensation growth is associated with 3.3 percent faster domestic employment compensation growth in the regression reported in column two. The estimated direct effects of trade-weighted foreign GDP growth and exchange rate movements are negligible in both regressions.

If firms with rapidly growing domestic activities choose to locate their foreign operations in relatively high growth economies, the results in Table 5 may not accurately reflect the influence of higher foreign growth rates on domestic factor demands. In order to evaluate this possibility, the regressions presented in the third and fourth columns of Table 7 use measures of unexpected host country growth as instruments. Specifically, these instruments are computed by taking residuals from a regression of GDP growth on its own lag, then weighting these residuals using firm specific weights that correspond to beginning of period levels of net property, plant and equipment. The regressions reported in columns three and four of Table 7 are run on the same sample as that used in the regressions reported in columns one and three of Table 5, and the estimated coefficients are quite similar (0.2503 and 0.2578 in the case of property, plant and equipment; 0.3888 and 0.3692 in the case of employment compensation), suggesting that it is the unpredictable component of GDP growth that is responsible for the results appearing in Table 5. An additional predictor of GDP growth is available for 1999, when the IMF published two-year growth predictions for a large number of countries. Computing instruments by first regressing GDP growth on its own lag and, when available, IMF growth projections and then weighting residuals by beginning of period net PPE in each country changes the estimates very little.

The merger and acquisition activities of multinational firms raise the possibility that the estimated impact of foreign investment on domestic investment might reflect what happens when one U.S. multinational firm buys another, thereby simultaneously acquiring the target's domestic and foreign assets. If this acquisition activity is most prevalent among firms with foreign affiliates located in high growth countries, then it could be responsible for the pattern that is apparent in the data. In such cases the estimated effect of foreign investment on domestic investment may offer a misleading picture of changes in factor demands, since acquisitions may

¹⁸ In each of the first stages of the specifications presented in Table 7, Parent Weighted GDP Growth Rates are significant in explaining growth in foreign activity.

entail purchasing bundles of foreign and domestic assets that are not what the acquirer would otherwise desire. The regressions presented in the first four columns of Table 8 address this potential problem by removing from the sample observations of parent companies that acquire other U.S. parent companies or divisions of other parents.¹⁹

Columns one and two of Table 8 present OLS specifications of regressions run on the restricted sample of firms. Estimated coefficients on foreign net PPE growth and foreign employment compensation growth are similar to those obtained from regressions using the whole sample and presented in columns one and three of Table 2. Estimated effects of foreign changes on domestic activity in the instrumental variable regressions presented in columns three and four of Table 8 are likewise similar to those presented in columns one and three of Table 5. Although the 0.1419 coefficient in column three is insignificant, it implies that 10 percent foreign investment is associated with 1.4 percent greater domestic investment. The 0.3023 coefficient in column four implies that 10 percent foreign wage growth is associated with 3.0 percent greater domestic employment compensation growth.

In a related vein, reported estimates do not capture the effect of a domestic firm's initial expansion in markets abroad. Since the IV estimation method requires the use of beginning of period values of foreign activity, it is not possible to construct an instrument for new foreign investment by firms without prior foreign exposure. Firms initiating activity abroad are responsible for only a small fraction of aggregate foreign investment, so their effect is unlikely to dominate the total responsiveness of domestic investment to foreign activities.²⁰ It is also possible to analyze a subset of observations representing the first period following a firm's foreign entry. The regressions presented in columns five through eight of Table 7 are run on this subsample of observations. Sample sizes are necessarily very small (between 569 and 611); nonetheless, the OLS results in columns five and six are similar to those reported in columns one

¹⁹ The BEA data identify purchases of one U.S. multinational firm by another and purchases of foreign affiliates previously owned by another firm in the BEA data.

²⁰ See Appendix Table 1 in Desai, Foley and Hines (2005b) for data on the magnitude of entry relative to the magnitude of growth of existing firms in the BEA data. The BEA data also allow one to consider the effects of introducing an affiliate on exports from the parent. It is possible to measure average changes in parent exports to unaffiliated foreign persons in a particular country during the period that a new affiliate appears in that country. During such periods, parent exports appear to increase. The average change in unaffiliated parent trade, measured as the change in unaffiliated parent trade scaled by the average of beginning and end of period unaffiliated trade, is 12.3%.

and two of the same table for the considerably larger sample of firms that do not merge. Point estimates of the effects of foreign investment and foreign employment compensation growth are larger in the IV specifications reported in columns seven and eight, and only the effects of foreign employment compensation growth are significant, owing to the small sample sizes.²¹ Thus, there is no indication that foreign expansion is associated with domestic contraction soon after firms initiate foreign activity.²²

Although the main specifications presented include fixed effects for each two-digit industry in each year, there is potential value in using more detailed industry classifications. Some countries may be dominated by small numbers of industries, in which firms experience common shocks that affect their foreign and domestic activities; in such cases, the foreign and domestic investments of the firms, and the GDPs of the countries in which they invest, would all be positively correlated. Alternatively, large movements in certain commodity prices could affect domestic and foreign activity in particular industries and be correlated with the growth of economies that are host countries of U.S. affiliates in these industries. In order to assess the possibility that these phenomena are important enough to drive the results, additional tests (not reported) include fixed effects specific to each three-digit parent industry for each time period in the data.²³ The estimated coefficients are again very similar to those reported in Table 5. To ensure that outliers or large firms do not drive the main results, the specifications presented in Table 5 have been run as quantile regressions, and they have been run using a sample that excludes the largest 5 percent of the firms in the sample, as measured by total start of period foreign property, plant and equipment. The results are likewise very similar to those reported in Table 5.

4.5. *General Equilibrium Considerations*

²¹ The first stages of the specifications presented in columns 3, 4, and 8 of Table 8 indicate that Parent Weighted GDP Growth Rates are significant in explaining measures of foreign activity growth. The instrument is positive, but not significant in the first stage of the specification in column 7, perhaps as a consequence of the small sample size.

²² Selection issues could also obscure the results if firms expand domestically when they cease to operate abroad. Because the data do not include detailed information about why firms leave the sample and do not track firms when they terminate their foreign activity, this concern cannot be easily addressed. As it happens, not many firms exit the sample, and those that do tend to be small, so they are unlikely to have major effects on the estimated coefficients.

²³ There are 101 two-digit industry/year fixed effects but 302 three-digit industry/year fixed effects.

These estimated effects of foreign operations on domestic sales and factor demands are identified by differences between firms in the growth rates of the foreign economies in which they invest, which in turn affect the rates at which firms expand their foreign investments. As a result, the estimates are cross-sectional in nature: they reflect comparisons of the subsequent domestic activities of firms that invested in certain foreign countries with firms that invested in others. The total domestic effects of policies affecting foreign investment include price changes that affect all firms and are not reflected in cross-sectional comparisons of some firms with others. These general equilibrium considerations include changes in output prices of industries with significant foreign exposure, any endogenous effects on interest rates, exchange rates, wages, prices of investment goods, and others. These endogenous price changes are likely to attenuate, but not reverse in sign, the estimated firm-level effects of foreign operations on domestic capital accumulation, employment, R&D spending, and exports. In the absence of a complete general equilibrium analysis it is difficult to estimate the aggregate magnitudes of these effects on the U.S. economy, but there is nonetheless a presumption that the signs of aggregate effects resemble those estimated on the basis of firm-level evidence.

5. *Conclusion*

Manufacturing firms that expanded their foreign operations between 1982 and 2004 simultaneously expanded their domestic operations, and this relationship persists when actual foreign expansions are replaced by predicted values based on weighted growth rates of foreign economies. Foreign investment that is triggered by foreign economic growth is associated with growing domestic capital accumulation, employment compensation, R&D, and exports to related parties. These results run counter to the simple intuition that foreign direct investment represents a diversion of domestic economic activity by firms undertaking the foreign investment. This intuition is based on the notion that each firm has a fixed amount of global production, so any additional foreign production comes at the cost of reduced domestic production. Neither firms nor economies operate on such a zero-sum basis, so there is ample reason to think that greater foreign production associated with foreign economic growth might stimulate greater demand for productive factors in the United States. While there may be considerable individual variation, the average experience of all U.S. manufacturing firms over the last two decades is inconsistent with the simple story that all foreign expansions come at the cost of reduced domestic activity.

These results carry implications for U.S. policies that influence levels of foreign investment by U.S. companies. The United States taxes the foreign incomes of U.S. firms, permitting taxpayers to claim tax credits for foreign income tax payments and to defer U.S. taxation of certain unrepatriated profits of foreign subsidiaries. A system of taxing foreign income while providing foreign tax credits is commonly justified by appeal to the principle of capital export neutrality, itself predicated on the intuition that foreign investment reduces domestic investment on a one-for-one basis.²⁴ The evidence that domestic manufacturing activity does not appear to fall in response to increased foreign investment spurred by foreign economic growth suggests that these principles, and the policies they support, are ripe for reconsideration. If foreign and domestic investment are not substitutes, then it becomes more attractive to exempt active foreign business income from domestic taxation, particularly given the benefits of improving asset ownership allocation by having a tax system that satisfies capital ownership neutrality (Desai and Hines, 2003).

Public fears over the possible outsourcing of economic activity have added force to policy proposals that, if enacted, would limit the foreign activities of American firms. Recent proposals include those providing specific incentives for firms that increase domestic employment relative to foreign employment, and others applying U.S. labor and environmental regulations to activities in foreign countries. Whatever their merits, adoption of these reforms would very likely constrain foreign activity by American firms. The evidence provided in this paper suggests that these initiatives may also have the unintended effect of reducing domestic activity by the same firms.

²⁴ The standard international tax theory is developed in Musgrave (1969) and Horst (1980), and reviewed by Gordon and Hines (2002).

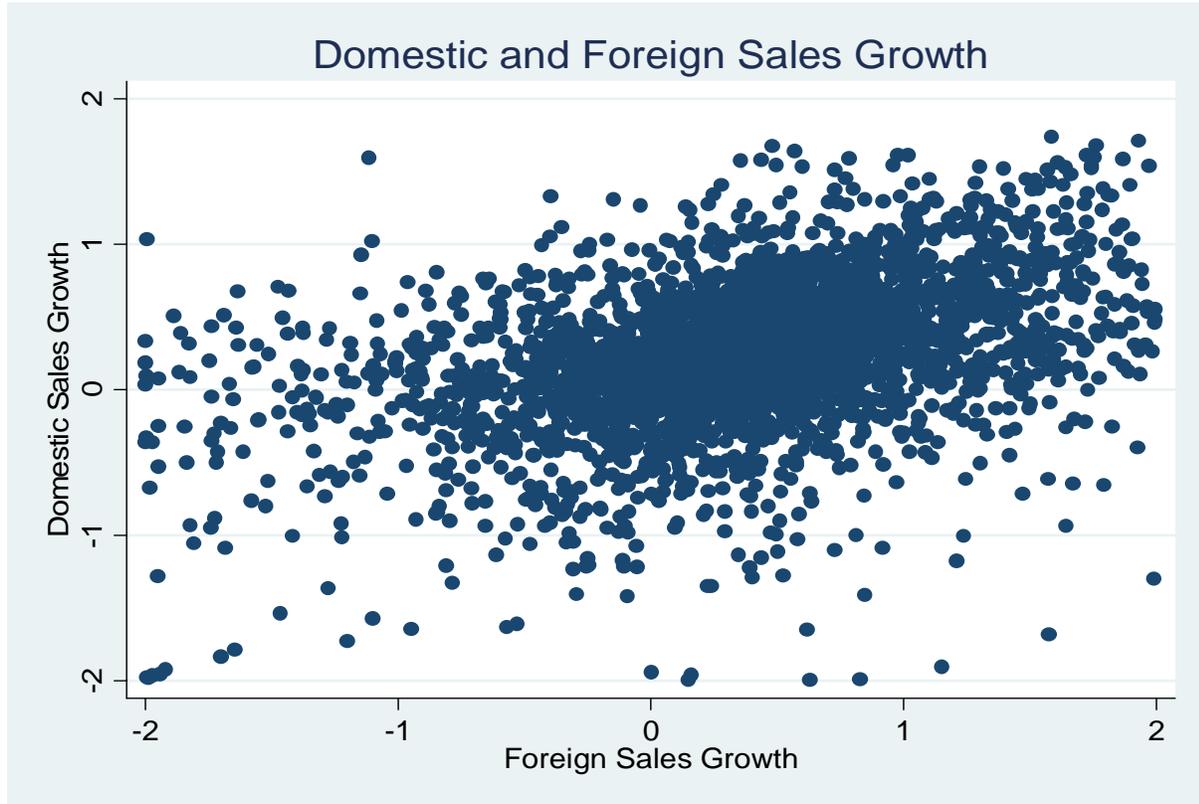
References

- Antràs, Pol (2003). "Firms, Contracts and Trade Structure." *Quarterly Journal of Economics* 118 (4), 1375-1418.
- Antràs, Pol and Elhanan Helpman (2004). "Global Sourcing." *Journal of Political Economy* 112 (3), 552-591.
- Blonigen, Bruce A. (2001). "In Search of Substitution between Foreign Production and Exports," *Journal of International Economics* 53:81-104.
- Blonigen, Bruce A. and Wesley W. Wilson (1999). "Explaining Armington: What Determines Substitutability Between Home and Foreign Goods," *Canadian Journal of Economics* 32:1-21.
- Brainard, S. Lael and David A. Riker (1997). "Are U.S. Multinationals Exporting Jobs?" NBER Working Paper No. 5958.
- Cragg, J. G. and S. G. Donald (1993). "Testing Identifiability and Specification in Instrumental Variable Models," *Economic Theory* 9, 222-240.
- Davis, Steven J., R. Jason Faberman and John Haltiwanger (2006). "The Flow Approach to Labor Markets: New Data Sources, Micro-Macro Links and the Recent Downturn." *Journal of Economic Perspectives* 20 (3), 3-26.
- Davis, Steven J., John C. Haltiwanger, and Scott Schuh (1996). *Job Creation and Destruction*, (Cambridge, MIT Press).
- Desai, Mihir A., C. Fritz Foley and James R. Hines Jr. (2004). "The Costs of Shared Ownership: Evidence from International Joint Ventures." *Journal of Financial Economics* 73 (2), 323-374.
- Desai, Mihir A., C. Fritz Foley and James R. Hines Jr. (2005a). "Foreign Direct Investment and the Domestic Capital Stock." *American Economic Review Papers and Proceedings* 95 (2), 33-38.
- Desai, Mihir A., C. Fritz Foley and James R. Hines Jr. (2005b). "Foreign Direct Investment and Domestic Economic Activity," NBER Working Paper No. 11717, October.
- Desai, Mihir A. and James R. Hines Jr. (2003). "Evaluating International Tax Reform." *National Tax Journal* 56 (3), 487-502.
- Devereux, Michael P. and Harold Freeman (1995). "The Impact of Tax on Foreign Direct Investment: Empirical Evidence and the Implications for Tax Integration Schemes." *International Tax and Public Finance* 2 (1), 85-106.
- Feenstra, Robert C. and Gordon H. Hanson (1996). "Globalization, Outsourcing and Wage Inequality." *American Economic Review* 86 (2), 240-245.

- Feenstra, Robert C. and Gordon H. Hanson (1999). "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the U.S. 1979-1990." *Quarterly Journal of Economics* 114 (3), 907-940.
- Feenstra, Robert C. and Gordon H. Hanson (2005). "Ownership and Control in Outsourcing to China: Estimating the Property-Rights Theory of the Firm." *Quarterly Journal of Economics* 120 (2), 729-761.
- Feldstein, Martin (1995). "The Effects of Outbound Foreign Direct Investment on the Domestic Capital Stock." In Martin Feldstein, James R. Hines Jr. and R. Glenn Hubbard (eds.), *The Effects of Taxation on Multinational Corporations* (Chicago: University of Chicago Press), 43-63.
- Gordon, Roger H. and James R. Hines Jr. (2002). "International Taxation." In Alan J. Auerbach and Martin Feldstein (eds.), *Handbook of Public Economics*, vol. 4 (Amsterdam: North-Holland), 1935-1995.
- Hanson, Gordon H., Raymond Mataloni and Matthew J. Slaughter. (2005). "Vertical Production Networks in Multinational Firms." *Review of Economics and Statistics* 87, 664-678.
- Harrison, Anne E. and Margaret S. McMillan (2004). "The Impact of Overseas Investment by U.S. Multinationals on Wages and Employment." Working Paper.
- Helpman, Elhanan (1984). "A Simple Theory of International Trade with Multinational Corporations." *Journal of Political Economy* 92 (3), 451-71.
- Helpman, Elhanan, Mark Melitz, and Stephen Yeaple (2004). "Export Versus FDI with Heterogeneous Firms," *American Economic Review* 94 (1), 300-316.
- Heston, Alan, Robert Summers and Bettina Aten (2002). *Penn World Table Version 6.1* (Philadelphia: Center for International Comparisons at the University of Pennsylvania).
- Hines, James R., Jr. (2005). "Do Tax Havens Flourish?" In James M. Poterba (ed.), *Tax Policy and the Economy*, vol. 19 (Cambridge, MA: MIT Press), 65-99.
- Horst, Thomas (1980). "A Note on the Optimal Taxation of International Investment Income." *Quarterly Journal of Economics* 94 (4), 793-798.
- Hummels, David, Jun Ishii and Kei-Mu Yi (2001). "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 54 (1), 75-96.
- Lipsey, Robert E. (1995). "Outward Direct Investment and the U.S. Economy." In Martin Feldstein, James R. Hines Jr. and R. Glenn Hubbard (eds.), *The Effects of Taxation on Multinational Corporations* (Chicago: University of Chicago Press), 7-33.
- Markusen, James R. (1984). "Multinational Firms, Multiplant Economies and Gains from Trade," *Journal of International Economics* 16 (1), 205-226.

- Markusen, James R. (2002). *Multinational Firms and the Theory of International Trade* (Cambridge: MIT Press).
- Musgrave, Peggy B. (1969). *United States Taxation of Foreign Investment Income: Issues and Arguments* (Cambridge, MA: International Tax Program, Harvard Law School).
- Riker, David A. and S. Lael Brainard (1997). "U.S. Multinationals and Competition from Low-Wage Countries." NBER Working Paper No. 5959.
- Slaughter, Matthew (2000). "Production Transfer within Multinational Enterprises and American Wages," *Journal of International Economics* 50 (2), 449-472.
- Stock, James H. and Motohiro Yogo, (2005) "Testing for Weak Instruments in Linear IV Regression." In D.W.K. Andrews and J.H. Stock (eds.), *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg* (Cambridge: Cambridge University Press), 80–108.
- Stevens, Guy V.G. and Robert E. Lipsey (1992). "Interactions Between Domestic and Foreign Investment." *Journal of International Money and Finance* 11 (1), 40-62.
- Tornqvist, Leo, Pentti Vartia, and Yrjo O. Vartia. (1985). "How Should Relative Changes Be Measured?" *American Statistician* 39 (1): 43-46.
- Yi, Kei-Mu (2003). "Can Vertical Specialization Explain the Growth of World Trade?" *Journal of Political Economy* 111 (1), 52-103.

Figure 1: Domestic and Foreign Sales Growth of Multinational Firms, 1982-2004



Note: The vertical and horizontal axes of the figure measure growth rates of domestic sales and foreign sales. Growth rates are defined as ratios of changes in sales to the average of beginning and ending period values. Each observation is a single multinational firm between two benchmark years, the benchmark years consisting of 1982, 1989, 1994, 1999, and 2004).

Table 1
Descriptive Statistics

	<u>Mean</u>	<u>Median</u>	<u>Standard Deviation</u>
Foreign Affiliate Net PPE Growth	0.3127	0.3313	0.8245
Foreign Affiliate Asset Growth	0.4071	0.4275	0.7073
Foreign Affiliate Employment Compensation Growth	0.3191	0.3467	0.7336
Foreign Affiliate Employment Growth	0.1141	0.1088	0.7366
Parent Weighted GDP Growth Rate	0.2368	0.2091	0.1036
Share of Sales Abroad	0.3237	0.2579	0.2998
Domestic Net PPE Growth	0.1295	0.0952	0.8995
Domestic Asset Growth	0.3121	0.3078	0.5330
Domestic Employment Compensation Growth	0.2164	0.2377	0.5066
Domestic Employment Growth	-0.0030	0.0005	0.4837
Parent R&D Growth	0.1922	0.2945	0.9320
Growth of Parent Exports to Affiliates	0.2664	0.4013	1.0464
GDP Growth Weighted by Parent Trade	0.2329	0.2093	0.0962
Change in Real Exchange Rate	-0.1229	-0.0807	0.2565

Notes: Growth rates of net property, plant and equipment (PPE), assets, employment compensation, and employment are computed as the ratio of the change in activity between benchmark years to the average of beginning and ending year levels of activity. Parent Weighted GDP growth rate is the weighted change, over benchmark periods, in the gross domestic product per capita of affiliate host countries, divided by the average of beginning and ending period values. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2006). Country weights used for each parent equal beginning of period net PPE levels in each country. Share of sales abroad is measured as of the beginning of each period, and it is computed by aggregating sales by each affiliate to persons outside of the affiliate's host country and dividing by total affiliate sales. Growth rates of parent research and development, and parent exports to affiliates, are ratios of changes between benchmark years to average values of these measures at the beginning and end of the period. GDP Growth Weighted by Parent Trade is calculated using weights equal to beginning of period parent host country U.S. dollar exchange rate to the average of this rate at the beginning and end of the period, using weights equal to start of period PPE. Real exchange rates are calculated using nominal exchange rates reported in Heston, Summers, and Aten (2006) and measures of inflation from the IMF International Financial Statistics database.

Table 2**Changes in Foreign and Domestic Inputs: OLS Specifications**

<i>Dependent Variable:</i>	Domestic Net PPE Growth	Domestic Asset Growth	Domestic Employment Compensation Growth	Domestic Employment Growth
	(1)	(2)	(3)	(4)
Constant	-0.3257 (0.5472)	-0.1270 (0.1254)	-0.3041 (0.4059)	0.0565 (0.1099)
Foreign Net PPE Growth	0.2018 (0.0151)			
Foreign Asset Growth		0.3241 (0.0153)		
Foreign Employment Compensation Growth			0.2454 (0.0150)	
Foreign Employment Growth				0.2263 (0.0145)
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,968	3,316	2,978	2,968
R-Squared	0.6893	0.3001	0.1904	0.1882

Note: The dependent variables are domestic growth rates of net property, plant and equipment (PPE) (column 1), assets (column 2), employment compensation (column 3), employment (column 4). Domestic and foreign growth rates are ratios of changes in activity between benchmark years to averages of the beginning and end of period values. All regressions are OLS specifications that include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 3**Foreign GDP Growth and Changes in Foreign Input Use**

<i>Dependent Variable:</i>	Foreign Net PPE Growth	Foreign Asset Growth	Foreign Employment Compensation Growth	Foreign Employment Growth
	(1)	(2)	(3)	(4)
Constant	-0.4615 (0.1203)	-0.2567 (0.0986)	-0.5229 (0.0577)	0.0224 (0.5342)
Parent Weighted GDP Growth Rate	1.4755 (0.2888)	1.1723 (0.2368)	1.1402 (0.2711)	0.6746 (0.2536)
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,844	3,137	2,842	2,834
R-Squared	0.0720	0.0897	0.0715	0.0478

Note: The dependent variables are foreign growth rates of net property, plant and equipment (PPE) (column 1), assets (column 2), employment compensation (column 3), and employment (column 4). Foreign growth rates are ratios of changes in activity between benchmark years to averages of the beginning and end of period values. Parent Weighted GDP growth rates are the weighted changes, between benchmark periods, in gross domestic product per capita of affiliate host countries, divided by averages of beginning and end of period values. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2006). Country weights used for each parent equal beginning of period net PPE levels in each country. All regressions are OLS specifications that include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 4**Foreign GDP Growth and Changes in Foreign Input Use: Further Evidence**

<i>Dependent Variable:</i>	Foreign Net PPE Growth	Foreign Asset Growth	Foreign Employment Compensation Growth	Foreign Employment Growth
	(1)	(2)	(3)	(4)
Constant	-0.3462 (0.1492)	0.1192 (0.1149)	0.1257 (0.1419)	0.0700 (0.5540)
Parent Weighted GDP Growth Rate	1.1986 (0.3583)	0.9130 (0.2973)	0.9274 (0.3407)	0.5280 (0.3347)
Share of sales abroad	-0.2006 (0.1394)	-0.1306 (0.1110)	-0.2152 (0.1266)	-0.2153 (0.1291)
Parent Weighted GDP Growth Rate * Share of Sales Abroad	0.6569 (0.5300)	0.5606 (0.4230)	0.8638 (0.4798)	0.6961 (0.4859)
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,774	3,049	2,777	2,769
R-Squared	0.0726	0.0917	0.0754	0.0509

Note: The dependent variables are foreign growth rates of net property, plant and equipment (PPE) (column 1), assets (column 2), employment compensation (column 3), and employment (column 4). Foreign growth rates are ratios of changes in activity between benchmark years to averages of the beginning and end of period values. Parent Weighted GDP growth rates are the weighted changes, between benchmark periods, in gross domestic product per capita of affiliate host countries, divided by averages of beginning and end of period values. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2006). Country weights used for each parent equal beginning of period net PPE levels in each country. Share of sales abroad is measured as of the beginning of each period, and it is computed by aggregating sales by each affiliate to persons outside of the affiliate's host country and dividing by total affiliate sales. All regressions are OLS specifications that include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 5**Effects of Foreign Factors on Domestic Factor Demand: IV Specifications**

<i>Dependent Variable:</i>	Domestic Net PPE Growth	Domestic Asset Growth	Domestic Employment Compensation Growth	Domestic Employment Growth
	(1)	(2)	(3)	(4)
Constant	1.0018 (0.0181)	0.5452 (0.0292)	0.1754 (0.0746)	-0.0131 (0.0052)
Foreign Net PPE Growth	0.2578 (0.1184)			
Foreign Asset Growth		0.2387 (0.1260)		
Foreign Employment Compensation Growth			0.3692 (0.1456)	
Foreign Employment Growth				0.6550 (0.2771)
IV w/ Parent Weighted GDP Growth?	Y	Y	Y	Y
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,844	3,137	2,842	2,834

Note: The dependent variables are domestic growth rates of net property, plant and equipment (PPE) (column 1), assets (column 2), employment compensation (column 3), and employment (column 4). Independent variables are corresponding foreign growth rates. Domestic and foreign growth rates are defined as ratios of changes in activity between benchmark years to averages of the beginning and end of period values. All regressions are IV specifications in which parent weighted GDP growth rates are used as instruments for foreign growth rates. These instruments are calculated by first computing GDP growth rates measured as the change in host country GDP per capita in between benchmark years scaled by average GDP per capita at the beginning and end of the period. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2006). These GDP growth rates are then weighted using weights equal to the beginning of period net PPE in each country. All specifications include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 6
Foreign Growth, Domestic R&D, and Domestic Exports

<i>Dependent Variable:</i>	Parent R&D Growth		Growth of Parent Exports to Affiliates	
	(1)	(2)	(3)	(4)
Constant	1.1877 (0.0335)	1.0017 (0.2439)	-0.1009 (0.2328)	1.7494 (0.0911)
Foreign Sales Growth	0.3225 (0.0318)	0.4991 (0.2316)	0.6642 (0.0373)	0.6473 (0.2525)
IV w/ Parent Weighted GDP Growth?	N	Y	N	Y
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,616	2,616	2,140	2,140
R-Squared	0.1145		0.2184	

Note: The dependent variables are the growth rate of parent R&D expenditures (columns 1 and 2) and parent exports to affiliates (columns 3 and 4). Growth rates are computed by taking ratios of changes in measures in between benchmark years to average values of measures at the beginning and end of the period. The regressions in columns 1 and 3 are OLS specifications, and the regressions in columns 2 and 4 are IV specifications. Weighed measures of host country GDP growth are used as instruments for foreign affiliate sales growth in columns 2 and 4. Instruments are calculated by first computing GDP growth rates measured as changes in host country GDP per capita between benchmark years scaled by average GDP per capita at the beginning and end of the period. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2002). These GDP growth rates are then weighted using weights equal to the beginning of period net PPE in each country. All specifications include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 7**Introducing Controls for Trade Patterns and Exchange Rates, and an Alternative Instrument**

<i>Dependent Variable:</i>	Domestic Net PPE Growth	Domestic Employment Compensation Growth	Domestic Net PPE Growth	Domestic Employment Compensation Growth
	(1)	(2)	(3)	(4)
Constant	0.3898 (0.1649)	0.3085 (0.0459)	1.0029 (0.0181)	0.1654 (0.0702)
Foreign Net PPE Growth	0.2656 (0.1368)		0.2503 (0.1184)	
Foreign Employment Compensation Growth		0.3343 (0.1577)		0.3888 (0.1372)
GDP Growth Weighted by Parent Trade	-0.1212 (0.1381)	-0.1474 (0.1391)		
Change in Real Exchange Rate	0.0289 (0.0512)	0.0340 (0.0469)		
IV w/ Parent Weighted GDP Growth?	Y	Y	N	N
IV w/ Parent Weighted GDP Growth Residuals?	N	N	Y	Y
Period/Industry Fixed Effects?	Y	Y	Y	Y
No. of Obs.	2,309	2,306	2,844	2,842

Note: The dependent variable in columns 1 and 3 is growth of domestic property, plant and equipment (PPE), and the dependent variable in columns 2 and 4 is growth of domestic employment compensation. Domestic and foreign growth rates are defined as ratios of changes in activity between benchmark years to averages of the beginning and end of period values. Changes in the real exchange rate equal ratios of changes in the beginning and end of period real host country U.S. dollar exchange rates to average values at the beginning and end of the period, weighted by beginning of period affiliate PPE. Real host country U.S. dollar exchange rates are computed using nominal exchange rates taken from Heston, Summers, and Aten (2006), and inflation is drawn from the IMF International Financial Statistics database. GDP Growth Weighted by Parent Trade is the weighted average of GDP growth rates, computed using weights equal to beginning of period parent exports to unrelated parties in a country. Values of per capita gross domestic product are taken from Heston, Summers, and Aten (2006). All regressions are IV specifications. Instrumental variables are calculated by first computing GDP growth rates measured as the change in host country GDP per capita between benchmark years scaled by average GDP per capita at the beginning and end of the period. Instruments in columns 1 and 2 weight host country GDP by beginning of period net PPE in each country. Instruments in the columns 3 and 4 equal residuals from regressions of GDP growth rates on its own lag, with these residuals then weighted by beginning of period PPE in each country. All specifications include period/industry fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.

Table 8
Controlling for Mergers and New Entrants

<i>Dependent Variable:</i>	Domestic Net PPE Growth	Domestic Employment Compensation Growth						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.2828 (0.0240)	0.0320 (0.0220)	0.2967 (0.0408)	0.0075 (0.0375)	-0.0715 (0.0551)	0.2964 (0.0471)	-0.1337 (0.0759)	-0.0435 (0.0940)
Foreign Net PPE Growth	0.1944 (0.0164)		0.1419 (0.1118)		0.1679 (0.0318)		0.5164 (0.4770)	
Foreign Employment Compensation Growth		0.2318 (0.0164)		0.3023 (0.1286)		0.1911 (0.0286)		0.6393 (0.2984)
IV w/ Parent Weighted GDP Growth?	N	N	Y	Y	N	N	Y	Y
Period Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Drop Acquirers?	Y	Y	Y	Y	N	N	N	N
Focus on New Entrants?	N	N	N	N	Y	Y	Y	Y
No. of Obs.	2,469	2,480	2,368	2,367	605	611	570	569
R-Squared	0.6798	0.1307			0.3983	0.1043		

Note: The dependent variables are domestic growth rates of net property, plant and equipment (PPE) (columns 1, 3, 5 and 7) and growth of domestic employment compensation (columns 2, 4, 6, and 8). Domestic and foreign growth rates are ratios of changes in activity between benchmark years to averages of beginning and end of period values. The regressions in columns 1, 2, 5 and 6 are OLS specifications and the regressions in columns 3, 4, 7 and 8 are IV specifications. Parent weighed GDP growth rates are used as instruments for foreign growth rates. Instrumental variables are calculated by first computing GDP growth rates measured as the change in host country GDP per capita between benchmark years scaled by average GDP per capita at the beginning and end of the period. Values of real gross domestic product per capita in current prices are taken from Heston, Summers, and Aten (2006). These GDP growth rates are then weighted using weights equal to the beginning of period net PPE in each country. The sample is restricted to non-acquirers in columns 1-4 and to new entrants in columns 5-8. All specifications include period fixed effects. Heteroskedasticity-consistent standard errors that correct for clustering at the parent level appear in parentheses.