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Competition for Multinational Investment in Developing Countries: Human Capital, Infrastructure, and Market Size

David L. Carr, James R. Markusen,
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10.1 Introduction

Globalization is a complex process about which little can be said confidently without sustained and systematic empirical investigation into its sources, channels, and effects. Unfortunately, both avid critics and supporters of globalization processes tend to argue on the basis of anecdotes, which are always available to support a particular case. One of the more significant complaints about multinational enterprises is that, when locating in developing countries, they look for countries with weak labor rights. Such conditions presumably permit firms to exploit local workers by paying them less than some notion of a fair wage. Given the breadth and complexity of the world economy, claims of this kind can be misleading and may support faulty policy prescriptions. Thus, economists look for systematic evidence in large data sets and use statistical techniques to identify underlying regularities amidst the noise.

The purpose of this paper is to give a broad outline and discussion of what knowledge we may claim with a reasonable degree of confidence about the patterns and determinants of foreign direct investment (FDI) flows to developing countries. We restrict the analysis to long-term direct investment and do not consider more volatile short-term capital move-

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ments. A basic task is to shed light on characteristics of developing countries that attract foreign investors. When analyzed through the filters of general-equilibrium theory and extensive econometric analysis, is the "sweatshop" view, in which multinational enterprises (MNEs) are primarily attracted to countries with low-wage labor, the decisive model?

We begin with a review of recent theory in section 10.2, examining Markusen's "knowledge-capital" model that allows for both horizontal and vertical motives for foreign investment. This analysis suggests channels through which FDI should be related to host-country characteristics. We then present some summary statistics about which countries attract inward investment in section 10.3. In section 10.4, we set out an econometric specification and provide estimates of this general-equilibrium model using data on outward investment from the United States to a large sample of countries from 1986 to 1997. Compared to our earlier work (Carr, Markusen, and Maskus 2001; Markusen and Maskus 2001), the new feature of the current paper is to introduce a measure of infrastructure quality into the econometric estimation. Both the summary statistics and econometric estimates we present indicate that manufacturing FDI flows to countries with relatively large markets, a relatively high endowment of labor skills, laws and legal institutions that are friendly to investment, and sound economic infrastructure.

Thus, our results do not support the sweatshop view of what features attract MNEs. Rather, the estimates support the view obtained from basic statistics that MNEs avoid the poorest countries in the world. Indeed, the evidence suggests that increases in the differences in skill endowments between the United States and its investment partners tends to reduce local affiliate activity significantly, as found earlier in Markusen and Maskus (2002) and Blonigen, Davies, and Head (2003). However, we emphasize that the data exercise in this paper considers only FDI in aggregate manufactures, rather than FDI in labor-intensive goods.

Overall, it is in the nature of what MNEs produce that makes cheap labor not a strong attraction for production in developing countries. Our conclusion is that developing countries stand to gain little in terms of increasing FDI by artificially suppressing wages—for example, by limiting rights of workers to organize and bargain collectively.[1] That strategy is likely to reduce productivity and investment, as noted by Martin and Maskus (2001). If attracting FDI in manufacturing is a development policy, it is more sensible to increase the human capital stock and improve the economic infrastructure. The conclusion that the quality of infrastructure matters positively for attracting FDI has been demonstrated in informal analyses by Wheeler and Mody (1992) for the Organization for Economic

1. Maskus (1997) and Organization for Economic Cooperation and Development (OECD; 1996) discuss such policies in a number of countries.

Cooperation and Development (OECD) economies and by Cheng and Kwan (2000) for China. Interestingly, however, infrastructure seems to play relatively little role in location decisions in sub-Saharan Africa, although it is important in other developing regions (Asiedu 2002).

10.2 A Theoretical Framework

While there are many motives for direct investment, one simple taxonomy is between the horizontal (also known as market seeking) and the vertical (also called resource seeking) investments. Horizontal investments refer to multinational activities abroad that produce roughly the same goods and services as the firm produces at home. Vertical investments refer to MNEs geographically fragmenting the production process, locating each stage where the factors used intensively in that stage are cheap.

Intuition would suggest that horizontal investments are made generally to serve local markets and are therefore attracted to large markets (the proverbial carrot) that are characterized by high trade costs that deter exporting to those markets (the stick). If MNEs tend to produce relatively sophisticated goods and services for high-income consumers, then horizontal investments will tend to be directed to other relatively advanced countries. Thus, a rough hypothesis is that horizontal investments tend to occur between high-income countries and with the output sold locally rather than exported.

Vertical investments seek favorable costs for different stages of production. One reasonable generalization is that the assembly and testing stages are less skilled-labor and capital intensive than are design and component production. Thus, firms will seek countries with low-wage and scarce labor skills for assembly and testing operations. Assuming that most of the output ultimately is to be sold in high-income countries, it follows that a large portion of the output from vertical investments should be traded internationally rather than sold domestically. Thus, we might conjecture that vertical investments tend to flow from high-income to low-income countries, with a high proportion of the output exported from the host country.

These generalizations are not perfect. There is rarely activity consisting of pure horizontal investment insofar as parent firms supply knowledge-based assets, services to and often components as well to subsidiaries. The relationship between trade versus domestic sales and vertical versus horizontal investments is imperfect as well. Many U.S. firms make what we would generally think of as horizontal investments in the European Union (EU) to serve the EU market, but production might be centered in a particular location, say Ireland. Since Ireland is a small part of EU consumption, the proportion of output exported from Ireland will be high.

Markusen's (2002) knowledge-capital model makes a number of assumptions about technologies that permit different types of firms to arise

endogenously as a function of the characteristics of two countries. First, he assumes the existence of firm-level scale economies, a property that he refers to as "jointness." It is assumed that knowledge-based assets are at least partially joint or public inputs across plants, giving rise to firm-level scale economies. Second, he assumes that the creation of knowledge-based assets can be geographically fragmented from output production at a fairly low cost, a process called "fragmentation." Third, he assumes that knowledge-based assets are skilled-labor intensive relative to production, but also generally claims that production is skilled-labor intensive relative to the rest of the economy. This assumption is referred to as "skilled-labor intensity."

Jointness is the key assumption that gives rise to horizontal multinationals. Firm-level scale economies encourage multiplant firms to exploit firm-level economies. If there are plant-level scale economies as well, however, it is not trivially true that firms will always choose foreign-branch plants. Foreign production will be chosen when the foreign market is large and trade costs are moderate to high relative to plant-level scale economies.

Fragmentation and skilled-labor intensity encourage the vertical dispersion of activities, locating stages of production where the factors each stage uses intensively are relatively cheap. Accordingly, skilled-labor-intensive headquarters activities and component production may be located in the high-income parent country, and less-skilled-labor-intensive production may be located in a developing country, with a large proportion of the output shipped back to the parent country.

One interesting general-equilibrium result follows from Markusen's assumption that branch-plant production (in particular, the fixed costs of setting up a branch plant) is more skilled-labor intensive than the rest of the economy. This results in an inverted U-shaped relationship for affiliate production in a developing country as a function of its skilled-labor scarcity. Vertical production in which an assembly plant is located in the developing country, for example, is most attractive for a firm when the developing country is moderately skilled-labor scarce. Resulting factor-price differences give the firm an incentive to locate its headquarters in the skilled-labor-abundant country and the assembly plant in the developing country. But as the developing country becomes very skilled-labor scarce, the price of skilled labor makes the fixed costs of the branch plant prohibitively expensive, and the firm has an incentive to keep the assembly plant at home.[2] Put a different way, the MNE needs a minimum number of skilled managers and technicians in the developing country, in which skills may

2. Note that such a shortage could be relieved by permitting a temporary inflow of skilled labor, perhaps within the firm from the headquarters to the plant location. The model assumes that factors are immobile across borders (which is fairly consistent with reality in many countries), thereby ruling out this possibility. The observation underscores the importance of the current global debate about the gains and losses from temporary increases in skilled-labor migration.

command a high relative price. In fact, at a sufficient degree of skilled-labor scarcity, the MNE will not invest even if unskilled labor is virtually free.

These results have some parallels in findings by Feenstra and Hanson (1996, 1997). In their model, there is a continuum of activities needed to produce a final good and these activities can be ordered by their skilled-labor intensity. Investment liberalization then leads to the shift of some less-skilled activities to developing countries. This outcome is similar to location of certain final production activities, such as assembly, in the Markusen model. Although Feenstra and Hanson do not explicitly address the question of how much activity is shifted depending on the skilled-labor scarcity of the developing country, our sense is that they would get a similar result that this output transfer would diminish as the developing country gets extremely skilled-labor scarce.

There are thus several versions of theory that predict that the price of unskilled labor is not a decisive factor in attracting inward foreign investment. The need for skilled managers and technicians means that inward investment diminishes as the potential host country gets sufficiently skilled-labor scarce.

In addition, labor-force composition in a developing country is likely correlated with other economic variables that are important to MNEs. These include physical, legal, and institutional infrastructure, in particular. Multinational firms need access to the services of roads, ports, reliable electricity, telecommunications systems, and the like. They also need a sound, transparent, and fair legal system, including an efficient customs service. Most of these variables are endogenously chosen by countries over the long run, and our intuition is that they are likely to be highly correlated with per capita income and the skill composition of the labor force. To the extent that they derive from the same primitive characteristics that determine the labor force, the bottom line is that these infrastructure requirements reinforce the view that the poorest countries will not attract much inward investment.

10.3 Some Stylized Facts

Table 10.1 presents some statistics on inward-direct-investment stocks relative to income. Specifically, the numbers are shares of inward world-FDI stocks divided by shares of world gross domestic product (GDP). Countries are grouped according to the United Nations (UN) definition in the *World Investment Report.* The "least developed countries" comprise a group of forty-eight of the poorest nations. These countries are also included in the group "developing countries," and so the latter group's figures would be larger if the least developed countries were taken out. However, this adjustment would be modest since both total FDI stocks and total GDP levels of the least developed countries are quite small. These statistics

Table 10.1 **Share of Inward World FDI Stock Divided by Share of World GDP**

	Developed Countries	Developing Countries	Least Developed Countries
1980	0.96	1.10	0.37
1985	0.91	1.36	0.51
1990	0.97	1.22	0.51
1995	0.92	1.40	0.72
1998	0.88	1.46	0.54

Sources: United Nations Conference on Trade and Development (UNCTAD; 2000) and Zhang and Markusen (1999).

Note: "Least developed countries" is a UN definition that consists of forty-eight countries.

reveal that there is a lot of two-way investment among the developed countries, with their share in inward investment close to their share of income. Developing countries are net recipients of inward investment, and their share of inward investment relative to their share of income has grown by 33 percent over the eighteen-year period.

The point of table 10.1, for our purposes, is the relatively low ratios for the least developed countries. These countries attract little inward investment in spite of very low wages for unskilled labor. The developing countries as a whole get about 2.5 times as much investment relative to income as do the poorest countries. We suspect that the unattractiveness of the least developed countries is a combination of poor labor skills, poor physical infrastructure, and generally poor government and legal institutions. It should be noted that the FDI-GDP ratios rose for the least developed countries over the period as well, but this trend largely reflects a declining share of world GDP generated in those nations.

Table 10.2, taken from Zhang and Markusen (1999) presents data that separate effects on inward FDI flows due to market size from effects due to per capita income. Developing countries are grouped according to per capita GDP, and then each group is decomposed into relatively large and small countries in terms of total GDP. Here we see a high correlation between GDP per capita and FDI per capita. Again, FDI in the poorest countries is remarkably small. However, within any income group, we also see that the larger countries get considerably more inward investment per capita than do the smaller countries.

We infer from this finding that investment in developing countries is not aimed solely at export production: The size of the local market matters, suggesting that a significant proportion of local output is intended for local sale. With plant-level scale economies and output produced for local sale, investment will be higher in larger economies, which is what we see in the data. If all output were destined for export markets, we should not ob-

Table 10.2 **Inward FDI Flows and Their Links with GDP Per Capita and National Incomes of Developing Countries in 1993**

Country Groups	Average FDI Per Capita
By GDP Per Capita (U.S.$)	
> 5,000	226.89
2,500–5,000	45.30
1,200–2,500	33.02
600–1,200	10.06
300–600	6.56
< 300	0.63
By Country Size in GDP (U.S.$ millions)	
>55,000	242.20
< 49,000	53.83
> 31,000	45.73
< 17,000	32.30
> 10,000	33.43
< 9,600	30.60
> 10,000	10.86
< 9,300	2.59
> 4,800	6.91
< 3,700	3.68
> 2,000	0.34
< 1,500	2.47

Sources: Table taken from Zhang and Markusen (1999). Original data for FDI as well as data for GDP and population are from International Monetary Fund (IMF; 1995a, b).

serve this relationship in the data even with significant plant-level scale economies.

10.4 Data and Estimation

We define variables in order to capture the influences suggested by theory, although we are constrained to measures for which we can obtain a panel of data. An unfortunate irony for present purposes is that much of the data on costs and infrastructure are generally not available for the poorest countries, while the lack of investment into those countries is one thing that we would like to explain.

The variables used in the estimation are as follows, in which *j* is employed as the general reference to the host country. Note that the United States is always the parent country, a problem that we will discuss further.

RSALES: Real affiliate sales of U.S. affiliates in country *j*
RSALESL: Real affiliate sales of U.S. affiliates in country *j* to the local market in *j*

RSALESE:	Real affiliate sales of U.S. affiliates in country *j* to all export markets
GDPUS:	Real GDP in the United States (there is significant time-series variation in U.S. GDP, which is important for estimation)
GDPJ:	Real GDP in country *j*
SKJ:	The share of the labor force in country *j* that is skilled
SKDIFF:	The share of skilled labor in the United States minus that in country *j* (SKUS – SKJ)
INVCJ:	An index of costs and barriers to investing in country *j*
TCJ:	An index of costs and barriers to exporting into country *j*
INFRAJ:	An index of overall infrastructure quality for country *j*
DISTANCE:	The distance between the United States and country *j*

The basic estimating equation is given by

$$\text{RSALES} = \alpha + \beta_0\text{GDPUS} + \beta_1\text{GDPJ} + \beta_2\text{SKDIFF} + \beta_3\text{SKDIFF} \cdot \text{GDPJ} + \beta_4\text{INVCJ} + \beta_5\text{TCJ} + \beta_6\text{INFRAJ} + \beta_7\text{DISTANCE}.$$

The theory underlying this formulation is discussed in Markusen (2002) and in Carr, Markusen, and Maskus (2001). Of particular interest here is the interaction term between skill differences and real GDP in the recipient country. This term is designed to capture the nonlinear relationship in the theoretical model between endowment differences and affiliate activity. This relationship varies depending on the size of the host country as discussed above. Thus, GDPJ and SKDIFF appear in two variables. Our hypotheses relate to the combination of the two effects, so consider the derivatives.

$$\frac{\partial \text{RSALES}}{\partial \text{GDPJ}} = \beta_1 + \beta_3 \cdot \text{SKDIFF} \tag{1}$$

$$\frac{\partial \text{RSALES}}{\partial \text{SKJ}} = -\beta_2 - \beta_3 \cdot \text{GDPJ} \tag{2}$$

The coefficient β_1 on GDPJ is expected to be positive, as is the coefficient β_0 on GDPUS. In the underlying two-country model, both variables capture relevant market sizes.

Recall that SKDIFF is the skilled-labor share in the United States minus the skilled-labor share in the host country. Because in most cases the United States is relatively skill abundant in comparison with its partner, this difference becomes *larger* the more skilled-labor scarce is the host. Considering such cases, the derivative in equation (2) reflects both the direct impact of an increase in host skill endowment (meaning a convergence toward the U.S. level) and the indirect impact through the interaction of skills with GDP. There is some theoretical ambiguity about the anticipated

sign here, as analyzed by Markusen. A purely vertical model would predict that the derivative in equation (2) is negative. Because outward investment is unskilled-labor seeking in this case, a convergence in skills would reduce affiliate activity. However, a purely horizontal model would predict that equation (2) is positive because outward investment seeks countries that are similar to the United States and because a convergence in skills would raise activity. The hybrid knowledge-capital model predicts some nonmonotonicity, with a rise in SKJ (a fall in SKDIFF for almost all observations) decreasing outward affiliate sales for relatively similar countries but increasing outward affiliate sales when the host is already very skilled-labor scarce. The theory cannot predict where the turning point is.

The coefficient on the interactive term β_3 is involved in two partial derivatives: the change in RSALES with respect to GDPJ and the change in RSALES with respect to SKDIFF. Coefficient β_3 is thus the cross-partial derivative between GDPJ and SKDIFF. If we conjecture that the effect of an increase in host-country size is larger the more similar it is to the United States in skilled-labor abundance, then we expect β_3 to be negative. If we conjecture that an increase in SKJ (generally a decrease in SKDIFF) has a more positive (or less negative) effect the larger country *j* is, then we again expect β_3 to be negative. Both of these conjectures clearly fit a horizontal model, but there is some ambiguity in the hybrid knowledge-capital model, as noted earlier.

To summarize, the model does not support predictions about the signs of individual coefficients β_2 and β_3. As we shall see shortly, the coefficient β_2 and β_3 generally have different signs in the regressions and, so it is important to compute equations (1) and (2) in order to ask whether or not U.S. investment is skilled-labor seeking, rather than considering only the sign of β_2.

The hypotheses for the coefficients on INVCJ and INFRAJ are clear, for each measures certain aspects of the costs of establishment and operation. The sign on INVCJ should be negative, and the sign on INFRAJ should be positive. The sign of the coefficient on TCJ is less clear. For horizontal investments, the sign should be positive as higher inward-trade costs induce a shift from exporting to producing in the host country. But for vertical investments in which the output is exported, the sign should be zero or negative, the latter occurring if the MNE needs to ship substantial amounts of component to the host-country plant, for example.

We also have hypotheses about the how regression results ought to differ for local sales versus export sales. Local sales should be more responsive to the host-country market size and should also be more skilled-labor seeking than export sales. Local sales should respond more positively to host-country trade costs. We hypothesize that export sales likely respond more negatively to investment costs and more positively to infrastructure, since firms have alternative locations to choose from in selecting a plant location

Table 10.3 Countries Included in the Regression Analysis

Developed Countries	Developing Countries
Australia	Argentina
Austria	Brazil
Belgium	Chile
Canada	China
Denmark	Colombia
Finland	Costa Rica
France	Egypt
Germany	Hong Kong
Greece	India
Ireland	Indonesia
Israel	The Republic of Korea
Italy	Malaysia
Japan	Mexico
The Netherlands	The Philippines
New Zealand	Singapore
Norway	South Africa
Portugal	Turkey
Spain	Venezuela
Sweden	
Switzerland	
The United Kingdom	
The United States (parent country only)	

for export production. Countries in which production is located for local sale by definition have no close competitors.

Data for the estimation form a panel of cross-country observations over the period 1986–1997. There are thirty-nine host countries for which we have at least nine years of complete data over this twelve-year interval, eighteen of which we classify as developing countries. Countries are listed in table 10.3. We take real sales volume of nonbank manufacturing affiliates in each country to indicate production activity. The U.S. Department of Commerce provides annual data on sales of foreign affiliates of American parent firms and on sales of U.S. affiliates of foreign parent firms. In this paper, we are only interested in outward investments, and so, unfortunately, the United States is the parent country in every observation. Theory suggests that this limits the analysis since the United States is always the larger of the two countries in any bilateral observation.

Annual sales values abroad are converted into millions of 1990 U.S. dollars using an exchange-rate-adjusted local-wholesale-price index, with exchange rates and price indexes taken from the *International Financial Statistics* (IFS) of the IMF. Real affiliate sales (RSALES) are broken down into two components, local sales (RSALESL) and export sales (RSALESE). We should emphasize that we do not have observations for

developing countries in which there is no U.S. affiliate activity. Since these are generally the world's poorest countries, this creates some bias in the estimation, a problem which will be discussed.

Real GDP is measured in billions of 1990 U.S. dollars for each country. For this purpose, annual real GDP figures in local currencies were converted into dollars using the market exchange rate. These data are also from the IFS.

Skilled-labor abundance is defined as the sum of occupational categories 0/1 (professional, technical, and kindred workers) and 2 (administrative workers) in employment in each country, divided by total employment. These figures are compiled from annual surveys reported in the *Yearbook of Labor Statistics* published by the International Labor Organization (ILO).[3] In cases where some annual figures were missing, the skilled-labor ratios were taken to equal the period averages for each country. The variable SKDIFF is the relative skill endowment of the parent country less that of the affiliate country (e.g., the variable is *positive* if the host country is skilled-labor scarce). As noted, this variable is typically positive.

The cost of investing in the affiliate country is a simple average of several indexes of perceived impediments to investment, reported in the *World Competitiveness Report* (WCR) of the World Economic Forum. The investment-barriers index includes (a) restrictions on the ability to acquire control in a domestic company; (b) limitations on the ability to employ foreign skilled labor; (c) restraints on negotiating joint ventures; (d) strict controls on hiring and firing practices; (e) market dominance by a small number of enterprises; (f) an absence of fair administration of justice; (g) difficulties in acquiring local bank credit; (h) restrictions on access to local- and foreign-capital markets; and (i) inadequate protection of intellectual property. The resulting indexes thus include some direct investment barriers and indirect measures of "good government" and are computed on a scale from 0 to 100, with a higher number indicating higher investment costs.

A trade-cost index is taken from the same source and is defined as a measure of national protectionism, or efforts to prevent importation of competitive products. It also runs from 0 to 100, with 100 being the highest trade costs. All of these indexes are based on extensive surveys of multinational enterprises. It should be noted that both the investment-cost and trade-cost indexes are ordinal and qualitative in nature and are without "natural units." Thus, regression coefficients represent the partial effects of a change in the average perceived costs of investing and trading.

Finally, we use an index of overall infrastructure quality, also taken from the WCR. We employ two measures of infrastructure. First, we take an index from the 1999 WCR that ranks countries based on the following ques-

3. These surveys are now available on the web at http://www.ilo.org.

tion: "The infrastructure of your country is far superior to that in other countries." This index ranges from 0 (strongly disagree) to 70 (strongly agree). There is only one observation on this variable for each country, and its value is used in every yearly observation for a given country. Consequently, there is no time variation in this measure of infrastructure, labeled INFRAJ1. A second measure does permit time variation by computing the simple averages of responses given to questions about the quality of six types of infrastructure: roads, railroads, ports, air transport, telecommunications, and power supply. Unfortunately these data go back to 1986 for only the industrialized countries and larger middle-income economies. Other countries enter the WCR database at different years during the sample. Thus, a number of imputations were made to this second measure, called INFRAJ2, to construct a full panel.[4]

We also incorporate a measure of distance, which is simply the number of kilometers of each country's capital city from Washington, D.C. It is unclear whether this variable captures elements of trade costs or of investment costs, since both should rise with distance.

For estimation we consider two samples. One uses the full sample of host countries, consisting of 452 observations. The means of the variables in this sample are shown in the top panel of table 10.4. A second sample uses only the developing countries and consists of 207 observations. Means of these variables are shown in the bottom panel of table 10.4. Most of the differences in the two samples are intuitively sensible. In the full sample average, host-country GDP, labor skills, and infrastructure are higher or more highly ranked, and investment and trade costs are lower relative to the developing-countries-only sample. One interesting feature of the data is that the share of affiliate output that is exported is slightly higher in the full sample. This is likely due in part to the influence of small, high-income countries such as Canada, Ireland, and the Nordic countries, in which foreign affiliates export a large proportion of their output to regional trading partners. Put another way, however, it is important to note the importance of local sales for foreign affiliates in the developing countries, where 64 percent of output is sold locally. This does not fit the popular image of developing-country affiliates as export-oriented assembly plants.

It is worth noting that the infrastructure variables do not on average seem to indicate significant differences between developing countries and the full sample. Using both INFRAJ1 and INFRAJ2, the mean observation in developing countries is 85 percent of that in the full sample.

Table 10.5 provides sample correlations. It is notable that real local sales are positively correlated with infrastructure quality in the large sample but are not correlated with infrastructure in the developing countries. Export

4. Details are available on request.

Table 10.4 Basic Data on U.S. Outward Affiliate Sales and Other Variables

Variable	Mean of Variable	Qualifying Feature
	All Countries (452 observations)	
RSALES	16,315.32	$millions. Proportion exported = 0.40
RSALESL	9,787.59	$millions
RSALESE	6,532.74	$millions
GDPJ	371.05	$billions
SKJ	0.18	Proportion of the labor force that is skilled
SKDIFF	0.11	Differences in skilled labor proportion
INVCJ	38.89	Range: 0–100; 100 = highest costs
TCJ	34.61	Range: 0–100; 100 = highest costs
INFRAJ1	45.07	Range: 0–70; 70 = best infrastructure
INFRAJ2	63.42	Range: 0–100; 100 = best infrastructure
DIST	8,555	Kilometers
	Developing Countries (207 observations)	
RSALES	5,785.49	$millions. Proportion exported = 0.36
RSALESL	3,672.97	$millions
RSALESE	2,111.07	$millions
GDPJ	161.94	$billions
SKJ	0.12	Proportion of the labor force that is skilled
SKDIFF	0.18	Differences in skilled labor proportion
INVCJ	45.26	Range: 0–100; 100 = highest costs
TCJ	39.85	Range: 0–100; 100 = highest costs
INFRAJ1	37.65	Range: 0–70; 70 = best infrastructure
INFRAJ2	54.00	Range: 0–100; 100 = best infrastructure
DIST	9,836	Kilometers

sales are positively associated with infrastructure, however. Another intriguing result is that export sales and distance are negatively correlated in the full sample but have no correlation in the developing-country sample.

There is a high degree of correlation among some of the independent variables. A larger recipient market (GDPJ) is slightly negative correlated with skill differences, as the larger countries tend to have skill ratios nearer those of the United States. Note that in the smaller sample this correlation becomes positive, indicating that smaller developing countries are more skilled-labor scarce in the data. An important distinction in the data is that, in the full sample, the correlations between GDPJ and investment costs and trade costs are essentially zero, while they are strongly positive in the developing countries. Skilled-labor scarce countries (a larger positive value of SKDIFF) have higher investment and trade costs and worse infrastructure, although these correlations are somewhat smaller in the developing-country sample than in the full sample. Note finally that investment costs and trade costs are strongly and negatively correlated with infrastructure quality.

Table 10.5 **Correlations among Key Variables**

	RSALES	RSALESL	RSALESE	GDPJ	SKDIFF	SKDIFF · GDPJ	INVCJ	TCJ	INFRAJ1	INFRAJ2	DIST
					All Countries						
RSALES	1.00										
RSALESL	0.98	1.00									
RSALESE	0.96	0.89	1.00								
GDPJ	0.55	0.62	0.42	1.00							
SKDIFF	–0.41	–0.37	–0.44	–0.10	1.00						
SKDIFF · GDPJ	0.15	0.22	0.03	0.85	0.26	1.00					
INVCJ	–0.32	–0.25	–0.40	–0.05	0.62	0.16	1.00				
TCJ	–0.16	–0.09	–0.25	0.08	0.42	0.25	0.71	1.00			
INFRAJ1	0.34	0.30	0.37	0.26	–0.50	0.09	–0.55	–0.30	1.00		
INFRAJ2	0.31	0.26	0.36	0.18	–0.57	0.00	–0.68	–0.42	0.73	1.00	
DISTANCE	–0.37	–0.35	–0.37	–0.09	0.37	0.10	0.10	0.27	0.09	0.02	1.00
					Developing Countries						
RSALES	1.00										
RSALESL	0.92	1.00									
RSALESE	0.79	0.48	1.00								
GDPJ	0.35	0.47	0.05	1.00							
SKDIFF	–0.48	–0.40	–0.45	0.15	1.00						
SKDIFF · GDPJ	0.06	0.12	–0.06	0.90	0.45	1.00					
INVCJ	–0.11	0.08	–0.37	0.41	0.39	0.40	1.00				
TCJ	–0.10	0.04	–0.28	0.44	0.40	0.43	0.75	1.00			
INFRAJ1	0.13	–0.08	0.41	–0.23	–0.39	–0.26	–0.59	–0.35	1.00		
INFRAJ2	0.16	0.01	0.34	–0.19	–0.40	–0.26	–0.54	–0.35	0.81	1.00	
DISTANCE	–0.21	–0.34	0.07	–0.04	0.26	0.08	–0.17	0.24	0.50	0.35	1.00

10.5 Estimation Strategy and Results

Our task is to estimate the general-equilibrium determinants of real affiliate sales in a panel of countries over the period 1986–1997. These data may be expected both to display cross-sectional heteroskedasticity and serial correlation within each country. Accordingly, we adopt two estimation techniques. First is weighted least squares (WLS), in which we posit that error variances depend on real GDP in the host countries and compute robust standard errors. Second is a generalized least squares (GLS) approach that permits heteroskedastic error variances and country-specific AR(1) coefficients.[5] An even more general specification would permit contemporaneous, non-zero covariances across panels, but there are insufficient degrees of freedom to implement it. As Beck and Katz (1995) demonstrate with Monte Carlo techniques, the latter approach would understate the true standard errors, while the method taken here generates less efficient but consistent estimates (Greene 2000). The GLS estimates report Newey-West standard errors robust to heteroskedasticity and first-order autocorrelation.

We do not include country effects. Most variation in the key variables of interest (size, skill differences, and especially investment costs, trade costs, and infrastructure quality) is cross-sectional rather than longitudinal. This variation is central to our analysis but would be obscured by country-specific dummies, rendering it virtually impossible to identify the impacts of those influences on sales. Instead, we control for the variables posited by the theory, with appropriately conservative standard errors. Note that the inclusion of first-order autocorrelation corrections by country poses a stiff test for estimating the coefficients of policy variables, the values of which change little over time.

Tables 10.6 through 10.8 depict regression results for the full sample for total sales (RSALES), local sales (RSALESL), and export sales (RSALESE) respectively, in which each model is estimated using each of the two infrastructure variables in turn. Considering table 10.5, both the WLS and GLS coefficients on GDPUS are positive and strongly significant, as anticipated. Use of GLS reduces the magnitudes of these coefficients, although they are robust to use of the different infrastructure measures. Investment costs significantly discourage inward investment using either method, but GLS dramatically cuts the size of the estimated impact. A similar result emerges for trade costs, which strongly encourage affiliate sales using WLS but have far smaller coefficients that fail to achieve significance at the 10 percent level using GLS.

The first and third columns indicate that high-quality infrastructure strongly encourages inward investment, using INFRAJ1. However, this

5. We also estimated a specification with an AR(1) coefficient common to all panels, but this case was rejected in favor of the more flexible approach.

Table 10.6 **RSALES Regression Results for Full Sample**

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	7.06	6.38	3.47	3.53
	(4.56/0.000)	(4.08/0.000)	(8.87/0.000)	(10.17/0.000)
GDPJ	76.59	77.60	57.61	50.34
	(28.50/0.000)	(28.51/0.000)	(16.00/0.000)	(13.40/0.000)
SKDIFF	100,223.00	92,804.00	46,184.00	24,641.00
	(7.77/0.000)	(7.07/0.000)	(8.14/0.000)	(4.77/0.000)
SKD · GDPJ	–472.76	–472.57	–333.45	–267.44
	(–22.77/0.000)	(–22.34/0.000)	(–13.88/0.000)	(–12.05/0.000)
INVCJ	–619.75	–636.33	–39.46	–70.02
	(–5.91/0.000)	(–5.70/0.000)	(–2.28/0.023)	(–4.19/0.000)
TCJ	414.25	405.31	14.73	12.82
	(6.72/0.000)	(6.47/0.000)	(1.37/0.172)	(1.32/0.186)
INFRAJ1	259.29		172.17	
	(4.72/0.000)		(7.49/0.000)	
INFRAJ2		123.41		10.02
		(2.56/0.011)		(1.01/0.313)
DISTANCE	–1.77	–1.61	–0.89	–0.82
	(–9.14/0.000)	(–8.33/0.000)	(–8.17/0.000)	(–9.57/0.000)
Intercept	–34,104.00	–26,317.00	–18,421.00	–9,148.00
	(–3.01/0.003)	(–2.24/0.026)	(–7.21/0.000)	(–4.04/0.000)
Adjusted R^2	0.83	0.83		
Log likelihood			–4,084.59	–4,077.53
No. of observations	452	452	452	452

Notes: The WLS has host-country-GDP-weighted OLS with robust standard errors; GLS has heteroskedasticity and panel-specific AR(1) corrections with robust standard errors. *T*-statistics followed by *p*-values are in parentheses.

variable is defined only for the year 1998, and its values are assigned to all earlier years for each country. Thus, it takes on the nature of any variable that would be stable over the period and correlated with the perceived quality of infrastructure at the end of the period. Turning to INFRAJ2 in columns (2) and (4), when infrastructure is permitted to vary within the panel, its influence becomes smaller, although still significant using WLS and insignificant using GLS. It is likely that this weakness in the estimation stems from collinearity between infrastructure and the cost variables. Note that the inclusion of INFRAJ2 raises the size and significance of the coefficient on investment costs in the GLS approach. Judging from the log-likelihood statistics in the GLS equations, the models with INFRAJ2 fit the data slightly better than those with INFRAJ1.

Similar results pertain in the regressions on local sales in table 10.7. Investment costs negatively affect local sales in the WLS case, and the coefficients are highly significant. Again, these magnitudes fall considerably us-

Table 10.7 RSALESL Regression Results for Full Sample

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	4.42	4.11	1.83	1.85
	(4.87/0.000)	(4.51/0.000)	(9.89/0.000)	(10.42/0.000)
GDPJ	48.20	48.65	35.63	35.99
	(30.56/0.000)	(30.63/0.000)	(14.75/0.000)	(15.55/0.000)
SKDIFF	53,054.00	49,129.00	14,735.00	9,964.00
	(7.01/0.000)	(6.41/0.000)	(5.04/0.000)	(3.51/0.000)
SKD · GDPJ	–281.61	–281.24	–170.11	–162.85
	(–23.10/0.000)	(–22.78/0.000)	(–12.82/0.000)	(–13.33/0.000)
INVCJ	–293.17	–307.72	–12.22	–26.21
	(–4.76/0.000)	(–4.73/0.000)	(–1.16/0.244)	(–2.56/0.011)
TCJ	270.03	266.03	4.70	3.53
	(7.46/0.000)	(7.28/0.000)	(0.74/0.458)	(0.60/0.552)
INFRAJ1	114.65		34.03	
	(3.56/0.000)		(3.13/0.002)	
INFRAJ2		46.39		–5.06
		(1.65/0.100)		(–0.85/0.40)
DISTANCE	–0.96	–0.88	–0.11	–0.08
	(–8.40/0.000)	(–7.79/0.000)	(–2.25/0.025)	(–1.85/0.064)
Intercept	–24,541.00	–20,240.00	–11,913.00	–9,208.00
	(–3.69/0.000)	(–2.95/0.000)	(–8.95/0.000)	(–7.44/0.000)
Adjusted R^2	0.84	0.85		
Log likelihood			–3,792.89	–3,782.76
No. of observations	452	452	452	452

Notes: See table 10.6.

ing GLS, although the estimate in column (4) is significant. Trade costs have a strongly positive impact using WLS, but the positive coefficients with GLS are imprecisely estimated. The first measure of infrastructure quality is positively associated with local sales, but the second measure is insignificant using GLS. Results for export sales in table 10.8 are qualitatively similar to those for local sales.

Turning to GDPJ and SKJ (a component of SKDIFF), it is not meaningful to give an economic interpretation to the direct coefficients as these factors appear in two places among the independent variables.[6] It is also inappropriate to make comparisons across the regressions in tables 10.6 through 10.8 because the dependent variables have different means. Thus, we take partial derivatives and compute elasticities in table 10.9 for each estimation method, evaluating the elasticities at the mean of each respective independent variable. Elasticities that derive from significant regression coefficients are listed in boldface.

6. In the tables, SKD · GDPJ refers to the product of SKDIFF and GDPJ.

Table 10.8 RSALESE Regression Results for Full Sample

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	2.63	2.27	0.85	0.72
	(3.47/0.000)	(2.95/0.003)	(5.52/0.000)	(4.93/0.000)
GDPJ	28.42	28.98	19.42	18.29
	(21.59/0.000)	(21.67/0.000)	(14.31/0.000)	(13.11/0.000)
SKDIFF	47,283.00	43,780.00	14,402.00	11,426.00
	(7.49/0.000)	(6.79/0.000)	(5.85/0.000)	(5.52/0.000)
SKD · GDPJ	–191.28	–191.47	–111.96	–98.48
	(–18.81/0.000)	(–18.43/0.000)	(–11.39/0.000)	(–10.48/0.000)
INVCJ	–328.18	–330.29	–12.97	–11.88
	(–6.39/0.000)	(–6.03/0.000)	(–2.26/0.024)	(–1.96/0.049)
TCJ	144.44	139.50	5.25	3.83
	(4.78/0.000)	(4.53/0.000)	(1.51/0.130)	(1.17/0.241)
INFRAJ1	144.71		23.14	
	(5.38/0.000)		(1.69/0.091)	
INFRAJ2		76.97		3.70
		(3.25/0.000)		(0.91/0.36)
DISTANCE	–0.82	–0.73	–0.15	–0.08
	(–8.59/0.000)	(–7.70/0.000)	(–3.08/0.002)	(–1.99/0.047)
Intercept	–8,512.00	–6,015.00	–5,245.00	–4,215.00
	(–1.71/0.087)	(–1.04/0.299)	(–5.17/0.000)	(–4.70/0.000)
Adjusted R^2	0.76	0.75		
Log likelihood			–3,636.68	–3,625.70
No. of observations	452	452	452	452

Notes: See table 10.6.

Because the relationships between our dependent variables and GDPJ and SKJ are nonlinear, we have computed elasticities at two different points in the sample for each variable. Recall that SKDIFF is *positive* when the host-country is skilled-labor scarce relative to the United States, which is true for the bulk of the observations in the sample. At the (positive) mean value of SKDIFF, affiliate sales have a modest income elasticity of 0.56 (WLS) or 0.48 (GLS). For skilled-labor-abundant countries (SKDIFF = 0), the income elasticity is much larger. In both cases, local sales are more income elastic than export sales, which is what we would expect. There are virtually no differences between these estimates arising from the use of differing infrastructure measures.

The elasticity of affiliate sales with respect to the host-country skilled-labor endowment (SKJ) is positive at mean host-country GDP, estimated at 0.83 (WLS) or 0.86 (GLS). This means that outward investment is skilled-labor seeking. However, for smaller countries (note that these are not necessarily the developing countries) captured by estimating the elasticity at one-half the mean market size, local sales are less responsive to a

Table 10.9 Elasticities of U.S. Outward-Affiliate Sales, Full Sample

	Estimated with INFRAJ1				Estimated with INFRAJ2			
	At Average SKDIFF		At SKDIFF = 0		At Average SKDIFF		At SKDIFF = 0	
	WLS	GLS	WLS	GLS	WLS	GLS	WLS	GLS
With respest to GDPJ								
RSALES	**0.56**	**0.48**	**1.74**	**1.31**	**0.58**	**0.48**	**1.76**	**1.14**
RSALESL	**0.65**	**0.64**	**1.82**	**1.35**	**0.67**	**0.69**	**1.84**	**1.36**
RSALESE	**0.42**	**0.40**	**1.61**	**1.10**	**0.45**	**0.42**	**1.65**	**1.04**
	Estimated with INFRAJ1				Estimated with INFRAJ2			
	At Average GDPJ		At 0.5 Average GDPJ		At Average GDPJ		At 0.5 Average GDPJ	
	WLS	GLS	WLS	GLS	WLS	GLS	WLS	GLS
With respect to SKJ								
RSALES	**0.83**	**0.86**	**–0.14**	**0.17**	**0.91**	**0.82**	**–0.06**	**0.28**
RSALESL	**0.95**	**0.89**	**–0.01**	**0.31**	**1.02**	**0.93**	**0.06**	**0.37**
RSALESE	**0.44**	**0.75**	**–0.22**	**0.18**	**0.75**	**0.69**	**–0.23**	**0.19**
With respect to INVCJ								
RSALES	**–1.48**	**–0.09**		**–1.52**	**–0.17**			
RSALESL	**–1.16**	–0.05		**–1.23**	**–0.10**			
RSALESE	**–1.95**	**–0.08**		**–1.97**	**–0.07**			
With respect to TCJ								
RSALES	**0.88**	0.03		**0.86**	0.03			
RSALESL	**0.95**	0.02		**0.94**	0.01			
RSALESE	**0.77**	0.03		**0.74**	0.02			
With respect to INFRA								
RSALES	**0.72**	**0.48**		**0.48**	0.03			
RSALESL	**0.53**	**0.16**		**0.30**	0.02			
RSALESE	**1.00**	**0.16**		**0.75**	0.03			

Note: Parameters coming from statistically significant coefficients are in boldface.

rise in skills. Employing WLS, these elasticities are negative. For GLS, at one-third the average market size, the elasticities of RSALES and RSALESE with respect to SKJ turn negative, while that for RSALESL changes signs at one-fifth the average GDPJ. This finding suggests that affiliate production is unskilled-labor seeking in small host countries. This may be particularly true in cases where the export motive is more important for smaller nations and where production for export is more sensitive to labor costs than production for local sale. Note from the computations that export sales are less skilled-labor seeking (and more unskilled-labor seeking) than local sales.

The remaining sets of elasticities have the hypothesized signs, although they are not always significantly different from zero. There are large differ-

Table 10.10 RSALES Regression Results for Developing-Country Sample

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	5.67	5.31	2.58	2.72
	(5.31/0.000)	(4.99/0.000)	(6.40/0.000)	(7.14/0.000)
GDPJ	81.74	80.73	71.54	73.11
	(9.74/0.000)	(9.50/0.000)	(7.82/0.000)	(8.46/0.000)
SKDIFF	–14,043.00	–24,789.00	12,640.00	10,407.00
	(–1.02/0.310)	(–1.88/0.062)	(1.61/0.108)	(1.29/0.198)
SKD · GDPJ	–317.22	–310.29	–283.48	–294.06
	(–7.86/0.000)	(–7.62/0.000)	(–7.03/0.000)	(–7.67/0.000)
INVCJ	–58.97	–83.51	–22.55	–28.16
	(–0.80/0.427)	(–1.12/0.264)	(–2.13/0.033)	(–2.45/0.014)
TCJ	5.97	–12.85	4.21	5.94
	(0.13/0.894)	(–0.29/0.773)	(0.64/0.520)	(0.85/0.396)
INFRAJ1	112.50		26.02	
	(2.14/0.034)		(0.55/0.582)	
INFRAJ2		3.96		–6.80
		(0.15/0.884)		(–0.83/0.405)
DISTANCE	–0.24	–0.04	–0.13	–0.13
	(–1.57/0.118)	(–0.31/0.759)	(–1.39/0.165)	(–1.51/0.305)
Intercept	–28,256.00	–20,379.00	–14,751.00	–13,561.00
	(–3.46/0.001)	(–2.67/0.008)	(–5.37/0.000)	(–6.52/0.000)
Adjusted R^2	0.72	0.71		
Log likelihood			–1,697.59	–1,701.37
No. of observations	207	207	207	207

Notes: See table 10.6.

ences in these parameters between the WLS and GLS estimates, with the latter being much smaller and sometimes not significantly different from zero. Again, the difference reflects the fact that the AR(1) corrections tend to remove much of the time-series variation from these policy variables. Export sales are more (negatively) sensitive to investment barriers than are local sales. The trade cost elasticities are positive for WLS but essentially zero for GLS. Total sales are positively responsive to the first infrastructure measure, as are local and export sales. The infrastructure measure that varies over time, INFRAJ2, has positive elasticities using WLS, with export sales being most sensitive to its quality. However, in GLS, this measure has no discernible impacts on any of the sales flows.

Regression estimates for the sample of developing countries are shown in tables 10.10 through 10.12.[7] Overall, the equations fit this sample to a de-

7. We ran the same regressions for the sample of developed countries as well. In all important respects for our purposes, the results were both qualitatively and quantitatively similar to the findings for the full sample of countries. One interesting difference was that increases in investment costs seemed to have greater deterrent impacts on inward FDI in developed

Table 10.11 RSALESL Regression Results for Developing-Country Sample

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	3.06	2.93	2.05	2.12
	(5.75/0.000)	(5.53/0.000)	(10.23/0.000)	(11.12/0.000)
GDPJ	81.76	81.48	49.48	49.64
	(19.55/0.000)	(19.33/0.000)	(6.37/0.000)	(6.56/0.000)
SKDIFF	22,331.00	17,975.00	11,158.00	7,563.00
	(3.26/0.001)	(2.74/0.001)	(2.01/0.045)	(1.57/0.117)
SKD · GDPJ	–336.41	–334.27	–200.69	–201.15
	(–16.74/0.000)	(–16.55/0.000)	(–6.01/0.000)	(–6.12/0.000)
INVCJ	–36.90	–47.23	–18.30	–21.08
	(–1.00/0.319)	(–1.28/0.203)	(–2.39/0.017)	(–2.82/0.005)
TCJ	2.15	–5.59	3.15	3.59
	(0.10/0.923)	(–0.25/0.800)	(0.75/0.451)	(0.88/0.382)
INFRAJ1	42.11		18.97	
	(1.61/0.110)		(0.92/0.355)	
INFRAJ2		–1.49		–1.55
		(–0.11/0.912)		(–0.32/0.748)
DISTANCE	–0.30	–0.22	–0.17	–0.13
	(–3.90/0.000)	(–3.25/0.001)	(–3.29/0.001)	(–3.91/0.000)
Intercept	–18,491.00	–15,297.00	–10,929.00	–10,182.00
	(–4.55/0.000)	(–4.04/0.000)	(–7.35/0.000)	(–7.95/0.000)
Adjusted R^2	0.85	0.85		
Log likelihood			–1,612.15	–1,612.31
No. of observations	207	207	207	207

Notes: See table 10.6.

gree similar to the full sample for total affiliate sales and local affiliate sales, but the export sales equation performs less well. The coefficients on GDPUS are highly significant and similar to their counterparts for the full sample, although generally somewhat smaller in magnitude, suggesting that demand in the U.S. market is a slightly less important determinant of affiliate activity in developing nations. In contrast, the coefficients on local GDP are somewhat larger in the total-sales and local-sales regressions for developing countries, indicating that size of the local market is at least as important in developing countries for attracting FDI as it is overall. These coefficients in export sales are negative and insignificant in the WLS cases for developing countries. Conceivably, this result indicates that export production has little relationship to the economic size of the host country. For example, Singapore and Hong Kong are small economies but large ex-

countries than in the overall sample. However, our overall conclusions were unchanged by considering this sample alone.

Table 10.12 RSALESE Regression Results for Developing-Country Sample

	Coefficients			
	WLS	WLS	GLS	GLS
GDPUS	2.61	2.39	0.23	0.37
	(4.25/0.000)	(3.90/0.000)	(1.57/0.117)	(2.46/0.014)
GDPJ	–0.34	–1.06	13.90	12.96
	(–0.07/0.944)	(–0.22/0.829)	(7.72/0.000)	(6.81/0.000)
SKDIFF	–36,983.00	–43,201.00	3,446.00	2,459.00
	(–4.68/0.000)	(–5.69/0.000)	(1.56/0.120)	(0.98/0.328)
SKD · GDPJ	20.70	25.43	–50.09	–48.67
	(0.89/0.373)	(1.09/0.279)	(–4.89/0.000)	(–4.88/0.000)
INVCJ	–23.27	–37.28	–2.64	–3.84
	(–0.55/0.585)	(–0.87/0.386)	(–0.86/0.388)	(–1.01/0.314)
TCJ	4.66	–6.29	1.62	2.49
	(0.18/0.86)	(–0.25/0.806)	(0.83/0.407)	(1.20/0.230)
INFRAJ1	69.47		–16.97	
	(2.30/0.023)		(–1.06/0.290)	
INFRAJ2		5.38		1.98
		(0.35/0.730)		(0.70/0.486)
DISTANCE	0.06	0.18	–0.02	–0.03
	(0.66/0.510)	(2.27/0.025)	(–0.69/0.491)	(–0.93/0.51)
Intercept	–9,623.00	–5,002.00	–1,258.00	–2,170.00
	(–2.05/0.041)	(–1.14/0.256)	(–1.41/0.158)	(–3.04/0.002)
Adjusted R^2	0.50	0.49		
Log likelihood			–1,467.92	–1,481.54
No. of observations	207	207	207	207

Notes: See table 10.6.

porters. However, the finding seems anomalous given the strongly positive coefficients registered in the GLS cases.

Regression coefficients on the policy variables in the developing-country sample are estimated less precisely than in the full sample, presumably, in part because of the smaller number of observations. In the GLS equations, local investment costs tend to have negative and significant impacts on affiliate activity, particularly for total and local sales. The effects of trade costs are imprecisely estimated and cannot be confidently signed in any of the specifications. Considering the WLS equations, the impacts of INFRAJ1 (the unchanging measure of infrastructure quality) are uniformly positive for each type of affiliate sales, but the coefficient magnitudes are generally lower than in the full sample.[8] However, the quality of infrastructure, as measured here, has no detectable impact on affiliate sales in the developing-country sample using the GLS approach. In our

8. Again, we caution that comparisons of coefficient sizes across samples can be misleading because the means of the dependent variables differ.

Table 10.13 Elasticities of U.S. Outward Affiliate Sales, Developing-Country Sample

	Estimated with INFRAJ1				Estimated with INFRAJ2			
	At Average SKDIFF		At SKDIFF = 0		At Average SKDIFF		At SKDIFF = 0	
	WLS	GLS	WLS	GLS	WLS	GLS	WLS	GLS
With respect to GDPJ								
RSALES	**0.71**	**0.59**	**2.29**	**2.00**	**0.71**	**0.58**	**2.26**	**2.05**
RSALESL	**0.96**	**0.61**	**3.60**	**2.18**	**0.97**	**0.61**	**3.59**	**2.19**
RSALESE	0.26	**0.38**	–0.03	**1.07**	0.27	**0.33**	–0.08	**0.99**
	Estimated with INFRAJ1				Estimated with INFRAJ2			
	At Average GDPJ		At 0.5 Average GDPJ		At Average GDPJ		At 0.5 Average GDPJ	
	WLS	GLS	WLS	GLS	WLS	GLS	WLS	GLS
With respect to SKJ								
RSALES	**1.36**	**0.69**	**0.82**	**0.21**	**1.56**	**0.77**	**1.04**	**0.28**
RSALESL	**1.05**	**0.70**	**0.16**	**0.17**	**1.18**	**0.82**	**0.30**	**0.29**
RSALESE	**1.91**	**0.27**	**2.00**	**0.03**	**2.22**	**0.30**	**2.34**	**0.08**
With respect to INVCJ								
RSALES	–0.46	**–0.18**			–0.65	**–0.22**		
RSALESL	–0.45	**–0.23**			–0.58	**–0.26**		
RSALESE	–0.50	–0.06			–0.80	–0.08		
With respect to TCJ								
RSALES	0.04	0.03			–0.09	0.04		
RSALESL	0.02	0.03			–0.06	0.04		
RSALESE	0.09	0.03			–0.12	0.05		
With respect to INFRA								
RSALES	**0.74**	0.17			0.04	–0.04		
RSALESL	**0.44**	0.20			–0.02	–0.02		
RSALESE	**1.25**	0.31			0.14	0.04		

Note: Parameters coming from statistically significant coefficients are in boldface.

view, this weakness likely reflects three factors. First, we have few least developed countries in the sample, for which both FDI and infrastructure quality would be low. Second, our measure of infrastructure may not capture its effects on investment adequately. Finally, the AR(1) corrections in the GLS approach essentially remove the trend increases in infrastructure quality, which seems to leave little variation across the developing-country sample.

The coefficients on SKDIFF vary across estimation techniques and across types of affiliate sales in tables 10.10 through 10.12. However, the full marginal impacts of a change in skill endowments depend on both the SKDIFF and SKDIFF · GDPJ coefficients, evaluated at various sample points. Thus, in table 10.13, we calculate relevant elasticities in a manner

parallel with table 10.9, again noting in boldface those parameters coming from statistically significant coefficients. Comparing results in tables 10.9 and 10.13, it seems that total sales and local sales are more elastic with respect to income increases in the developing economies than in the overall sample. This is especially true for relatively high-skilled host countries, such as Singapore, where local production is highly income elastic. Export production is somewhat less sensitive to an increase in local market size in developing countries.

Interestingly, all of the elasticities with respect to increases in skill endowments are positive and significant in the developing-country sample. Thus, affiliate production is clearly skilled-labor seeking within this sample of largely middle-income nations. Contrary to the results for the full sample, affiliate production for export is more skilled-labor seeking than production for local sale, at least using the WLS coefficients. However, this result does not survive the use of GLS and must be left open for further research. Finally, it seems that the investment-cost variable has a negative impact on local sales (using GLS) and that infrastructure quality has a positive impact on all sales flows (using WLS). Production for export is more sensitive to infrastructure quality than are domestic and total production. Again, however, these results are sensitive to the definition of infrastructure and the estimation technique. The trade-cost variable has a very small numerical magnitude, and it is never statistically significant.

10.6 Summary and Conclusions

As is often observed, there is a strong tendency for those concerned about the effects of globalization to see MNEs as primarily drawn to low-wage labor-abundant countries. It is easy to find anecdotes to support this view. The purpose of this paper is to see whether or not this characterization holds up in a relatively comprehensive data set.

A casual look at data in the *World Investment Report* makes it clear that the poorest countries of the world receive very little investment. It is not clear whether this is due to poor labor skills, poor infrastructure, or bad governance. Thus, we construct a data set of U.S. outward-affiliate activities and try to explain the cross-country variation by a set of host-country characteristics including size, labor-force composition, investment barriers, trade costs, and physical infrastructure. We use a full sample of all host countries and a subsample using only developing countries. Unfortunately, the data exclude all of the world's poorest countries, and, since these get almost no inward investment, we are losing many of the observations that we would most like to explain.

The general conclusion is that U.S. outward investment seeks large, skilled-labor-abundant countries. In the full sample, outward investment seems to be unskilled-labor seeking for small markets, a conclusion that

holds up in the developing-country subsample, which includes mainly less skilled-labor-abundant countries.[9]

The preponderance of results suggests that increases in investment costs or investment barriers discourage inward investment and affiliate activity. Higher trade costs seem to encourage investment, but this result is weak, especially in the developing-country sample. Finally, higher-quality infrastructure seems to encourage investment and affiliate sales in most of our specifications. This result is in evidence sufficiently enough that it would be worthwhile to develop a more comprehensive infrastructure index and to incorporate many more countries into the analysis.

Turning to production for local sales versus exports, the data reveal the unexpected result that the share of production sold locally is in fact a bit lower in the full sample than in the developing-country sample. The characterization that MNE enter developing countries primarily to produce for export is another view that is not supported by the analysis in this paper. Overall, we reach the following conclusions from comparing the local-sales and export-sales regressions.

First, affiliates in developing countries are not more export oriented than affiliates in the full sample of countries; local market sales are over 60 percent of the total in developing countries. Second, affiliate production is more income elastic the more similar the host country is to the United States in labor-force composition. Third, production for local sale is more income elastic than production for export sale. Fourth, production activities for both local sales and exports are generally skilled-labor seeking, but which type of flow is more skilled-labor seeking differs between the full sample and the developing-country sample. It is interesting that activity in the developing countries appears to be more responsive to an increase in local skill endowments than in the full sample, at least according to the WLS regressions. Fifth, production for export sale is more sensitive to investment costs and infrastructure quality than is production for local sale. However, these last two results are not robust to estimation technique. Note that our regressions perform worst in explaining production for export sales in developing countries, indicating that missing explanatory variables likely are important.

All of these results fit reasonably well with both formal theories of the MNE and informal conjectures about the role of infrastructure. These results and the related theory do not lend support to view that MNEs exploit and impoverish developing countries. Indeed, the theories to which the empirical results lend support suggest that inward investments are of substantial benefit to host countries, both in terms of overall income and in terms of promoting labor-skills upgrading. Finally, we note again the absence of data on the poorest of the developing countries. It would be use-

9. See also Brainard (1997), Brainard and Riker (1997), and Yeaple (2003).

ful to extend this research to include determinants of activity in those nations.

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Comment

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The paper examines the factors that are important in attracting multinational investment to a country. This is an important issue because, as the authors point out, the charge is often made that the presence of footloose multinationals creates an incentive for countries to engage in a "race to the bottom," particularly in labor standards. However, might it not be possible that in other dimensions there is a "race to the top"? Multinationals may be attracted by good institutions, good business environments, and high-quality infrastructure. To establish the incentives that countries face we need to know what it is that attracts multinational activity, and this is precisely the goal of this paper.

The authors use data on the activities of U.S.-based multinationals to investigate the importance of a number of different factors. They start by reviewing theory, and noting that different forces are important for different sorts of FDI. The usual distinction is between horizontal (or market-serving) investment, and vertical (or production-cost-saving) investment. The authors outline the way in which these can be nested in a single model, although even then the effects are complex. Affiliate activities may be unskilled labor intensive relative to the United States, but quite skilled labor intensive relative to the endowments of many developing countries. There may then be an inverse U-shaped relationship between affiliate presence and potential host countries' skilled-labor abundance.

The econometric model developed by the authors is applied to a panel of data on sales of U.S. multinationals' affiliates located in thirty-nine host countries (unfortunately, the data set does not extend to the lowest-income countries). Affiliate activity is a function of host-country size, endowment of skilled labor, barriers to investment and to trade, infrastructure quality,

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and distance from the United States. Robust results are found on the importance of market size (positive), investment costs (negative), trade costs (positive), and distance (negative). Good infrastructure also tends to raise investment, although results are not robust over all specifications.

Insights on how the type of investment that multinationals undertake varies with the characteristics of host countries is derived by interacting measures of skill with measures of market size. The authors find that having a highly skilled labor force promotes multinational activity in large countries. However, in small countries the presence of highly skilled labor is much less important. Looking just at the extent to which multinationals export products from the host country, *low* skill intensity becomes a positive force. This suggests, then, the coexistence in the data of two types of investment. Rather skill-intensive horizontal activity goes to large and skill-abundant countries, with less skill-intensive vertical activity being more important for smaller economies.

On the critical side, a number of comments can be made about the authors' econometric specification. It is surprising that they use a linear, not log-linear, specification. It is natural to think of many of the relationships as ratios (sales relative to GDP, rather than the absolute level of sales), particularly since there is a huge range of country sizes (from Singapore to China) in the data. Their linear specification means, for example, that a 1-point increase in the index of investment costs is associated with the same absolute dollar change in multinational activity in China as in New Zealand. A proportional relationship would seem more plausible.

It would have been interesting to see estimates of the impact of various measures of production costs. The authors use an endowment quantity measure (the share of the labor force that is skilled) rather than a price measure, no doubt based on general-equilibrium reasoning. However, use of a labor-cost measure instead of (or as well as) the endowment measure would be interesting, and not subject to serious endogeneity concerns.

Finally, it would have been good if some of the trade-offs implied by the estimates had been drawn out more explicitly. If a country is more remote, how much better does its infrastructure have to be to attract the same level of multinational activity? If wages go up, does this deter investment, and how much of an improvement in the business environment can offset it? Answering these questions would establish the trade-offs that countries face in shaping policy to attract investment, and the incentives they have for engaging in races to the bottom or to the top.