

OFFSHORING, FOREIGN DIRECT INVESTMENT, AND THE STRUCTURE OF U.S. TRADE

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Abstract

Theory suggests that multinational enterprises (MNEs) play the role of factor service intermediaries in international trade. This paper presents the results of an empirical analysis that exploits variation in the intrafirm trade by U.S. MNEs across countries and industries to assess this theory. The results provide support for recent models of multinational enterprise and suggest that the activities of U.S. MNEs alter the structure of international trade, particularly among middle-income countries. (JEL: D2, F1, F23, L2)

1. Introduction

In the United States there is widespread concern that U.S. multinationals are “exporting jobs” by replacing production facilities in the U.S. with facilities in low-wage, developing countries. At the same time, many believe that there is a trend among firms to cease the production of intermediate inputs, choosing instead to buy these parts from unaffiliated firms located in developing countries. These phenomena have been called “offshoring,” which one labor union group defines as “the transfer, through foreign direct investment or subcontracting, of all or part of the production of goods and services to another country with the intention to re-import them to the home country.”¹

As international trade has always been politically controversial, it is questionable whether there is much new in the uproar over “offshoring.” That a significant portion of offshoring is done by multinational enterprises (MNEs) raises interesting questions, however. Why are some international transactions carried out within a firm while others are carried out on markets? When transactions are better carried out within an MNE, what implications do restrictions on foreign direct

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1. Trade Union Advisory Committee to the OECD (2004).

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investment (FDI) have for international trade in factor services? Over several decades a theoretical literature has evolved to answer these questions.

In this paper, I present empirical evidence that supports elements of this literature. I explore the variation across countries and industries in the extent to which exports out of and imports into the United States are conducted between the affiliates of U.S. multinationals and their U.S. parent firms. I focus on this component of FDI (known as intrafirm trade) because it is most directly relevant to the phenomenon of offshoring FDI as defined.

The results support recently developed models of international trade and incomplete contracts and paint a vivid picture of the role played by the offshoring of U.S. MNEs in foreign exports to the United States. I show that the predictions of the model of Antras and Helpman (2004) are consistent with the data for less-developed, and middle-income countries, but have less to say about the intrafirm trade of the most developed countries. The results also suggest that “knowledge capital” provided by U.S. MNEs play the most distinct role for the trade patterns of middle-income countries.

2. Theory with Respect to Offshoring FDI

In this section I discuss some of the theoretical literature on the role of multinational firms as intermediaries in the conduct of net factor service trade. As is well-known from Heckscher-Ohlin, factor endowment differences across countries give rise to factor price differences across countries, which in turn provide a motive for firms to split their production processes across countries, namely, to off-shore production activities to countries in which those activities can be performed at low cost. The “offshoring” of intermediate inputs (or stages of production) of a final product can be thought of as factor service trade.

A key issue that arises when intermediate inputs can be produced independently from the final product is who should control the production of each input. Why are some international transactions between parties related through FDI (ownership of foreign capacity) whereas other transactions occur at “arm’s length” between firms on markets (outsourcing)? If market failures cause firms to favor ownership of multiple stages of production so that offshoring is infeasible in the absence of FDI, then MNEs must play the role of intermediaries in factor service trade.

The literature on FDI has long treated MNE as an imperfect solution to the problem of incomplete contracts. One venerable branch of this literature focuses on the importance of intangible assets such as knowledge or reputation. If property rights over such assets are hard to enforce, then firms have an incentive to internalize activities via ownership of foreign producers to prevent such assets from being ill used. Hence, MNEs should arise in industries

where intangible assets, such as technology or product differentiation, play an important role.

Recent work highlights the role of relationship-specific investments. For instance, Antras and Helpman (2004) build on the work by Grossman and Hart (1986) in which ownership corresponds to residual rights of control. When two agents must each make non-contractible, relationship-specific investments to produce a joint benefit, ownership has a critical effect on the incentives of each agent to invest. The key insight is that ownership should be assigned to the agent whose investment contributes most to the relationship.

Antras and Helpman (2004) map Grossman and Hart into an international setting by assuming that a “headquarter service” has to be provided by an agent in one country and a manufactured component must be provided by a different agent that could be located in either a low cost country or in the home market. When “headquarter services” contribute most to the relationship, the assignment of property rights to the final goods producer (vertical integration) leads to higher variable profits than could be achieved by the assignment of property rights to the intermediate producer (outsourcing).

The framework of Antras and Helpman also features firm cost heterogeneity and fixed costs to modes of international organization. They show that when fixed costs to offshoring-FDI are especially high that not all firms engage in offshoring-FDI even when factor price differences between countries favor offshoring and the features of an industry’s technology favor vertical integration. In fact, only the most efficient firms will find that the combined benefits of lower factor costs and proper assignment of property rights will be sufficient to overcome large fixed costs.

An implication of this sorting result is that industries with greater dispersion in productivity should feature a larger share of offshoring conducted by MNE. An increase in dispersion in the distribution of productivity across firms pushes more of the mass to the extremes so that a larger fraction of offshoring firms find it profitable to vertically integrate. Hence, the share of “intrafirm” trade in total trade in an “offshoring” industry should be increasing in the degree of dispersion across firms.

There are other possible explanations for intrafirm trade patterns that are not motivated by factor price differences across countries and therefore are not associated with “offshoring” per se. For instance, in the multi-product firm setting of Baldwin and Ottaviano (2001), oligopolistic firms may produce some varieties of their product in one country and other varieties in another. If firms maintain control of distribution in each location, then intrafirm trade is more akin to reciprocal dumping than “offshoring.”

In summary, theory predicts that U.S. multinational enterprises are likely to play an important role in offshoring in certain industries and countries. For U.S. offshoring-FDI to occur in a given country, that country must have a comparative

advantage in some portion of a production process in which a U.S. MNE has a comparative advantage in headquarter services. Further, the technology of that sector must be such that the proper assignment of property rights favors ownership by the U.S. MNE. Finally, given the existence of fixed costs to offshoring-FDI, a higher degree of productivity dispersion will increase the propensity to engage in offshoring-FDI rather than offshoring-outsourcing.

3. Data

I use the extent of “intrafirm” trade between the U.S. parent firms of U.S. MNEs and their foreign affiliates to measure offshoring-FDI by U.S. MNEs. The data comes from the 1994 Benchmark Survey, conducted by the Bureau of Economic Analysis. My primary measure is the value of imports by U.S. parent firms from their foreign affiliates. For each majority-owned affiliate of a U.S. MNE, I observe (1) its country of residence, (2) its mainline of business, and (3) the value of its exports to its parent firm. I assume that the actual goods traded correspond to the mainline of business of the affiliate so that they may be compared to total trade volumes between host and source country.

Because my primary focus is on industry variation, this intrafirm trade is aggregated over affiliates in various country groupings.² I also consider Canadian and Mexican trade with the U.S. individually as these countries account for over 60% of total U.S. offshoring-FDI. The data set contains 51 manufacturing classifications (which lie roughly between two- and three-digit 1987 SIC industrial classifications) and 58 countries.³ My gauge of the relative importance of offshoring-FDI is the ratio of the value of intrafirm trade of U.S. MNEs to the value of total U.S. imports, *IMPORTSH*, where U.S. import data are from Feenstra, Romalis, and Schott (2002).

For completeness, I also measure offshoring FDI by the exports of U.S. parents to their foreign affiliates of intermediate inputs (goods for further processing) in total U.S. Exports, *EXPORTSH*. While less directly related to offshoring FDI (there may be no re-export to the U.S.), trade in unfinished products for further processing is evidence of geographic fragmentation of production associated with offshoring. Here I use industry of U.S. parent to classify the type of good produced. U.S. export data is also taken from Feenstra et al. (2002).

2. By aggregating over countries, we reduce the econometric problems associated with a large number of zeros across country-industry pairs. This is problem is particularly acute for the smallest and least-developed countries.

3. Industry, 271 Newsprint, was dropped for lack of industry data. See Table 1 for a list of country groups.

4. Empirics

I analyze the industry characteristics that are associated with variation in the share of U.S. parent firms' imports from their foreign affiliates in total U.S. imports (*IMPORTSH*) and in the share of U.S. parent firms' exports of good for further processing to their foreign affiliates in total U.S. exports (*EXPORTSH*). Theory suggests that this share should be large when the U.S. has a comparative advantage in a substantial portion of the production process and intangible assets/relationship specific investments provided by the MNE are important.

I consider the following specification:

$$\begin{aligned} TRADESH_{jc} = & DISPERSE_j^{\beta_0} * KAPINT_j^{\beta_1} * RDINT_j^{\beta_2} * ADINT_j^{\beta_3} * \\ & SKINT_j^{\beta_4} * SCALE_j^{\beta_5} * VERT_j^{\beta_6} + \eta_{jc}, \end{aligned} \quad (1)$$

where j indexes industries and *TRADESH* is alternately *IMPORTSH* and *EXPORTSH*. My choice of covariates is similar to Antras (2003).⁴ *KAPINT_j* is the capital-labor ratio for industry j taken from NBER Productivity database for 1994. *RDINT_j* is the ratio of R&D expenditures to sales in industry j and *ADINT_j* is the ratio of advertising expenditures to sales. Both of these variables are taken from a 1977 FTC line of business survey. *SKINT_j* is the share of workers in industry j that have at least a high-school education and *SCALE_j* is the average size of a plant in industry j . Both of these variables are taken from Yeaple (2003). *VERT_j* is the ratio of value-added to sales in industry j and is taken from the NBER Productivity database for 1994.

Finally, *DISPERSE_j* is my measure of the extent of productivity dispersion across firms within an industry. According to Antras and Helpman (2004), differences in firm size as measured by final good sales reflect differences in productivity because more productive firms sell more. As shown in Helpman, Melitz, and Yeaple (2004) a conceptually valid measure of productivity dispersion is the standard deviation of the logarithm of firm sales across firms within an industry. I use the measure from Helpman, Melitz, and Yeaple (2004), who compute this measure using establishment data from the 1997 U.S. Census of Manufacturers.

Following the suggestion of Silva and Tenreyro (forthcoming), we estimate the model as a Poisson regression. This method of estimation has the advantage that it naturally allows us to avoid having to take the logarithm of zero. As discussed in Wooldridge (1999), this method of estimation will produce consistent estimates as long as the conditional expectation function is not misspecified.

The coefficient estimates provide information about the nature of industries in which offshoring-FDI by U.S. MNEs plays an important role in the rest of

4. Even if the covariates were identical, the analysis would be different from Antras (2003) because I focus on the intrafirm trade of U.S. MNEs and not the intrafirm trade of foreign MNEs into the U.S.

TABLE 1. Country coverage of the data set.

Least Developed Countries

Costa Rica, Guatemala, Paraguay, Panama, Dominican Republic, Peru, Nicaragua, Ecuador, El Salvador, Colombia, Honduras, Jamaica, Romania, Nigeria, Egypt, China, India, Indonesia, Pakistan, Philippines

Newly Developed Countries

Argentina, Brazil, Chile, Mexico, Trinidad, Uruguay, Venezuela, Greece, Hungary, Poland, Portugal, Spain, Turkey, South Africa, Israel, Malaysia, Korea, Taiwan, Thailand

Most Developed Countries

Canada, Austria, Belgium, Denmark, Finland, Germany, Italy, Ireland, Netherlands, Norway, Sweden, Switzerland, United Kingdom, Australia, Hong Kong, Japan, New Zealand, Singapore

the world's exports to the United States. For instance, a positive coefficient on *KAPINT* implies (i) that internalization is important in capital intensive industries and (ii) that U.S. MNEs in particular have an ownership advantage in these industries.⁵

My strategy is to estimate the model first for the entire world's exports to the United States and then separately for different sets of countries. I divide the sample into three groups on the basis of their GDP per capita in 1994. The country groupings can be found in Table 1. By disaggregating the sample by level of country development I allow the U.S. industry characteristics associated with U.S. intrafirm trade to vary across countries. Allowing for slope heterogeneity is important because countries at different levels of development are likely in different cones of diversification, that is, electronics components from Sweden are likely different than components from Malaysia and involve different contracting issues. Descriptive statistics for industry characteristics are shown in Table 2.

I first discuss the results that correspond to the aggregate sample of all 58 countries shown in column 1 of Table 3. First, the coefficient on *KAPINT* is positive and statistically significant. This result is consistent with that of Antras (2003) who argued that this is evidence that multinational corporations play an important role in providing capital to their foreign affiliates. The positive and statistically significant coefficient on *RDINT* is also consistent with Antras (2003) and many other studies. It indicates that internalization is important in those industries in which proprietary knowledge assets play a key role. The coefficients are essentially zero on *ADINT* and *SKINT*.

A particularly interesting result is that a higher degree of dispersion is associated with greater ownership of the production activities associated with offshoring. This result is consistent with the predictions of Antras and Helpman (2004). This result further supports the conclusion drawn in Helpman, Melitz,

5. It is important to point out that a coefficient of zero does not necessarily imply that internalization is not important because it possible that local rather than U.S. multinational enterprises might play an important role.

TABLE 2. Descriptive statistics.

Variable	Mean	Std. Dev.
<i>KAPINT</i>	4.31	0.70
<i>RDINT</i>	1.15	1.58
<i>ADINT</i>	1.99	0.70
<i>SKINT</i>	-0.89	0.35
<i>DISPERSE</i>	1.74	0.31
<i>SCALE</i>	3.31	0.80
<i>VERT</i>	-0.71	0.25
<i>IMPORTSH</i>	0.10	0.13
<i>EXPORTSH</i>	0.075	0.084

Note: All variables, except *IMPORTSH* and *EXPORTSH*, are in logarithms.

and Yeaple (2004) that firm heterogeneity plays an important role in the structure of international commerce.

Before turning to the results for sets of countries at different levels of development, I first comment on the relative importance of U.S. MNE in total trade for these groups of countries. First, the more developed the country grouping, the less likely that there is no intrafirm trade within an industry category. Second, the share of intrafirm trade in total trade is increasing in the level of development. These facts suggest that much of intrafirm trade volumes do not involve offshoring-FDI!

Now consider the coefficient estimates for countries at different levels of development, shown in columns 2–4. There are interesting differences across

TABLE 3. Industry characteristics and U.S. intrafirm imports as a share of U.S. imports.

	(1) Full sample	(2) LDCs	(3) Emerging	(4) Developed	(5) Mexico	(6) Canada
<i>KAPINT</i>	0.74 (0.22)	1.15 (0.33)	0.79 (0.23)	0.17 (0.21)	0.24 (0.21)	0.20 (0.18)
<i>RDINT</i>	0.24 (0.10)	0.18 (0.20)	0.26 (0.14)	0.41 (0.09)	0.35 (0.14)	0.46 (0.11)
<i>ADINT</i>	0.06 (0.21)	0.52 (0.46)	-0.11 (0.36)	0.23 (0.20)	-0.35 (0.36)	0.35 (0.23)
<i>SKILLINT</i>	0.21 (0.46)	-1.40 (0.85)	0.96 (0.53)	-0.21 (0.41)	0.50 (0.60)	-0.11 (0.49)
<i>DISPERSE</i>	1.42 (0.51)	2.20 (0.55)	1.47 (0.67)	0.41 (0.51)	1.58 (0.52)	0.51 (0.44)
<i>SCALE</i>	-0.53 (0.22)	-0.25 (0.50)	-0.74 (0.29)	-0.25 (0.18)	-0.63 (0.33)	-0.18 (0.22)
<i>VERT</i>	-0.17 (0.48)	-1.25 (1.19)	-0.22 (0.71)	-1.25 (0.44)	1.18 (0.93)	-1.13 (0.39)
<i>N</i>	51	51	51	51	51	51
Positive Obs	51	37	45	51	39	50
Pseudo R^2	0.11	0.14	0.14	0.07	0.12	0.11

Note: Independent variables are in logs. Standard errors in parentheses are robust to heteroskedasticity. Constant suppressed. Coefficients statistically significant at the 10% level in **bold**.

countries. First, consider the coefficients on *KAPINT* in each column. The coefficient is positive for all three country groups but is statistically significant for only the least and newly developed countries. Further, the size of the coefficient estimate is decreasing in the level of development. I find the opposite pattern for R&D intensity. The coefficient on *RDINT* is positive for all country groups but is statistically significant for only the newly developed and developed countries. Other interesting differences between country groups can be found on the coefficient for *SKINT*, which is negative but statistically significant for the least developed countries but is positive and statistically significant for the newly developed countries.

These results suggest that the least developed countries do not produce on average a set of goods that require “knowledge inputs” from U.S. MNEs but that do require physical capital inputs. Physical capital inputs from U.S. MNEs are also important for moderately developed countries. Where “knowledge capital” is important is for the moderately developed countries, such as Malaysia, as is reflected in the positive and statistically significant coefficients on *RDINT* and *SKINT*. The results suggest that the set of goods being exported to the U.S. would be substantially different for moderately developed countries were FDI restricted.

Finally, note that the coefficient on *DISPERSE* follows the coefficient estimates on *KAPINT*. It is positive and statistically significant for only the two sets of developing countries and decreasing in size with level of development.

Taken as a whole, the results can be interpreted as providing support for the type of model proposed by Antras and Helpman (2004). Intrafirm trade is important in those industries in which a U.S. firm needs to make important relationship-specific investment for production in the developing world. Moreover, as predicted by Antras and Helpman (2004), firm heterogeneity is important in the structure of offshoring FDI to less and moderately developed countries.

Because Canada and Mexico together account for more than 60% of the U.S. intrafirm imports into the United States, I estimate equation (1) for each country individually. The results are shown in the last two columns of Table 3 respectively. Consider first the coefficient estimates for Mexico, which are shown in column 5. Of the coefficients of interest, *RDINT* and *DISPERSE*, are statistically significant, but the coefficient on *KAPINT* is not. The results for Mexico seem to lie somewhere between the results for the sample of emerging markets and the developed country sample. Importantly, however, greater firm heterogeneity is associated with more offshoring-FDI in total offshoring. Now consider the results for Canada shown in column 6. These estimates are almost exactly those found for the set of developed countries shown in column 4.

For the purpose of comparison, the results corresponding to our alternate measure of offshoring FDI (*EXPORTSH*) are shown in Table 4. Although the coefficient estimates are, for the most part, not estimated with precision, there are

TABLE 4. Industry characteristics and U.S. parent intermediate exports to their affiliates as a share of total U.S. exports.

	(1) Full sample	(2) LDCs	(3) Emerging	(4) Developed
<i>KAPINT</i>	0.19 (0.17)	0.57 (0.28)	0.27 (0.22)	0.21 (0.18)
<i>RDINT</i>	0.31 (0.14)	0.24 (0.19)	0.34 (0.20)	0.31 (0.13)
<i>ADINT</i>	0.16 (0.25)	0.51 (0.40)	-0.04 (0.37)	0.10 (0.24)
<i>SKILLINT</i>	0.19 (0.39)	-0.16 (0.61)	0.22 (0.57)	0.08 (0.39)
<i>DISPERSE</i>	0.10 (0.57)	-0.04 (0.77)	0.49 (0.70)	0.14 (0.56)
<i>SCALE</i>	-0.23 (0.22)	-0.67 (0.40)	-0.22 (0.33)	-0.33 (0.22)
<i>VERT</i>	-0.72 (0.50)	0.22 (0.52)	-0.81 (0.73)	-0.69 (0.44)
<i>N</i>	51	51	51	51
Positive Obs	50	42	47	50
Pseudo R^2	0.05	0.06	0.06	0.05

Note: Independent variables are in logs. Standard errors in parentheses are robust to heteroskedasticity. Constant suppressed. Coefficients statistically significant at the 10% level in **bold**.

some interesting similarities in the pattern of coefficients across country groupings for *KAPINT* and *RDINT*. An industry's capital intensity matters for the least developed countries but is irrelevant for the more developed countries. This result is consistent with a story in which capital intensive intermediates are shipped to affiliates located in developing countries, further processed, and then shipped back to the U.S. Similarly, R&D intensity matters only for the more developed countries. A key difference is that *DISPERSE* is never statistically significant, suggesting perhaps that the export of goods for further processing is less related to offshoring-FDI.

5. Conclusion

My results are consistent with key implications of the recent models of the international organization of production and shed light on the industry characteristics associated with the need for internalization within U.S. MNEs for countries at different levels of development. Offshoring-FDI is more prevalent in capital intensive industries in relatively capital scarce countries while R&D intensity is associated with offshoring-FDI in relatively skilled-labor abundant countries. The results confirm the importance of firm heterogeneity in the international organization of production: Greater dispersion in productivity across firms within a single industry is associated with more FDI.

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