Differences in Foreign-Owned U.S. Manufacturing Establishments by Country of Owner

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THIS ARTICLE is the second in a series of articles that examine the characteristics of foreign-owned U.S. manufacturing establishments. In a January 1994 article, a profile of foreign-owned U.S. manufacturing establishments, or plants, showed that these establishments pay higher wages and are more productive than U.S.-owned establishments. However, the differences were found to be largely attributable to differences in industry mix, plant scale, and occupational mix, rather than to foreign ownership per se.[1]

This article extends the earlier analysis by examining whether the industry mix and operating characteristics of foreign-owned U.S. manufacturing establishments vary by country of owner and by examining the reasons for these variations.[2] The analysis covers establishments owned by investors from six major investing countries—Canada, France, Germany, Japan, the Netherlands, and the United Kingdom—and is based on data for 1991, the most recent data available.

The following are the key findings of the analysis:

The U.S. manufacturing establishments of each of the major investing countries tend to be much larger, pay higher wages, and be more productive than the U.S.-owned establishments. However, these tendencies vary by country of owner, particularly in the cases of plant scale and productivity. Some of these variations are due to differences in industry mix—that is, to differences among countries in the industry distribution of their U.S. establishments—and some are due to differences within the same industries.

With respect to differences in industry mix:

- The establishments of all six countries tend to be concentrated in industries with large establishments. This tendency is strongest for Netherlands-, Japanese-, and German-owned establishments. When the effects of differences in industry mix are isolated from those of within-industry differences, these three countries' establishments were found to be over twice as large, on average, as U.S.-owned establishments.
- The establishments of all six countries tend to be concentrated in high-wage industries. This tendency is strongest for Japanese-owned establishments and weakest for British-owned establishments. When the effects of differences in industry mix are isolated from those of within-industry differences, the compensation per employee of Japanese-owned establishments is found to be 23 percent higher, on average, than that of U.S.-owned establishments. In contrast, the compensation per employee of British-owned establishments is only 3 percent higher.
- The establishments of all six countries show a strong tendency to be concentrated in high-labor-productivity industries. This tendency is strongest for Netherlands-owned establishments and weakest for French- and British-owned establishments. When the effects of differences in industry mix are isolated from those of within-industry differences, the value added per production-worker hour of Netherlands-owned establishments is found to be 60 percent higher than that of U.S.-owned establishments, and that of French- and British-owned establishments is about 20 percent higher.

1. See "Characteristics of Foreign-Owned U.S. Manufacturing Establishments," SURVEY OF CURRENT BUSINESS 74 (January 1994): 34–59.

2. For convenience, the establishments of U.S. affiliates of foreign companies are referred to in this article as "foreign-owned establishments," even though the percentage of foreign ownership in a U.S. affiliate may be as low as 10 percent. (A U.S. affiliate is a U.S. business enterprise that is owned 10 percent or more, directly or indirectly, by a foreign person.) The data analyzed here are not adjusted for percentage of foreign ownership. Thus, for example, the employment data include all employees of a given establishment, even though the foreign investor may own less than 100 percent of the affiliate to which the establishment belongs. However, most affiliates are majority owned (that is, they are owned more than 50 percent by direct investors); majority-owned affiliates accounted for 86 percent of the manufacturing employment of all U.S. affiliates in 1991.

With respect to differences within industries:

- The establishments of all six countries tend to be significantly larger than U.S.-owned establishments in the same industries. The differences range from 4.5 times larger for German-owned establishments to 3.5 times larger for British- and Netherlands-owned establishments.
- The establishments of five of the six countries differ little from U.S.-owned establishments in the degree to which their output results from their own production or from production originating elsewhere. However, Japanese-owned establishments rely more heavily on production originating elsewhere than the establishments of the other countries; that is, a relatively large share of the output of Japanese-owned establishments reflects materials purchased from others. The ratio of purchased materials to output for Japanese-owned establishments is 10 percent higher than that for U.S.-owned establishments in the same industries; the ratios for the establishments of each of the other five countries are all within 3 percent of the ratio for U.S.-owned establishments.
- The establishments of the six countries maintain larger materials inventories relative to value added than do U.S.-owned establishments in the same industries. For Japanese-owned establishments, the ratio of materials inventory to value added is 62 percent higher than that of U.S.-owned establishments. The ratios of the other foreign-owned establishments ranged from 35 percent higher for German-owned establishments to 14 percent higher for Canadian-owned establishments.
- Compensation rates within given industries vary among the establishments of the six investing countries largely because of differences in plant scale, capital intensity, and location. However, even after these factors are accounted for, wage rates of French-owned establishments are about 6 percent higher, and wage rates of British-owned establishments are about 4 percent lower, than those of the other foreign-owned establishments.
- Labor productivity varies significantly among the establishments of the six countries. Most of this variation appears to be attributable to differences in plant scale, capital intensity, employee skills, and location. Nevertheless, even after these factors are accounted for, value added per production-worker hour of British-owned establishments is about 5 percent higher, and that of Japanese-owned establishments is about 12 percent lower, than that of the other foreign-owned establishments.

These findings are based on 1991 data for a sample of the U.S. manufacturing establishments of the six major investing countries that was extracted from the Census Bureau's Annual Survey of Manufactures (ASM) through a joint project of the Bureau of Economic Analysis (BEA) and the Census Bureau.[3] The establishments in the sample accounted for over three-quarters of the manufacturing employment of all foreign-owned U.S. manufacturing establishments in 1991.

The remainder of this article consists of three sections and an appendix. The first section outlines the economic rationale for the variations in the characteristics of foreign-owned operations by country of owner. The second examines whether the variation in the concentration of foreign-owned establishments in industries with particular attributes depends on the country of the establishments' owners. The third investigates within-industry differences in the operating characteristics of foreign-owned establishments that have different countries of ownership. The appendix describes the data on foreign-owned establishments and presents the regression equations used in analyzing the variation in wage rates and labor productivity across countries.

Economic Rationale for Country-of-Ownership Differences

The questions of why foreign direct investment occurs and of why the characteristics of foreign-owned operations may vary by country of owner have been studied extensively. According to one widely accepted explanation of direct investment, foreign investors are more likely to be active in industries with particular attributes, and in a given host country, the characteristics of the plants owned by investors from one foreign country tend to differ from those owned by investors from other foreign countries. This explanation follows from the premise that foreign investors face inherent disadvantages when investing abroad: They are less familiar with the general business

3. For data covering the universe of foreign-owned U.S. manufacturing establishments, see *Foreign Direct Investment in the United States: Establishment Data for Manufacturing, 1991* (Washington, DC: U.S. Government Printing Office, September, 1994).

The data are classified by country of ultimate beneficial owner (UBO). The UBO is that person, proceeding up a U.S. affiliate's ownership chain, beginning with and including the foreign parent, that is not owned more than 50 percent by another person. The foreign parent is the first foreign person in the affiliate's ownership chain.

environment and frequently with the language in the host country than local entrepreneurs, and they must manage their foreign investments from a distance. To offset or overcome these disadvantages and to compete successfully abroad, the foreign firm making the investment must possess specific advantages—such as specialized knowledge, goodwill, advanced technology, marketing skills, or production-management or other organizational capabilities.[4]

Typically, these firm-specific advantages are not distributed evenly across industries and countries. As a result, the industries in which the investments are made are likely to depend on the country of the investor. In addition, because the investor must structure its foreign businesses in a way that will exploit these advantages, the characteristics of a business owned by a particular foreign country are likely to differ from those of businesses that are domestically owned or that are owned by other foreign countries.[5] For example, if a foreign-owned U.S. plant utilizes a technology developed by its foreign parent, that plant may require more capital or a different mix of employee skills than a U.S.-owned plant or a U.S. plant owned by a foreign investor from another country.

Although firm-specific advantages may lead to differences in operating characteristics, economic theory suggests that under competitive market conditions, payments for factors of production should be the same in foreign—and domestically owned businesses. For example, the wages paid to workers of the same skill level should be the same. However, in the United States, wage rates differ substantially across industries for the same occupations, and some analysts have suggested that these differences may be the result of less than perfectly competitive labor markets.[6] If labor markets are not fully competitive—for example, due to differences in unionization or to regionally segmented labor markets—businesses owned by investors from one foreign country may be able to pay different wages to workers of the same skill level than those paid by domestically owned businesses or businesses owned by investors from other foreign countries.

4. This theory was first developed by Stephen H. Hymer. See Stephen H. Hymer, *The International Operations of National Firms* (Cambridge, MA: MIT Press, 1976).

5. For a discussion of both the theoretical and empirical literature on how the variations in the characteristics of foreign-owned businesses depend on the country of the foreign owner, see John H. Dunning, *Multinational Enterprises and the Global Economy* (Wokingham, England: Addison-Wesley, 1993).

6. For this interpretation of wage-rate differentials, see Edward M. Graham and Paul R. Krugman, *Foreign Direct Investment in the United States* (Washington, DC: Institute for International Economics, 1995). According to other analysts, the difficulty of measuring some economic factors makes it appear as if unexplained wage differentials exist; see Lawrence F. Katz and Lawrence H. Summers, "Industry Rents: Evidence and Implications," *Brookings Papers on Economic Activity, Microeconomics 1989* (Washington, DC: *Brookings Institution, 1989)* and the comments by the discussants.

Table 1.—Selected Data for Foreign-Owned and All U.S. Establishments in Manufacturing, 1988–91

	Foreign-owned establishments				All U.S. establishments				Foreign-owned establishments as a percentage of all U.S. establishments			
	1988	1989	1990	1991	1988	1989	1990	1991	1988	1989	1990	1991
Number of establishments [1]	9,105	10,458	11,934	12,741	362,906	363,166	378,087	373,999	2.5	2.9	3.2	3.4
Value added (millions of dollars)	131,778	161,929	177,361	183,579	1,262,412	1,308,103	1,326,362	1,313,829	10.4	12.4	13.4	14.0
Value of shipments (millions of dollars)	303,362	371,912	417,539	423,136	2,682,606	2,793,015	2,873,502	2,826,207	11.3	13.3	14.5	15.0
Total employment (thousands)	1,543.4	1,815.3	2,004.2	2,004.6	19,148.3	19,040.8	18,840.3	18,061.9	8.1	9.5	10.6	11.1

1. Consists of operating establishments and administrative and auxiliary establishments. Because the number of manufacturing establishments is not shown in the Census Bureau's ASM publications, data on the number of U.S. manufacturing establishments are from the Census Bureau's annual *County Business Patterns.*

Table 2.—Plant Scale, Wage Rates, and Labor Productivity of Foreign- and U.S.-Owned Establishments in Manufacturing, 1988–91

	Foreign-owned establishments				U.S.-owned establishments				Ratio of foreign-owned establishments to U.S.-owned establishments (percent)			
	1988	1989	1990	1991	1988	1989	1990	1991	1988	1989	1990	1991
Plant scale:												
Value added per establishment (thousands of dollars) [1]	16,664	18,050	17,334	17,131	3,270	3,328	3,214	3,212	510	542	539	533
Wage rates:												
Production wages per hour (dollars)	11.84	12.08	12.57	12.88	10.57	10.81	11.04	11.33	112	112	114	114
Labor productivity:												
Value added per production-worker hour (dollars)	70	73	74	77	49	51	52	54	142	144	140	141
Output per production-worker hour (dollars) [2]	161	169	173	177	104	108	112	116	155	157	154	153

1. Plant scale is computed by dividing value added by the number of operating establishments.
2. Output is measured as shipments plus the change in finished goods and work-in-process inventories.

Industry-Mix Differences

Overall, foreign-owned manufacturing establishments tend to have larger plants, pay higher wages, and be more productive than U.S.-owned establishments. These differences persisted throughout the rapid expansion in foreign direct investment in U.S. manufacturing over the 1988–91 period for which data on foreign-owned manufacturing establishments are now available (tables 1 and 2). Some of these differences vary substantially by country of investor, and the variations reflect both industry-mix and within-industry differences. In this section, the industry mix of the establishments of each of the six major investing countries is compared with that of U.S.-owned establishments.[7]

Plant scale

As can be seen in table 3, the tendency to be concentrated in industries with larger-than-average plant scale (value added per establishment) varies considerably by country of owner.[8] The table shows, for each country, both an overall measure of the plant scale of foreign-owned establishments in relation to that of U.S.-owned establishments (first column) and a measure of the relative plant scale of foreign-owned establishments that isolates industry-mix effects (second column).[9] Specifically, the second column shows how the plant scale of foreign-owned establishments would compare with that of U.S.-owned establishments if in each industry, plant scale were the same for the two groups of establishments and if the only difference were in the distribution of establishments by industry.[10] Differences across countries in this measure indicate the extent to which country of ownership influences the concentration of foreign-owned establishments in industries with large plant scale.

As the second column indicates, Netherlands-, Japanese-, and German-owned establishments tend to be more concentrated in industries with large plant scale than the establishments of the other countries.[11] The concentration of British-owned establishments is the weakest, but it is still significant compared with that of U.S.-owned establishments.[12]

Wage rates

The concentration of foreign-owned U.S. establishments in industries with above-average compensation per employee tends to vary among the six countries, but the variation is not as large as that in plant scale. Japanese-owned establishments show the strongest tendency to operate in high-wage industries; when the effects of differences in industry mix are isolated from those of within-industry differences, compensation per employee of Japanese-owned establishments is found to be 23 percent higher than

7. The discussion in the remainder of the article is based on an analysis of data for 1991, but data for 1988–90 were also examined. The results for these years were consistent with those for 1991.

8. Table 3 covers 457 of the 459 four-digit Standard Industrial Classification (SIC) industries for which data on all U.S. manufacturing establishments are available from the ASM; data for 2 industries are suppressed in order to avoid the disclosure of data for individual establishments.

Value added, as measured by the Census Bureau's ASM, is the numerator for plant scale. It differs from BEA's national income and product accounts measure of gross product: Value added includes purchased services but excludes indirect taxes, and it reflects inventory change valued at book value rather than at replacement cost. In the ASM, value added is calculated as the value of shipments plus the net change in finished goods and work-in-process inventories less the cost of materials consumed.

Because the number of manufacturing establishments is not shown in the Census Bureau's ASM publications, average plant scale for U.S.-owned establishments was computed using the total value added from the ASM and the number of U.S. manufacturing establishments shown in the Census Bureau's *County Business Patterns, 1991: United States* (Washington DC: U.S. Government Printing Office, 1993).

Table 3.—Plant Scale of Foreign-Owned Establishments Relative to That of U.S.-Owned Establishments, 1991

Country of owner	Percent	
	Overall difference	Industry-mix differences
All countries	501	203
Canada	633	202
France	459	207
Germany	623	232
Netherlands	688	237
United Kingdom	407	174
Japan	535	234

NOTE.—This table was constructed using data for 457 four-digit SIC industries, including those that do, and do not, have foreign-owned establishments.

9. In the measures on the "all countries" line in the table, the plant scale of all foreign-owned establishments is compared with that of U.S.-owned establishments. These "all-countries" measures are provided for reference but are not discussed in the text.

10. The values in the second column can be expressed algebraically as

$$\left[\frac{P + \sum_i p_i (s_i^a - s_i)}{p}\right] * 100$$

where P is average plant scale for all industries, p_i is plant scale for industry i, and s_i is the share of the ith industry in the total number of establishments for all industries. Variables with the superscript a denote data for foreign-owned establishments.

11. Several of the industries with relatively large plants that have significant numbers of Netherlands-, Japanese-, and German-owned establishments are in chemicals manufacturing. For example, all three countries have numerous establishments in various industries in the industrial inorganic and organic chemicals groups (SIC 281 and 286) and in pharmaceutical preparations (SIC 2834).

12. A comparison of the values in the second column with those in the first column indicates that the overall measure of relative plant scale is both significantly larger for each country and more variable across countries than the measure that isolates industry-mix effects. The overall measure tends to be larger and more variable because it reflects not only the differences in industry mix, but also the differences *within* industries; see the section "Within-Industry Differences."

that of U.S.-owned establishments (second column of table 4). German-owned establishments are also heavily concentrated in high-wage industries. British-owned establishments have the weakest concentration in high-wage industries.[13]

Japanese- and German-owned establishments may be relatively heavily concentrated in industries that have high compensation per employee because these industries typically have an employee mix weighted toward skilled occupations. Japanese- and German-parent companies that invest abroad often have firm-specific advantages that are technology related—advantages that usually occur in industries employing relatively large numbers of skilled, and thus highly paid, workers.

Labor productivity

The concentration of foreign-owned establishments in industries with high labor productivity tends to vary significantly by country. Two measures of labor productivity—value added per production-worker hour and output per production-worker hour—show similar results (columns 2 and 4 of table 5).[14] According to both measures, the tendency to be concentrated in high-labor-productivity industries is strongest for Netherlands-owned establishments and weakest for French- and British-owned establishments.[15]

Within-Industry Differences

This section examines the tendency of the foreign-owned establishments of the individual countries to have different characteristics within industries. In addition to differences in plant scale, wage rates, and labor productivity, this section also examines differences within industries in the degree to which the output of the establishments results from their own production or from production originating elsewhere and differences in the size of their materials inventories relative to their production. As before, each country's manufacturing establishments are compared with U.S.-owned manufacturing establishments.

Plant scale

In the same industries, the establishments of all six countries tend to have significantly larger plants than U.S-owned establishments, and the within-industry differences vary by country (column 7 of table 6). For a given country, the within-industry difference is measured as the difference in plant scale that would have resulted if the industry distribution of the country's establishments were the same as that of U.S.-owned establishments and if the only difference between the two groups of establishments were in the

13. Among the high-wage industries in which the employment of Japanese-owned establishments are concentrated are blast furnaces and steel mills (SIC 3312), tires and inner tubes (SIC 3011), semiconductor and related devices (SIC 3674), motor vehicles and car bodies (SIC 3711), and household audio and video equipment (SIC 3651). Among the high-wage industries in which the employment of German-owned establishments are concentrated are a number in chemicals manufacturing, including pharmaceutical preparations (SIC 2834), noncellulosic organic fibers (SIC 2824), industrial organic chemicals, nec (SIC 2869), cyclic crudes and intermediates (SIC 2865), and plastic materials and resins (SIC 2821).

14. Output is measured as shipments plus the change in finished goods and work-in-process inventories. Productivity is measured using both output and value added because the two measures provide different advantages. For example, output, unlike value added, reflects the contribution of intermediate inputs to production; however, value added avoids the double counting that can occur in the output measure when one establishment provides materials used by other establishments in the same industry. For a discussion of the advantages and disadvantages of the two alternative measures of productivity, see William Gullickson, "Measurement of Productivity Growth in U.S. Manufacturing," *Monthly Labor Review* 118 (July 1995): 13–28.

Both value added per production-worker hour and output per production-worker hour measure productivity relative to a single input—labor. However, the variation in each measure may reflect differences in the use of other inputs, such as capital and intermediate inputs.

15. Netherlands-owned establishments are concentrated in a number of high-labor-productivity industries within chemicals manufacturing and in petroleum refining. The high labor productivity in these industries partly reflects their capital-intensive production processes.

Table 4.—Compensation per Employee of Foreign-Owned Establishments Relative to That of U.S.-Owned Establishments, 1991

Country of owner	Percent	
	Overall difference	Industry-mix differences
All countries	116	110
Canada	118	109
France	119	111
Germany	122	116
Netherlands	115	109
United Kingdom	108	103
Japan	121	123

NOTE.—This table was constructed using data for 457 four-digit SIC industries, including those that do, and do not, have foreign-owned establishments.

Table 5.—Labor Productivity of Foreign-Owned Establishments Relative to That of U.S.-Owned Establishments, 1991

Country of owner	Percent			
	Value added per hour		Output per hour	
	Overall difference	Industry-mix differences	Overall difference	Industry-mix differences
	(1)	(2)	(3)	(4)
All countries	142	126	153	133
Canada	162	127	158	140
France	134	116	138	120
Germany	155	134	144	129
Netherlands	179	160	226	203
United Kingdom	153	124	144	121
Japan	106	125	150	129

NOTE.—This table was constructed using data for 457 four-digit SIC industries, including those that do, and do not, have foreign-owned establishments.

plant scale in each industry.[16] These differences range from 4.5 times larger than U.S.-owned plants for German-owned establishments to 3.5 times larger for British- and Netherlands-owned establishments. The plants of the other three countries are roughly 4 times as large as those of U.S.-owned establishments.

As discussed in the January 1994 SURVEY article, large plants may be sought out by foreign investors because the income and other benefits that normally accrue to such plants tend to offset the inherent disadvantages foreign investors face when investing in the United States and when subsequently operating their U.S. businesses. For example, foreign investors may concentrate their investments in relatively large plants in order to spread the comparatively high fixed costs that they incur over a larger volume of output. Operating large plants may also benefit foreign investors by simplifying the organizational structure, reducing the number of units that must be managed, and lowering the number of local business environments with which they must become familiar.

Purchased materials

Establishments may differ in the degree to which their output results from their own production or from production originating elsewhere. The extent to which establishments rely on production originating elsewhere can be measured by the ratio of the value of purchased materials to the value of total output for each country's establishments. Based on this measure, the differences among the establishments of all the countries except Japan are relatively small (column 7 of table 7).[17] Japanese-owned establishments rely much more heavily on purchased materials than do the establishments of the other five countries.[18]

The heavy reliance on purchased materials by Japanese-owned establishments is consistent with the tendency of Japanese parent companies to rely on subcontracting in their production. It may also result because more Japanese-owned manufacturing plants are new, compared with

16. Using the notation from footnote 10, the values shown in column 7 of table 6 can be expressed algebraically as

$$\left[\frac{P + \sum_i s_i (p_i^a - p_i)}{p}\right] * 100.$$

In contrast to tables 3–5 in the section "Industry-Mix Differences," which cover industries both with and without foreign-owned establishments, tables 6–9 and 11–14 cover only industries with foreign-owned establishments. Differences in industry mix occur because the intensity of foreign investment varies across industries; thus, when relative investment intensities are analyzed, industries with no foreign investment must be accounted for in the same way as industries with extensive foreign investment. When within-industry differences are analyzed, only industries with foreign-owned establishments are included, because industries that do not have foreign-owned establishments provide no information about the within-industry differences between foreign- and U.S.-owned establishments. Because the number of industries in which the six countries have establishments varies, the number of industries in table 6 (column 1) varies by country.

In addition to within-industry differences (column 5), the overall differences in the table (column 4) reflect differences in industry mix and the interaction of industry mix and within-industry differences. Because table 6 covers only industries with foreign-owned establishments, the industry-mix effects implicit in table 6 differ from those shown in table 3.

17. Column 7 shows within-industry differences in the ratio of cost of materials to total output. The cost of materials consists of materials obtained from all suppliers, whether U.S. or foreign. The cost of materials consists of charges for materials consumed or put into production during the year, including freight charges and other charges incurred by the establishment in acquiring these materials. It also includes the cost of fuel consumed.

18. A recent analysis of BEA's enterprise data also found that Japanese-owned U.S. companies tend to rely on production originating elsewhere to a much greater extent than do other foreign-owned U.S. companies. William J. Zeile, "Imported Inputs and the Domestic Content of Production by Foreign-Owned Manufacturing Affiliates in the United States," in *Geography and Ownership as Bases for Economic Accounting*, ed. Robert E. Baldwin, Robert E. Lipsey, and J. David Richardson (Chicago: University of Chicago Press, forthcoming in 1996).

Table 6.—Plant Scale of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Thousands of dollars				Percent	
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	3,373	19,209	15,835	9,431	569	380
Canada	173	3,129	23,976	20,847	8,987	766	387
France	160	3,977	15,957	11,980	11,756	401	396
Germany	174	2,914	24,053	21,139	10,328	825	454
Netherlands	98	3,811	25,753	21,942	9,989	676	362
United Kingdom	272	3,342	14,336	10,994	8,173	429	345
Japan	181	3,482	25,519	22,037	10,418	733	399

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.

2. Measured as the difference in plant scale that would have resulted if the industry distribution of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in the plant scale in each industry.

NOTE.—Plant scale is measured as value added per establishment.

those of the other five countries. As shown in the following tabulation, outlays to establish new businesses in manufacturing as a share of total outlays to acquire existing businesses and establish new businesses in manufacturing was much higher for Japan than for any of the other five countries:[19]

Country of investor	Percent
Canada	4
France	2
Germany	3
Netherlands	6
United Kingdom	2
Japan	14

When a newly built plant begins operations and its workforce is relatively inexperienced, activities in the plant many cover only a few production stages; as the plant matures, it may be able to substitute its own production for production originating elsewhere. In addition, because foreign owners may be unfamiliar with the U.S. business environment when they first set up their U.S. plants, newly built foreign-owned plants may be more likely to rely on materials purchased from their foreign owners.[20]

Inventories

To some extent, the variation in the use of purchased materials is paralleled by a variation in the size of materials inventories relative to value added. The ratio of materials inventories to value added for Japanese-owned establishments is 62 percent higher than that for U.S.-owned establishments within the same industries, by far the largest difference for any country (column 7 of table 8). However, the establishments of the other five countries also maintained relatively large inventories of materials; the ratio ranged from 35 percent higher for German-owned establishments to 14 percent higher for Canadian-owned establishments.

The finding that Japanese-owned establishments have unusually large materials inventories is somewhat surprising, given Japanese companies' reputation for keeping inventories at a minimum through their "just-in-time" system of deliveries from suppliers. One reason for the large inventories may be the particularly heavy reliance by these establishments on purchased materials, much of which are imported.[21] Because these materials typically travel over longer distances and by different modes of transportation than materials purchased domestically, imported materials may be shipped less often and in larger quantities than domestically purchased materials. Thus, Japanese-owned plants that rely on imported materials may have to carry comparatively large inventories in order to ensure that their supply is not interrupted. The differences among the establishments of the other five countries in their reliance on imported materials also appear to partly explain the differences in the relative size of their materials inventories.

19. The data in the tabulation, which are from BEA's survey of U.S. businesses acquired or established by foreign direct investors, are averages for 1987–91 and cover only the plants built when a new U.S. business enterprise (a new U.S. affiliate) is created. New plants built by existing U.S. affiliates and plant expansions by existing U.S. affiliates are not covered.

20. Numerous studies have shown that newly built foreign plants of multinational companies tend to have large imports from their parent companies. One of the first studies was Raymond R. Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics* 80 (May 1966): 190–207.

21. According to Zeile, imported materials account for a large portion of the purchased materials of the Japanese-owned U.S. affiliates; see "Imported Inputs and the Domestic Content of Production."

Table 7.—Ratio of the Cost of Purchased Materials to Output of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Percent					
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	53.4	55.3	1.9	0.9	104	102
Canada	173	54.4	51.2	–3.2	–1.3	94	98
France	160	55.5	53.5	–2.0	1.5	96	103
Germany	174	49.8	49.2	–.7	–1.2	99	98
Netherlands	98	48.1	47.3	–.8	–1.5	98	97
United Kingdom	272	52.6	49.6	–3.0	–.8	94	99
Japan	181	50.9	64.8	13.8	5.2	127	110

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.

2. Measured as the difference in the ratio of the cost of purchased materials to output that would have resulted if the industry distribution of the output of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in the ratio of the cost of purchased materials to output in each industry.

Wage rates

Compensation rates vary considerably among establishments of the major investing countries; an analysis shows that these variations appear to largely result from factors typically associated with variations in compensation rates, such as location and plant scale. When these factors are controlled for, only British- and French-owned establishments appear to have compensation rates that differ from those of the other foreign-owned establishments in the same industries.

Although the within-industry variation in compensation per employee among the establishments of the six countries is smaller than that for any of the characteristics examined so far, it is significant. Compared with U.S.-owned establishments in the same industries, the differences in compensation per employee ranged from 9 percent higher for French-owned establishments to 1 percent lower for Japanese-owned establishments (table 9, column 7).[22]

22. For other studies of compensation rates of foreign-owned U.S. manufacturing establishments, using the BEA-Census Bureau data, see Robert E. Lipsey, "Foreign-Owned Firms and U.S. Wages," *National Bureau of Economic Research Working Paper No. 4927* (November 1994) and J. Bradford Jensen and Mark Doms, "A Comparison Between Operating Characteristics of Domestic and Foreign Owned Manufacturing Establishments in the United States," in *Geography and Ownership as Bases for Economic Accounting*.

Using 1987 data, Lipsey found a somewhat different pattern, particularly with regard to Japanese-owned establishments, than that found in this article. He found that the within-industry compensation rates of the Japanese-owned establishments in manufacturing are higher than those of U.S.-owned establishments, while this article finds that Japanese-owned establishments' compensation rates are slightly lower. The disparity may reflect differences in the level of industry detail used. Lipsey used published data on foreign-owned establishments, generally at the two-digit SIC level, presumably to avoid the sometimes high degree of suppression in the published data at finer levels of detail. In contrast, the analysis in this article is based largely upon data at the four-digit SIC level. Thus, Lipsey's finding may actually reflect industry-mix effects; specifically, in many two-digit industries, Japanese-owned establishments are concentrated in the four-digit industries with the highest compensation rates.

Doms and Jensen, in their analysis based on 1987 data, controlled for differences in industry mix and several other factors and found that wage rates of foreign-owned establishments vary by country of owner. They also found that Japanese- and Australian-owned establishments pay lower production-worker wages than other foreign-owned establishments.

Table 8.—Ratio of Materials Inventory to Value Added of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Percent					
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	8.9	9.8	0.8	2.1	109	123
Canada	173	9.2	7.3	–1.9	1.3	79	114
France	160	8.9	8.2	–.7	1.7	92	119
Germany	174	9.1	10.0	.9	3.2	110	135
Netherlands	98	8.3	7.2	–1.1	1.3	86	116
United Kingdom	272	8.5	8.8	.3	2.3	103	127
Japan	181	8.2	14.2	6.0	5.1	172	162

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.
2. Measured as the difference in the ratio of materials inventory to value added that would have resulted if the industry distribution of the value added of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in the ratios of materials inventory to value added in each industry.

Table 9.—Compensation per Employee of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Dollars				Percent	
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	34,541	39,754	5,214	1,401	115	104
Canada	173	34,804	40,654	5,850	1,679	117	105
France	160	36,403	41,544	5,141	3,374	114	109
Germany	174	34,376	42,228	7,852	2,642	123	108
Netherlands	98	36,787	38,605	1,818	1,821	105	105
United Kingdom	272	35,202	37,350	2,148	684	106	102
Japan	181	36,852	41,209	4,356	–551	112	99

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.
2. Measured as the difference in compensation per employee that would have resulted if the industry distribution of the employment of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in compensation per employee in each industry.

The following analysis examines the extent to which the variation in within-industry compensation rates is attributable to differences in occupational mix, location, plant scale, and capital intensity. Because data limitations make it impossible to use the compensation-per-employee measure for certain aspects of the analysis, this analysis also uses two alternative measures of compensation rates—payroll per employee and hourly wage rates of production workers.[23]

Occupational mix.—Compensation rates may vary because the establishments of the six countries have different occupational mixes. Although detailed occupational data are not available from the ASM, a breakdown of total employment and total payroll between two broad groups—production workers and nonproduction workers—is available.[24] Nonproduction workers are usually considered to be higher skilled, on average, than production workers. A comparison of payroll per employee for the two groups supports this view: For both all U.S. establishments and foreign-owned establishments, payroll per employee of nonproduction workers is significantly higher than that of production workers for total manufacturing and for each two-digit SIC manufacturing industry (table 10).[25]

The role of occupational mix in explaining wage differences can be examined by comparing variations in wages of production workers with variations in compensation per employee of all workers. This comparison indicates whether variation by country in the ratio of nonproduction workers to production workers is a source of inter-country differences in overall rates of pay.

Across the establishments of the six countries, the range of within-industry differences is somewhat narrower for hourly wage rates of production workers than it is for compensation per employee of all workers (column 7 of table 11 and column 7 of table 9, respectively), suggesting that differences in occupational mix may explain some of the variation in compensation rates. However, in some cases, the differences in the hourly wage rates of production workers are wider than those in the compensation per employee of all workers.[26]

23. Compensation covers benefits as well as wages and salaries; payroll covers only wages and salaries.

24. Production workers are workers—up through the line-supervisor level—at an operating establishment who are engaged in fabricating, processing, assembling, inspecting, receiving, storing, handling, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (power plant, for example), record keeping, and other services closely associated with these production operations at the establishment.

Nonproduction workers are workers engaged in factory supervision above the line-supervisor level and workers engaged in the following activities: Sales (including drivers/salespersons), sales delivery (highway truck drivers and their helpers), advertising, credit, collection, installation and servicing, clerical and routine office functions, executive, purchasing, financial, legal, personnel (including cafeteria and medical personnel), professional, and technical.

25. Payroll per employee rather than compensation per employee is shown in table 10 because data on employee benefits by type of worker are not available from the ASM.

Educational attainment, which is an indicator of employee skill level, is also higher for nonproduction workers than for production workers; see Eli Berman, John Bound, and Zvi Griliches, "Changes in the Demand for Skilled Labor Within U.S Manufacturing Industries: Evidence from the Annual Survey of Manufacturing," *Quarterly Journal of Economics* 109 (May 1994): 367–97.

26. Lipsey found that differences in occupational mix played a role in explaining why compensation rates are higher in foreign-owned establishments than in U.S.-owned establishments only for German-owned establishments, and even in this case, occupational mix only explained part of the difference. See "Foreign-Owned Firms and U.S. Wages."

Table 10.—Payroll per Employee of Production and Nonproduction Workers of All U.S. Establishments and Foreign-Owned Establishments, 1991

[Dollars]

SIC code	Industry	All U.S. establishments		Foreign-owned establishments	
		Production workers	Nonproduction workers	Production workers	Nonproduction workers
	Manufacturing	23,139	38,002	26,220	42,431
20	Food and kindred products	20,346	31,638	23,086	34,597
21	Tobacco products	34,829	46,345	(D)	(D)
22	Textile mill products	16,725	33,348	18,768	38,639
23	Apparel and other textile products	12,324	28,304	14,353	28,196
24	Lumber and wood products	18,119	30,737	19,790	31,828
25	Furniture and fixtures	16,961	33,340	(D)	(D)
26	Paper and allied products	28,023	41,814	29,698	45,135
27	Printing and publishing	21,878	30,706	25,309	31,946
28	Chemicals and allied products	31,013	43,874	33,281	46,739
29	Petroleum and coal products	37,989	48,647	39,695	51,284
30	Rubber and miscellaneous plastics products	20,567	36,290	25,352	39,110
31	Leather and leather products	13,402	32,760	15,576	28,978
32	Stone, clay, and glass products	24,100	34,250	26,752	37,261
33	Primary metal industries	29,390	40,245	32,167	41,968
34	Fabricated metal products	23,694	36,462	26,374	39,169
35	Industrial machinery and equipment	25,757	39,578	25,827	41,209
36	Electronic and other electric equipment	22,299	40,714	22,529	40,580
37	Transportation equipment	32,792	44,072	28,350	41,502
38	Instruments and related products	25,842	44,759	24,032	42,742
39	Miscellaneous manufacturing industries	16,899	32,613	19,960	36,385

(D) Suppressed to avoid disclosure of data of individual companies.

SIC Standard industrial classification

Location.—Wage rates may also vary by country of owner because the establishments of one country may be more (or less) concentrated than the establishments of other countries in geographic areas where wages are relatively high (or low). However, even after controlling for differences in distributions of employment across States (see column 2 of table 12), payroll per employee still varies considerably.[27] This variation may exist partly because, as discussed earlier, the establishments of the six countries tend to be concentrated to different degrees in high-wage industries. Furthermore, this concentration may not be uniformly distributed across States. Controlling for differences in State-by-industry distributions (see column 3 of table 12) significantly narrows the differences in payroll per employee across the establishments of the six countries.[28]

Other factors.—In addition to occupational mix and location, other factors may influence compensation rates. One is the extent to which the employees of the establishments are unionized. Data are not available from the ASM on the number of employees who are in unions, but such data are available from BEA's 1992 benchmark survey of foreign direct investment in the United States.[29] Because the benchmark survey data are collected on an enterprise basis, they are not directly comparable with the establishment data from the ASM. However, the enterprise data do suggest that there is little relationship between unionization rates and the variation in compensation rates of the establishments of different countries, once differences in industry mix are taken into account.

The variation in compensation rates may also reflect differences in plant scale and capital intensity. In the January 1994 SURVEY article, it was found that at the all-countries level, differences in compensation rates between foreign- and U.S.-owned establishments are significantly correlated with differences in plant scale. Because the size of foreign-owned plants depends on the country of owner, the variation in compensation rates may partly reflect differences in scale. Capital intensity could influence compensation rates if higher skilled labor tends to be required in plants that use large amounts of capital. In addition, if skill levels are higher in capital-intensive plants, employee training may be relatively expensive and the plants may pay higher wages

27. Payroll per employee rather than hourly wage rates or compensation per employee was used in this section because the all-U.S. data source for these comparisons, *County Business Patterns, 1991*, provides data only on total payroll and employment.

For the establishments of each country, the relative payroll-per-employee measure in column 2 of the table is smaller than that in column 1, indicating that each country's establishments tend to be more concentrated in high-wage States than the U.S.-owned establishments.

28. For the establishments of each country, the relative payroll-per-employee measure in column 3 of the table is smaller than that in column 2, indicating that each country's establishments tend to be concentrated in the higher-wage industries within individual States.

The conclusions based on the measures shown in table 12 are subject to two important qualifications. First, in constructing column 3, the differences in the industry distributions were controlled for by using data at the three-digit SIC level, because all-U.S. data on payroll per employee within States is not available at the four-digit level. Rough calculations indicate that if four-digit, rather than three-digit, industry data had been used, the relative payroll-per-employee measure shown for Japanese-owned establishments would probably have been less than 100 percent instead of the 101 percent shown.

Second, the boundaries of labor markets may not coincide with State boundaries. Wage rates in one part of a State may be higher than those in another part of the State (for example, wage rates may be higher in urban areas than in rural areas). As a consequence, State data may not always gauge accurately whether foreign-owned establishments have a tendency to be located in areas where wages are particularly high (or low).

29. See U.S. Department of Commerce, Bureau of Economic Analysis, *Foreign Direct Investment in the United States: 1992 Benchmark Survey, Final Results* (Washington, DC: U.S. Government Printing Office, September 1995).

Table 11.—Production-Worker Wages per Hour of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Dollars				Percent	
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	11.37	12.87	1.50	0.31	113	103
Canada	173	11.52	13.46	1.95	.11	117	101
France	160	11.66	13.36	1.69	.80	115	107
Germany	174	11.43	13.30	1.87	.78	116	107
Netherlands	98	11.61	12.00	.38	(†)	103	100
United Kingdom	272	11.53	11.87	.34	.26	103	102
Japan	181	12.13	13.74	1.61	–.17	113	99

† Less than 0.005(±).

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.

2. Measured as the difference in production-worker wages per hour that would have resulted if the industry distribution of the production-worker hours of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in production-worker wages per hour in each industry.

to reduce employee turnover and the associated training costs.

Combined effects.—The prior analysis suggests that variation in compensation rates among the six countries' establishments is associated with variations in industry composition, occupational mix, location, plant scale, or capital intensity. In order to determine whether differences in compensation rates remain once these factors are simultaneously taken into account, multiple regression equations were estimated in which the dependent variable was hourly wage rates of production workers, and the independent variables were plant scale, capital intensity, control variables for four-digit SIC industry and for location (State), and dummy variables to indicate residual country-of-ownership differences.[30] Six equations—one for each country—were estimated. In each case, the observations were the individual establishments of the six countries. In the equation for each country, the variable for country of owner was used to test whether the establishments of that country differed from the establishments of the other five, once the industry and State controls and the other independent variables were taken into account.[31] Key findings of this analysis are discussed below; the estimated equations are shown in the appendix.

The regression analysis indicates that among the establishments of the six countries, the variation in hourly wage rates largely results from differences in industry mix, location, plant scale, and capital intensity. However, even after these factors are taken into account, the wage rates of French-owned establishments are about 6 percent higher, and those of British-owned establishment are about 4 percent lower, than those of the other foreign-owned establishments.

These results are based on tests that assume that the relationship between hourly wage rates and both plant scale and capital intensity is the same for the establishments of each country (that is, that the regression coefficient for each variable is the same for each country). In order to check whether the effect of a particular country's ownership may reflect differences in the relationship between the other independent variables and country of ownership (slope effects) rather than any overall country-of-ownership effect (intercept effect), a second set of regression equations was estimated in which the relationship between wage rates and both plant scale and capital intensity can vary depending on the country of owner.

The results from the second set of equations indicate that the relatively high production-worker wage rates in French-owned establishments are due to a stronger positive relationship between wage rates and capital intensity for those establishments than for the establishments of the other five countries. Further, French-owned establishments with the same capital intensity as the establishments owned by the other countries tend to have higher production-worker wage rates than the other establishments and the higher the capital intensity, the larger the gap between the wage rates of French-owned establishments and those of the other establishments.

The reasons for the relatively high compensation rates for French-owned establishments and the relatively low compensation rates of British-owned establishments are unclear. The differences in the compensation rates may reflect differences in the firm-specific advantages that enable foreign companies to invest successfully in the United States. For example, the advantages of parent companies in one foreign country may stem from production-management or other organizational capabilities rather than from the possession of advanced technology. If so, compensation rates of that country's establishments

30. The sample data used to estimate the regression equations differ somewhat in coverage from those used in the analysis of the preceding sections. It should also be noted that, in the regressions, capital intensity was measured indirectly using a proxy variable, because the data needed to measure it directly are not available. See the appendix for a discussion of how the sample was selected and a description of the capital intensity variable.

31. An alternative to estimating a separate regression equation for each country is to estimate a single equation that includes country-of-ownership variables for five of the six countries, with the sixth country serving as a the base. In general, the results from this alternative method, which are presented in the appendix, are consistent with those from the separate regression equations.

Table 12.—Payroll per Employee: Foreign-Owned Establishments Compared With U.S.-Owned Establishments, 1991

[Percent]

Country of owner	Overall	After adjustment for differences in distributions	
		Across States	Across States and industries
	(1)	(2)	(3)
Canada	119	107	98
France	114	109	98
Germany	120	115	101
Netherlands	118	104	102
United Kingdom	107	101	98
Japan	114	106	101

NOTE.—Column 1 shows payroll per employee of foreign-owned establishments relative to that of U.S.-owned establishments before controlling for differences in distributions across States. Column 2 shows the relative payroll-per-employee measure that would result if the distributions of the foreign-owned establishments across States were the same as that of the U.S.-owned establishments and if the only difference between the two groups of establishments were in payroll per employee within each State. Column 3 was constructed by controlling for differences between foreign- and U.S.-owned establishments in distributions both across States and across three-digit SIC industries within States. Specifically, column 3 shows the relative payroll-per-employee measure that would result if the distributions of the foreign-owned establishments across industries within individual States were the same as those of U.S.-owned establishments and if the only difference between the two groups of establishments were in payroll per employee within each State-industry cell.

may be relatively low, because these establishments are less likely than those of other countries to use technologically complex production processes that require relatively large numbers of high-skill, high-wage production workers. Variations in the skill mix of production workers were not controlled for in this analysis, and they may be the source of some of the differences in the wage rates of foreign-owned establishments by country of owner.

Labor productivity

The variation in labor productivity across the establishments of the six countries appears to be largely attributable to differences among the establishments in factors such as plant scale and employee skill level. However, some evidence suggests that once these factors are taken into account, the labor productivity of British-owned establishments tends to be somewhat higher, and the labor productivity of Japanese-owned establishments somewhat lower, than that of the other foreign-owned establishments.

Whether labor productivity is measured as value added per production-worker hour or as output per production-worker hour, the labor productivity of the establishments of the six countries varies significantly from country to country, but each country's establishments have higher labor productivity than U.S.-owned establishments in the same industries.[32] Using the value-added measure, the labor productivity of French- and Netherlands-owned establishments is particularly high relative to that of U.S.-owned establishments—40 percent and 38 percent higher, respectively (table 13, column 7). In contrast, the labor productivity of Japanese-owned establishments is only 7 percent higher. Using the output measure, the differences in labor productivity range from 43 percent higher for Netherlands-owned establishments to 8 percent higher for Canadian-owned establishments (table 14 column 7).

If the within-industry differences in labor productivity for the establishments of the six countries are ranked, both measures of productivity yield similar rankings, except that the Japanese-owned establishments rank sixth on the basis of the value-added measure and third on the basis of the output measure. This disparity may reflect a tendency for the operations of Japanese-owned establishments to be structured differently from those of the establishments of the other countries. That structural differences exist is suggested by the earlier finding that the ratio of purchased materials to output tends to be much larger for Japanese-owned establishments than for the other establishments.

The remainder of this section evaluates the extent to which variation in labor productivity by country of owner reflects differences among the establishments in factors that often influence labor productivity—plant scale, capital intensity, and employee skill levels. In the January 1994 SURVEY article, it was found that at the all-countries level, the labor productivity of foreign-owned establishments differed significantly from that of U.S.-owned establishments and that most of this difference was attributable to differences in industry mix, plant scale, capital intensity, and employee skill level. In order to determine if this finding holds across countries, multiple regression equations that simultaneously take these

32. The value-added and the output measures each have unique advantages as measures of labor productivity (see footnote 14).

Table 13.—Value Added per Production-Worker Hour of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Dollars				Percent	
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	53	80	27	7	150	114
Canada	173	54	91	37	8	169	114
France	160	59	74	16	24	126	140
Germany	174	50	87	37	15	174	130
Netherlands	98	63	109	46	24	173	138
United Kingdom	272	56	84	27	13	149	124
Japan	181	58	65	7	4	113	107

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.

2. Measured as the difference in value added per production-worker hour that would have resulted if the industry distribution of the production-worker hours of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in value added per production-worker hour in each industry.

factors into account were estimated for each country. In the regressions, the dependent variable was labor productivity and the independent variables were plant scale, capital intensity, employee skill level, control variables for four-digit SIC industry and for State, and dummy variables to indicate residual country-of-ownership differences. Separate equations were estimated for the value-added and the output measures of labor productivity. In addition, because an establishment's output embodies purchased materials as well as its own value added, a measure of the use of purchased materials relative to total output was included as an independent variable in the equations using the output measure.

When the value-added measure was used as the dependent variable, the regression results suggest that most of the differences in labor productivity across the establishments of the six countries are attributable to differences in plant scale, capital intensity, employee skill level, industry, and location. However, even after these factors are taken into account, the labor productivity of British-owned establishments is about 5 percent higher, and the labor productivity of Japanese-owned establishments about 12 percent lower, than that of the establishments of the other countries.

These results were based on regressions in which it was assumed that the relationships between labor productivity and plant scale, capital intensity, and employee skill level are the same for the establishments of each country. A second set of equations was estimated in which this assumption was relaxed. The results of these regressions suggest that the relatively high labor productivity of British-owned establishments reflects a stronger positive relationship between labor productivity and capital intensity for those establishments than for the establishments of the other five countries. Further, British-owned establishments with the same capital intensity as the other establishments tend to have higher labor productivity than the other establishments and the higher the capital intensity, the larger the gap between their productivity and that of the other establishments.

When the output measure was used as the dependent variable, no systematic differences in productivity were found across the establishments of the six countries once differences in industry mix, location, use of purchased materials, plant scale, capital intensity, and employee skill were taken into account.

These results are based on regression equations in which it was assumed that the relationships between labor productivity and the use of purchased materials, plant scale, capital intensity, and employee skill level are the same for the establishments of each country. A second set of regression equations was estimated in which this assumption was relaxed. Like the results of the value-added regressions, the results of these regressions suggest a stronger positive relationship between labor productivity and capital intensity for British-owned establishments than for the establishments of the other countries. These results also suggest that the positive relationship between the use of purchased materials and labor productivity is stronger for Japanese-owned establishments than for the other establishments. In contrast, the results suggest that for Canadian-owned establishments, high labor productivity is associated with lower, rather than higher, use of purchased materials.

A number of factors that were not taken into account in this analysis may explain the differ-

Table 14.—Output per Production-Worker Hour of Foreign- and U.S.-Owned Establishments, 1991

Country of owner	Number of industries [1]	Dollars				Percent	
		U.S.-owned establishments	Foreign-owned establishments	Differences		Foreign-owned establishments relative to U.S.-owned establishments	
				Overall difference	Within-industry differences [2]	Overall difference (Col.3/Col.2) × 100	Within-industry differences ((Col.2+Col.5)/Col.2) × 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All countries	410	115	182	67	20	158	117
Canada	173	119	188	69	10	158	108
France	160	133	160	26	57	120	143
Germany	174	100	165	65	24	165	124
Netherlands	98	122	210	88	40	172	133
United Kingdom	272	120	168	48	25	140	121
Japan	181	119	194	75	39	163	133

1. The all-countries line covers the four-digit SIC industries in which at least one of the six countries has establishments. The line for a country covers those four-digit SIC industries in which that country has establishments.

2. Measured as the difference in output per production-worker hour that would have resulted if the industry distribution of the production-worker hours of foreign-owned establishments were the same as that of U.S.-owned establishments and if the only differences between the two groups of establishments were in output per production-worker hour in each industry.

ences in the labor productivity of British- and Japanese-owned establishments. For example, the productivity, like the wage rates, of foreign-owned establishments may be influenced by the firm-specific advantages of the establishments' parent companies.

The variation in labor productivity may also reflect a variation in the average age of the foreign-owned establishments by country of owner. Many Japanese-owned establishments are relatively new. Productivity in new plants may be relatively low because these plants often operate at less-than-full capacity and because they may incur training and other costs that are not incurred in older plants.[33]

Appendix

This appendix consists of a description of the data on foreign-owned establishments and a discussion of the estimated regression equations and of the alternative regression method that were used in the analysis of wage rates and labor productivity.

The data

The data for foreign-owned establishments were obtained from the Census Bureau's Annual Survey of Manufactures (ASM) through a project that linked BEA enterprise, or company, data on foreign direct investment in the United States with Census Bureau establishment, or plant, data for all U.S. companies. Data were obtained for most of the ASM items for the universe of foreign-owned manufacturing establishments.

The panel of foreign-owned establishments examined in this article covers a subset of the universe of such establishments. The panel includes only the establishments owned by foreign investors from the six countries selected for study. It excludes administrative and auxiliary establishments because the data available by detailed industry cover only operating establishments, and it excludes establishments for which data were imputed (estimated).

Published ASM statistics cover all manufacturing establishments in the United States. These statistics are estimates derived by combining the data for establishments in the ASM sample with the data estimated for establishments not in the sample. The foreign-owned establishments not in the sample were excluded from the panel because the procedure used to estimate data for them employs industry-level ratios that do not differentiate between foreign- and U.S.-owned establishments and therefore tends to mask the differences between the two groups of establishments. The panel also excludes extreme outliers. These outliers consist of a few foreign-owned establishments whose data appear to be erroneous or for which temporary circumstances peculiar to the establishments resulted in unusual values and of a few establishments that appear to have been engaged in activities that are not typical of other foreign- and U.S.-owned establishments in the same four-digit industry.[34]

Even after these exclusions, the panel includes 84 percent of all foreign-owned manufacturing establishments. It also accounts for a large portion of the universe totals for both value added and employment—88 percent and 85 percent, respectively. Among the six major investing countries, value added accounted for by the panel ranged from 79 percent of the universe total for Japanese-owned establishments to 91 percent of the total for Canadian-, Netherlands-, and British-owned establishments.

The panel of establishments used to estimate the regression equations differs slightly from that described here; the differences are noted in the next section.

Regression analysis

As indicated in the main text of the article, several multiple regression equations were estimated to analyze the variations in wage rates and in labor productivity among the establishments of the six countries. The regressions for wage rates are shown in tables 15 and 16, and those for labor productivity, in tables 17–20. The main text discusses the variables used in the regressions and key results.

Two sets of regressions were run for wage rates, and two were run for each of the labor productivity measures. The first set of regressions is based on the assumption that the relationships between the independent variables and the dependent variable is the same for the establishments of each country (that is, that the regression

33. Doms and Jensen used data from several Census Bureau economic censuses to create a proxy for plant age and found that labor productivity was relatively low in Japanese-owned plants even after plant age is taken into account. They also found that the productivity of foreign-owned plants is generally higher than that of U.S.-owned plants but lower than that of U.S. plants of U.S. multinational companies. See "A Comparison Between Operating Characteristics of Domestic and Foreign Owned Manufacturing Establishments."

34. In "Characteristics of Foreign-Owned U.S. Manufacturing Establishments," outliers were controlled for by limiting the analysis to only those four-digit industries with six or more foreign-owned establishments. That approach was rejected for this study because of the relatively small number of four-digit industries in which individual investing countries own six or more establishments.

coefficient for each variable is the same for each country). The second set of regressions relaxes this assumption; that is, the second set of regressions checks whether the effect of a particular country's ownership is due to differences in the relationship between the other independent variables and the country of ownership (slope effects) rather than to any overall country-of-ownership effect (intercept effect).

Unlike the analysis elsewhere in the article, which was based on industry-level aggregations, the regressions used establishment-level data. Six equations—one for each country—were estimated for each set of regressions. In each case, the observations were the individual establishments of all six countries. In the equation for each country, a dummy variable for that

Table 15.—Regression Analysis: Country-of-Ownership Effects on Production-Worker Wages (Intercept Only), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables	
			Country	Intercept effect [2]
1	6,139	0.696	Canada	0.006 *(.019)*
2	6,139	.698	France	.063 *** *(.018)*
3	6,139	.696	Germany	.005 *(.018)*
4	6,139	.696	Netherlands	.008 *(.024)*
5	6,139	.697	United Kingdom	–.043 *** *(.013)*
6	6,139	.696	Japan	.005 *(.018)*

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.

1. Each equation included controls for four-digit SIC industry and for State and included variables for plant scale and capital intensity. The coefficients for plant scale and capital intensity were significant at the 1-percent level in all equations, and the values for each coefficient varied only slightly across equations. In all equations, the coefficients of the plant-scale variable rounded to 0.065, and those of the capital-intensity variable rounded to –0.032. Capital intensity was measured using a proxy variable (see the appendix).

2. In each equation, the country-of-owner dummy variable tested whether the wages paid by the establishments of the specified country differed from those paid by the establishments of the other five countries, once the industry and State controls and the other independent variables were taken into account.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

Table 17.—Regression Analysis: Country-of-Ownership Effects on Value Added per Production-Worker Hour (Intercept Only), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables	
			Country	Intercept effect [2]
1	6,139	0.814	Canada	0.014 *(.037)*
2	6,139	.814	France	.023 *(.035)*
3	6,139	.814	Germany	–.023 *(.035)*
4	6,139	.814	Netherlands	.014 *(.045)*
5	6,139	.814	United Kingdom	.053 ** *(.025)*
6	6,139	.814	Japan	–.118 *** *(.034)*

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.

1. Each equation included controls for four-digit SIC industry and for State and included variables for plant scale, capital intensity, and employee skill level. The coefficients for plant scale, capital intensity, and employee skill level were significant at the 1-percent level in all equations, and the values for each coefficient varied only slightly across equations. In all equations, the coefficients of the plant-scale variable rounded to 0.220, those of the capital-intensity variable rounded to 0.259, and those of the employee- skill-level variable ranged from 0.621 to 0.626. Capital intensity was measured using a proxy variable (see the appendix).

2. In each equation, the country-of-owner dummy variable tested whether the value added per production-worker hour of establishments of the specified country differed from that of the establishments of the other five countries, once the industry and State controls and the other independent variables were taken into account.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

Table 16.—Regression Analysis: Country-of-Ownership Effects on Production-Worker Wages (Intercept and Slope), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables [2]			
			Country	Intercept effect	Slope effect	
					Plant scale [3]	Capital intensity [3]
1	6,139	0.696	Canada	–0.149 *(.108)*	0.020 * *(.011)*	0.014 *(.017)*
2	6,139	.697	France	.125 *(.094)*	–.004 *(.010)*	.025 * *(.013)*
3	6,139	.696	Germany	–.016 *(.104)*	(†) *(.011)*	–.015 *(.017)*
4	6,139	.696	Netherlands	.288 * *(.158)*	–.029 * *(.016)*	.009 *(.026)*
5	6,139	.697	United Kingdom	–.062 *(.072)*	–.001 *(.008)*	–.016 *(.010)*
6	6,139	.696	Japan	.040 *(.104)*	–.008 *(.011)*	–.022 *(.016)*

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.
† Less than 0.0005(±).

1. Each equation included controls for four-digit SIC industry and for State and included variables for plant scale and capital intensity. The coefficients for plant scale and capital intensity were significant at the 1-percent level in all equations. The coefficients of the plant-scale variable ranged from 0.061 to 0.067, and those of the capital-intensity variable ranged from –0.026 to –0.035.

2. In each equation, the country-of-owner dummy variables tested whether the wages paid by the establishments of the specified country differed from those paid by the establishments of the other five countries, once the industry and State controls and the other independent variables were taken into account.

3. See the text and the appendix for the definitions of these variables.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

country is used to test whether that country's establishments differed from the establishments of the other five countries once the industry and State controls and the other independent variables were taken into account.

In the regressions, capital intensity was measured indirectly using a proxy variable—the ratio of total fuel costs to production-worker wages—because the data needed to measure it directly were not available.[35] The regressions controlled for industry and State by including the mean values of the dependent variables in each industry in each State as independent variables. This procedure is equivalent to including dummy variables in the equations for each industry-State cell.

The sample of establishments used for the regression analysis was somewhat smaller than that used for the analysis elsewhere in the article because it excluded establishments for which the value for one of the variables in the regression equations either could not be calculated or was an extreme outlier. (Most of the variables in the regression equations are ratios—for example, value added per production-worker hour; a value for a ratio could not be calculated for a particular establishment if the denominator was zero.) A total of 6,139 establishments were included in the sample used for the regression analysis. These establishments accounted for 82 percent of the employment and 86 percent of the value added of all operating establishments of the six countries.

35. In "Characteristics of Foreign-Owned U.S. Manufacturing Establishments," an alternative proxy, the non-employee compensation share of value added, was used. Tests of how well the alternative proxy and the one used in this article correspond to a capital stock measure obtained in BEA's annual survey of foreign direct investment in the United States indicated that the correlation was much closer for the proxy used in this article than for the alternative.

Table 19.—Regression Analysis: Country-of-Ownership Effects on Output per Production-Worker Hour (Intercept), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables	
			Country	Intercept effect [2]
1	6,139	0.852	Canada	–0.007 (.032)
2	6,139	.852	France	.013 (.030)
3	6,139	.852	Germany	–.009 (.030)
4	6,139	.852	Netherlands	.001 (.039)
5	6,139	.852	United Kingdom	.016 (.022)
6	6,139	.852	Japan	–.030 (.029)

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.

1. Each equation included controls for four-digit SIC industry and for State and included variables for plant scale, capital intensity, employee skill level, and the ratio of purchased materials to output. The coefficients for plant scale, capital intensity, employee skill level, and the ratio of purchased materials to output were significant at the 1-percent level in all equations, and the values for each coefficient varied only slightly across equations. In all equations, the coefficients of the plant-scale variable rounded to 0.115, those for the capital- intensity variable rounded to 0.312, those for the employee-skill-level variable ranged from 0.708 to 0.710, and those for the ratio of the purchased-materials-to- output variable ranged from 0.155 to 0.157. Capital intensity was measured using a proxy variable (see the appendix).

2. In each equation, the country-of-owner dummy variable tested whether output per production-worker hour of the establishments of the specified country differed from that of the establishments of the other five, once the industry and State controls and the other independent variables were taken into account.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

Table 18.—Regression Analysis: Country-of-Ownership Effects on Value Added per Production-Worker Hour (Intercept and Slope), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables [2]				
			Country	Intercept effect	Slope effect		
					Plant scale [3]	Capital intensity [3]	Employee skill level [4]
1	6,139	0.814	Canada	–0.121 *(.262)*	–0.034 *(.022)*	–0.093 ** *(.033)*	0.114 *(.094)*
2	6,139	.815	France	–.597 ** *(.282)*	.085 *** *(.021)*	–.006 *(.026)*	–.044 *(.099)*
3	6,139	.814	Germany	.335 *(.279)*	–.015 *(.022)*	–.057 * *(.032)*	–.122 *(.102)*
4	6,139	.814	Netherlands	–1.345 ** *(.438)*	.047 *(.031)*	–.082 *(.051)*	.324 *(.142)*
5	6,139	.815	United Kingdom	.344 * *(.191)*	–.008 *(.016)*	.073 *** *(.020)*	–.044 *(.065)*
6	6,139	.814	Japan	–.129 *(.266)*	–.017 *(.021)*	–.016 *(.030)*	.054 *(.084)*

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.

1. Each equation included controls for four-digit SIC industry and for State and variables for plant scale, capital intensity, and employee skill level. The coefficients for plant scale, capital intensity, and employee skill level were significant at the 1-percent level in all equations. The coefficients of the plant-scale variable ranged from 0.207 to 0.227, those for the capital-intensity variable ranged from 0.230 to 0.269, and those for the employee-skill-level variable ranged from 0.606 to 0.648.

2. In each equation, the country-of-owner dummy variables tested whether the value added per production-worker hour of establishments of the specified country differed from that of the establishments of the other five countries, once the industry and State controls and the other independent variables were taken into account.

3. See the text and the appendix for the definitions of these variables.

4. Measured as production-worker wages per hour.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

Alternative regression method

The results obtained when an alternative regression method was used are shown in table 21. Under this method, for each dependent variable, a single equation was estimated that includes country-of-ownership variables for five of the six countries, and the sixth country was used as the base.

In the alternative regressions, the coefficients of the country-of-ownership variables provide estimates of the extent to which the wage rates or labor productivity of the establishments of each of the five countries differ from the wage rates or labor productivity of the establishments of the base country. The country chosen to serve as base country could have been any of the six countries. In order to facilitate the comparisons of the results of these regressions with the previous regressions, the base country selected was the one for which the coefficient for the country-of-ownership variable was closest to the average for the establishments of all six countries. Thus, in the wage-rate equation, Germany was chosen as the base country, and in the productivity equations, Canada was chosen.

The regression results shown in table 21 are generally consistent with those shown in tables 15, 17, and 19. For example, a comparison of the wage-rate regressions for the two methods indicates that if the coefficients of the country-of-owner variables in the equation in table 21

Table 20.—Regression Analysis: Country-of-Ownership Effects on Output per Production-Worker Hour (Intercept and Slope), 1991

Equation [1]	Number of observations	R^2	Country-of-owner variables [2]					
			Country	Intercept effect	Slope effect			
					Ratio of purchased materials to output [3]	Plant scale [3]	Capital intensity [3]	Employee skill level [4]
1	6,139	0.854	Canada	–0.068 *(.227)*	–0.240 *** *(.053)*	–0.038 * *(.019)*	–0.045 *(.029)*	0.053 *(.081)*
2	6,139	.853	France	–.334 *(.244)*	–.024 *(.064)*	.050 ** *(.019)*	–.005 *(.023)*	–.039 *(.086)*
3	6,139	.853	Germany	.007 *(.244)*	–.052 *(.068)*	–.002 *(.019)*	–.066 ** *(.028)*	–.053 *(.089)*
4	6,139	.853	Netherlands	–.938 ** *(.381)*	.030 *(.084)*	.047 * *(.028)*	–.044 *(.046)*	.186 *(.123)*
5	6,139	.853	United Kingdom	.310 * *(.165)*	–.004 *(.047)*	–.012 *(.014)*	.083 *** *(.017)*	–.024 *(.056)*
6	6,139	.855	Japan	–.107 *(.228)*	.504 *** *(.065)*	.030 *(.019)*	–.063 ** *(.026)*	.022 *(.072)*

*** Significant at the 1-percent level.
** Significant at the 5-percent level.
* Significant at the 10-percent level.

1. Each equation included controls for four-digit SIC industry and for State and included variables for plant scale, capital intensity employee skill level, and the ratio of purchased materials to output. The coefficients for plant scale, capital intensity, employee skill level, and the ratio of purchased materials to output were significant at the 1-percent level in all equations. The coefficients of the plant-scale variable ranged from 0.107 to 0.124, those for the capital-intensity variable ranged from 0.279 to 0.324, those for the employee-skill-level variable ranged from 0.698 to 0.724, and those for the ratio of the purchased-materials-to-output variable ranged from 0.089 to 0.212.

2. In each equation, the country-of-owner dummy variables tested whether output per production-worker hour of the establishments of the specified country differed from that of the establishments of the other five, once the industry and State controls and the other independent variables were taken into account.

3. See the text and the appendix for the definitions of these variables.

4. Measured as production-worker wages per hour.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

Table 21.—Regression Analysis: Alternative Method, 1991

Dependent variable	Number of observations	R^2	Plant scale [1]	Capital intensity [1]	Employee skill level [2]	Ratio of purchased materials to output [1]	Country-owner variables					
							Canada	France	Germany	Netherlands	United Kingdom	Japan
Production-worker wages per hour [3]	6,139	0.697	0.065 *** *(.005)*	–0.031 *** *(.008)*			–0.001 *(.025)*	0.047 * *(.024)*	[B]	0.002 *(.028)*	–0.032 *(.020)*	–0.003 *(.023)*
Value added per production-worker hour [3]	6,139	.814	.220 *** *(.009)*	.259 *** *(.015)*	.624 *** *(.035)*		[B]	.010 *(.047)*	–.038 *(.048)*	–.006 *(.056)*	.019 (.040)	–.116 ** *(.047)*
Output per production-worker hour [3]	6,139	.852	.115 *** *(.008)*	.312 *** *(.013)*	.709 *** *(.030)*	.157 *** *(.025)*	[B]	.018 *(.041)*	–.003 *(.041)*	.004 *(.048)*	.016 *(.035)*	–.020 *(.041)*

*** Significant at the 1- percent level.
** Significant at the 5- percent level.
* Significant at the 10-percent level.
[B] Base country (see the appendix).

1. See the text and the appendix for the definitions of these variables.
2. Measured as production-worker wages per hour.
3. The equation included controls for four-digit SIC industry and for State. In the equation, the country-of-owner dummy variables tested whether the establishments of each of the other five countries differed from the establishments of the base country, once the industry and State controls and the other independent variables were taken into account.

NOTE.—The observations were the individual establishments of the six countries. All variables were expressed as natural logs; numbers in parentheses are standard errors.

are ranked in terms of their size, the ranking is identical to that obtained when the coefficients of the country-of-owner variables in table 15 are ranked. In particular, both methods indicate that the wage rates of French-owned establishments are higher than those of the other establishments once differences in industry mix, location, scale, and capital intensity are taken into account. Similarly, both methods indicate that the wage rates of British-owned establishments are lower than those of the other establishments.

Although providing similar rankings, the two sets of results differ in the degree of confidence associated with the estimated coefficients of the country-of-owner variables. For example, in the equations in table 15, the coefficients of the country-of-owner variables in the equations for both France and the United Kingdom are significant at the 1-percent level. In contrast, in the wage-rate equation in table 21, the coefficient for the country-of-owner variable for France is significant only at the 10-percent level, and the coefficient for the United Kingdom is not statistically significant.

These differences in statistical significance arise because in table 21, the coefficients are estimated on the basis of a comparison of the establishments of a particular country with the establishments of the base country (Germany, in the case of the wage-rate equation) and because in table 15, the coefficients are estimated on the basis of a comparison of the wage rates of the establishments of a particular country with the wage rates of the establishments of the other five countries taken as a group. When a single country is used as the base country, associations between the industry mix or location variables and the country-of-owner variables for either the base country or the subject country can limit the ability of the regression procedure to separate the country-of-ownership effects from the industry-mix effects or the location effects.