Offshoring Jobs? Multinationals and U.S. Manufacturing Employment *

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Abstract:

Critics of globalization claim that U.S. manufacturing firms are being driven by the prospects of cheaper labor to shift employment abroad. Yet the evidence, beyond anecdotes, is slim. Using firm-level data collected by the U.S. Bureau of Economic Analysis (BEA), we estimate the impact on U.S. manufacturing employment of foreign employment by U.S. firms, controlling for intra-firm trade and technological change. Using several different approaches to estimating labor demand, we find that employment in low income countries substitutes for employment at home. We also find that employment in high income affiliates is complementary with U.S. employment. These results suggest that the location of foreign affiliates determines the employment effects of offshoring. U.S. capital investments in both high and low income affiliates are associated with a downward shift in labor demand for U.S. manufacturing enterprises. Finally, technological change and intra-firm trade are also important determinants of U.S. manufacturing employment.

I. Introduction

During the last three decades, manufacturing employment in the United States has fallen steadily.[1] Over this same period U.S.-based multinationals increased their foreign activities at a rapid pace. These parallel developments have led critics of globalization to conclude that U.S. firms are shutting down factories at home and shifting employment abroad. This public outcry has not gone unnoticed in Congress. On October 22, 2004 the U.S. Congress passed the American Jobs Creation Act of 2004. The Act contains a provision to encourage profit repatriation back to the U.S. by domestic multinationals--explicitly for the purpose of job creation at home.

Why should offshore activities—either through arms-length outsourcing or U.S. outward foreign investment—be perceived any differently than international trade in goods? Just as international trade benefits the economy as a whole, but creates both winners and losers in the domestic economy, we would expect some winners and losers from offshoring. Yet some recent studies claim that there are no domestic employment losses from offshoring activities, suggesting that the effect of outward foreign investment is fundamentally different from international trade. Borga (2005), Desai, Foley, and Hines (2005), and Slaughter (2003) find that expansion of U.S. multinationals abroad stimulates job growth at home. Slaughter (2003) reports the largest positive effects of offshoring: he suggests that for every new job abroad, U.S. employment increases two-fold.[2] Reviewing these studies, Mankiw and Swagel (2006) conclude that "foreign activity does not crowd out domestic activity; the reverse is true."

A second set of studies (Brainard and Riker (2001), Hanson, Mataloni and Slaughter (2003), Muendler and Becker (2006)) reaches the opposite conclusion: jobs abroad replace jobs at home, but the effect is small. How can we reconcile these different studies? Some of the discrepancies may be due to sample selection. For example, Slaughter (2003) reaches opposite conclusions depending on whether he uses the entire universe of multinationals or manufacturing alone. Methodological differences may also account for some of the discrepancies. Desai et al (2005) examine U.S. employment growth at home as a function of employment growth abroad without disaggregating affiliate activity into high and low income

[1] Economic Report of the President, 2007.

locations. These different answers to the same question are problematic because policy makers are left uncertain as to whether social safety nets for workers displaced by trade competition should be extended to workers displaced by multinational activity abroad.

In this paper, we resolve the controversy by developing an empirical framework which allows firms to simultaneously determine employment and the capital stock at home and abroad. With this framework, we are able to separately identify the impact on home employment of affiliate hires in low and high income countries, expansion of the capital stock across different locations, changes in intra-firm and arms-length trade, and technological change. We address endogeneity problems using instrumental variables techniques. Instruments for employment abroad include factors that positively affect labor supply and labor productivity in affiliate locations, such as educational attainment and number of personal computers per capita. We also account for sample selection problems: U.S. firms most affected by global competition may leave the sample. To identify determinants of entry and exit which do not belong in the labor demand equation, we draw on the recent literature on firm heterogeneity. Finally, to address the possibility that methodological differences might be driving the conflicting results described above, we adopt a variety of different approaches to estimating labor demand and a range of econometric techniques.

We find that some jobs have indeed been "exported abroad," disputing arguments that offshoring by U.S. manufacturing firms leads to net job expansion at home. Yet this is only part of the explanation for the sharp contraction in U.S. parent employment. Other quantitatively important determinants of U.S. multinational employment include import competition, physical investment abroad by U.S. parents, and technological change. Offshoring affects U.S. manufacturing employment through a direct negative impact on domestic labor demand as well as through indirect effects that operate via expansion of the affiliate capital stock and greater intra-firm trade. The negative impact of outward investment and intra-firm trade on U.S. multinational employment is probably twice as important as the negative effects of expanding affiliate employment in low-income countries. These results are robust to a variety of econometric specifications.

[2] Slaughter's estimates are presented in a recent high profile report released by the government on the consequences of offshoring for the US economy.

Our research shows that the impact of affiliate employment on U.S. jobs varies with affiliate location. Employment in low-income affiliates substitutes for U.S. employment: the 40 percentage point increase in low-income affiliate employment between 1977 and 1999 accounted for a drop in U.S. parent manufacturing employment of up to 15 percent. However, employment in high-income affiliates is complementary with parent employment. That complementarity is driven by the fact that employment of US multinationals in both the US and in their high-income affiliates contracted, leading to the observed positive correlation (reported in Borga (2005) and Desai, Foley and Hines (2005)) between employment at home and abroad. These results help to reconcile contradictory findings in the academic literature and anecdotal evidence in the popular press of factory closings and falling manufacturing employment. We also explore the possibility that access to cheap labor has helped U.S. parents to survive. Our analysis suggests that this is likely to be the case: firms with a higher percentage of employees in developing countries are more likely to survive.

While the literature on the manufacturing employment effects of offshoring is limited, there is a more extensive literature on the impact of international trade on U.S. jobs. Revenga (1992) finds a negative impact of changes in import prices on U.S. employment growth. Katz and Murphy (1992) also find that increased import competition negatively affected relative labor demand in the U.S., particularly in the 1980s with the burgeoning of the U.S. trade deficit. The different effects of U.S. multinational activity on domestic employment outcomes depending on affiliate location is consistent with evidence on the employment effects of international trade documented by Borjas, Katz and Freeman (1997) and Bernard, Jensen and Schott (2006). Borjas, Freeman and Katz (1997) find that increased trade with developing countries depresses wages at the bottom of the income distribution. Bernard et al. examine the impact of U.S. imports on both the survival and employment of U.S. manufacturing firms. They find that imports only harm U.S. manufacturing employment when those imports are from low wage countries.

The remainder of this paper is organized as follows. In Section II, we describe the Bureau of Economic Analysis data on outward direct investment and our choice of sample. In Section III we outline broad trends in employment for U.S. parent companies and their affiliates. We also report the correlations between expansions and contractions at home and abroad for U.S. multinationals. Section IV describes the empirical framework and discusses econometric issues, including the strategy for identification and the proposed correction for selection out of the BEA dataset. Section V presents the results and Section VI concludes.

II. The BEA Data

We analyze the firm-level surveys on U.S. direct investment abroad, collected each year by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. The BEA collects confidential data on the activities of U.S.-based multinationals, defined as the combination of a single U.S. entity that has made the direct investment, called the parent, and at least one foreign business enterprise, called the foreign affiliate. We use the data collected on majority-owned, non-bank foreign affiliates and non-bank U.S. parents for the benchmark years between 1977 and 1999. The benchmark years are 1977, 1982, 1989, 1994 and 1999 and include more comprehensive information than the annual surveys. To our knowledge, very little work has been done with the firm-level data using the entire length of the time series.[3]

Creating a panel using the benchmark years of the BEA survey data is a nontrivial task. First, not all firms are required to report to the BEA and reporting requirements vary across years. Second, because we are interested in understanding what is happening at the industry level, we must consider the implications of the changes to the Standard Industrial Classification (SIC) codes in 1972 and 1987 and the switch from SIC codes to the North American Industrial Classification System (NAICS) codes in 1997. The fact that parents are allowed to consolidate information for several affiliates in one country on a single form calls for special care in the aggregation and interpretation of affiliate level data.

All foreign affiliates with sales, assets or net income in excess of a certain amount in absolute value must report to the BEA. This amount was $.5 million dollars in 1977, $3 million dollars in 1982,

[3] Although the BEA parent identification codes changed between 1977 and 1982, linking parents from 1977 to the remaining benchmark years proved relatively straightforward. This is because in addition to a parent identification code created by the BEA (which changed between 1977 and 1982) each parent has an employee identification number (EIN) assigned to it by the Internal Revenue Service which did not change during the period 1977-1999.

1989 and 1994 and jumped to $7 million dollars in 1999. In addition, a new reporting requirement was imposed on parents in 1999. Parents whose sales, assets or net income exceeded $100 million (in absolute value) were required to provide more extensive information than parents whose sales, assets or net income fell below $100 million.[4] To determine whether the changes in reporting requirements biased our sample toward small firms in the early years, we imposed a double filter on the data using the uniform cutoff for affiliates (based on the strictest reporting requirement of $100 million in 1999) of $5.59 million in 1982 U.S. dollars and $79.87 1982 U.S. dollars for parents. As it turns out, the reporting requirements were large enough that imposing the filter on the data makes little difference. Therefore, we use all of the available *actual* data. We drop from our sample data that has been "estimated" by the BEA.[5]

Finally, there is the issue of how to choose our sample of "manufacturing" firms.[6] Parent employment is classified both by industry of sales (up to ten industries are reported) and by industry of employment. Since none of the other data are classified by industry of employment, we choose our sample based on industry of sales using only those parents whose primary industry of sales is manufacturing. Parents have several affiliates and these affiliates are typically spread across a number of industries. We choose only affiliates classified in manufacturing since our goal is to determine whether manufacturing jobs at home are being replaced by manufacturing jobs abroad. We further limit the sample

Using the EIN number, plus the country in which the affiliate operates, we are able to track parent/affiliate pairs over time.

4 Parents who do not meet this cutoff but who have affiliates that meet the $7 million cutoff are still required to provide extensive information for affiliates.

5 This means that we have also dropped firms whose reporting status in that benchmark year is "exempt" (be 11 code equal to five) since data for these firms are also effectively estimated based on data in the previous benchmark survey.

6 To document what has happened within industries in manufacturing over time, we created a concordance that allows us to assign SIC codes to NAICS codes. This was necessary because in 1999 the BEA collected data on NAICS codes and not SIC codes. We chose to convert SIC codes to NAICS codes since all future information will be collected on the basis of NAICS codes. For example, data for the benchmark year 2004 will be available shortly and firms report based on NAICS codes. The 1977 and 1982 benchmark years are based on the 1972 SIC codes. The 1989 and 1994 benchmark years are based on the 1987 SIC codes. The 1999 benchmark data are based on the 1997 NAICS codes. In addition to the fact that the industry codes are not directly comparable across all benchmark years, the BEA industry codes have been slightly modified to reflect the fact that these are enterprise data and are called, respectively, SIC-ISI and NAICS-ISI. Working with these codes, we created a program (available upon request) that assigns the SIC-ISI codes for the years 1977-1994 to NAICS-ISI codes. Both parents and affiliates are classified into their primary industry of sales using the following algorithm, which tracks the algorithm used by the BEA: the top five industries by parent or affiliate sales are used to assign to each parent or affiliate one of the 22 aggregates. Sales are collapsed into the top five industries of sales and then the maximum sale by industry is identified. A parent or affiliate is classified as being in manufacturing if its maximum sales across the top five industries of sales is in manufacturing.

to parents whose affiliates report non-zero production employment which allows us to identify the effects of hiring both non-production and production workers on U.S. employment.

There are a number of parents who have been reclassified from manufacturing to wholesale trade and services. For example, several firms were in manufacturing but are now classified in wholesale trade because almost all of their manufacturing is done overseas and not in the United States. To account for this, we chose our sample in two different ways. First, we included parents who either were classified in manufacturing or had previously been classified in manufacturing and their manufacturing affiliates. Next, we included only parents who were currently in manufacturing in any given year and their manufacturing affiliates. Since the results are not sensitive to this distinction, we use the larger of the two samples, keeping all parents that were *ever* classified in manufacturing and their manufacturing affiliates.

While the number of U.S. parents included in the BEA sample may appear small (see Table 1), these enterprises accounted for the majority of economic activity in U.S. manufacturing during the sample period. Appendix Table A.1 updates a table by Mataloni and Fahim-Nader (1996) to 1999 and reports the coverage of the BEA data for benchmark years 1982 through 1999.[7] In 1982, sales by these enterprises accounted for over 84 percent of total manufacturing sales in the United States. These enterprises also accounted for 53 percent of all exports of goods, and 66 percent of employment in manufacturing. However, the share of these firms as a share of total U.S. economic activity over the period has declined. Appendix Table A.1 shows that in 1999, these enterprises accounted for only 58 percent of U.S. manufacturing sales and 44 percent of employment. These firms continued to account for most of U.S. research and development expenditures throughout the sample period: in the 1980s and 1990s, Mataloni and Fahim-Nader (1996) show that the U.S. parents included in the BEA sample accounted for over 80 percent of total private U.S. research and development expenditures.

Appendix Table A.1 also shows that the proportion of services firms accounted for by the BEA sample is extremely small. In 1982, the BEA sample accounted for only 1 percent of service sector employment and three percent of gross product. By 1999, the BEA sample still accounted for only 2 percent of service sector employment and only six percent of gross product in services. Consequently, using that sample to infer broad trends in services could be misleading, and is certainly not representative of the majority of the service industry in the United States. What the numbers in Appendix Table A.1 suggest is that multinationals account for a very small share of U.S. activity in services, and a much larger share of U.S. activity in manufacturing.

How reliable are these data? These are the only data officially collected by a U.S. government agency on affiliate activity abroad. We have initiated a number of data checks to analyze the reliability of the coverage.[8] First, we contacted Statistics Canada to check whether they record information on affiliates of U.S. multinationals in Canada, which would allow us to cross-check U.S. data on foreign affiliates there with Canadian data on inward foreign investment. Statistics Canada informed us that they do not gather data on affiliates because it is too difficult to define a foreign affiliate and referred us to the BEA. We were, however, able to cross-check the employment numbers for U.S. affiliate activity reported by the BEA with data on inward foreign investment reported by the official statistical agencies in Germany and Sweden. These checks are reported in Appendix Table A.2. We report total employment in both countries as indicated by the BEA database and show that it is quite close to the same numbers collected by the national statistical agencies. Although there are some discrepancies, it is important to note that the fiscal year for U.S. parents and their foreign affiliates does not always correspond to the calendar year: the BEA classifies a firm in 1999 if its fiscal year ends in 1999—this could be for any month in 1999. Although most firms have their fiscal year ending in December, enough have earlier end dates that some of the 1999 BEA employment figures correspond to a mix of the 1998 and 1999 employment figures reported by the statistical bureaus for Sweden and Germany.

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[7] See the December 1996 issue of *The Survey of Current Business*, "Operation of US Multinational Companies: Preliminary Results from the 1994 Benchmark Survey," by Mataloni and Fahim-Nader, as well as the authors' own calculations.

[8] We are particularly grateful to Marc Muendler and Karolina Eckholm for helping us do this cross-checking. They provided the data on the activities of US multinational affiliates in Germany and Sweden.

III. Trends in Employment: 1977-1999

Table 1 shows that between 1977 and 1999 the multinational manufacturing firms in our sample shed 4 million jobs in the United States.[9] The contraction in employment in the U.S. has been mirrored by job reductions (for the period between 1977 and 1999) or job stagnation (for the period between 1982 and 1999) for affiliates in developed countries. In developed country affiliates, employment fell by roughly half a million between 1977 and 1999. Real wages in both the U.S. and in developed country affiliates increased, with the averages suggesting a 22 percent increase in real wages between 1977 and 1999 in the U.S. and a 29 percent increase in real wages during the same period in developed country affiliates. The job losses in the U.S. and in developed country affiliates have been only partially offset by an increase in the number of jobs in developing countries, where the number of jobs increased by half a million between 1977 and 1999. Unlike in the developed countries, real wages paid by U.S. based multinationals to employees in their developing country affiliates have fallen. The evidence for the U.S. parents is in line with the aggregate trends in the U.S. manufacturing sector derived from the NBER Manufacturing Productivity Database.

There has been a substantial shift in activity from developed to developing country affiliates. Affiliate employment as a share of global employment increased from 28 percent in 1977 to nearly 36 percent in 1999. The increase was almost entirely driven by a doubling of affiliate employment shares in developing countries, from 8 to 15 percent. Affiliate employment in developed countries, as a share of total worldwide employment, remained roughly constant over the entire period at around 20 percent. Affiliate share of employee compensation and investment also total increased as a result of increased activity in developing countries.

The contraction in domestic jobs in the manufacturing sector has been more than offset by job creation in the services sector. Table 2 shows that between 1977 and 1999, employment by U.S. parents

[9] The variables we use are reported to the BEA on the basis of the fiscal year. General trends in employment weighted averages are reported in Table 1 for manufacturing and in Table 2 for services. The numbers in Table 2 include all firms classified in services under the SIC classification prior to 1997 and under the NAICS system post-1997. Because the NAICS system classifies some industries as services that were not previously classified as

in the sample increased by more than 4 million or 802 percent. This increase reflects both expansion by existing services multinationals and the fact that U.S. services enterprises are entering the BEA database by increasing affiliate activity. Expansion at home has been accompanied by expansion abroad. In developed country affiliates employment increased from 73 thousand in 1977 to 1.2 million in 1999 and in developing country affiliates employment rose from 24 thousand in 1977 to 363 thousand in 1999. While the share of affiliate activity still accounts for a much smaller share than affiliate activity in manufacturing, it has grown much more rapidly in services. Except for affiliate share of compensation, this increase in overseas activity has been fairly evenly spread between developed and developing country affiliates.

While the contraction in employment in the manufacturing sector may have been offset by employment increases in the service sector, between 1977 and 1999 real compensation per worker in services amounted to roughly half of real compensation per worker in the manufacturing sector. This may be partly a reflection of the change in the mix of workers in the U.S. manufacturing sector—if unskilled U.S. workers have been replaced by unskilled foreign workers then the average wage in the U.S. manufacturing sector reflects the wages of skilled workers. However, the fact that this differential existed even in 1977 before the big contraction in U.S. manufacturing suggests that this is not the only reason for the difference. Since time-series data on the composition of employment for U.S. parents is not available, it is difficult to reach any strong conclusions on this point.

We now turn to a discussion of broad trends in the pattern of manufacturing employment changes in U.S. parents and their affiliates. We restrict our analysis to the period 1982 to 1999 for comparability with the work by Brainard and Riker (1997, 2001) and Desai et al. (2005) who used these same data beginning in 1982.[10] As a first test of whether U.S. parents are substituting U.S. employment with affiliate employment, we created a series of employment offsets at the industry level. Figure 1 shows employment offsets aggregated to the 3-digit level for the manufacturing sector. Changes in parent (U.S.)

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services, the employment numbers are slightly exaggerated. However, when we restrict our analysis of services to only those sub-categories that can be exactly matched across years, we get nearly identical trends.

[10] If we extend the period to 1977 and redo the results for 1977 to 1999 the results look similar though we lose some of our variables. In addition, if we use 1977 we are unable to correct for selection bias since no electronic version of the data exists prior to 1977.

employment are indicated by the horizontal axis and changes in affiliate employment are indicated by the vertical axis. A point in the upper right-hand quadrant indicates expansion both at home and abroad. A point in the lower left-hand side quadrant indicates contraction at home and abroad. Substitution occurs if data points are either in the upper left-hand quadrant (indicating contraction at home and expansion in affiliate employment) or in the lower right-hand quadrant (indicating expansion at home and contraction abroad). Fears over offshoring are centered on supposed activity in the upper left-hand quadrant, which would indicate expansion of affiliate employment and contraction of employment in the U.S.; so-called substitution of foreign for U.S. jobs. As Figure 1 shows, most of the activity of U.S. manufacturing multinational enterprises has taken place in the lower left-hand quadrant, indicating employment contraction both at home and abroad.

Figures 2 and 3 separate changes in employment from 1982 to 1999 based on the location of the parent's affiliates. Figure 2 reports employment offsets at the 3 digit level for developed country affiliates and parents; Figure 3 reports the same trends for developing country affiliates. The trends are similar across Figures 1 and 2: employment in high-income affiliates and parent employment are complementary but that relationship is driven by the contraction in manufacturing. However, Figure 3 reveals that employment in low-income affiliates substitutes for employment at home. Moreover, the downward sloping regression line appears to be driven by contraction in two key sectors: computers and electronics.

IV. Empirical Framework and Identification Issues

Previous work has used a variety of approaches to test for the impact of foreign affiliate activity on labor demand at home, making it difficult to identify whether the conflicting results stem from different approaches or different datasets and time periods. Brainard and Riker (1997) estimate labor demand as a function of wages in different locations, Desai et al (2005) estimate a reduced form equation with log labor at home as a function of log labor abroad, and Brainard and Riker (2001), Hanson, Mataloni and Slaughter (2003) and Muendler and Becker (2006) use a translog cost function approach to derive factor shares as a function of wages in different locations. Katz and Murphy (1992) and Card (2001), focusing on the effects of immigration and trade, both use a CES functional form to derive an equilibrium relationship between the ratio of employment at home to employment abroad and the ratio of wages at home to wages abroad. We begin by deriving an empirical framework based on factor quantities, which are directly observable in our dataset. For purposes of comparison with previous work and as a robustness check we also derive estimating equations using these other approaches.

Framework Based on Factor Quantities

Consider a representative firm that has the choice of producing either at home (*h*), or abroad (*f*). To simplify the analysis we restrict ourselves to two locations, but in our empirical estimation we will allow for sales and production in three locations – home, low-income countries and high-income countries. We assume that firm *i*'s global production function, omitting time subscripts, can be described in the following way:

(1) $Q_i = A_i K_i^{\beta} L_i^{1-\beta}$

where Q is total output, and K and L are total capital (and other non-labor inputs) and labor employed and A represents Hicks neutral technological change.

We introduce the possibility of production in various locations in the following way:

(2) $L_i = g(L_h, L_f)$

(3) $K_i = f(K_h, K_f)$.

We do not impose functional forms on (2) and (3) to acknowledge the fact that labor (capital) at home and labor (capital) abroad could be perfect complements (the Leontief aggregation), perfect substitutes (a linear function) or something in between (the CES class of functions). This framework is flexible enough to allow for a range of production technologies, including Brainard and Riker's (2001) assumption that production is vertically decomposed across high-wage and low-wage regions. Nor is our empirical approach restricted to the framework in (2) and (3): we could also have assumed a purely horizontal decomposition across locations, with Q at home equal to $g(L_h,K_h)$ and Q abroad equal to $f(L_f,K_f)$.

The firm maximizes the following global profit function:

$$(4)\ \pi_i = P_i Q_i - w_h L_h - w_f L_f - r_h K_h - r_f K_f$$

Where π_i is the firms' total profits, P_i is a function of prices received at home and abroad and Q_i is the firms' total output.

Since we are interested in labor demand and wages in the U.S., we maximize (4) with respect to labor demand at home (L_h) and obtain the following first order condition:

$$(5)\ w_h = P_i \frac{\partial Q_i}{\partial L_h} \quad .$$

The marginal product of labor at home depends on the form of the aggregate production function and on the functional forms of equations (2) and (3). In other words,

$$(6)\ \frac{\partial Q_i}{\partial L_h} = \frac{\partial Q_i}{\partial L_i}\frac{\partial L_i}{\partial L_h} = \beta A_i \left(\frac{K_i}{L_i}\right)^{(1-\beta)} \frac{\partial L_i}{\partial L_h}$$

Equations (5) and (6) implicitly define the following labor demand function:

$$(7)\ L_h = z(w_h, L_f, K_h, K_f, P_i, A_i),$$

where the sign of the derivatives of L_h with respect to its arguments depends on the functional forms assumed in (2) and (3). For example, if the aggregation in (2) is Leontief, then labor at home and labor abroad are perfect complements and the sign on $\frac{\partial L_h}{\partial L_f}$ depends on whether labor abroad is the binding constraint. The opposite extreme is the case in which labor at home and labor abroad are perfect substitutes in which case $\frac{\partial L_h}{\partial L_f} < 0$. Similarly the sign on $\frac{\partial L_h}{\partial K_f}$ depends on the degree of substitutability between U.S. and foreign capital. As long as $\frac{\partial L_h}{\partial K_h} > 0$, investment abroad reduces the demand for labor at home if investment abroad and investment at home are substitutes. If investment abroad and investment at home are perfect complements then the impact of investment abroad on the demand for labor at home depends on which is the binding constraint. If investment abroad is the binding constraint, then it should have a positive impact on domestic employment, otherwise it will have no effect. In the polar extreme where investment abroad and investment at home are perfect substitutes then investment abroad will have a negative impact on home labor demand through its impact on domestic investment.

Equation (7) makes clear that estimating employment at home as a function of foreign employment without controlling for capital inputs, productivity shocks and demand shocks both at home and abroad is likely to lead to biased or incorrect estimates. To the extent that final goods prices are influenced by demand abroad (for example, affiliates may sell in local markets), using foreign demand shocks as instruments for labor employed abroad could exacerbate simultaneity bias.

To derive our wage equation, we assume that labor supply at home is an upward sloping function of home wages (w_h) and time effects (possibly associated with increasing educational opportunities common across industries but changing over time) so that:

$$(8) \quad L_h = s(t, w_h) .$$

Labor market clearing implies the following reduced form equations for employment:

$$(9) \quad L_h = q(L_f, K_h, K_f, P_i, A_i, t)$$

Our first set of estimating equations is based on log-linearization of (9) and takes the following form:

$$(10) \quad \log L_{iht} = \beta_0 + \sum_j \alpha_j P_{ijt} + \sum_j \beta_j A_{ijt} + \sum_{j \neq h} \gamma_{hj} L_{ijt} + \sum_j \omega_j K_{ijt} + d_t + f_i + \varepsilon_{ijt}$$

where log *L* is the net annual log employment by the U.S. parent in the United States, *P* are final goods prices, *A* represents technological change, *L* is log of foreign employment for the U.S. parent and K is the log of the capital stock. We allow for time effects *d* and a firm-specific (common to the parent and its affiliate) fixed effect f_i, which takes into account both firm-specific productivity differences and other non-varying firm characteristics, while *j* indexes location and *t* indexes time. We divide the locations in which U.S. firms can do business into high-income and low-income locations.

For comparison with work by Brainard and Riker (2001) we replace labor demand abroad with wages abroad on the right-hand side of equation (10) to obtain the following estimating equation:

$$(11) \quad \ln L_{iht} = \beta_0 + \sum_j \alpha_j \ln P_{ijt} + \sum_j \beta_j A_{ijt} + \sum_j \eta_{hj} w_{jt} + \sum_j \omega_j K_{ijt} + d_t + f_i + \varepsilon_{ijt}$$

where *L* is U.S. employment now expressed as a function of wages at home and abroad in addition to the other controls included earlier.

Framework Based on a Translog Cost Function Approach

An alternative framework based on a translog cost function for estimating the impact of foreign competition on domestic employment has been adopted by Brainard and Riker (2001), Hanson, Mataloni and Slaughter (2003) and Muendler and Becker (2006). This alternative approach has the advantage that the translog cost function approximates many well behaved cost functions. The disadvantage lies in the way the approach has been implemented: most recent applications assume a short-run cost function, and allow capital *K* and technology *A* to be predetermined. Nevertheless, we also report results using this approach for the sake of completeness. Following the previous work cited above, we assume that short-run costs are determined by labor costs in various locations. Consequently, the short-run translog variable cost (TVC) function (omitting time and parent subscripts) is given by:

(12)

$$
\begin{aligned}
\ln \mathrm{TVC} = {} & \alpha_0 + \sum_j \varpi j \ln Y + \sum_j \alpha_{jw} \ln W + \sum_j \nu j \ln K + \sum_j \alpha_{jA} \ln A \\
& + \frac{1}{2}\sum_j \sum_k \alpha_{jY} \left(\ln Y\right)^2 + \frac{1}{2}\sum_j \sum_k \xi_{jk} \left(\ln W\right)^2 + \frac{1}{2}\sum_j \sum_k \beta_{jk} \left(\ln A\right)^2 \\
& + \frac{1}{2}\sum_j \sum_k \omega_{jk} \left(\ln K\right)^2 + \sum_j \sum_k \vartheta_{jk} \ln W \ln K + \sum_j \sum_k \tau_{jk} \ln Y \ln A \\
& + \sum_j \sum_k \rho_{jk} \ln Y \ln W + \sum_j \sum_k \chi_{jk} \ln K \ln A + \sum_j \sum_k \varphi_{jk} \ln K \ln Y + \sum_j \sum_k \kappa_{jk} \ln A \ln W + \varepsilon
\end{aligned}
$$

Differentiating ln TVC with respect to ln *Wj* according to Shepard's lemma, and allowing for a firm fixed effect, yields labor share in location *j* for parent *i* at time *t*:

(13) $$LSHARE_{ijt} = \beta_0 + \sum_j \rho_j \ln Y_{ijt} + \sum_j \kappa_j \ln A_{ijt} + \sum_j \xi_j \ln w_{jt} + \sum_j \vartheta_j \ln K_{ijt} + f_i + \varepsilon_{ijt}\,.$$

where LSHARE is defined as the cost share of labor expenditures in location *j* for parent *i* in time *t*, relative to expenditures on labor across all locations.[11]

Framework Based on a CES Input Function Approach

For comparison with a popular approach adopted by labor economists (see Katz and Murphy (1992) or Card (2001)) and to check the robustness of our results, we also consider aggregating capital and labor across locations using a CES function. Thus we define L and K as follows:

(14) $$L_i = \left[\sum_j (e_{ij} N_{ij})^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

(15) $$K_i = \left[\sum_j (a_{ij} K_{ij})^{\frac{\omega-1}{\omega}} \right]^{\frac{\omega}{\omega-1}}$$

[11] Equation (13) can be jointly estimated using a SUR approach across all N-locations, if N is the total number of locations. Although less efficient, we estimate only the share equation at home, leaving joint estimation with affiliate share equations in other locations for future work.

where *e* and *a* represent productivity shocks, L_i is the total quantity of labor used, K_i is the total quantity of capital used and σ (ω) is the Allen elasticity of substitution between labor (capital) in location i and j and is defined below.[12]

The first-order condition with respect to labor hired in the U.S. is:

$$(16) \quad p_{i,h} Y_L \frac{\partial L_i}{\partial L_{i,h}} = w_{i,h}$$

and the first-order condition with respect to labor hired abroad is:

$$(17) \quad p_{i,f} Y_L \frac{\partial L_i}{\partial L_{i,f}} = w_{i,f}$$

where p are final goods prices at home and abroad and w are wages at home and abroad.

Since,

$$(18) \quad \frac{\partial L_i}{\partial L_{i,h}} = \frac{\sigma}{\sigma - 1}\left[\sum_j \left(e_{ij} L_{ij}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{1}{\sigma-1}} \frac{\sigma - 1}{\sigma}\left[\left(e_{i,h} L_{i,h}\right)\right]^{\frac{-1}{\sigma}} \quad e_{i,h}$$

and,

$$(19) \quad \frac{\partial L_i}{\partial L_{i,f}} = \frac{\sigma}{\sigma - 1}\left[\sum_j \left(e_{ij} L_{ij}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{1}{\sigma-1}} \frac{\sigma - 1}{\sigma}\left[\left(e_{i,f} L_{i,f}\right)\right]^{\frac{-1}{\sigma}} \quad e_{i,f}$$

we can insert (18) into (16) and (19) into (17) and take the ratio of (16) to (17) to obtain the ratio of the first-order conditions:

$$(20) \qquad \frac{p_{ih} e_h^{\frac{\sigma-1}{\sigma}} L_h^{\frac{-1}{\sigma}}}{p_{if} e_{if}^{\frac{\sigma-1}{\sigma}} L_{if}^{\frac{-1}{\sigma}}} = \frac{w_{ih}}{w_{if}}.$$

Taking logs of both sides of (20) yields the following:

[12] If sigma is equal to zero, we have the case of perfect complements (i.e. left shoes and right shoes, the leontief function that looks like $L=\min(L_h, L_f)$ this is obviously extreme but might be applicable to some kinds of natural resource extraction where unless you have some workers abroad pumping out the oil, workers in the US cant do

$$(21) \quad \ln(L_h / L_f) = \sigma \ln \frac{p_h}{p_f} + (\sigma - 1) \ln \frac{e_h}{e_f} \quad - \sigma \ln \frac{w_h}{w_f} \quad .$$

Equation (21) underscores the fact that as long as there is some substitution between domestic and foreign labor (i.e. σ >0), the cost of labor abroad plays an important role in determining the demand for U.S. labor.

Comparing Elasticities of Labor Demand Across Specifications

All four approaches described above yield coefficient estimates which can be used to derive elasticities of factor demand η and Allen elasticities of substitution σ . In equation (11), the key parameters are the η 's. The term η_{ij} is generally referred to as the elasticity of factor demand. Typically, inputs i and j are referred to as p-complements if η_{ij} is less than zero, and p-substitutes if η_{ij} is greater than zero. A negative cross-wage elasticity would imply that an increase in foreign wages reduces the demand for U.S. labor, while a positive sign indicates that U.S. and foreign labor are price substitutes. The relationship between η_{ij} in equation (11) and γ_{ij} in equation (10) is given by the following:

$$(22) \frac{\partial \ln L_i}{\partial \ln w_j} = \eta_{ij} = \frac{\partial \ln L_i}{\partial \ln L_j} \frac{\partial \ln L_j}{\partial \ln w_j} = \gamma_{ij} \eta_{jj}$$

where η_{jj} is the own elasticity of labor demand in location j.

The key parameters in equation (13) are the ξ_j s. To convert these into Allen partial elasticities of substitution between locations, we can calculate the following if we have labor shares s_j :

$$(23) \, \sigma_{jk} = (\xi_{jk} + s_j s_k) / s_j s_k$$
$$\sigma_{jj} = (\xi_{jj} + s_j s_j - s_j) / s_j s_j$$

anything. The polar opposite is σ tending to infinity (i.e. labor at home and labor abroad are perfect substitutes so $L = L_h + L_f$) – this is also extreme but some version of this might be realistic for production workers.

The Allen partial elasticity of substitution σ_{jk} gives us the percentage change in the ratio of L_j to L_k with respect to the percentage change in the ratio of w_k to w_j. The Allen partial elasticity of substitution is directly estimated as the coefficient on relative wages using the CES approach (equation (21)). To convert the Allen partial elasticity of substitution into an elasticity of factor demand, we multiply by the factor share:

$$(24)\ \eta_{ij} = s_j \sigma_{ij} = \partial \ln L_i / \partial \ln w_j$$

As defined earlier, η_{ij} is the elasticity of factor demand and represents the percentage change in employment in location *i* in response to a percentage change in the wage in location *j*. Factor shares are typically computed by taking the sample means of the data.[13] We will report both Allen and factor price elasticities of substitution for each of the four estimation strategies in Table 6.

Estimation Issues and Identification Strategy

To estimate equations (10), (11), (13) and (21) we need data on home and foreign technology shocks (*A*'s), employment (*L*'s), capital (*K*'s), wages, and price shocks (*P*'s). We measure technology shocks with firm-level research and development (R&D) expenditures. Wages are measured at the firm-level, but since these are clearly endogeneous we instrument them using industrial wages gathered by UNIDO by country and year. We measure *L* as the number of employees at home and abroad, and measure *K* as the net book value of property, plant, and equipment at home and abroad. In previous work, we also controlled for intermediate inputs by including the log of real intermediate input purchases from within the United States, but the results were unaffected and are not reported here.

In U.S. manufacturing, international competition plays an important role in price determination. Consequently, we proxy for U.S. demand shocks using both industry dummies and import competition

[13] Confidence intervals can be computed using bootstrapped standard errors.

within and external to the firm. We use industry-level import penetration to proxy for competition from third party imports. These data were made available at the 4-digit ISIC level for 1977 through 1999 by Bernard, Jensen, and Schott (2006). Firms in our sample also report imports to and exports from each affiliate location, giving us a measure of intra-firm trade. This information also allows us to compare the impact of imports manufactured by affiliates and imports outside the firm's control on domestic labor demand.[14]

Following Desai et al (2006), we proxy for foreign price shocks with GDP growth in high- and low-income affiliate locations. Our summary statistics and raw correlations, as well as previous work by Brainard and Riker (1997, 2001) and Bernard et al. (2006), suggest that the degree to which foreign employment, investment and imports affect domestic labor outcomes will depend critically on their location. U.S. affiliate employment in high-income countries is likely to have very different effects than affiliate employment in low-income countries on U.S. labor market outcomes. To account for this, we include separate values for foreign capital, labor, R&D expenditures, imports, and demand shocks for high- and low-income countries.

Since U.S.-based multinationals have affiliates in multiple locations, we construct aggregate measures of activity abroad for affiliate activity in high- and low-income countries. Specifically, we use employment weighted averages of the right-hand side variables in equations (10), (11), (13) and (21) across affiliate country locations within each set of high- and low-income countries. Our weights are the parent's share of foreign employment in each affiliate location, using the initial distribution of employment across countries within each high or low-income set of countries. The initial distribution of employment is determined by when the parent first enters the sample.

Estimation of (10), (11), (13) and (21) using OLS is likely to lead to biased coefficient estimates since capital, foreign employment, firm-specific wages, and firm-specific trade flows are simultaneously determined with home employment. Therefore, we also estimate equations (10), (11), (13) and (21) using instrumental variables (IV). Given the large number of endogenous variables, we choose to label our

[14] In previous work we also separately controlled for goods imported from the exported to the affiliate but manufactured by third parties, but these additional variables are excluded in the current draft because they were not

firm-specific proxies for technology shocks as controls and focus on the following endogenous variables: capital stock (at home, as well as in high- and low-income affiliates), employment (in high- and low-income affiliates), exports to foreign affiliates and imports from foreign affiliates. Our instruments for the capital stock abroad include capital controls in the host country affiliate, the median host country tax rate, and a measure of political risk. These measures are all correlated with foreign investment in the host country and should only affect parent employment through their impact on investment. Our instruments for intra-firm trade are U.S. tariffs at the four-digit industry level, freight costs, the distance between the host and the source country, and trade agreements signed between the host country and the United States. Tariffs and freight costs are taken from Bernard et al (2006), while the distance measures and trade agreements were provided by Andrew Rose. These measures are all correlated with bilateral trade but should be excluded from the estimating equation. Finally, instruments for employment (or firm-specific wages) in high- and low-income locations include the percentage of national income spent on education, the number of PC's per 1,000 people, and industrial wages. The first two are taken from the World Bank and the last from UNIDO. The measures we use determine both the supply of labor available as well as the quality of that labor, yet should only affect U.S. labor market outcomes through their impact on the choice of employment in affiliate locations.

In addition to problems of simultaneity bias, we also face potentially important selection problems. The dependent variables in our estimating equations - the log of parent employment and U.S. labor cost shares - are not observed in every time period. We are particularly concerned about attrition, since the sample could exhibit "survivorship bias" if some firms relocate *all* operations abroad, close down U.S. operations and exit the sample. In this case, our estimates of the employment costs of multinational activity could be downward biased.

Following Wooldridge (2002) we model this selection problem as follows. If our equation of interest is given by:

$$y_{it} = x_{it}\beta + u_{it}, \; t = 2,...,T \;,$$

---

statistically significant and were collinear with imports and exports manufactured by the affiliate and parent.

then conditional on the parent reporting in the previous period, i.e. $s_{i,t-1} = 1$, we can write a reduced form selection equation for $t \geq 2$ as,

$$s_{it} = 1[w_{it}\delta_t + v_{it} > 0], \qquad where, \qquad v_{it} \mid \{x_{it}, w_{it}, s_{i,t-1} = 1\} \sim Normal\,(0,1)$$

Where s_{it} is a binary selection indicator equal to one if the firm is present in the BEA database in years t and t+1. A problem arises if the error terms u_{it} and v_{it} are correlated. In the context of panel data with an unobserved firm fixed effect, attrition, and endogenous right-hand side variables, Wooldridge (2002) proposes as a solution a variant of a two-stage Heckman correction for selection modified for a panel context. In each period, Wooldridge proposes estimating a selection equation using a probit approach and calculating lambda, the inverse Mills ratio, for each time period and each parent *i*. Once a series of lambdas have been estimated for each year and parent, the estimating equations are augmented by these lambdas. For example, equation (10) would be estimated as the following:

$$(11') \quad \log L_{iht} = \beta_0 + \sum_j \alpha_j P_{ijt} + \sum_j \beta_j A_{ijt} + \sum_{j \neq h} \gamma_{hj} L_{ijt} + \sum_j \omega_j K_{ijt} + \rho_2\, d2_t\, \hat{\lambda}_{it} + \cdots + \rho_T\, dT_t\, \hat{\lambda}_{it} + f_i + \varepsilon_{ijt}$$

In the case where there are endogenous right-hand side variables, then (10') can be estimated using as instruments the original instrument list augmented to include the estimated lambdas. However, this approach is only successful if in addition to the instruments for the endogenous right-hand side variables, we can identify determinants of the binary selection variable s_{it} which are observed before the firm exits the sample (in period t-1) and which do not belong in the estimating equation. We have identified candidate variables using the insights derived from a class of models indicating that heterogeneity in productivity is a significant determinant of whether firms enter into international trade or foreign investment (see Melitz (2003)). These models suggest that selection is likely to be a function of the plant's level of (exogenously determined and unchanging) total factor productivity relative to other firms in the same industry. While the theoretical framework suggests that an individual firm's productivity (proxied by the increase in R&D expenditures) should be correlated with wages or employment, we use the level of a firm's productivity relative to a benchmark firm in the same sector as our excluded measure of productivity. Another determinant of survival which does not belong in the estimating equations is parent profitability. Consequently, we will apply the approach to selection outlined above, using as the two excluded determinants of survival the parent's profitability and its productivity relative to other firms in the industry in the previous period.

V. Results

We begin by reporting sample means in Table 3. The share of parent expenditures on their U.S. labor force relative to total worldwide expenditures on employment during the sample period was 58.4 percent. Affiliates in high-income countries accounted for 37.1 percent of expenditures on employees and affiliates in low-income countries accounted for the remaining 5 percent. While the U.S. mean share fell, the mean share of labor expenditures by the parent on affiliate employment increased in both low and high-income affiliate locations. The means and changes in means in Table 3 are different than those presented in Table 1, since Table 1 weights the data by employment shares and Table 3 presents sample means. In addition, Table 3 only includes enterprises with non-missing observations for all the dependent and independent variables in 1982 and 1999.

Although labor expenditure shares show small mean changes over time in Table 3, actual employment fell dramatically in the U.S. and increased dramatically in low-income affiliates. The reason why the employment changes were very large but expenditure share changes were not is because wage trends offset the employment developments: real wages in the sample went up in the United States and high income affiliates and fell in low-income affiliate countries. One explanation which is consistent with these wage trends is a change in the composition of employment: U.S. parents (and their high-income affiliates) are retaining relatively high-skilled workers and shifting relatively low-skilled jobs to low-income countries where labor is less expensive. We cannot easily test this hypothesis since we do not have detailed information on worker characteristics at the U.S. parents. However, the increase in R&D intensity at the U.S. parent but not at affiliates (see Table 3) and the decline in real wages in affiliates in low-income locations (see Table 1) are consistent with this possibility.

Research and development expenditures at the U.S. parent were on average 3.5 percent of total sales; in high-income affiliates the corresponding fraction was 1.5 percent and in low-income affiliates research and development expenditures accounted for .9 percent of sales. The share of R&D expenditures in sales nearly doubled, increasing by 2.8 percentage points between 1977 and 1999 in the United States, but fell in both low- and high-income affiliates. The trends are very similar if instead we proxy technology with research and development employment as a percentage of total employment. The rising share of R&D expenditures in sales for U.S. manufacturers is consistent with skill-biased technological change and rising average manufacturing wages.

Exports to foreign affiliates from the U.S. parent accounted on average for 4.1 percent of sales, and imports to the U.S. parent from the foreign affiliate accounted for an average 2.9 percent of sales. Average import penetration in the four-digit SIC sector over the period across all of manufacturing was 13.4 percent. Import penetration increased by 12.5 percentage points between 1977 and 1999, which reflects an enormous increase in the U.S. exposure of manufacturing to import competition. Exports to and imports from foreign affiliates as a share of sales also increased between 1977 and 1999, by an average of 5.4 and 1.4 percentage points. The increase in exports to foreign affiliates reflects more than a doubling of intra-firm trade. To the extent that exports to foreign affiliates are designated for further processing, this trend provides evidence of increasing outsourcing activity.

Fixed Effect and IV Results for Labor Demand

We cannot estimate equation (10') without estimates of the inverse mills ratios – our λs in equation (10'). Thus, we begin by reporting in Table 4 the results of the probit selection equations for each of the years 1982, 1989, 1994, and 1999. The probits for each of the years identify the determinants of survival based on determinants from the previous period in which data was collected. For example, in column (1), the coefficients tell us the marginal impact of different variables in 1977 on remaining in the dataset in 1982. For efficiency, we include all the instruments used in the second stage to predict affiliate employment and wages, in addition to two variables that are only included in the selection equation: profitability and total factor productivity. Profitability is calculated as the ratio of net income to sales.

Total factor productivity is (TFP) calculated as the average residual across all years from subtracting share-weighted factor inputs from output. Factor inputs include employment, capital stock, and intermediate inputs. Total Factor Productivity is normalized by the highest TFP level within that three-digit industry. The results show that high TFP (relative to the industry) and high profitability are significant predictors of continuing in the BEA sample. Profitability is a significant predictor of survival in all years, while TFP is a significant predictor of survival in 1982. A number of other variables also significantly affect the probability of survival. Firms are more likely to survive if they operate in affiliate locations with higher educational expenditures and higher GDP per capita. While R and D spending significantly (positively) affects survival in high income locations, it has no significant impact on survival in low income locations. Import penetration in the U.S. is significantly and negatively associated with the probability of survival, while U.S. tariffs on imports are positively associated with survival. U.S. parents are less likely to survive when a free trade area is formed in the parent's affiliate location, which is consistent with the negative impact of import competition and the positive effect of tariff protection. Other factors associated with the business climate in the affiliate location, including political risk, capital controls, and the tax rate, do not significantly affect the U.S. parent's probability of survival.

We report the results of estimating (10') in Table 5. The log of U.S. employment is our dependent variable and we use a within transformation of the data to eliminate the firm fixed effect. The first column of Table 5 reports the coefficient on foreign affiliate employment, aggregated across all locations, in an OLS regression of log U.S. parent employment on log affiliate employment. The point estimate of .151 indicates that a 10 percent increase in foreign employment would lead to a 1.51 percent increase in U.S. parent employment. The next two columns show that this result is very sensitive to the location of the affiliate and to the addition of other controls. If we decompose affiliate employment into high and low income regions, column (2) shows that the coefficient on high-income affiliate employment is .192 while the coefficient on low-income affiliate employment is significant and negative at -.02. These coefficients suggest that employment in high-income affiliates is complementary with U.S. employment but that employment in low-income affiliate's substitutes for U.S. employment. The point estimates imply that a 10 percent increase in affiliate employment in high-income countries is associated with a 1.9

percent increase in U.S. employment, while a 10 percent increase in affiliate employment in low-income countries is associated with a .2 percent fall in U.S. employment. Since high-income affiliate employment fell while low-income affiliate employment increased, the point estimates in column (2) are consistent with employment declines in the United States.

In column (3) we separate affiliate employment into non-production workers and production workers, which roughly corresponds to skilled and unskilled labor. The point estimates for both skilled and unskilled workers continue to be positive and significantly correlated with U.S. employment for high-income affiliates, and are not significantly different from each other. However, for low-income affiliates, the point estimate is statistically insignificant for non-production workers in affiliates based in low-income countries and is equal to -.042 and statistically significant for production workers in these same affiliates. This suggests that substitution is occurring through the use of production (unskilled) workers, as jobs are being shifted from U.S. workers to production workers in low-income countries.

The next two columns of Table 5 explore the impact of controlling for selection by including the inverse Mills ratio computed separately for each year. We also add variables to control for technological change (R&D expenditures in each location as a share of total sales in each location), the capital stock in each location, GDP per capita in purchasing power parity dollars in high-income and low-income locations (to control for demand shocks abroad), import penetration into the U.S. (to control for demand shocks in the U.S.), and exports to (imports from) affiliates. The sample size decreases significantly, since implementing the selection correction eliminates the first time series observation for each parent.

Although a joint F-test for the inclusion of the selection terms is statistically significant, a comparison of the coefficients reported in columns (4) and (5) suggests that correcting for selection does not significantly affect the results. Adding the inverse Mills ratio to control for selection out of the sample does not change the sign and barely changes the point estimates on the coefficients. The coefficient on low-income affiliate employment remains negative and statistically significant, suggesting that employment in low-income countries by U.S. multinationals substitutes for home employment. The point estimate is -.037 with correction for attrition and -.040 without the correction, indicating that a 10 percent increase in employment in low income affiliates by U.S. parents would reduce employment at home by .4 percent. The coefficient on employment in high income affiliates is .110 with the correction and .114 without, indicating that a 10 percent increase in high income affiliate employment would be associated with a 1.1 percent increase in U.S. employment. Since the coefficients on the other independent variables are similarly unaffected and we lose more than 50 percent of the sample when we correct for attrition, in the remainder of the paper we do not control for attrition bias.

Column (6) presents the results with the addition of all the right-hand side variables, but without the selection correction. Although the negative impact of affiliate employment in low-income countries on U.S. employment in manufacturing is significant (suggesting that a 10 percent increase in low income affiliate employment is associated with a .2 percent employment contraction at home), the results in Table 5 indicate that other factors played an equally important role in determining employment at the firm level. In column (6), a 10 percent increase in the capital stock at home increases U.S. manufacturing employment by 5.6 percent. Conversely, a 10 percent increase in the capital stock in high- or low-income affiliates is associated with a U.S. employment decline of between .1 and .4 percent..

Increases in trade, both arms length and between the U.S. parent and its affiliates, are also associated with U.S. manufacturing employment declines. The over 10 percentage point increase in import penetration reported in Table 3 implies a decline in U.S. manufacturing employment of 1.3 percent. Even larger negative effects on U.S. employment are associated with intra-firm trade. A 10 percentage point increase in imports from (exports to) the foreign affiliate is associated with an employment decline of 10.6 percentage points (for exports, 4 percentage points). The IV estimates in column (5) suggest a much larger negative impact. While an employment decline associated with increasing exports from the U.S. parent to its foreign affiliate seems puzzling, the data shows a strong positive correlation between exports to foreign affiliates and exports to foreign affiliates for further processing, suggesting that U.S. exports to foreign affiliates reflect increased outsourcing of manufacturing activity, rather than increased sales. Foreign demand shocks are also associated with significant effects on U.S. employment, although the effects again vary with affiliate location. While positive foreign demand shocks are associated with a positive impact on U.S. employment in high income affiliate locations, the opposite is true for low income affiliate locations.

Big negative effects are also associated with our proxy for technological change, the share of research and development expenditures in sales. The results in column (6) of Table 5 indicate that a ten percentage point increase in the U.S. R&D expenditure share in sales would be associated with a 5.3 percentage point decline in total parent employment. Although parent R&D employment increased by less than 4 percentage points on average between 1977 and 1999 (implying a reduction in home employment of 2 percent), the coefficient estimates suggest that technological change as a source of falling manufacturing employment could be important in the future.

Before turning to the instrumental variable (IV) estimates in column (7) of Table 5, we discuss the first-stage estimates for the IV regression. Table 7 reports the first-stage results for employment in high- and low-income affiliates, and capital stock in all three locations. We also report the first-stage F-statistics. The first-stage results show that the first-stage F-statistic is sufficiently large that our instruments have enough power to explain the endogenous variables. The only possible exception is for the parent-specific imports from affiliates. For parent imports from affiliates, the instruments are somewhat weaker but still exceed the threshold indicating a weak instrument problem.

Column (7) of Table 5 reports the results of instrumental variable estimation, using the instrument list described above. The over-identification test suggests that we cannot reject that the instruments are valid. The IV correction inflates the negative coefficient on employment in low-income affiliates, which is consistent with measurement error biasing towards zero the within estimates or simultaneity bias leading to coefficient estimates which are too positive. Consistent with simultaneity bias or measurement error, the coefficients in column (7) on affiliate employment become more negative in low-income affiliates relative to the OLS estimates. In column (7), the IV estimates indicate that a 10 percent increase in foreign affiliate employment is associated with a .1 percent employment increase in the U.S. if the affiliate is in a high-income country and a 3.8 percent decline in U.S. employment if the affiliate is in a low-income country. Since low-income affiliate employment increased by forty percent between 1977 and 1999 (see Table 1) and high-income affiliate employment fell, this implies a fall in U.S. manufacturing employment of 16 percentage points.

Column (8) includes the breakdown for production and non-production worker employment in low- and high-income affiliates. The results are quite similar: employment in the U.S. is complementary with the use of both production and non-production workers in high-income affiliates but substitutable with the use of production labor (unskilled labor) in low-income countries. Since the results suggest that the coefficients vary primarily by location and not extensively across skill categories, in the remainder of the paper we concentrate on separating effects through location and not by skill category.

Alternative Specifications

We begin by estimating equation (11), which replaces employment in affiliates as an independent variable with wages in low- and high-income affiliates. The coefficient estimates are reported in Appendix Table A.4 and the elasticities of factor demand and Allen elasticities of substitution are reported in the second column of Table 6. The firm-specific log wages were instrumented with UNIDO industrial wages, which were calculated as the weighted average of affiliate wages, with the weights given by initial parent or affiliate employment across locations. The coefficient on high-income affiliate wages is negative and significant, suggesting that high-income affiliate employment and U.S. parent employment are complements: when wages in high-income affiliates increase, this hurts employment at home. The IV estimate, at -.844, suggests that a 1 percentage point increase in high-income affiliate wages is associated with a .84 percentage point decline in U.S. employment. However, the positive coefficient on wages in low-income affiliates suggests that employment there acts as a substitute for employment at home: a 10 percentage point fall in low-income affiliate wages is associated with a .2 to .9 percentage point reduction in U.S. employment. The own wage elasticity of demand, which is between -0.41 (IV) and -0.48 (OLS), is consistent with previous studies of U.S. labor demand surveyed by Hamermesh (1993).

The implied labor demand elasticities and elasticities of substitution for equations (10) and (11) can be compared in columns (1) and (2) of Table 6. The η's and σ's are broadly consistent with each other, suggesting that affiliate employment in high-income locations is complementary with U.S. manufacturing employment, while affiliate employment in low-income locations substitutes for U.S.

employment.[15] The elasticity of labor demand varies from .02 to .09 for low income affiliates, suggesting that increasing low income affiliate wages boost U.S. employment. The elasticity varies between -.03 and -.84 for high income affiliates, suggesting that increasing wages in high income affiliates dampens U.S. labor demand for parents.

An alternative approach adopted by Katz and Murphy (1992) and Card (2001) involves estimating equation (21). Their approach allows us to directly infer the Allen elasticity of substitution σ from the coefficient on relative wages. As indicated in Appendix Table A.5, the implied Allen elasticity of substitution is positive for low income affiliates and negative for high income affiliates, corroborating previous results showing that labor in low income regions substitutes for parent employment. Failure to separate estimates by location of affiliates (reported in the first two rows of Appendix Table A.5) yields the result that employment at home and abroad is complementary, as reported in the first column of Table 5 which pools affiliate employment across high and low income regions..

The implied elasticities σ and η are compared with previous approaches in column (3) of Table 6. The magnitudes are remarkably consistent with the first two columns, yielding a price elasticity of demand η_{ij} which varies between .02 and .03 in low income affiliates and -.2 and -.4 in high income affiliates. Recall that a negative elasticity η_{ij} would imply that an increase in foreign wages reduces the demand for U.S. labor, while a positive sign indicates that U.S. and foreign labor are price substitutes. Confirming the earlier results, in high income affiliates labor is a complement to U.S. labor, while in low income affiliates U.S. and foreign labor are substitutes.

While the first three approaches yield remarkably consistent results, the cost share approach reveals somewhat different estimates for the high income affiliates, suggesting that labor in both high and low income locations substitutes for U.S. labor. We report results of estimating equation (13) in

[15] Using a similar approach but focusing *only* on the overseas affiliates of US parents, Brainard and Riker (1997) find that US affiliates in low income countries are complementary with affiliates in high income countries, while affiliates located in similar regions act as substitutes. Brainard and Riker suggest that this is evidence of vertical relationships between affiliates in high and low income regions, while affiliates from similar regions compete with each other. We find the opposite: US parent employment is complementary with employment in high income regions but substitutable with employment in low income regions. One area we leave for further research is to reproduce the results in Table 5 and Appendix Table A.4 for affiliates in high and low income locations. It is

Appendix Table A.6 and the implied elasticities in column (4) of Table 6. The coefficients on factor shares imply that foreign labor substitutes for home labor in *both* high- and low-income affiliate locations. The magnitudes for the low income affiliates are consistent with the results from the first three approaches and remarkably similar to those derived by Muendler et al (2006) and Brainard and Riker (2001): a 10 percentage point decline in foreign wages would be associated with a .4 percent fall in U.S. employment. For high income affiliates, the translog cost function approach also implies substitutability between U.S. and foreign labor: a 10 percentage point decline in high income wages would be associated with a 3 percent fall in U.S. employment. As expected, the own price elasticity is negative. Both the results in column (4) and previous studies (on Germany, Sweden, and the United States) reveal that a translog cost function approach will lead researchers to conclude that foreign affiliate employment substitutes for home employment across all locations.

The estimated own price elasticity of demand in the translog approach is also consistent with previous studies on labor demand. The own price elasticity of demand varies between -.3 and -.5 and is precisely what we would have expected from previous work on labor demand and Hamermesh's assessment of the literature. He suggests a plausible range between -.1 and -.75, with his best guess at -.3. However, we should point out that the common assumption that the capital stock is fixed in the short-run is not appropriate in our case since we are looking at five year intervals. Indeed, changes in the capital stock and changes in trade are associated with significant effects on the cost share, suggesting that the more general approaches reported in columns (1) through (3) in Table 6 are more appropriate. An additional concern has to do with the measurement of wages. The numbers in Table 1 are consistent with a shift in the composition of the labor force in U.S. manufacturing away from "production" workers – parent employment has gone down while parent wages have increased. Thus, it is not clear what a share dependent variable is measuring and with the current BEA data, we cannot figure this out since U.S. wages are not broken down by skill level.[16]

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conceivable that affiliates in similar regions act as substitutes, but that only activities in high income regions are complementary with US parent employment.

[16] The 1982 benchmark survey did include this information and the 2004 survey includes occupational codes.

As a final cross-check on these conclusions, we turn to a pure reduced-form approach. It can be shown that all the endogenous variables in our system of equations could be made a function of the exogenous variables and the instruments in our framework. The resulting estimating equation for U.S. employment and the capital stock are a function of wages in the U.S. and abroad, price shocks at home and abroad, and the instruments. This is essentially the first-stage in our instrumental variable estimation. We report all these results, along with the other first-stage estimates, in Table 7. For purposes of comparison, we also report the key elasticities derived from Table 7 in the final column of Table 6.

Of primary interest are the reduced form regressions with the log of U.S. employment and the log of the U.S. capital stock as the dependent variables, reported in columns (1) and (2) of Table 7. The results for the log of U.S. employment are consistent with the translog specification, with a positive coefficient on both wages in high and low income affiliates. The results imply that lower wages abroad reduce U.S. employment, suggesting that U.S. employment and foreign affiliate employment are substitutes. The magnitudes are small, suggesting that a 10 percentage point wage reduction in affiliate locations would be associated with an employment increase in the U.S. of .1 to .7 percent.

Other factors play an important role. R and D expenditures are associated with a reduction in domestic U.S. manufacturing employment, as is import penetration from low-income countries. The magnitudes suggest that a 1 percentage point increase in the share of R and D in sales is associated with a .7 percentage point reduction in U.S. manufacturing employment. The creation of a free trade area between the United States and the country of the foreign affiliate is associated with a 7 percent reduction in U.S. parent employment. Conversely, higher U.S. tariffs on imports are significantly and positively associated with U.S. parent employment. The magnitudes are large: a 1 percentage point increase in U.S. tariffs is associated with a 2.5 percentage point increase in manufacturing employment.

Although U.S. parent employment responds significantly to offshore employment expansion, the impact of offshoring on the domestic (parent) capital stock is even greater. This is an effect which has been overlooked in previous analyses of offshoring on U.S. parent activity. Higher wages in affiliate locations have a large impact on the U.S. capital stock: a 10 percent fall in wages in high income affiliates would reduce the parent capital stock by 1 percent. Arm's length trade, proxied by import penetration and penetration from low-income countries, significantly and negatively affects the parent capital stock. The signing of a free trade area with the U.S. is associated with a 22.4 percent decline in the parent capital stock, suggesting that the focus of concern should shift from employment to investment. Higher U.S. tariffs conversely are associated with an increase in the parent capital stock; the point estimate implies that a 1 percentage point increase in U.S. tariffs is associated with a 3.5 percentage point increase in the domestic capital stock. While previous studies have emphasized the employment effects of international competition, the results in column (2) suggest that studies should be focusing on the much larger impact on US manufacturing investment.

One result is consistent across all specifications: employment in low-income affiliates substitutes for U.S. employment. This outcome is robust to whichever framework we choose, although the magnitudes vary. It is important to emphasize that our basic specification (Table 5) provides the most conservative estimates of the negative impact of a fall in low-income affiliate wages on U.S. employment. All the other specifications (see Table 6, rows 2 and 3) suggest much larger effects. Take, for example, the price elasticity of demand of .03 derived from the CES approach. Recalling that $\eta_{ij} = \gamma_{ij}\eta_{jj}$ and using the value of -.073 from the reduced form estimates in Table 7 for η_{jj} in low income affiliates yields an elasticity of -.410 for the implied response of domestic U.S. employment to low-income affiliate employment (the γ_{ij} 's reported in Table 5). This suggests that for every percentage point increase in low income affiliate employment, U.S. parents reduce their domestic workforce by .41 percent. Doing the same calculation for the labor demand elasticity of .041 derived from the translog cost function approach implies that a 1 percentage point increase in foreign affiliate employment would lead to a reduction in home parent employment of .6 percent.

The evidence also suggests that other aspects of globalization have played a significant role in accounting for the downsizing of the U.S. manufacturing sector. One factor that has not received any attention in previous literature is the impact of U.S. multinationals expanding physical investment abroad. Increases in the capital stock in foreign affiliates are associated with significant declines in U.S. employment; these declines are at least as significant as the impact of expanding foreign employment.

All the approaches show that both arms length trade, as captured by U.S. import penetration, and intra-firm trade have also played an important role in reducing U.S. manufacturing employment.

Which Determinants Matter Most for Explaining U.S. Parent Employment?

We summarize the effects of offshoring, trade, and technical change on U.S. manufacturing employment in Table 8. We combine the OLS and IV coefficient estimates presented in Table 5 with the actual aggregate changes in employment, investment, trade, R&D intensity, and GDP per capita changes across affiliate locations taken from Table 1. Focusing on the last column in Table 8, which combines the instrumental variable estimates from Table 5 with actual mean changes in the BEA sample between 1977 and 1999, we see that the major determinants of contraction in U.S. manufacturing parent employment are (1) increasing employment in low income affiliates (2) a corresponding increase in physical investment abroad and (3) increasing trade between the U.S. parent and its affiliates. Increasing employment in low-income affiliates accounts for a 15 percentage point drop in parent employment, while increasing investment in low and high income affiliates accounts for 34 and 6 percent of the drop in US manufacturing employment. Intra-firm trade is associated with nearly a fifty percent drop in manufacturing employment. These figures suggest that substituting parent employment for labor in low income countries is less important than the increasing expansion of the affiliate capital stock and increasing intra-firm trade.

One final possibility is that hiring workers in low income countries, while associated with contraction in the U.S., prevents the parent from shutting down operations. Borjas, Freeman and Katz (1997) study the counterfactual by asking what would have happened to low wage workers if imports from developing countries had been instead produced by U.S. firms. In a similar spirit, we would like to know what might have happened to U.S. workers if the parent had not hired workers in developing countries. It is impractical for us to try to estimate the parent cost of production and ultimately the demand for its products if the firm had used higher wage workers than their foreign counterparts. Instead, we estimate the impact of hiring workers in developing countries on the parent's probability of survival.

In Table 9, we report the results of this analysis. We begin with a simple regression of our survival indicator on the percentage of employees a firm hires in developing countries in period t-1. We see in column (1) that a 1 percent increase in the number of employees hired in developing countries increases the parent probability of survival by 0.16 percent. In column (2) we augment the regression with firm size measured as the log of the parents' *total* capital stock. The magnitude of the coefficient on percent employees in developing countries drops dramatically as does its statistical significance. This is not surprising since firm size and percent employees in developing countries are highly correlated. In column (3) we include all of the controls used to determine the probability of survival in Table 4 – again the coefficient on percent employees in developing countries is small in magnitude and statistically insignificant.

Because the firm size effect swamps the effect of percent employment in developing countries and because we know that it is primarily large firms that hire workers in developing countries, we turn in column (4) to an analysis of large firms. We define large firms as firms with more than 20,000 employees in the U.S., which amounts to roughly 15% of our sample. The results in column (4) indicate that *among large firms* hiring workers in low-income countries does increase the probability of survival.

VI. Concluding Comments

This paper measures the impact of different forms of globalization on manufacturing employment by U.S. multinationals in the United States. Over the period 1977 to 1999 multinational manufacturing firms shed more than 4 million jobs in the United States. Over this same period, the number of workers hired by affiliates in developing countries increased while wages paid to these workers declined. These facts are consistent with the notion that U.S. parents are exporting low-wage jobs to low-income countries. However, the expansion in manufacturing employment in developing countries amounts to only one quarter of the jobs lost at home. In this paper, we show that other factors--including technological change, expanding US investment abroad, and international trade--are important determinants of U.S. manufacturing employment. Moreover, we cannot rule out the possibility that job losses might have been greater in the absence of offshoring.

We present a general approach to measuring the impact of globalization on U.S. manufacturing employment. Our approach takes into account the simultaneity between a firm's employment decision in the U.S. and its foreign affiliates. To solve the endogeneity problem, we develop a series of first-stage regressions that explain U.S. multinational expansion at home and abroad as a function of predetermined factors such as free trade agreements, educational expenditures in destination countries, and restrictions on capital repatriation. We address the problem of attrition in the sample by using a two-stage Heckman approach and modeling survival as a function of the productivity and profitability of the U.S. parent.

We apply our framework to the Bureau of Economic Analysis (BEA) data on U.S. multinational enterprises to identify the determinants of job losses in U.S. manufacturing. We find that across all specifications, employment in low-income affiliates substitutes for U.S. employment. However, the effect is not large: our point estimates suggest that the 40 percentage point increase in low income affiliate employment of US multinationals between 1977 and 1999 only accounted for a drop in U.S. domestic manufacturing employment of 15 percent.

Other aspects of globalization have probably played a more important role in affecting parent manufacturing employment. These include an increase in physical investment abroad, and trade between the U.S. parent and its affiliates. In other words, offshoring affects U.S. manufacturing employment primarily by expanding the foreign affiliate capital stock and increasing intra-firm trade. Nevertheless, it is clear that adding another worker in low income affiliate locations reduces employment at home, contradicting the claims made by Mankiw and Swagel (2006) regarding the job-creating effects of offshoring.

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TABLE 1
TRENDS OF U.S. MULTINATIONALS IN MANUFACTURING 1977-1999

Variable	1977	1982	1989	1994	1999
Number of Parents	1746	1183	1230	1221	785
Affiliate Share of Jobs	28.33%	26.57%	31.43%	33.91%	35.62%
Developed Country Affiliate Share of Jobs	20.09%	18.43%	21.59%	22.78%	20.98%
Developing Country Affiliate Share of Jobs	8.22%	8.11%	9.84%	11.08%	14.64%
Affiliate Share of Compensation	18.97%	17.56%	22.96%	25.61%	24.17%
Developed Country Affiliate Share	16.35%	14.44%	20.15%	21.95%	19.27%
Developing Country Affiliate Share	2.59%	3.09%	2.80%	3.63%	4.89%
Affiliate Share of Total Investment	25.99%	23.29%	25.14%	29.08%	29.10%
Developed Country Affiliate Share	20.12%	17.29%	20.95%	23.72%	20.88%
Developing Country Affiliate Share	5.67%	5.80%	4.17%	5.33%	8.22%
Parents					
Total Employment	11017	9771	9137	6893	7181
Real Total Compensation (per worker)	31.34	31.82	33.25	36.67	37.87
Capital Stock (Net PPE)	389	369	343	282	306
R&D Spending (% Sales)	1.39%	2.81%	3.38%	3.93%	5.08%
Exports to Foreign Affiliates (% Sales)	1.85%	3.66%	5.41%	6.93%	7.35%
Imports from Foreign Affiliates (% Sales)	2.95%	2.90%	4.39%	5.84%	7.11%
Developed Country Affiliates: All					
Total Employment	3089	2753	2876	2376	2531
Real Total Compensation (per worker)	21	21	27	31	27
Capital Stock (Net PPE)	99.21	118.34	145.11	138.21	151.63
Developing Country Affiliates: All					
Total Employment	1263	1079	1311	1156	1766
Real Total Compensation (per worker)	11	10	9	9	8
Capital Stock (Net PPE)	20.71	32.89	27.66	32.24	60.76
Macro Trends in Countries of Operations					
GDP per capita in High-Income Countries	5076	7728	14320	17628	18773
GDP per capita in Low-Income Countries	1250	1678	2217	3117	2938
U.S. Import Penetration	7.91%	9.93%	16.24%	19.73%	21.95%
U.S. Import Penetration with some products from Low Wage Countries	34.99%	44.51%	55.14%	58.57%	59.77%

Source: Bureau of Economic Analysis. Note: Data is for manufacturing parents and their manufacturing affiliates with non-missing observations for labor's share of income and positive employment. Multiple affiliates in one country are treated as one affiliate. Weighted by employment shares, where applicable. Real total compensation are in '000 of 82-84 U.S. dollars; capital stock are in '000,000 of 82-84 U.S. dollars. Data on GDP per capita are from the World Bank, data on import penetration are from Peter Schott’s website.

TABLE 2

TRENDS OF U.S. MULTINATIONALS IN SERVICES 1977- 1999

Variable	1977	1982	1989	1994	1999
Number of Parents	58	76	112	133	242
Number of Countries in which Parents Have Affiliates	6.74	4.12	4.92	6.97	11.62
Developed Countries	5.19	3.10	4.27	5.64	7.61
Developing Countries	1.56	1.02	0.65	1.33	3.94
Affiliate Share of Jobs	15.43%	9.21%	16.93%	19.13%	25.09%
Developed Country Affiliate Share of Jobs	11.67%	7.09%	15.36%	16.22%	19.41%
Developing Country Affiliate Share of Jobs	3.76%	2.12%	1.57%	2.91%	5.67%
Affiliate Share of Compensation	13.41%	7.25%	14.99%	17.30%	21.75%
Developed Country Affiliate Share of Compensation	11.20%	6.06%	14.45%	16.38%	19.29%
Developing Country Affiliate Share of Compensation	2.21%	1.19%	0.54%	0.92%	2.46%
Affiliate Share of Total Investment	13.97%	6.76%	17.65%	21.60%	23.17%
Developed Country Affiliate Share of Investment	11.88%	5.79%	17.06%	20.15%	19.47%
Developing Country Affiliate Share of Investment	2.09%	0.96%	0.59%	1.45%	3.70%
Parents					
Total Employment	532	867	1377	1658	4795
Real Total Compensation (per worker)	19.55	18.82	20.78	20.22	24.91
Developed Country Affiliates: All					
Total Employment	73	68	255	333	1243
Real Total Compensation (per worker)	19.17	18.12	18.79	19.54	21.06
Developing Country Affiliates: All					
Total Employment	24	20	26	60	363
Real Total Compensation (per worker)	13.18	11.32	8.16	6.49	10.37

Source: Bureau of Economic Analysis. Note: Data is for parents and their affiliates with non-missing observations for labor's share of income and positive employment. Multiple affiliates in one country are treated as one affiliate. Weighted by employment shares, where applicable. Real total compensation are in '000 of 82-84 U.S. dollars.

TABLE 3

SUMMARY STATISTICS

Variable	No. of Obs	Mean	Standard Deviation	Change in 1982-1999	Change in 1977-1999
U.S. (domestic) Share in Labor Expenditures across all locations	3368	0.584	(0.323)	-0.082	-0.077
High-Income Affiliate Share in Labor Expenditures	3368	0.371	(0.293)	0.070	0.065
Low-Income Affiliate Share in Labor Expenditures	3368	0.050	(0.096)	0.015	0.015
Log U.S. Employment	3368	7.762	(1.663)	-0.062	-0.155
Log High-Income Affiliate Employment	3368	5.895	(2.250)	-0.319	-0.421
Log Low-Income Affiliate Employment	3368	2.872	(3.476)	1.479	1.586
Log U.S. Capital Stock	3368	10.897	(2.098)	0.806	0.833
Log High-Income Affiliate Capital Stock	3368	8.633	(2.949)	0.782	0.712
Log Low-Income Affiliate Capital Stock	3368	4.099	(4.787)	1.163	1.592
U.S R&D Spending (% in Sales)	3368	0.035	(0.018)	0.019	0.028
High-Income Affiliate R&D Spending (% in Sales)	3368	0.015	(0.013)	-0.001	-0.016
Low-Income Affiliate R&D Spending (% in Sales)	3368	0.009	(0.005)	-0.002	-0.009
Import Penetration, Schott	3368	0.134	(0.099)	0.108	0.125
Import Penetration from Low-Income Countries, Schott	3368	0.441	(0.215)	0.191	0.310
Exports to Foreign Affiliates (share in sales)	3368	0.041	(0.067)	0.008	0.054
Imports from Foreign Affiliates (share in sales)	3368	0.029	(0.063)	0.019	0.014
Log GDP p.c. PPP in High-Income Affiliates	3368	8.503	(2.448)	1.321	1.983
Log GDP p.c. PPP in Low-Income Affiliates	3368	2.631	(3.437)	0.198	0.171
TFP firm - TFP max by Industry	3368	-0.212	(0.228)	0.153	0.082
Profit Margin	3368	0.053	(0.065)	0.018	0.022
Capital Controls (1 if controls, 0 otherwise), IMF	3368	0.359	(0.396)	-0.182	-0.694
Government Spending on Education as Share of GNI, WDI	3368	4.428	(2.014)	-0.140	-0.131
Country Tax Rate	3368	0.297	(0.127)	-0.189	-0.224
Free Trade Area (1 if U.S. has trade agreement with country), Rose	3368	0.542	(0.378)	0.285	0.352
Distance (Miles Between Source and Host), WDI	3368	2227	(1334)	-100.5	-40.33
U.S. Tariffs on Imports, Schott	3368	0.030	(0.019)	-0.025	-0.035
Freight Costs to U.S., Schott	3368	0.049	(0.031)	-0.008	-0.026
Political Risk (Ranges from 0-6 with 6 being the least risky), ICRG	3368	4.613	(2.860)	-0.252	-0.308
Number of PCs per 1000 people, WDI	3368	109.3	(98.22)	238.1	243.6
Industrial Wages in High Income Countries, UNIDO	3368	9.026	(0.681)	-0.041	0.154
Industrial Wages in Low Income Countries, UNIDO	3368	6.731	(1.271)	-.0611	-0.704
Industrial Wages in the United States, UNIDO	3368	9.725	(0.071)	0.188	0.121

Unless indicated, variables are computed using the BEA benchmark surveys of direct investment abroad for the years 1977, 1982, 1989, 1994, 1999.

TABLE 4

YEAR-BY-YEAR PROBIT ESTIMATES OF THE PROBABILITY OF SURVIVAL

MARGINAL EFFECTS REPORTED ONLY

	1982	1989	1994	1999	All Years Pooled Together
Total Factor Productivity of Parent	0.282	0.013	0.105	0.029	0.054
	(0.110)	(0.084)	(0.131)	(0.081)	(0.025)
Profit Margin of Parent	1.166	1.344	1.244	0.972	1.200
	(0.318)	(0.357)	(0.269)	(0.259)	(0.148)
Education Expenditures (% GNI)	0.050	0.009	0.015	0.046	0.028
	(0.013)	(0.024)	(0.029)	(0.036)	(0.008)
Log GDP p.c. High-Income Countries	0.033	0.011	0.007	0.021	0.021
	(0.006)	(0.007)	(0.008)	(0.009)	(0.003)
Log GDP p.c. Low-Income Countries	0.019	0.014	0.002	0.037	0.019
	(0.006)	(0.008)	(0.007)	(0.007)	(0.003)
R&D Spending (% Sales)	0.149	0.595	0.415	0.343	0.189
	(0.161)	(0.455)	(0.282)	(0.194)	(0.104)
R&D Spending in High-Income	0.418	0.150	0.321	1.294	0.458
Countries (% Sales)	(0.207)	(0.272)	(0.589)	(0.690)	(0.161)
R&D Spending in Low-Income	0.560	-1.513	4.377	-0.823	0.230
Countries (% Sales)	(0.404)	(1.120)	(3.063)	(0.786)	(0.279)
Import Penetration	-0.564	-0.360	-0.324	-0.130	-0.171
	(0.393)	(0.427)	(0.149)	(0.072)	(0.042)
Import Penetration from Low-Wage	-0.057	-0.035	-0.267	-0.055	-0.081
Countries	(0.133)	(0.156)	(0.181)	(0.173)	(0.074)
Median Country Tax Rate	0.308	0.045	0.294	0.168	0.203
	(0.204)	(0.043)	(0.179)	(0.185)	(0.171)
Capital Controls	0.052	0.010	-0.025	0.098	0.020
	(0.077)	(0.078)	(0.077)	(0.150)	(0.035)
Distance Between Source and Host	0.017	0.024	0.019	-0.021	-0.010
	(0.027)	(0.045)	(0.025)	(0.021)	(0.011)
Free Trade Area with the U.S.	0.048	-0.089	-0.215	-0.114	-0.115
	(0.096)	(0.170)	(0.073)	(0.059)	(0.042)
U.S. Tariffs on Imports	0.770	3.772	-0.213	-0.129	0.803
	(0.176)	(1.903)	(1.829)	(1.669)	(0.312)
Freight Costs to the U.S.	-0.268	-0.956	-1.935	-0.439	-0.380
	(0.157)	(1.636)	(1.423)	(0.764)	(0.192)
Political Risk	0.000	-0.010	0.018	-0.023	0.003
	(0.000)	(0.021)	(0.021)	(0.022)	(0.008)
Number of PCs per 1,000 people	0.000	-0.003	-0.001	0.001	-0.001
	(0.000)	(0.011)	(0.001)	(0.001)	(0.000)
Observations	1106	724	888	859	3584

Robust standard errors in parentheses. Coefficients reported are marginal probabilities computed at the mean of the regressors. Probability of survival reflects the likelihood that a firm survived between the previous period (five years ago) and the current period. Last column, which pools all years, includes time dummies whose coefficients are not reported here.

TABLE 5

WITHIN ESTIMATES OF LABOR DEMAND BY U.S. PARENTS

	FE	FE	FE	FE	FE	FE	FE/IV	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Affiliate Employment	0.151							
	(0.010)							
Log Affiliate Employment in High-Income Countries		0.192		.110	.114	0.102	-0.011	
		(0.015)		(.015)	(.019)	(0.010)	(0.199)	
Log Affiliate Employment in Low-Income Countries		-0.020		-.037	-.040	-0.022	-0.379	
		(0.006)		(.013)	(.013)	(0.006)	(0.105)	
Log Non-Production Worker Employment in High-Income Countries			0.068					0.032
			(0.012)					(0.006)
Log Production Worker Employment in High-Income Countries			0.042					0.021
			(0.010)					(0.005)
Log Non-Production Worker Employment in Low Income Countries			0.010					-0.003
			(0.009)					(0.005)
Log Production Worker Employment in Low-Income Countries			-0.042					-0.015
			(0.009)					(0.005)
Log U.S. Capital Stock				.575	.573	0.561	0.116	0.561
				(.024)	(.024)	(0.011)	(0.356)	(0.011)
Log Affiliate Capital Stock in High-Income Countries				-.056	-.062	-0.036	0.108	-0.012
				(.006)	(.015)	(0.008)	(0.158)	(0.007)
Log Affiliate Capital Stock in Low-Income Countries				-.031	-.032	-0.011	-0.177	-0.005
				(.009)	(.009)	(0.004)	(0.076)	(0.003)
R&D Spending (% Sales)				-.176	-.161	-0.531	-0.518	-0.547
				(.086)	(.066)	(0.068)	(0.202)	(0.069)
R&D Spending in High-Income Countries (% Sales)				.033	.055	0.175	-0.059	-0.047
				(.269)	(.271)	(0.093)	(0.326)	(0.094)
R&D Spending in Low-Income Countries (% Sales)				-.106	-.046	-0.404	-0.364	-0.456
				(.933)	(.939)	(0.129)	(0.316)	(0.130)
Import Penetration by Sector and Year				-.033	-.126	0.203	0.429	0.201
				(.198)	(.199)	(0.095)	(0.461)	(0.095)
Import Penetration from Low-Income Countries by Sector and Year				-.016	-.062	0.090	-0.108	0.085
				(.102)	(.102)	(0.047)	(0.182)	(0.047)
Log GDP per capita in High-Income Countries (ppp)				.005	.004	0.023	0.045	0.023
				(.002)	(.003)	(0.004)	(0.021)	(0.004)
Log GDP per capita in Low-Income Countries (ppp)				-.004	-.004	-0.009	-0.090	-0.006
				(.010)	(.010)	(0.004)	(0.055)	(0.004)
Exports to Foreign Affiliates (Share in Sales)				-.571	-.659	-0.400	-5.224	-0.345
				(.309)	(.308)	(0.126)	(3.692)	(0.127)
Imports from Foreign Affiliates (Share in Sales)				-.727	-.756	-1.064	-4.370	-1.162
				(.383)	(.321)	(0.143)	(3.175)	(0.144)
Selection Controls	No	No	No	Yes	No	No	No	No
F-stat Lambdas				0.000				
Sargan Test							0.442	
Observations	3368	3368	3368	1445	1445	3368	3368	3368
R-squared	0.18	0.17	0.14	.868	.867	0.58	0.23	0.57

Robust standard errors in parentheses. The "F-stat Lambdas" reports the p-value of the joint significance of the controls for selection. The Sargan Test reports the p-value of Sargan's (1958) test of over-identifying restrictions. It is a test of the joint null hypothesis that the excluded instruments are valid instruments, i.e., uncorrelated with the error term and correctly excluded from the estimated equation. The reported p-value indicates the level of confidence with which we do not reject our model. Instruments used are: wages by location, education expenditures, capital controls, country tax rates, political risk, personal computers per 1,000 people, distance, free trade agreements with the U.S., tariffs and freight costs. For a complete description of these variables see Appendix Table A.3.

TABLE 6

Implied Elasticity of Labor Demand and Allen Elasticity of Substitution Across Alternative Specifications

	(1) Basic Specification (Table 5)	(2) Replacing log employment in location j with wages in location j (Table A.4)	(3) CES specification (Table A.5)	(4) Translog Cost Function (Table A.6)	(5) Reduced Form (from column (1) in Table 7)
Implied Elasticity of Labor Demand ηij					
(% Change in Li in Response to % Change in wj					
Own Elasticity of Labor Demand					
OLS	--	-0.476	--	-0.356	-0.225
Elasticity with respect to wages in Low Income Countries					
OLS	0.002	0.016	0.008	0.041	0.009
IV	0.028	0.087	0.030	0.045	--
Elasticity with respect to wages in High Income Countries					
OLS	-0.034	-0.030	-0.157	0.345	0.070
IV	0.004	-0.844	-0.446	0.304	--
Implied Allen Elasticity of Substitution σij					
Own Elasticity of Substitution					
OLS	--	-0.815	--	-0.610	-0.131
Elasticity with respect to Low Income Countries					
OLS	.040	0.320	0.161	0.829	0.180
Elasticity with respect to High Income Countries					
OLS	-.092	-.081	-0.422	0.931	0.189

Robust standard errors in parentheses. The Sargan Test reports the p-value of Sargan's (1958) test of over-identifying restrictions. It is a test of the joint null hypothesis that the excluded instruments are valid instruments, i.e., uncorrelated with the error term and correctly excluded from the estimated equation. Instruments used are: education expenditures, capital controls, country tax rates, political risk, personal computers per 1,000 people, distance, free trade agreements with the U.S., tariffs and freight costs. For a complete description of these variables see Appendix Table A.3.

TABLE 7

FIRST STAGE AND REDUCED FORM ESTIMATES OF THE DETERMINANTS OF EMPLOYMENT, INVESTMENT, AND INTRA-FIRM TRADE

	Log U.S. Employment	Log U.S. Capital Stock	Log High-Income Affiliate Employment	Log Low-Income Affiliate Employment	Log High-Income Affiliate Capital Stock	Log Low-Income Affiliate Capital Stock	Exports to Foreign Affiliates (%Sales)	Imports from Foreign Affiliates (% Sales)
Log Industrial Wages in the U.S.	-0.225	0.394	0.222	0.448	0.582	1.442	0.025	0.014
	(0.076)	(0.092)	(0.134)	(0.254)	(0.175)	(0.356)	(0.007)	(0.007)
Log Industrial Wages in High-Income Countries	0.070	0.103	-0.332	0.088	0.424	0.131	0.003	-0.009
	(0.024)	(0.030)	(0.043)	(0.082)	(0.056)	(0.114)	(0.002)	(0.002)
Log Industrial Wages in Low-Income Countries	0.009	0.016	0.049	-0.073	0.031	0.118	-0.003	0.000
	(0.003)	(0.007)	(0.011)	(0.020)	(0.014)	(0.028)	(0.000)	(0.001)
Education Expenditures as a Share of GNI	-0.038	-0.038	0.120	0.091	0.090	0.046	0.001	0.003
	(0.013)	(0.016)	(0.024)	(0.045)	(0.031)	(0.063)	(0.001)	(0.001)
Log GDP per capita in High-Income Countries (ppp)	0.037	0.027	0.039	-0.091	0.067	-0.038	-0.003	0.000
	(0.007)	(0.008)	(0.012)	(0.022)	(0.015)	(0.031)	(0.001)	(0.001)
Log GDP per capita in Low-Income Countries (ppp)	0.005	0.009	0.014	0.532	0.053	0.618	0.001	0.000
	(0.007)	(0.008)	(0.012)	(0.022)	(0.015)	(0.031)	(0.001)	(0.001)
R&D Spending (% Sales)	-0.707	0.362	0.061	0.358	0.278	1.181	0.002	0.024
	(0.099)	(0.119)	(0.175)	(0.330)	(0.228)	(0.462)	(0.009)	(0.008)
R&D Spending in High-Income Countries (% Sales)	0.205	0.269	-0.092	0.606	1.229	0.925	-0.013	0.010
	(0.135)	(0.163)	(0.239)	(0.451)	(0.311)	(0.632)	(0.013)	(0.012)
R&D Spending in Low-Income Countries (% Sales)	-0.187	-0.399	0.416	0.967	-0.051	2.139	-0.033	0.002
	(0.186)	(0.225)	(0.329)	(0.622)	(0.429)	(0.872)	(0.014	(0.016)
Import Penetration	0.004	-0.484	0.125	-1.028	-0.160	-2.161	0.063	0.008
	(0.139)	(0.168)	(0.247)	(0.465)	(0.321)	(0.652)	(0.013)	(0.012)
Import Penetration from Low-Income Countries	-0.063	-0.178	-0.185	0.684	-0.116	0.604	0.028	-0.014
	(0.030)	(0.085)	(0.125)	(0.235)	(0.162)	(0.330)	(0.007)	(0.006)
Median Country Tax Rate	0.009	0.017	0.012	-0.023	-0.043	-0.068	-0.001	0.000
	(0.016)	(0.009)	(0.028)	(0.054)	(0.017)	(0.025)	(0.002)	(0.001)
Capital Controls	-0.022	-0.026	-0.103	0.046	-0.006	0.161	0.011	-0.006
	(0.036)	(0.044)	(0.064)	(0.120)	(0.083)	(0.169)	(0.003)	(0.003)
Political Risk	0.011	0.024	0.038	-0.017	0.068	0.075	0.002	-0.001
	(0.011)	(0.013)	(0.019)	(0.037)	(0.025)	(0.021)	(0.001)	(0.001)
Number of PCs per 1000 people	0.002	0.001	0.002	0.006	0.001	0.004	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Distance Between Source and Host Country	0.040	0.064	0.149	0.174	0.050	0.259	0.002	-0.003
	(0.017)	(0.020)	(0.029)	(0.055)	(0.038)	(0.078)	(0.002)	(0.001)
Free Trade Area with the U.S.	-0.073	-0.224	0.280	-0.244	0.156	0.184	-0.030	0.017
	(0.034)	(0.053)	(0.078)	(0.147)	(0.102)	(0.207)	(0.004)	(0.004)
U.S. Tariffs on Imports	2.564	3.504	5.083	8.456	8.239	6.233	0.237	-0.195
	(0.622)	(0.751)	(1.101)	(2.077)	(1.433)	(2.912)	(0.059)	(0.053)
Freight Costs to U.S.	-0.931	-0.706	-0.361	0.183	-1.726	-1.262	0.006	0.042
	(0.424)	(0.513)	(0.751)	(1.417)	(0.677)	(0.587)	(0.040)	(0.036)
F-Statistic (for exclusion of excluded instruments in first stage)		15.33	16.44	17.18	14.94	13.94	29.13	13.98
Observations	3368	3368	3368	3368	3368	3368	3368	3368
R-squared	0.18	0.19	0.19	0.39	0.19	0.32	0.30	0.15

TABLE 8

CALCULATING THE IMPACT OF DIFFERENT ASPECTS OF GLOBALIZATION ON U.S. EMPLOYMENT OUTCOMES

Factors Affecting U.S. Labor Demand	Impact of a 10 percent Increase in Factor on Percentage Change in U.S. Employment (OLS Estimates) (1)	Impact of a 10 percent Increase in Factor on Percentage Change in U.S. Employment (Instrumental Variable Estimates) (2)	Actual Increase in Factor in BEA Sample 1977-1999 (3)	Percentage Change in Labor Demand (Equals Column (1) x Column (3)) (4)	Percentage Change in Labor Demand (Equals Column (2) x Column (3)) (5)
Log Employment High-Income Affiliates	1.02%	-0.11 %	-18.1%	-1.8 %	0.2 %
Log Employment Low-Income Affiliates	-0.22%	-3.79 %	39.8 %	-0.9 %	-15.1 %
Log Parent Capital Stock	5.61%	1.16 %	-21.3 %	-11.9 %	-2.5 %
Log Capital Stock High-Income Affiliates	-0.36%	1.08 %	52.8 %	-1.9 %	-5.7 %
Log Capital Stock Low-Income Affiliates	-0.11%	-1.77 %	193.4%	-2.1 %	-34.2 %
U.S. R&D Spending Share	-5.31%	-5.18 %	3.69	-2.0 %	-1.9 %
U.S. Import Penetration	2.03%	4.29 %	14.04	2.9 %	6.0 %
U.S. Import Penetration from Low-Income Countries	0.90	-1.08 %	24.78	2.2 %	-2.7 %
High-Income Affiliates Log GDP per capita	0.23%	0.45 %	269.83	6.2 %	12.1 %
Low-Income Affiliates Log GDP Per Capita	-0.09%	-0.90 %	135.04	-1.2 %	-12.2 %
Exports to Foreign Affiliates (Share in Sales)	-4.00%	-52.24 %	5.5	-2.2 %	-28.7
Imports from Foreign Affiliates (Share in Sales)	-10.64%	-43.70 %	4.16	-4.4 %	-18.2

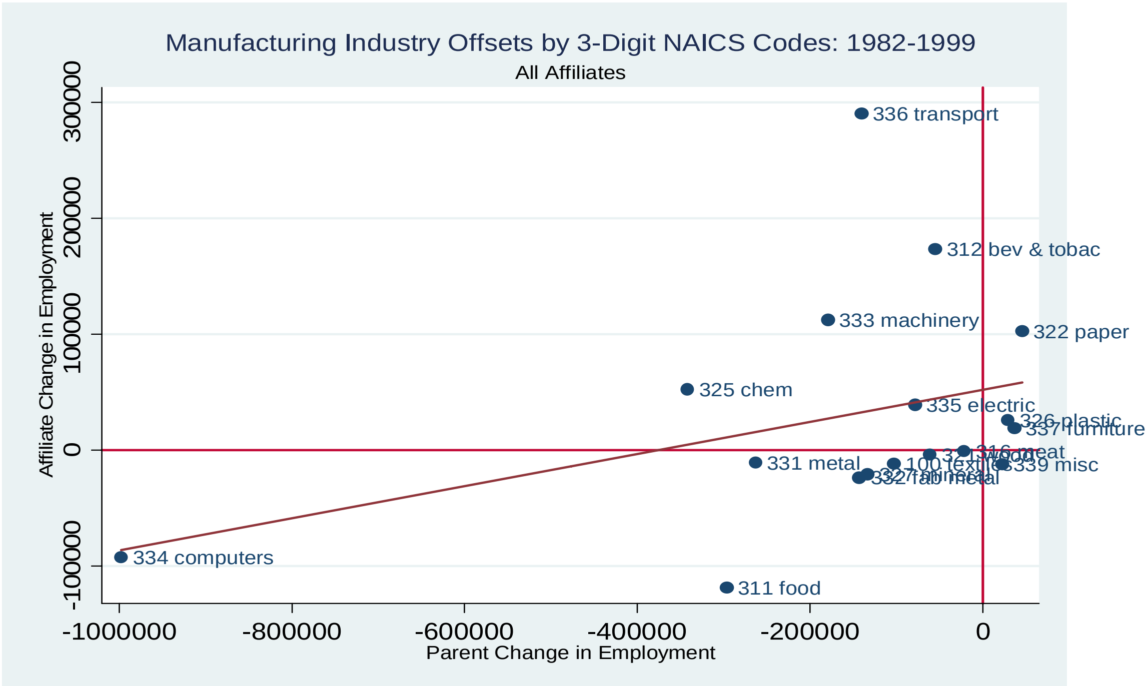
TABLE 9

DOES HIRING WORKERS IN LOW-INCOME COUNTRIES INCREASE A FIRM'S PROBABILITY OF SURVIVAL?
MARGINAL EFFECTS REPORTED ONLY

Dependent Variable: Whether firm was in existence in the last period.	No Controls	No Controls Except Firm Size	Adding All Controls	Adding All Controls but only retaining firms with at least 20,000 Employees
Employees in Developing Countries	0.155	0.029	0.023	0.105
	(015)	(0.018)	(0.018)	(0.052)
Firm Size (Log of Capital Stock)		0.068	0.067	0.053
		(0.004)	(0.005)	(0.023)
Total Factor Productivity (TFP)			0.066	0.076
			(0.037)	(0.091)
Profit Margin			1.091	1.563
			(0.126)	(0.325)
Other Controls?	No	No	Yes	Yes
Time Dummies?	Yes	Yes	Yes	Yes
Observations	3584	3584	3584	3584

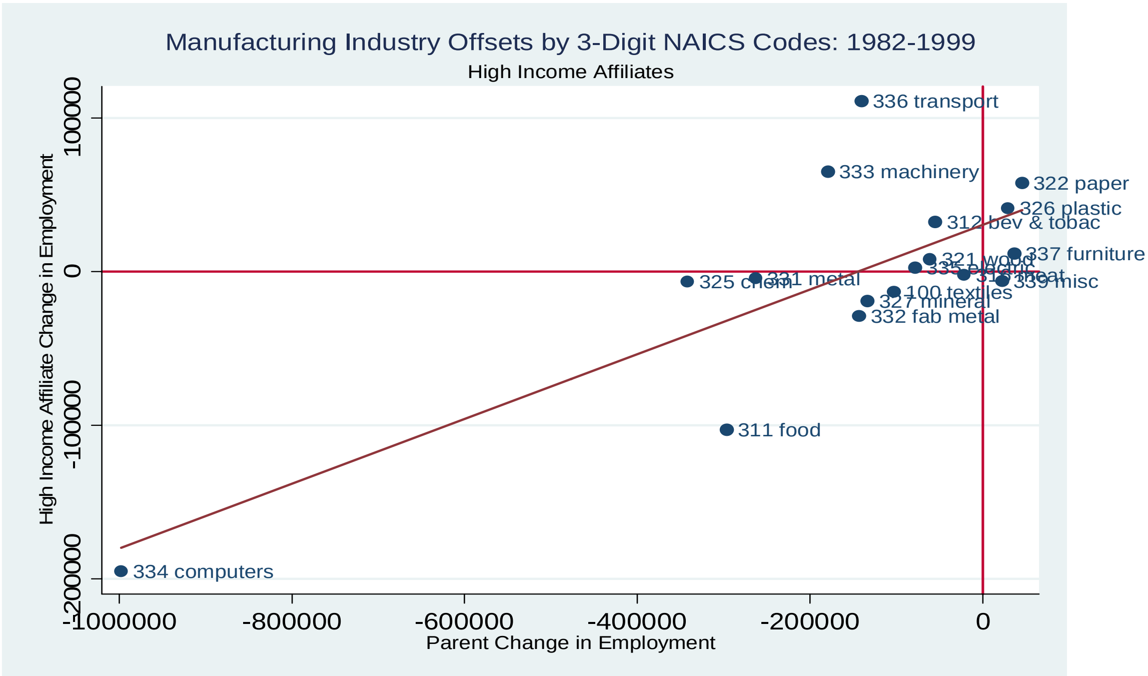
Robust standard errors in parentheses. Probability of survival reflects the likelihood that a firm survived between the previous period (five years ago) and the current period. Additional controls in columns (3) and (4) are the same as those reported in Table 4.

Figure 1: All Affiliates



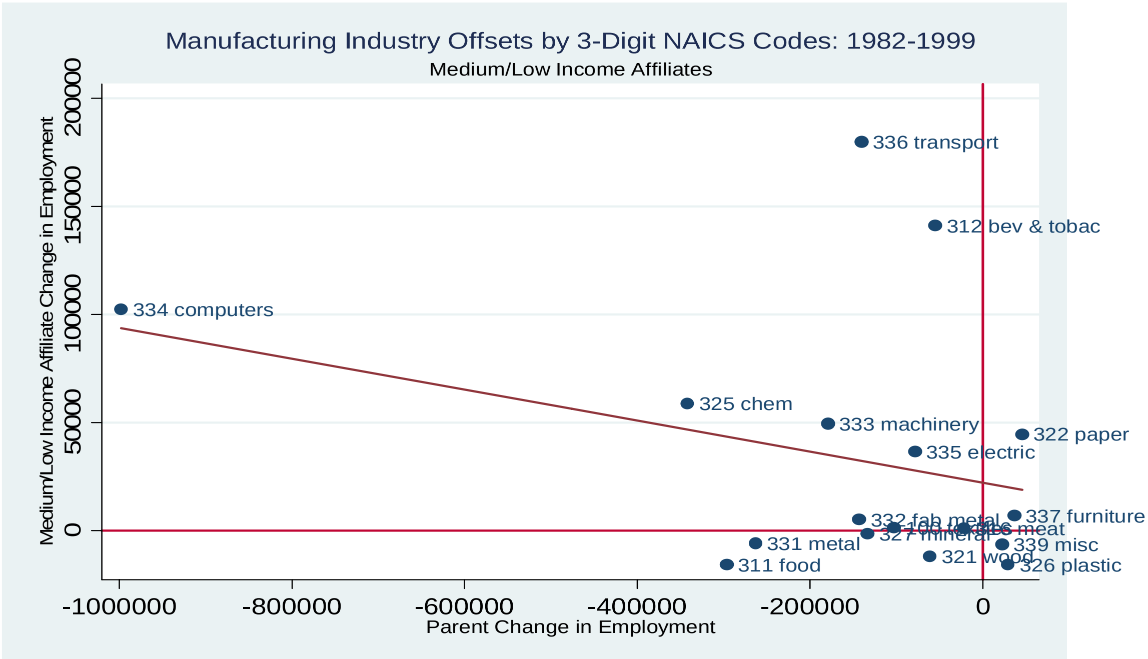
Source: Author's calculations based on BEA's outward FDI data

Figure 2: High Income Affiliates



Source: Author's calculations based on BEA's outward FDI data

Figure 3: Medium/Low Income Affiliates



Source: Author's calculations based on BEA's outward FDI data

APPENDIX TABLE A.1:

COVERAGE OF THE BEA SAMPLE

Year and Variable	Coverage of BEA Sample in Manufacturing	Coverage of BEA Sample in Services	Coverage of BEA Sample in Total U.S. Economic Activity (Includes Manufacturing, Services, Wholesale Trade and Other)
1982			
Total Number of Employees in BEA Sample	11,400,298	619,834	18,341,101
Coverage of the BEA Sample (in %) Relative to Employment for All Firms operating in the U.S.	65.66 %	0.92 %	20.45 %
Gross Product in the BEA Sample (U.S. Dollars)	531,453,350	15,465,862	762,326,385
Coverage of the BEA Sample (in %) Relative to Gross Product for All Firms operating in the U.S.	84.49 %	3.28 %	31.48 %
Value of Dollar Export Sales by Firms in the BEA Sample	113,119,987	251,358	151,396,797
Coverage of the Bea Sample (in %) Relative to Exports ofr All Firms operating in the U.S.	53.36 %	NA	NA
1989			
Total Number of Employees in BEA Sample	10,300,000	1,354,103	17,829,543
Coverage of the BEA Sample (in %) Relative to Employment for All Firms operating in the U.S.	57.27 %	1.61 %	16.51 %
Gross Product in the BEA Sample (U.S. Dollars)	652,916,905	47,014,029	999,242,784
Coverage of the BEA Sample (in %) Relative to Gross Product for All Firms operating in the U.S.	66.35	4.87	24.36
Value of Dollar Export Sales by Firms in the BEA Sample	183,400,000	659,909	214,832,083
Coverage of the Bea Sample (in %) Relative to Exports ofr All Firms operating in the U.S.	43.08	NA	NA
1994			
Total Number of Employees in BEA Sample	7,906,466	1,763,642	15,098,106
Coverage of the BEA Sample (in %) Relative to Employment for All Firms operating in the U.S.	46.45 %	1.93 %	13.21 %
Gross Product in the BEA Sample (U.S. Dollars)	677,653,022	71,048,064	1,114,413,633
Coverage of the BEA Sample (in %) Relative to Gross Product for All Firms operating in the U.S.	58.07 %	5.29 %	21.44 %
Value of Dollar Export Sales by Firms in the BEA Sample	220,559,766	1,765,125	253,492,391
Coverage of the Bea Sample (in %) Relative to Exports ofr All Firms operating in the U.S.	43.08 %	NA	NA

1999			
Total Number of Employees in BEA Sample	7,574,910	2,220,174	18,418,115
Coverage of the BEA Sample (in %) Relative to Employment for All Firms operating in the U.S.	43.73 %	2.12 %	14.28 %
Gross Product in the BEA Sample (U.S. Dollars)	798,862,384	118,838,810	1,621,453,486
Coverage of the BEA Sample (in %) Relative to Gross Product for All Firms operating in the U.S.	58.18 %	6.18 %	22.60 %
Value of Dollar Export Sales by Firms in the BEA Sample	297,668,602	7,872,596	344,427,514
Coverage of the Bea Sample (in %) Relative to Exports ofr All Firms operating in the U.S.	43.58	NA	NA

APPENDIX TABLE A.2:
CROSS CHECKING THE ACCURACY OF THE BEA DATABASE

	Imposing a Cut-off (Reporting Requirement of a Balance Sheet Total of at least 7 Million Euros for Germany, U.S. reporting requirements vary over time, no reporting requirement for Sweden)	Imposing no Cut-off on Germany affiliate reporting
BEA Data		
Employees of U.S. Affiliates in 1999 in Germany	458,744	NA
Employees of U.S. Affiliates in 1999 in Sweden	67,044	NA
German Government Data (Direct U.S. Ownership only)		
Employees of U.S. Affiliates in 1998	466,941	488,866
Employees of U.S. Affiliates in 1999	509,537	532,594
Employees of U.S. Affiliates in 2000	488,157	509,176
Swedish Government Data		
Employees of U.S. Affiliates in 1997 (Majority owned only)	51,138	NA
Employees of U.S. Affiliates in 1998 yoo(Majority owned only	61,089	NA
Employees of U.S. Affiliates in 1999 (Majority owned only)	78,621	NA

APPENDIX TABLE A.3:

DESCRIPTION OF VARIABLES AND DATA SOURCES

Variable Name	Source	Description
Exports to Foreign Affiliates (share in sales)	U.S. Bureau of Economic Analysis	goods only; valued f.a.s. at the port of exportation
Imports from Foreign Affiliates (share in sales)	U.S. Bureau of Economic Analysis	goods only; valued f.a.s. at the port of exportation
Log Capital Stock	U.S. Bureau of Economic Analysis	Deflated previous periods net book value of property, plant and equipment computed for parents, high-income affiliates and middle/low income affiliates separately.
Log Wage (Industry level)	U.S. Bureau of Economic Analysis	Wages and salaries of employees and employer expenditures for all employee benefit plans in parents computed separately for parents, high-income affiliates and other affiliates and averaged across industries.
Log Employment	U.S. Bureau of Economic Analysis	Log of the number of full-time and part-time employees on the payroll at the end of the fiscal year in all affiliates. However, a count taken during the year was accepted if it was a reasonable proxy for the end-of-year number. Computed separately for parents, high-income affiliates and other affiliates.
Log Non-Production Worker Employment	U.S. Bureau of Economic Analysis	Log of total high-income affiliate employment less production workers computed for high-income and other affiliates.
Log Production Worker Employment	U.S. Bureau of Economic Analysis	Log of number of production workers in high-income affiliates engaged in manufacturing activities - for manufacturing affiliates computed for high-income and other affiliates
R&D Share	U.S. Bureau of Economic Analysis	Expenditures on research and development as a percentage of sales. Computed separately for U.S. parents, affiliates in high-income locations and affiliates in low-income locations.
Profit Margin	U.S. Bureau of Economic lyAnalysis	Average across all periods of the ratio of net income to sales.
Total Factor Productivity	U.S. Bureau of Economic Analysis	TFP firm – TFP max by Industry
U.S. Import Penetration	Bernard, Jensen and Schott (2005)	Imports into the U.S. divided by imports into the U.S. plus total production in the U.S. less exports from the U.S. by year by 4-digit SIC 1987 revision code industrial classification.
U.S. Import Penetration from Low-Income Countries	Bernard, Jensen and Schott (2005)	Share of products in an industry sourced from at least one country with less than 5 percent of U.S. per capita GDP
U.S. Tariffs on Imports	Bernard, Jensen and Schott (2005)	Tariffs on U.S. imports are calculated by SIC 1987 industry and by year. The import weighted average tariff is calculated as duties divided by the customs value.

Freight costs to U.S.	Bernard, Jensen and Schott (2005)	Import weighted freight rates, where the freight rate is defined as 1 – (CIF/FOB). Freight rates are calculated by year and by 4-digit SIC 1987 revision code industrial classification
Capital Controls in Country of Affiliate	International Monetary Fund	0/1 measure of whether a country places restrictions on capital movements (1 being the most restrictive) by country by year.
Median Tax Rate in Country of Affiliate		
Political Risk in Country of Affiliate		
Education Expenditures	The World Bank, World Development Indicators	Adjusted savings: education expenditure (% of GNI)
Free Trade Agreement with Country of Affiliate	Andrew Rose, website at Haas	=1 if U.S.A has a free trade agreement with affiliate country
Log GDP per capita in High-Income Affiliate	The World Bank, World Development Indicators	Purchasing power parity dollars
Log GDP per capita in Low-Income Affiliate	The World Bank, World Development Indicators	Purchasing power parity dollars
Personal Computers per 1000 people	The World Bank, World Development Indicators	Personal computers (per 1,000 people)
Distance	Andrew Rose, website at Haas	Distance between Source and Host

APPENDIX TABLE A.4:

ALTERNATIVE SPECIFICATION FOR LABOR DEMAND WITH INDU.S.TRY WAGES AS INDEPENDENT VARIABLES: FIXED EFFECT (FE) AND IV ESTIMATES

	OLS	IV
Log U.S. Industrial Wages	-0.476	-0.406
	(0.019)	(0.299)
Log Industrial Wages in High-Income Countries	-0.030	-0.844
	(0.016)	(0.286)
Log Industrial Wages in Low-Income Countries	0.016	0.087
	(0.009)	(0.038)
Log U.S. Capital Stock	0.569	0.606
	(0.010)	(0.223)
Log Capital Stock in Affiliates in High Income	-0.025	-0.014
Countries	(0.005)	(0.001)
Log Capital Stock in Affiliates in Low Income	-0.003	-0.012
Countries	(0.001)	(0.003)
R&D Spending (% Sales)	-0.427	-0.315
	(0.064)	(0.154)
R&D Spending (% Sales) in High-Income Countries	0.076	0.854
	(0.084)	(0.314)
R&D Spending (% Sales) in Low-Income Countries	-0.373	-0.810
	(0.121)	(0.277)
Import Penetration	-0.222	-0.261
	(0.089)	(0.272)
Import Penetration from Low-Income Countries	0.079	-0.090
	(0.043)	(0.040)
Log GDP per capita in High-Income Countries (ppp)	0.016	0.037
	(0.004)	(0.016)
Log GDP per capita in Low-Income Countries (ppp)	-0.005	0.017
	(0.004)	(0.043)
Exports to Foreign Affiliates (share in sales)	-0.094	-0.432
	(0.020)	(0.126)
Imports from Foreign Affiliates (share in sales)	-0.809	-6.148
	(0.135)	(4.659)
Sargan Test		0.186
Observations	3368	3368
R-squared	0.63	0.10

Robust standard errors in parentheses. The Sargan Test reports the p-value of Sargan's (1958) test of over identifying restriction. It is a test of the joint null hypothesis that the excluded instruments are valid instruments, i.e. uncorrelated with the error term and correctly excluded from the estimated equation. The reported p-value indicates the level of confidence with which we do not reject our model. Instruments used are: education expenditures, capital controls, country tax rates, political risk, personal computers per 1,000 people, distance, free trade agreement with U.S. tariffs and freight costs. For example, description of these variables see Appendix A.3.

APPENDIX TABLE A.5:

CES SPECIFICATION: DEPENDENT VARIABLE IS RATIO OF LOG EMPLOYMENT AT HOME TO LOG EMPLOYMENT ABROAD
REPORTED COEFFICIENT IS ON THE INDEPENDENT VARIABLE : (LOG) WAGES AT HOME RELATIVE TO WAGES ABROAD
COEFFICIENT IS (THE NEGATIVE OF) THE IMPLIED ALLEN ELASTICITY OF SUBSTITUTION σij

	OLS	IV
Home versus abroad		
No Controls	0.760	
	(.018)	
With Controls	.659	0.939
	(.013)	(.166)
Home versus High Income		
No Controls	0.508	
	(.098)	
With Controls	0.422	1.201
	(.025)	(.534)
Home versus Low Income		
No Controls	-1.178	
	(.076)	
With Controls	-0.161	-0.603
	(.025)	(.543)
Observations		
R-squared		

Robust standard errors in parentheses. Other controls (not reported) include capital stock by location, R and D expenditures by location, import penetration and GDP per capita in high and low income countries. See instrument list in Table 5 for IV estimates. For a complete description of these variables see Appendix Table A.3.

APPENDIX TABLE A.6:
TRANSLOG COST SHARE SPECIFICATION: DEPENDENT VARIABLE IS US WAGE BILL AS A SHARE OF TOTAL EXPENDITURES ON LABOR ACROSS ALL LOCATIONS

	OLS	IV
Log U.S. Industrial Wages	0.035	0.221
	(0.011)	(0.081)
Log Industrial Wages in High-Income Countries	-0.015	-0.039
	(0.008)	(0.021)
Log Industrial Wages in Low-Income Countries	-0.005	-0.003
	(0.002)	(0.0001)
Log U.S. Capital Stock	0.040	0.153
	(0.004)	(0.049)
Log Capital Stock of Affiliates in High-Income Countries	-0.075	-0.108
	(0.002)	(0.017)
Log Capital Stock of Affiliates in Low-Income Countries	-0.016	-0.030
	(0.001)	(0.007)
Log GDP per capita ppp $ in High-Income Countries	-0.008	-0.004
	(0.002)	(0.002)
Log GDP per capita ppp $ in Low-Income Countries	-0.004	-0.014
	(0.002)	(0.007)
R&D Spending (% Sales)	0.049	0.157
	(0.027)	(0.042)
R&D Spending (% Sales) in High-Income Countries	0.019	0.025
	(0.035)	(0.113)
R&D Spending (% Sales) in Low-Income Countries	-0.084	-0.051
	(0.032)	(0.016)
Import Penetration	0.025	-0.325
	(0.038)	(0.119)
Import Penetration from Low-Wage Countries	-0.009	0.006
	(0.019)	(0.066)
Exports to Foreign Affiliates (Share in Sales)	-0.210	-3.614
	(0.043)	(1.698)
Imports from Foreign Affiliates (Share in Sales)	-0.253	-6.806
	(0.043)	(3.291)
Sargan Test		0.112
Observations	3368	3368
R-squared	0.50	0.24

Robust standard errors in parentheses. The Sargan Test reports the p-value of Sargan's (1958) test of over identifying restriction. It is a test of the joint null hypothesis that the excluded instruments are valid instruments, i.e. uncorrelated with the error term and correctly excluded from the estimated equation. The reported p-value indicates the level of confidence with which we do not reject our model. Instruments used are: education expenditures, capital controls, country tax rates, political risk, personal computers per 1,000 people, distance, free trade agreement with U.S. tariffs and freight costs. For a description of these variables see Appendix A.3.

APPENDIX TABLE A.7:
WORLD BANK COUNTRY CLASSIFICATIONS

Country Name	World Bank Classification
Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Dem. Rep. Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Taiwan, United Kingdom	High Income: OECD
Aruba, The Bahamas, Bahrain, Bermuda, Cayman Islands, Cyprus, Hong Kong, Israel, Kuwait, Netherlands Antilles, Singapore, Slovenia, United Arab Emirates	High Income: non OECD
Argentina, Barbados, Botswana, Brazil, Chile, Costa Rica, Czech Republic, Dominica, Estonia, Hungary, Latvia, Lebanon, Malaysia, Malta, Mexico, Panama, Poland, Saudi Arabia, Slovak Republic, Trinidad and Tobago, Uruguay, Venezuela, RB	Upper Middle Income
China, Colombia, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Fiji, Guatemala, Guyana ,Honduras, Jamaica, Kazakhstan, Morocco, Namibia, Peru, Philippines, Romania, Russian Federation, South Africa, Sri Lanka, Swaziland, Thailand, Tunisia, Turkey	Lower Middle Income
Dem. Rep. Congo, Eritrea, Ghana, Haiti, India, Indonesia, Kenya, Malawi, Mozambique, Nicaragua, Nigeria, Pakistan, Senegal, Tanzania, Ukraine, Uzbekistán, Vietnam, Rep. Yemen, Zambia, Zimbabwe	Low Income

For the purposes of our analysis, we code as high income countries those classified as either “high income: OECD” or “high income: non OECD”. All other countries are classified as middle/low income countries.