

# Research and Development Activities of U.S. Multinational Companies

## Preliminary Results From the 2004 Benchmark Survey

By Daniel R. Yorgason

THE Bureau of Economic Analysis (BEA) has embarked on a long-term effort to provide more extensive economic data and analysis about research and development activity and its effects on the economy. In keeping with this goal, this article on the research and development (R&D) activities of U.S. multinational companies (MNCs) has been prepared to supplement an earlier article summarizing other general results from BEA's 2004 benchmark survey of U.S. direct investment abroad.<sup>1</sup> The benchmark survey is more comprehensive than BEA's annual surveys in its coverage of companies and in the information gathered on R&D activities.

The information presented here complements other BEA research on the effects of R&D activity on economic growth. Last September, BEA released a new R&D satellite account developed in conjunction with the National Science Foundation.<sup>2</sup> The satellite account recognizes that R&D is actually a form of investment—investment that produces an intangible asset, knowledge. In order to measure the effect of R&D activity on investment, saving, and the gross domestic product (GDP), the satellite account modifies the accounting conventions used in GDP accounts and treats R&D spending as investment rather than as an expense. The MNC R&D data, and related BEA research on R&D and other innovation-related activities of

MNCs, will assist in the further development of the R&D satellite account. Two goals for this work are to determine how to introduce an international dimension into the satellite account and to assess the extent to which R&D data from U.S. MNCs can be used in improving the estimates of domestic R&D (see the box "Multinational Companies and R&D: Other Issues").

In furtherance of these goals, BEA, the National Science Foundation (NSF), and the Census Bureau (which conducts an R&D survey on behalf of NSF) are currently engaged in a project linking data from their surveys to provide a more complete picture of R&D associated with U.S. and foreign MNCs. Results from this project are scheduled to be published later this year.<sup>3</sup> The data link will provide information on the types of R&D conducted by MNCs (basic research, applied research, and development) and the location, by state, of their R&D conducted in the United States.

In addition to the international aspects, work on the R&D satellite account will continue in several other areas, including improving output measures and input deflators, better identifying the owners and location of use of R&D assets, and estimating capital services for R&D.<sup>4</sup> Work on the satellite account also will examine ways to incorporate aspects of BEA's industry and regional accounts.

### Highlights

In 1999–2004, current-dollar R&D expenditures of U.S. MNCs grew at an average annual rate of 4 percent, to \$179.9 billion in 2004 (table A, chart 1).<sup>5</sup> This rate of growth for MNCs was about the same as the rate of growth for MNC value added. The roughly equal growth rates reflects the offsetting effects of (1) an increase in the share of MNC R&D expenditures

1. A MNC comprises a U.S. parent company and its foreign affiliates. This analysis of R&D activities of U.S. MNCs focuses exclusively on data for majority-owned foreign affiliates (MOFAs) rather than on data for all foreign affiliates because the data items necessary for this analysis are only collected for MOFAs. Conceptually, many data users prefer the data for majority-owned affiliates because such affiliates are unambiguously under U.S. control; foreign affiliates that are minority owned by a U.S. resident could also be under the influence or control of foreign investors. In addition, most foreign affiliates are majority owned. For example, in 2004, MOFAs accounted for 86 percent of the employment by all nonbank foreign affiliates.

Raymond J. Mataloni Jr. and Daniel R. Yorgason, "Operations of U.S. Multinational Companies: Preliminary Results From the 2004 Benchmark Survey," *SURVEY OF CURRENT BUSINESS* 86 (November 2006): 37–68. For more information on the benchmark survey, see the appendix to that article.

2. The full release is accessible on BEA's Web site at <[www.bea.gov/bea/newsrelarchive/2006/rdspend06.htm](http://www.bea.gov/bea/newsrelarchive/2006/rdspend06.htm)>. An article 3 months later discusses the same topic: Sumiye Okubo, Carol A. Robbins, Carol E. Moylan, Brian K. Sliker, Laura I. Schultz, and Lisa S. Mataloni, "BEA's 2006 Research and Development Satellite Account: Preliminary Estimates of R&D for 1959–2002 and Effect on GDP and Other Measures," *SURVEY* 86 (December 2006): 14–44.

3. A report examining the feasibility of this data link project is available on BEA's Web site at <[www.bea.gov/bea/di/FinalReportpublic.pdf](http://www.bea.gov/bea/di/FinalReportpublic.pdf)>.

4. Okubo, et al., 22–23.

5. Data on R&D expenditures are collected on both a performer basis and funder basis in the benchmark survey. In the annual surveys, expenditure data are only collected on a performer basis. Unless otherwise noted, in this article, "R&D expenditures" are the expenditures for R&D that is performed by the MNC rather than for the R&D that is funded by the MNC. This treatment is consistent with the performance-based estimates published by NSF and with the data from BEA's annual surveys.

accounted for by foreign affiliates, whose R&D was lower in relation to value added than that of their parents, and (2) more rapid growth of R&D expenditures than of value added for both U.S. parents and their foreign affiliates.

Of the \$179.9 billion in R&D expenditures of U.S. MNCs in 2004, 85 percent was accounted for by U.S. parents and 15 percent was accounted for by their foreign affiliates. The parents' 85-percent share was higher than their 73-percent share of MNC value

added. The large R&D share of U.S. parents partly reflects the relative abundance of U.S. scientific and technical resources, including highly educated workers, in the United States. It may also reflect U.S. companies' efforts to limit the diffusion of their strategic technologies in order to preserve their competitive position among international companies. Also, because of scale economies in R&D and because information generated by R&D in one location can often be shared with far-flung operating units at low or zero marginal cost,

**Table A. R&D Expenditures of Nonbank U.S. Multinational Companies for 1994, 1999, and 2004**

	R&D performed by U.S. MNCs			Addenda	
	MNC total	U.S. parents	MOFAs	Ratio of U.S.-parent R&D expenditures to R&D expenditures of all U.S. businesses (percent) <sup>1</sup>	MOFAs as a percentage of MNC total ((column 3/column 1) x 100)
	(1)	(2)	(3)	(4)	(5)
	Millions of dollars			Percent	
<b>1994</b>					
<b>Total</b> .....	<b>103,451</b>	<b>91,574</b>	<b>11,877</b>	<b>76.6</b>	<b>11.5</b>
Type:					
For themselves.....	84,574	75,673	8,901	n.a.	10.5
For others <sup>2</sup> .....	18,876	15,900	2,976	n.a.	15.8
Of which:					
For the Federal Government .....	n.a.	13,267	n.a.	59.1	n.a.
Addendum: Performed by others on behalf of the MNC .....	7,105	5,561	1,544	n.a.	21.7
<b>1999</b>					
<b>Total</b> .....	<b>144,435</b>	<b>126,291</b>	<b>18,144</b>	<b>69.1</b>	<b>12.6</b>
Type:					
For themselves.....	124,252	111,008	13,244	n.a.	10.7
For others <sup>2</sup> .....	20,183	15,283	4,900	n.a.	24.3
Of which:					
For the Federal Government .....	n.a.	7,810	n.a.	34.7	n.a.
Addendum: Performed by others on behalf of the MNC .....	11,726	10,344	1,382	n.a.	11.8
<b>2004</b>					
<b>Total</b> .....	<b>179,914</b>	<b>152,384</b>	<b>27,529</b>	<b>73.2</b>	<b>15.3</b>
Type:					
For themselves.....	166,330	141,877	24,453	n.a.	14.7
For affiliated businesses <sup>3</sup> .....	4,313	1,835	2,479	n.a.	57.5
For unaffiliated entities.....	9,270	8,673	597		6.4
Of which:					
For the Federal Government .....	n.a.	6,049	n.a.	29.9	n.a.
Addendum: Performed by others on behalf of the MNC .....	7,794	6,338	1,456	n.a.	18.7
<b>Addenda</b>					
Percent					
<b>1994</b>					
<b>Total</b> .....	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>		
Type:					
For themselves.....	81.8	82.6	74.9		
For others <sup>2</sup> .....	18.2	17.4	25.1		
Of which:					
For Federal Government .....	n.a.	14.5	n.a.		
<b>1999</b>					
<b>Total</b> .....	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>		
Type:					
For themselves.....	86.0	87.9	73.0		
For others <sup>2</sup> .....	14.0	12.1	27.0		
Of which:					
For the Federal Government .....	n.a.	6.2	n.a.		
<b>2004</b>					
<b>Total</b> .....	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>		
Type:					
For themselves.....	92.4	93.1	88.8		
For affiliated businesses <sup>3</sup> .....	2.4	1.2	9.0		
For unaffiliated entities.....	5.2	5.7	2.2		
Of which:					
For the Federal Government .....	n.a.	4.0	n.a.		

n.a. Not available

1. These estimates are computed using data from the National Science Foundation's Web site at <http://www.nsf.gov/statistics/inbrief/nsf07304/>.

2. Information of the portion of R&D performed by the MNC for affiliated and for unaffiliated entities was separately collected in 2004, but this split was not collected in 1994 and 1999.

3. In the case of U.S. parents, affiliated businesses consist of their foreign affiliates. In the case of

MOFAs, affiliated businesses consist of the U.S. parent and all other foreign affiliates belonging to the same U.S. parent.

MNC Multinational company

MOFA Majority-owned foreign affiliate

R&D Research and development

it may be easier and more efficient for MNCs to concentrate R&D activities in the United States rather than some other activities, such as production or distribution.

The 15-percent share of R&D expenditures accounted for by foreign affiliates was 2 percentage points higher than in 1999 and 3 percentage points higher than in 1994. The rise coincided with a general rise in the importance of foreign affiliates in U.S.-MNC operations; the share of MNC value added accounted for by foreign affiliates rose to 27 percent in 2004 from 23 percent in 1999. R&D also became more broadly diffused among affiliates in 1999–2004. The number of affiliates participating in R&D as a share of

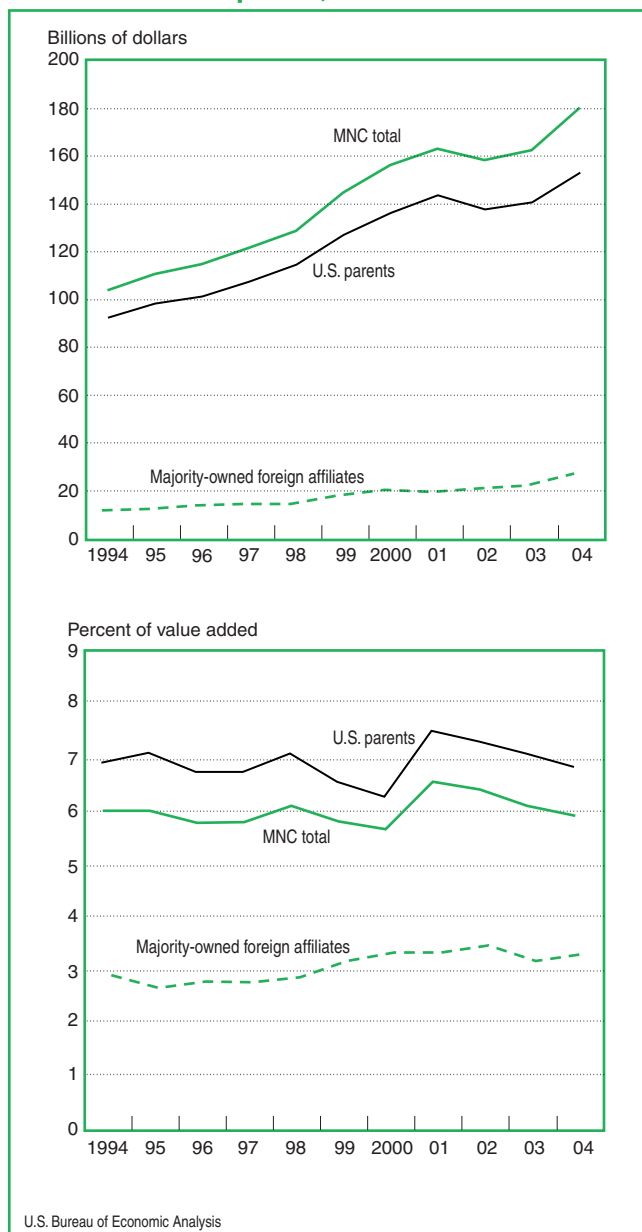
all affiliates increased by more than a third, and the number of countries hosting R&D-performing affiliates increased from 66 to 73 (for more information on which entities perform R&D, see the appendix “R&D: What Is It and Who Conducts It?”).

Other key results of the R&D activities of U.S. multinational companies from the 2004 benchmark survey include the following:

- The 4-percent average annual growth rate of R&D expenditures in 1999–2004 was down from a 7-percent rate in 1994–99; the slower growth coincided with lower value-added growth (4-percent average annual growth in 1999–2004, compared with 8-percent growth in 1994–99).
- R&D employment of MNCs was 998,000 in 2004, up from 770,000 in 1999.<sup>6</sup> The average annual rate of R&D employment growth was 5 percent. U.S. parents, with R&D employment of 819,000, accounted for 82 percent of the total in 2004, compared with 84 percent in 1999.
- R&D by MNCs was performed primarily, and increasingly, for themselves. In 2004, 92 percent of R&D expenditures reflected work performed by the parent or by the affiliate for themselves (“own-account” spending), up from 86 percent in 1999 and 82 percent in 1994.
- The share of R&D performed under contract for affiliated businesses—2 percent—was relatively small. Foreign affiliates performed more R&D under contract for affiliated businesses than did U.S. parents.
- U.S. parents accounted for 73 percent of R&D expenditures by all U.S. businesses in 2004, an increase from the 69-percent share in 1999 but less than the 77-percent share in 1994.
- R&D expenditures by foreign affiliates were highest in the United Kingdom, Germany, and Canada. Expenditures by foreign affiliates in these three countries totaled \$12.9 billion or 47 percent of all R&D spending by all affiliates. This share fell from 50 percent in 1999, reflecting an increase in the geographic dispersion of affiliates’ R&D.

The remainder of this article is composed of two sections and an appendix. The first section focuses on the R&D expenditures and R&D employment of U.S. parents in 2004. The second section examines the R&D expenditures and R&D employment of their majority-owned foreign affiliates. The appendix provides additional detail on the types of activities included in R&D, and compares selected characteristics of MNCs that conduct R&D with those of MNCs that do not.

**Chart 1. R&D Expenditures of Nonbank U.S. Multinational Companies, 1994–2004**



6. In the text, employment data are rounded to the nearest thousand. In the tables, they are rounded to the nearest hundred.

## R&D by U.S. Parents

In 2004, R&D expenditures by U.S. parents were \$152.4 billion, up from \$126.3 billion in 1999. Of the 2004 total, \$141.9 billion, or 93 percent, was own-account spending, \$6.0 billion, or 4 percent, was for projects funded by the Federal Government, \$2.6 billion, or 2 percent, was for projects funded by other unaffiliated entities, and \$1.8 billion, or 1 percent, was spending for projects funded by the parents' foreign affiliates. The 93-percent share of own-account spending was 5 percentage points higher than in 1999 and 10 percentage points higher than in 1994. The declines in non-own-account spending largely reflect declines in the share of federally funded R&D; the 4-percent share was down from 6 percent in 1999 and 15 percent

in 1994.

Just as U.S. parents performed some R&D *for* others, they also had some R&D performed for them *by* others. R&D performed for parents by others totaled \$6.3 billion. Of total R&D funded by MNCs, the share performed by others was 4 percent, only half the share in 1999.<sup>7</sup> R&D performed by others typically supplemented rather than replaced R&D performed by parents for themselves; only 11 out of 2,267 parents had

7. The estimates of R&D expenditures of U.S. MNCs on a funder basis follow financial accounting standards and are typically treated as an expense on firms' income statements. If a change were to be made to follow the definitions underlying the R&D satellite account, R&D expenditures on this basis would be capitalized, and the depreciation of the R&D stock would be treated as an expense. This alternative treatment would raise the estimates of value added by MNCs.

## Multinational Companies and R&D: Other Issues

The benchmark and annual surveys of U.S. direct investment abroad are the primary resources for assessing the size and scope of research and development (R&D) activities of U.S. multinational companies (MNCs). The main text of this article addresses several basic issues related to MNCs and R&D, such as the division of performance between U.S. parents and foreign affiliates, parents' performance relative to that of all U.S. businesses, the geographic (for foreign affiliates) and industry distributions of R&D performers, and the extent to which MNCs perform R&D for others or fund R&D by others. However, it leaves several other issues unaddressed.<sup>1</sup> Some of these other issues might be addressed by more detailed or technical analyses of data collected in the benchmark and annual surveys, and others might require data from other sources or data that are not currently available. Several issues of particular interest are grouped below according to whether they relate to firm-level behavior and performance, measurement of R&D, or the effect of R&D on national economic performance:

### R&D and the firm

- What factors lead an MNC to conduct R&D?
- Does R&D lead a company to grow more quickly than it otherwise would? How does R&D affect other measures of parent and affiliate performance, such as productivity and profitability?
- Does R&D by a company's competitors put it at a relative disadvantage?
- How does an MNC determine whether to conduct its R&D in the United States or abroad? If abroad, what determines

1. However, these other issues may have been (or may be currently being) addressed by other research, but most of the questions listed continue to be largely unresolved. For recent examples of research touching on some of these issues, see United Nations Conference on Trade and Development, *World Investment Report 2005: Transnational Corporations and the Internationalization of R&D* (New York and Geneva: United Nations, 2005), or Jerry Thursby and Marie Thursby, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Here or There? A Survey of Factors in Multinational R&D Location* (Washington DC: The National Academies Press, 2006).

the particular location? To what extent do factors such as taxes or protection of intellectual property rights affect MNC decisions on where within the MNC to locate the ownership of R&D results?

- To what extent can U.S.-parent R&D spending complement, or be substituted for, foreign-affiliate R&D spending?
- How does R&D by parents affect the productivity and other measures of foreign-affiliate performance?
- To what extent are R&D findings shared with the various entities of an MNC? Are the findings of parents more readily shared than those of affiliates? Does the location of an affiliate determine whether it receives R&D output from the parent or other affiliates or how much it receives?

### Measurement of R&D

- How are R&D results valued by MNCs, and how should they be valued by statistical agencies (for example, for use in satellite accounts)? Are market values available, or are cost-based estimates the only option?
- To what extent, if any, should R&D capital be viewed as accruing to R&D performers rather than, or in addition to, R&D funders?
- To what extent should the lags and risks associated with R&D affect the measurement of R&D capital?
- How quickly does R&D capital depreciate, and are there important differences in depreciation rates over industries and countries?

### R&D and national performance

- What role does R&D by MNCs play in generating spillovers (externalities) in the United States, in the host countries of R&D-performing affiliates, or in the host countries of R&D-using affiliates?
- Does the increasing share of R&D performed by foreign affiliates imply that the United States is losing its comparative advantage in R&D?
- What factors promote the selection of affiliates located in low-wage host countries to perform R&D?

R&D performed for them but were not themselves also R&D performers.

U.S. parents constitute a major portion of all R&D performance in the United States; in 2004, they accounted for 73 percent of the R&D performed by all U.S. businesses. The importance of parents in R&D is attributable partly to their industry distribution; for example, parents account for a particularly large share of U.S. economic activity in manufacturing, an industry sector with relatively high levels of R&D. Size may also contribute; companies with overseas operations tend to be larger than other U.S. businesses. The share of U.S.-business R&D accounted for by parents rose from that in 1999 but was still smaller in 2004 than in 1994. MNCs' share of R&D performed for the Federal Government was much smaller—30 percent of all federally funded R&D—and was smaller than it was in 1999 and 1994.

### R&D expenditures: Industry distribution and intensity

R&D by U.S. parents tends to be highly concentrated in specific industries. This concentration partly results from the definition of R&D; R&D only includes certain activities within the set of all innovative or knowledge-generating activities (see the appendix “R&D: What is It and Who Conducts It?”). Industry characteristics

such as type of product or industry maturity may also be factors.

R&D expenditures in three industry sectors—manufacturing (\$120.9 billion), information (\$14.0 billion), and professional, scientific, and technical services (\$12.8 billion)—accounted for 97 percent of all R&D expenditures by U.S. parents in 2004 (tables B and 1, chart 2). Manufacturing accounted for 79 percent of all R&D expenditures. Within the three sectors, R&D expenditures were unevenly distributed. In manufacturing, three industries—chemicals, computers and electronic products, and transportation equipment—accounted for 84 percent of R&D expenditures, well above their 48-percent share of value added (chart 3). In information, R&D expenditures were concentrated in publishing industries, mostly because of the software publishing subindustry. In professional, scientific, and technical services, they were concentrated in computer systems design and related services.

The concentration of U.S.-parent R&D expenditures in the three major R&D-performing sectors closely matched the concentration of R&D of all U.S. businesses (95 percent).<sup>8</sup> However, the distribution of parent R&D expenditures among these three sectors

8. The similarity of industry concentration is not surprising given U.S. parents' 73-percent share of R&D expenditures by all U.S. businesses.

**Table B. R&D Expenditures of Nonbank U.S. Multinational Companies and All U.S. Businesses by Selected Industry of U.S. Parent, 2004<sup>1</sup>**

	R&D expenditures (millions of dollars)			MOFA share of total MNC (percent)	R&D expenditures of all U.S. R&D businesses (millions of dollars) <sup>2</sup>	Ratio of U.S.-parent R&D expenditures to R&D expenditures of all U.S. businesses (percent)
	MNC total	U.S. parents	MOFAs			
<b>All industries<sup>3</sup></b> .....	<b>179,913</b>	<b>152,384</b>	<b>27,529</b>	<b>15.3</b>	<b>208,301</b>	<b>73.2</b>
<b>Manufacturing</b> .....	<b>145,122</b>	<b>120,851</b>	<b>24,271</b>	<b>16.7</b>	<b>147,288</b>	<b>82.1</b>
<i>Of which:</i>						
Petroleum and coal products .....	1,326	1,251	75	5.7	1,603	78.0
Chemicals .....	47,274	40,270	7,004	14.8	(D)	(D)
<i>Of which:</i>						
Basic chemicals .....	2,075	1,881	194	9.4	2,393	78.6
Resins and synthetic rubber, fibers, and filaments .....	2,681	2,392	289	10.8	2,096	114.1
Pharmaceuticals and medicines .....	37,000	31,046	5,954	16.1	31,477	98.6
Machinery .....	6,656	5,780	876	13.2	6,579	87.9
Computers and electronic products .....	41,468	35,810	5,658	13.6	48,296	74.1
<i>Of which:</i>						
Computers and peripheral equipment .....	7,562	7,371	191	2.5	5,734	128.6
Electrical equipment, appliances, and components .....	1,476	1,266	210	14.2	2,664	47.5
Transportation equipment .....	33,862	25,795	8,067	23.8	(D)	(D)
<i>Of which:</i>						
Motor vehicles, bodies and trailers, and parts .....	21,954	14,662	7,292	33.2	15,677	93.5
Miscellaneous manufacturing .....	4,975	4,397	578	11.6	4,388	100.2
<b>Information</b> .....	<b>15,193</b>	<b>14,003</b>	<b>1,190</b>	<b>7.8</b>	<b>22,593</b>	<b>62.0</b>
<b>Professional, scientific, and technical services</b> .....	<b>14,438</b>	<b>12,787</b>	<b>1,651</b>	<b>11.4</b>	<b>28,709</b>	<b>44.5</b>
<i>Of which:</i>						
Architectural, engineering, and related services .....	(D)	91	(D)	(D)	4,265	2.1
Computer systems design and related services .....	10,087	8,689	1,398	13.9	11,575	75.1
<b>Other<sup>4</sup></b> .....	<b>5,160</b>	<b>4,743</b>	<b>417</b>	<b>8.1</b>	<b>9,711</b>	<b>48.8</b>
<i>Of which:</i>						
Construction .....	3	3	0	0	1,481	0.2
Retail trade .....	57	53	4	7.0	1,596	3.3

D Suppressed to avoid disclosure of data of individual companies.

1. In this table, MOFA's R&D expenditures are classified by the industry of their U.S. parent. In table 2, MOFA's R&D expenditures are classified by their own industry.

2. Data are from the National Science Foundation's Web site at <<http://www.nsf.gov/statistics/inbrief/nsf07304/>>.

3. "All industries" includes agricultural industries in the benchmark survey of U.S. direct investment abroad. In NSF's survey of all U.S. businesses, agricultural industries are excluded.

4. "Other" in this table is a catch-all category and does not correspond to the "other industries" category used in other tables in this article or in other reports on the results from BEA's surveys of MNCs by industry. "Other" also includes agricultural industries for the survey of U.S. direct investment abroad but not for the survey of all U.S. businesses. See footnote 3.

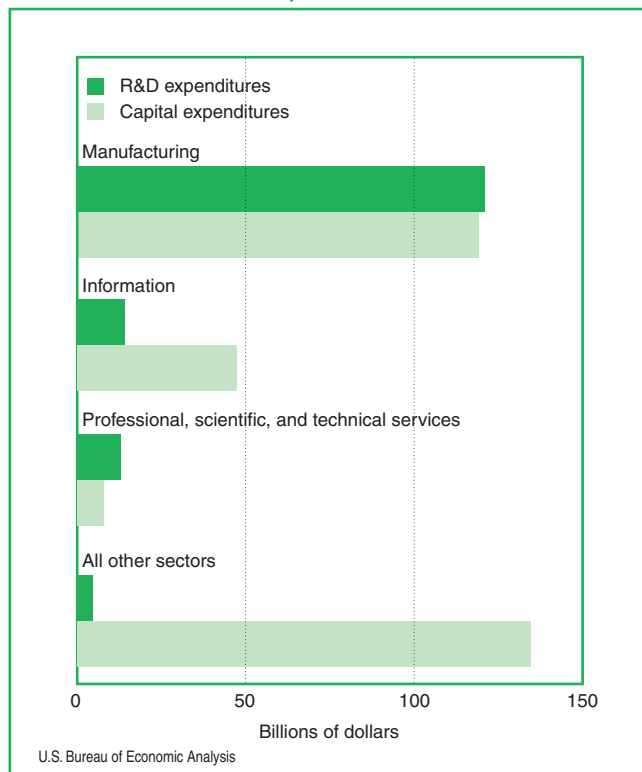
MNC Multinational company  
MOFA Majority-owned foreign affiliate  
R&D Research and development

differed somewhat from that of R&D expenditures by all U.S. businesses. U.S.-parent R&D expenditures were more concentrated in manufacturing (parents' 82 percent of all-U.S.-business R&D in manufacturing was significantly higher than their 73-percent share at the all-industries level) and were less concentrated in information (62 percent of all-U.S.-business R&D) and in professional, scientific, and technical services (45 percent).

Among other industries, the proportion of all-U.S.-business R&D accounted for by U.S. parents varied widely, ranging from close to zero (for example, in construction) to over 100 percent (for example, in construction) to over 100 percent (for example, in computers and peripheral equipment).<sup>9</sup> Parents' R&D spending was particularly notable, both in absolute and relative terms, in pharmaceuticals and medicines in chemicals manufacturing and in "motor vehicles, bodies and trailers, and parts" in transportation equipment manufacturing. In pharmaceuticals and medicines, R&D expenditures accounted for 99 percent of the all-U.S.-business total, and in "motor vehicles, bodies and trailers, and parts," parents' spending accounted for 94 percent of the all-U.S.-business total.

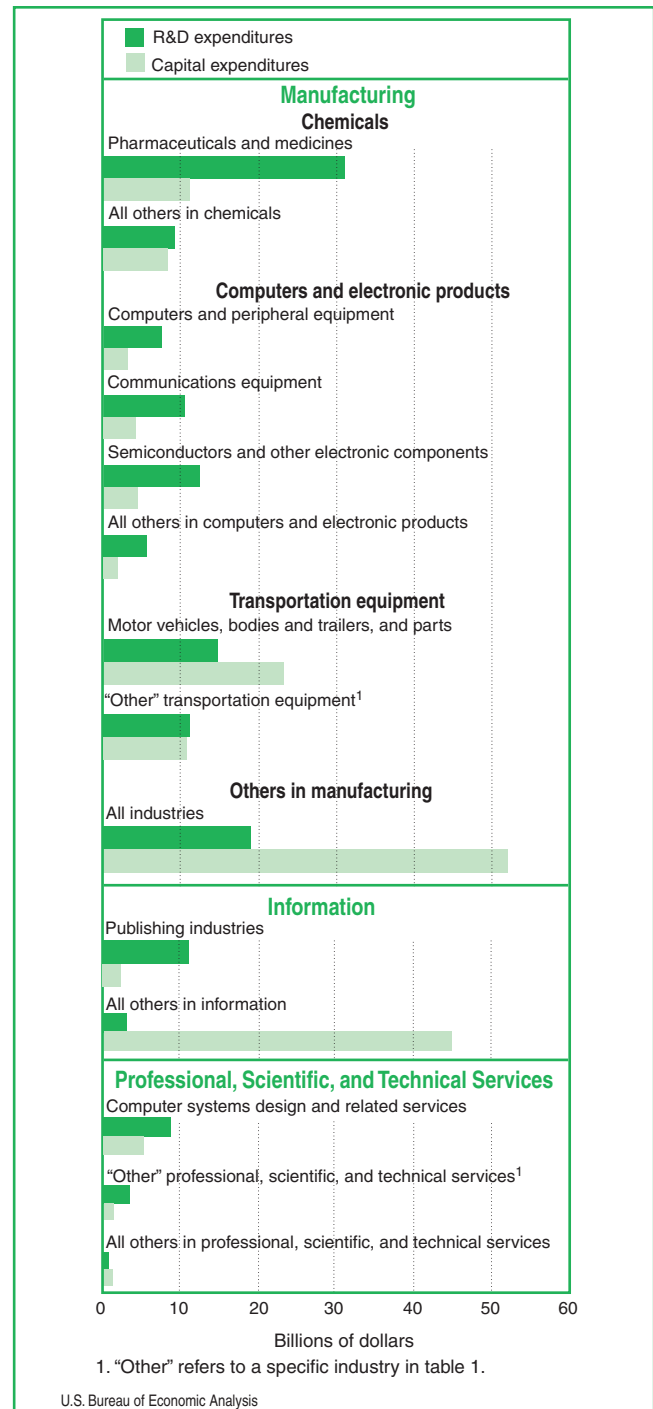
9. Differences in industry classification and geographic coverage of the BEA data for MNCs and the NSF data for all U.S. businesses may partly explain instances in which the proportion exceeds 100 percent. For instance, Puerto Rico is excluded in NSF's surveys of R&D, but it is included in BEA's surveys of direct investment.

**Chart 2. R&D Expenditures and Capital Expenditures of Nonbank U.S. Parents, 2004**



R&D expenditures relate to the accumulation of intangible assets; charts 2 and 3 also show data on parents' capital expenditures—that is, expenditures for property, plant and equipment—which relate to the accumulation of tangible assets. The R&D expenditures of U.S. parents were approximately half those of their capital expenditures (\$308.7 billion), but the size of R&D expenditures relative to capital expenditures

**Chart 3. R&D Expenditures and Capital Expenditures of Nonbank U.S. Parents, Selected Industries, 2004**



varied markedly across sectors. In both manufacturing and professional, scientific, and technical services, U.S. parents' R&D expenditures exceeded their capital expenditures. In most other industries, however, R&D expenditures were markedly smaller than capital expenditures.

Table 1 not only documents the industry concentration of parents' R&D expenditures discussed above, but it also provides information on the "intensity" of those expenditures—measured as the ratio of the level of R&D expenditures to the level of value added.<sup>10</sup> This measure allows the propensities of firms in different industries that conduct R&D to be examined, abstracting from differences in industry size (see also chart 4). By this measure, the intensity of U.S.-parent R&D expenditures was 7 percent.<sup>11</sup>

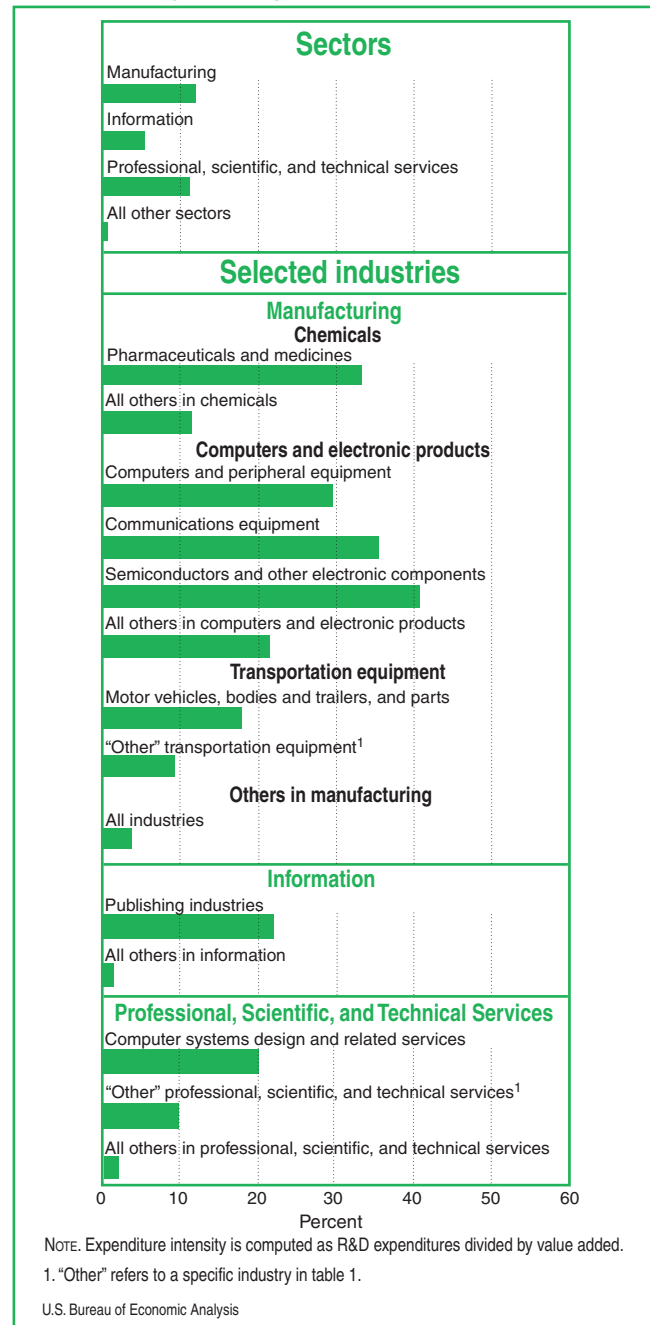
For the three major R&D-performing industry sectors—manufacturing; information; and professional, scientific, and technical services—parents' R&D intensities were 12 percent, 5 percent, and 11 percent, respectively. Within manufacturing, intensities were particularly high in semiconductors and other electronic components (41 percent), communications equipment (36 percent), pharmaceuticals and medicines (33 percent), computers and peripheral equipment (30 percent), and motor vehicles, bodies and trailers, and parts (18 percent). In information, the intensity was particularly high in publishing industries (22 percent, mostly due to the software publishing subindustry). In professional, scientific, and technical services, the intensity was particularly high in computer systems design and related services (20 percent).

Industry patterns of U.S.-parent R&D expenditures have changed since the 1999 survey. The share of the information sector in U.S.-parent R&D expenditures

rose to 9 percent in 2004 from 5 percent in 1999, primarily because of sharply higher spending by parents in publishing industries. The share of professional, scientific, and technical services rose to 8 percent from 7 percent. The share of manufacturing fell to 79 percent from 83 percent, primarily because of a decrease in spending by parents in transportation equipment (and despite an increase in pharmaceuticals).

Overall, the R&D expenditure intensity for U.S. parents increased only slightly from 1999 to 2004—from

**Chart 4. R&D Expenditure Intensities of Nonbank U.S. Parents by Industry, 2004**



10. This measure is also used by the NSF in many of its studies of R&D and allows analysts to focus on the output originating in firms in a specific industrial sector by subtracting the cost of services and materials purchased from other firms in that sector or in other sectors. Nonetheless, other measures of R&D intensity are also useful in the analysis of R&D, including the ratio of R&D expenditures to sales, the ratio of R&D employment to total employment, or either of these intensity measures computed just for R&D-performing firms. Other measures may relate more closely to the results of R&D, such as the number of patent applications or the number of patents granted. In some cases, the conclusions reached may differ, depending on the particular measure used.

11. An alternative measure of R&D expenditure intensity is shown in table 1—the ratio of R&D expenditures to the value added of R&D-performing parents. Because a minority of parents (and affiliates) had R&D expenditures, the ratio of expenditures to value added was substantially different, at both the all-industry level and at the detailed-industry level, depending on which of these two measures is used. Thus, this alternative is useful in showing the impact of nonperformers on detailed industry and higher level ratios. In the aggregate, this measure is nearly twice as high as the measure discussed in the text (13 percent versus 7 percent), but for individual industries, its size relative to that of the measure discussed in the text varies substantially. For example, it is only slightly higher in manufacturing (13 percent versus 12 percent), but it is much higher in information (21 percent versus 5 percent), reflecting particularly high R&D intensity by a number of software publishers.

NOTE. Expenditure intensity is computed as R&D expenditures divided by value added.

1. "Other" refers to a specific industry in table 1.

6.6 percent to 6.9 percent. However, there were sizable changes in intensity in several industries. In semiconductors and other electronic components manufacturing and in publishing industries, the intensity nearly doubled. In “other” chemicals, in contrast, the intensity fell sharply.

### R&D employment: Industry distribution and intensity

R&D employment is one aspect of MNC R&D activity for which data are collected only in the benchmark survey. U.S. parents employed 819,000 R&D workers in 2004 (table 1). In conjunction with total R&D expenditures, this R&D employment total implies that R&D spending per R&D employee was approximately \$186,000 (table C). In the industries with high intensity of R&D expenditures, R&D spending per R&D employee was particularly high in chemicals (approximately \$251,000), and it was particularly low in professional, scientific, and technical services (approximately \$153,000).<sup>12</sup>

Industry distributions of R&D employment were similar to those of R&D expenditures. Together, the three major R&D-performing industry sectors—manufacturing (633,000 R&D employees), professional, scientific, and technical services (84,000), and information (67,000)—accounted for about the same share of R&D employment (96 percent) as the share of R&D expenditures (97 percent).

In 2004, 4 percent of U.S. parents’ employees worked in R&D (this share can also be viewed as an “intensity” as shown for 2004 in the right column of table 1). The share of employees employed in R&D was

12. For several industries with low intensities, spending per R&D employee was below \$153,000.

**Table C. R&D Expenditures Per R&D Employee by Selected Industry, 2004**

[Dollars]

	U.S. parents	MOFAs
<b>All industries</b> .....	<b>186,129</b>	<b>153,518</b>
Manufacturing.....	191,080	154,455
Chemicals.....	251,243	233,019
<i>Of which:</i>		
Pharmaceuticals and medicines.....	258,232	284,518
Computers and electronic products.....	179,786	132,707
<i>Of which:</i>		
Computers and peripheral equipment.....	149,879	205,329
Communications equipment.....	159,839	128,908
Semiconductors and other electronic components.....	199,694	132,591
Transportation equipment.....	168,656	137,359
Motor vehicles, bodies and trailers, and parts.....	170,432	138,303
Other.....	166,372	126,674
Information.....	208,806	179,300
<i>Of which:</i>		
Publishing industries.....	239,160	188,570
Professional, scientific, and technical services.....	152,700	139,396
<i>Of which:</i>		
Computer systems design and related services.....	160,678	130,763
Other.....	179,036	155,812

MOFAs Majority-owned foreign affiliates  
R&D Research and development

relatively high in manufacturing (8 percent) and professional, scientific, and technical services (9 percent).

The combined share of R&D employment by parents in the three major industry sectors increased, rising 2 percentage points from 1999 to 2004. The share of parents in manufacturing rose to 77 percent in 2004 from 75 percent in 1999, and the share in information edged up to just over 8 percent from just under 8 percent. However, the share of parents in professional, scientific, and technical services edged down to 10 percent from 11 percent.

### R&D by Foreign Affiliates

In 2004, R&D expenditures by the foreign affiliates of U.S. parents was \$27.5 billion, or 15 percent of R&D expenditures by MNCs. In 1999, affiliate spending was \$18.1 billion, or 13 percent of MNC expenditures. In 2004, the intensity of R&D expenditures by foreign affiliates, at 3 percent, was less than the 7-percent intensity of their parents. R&D expenditures of foreign affiliates were also small relative to their capital expenditures. The value of the R&D expenditures of foreign affiliates was less than a fourth of the value of their capital expenditures (\$123.1 billion); for parents, the value of R&D expenditures was half of that of their capital expenditures.

Of all the affiliate R&D performed in 2004, \$24.5 billion, or 89 percent, was own-account R&D, \$2.5 billion, or 9 percent, was for affiliated businesses, and \$0.6 billion, or 2 percent, was for unaffiliated entities. The affiliate share of own-account R&D was a little lower than the parent share (93 percent). It increased 16 percentage points from 1999 to 2004. The 9-percent share of R&D for affiliated businesses—consisting of the U.S. parent and other foreign affiliates of the U.S. parent—was substantially larger than the 1-percent share of parent R&D conducted for their foreign affiliates. However, foreign affiliates may often benefit, directly or indirectly, from the R&D conducted by their parents, even if they are not funding or directing that R&D work. In dollar terms, the \$2.5 billion in R&D expenditures by foreign affiliates for affiliated businesses exceeded the spending by U.S. parents (\$1.8 billion) for their foreign affiliates.<sup>13</sup> R&D expenditures for affiliated businesses were particularly high for foreign affiliates in the publishing industry and in the computers and electronics products manufacturing industry, especially in computers and peripheral equipment and in semiconductors and other electronic components.

As with U.S. parents, the 2004 R&D performed for foreign affiliates by others (\$1.5 billion) was less than

13. Information on R&D expenditures for affiliated businesses was collected for the first time on the 2004 benchmark survey, so no comparison can be made with data for earlier years.



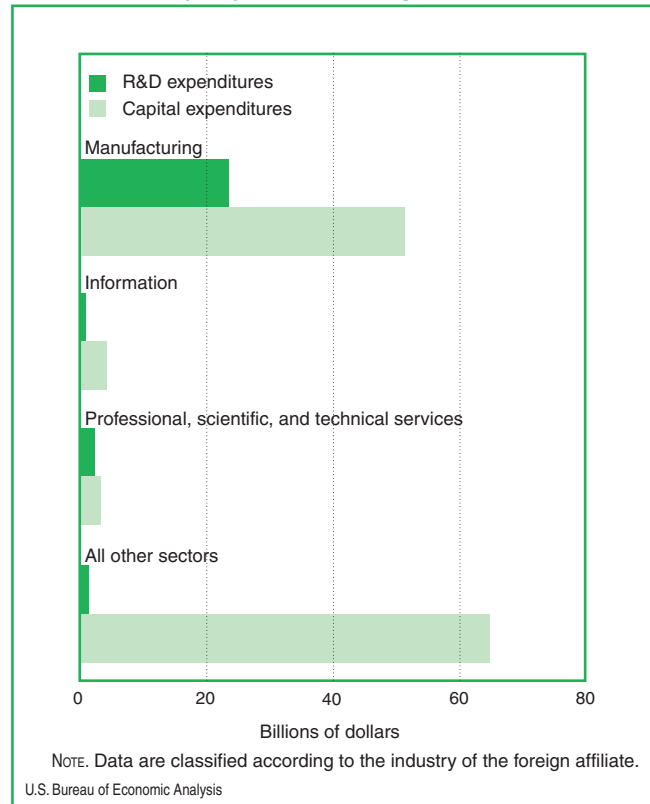
the R&D performed for others by the affiliates (\$2.1 billion). Of the total R&D funded by foreign affiliates, 6 percent was performed by others, compared with the 4-percent share of parent-funded R&D performed by others.

### R&D expenditures: Industry distribution and intensity

By industry of U.S. parent, foreign affiliates' share of MNC R&D expenditures was slightly higher in manufacturing (17 percent) than the 15-percent share of all industries (table B). Within manufacturing, the foreign-affiliate share of MNC R&D expenditures was particularly high in transportation equipment—especially in motor vehicles, bodies and trailers, and parts—where the \$7.3 billion of expenditures represented a third of the MNC total.

By industry of foreign affiliate, the three sectors—manufacturing; professional, scientific, and technical services; and information—that accounted for nearly all (97 percent) of R&D expenditures by U.S. parents accounted for 95 percent of R&D expenditures by foreign affiliates (table 2, chart 5). Affiliates' expenditures were highest in manufacturing (\$23.3 billion), followed by professional, scientific, and technical services (\$2.1 billion), and information (\$0.8 billion).

**Chart 5. R&D Expenditures and Capital Expenditures of Nonbank Majority-Owned Foreign Affiliates, 2004**



### Key Terms

The following key terms are used to describe U.S. multinational companies (MNCs).<sup>1</sup>

**U.S. multinational company (U.S. MNC).** The U.S. parent and its foreign affiliates. (In this article, an MNC is defined as the U.S. parent and its majority-owned foreign affiliates.)

**U.S. parent.** A person, resident in the United States, that owns or controls 10 percent or more of the voting securities, or the equivalent, of a foreign business enterprise. "Person" is broadly defined to include any individual, branch, partnership, associated group, association, estate, trust, corporation, or other organization (whether or not organized under the laws of any state), or any government entity. If incorporated, the U.S. parent is the fully consolidated U.S. enterprise consisting of (1) the U.S. corporation whose voting securities are not owned more than 50 percent by another U.S. corporation and (2) proceeding down each ownership chain from that

U.S. corporation, any U.S. corporation whose voting securities are more than 50 percent owned by the U.S. corporation above it. A U.S. parent comprises the domestic operations of a U.S. MNC, covering operations in the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and all other U.S. areas.

**U.S. direct investment abroad.** The ownership or control, directly or indirectly, by one U.S. person of 10 percent or more of the voting securities of an incorporated foreign business enterprise or the equivalent interest in an unincorporated business enterprise.

**Foreign affiliate.** A foreign business enterprise in which there is U.S. direct investment, that is, in which a U.S. person owns or controls (directly or indirectly) 10 percent or more of the voting securities or the equivalent. Foreign affiliates comprise the foreign operations of a U.S. MNC over which the parent is presumed to have a degree of managerial influence.

This article focuses on the operations of **majority-owned foreign affiliates** of U.S. parents; for these affiliates, the combined ownership of all U.S. parents exceeds 50 percent. In 2004, these affiliates accounted for 86 percent of the employment of all foreign affiliates of U.S. MNCs, up from 84 percent in 1999.

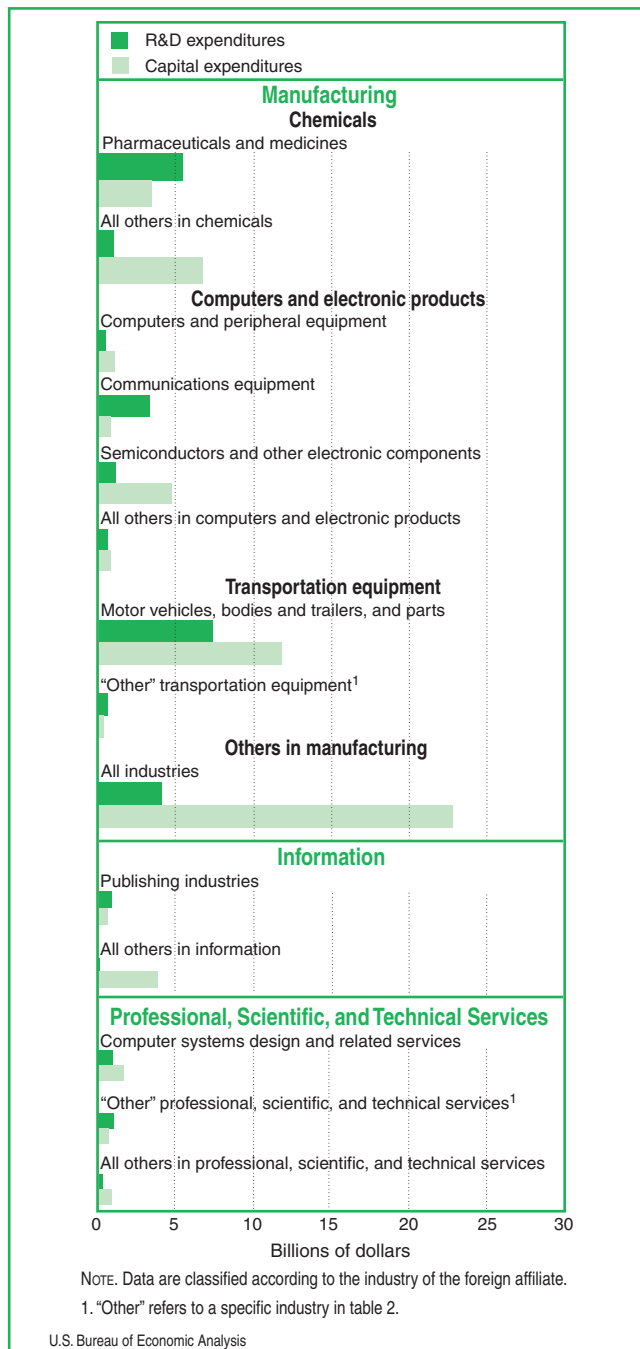
1. For a more comprehensive discussion of the terms and the concepts used to describe U.S. MNCs and their operations, see Raymond J. Matoloni Jr., "A Guide to BEA Statistics on U.S. Multinational Companies," SURVEY 75 (March 1995): 38–55. Data on the operations of U.S. MNCs cover the survey respondent's fiscal year ending in the reference year of the data.

Manufacturing alone accounted for 85 percent of total foreign affiliate R&D expenditures. At a more detailed level, affiliates in one subindustry in manufacturing—motor vehicles, bodies and trailers, and parts—had R&D expenditures of \$7.2 billion, or 30 percent of the all-industry total (chart 6).

In contrast to the parents' R&D expenditures, affiliates' R&D expenditures in wholesale trade (\$1.2 billion) were larger than those in information, mainly

because wholesale trade is a more important industry for foreign affiliates than for their parents; this industry accounted for 15 percent of foreign affiliates' value

**Chart 6. R&D Expenditures and Capital Expenditures of Nonbank Majority-Owned Foreign Affiliates, Selected Industries, 2004**



**Availability of Data on U.S. Direct Investment Abroad**

BEA collects two broad sets of data on U.S. direct investment abroad: (1) Financial and operating data of U.S. multinational companies (MNCs) and (2) international transactions and direct investment position data. The first data set provides a picture of the overall activities of foreign affiliates and U.S. parent companies, using a variety of indicators of their financial structure and operations. The second data set covers a foreign affiliate's transactions with its U.S. parent(s), focusing on the U.S. parent's share, or interest, in its affiliate rather than on the affiliate's size or level of operations.<sup>1</sup>

The preliminary estimates of the worldwide research and development (R&D) activities of MNCs for 2004—one aspect collected among many in the financial and operating data set—are presented in this article. Preliminary estimates related to other aspects of the operations of MNCs for 2004 and final estimates for 2003 were published in November 2006.<sup>2</sup> These estimates, along with more detailed estimates of MNC R&D activities, are available on BEA's Web site. The estimates are based on the 2003 Annual Survey of U.S. Direct Investment Abroad and the 2004 Benchmark Survey of U.S. Direct Investment Abroad.

The final estimates of U.S. MNC operations for 1977 and for 1982–2003, along with international transactions and direct investment position data, are available in publications or in files that can be downloaded for free from BEA's Web site at <[www.bea.gov](http://www.bea.gov)>. For more information on these products and how to obtain them, go to <[www.bea.gov/bea/ai/iidguide.htm](http://www.bea.gov/bea/ai/iidguide.htm)>.

BEA has also recently launched a free service on its Web site that allows users to access interactively detailed data on the operations of U.S. multinational companies, on the operations of foreign-owned companies in the United States, and on other aspects of U.S. direct investment abroad and foreign direct investment in the United States. For an introductory guide to this service, see Ned G. Howenstine, "Primer: Accessing BEA Direct Investment Data Interactively," SURVEY 86 (May 2006): 61–64.

1. Jennifer L. Koncz and Daniel R. Yorgason, "Direct Investment Positions for 2005: Country and Industry Detail," SURVEY 86 (July 2006); and Jeffrey H. Lowe, "U.S. Direct Investment Abroad: Detail for Historical-Cost Position and Related Capital and Income Flows, 2003–2005," SURVEY 86 (September 2006): 87–129.

2. Raymond J. Mataloni Jr. and Daniel R. Yorgason, "Operations of U.S. Multinational Companies: Preliminary Results From the 2004 Benchmark Survey," SURVEY 86 (November 2006): 37–68.

added, compared with only 5 percent of the parents' value added. The R&D expenditures by wholesale trade affiliates may also reflect secondary activities of these affiliates in industries, such as manufacturing, that are more typically associated with R&D activity.

The concentration of R&D expenditures is also evident in the intensity of R&D expenditures. Affiliates' R&D intensity in manufacturing (6 percent) and in professional, scientific, and technical services (5 percent) exceeded the 3-percent intensity at the all-industry level (chart 7). In all the other sectors, including information (with the next largest intensity of 2 percent), intensities were less than 3 percent.

As noted, the 3-percent affiliate intensity at the all-industry level was less than the 7-percent parent intensity. Affiliate intensities were also generally lower at more detailed industry levels. For example, in the computers and electronic products manufacturing industry, affiliate intensities for all but one subindustry were less than 9 percent, but parent intensities for all the subindustries shown in chart 4 were at least 21 percent.<sup>14</sup>

The industry pattern of affiliate R&D expenditures has changed since the 1999 benchmark survey. The share of these expenditures accounted for by manufacturing declined in 1999–2004, to 85 percent from 90 percent. The shares rose for wholesale trade; information; and professional, scientific, and technical services. In information, shares roughly tripled (though from a small base), rising to 3 percent in 2004 from 1 percent in 1999. In wholesale trade, shares were up by over half.

The average intensity of R&D expenditures of foreign affiliates increased only minimally (0.1 percentage point) in 1999–2004. In information, however, the intensity increased 1.5 percentage points. At a more disaggregated level, in computers and electronic products manufacturing, the intensity was up, particularly because of an increase in communications equipment. Despite the small increase at the aggregate level, intensities for all of the large R&D-performing sectors increased. The small increase in intensity at the aggregate level may have partly reflected a shift in the sectoral composition of value added away from manufacturing, which had the highest intensity in both 1999 and 2004, and toward other sectors in which R&D was less significant.<sup>15</sup>

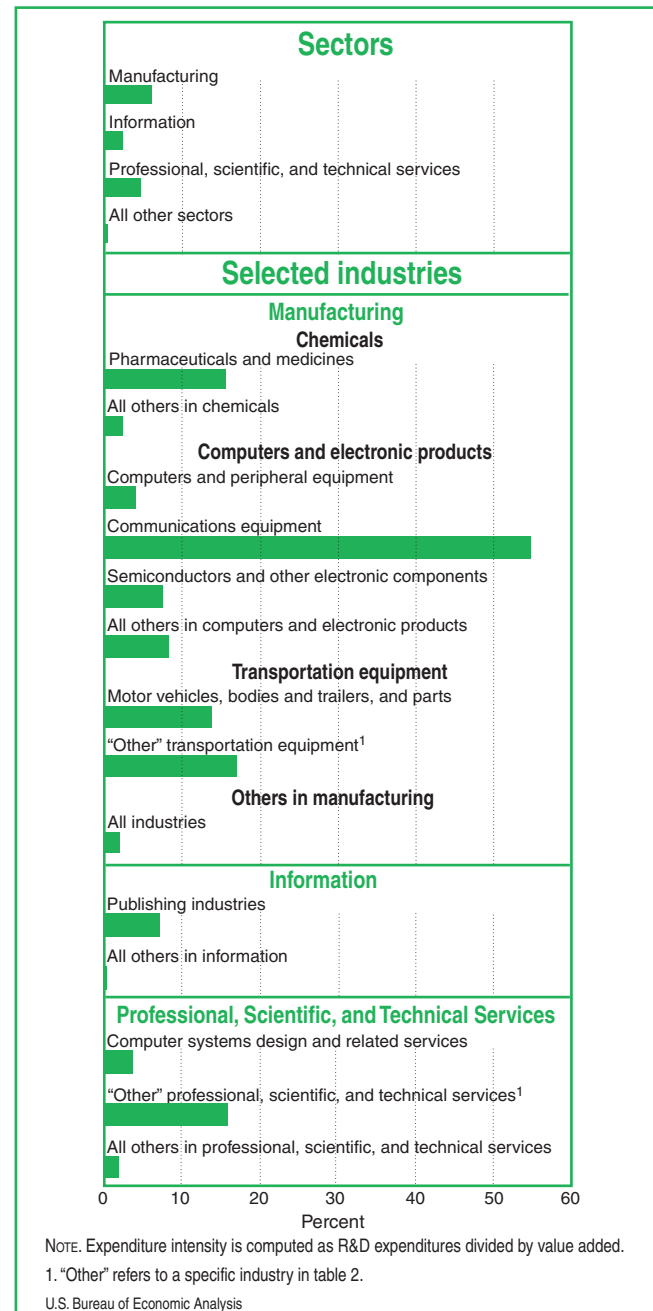
14. The one exception, communications equipment, had an affiliate intensity of 55 percent. Very high intensities such as this can result from situations where value added—the denominator in the intensity calculation—is unusually low, which might occur when startups constitute a large segment of a particular industry. In such situations, the share of employees in R&D may be a more informative intensity measure for many purposes.

15. Affiliates in manufacturing were responsible for 56 percent of foreign affiliates' value added in 1999 but for only 47 percent in 2004.

As foreign affiliates' share of MNC value added increased from 1999 to 2004 (rising to 27 percent from 23 percent), so did their share of the R&D activities of MNCs in several industries.<sup>16</sup> In particular, in both information and wholesale trade, foreign affiliates' shares of MNC R&D expenditures were up strongly. In

16. Note that these shares differ from those shown in table B, because affiliates are classified by their own industry, but, in table B, they are classified by the industry of their U.S. parent.

**Chart 7. R&D Expenditure Intensities of Nonbank Majority-Owned Foreign Affiliates by Industry of Affiliate, 2004**



information, affiliates' share of R&D expenditures more than doubled, growing to 5.7 percent from 2.3 percent.

**R&D employment: Industry distribution and intensity**

In 2004, foreign affiliates had 179,000 R&D employees, or 2 percent of total employment by foreign affiliates. These workers represent 18 percent of all R&D workers employed by MNCs. By industry of affiliate, affiliates' shares of MNC R&D employment were particularly high in wholesale trade (32 percent) and were particularly low in information (7 percent). R&D expenditures per R&D employee was approximately \$154,000, roughly \$32,000 less than the \$186,000 per employee for parents (table C).<sup>17</sup> R&D spending per R&D employee was particularly high in pharmaceuticals (\$285,000) and was particularly low in communications equipment (\$129,000).

Manufacturing affiliates employed 151,000 R&D workers, or 84 percent of all affiliate R&D workers. Within manufacturing, transportation equipment accounted for the most of the employees—56,000, or nearly a third of all R&D workers of foreign affiliates.

The share of R&D employment of affiliates in manufacturing declined in 1999–2004, to 84 percent from 88 percent in 1999, similar to the drop in these affiliates' share of R&D expenditures. Like their shares of R&D expenditures, affiliates' employment shares rose in wholesale trade, information, and professional, scientific, and technical services.

At the aggregate level, R&D employment intensity increased to 2.1 percent from 1.6 percent. That increase was larger than the increase in expenditure intensity. In manufacturing, R&D employment intensity rose to 3.6 percent from 2.5 percent.

**R&D expenditures: Geographic distribution and intensity**

Of the foreign affiliates' \$27.5 billion in R&D expenditures in 2004, \$18.1 billion (66 percent) was by affiliates in Europe, \$4.9 billion (18 percent) was by affiliates in Asia and Pacific, and \$2.7 billion (10 percent) was by affiliates in Canada (table 3). Europe's leading position reflected both its relative importance in production by foreign affiliates and its relatively high R&D expenditure intensity (4 percent); among major regions, only the Middle East (11 percent) had a higher intensity, reflecting R&D in Israel.

By country, the largest affiliate R&D expenditures

were in the United Kingdom (\$5.5 billion), Germany (\$4.7 billion), and Canada (\$2.7 billion) (chart 8). Expenditures also exceeded \$1.0 billion in France, Japan, and Sweden. R&D expenditure intensities in all of these countries except Canada were greater than the

**Chart 8. R&D Expenditures and Capital Expenditures of Nonbank Majority-Owned Foreign Affiliates, Selected Countries, 2004**



17. By comparison, average employee compensation for each worker was \$20,000 less for affiliates than for parents (\$38,000 versus \$58,000).

3-percent worldwide intensity (chart 9). Germany's intensity was 6 percent, and Sweden's was 14 percent. Among the other countries shown in chart 8, intensities were particularly high in Israel (35 percent) and in Singapore, Switzerland, and China (5 percent in each). In Israel, much of the R&D expenditures were in computers and electronic products manufacturing—particularly in computer and peripheral equipment and communications equipment—and in professional, scientific, and technical services.

The shares of R&D expenditures accounted for by affiliates in Europe fell 1 percentage point to 66 percent in 2004, and their share of R&D employment fell 3 percentage points to 64 percent. Balancing the fall in the European share, R&D expenditure shares of Can-

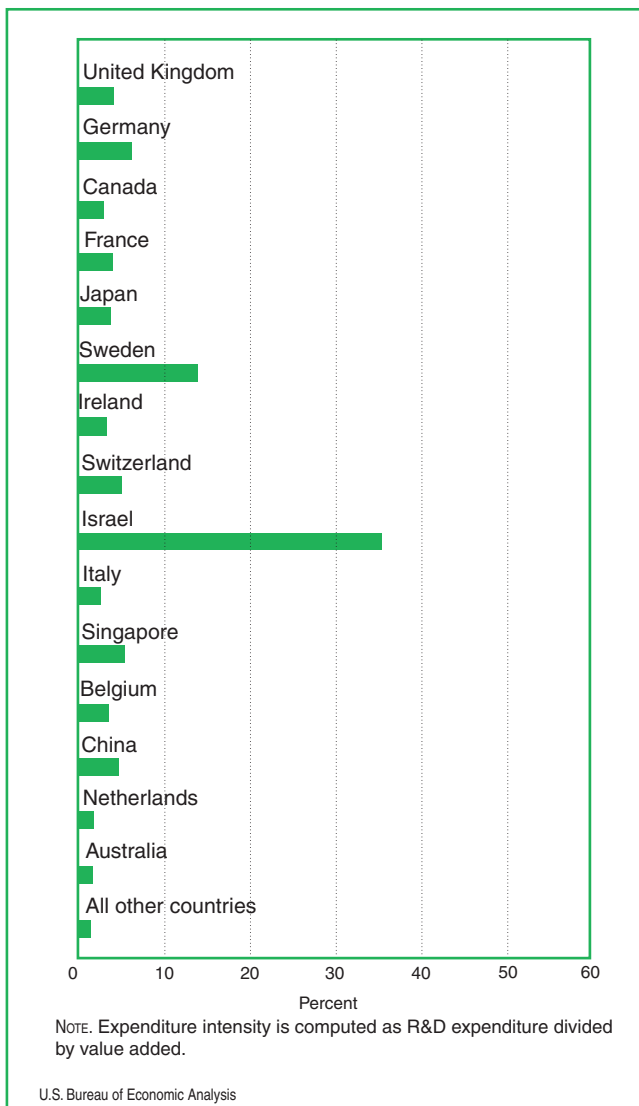
ada and the Middle East both rose slightly, to 10 percent and 3 percent, respectively.

The share of R&D expenditures accounted for by affiliates in the United Kingdom, the top R&D-performing country, fell 2 percentage points in 1999–2004, to 20 percent. Shares of affiliates in Germany, France, and Japan also fell. R&D activities became somewhat more broadly dispersed during this period, as the combined R&D expenditure share of the top six R&D-performing countries—using the 2004 rankings—fell 7 percentage points to 65 percent.

### R&D employment: Geographic distribution and intensity

For R&D employment, the 2004 ranking of the top six countries—the United Kingdom, Germany, Canada, France, Japan, and Sweden—was the same as the ranking by R&D expenditures. However, Israel, with over 6,000 R&D employees, was seventh, ahead of Ireland and Switzerland. Israel also had the highest R&D employment intensity (R&D employment as a share of total employment), 18 percent. Sweden's employment intensity (9 percent) was also relatively high.

**Chart 9. R&D Expenditure Intensities of Nonbank Majority-Owned Foreign Affiliates, Selected Countries, 2004**



## Appendix

### R&D: What Is It and Who Conducts It?

R&D, as generally defined and as used in this article covers many, but not all, innovative activities. This appendix compares several popular definitions of R&D with a particular emphasis on the definition used in this article. It then discusses the characteristics of U.S. MNCs that conduct R&D.

#### R&D: What is it?

The *Frascati Manual*, one of two international standards for R&D statistics, provides the following basic definition of R&D:

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.<sup>18</sup>

The *Frascati Manual* provides additional specific guidance in identifying which activities constitute R&D and which do not, and it includes the requirement that R&D activities be classified as basic research, applied research, or development. The other international standard is the *System of National Accounts 1993*

18. Organisation for Economic Co-operation and Development (OECD), *Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development* (Paris: OECD Publications, 2002): 30.

(SNA).<sup>19</sup> Broadly, this standard differs from that in the *Frascati Manual* by placing less emphasis on novelty or the resolution of scientific or technological uncertainty and more emphasis on activities that result in products being brought to market. The SNA definition of R&D includes some activities excluded by the *Frascati* definition (for example, market research and quality control) and excludes others included by the *Frascati* definition (for example, activities that increase knowledge without affecting economic activity).

The National Science Foundation (NSF) is primarily responsible for data collection on U.S. domestic R&D, and in its surveys, it closely follows the *Frascati* definition of R&D.<sup>20</sup> BEA has adopted the NSF definition for its surveys of MNCs. In practice, the definitions used in the NSF and BEA surveys are somewhat more restrictive than the *Frascati* definition, focusing on work in the natural sciences and engineering and excluding work in the social sciences and humanities.

The three types of R&D activities are described in the instructions for BEA's benchmark survey of U.S. direct investment abroad as follows:

**Basic research** is the pursuit of new scientific knowledge or understanding that does not have specific immediate commercial objectives, although it may be in fields of present or potential commercial interest.

**Applied research** applies the findings of basic research or other existing knowledge toward discovering new scientific knowledge that has specific commercial objectives with respect to new products, services, processes, or methods.

**Development** is the systematic use of the knowledge or understanding gained from research or practical experience directed toward the production or significant improvement of useful products, services, processes, or methods, including the design and development of prototypes, materials, devices, and systems.<sup>21</sup>

## R&D: Who conducts it?

R&D is performed by a subset of U.S. parents and foreign affiliates. However, these firms tend to be among the largest in the MNC data set. Additionally, R&D performance tends to be persistent (that is, individual firms tend to maintain their status as R&D performers or as nonperformers). The following details are based on data from the 2004 benchmark survey of U.S. direct investment abroad and changes since the 1999 benchmark survey.

**Incidence of R&D performance.** Only about a third of U.S. parents, and an even smaller share of foreign affiliates, performed R&D in 2004.

- In 2004, 34 percent of parents and 9 percent of affiliates performed R&D.
- Parents and affiliates both performed R&D in 17 percent of MNCs, only parents performed R&D in 17 percent of MNCs, and only affiliates performed R&D in 3 percent of MNCs.
- In manufacturing, 52 percent of U.S. parents and 21 percent of foreign affiliates performed R&D. Parents and affiliates both performed R&D in 29 percent of the manufacturing MNCs, only parents performed R&D in 23 percent, and only affiliates performed R&D in 4 percent.

**Size of R&D performers.** R&D activity tends to be concentrated among the larger firms. However, among R&D-performing firms, a relation between R&D intensity and firm size is more difficult to confirm; the differences in size among firms grouped by their R&D intensities are small and may be positive or negative, depending on the indicator used for size.

- The average value added of R&D-performing parents was 232 percent of the average value added of nonperforming parents.
- Of R&D-performing parents, the average value added of the half with the highest R&D employment intensities was 124 percent of the average value added of R&D-performing parents with the lowest intensities.<sup>22</sup> However, most of this difference is attributable to the largest parents tending to be high-intensity R&D performers; the difference between the average value added of low-intensity performers and high-intensity performers substantially narrows when the top 1 percent of value-added-generating parents are excluded

19. Commission of the European Communities—Eurostat, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and World Bank, *System of National Accounts 1993* (Brussels/Luxembourg, New York, Paris, Washington, DC, 1993). The revised SNA, due out in 2008, will likely recommend the capitalization of R&D in satellite accounts, as noted in United Nations, “Report of the Intersecretariat Working Group on National Accounts” (E/CN.3/2007/7, distributed December 19, 2006). BEA recently released several different estimates of the capitalized value of domestic expenditures on R&D, and demonstrated the effect of these estimates on GDP, in its R&D satellite account (Okubo, et al.).

20. As noted, the Census Bureau collects the data on behalf of NSF.

21. The survey is available on BEA's Web site at <[www.bea.gov/surveys/diasurv.htm](http://www.bea.gov/surveys/diasurv.htm)>. Data on the three types of R&D are not collected separately in BEA's surveys, but a breakout will be available for U.S. parents in the forthcoming project linking BEA's and NSF's R&D data. For more information on the linking project, see the introduction to this article and footnote 3.

22. R&D employment intensity is defined as R&D employment as a share of total employment. R&D employment intensities are used here rather than R&D expenditure intensities because the expenditure intensity calculation uses value added in its denominator. Because value added—particularly at the firm level—can be very small (or negative) relative to R&D expenditures, generating meaningful firm-level intensity comparisons is difficult. Nonetheless, if expenditure intensities are used, the results are similar.

from the analysis.<sup>23</sup>

- Using a different indicator of size—ranking by average value-added percentile rather than average amount of value added—the results change somewhat.<sup>24</sup> By this alternative measure, R&D performers ranked substantially above nonperformers, but high-intensity performers were similar to low-intensity performers. Parents with no R&D were, on average, in the 44<sup>th</sup> percentile of value added. R&D performing parents were ranked much higher on average; high-intensity parents were in the 67<sup>th</sup> percentile, and low-intensity parents were in the 69<sup>th</sup>.<sup>25</sup>
- The average value added of R&D-performing affiliates was 436 percent of the average value added of nonperforming affiliates.
  - The average value added of R&D-performing affiliates with high-intensity performance was 116 percent of that of R&D-performing affiliates with

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23. “High-intensity group” (or variants of this term) refers to the half of R&D performers with the highest R&D employment intensities, and “low-intensity group” refers to the half of R&D performers with the lowest R&D employment intensities.

24. There are multiple similar, but not identical, definitions of percentile. The value-added percentiles used here are constructed by ranking the parents according to their value added and dividing the set of parents into 100 groups, each with equal numbers of parents. The group consisting of the parents with the highest levels of value added are in the 100<sup>th</sup> percentile and the group consisting of the parents with the lowest levels of value added are in the 1<sup>st</sup> percentile.

25. Slightly more sophisticated calculations that excluded parents or affiliates in industries with little R&D or that adjusted for parent or affiliate industry (or that did both) did not considerably change the results.

low-intensity performance. Like the parents, the difference between the two groups is largely driven by the top 1 percent of value-added-generating affiliates.

- The average ranking by value-added percentile of affiliates with no R&D employment was 25 points less than that of both affiliates with high R&D employment intensities and affiliates with low intensities.

**Persistence of R&D performance.** MNCs that perform R&D tend to continue performing; firms that do not perform tend to continue not performing.<sup>26</sup>

- Of the MNCs that reported in both the 1999 and 2004 benchmark surveys, 33 percent performed R&D in both years, 55 percent performed no R&D in either year, 6 percent performed R&D only in 1999, and 7 percent performed R&D only in 2004.
- Of the U.S. parents that reported in both the 1999 and 2004 benchmark surveys, 31 percent performed R&D in both years, 57 percent performed no R&D in either year, 7 percent performed R&D only in 1999, and 5 percent performed R&D only in 2004.

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26. The unit of observation is the MNC or the U.S. parent. Foreign affiliates are not considered as units of observation because verifying the continuity of a given affiliate from one benchmark survey to the next is more problematic for an individual foreign affiliate than it is for an individual parent or for a group of all affiliates of the same parent.

*Tables 1–3 follow.*

**Table 1. R&D Expenditures, Employment, and Intensities of Nonbank U.S. Parents by Industry, 1999 and 2004**

	R&D expenditures (millions of dollars)		R&D employment (thousands of employees)		R&D intensity (percent)					
	1999	2004	1999	2004	Ratio of R&D expenditures to value added		Ratio of R&D expenditures to value added of R&D- performing U.S. parents		Ratio of R&D employment to total employment	
					1999	2004	1999	2004	1999	2004
<b>All industries</b> .....	<b>126,291</b>	<b>152,384</b>	<b>646.8</b>	<b>818.7</b>	<b>6.6</b>	<b>6.9</b>	<b>10.8</b>	<b>12.8</b>	<b>2.8</b>	<b>3.8</b>
<b>Mining</b> .....	<b>212</b>	<b>(D)</b>	<b>3.1</b>	<b>3.2</b>	<b>1.1</b>	<b>(D)</b>	<b>1.8</b>	<b>(D)</b>	<b>2.8</b>	<b>1.7</b>
Oil and gas extraction.....	53	(D)	0.3	0.1	0.6	(D)	1.2	(D)	1.6	0.5
Other .....	159	447	2.8	3.1	1.6	2.5	2.1	4.9	3.1	1.9
<b>Utilities</b> .....	<b>81</b>	<b>18</b>	<b>1.6</b>	<b>0.2</b>	<b>0.1</b>	<b>(*)</b>	<b>0.2</b>	<b>0.1</b>	<b>0.4</b>	<b>0.1</b>
<b>Manufacturing</b> .....	<b>104,842</b>	<b>120,851</b>	<b>485.9</b>	<b>632.5</b>	<b>11.3</b>	<b>12.0</b>	<b>12.2</b>	<b>13.1</b>	<b>5.4</b>	<b>8.0</b>
Food .....	934	1,400	21.7	9.2	1.9	1.9	2.0	2.1	3.4	1.3
Beverage and tobacco products.....	501	452	2.4	2.6	1.1	0.8	1.2	1.0	0.9	1.1
Textiles, apparel, and leather products.....	275	102	2.7	1.2	1.5	0.9	2.8	2.1	0.7	0.7
Wood products .....	31	105	0.2	0.9	0.9	1.1	1.4	1.1	0.5	1.2
Paper.....	1,478	1,336	9.2	8.6	3.2	3.7	3.3	5.1	2.1	2.8
Printing and related support activities.....	129	220	1.3	2.0	1.2	1.8	2.0	2.6	0.8	1.1
Petroleum and coal products.....	990	1,251	8.1	7.2	1.2	1.0	1.3	1.2	2.9	3.4
Chemicals .....	28,198	40,270	112.9	160.3	21.0	22.9	21.7	23.4	11.5	17.3
Basic chemicals .....	1,627	1,881	12.7	9.5	8.6	10.4	9.3	10.6	8.7	7.9
Resins and synthetic rubber, fibers, and filaments.....	2,784	2,392	13.6	14.9	14.6	13.2	14.7	13.2	10.7	15.8
Pharmaceuticals and medicines .....	18,382	31,046	61.2	120.2	32.8	33.0	32.9	33.2	17.7	28.2
Soap, cleaning compounds, and toilet preparations	1,957	2,584	9.9	7.4	10.8	12.2	11.5	12.5	6.8	6.6
Other .....	3,449	2,368	15.4	8.3	15.9	9.8	16.6	10.7	6.9	4.9
Plastics and rubber products.....	1,031	925	8.2	6.8	4.4	4.0	4.7	4.4	2.7	2.6
Nonmetallic mineral products.....	371	426	3.2	2.2	2.7	3.0	3.2	3.8	2.1	1.5
Primary and fabricated metals .....	1,320	1,211	9.7	13.6	2.9	2.2	3.4	2.7	1.6	2.6
Primary metals .....	760	472	3.8	8.2	3.3	1.6	3.8	1.9	1.3	3.0
Fabricated metal products.....	560	739	5.9	5.4	2.4	2.9	2.9	3.8	1.8	2.1
Machinery .....	5,252	5,780	34.9	32.2	10.3	11.0	11.4	11.7	5.2	5.4
Agriculture, construction, and mining machinery .....	1,340	1,722	7.4	8.3	10.6	12.4	11.3	12.7	4.8	6.4
Industrial machinery.....	1,250	1,652	8.7	5.0	17.8	24.8	20.3	28.4	11.2	6.4
Other .....	2,662	2,405	18.9	19.0	8.5	7.6	9.6	8.1	4.3	4.9
Computers and electronic products .....	30,298	35,810	132.7	199.2	28.6	32.3	29.5	33.3	13.2	21.1
Computers and peripheral equipment.....	5,659	7,371	24.5	49.2	29.0	29.5	29.6	29.6	12.9	23.3
Communications equipment.....	13,276	10,473	68.7	65.5	38.4	35.5	38.6	37.8	20.8	29.7
Audio and video equipment.....	407	433	2.1	2.6	7.4	18.4	7.5	19.1	3.7	10.4
Semiconductors and other electronic components.....	8,997	12,369	25.9	61.9	23.0	40.7	24.2	41.7	7.8	27.0
Navigational, measuring, and other instruments.....	1,579	(D)	9.8	19.7	25.3	(D)	28.1	(D)	11.1	7.7
Magnetic and optical media .....	381	(D)	1.7	0.2	30.3	(D)	34.9	(D)	16.4	6.4
Electrical equipment, appliances, and components.....	2,958	1,266	23.9	8.5	9.4	7.9	10.2	8.6	5.3	4.2
Transportation equipment.....	29,162	25,795	99.7	152.9	12.3	12.8	12.8	13.1	4.5	8.2
Motor vehicles, bodies and trailers, and parts.....	17,513	14,662	62.8	86.0	13.3	17.9	13.9	19.1	5.4	8.9
Other .....	11,649	11,133	36.9	66.9	11.1	9.3	11.5	9.3	3.5	7.5
Furniture and related products.....	90	106	1.6	1.1	1.2	1.3	1.3	1.4	1.2	0.9
Miscellaneous manufacturing.....	1,826	4,397	13.7	24.0	8.1	11.5	9.3	12.1	4.5	6.7
<b>Wholesale trade</b> .....	<b>4,000</b>	<b>(D)</b>	<b>26.3</b>	<b>17.0</b>	<b>5.0</b>	<b>(D)</b>	<b>10.0</b>	<b>(D)</b>	<b>2.9</b>	<b>2.1</b>
<i>Of which:</i>										
Professional and commercial equipment and supplies.....	2,635	(D)	15.3	(D)	11.9	(D)	19.4	(D)	6.6	(D)
Petroleum and petroleum products .....	(D)	(D)	0.2	0.5	(D)	(D)	(D)	(D)	0.6	0.9
<b>Information</b> .....	<b>6,763</b>	<b>14,003</b>	<b>50.6</b>	<b>67.1</b>	<b>2.7</b>	<b>5.4</b>	<b>5.5</b>	<b>20.8</b>	<b>2.6</b>	<b>3.8</b>
<i>Of which:</i>										
Publishing industries .....	4,050	11,018	25.1	46.1	10.2	21.9	20.0	43.5	7.7	14.3
Telecommunications.....	(D)	283	7.3	(D)	(D)	0.2	(D)	1.2	0.9	(D)
<b>Finance (except depository institutions) and insurance</b> .....	<b>315</b>	<b>350</b>	<b>2.7</b>	<b>8.2</b>	<b>0.3</b>	<b>0.2</b>	<b>3.4</b>	<b>1.0</b>	<b>0.2</b>	<b>0.7</b>
Finance, except depository institutions .....	240	183	(D)	(D)	0.5	0.3	9.4	2.8	(D)	(D)
Securities, commodity contracts, and other intermediation .....	(D)	(D)	0.1	(D)	(D)	(D)	(D)	(D)	(*)	(D)
Other finance, except depository institutions .....	(D)	(D)	(D)	0.1	(D)	(D)	(D)	(D)	(D)	0.1
Insurance carriers and related activities.....	75	167	(D)	(D)	0.1	0.2	1.1	0.6	(D)	(D)
<b>Professional, scientific, and technical services</b> .....	<b>8,522</b>	<b>12,787</b>	<b>68.1</b>	<b>83.7</b>	<b>8.9</b>	<b>11.1</b>	<b>19.4</b>	<b>23.0</b>	<b>6.7</b>	<b>8.7</b>
Architectural, engineering, and related services .....	49	91	0.4	(D)	0.7	0.6	2.4	2.7	0.3	(D)
Computer systems design and related services .....	7,453	8,689	45.1	54.1	17.7	20.0	20.3	22.1	11.5	15.1
Management, scientific, and technical consulting .....	(D)	580	(D)	(D)	(D)	4.9	(D)	11.4	(D)	(D)
Advertising and related services .....	(D)	1	(*)	(*)	(D)	(*)	(D)	0.5	0.2	(*)
Other .....	716	3,427	(D)	19.1	2.5	9.6	28.7	44.8	(D)	6.8
<b>Other industries</b> .....	<b>1,556</b>	<b>1,028</b>	<b>8.5</b>	<b>6.9</b>	<b>0.5</b>	<b>0.2</b>	<b>3.3</b>	<b>3.7</b>	<b>0.1</b>	<b>0.1</b>
Agriculture, forestry, fishing, and hunting .....	2	32	(*)	0.4	0.2	1.8	0.4	2.1	0.1	1.6
Construction .....	(D)	3	(D)	(*)	(D)	(*)	(D)	1.8	(D)	(*)
Retail trade.....	(D)	53	(D)	0.7	(D)	(*)	(D)	0.8	(D)	(*)
Transportation and warehousing.....	26	(*)	0.2	(D)	(*)	(*)	0.2	(*)	(*)	(D)
Real estate and rental and leasing.....	(D)	(D)	0.1	0.1	(D)	(D)	(D)	(D)	0.1	(*)
Real estate .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rental and leasing (except real estate).....	(D)	(D)	0.1	0.1	(D)	(D)	(D)	(D)	0.1	(*)
Management of nonbank companies and enterprises .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Administration, support, and waste management .....	6	(D)	0.1	(D)	(*)	(D)	0.2	(D)	(*)	(D)
Health care and social assistance.....	(D)	32	0.1	0.2	(D)	0.1	(D)	1.3	(*)	0.1
Accommodation and food services.....	25	9	0.3	(*)	0.1	(*)	0.3	0.2	(*)	(*)
Accommodation .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food services and drinking places.....	25	9	0.3	(*)	0.1	(*)	0.3	0.2	(*)	(*)
Miscellaneous services .....	15	163	0.1	1.4	0.2	1.0	2.0	7.3	0.1	0.4

D Suppressed to avoid disclosure of data of individual companies.  
 \* Less than \$500,000, fewer than 50 employees, or less than 0.05 percent (+/-).  
 R&D Research and development



Table 2. R&D Expenditures, Employment, and Intensities of Nonbank Majority-Owned Foreign Affiliates by Industry, 1999 and 2004<sup>1</sup>

	R&D expenditures (millions of dollars)		R&D employment (thousands of employees)		R&D intensity (percent)					
					Ratio of R&D expenditures to value added		Ratio of R&D expenditures to value added of R&D- performing MOFAs		Ratio of R&D employment to total employment	
	1999	2004	1999	2004	1999	2004	1999	2004	1999	2004
<b>All industries</b> .....	<b>18,144</b>	<b>27,529</b>	<b>123.5</b>	<b>179.3</b>	<b>3.2</b>	<b>3.3</b>	<b>9.2</b>	<b>11.0</b>	<b>1.6</b>	<b>2.1</b>
<b>Mining</b> .....	<b>8</b>	<b>8</b>	<b>0.1</b>	<b>0.1</b>	<b>(*)</b>	<b>(*)</b>	<b>0.1</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>
Oil and gas extraction .....	4	3	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Other .....	4	4	0.1	(*)	0.1	(*)	1.3	1.2	0.1	(*)
<b>Utilities</b> .....	<b>(*)</b>	<b>2</b>	<b>(*)</b>	<b>(*)</b>	<b>(*)</b>	<b>(*)</b>	<b>0.5</b>	<b>2.0</b>	<b>(*)</b>	<b>(*)</b>
<b>Manufacturing</b> .....	<b>16,388</b>	<b>23,288</b>	<b>108.5</b>	<b>150.8</b>	<b>5.2</b>	<b>6.0</b>	<b>9.5</b>	<b>11.3</b>	<b>2.5</b>	<b>3.5</b>
Food .....	367	634	3.3	3.4	2.0	2.6	3.1	3.9	1.0	0.9
Beverage and tobacco products .....	32	23	0.3	0.2	0.1	0.1	0.3	0.2	0.2	0.2
Textiles, apparel, and leather products .....	37	68	0.4	0.5	1.0	2.0	3.7	5.4	0.3	0.4
Wood products .....	2	1	(*)	(*)	0.1	(*)	1.1	0.3	0.1	(*)
Paper .....	265	88	1.9	0.7	3.0	0.8	5.9	1.9	1.4	0.6
Printing and related support activities .....	3	11	0.0	0.1	0.3	0.7	1.0	9.7	0.1	0.3
Petroleum and coal products .....	66	43	0.5	0.4	0.1	0.1	0.3	0.2	1.2	1.0
Chemicals .....	4,340	6,254	25.4	26.8	7.4	8.2	11.3	13.6	4.5	4.8
Basic chemicals .....	106	147	1.5	1.6	1.2	1.3	3.0	3.0	1.9	2.2
Resins and synthetic rubber, fibers, and filaments .....	173	242	2.0	2.0	3.7	3.9	4.7	4.6	5.0	4.7
Pharmaceuticals and medicines .....	3,578	5,302	17.1	18.6	14.0	15.5	17.3	20.9	8.5	9.2
Soap, cleaning compounds, and toilet preparations .....	135	186	1.4	1.9	1.5	1.6	3.0	4.6	1.1	1.4
Other .....	348	377	3.5	2.7	3.2	3.0	5.9	6.0	3.0	2.4
Plastics and rubber products .....	216	293	1.9	2.2	2.6	2.7	7.5	4.7	1.1	1.3
Nonmetallic mineral products .....	38	378	1.7	0.6	1.0	6.6	4.0	17.0	2.5	0.8
Primary and fabricated metals .....	151	197	1.4	1.9	1.2	1.3	3.1	2.5	0.6	0.8
Primary metals .....	27	40	0.3	0.5	0.6	0.6	1.1	0.9	0.4	0.4
Fabricated metal products .....	124	157	1.2	1.4	1.6	1.9	5.1	4.7	0.8	1.1
Machinery .....	748	791	6.4	6.7	4.0	3.8	7.2	7.8	1.8	1.9
Agriculture, construction, and mining machinery .....	168	230	1.3	1.5	4.7	4.3	7.3	7.2	2.2	2.0
Industrial machinery .....	216	118	1.3	1.1	9.9	5.5	17.1	13.7	3.7	3.4
Other .....	364	443	3.8	4.1	2.8	3.3	5.3	7.2	1.5	1.7
Computers and electronic products .....	3,773	5,283	22.8	39.8	10.0	13.5	19.1	22.1	3.0	6.2
Computers and peripheral equipment .....	356	479	2.1	2.3	2.7	4.0	6.2	12.7	0.9	1.7
Communications equipment .....	2,403	3,179	12.8	24.7	38.3	54.8	44.6	64.6	12.9	19.1
Audio and video equipment .....	146	(D)	1.2	0.5	43.1	(D)	n.m.	(D)	2.4	1.4
Semiconductors and other electronic components .....	644	1,057	5.1	8.0	4.8	7.4	9.5	9.5	1.6	3.0
Navigational, measuring, and other instruments .....	224	500	1.7	4.1	6.2	9.5	12.0	14.7	3.3	6.1
Magnetic and optical media .....	0	(D)	0.0	0.3	0.0	(D)	0.0	(D)	0.0	3.4
Electrical equipment, appliances, and components .....	214	551	3.8	5.5	2.9	5.2	5.0	7.5	1.4	2.2
Transportation equipment .....	5,669	7,741	35.5	56.4	11.6	14.0	16.9	20.6	4.1	6.0
Motor vehicles, bodies and trailers, and parts .....	5,385	7,161	32.7	51.8	11.6	13.8	16.8	20.1	4.0	5.8
Other .....	284	579	2.8	4.6	11.0	17.0	19.8	28.8	6.8	9.6
Furniture and related products .....	(D)	44	0.2	0.4	(D)	2.7	(D)	4.7	0.5	1.3
Miscellaneous manufacturing .....	(D)	887	2.9	5.2	(D)	5.9	(D)	10.0	1.7	2.9
<b>Wholesale trade</b> .....	<b>515</b>	<b>1,205</b>	<b>4.0</b>	<b>7.9</b>	<b>0.7</b>	<b>1.0</b>	<b>5.0</b>	<b>7.7</b>	<b>0.6</b>	<b>1.1</b>
<i>Of which:</i>										
Professional and commercial equipment and supplies .....	272	724	2.0	5.0	1.0	2.2	5.3	8.8	0.8	1.7
Petroleum and petroleum products .....	(D)	(*)	0.1	(*)	(D)	(*)	(D)	1.8	0.2	0.2
<b>Information</b> .....	<b>161</b>	<b>843</b>	<b>1.2</b>	<b>4.7</b>	<b>0.8</b>	<b>2.3</b>	<b>11.2</b>	<b>14.2</b>	<b>0.4</b>	<b>1.5</b>
<i>Of which:</i>										
Publishing industries .....	132	781	0.8	4.1	2.6	7.0	11.0	14.2	1.4	5.4
Telecommunications .....	1	42	(*)	0.4	(*)	0.4	12.7	31.1	(*)	0.5
<b>Finance (except depository institutions) and insurance</b> .....	<b>1</b>	<b>1</b>	<b>0.0</b>	<b>(*)</b>	<b>(*)</b>	<b>(*)</b>	<b>n.m.</b>	<b>0.6</b>	<b>0.0</b>	<b>(*)</b>
Finance, except depository institutions .....	0	0	0.0	(*)	0.0	(*)	0.0	5.5	0.0	(*)
Securities, commodity contracts, and other intermediation .....	0	1	0.0	(*)	0.0	(*)	0.0	5.5	0.0	(*)
Other finance, except depository institutions .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Insurance carriers and related activities .....	1	(*)	0.0	(*)	(*)	(*)	n.m.	(*)	0.0	(*)
<b>Professional, scientific, and technical services</b> .....	<b>1,040</b>	<b>2,120</b>	<b>9.5</b>	<b>15.2</b>	<b>3.3</b>	<b>4.6</b>	<b>22.3</b>	<b>14.0</b>	<b>2.4</b>	<b>3.2</b>
Architectural, engineering, and related services .....	(D)	152	(D)	1.3	(D)	4.7	(D)	72.9	(D)	3.4
Computer systems design and related services .....	305	888	2.6	6.8	1.9	3.5	7.9	6.4	1.7	2.9
Management, scientific, and technical consulting .....	(D)	97	0.1	0.8	(D)	1.5	(D)	171.2	0.1	1.6
Advertising and related services .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other .....	519	982	(D)	6.3	15.5	15.7	114.7	97.3	(D)	6.6
<b>Other industries</b> .....	<b>31</b>	<b>64</b>	<b>0.2</b>	<b>0.7</b>	<b>0.1</b>	<b>0.1</b>	<b>2.4</b>	<b>3.5</b>	<b>0.0</b>	<b>(*)</b>
Agriculture, forestry, fishing, and hunting .....	5	(D)	0.1	0.3	0.9	(D)	4.2	(D)	0.1	0.5
Construction .....	(*)	8	0.0	0.1	(*)	0.3	(*)	6.4	0.0	0.4
Retail trade .....	1	4	(*)	(*)	(*)	(*)	1.4	1.1	(*)	(*)
Transportation and warehousing .....	0	(*)	0.0	(*)	0.0	(*)	0.0	(*)	0.0	(*)
Real estate and rental and leasing .....	1	2	(*)	(*)	(*)	(*)	1.1	1.6	(*)	(*)
Real estate .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rental and leasing (except real estate) .....	1	2	(*)	(*)	(*)	(*)	1.1	1.6	(*)	(*)
Management of nonbank companies and enterprises .....	16	(D)	0.1	0.1	n.m.	(D)	23.3	(D)	0.7	0.3
Administration, support, and waste management .....	0	5	0.0	0.1	0.0	(*)	0.0	1.0	0.0	(*)
Health care and social assistance .....	(*)	0	(*)	0.0	(*)	0.0	n.m.	0.0	(*)	0.0
Accommodation and food services .....	(*)	(*)	(*)	(*)	(*)	(*)	0.1	0.1	(*)	(*)
Accommodation .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food services and drinking places .....	(*)	(*)	(*)	(*)	(*)	(*)	0.1	0.1	(*)	(*)
Miscellaneous services .....	8	7	0.1	0.1	0.2	0.2	1.1	3.9	0.1	0.1

\* Less than \$500,000, fewer than 50 employees, or less than 0.05 percent (+/-).

D Suppressed to avoid disclosure of data of individual companies.

n.m. Not meaningful

1. In this table, MOFAs R&D expenditures are classified by their own industry. In table B, their R&D expendi-

tures are classified by the industry of their U.S. parent.

MOFAs Majority-owned foreign affiliates

R&D Research and development

**Table 3. R&D Expenditures, Employment, and Intensities of Nonbank Majority-Owned Foreign Affiliates by Country, 1999 and 2004**

	R&D expenditures (millions of dollars)		R&D employment (thousands of employees)		R&D intensity (percent)					
	1999	2004	1999	2004	Ratio of R&D expenditures to value added		Ratio of R&D expenditures to value added of R&D- performing MOFAs		Ratio of R&D employment to total employment	
					1999	2004	1999	2004	1999	2004
<b>All countries</b> .....	<b>18,144</b>	<b>27,529</b>	<b>123.5</b>	<b>179.3</b>	<b>3.2</b>	<b>3.3</b>	<b>9.2</b>	<b>11.0</b>	<b>1.6</b>	<b>2.1</b>
<b>Canada</b> .....	<b>1,681</b>	<b>2,702</b>	<b>7.9</b>	<b>18.4</b>	<b>2.6</b>	<b>2.9</b>	<b>6.8</b>	<b>9.9</b>	<b>0.8</b>	<b>1.7</b>
<b>Europe</b> .....	<b>12,217</b>	<b>18,148</b>	<b>83.1</b>	<b>113.8</b>	<b>3.8</b>	<b>3.9</b>	<b>9.6</b>	<b>12.0</b>	<b>2.4</b>	<b>2.9</b>
Austria .....	82	134	0.6	0.8	2.4	2.9	9.8	10.7	1.8	2.3
Belgium .....	375	628	2.2	2.4	2.8	3.4	15.1	14.8	1.8	2.0
Czech Republic .....	6	20	0.1	(*)	0.5	0.7	5.1	3.6	0.2	(*)
Denmark .....	57	143	0.5	0.8	1.9	2.6	11.4	13.1	1.6	2.2
Finland .....	59	106	0.5	0.9	2.6	3.7	11.0	14.7	3.5	4.7
France .....	1,452	1,854	10.8	10.5	3.9	3.9	8.9	11.6	2.0	1.9
Germany .....	3,377	4,693	25.3	32.6	5.5	6.3	11.6	12.2	3.9	5.4
Greece .....	6	8	0.1	(*)	0.6	(*)	3.0	5.7	0.4	(*)
Hungary .....	13	25	0.2	(*)	1.1	1.1	3.4	6.0	0.4	(*)
Ireland .....	251	876	1.3	4.7	1.7	3.2	3.9	6.8	1.5	5.7
Italy .....	504	727	3.8	5.9	2.3	2.5	8.9	8.2	2.0	2.5
Luxembourg .....	(D)	101	0.7	0.8	(D)	n.m.	(D)	17.1	7.4	7.7
Netherlands .....	374	533	3.8	4.1	2.0	1.9	5.7	7.7	2.3	2.3
Norway .....	26	33	0.2	(*)	0.4	(*)	0.9	1.2	0.5	1.0
Poland .....	34	38	0.1	(*)	2.9	0.8	10.1	5.9	0.2	(*)
Portugal .....	14	9	0.1	(*)	0.6	(*)	4.1	1.9	0.2	(*)
Russia .....	1	17	(*)	(*)	0.9	0.6	n.m.	4.5	(*)	(*)
Spain .....	(D)	327	1.8	2.3	(D)	2.2	(D)	6.1	1.1	1.2
Sweden .....	1,036	1,525	1.7	8.6	16.7	13.8	45.6	37.1	2.3	8.5
Switzerland .....	231	868	1.5	4.1	2.6	4.9	7.8	14.1	2.8	6.1
Turkey .....	6	12	(*)	(*)	0.3	(*)	2.7	5.2	0.1	(*)
United Kingdom .....	4,000	5,462	27.7	33.5	3.9	4.1	9.0	14.5	2.6	2.9
Other .....	1	14	0.1	(*)	0.1	(*)	1.7	1.2	0.2	(*)
<b>Latin America and Other Western Hemisphere</b> .....	<b>613</b>	<b>882</b>	<b>9.0</b>	<b>8.3</b>	<b>1.0</b>	<b>1.1</b>	<b>4.4</b>	<b>4.9</b>	<b>0.6</b>	<b>0.5</b>
South America .....	366	394	6.3	5.1	1.1	1.0	4.0	3.6	1.0	0.8
Argentina .....	26	23	0.3	(*)	0.4	(*)	2.2	1.0	0.3	(*)
Brazil .....	288	340	5.4	4.6	1.7	1.9	4.2	4.7	1.5	1.3
Chile .....	4	9	(*)	(*)	0.1	(*)	3.7	3.2	0.1	(*)
Columbia .....	6	4	0.1	(*)	0.3	(*)	1.5	0.8	0.3	(*)
Ecuador .....	(*)	0	(*)	0.0	(*)	0.0	0.3	0.0	0.5	0.0
Peru .....	2	2	0.1	(*)	0.1	(*)	2.1	1.6	0.3	(*)
Venezuela .....	40	14	0.4	(*)	1.3	(*)	7.5	3.7	0.7	(*)
Other .....	(*)	1	(*)	0.0	(*)	(*)	0.2	0.7	(*)	0.0
Central America .....	240	(D)	2.7	3.3	1.2	(D)	5.3	(D)	0.3	(*)
Costa Rica .....	2	5	(*)	(*)	0.4	0.7	n.m.	2.8	0.1	(*)
Honduras .....	0	1	0.0	(*)	0.0	(*)	0.0	2.9	0.0	0.8
Mexico .....	238	(D)	2.7	3.0	1.4	(D)	5.3	(D)	0.3	(*)
Panama .....	(*)	(*)	0.0	(*)	(*)	(*)	1.0	1.0	0.0	(*)
Other .....	(*)	(*)	(*)	(*)	(*)	(*)	1.0	(*)	(*)	(*)
Other Western Hemisphere .....	6	(D)	(*)	(*)	0.1	(D)	6.1	(D)	(*)	(*)
Barbados .....	(*)	(D)	0.0	(*)	(*)	(D)	n.m.	(D)	0.0	(*)
Bermuda .....	1	0	0.0	0.0	0.1	0.0	n.m.	0.0	0.0	0.0
Dominican Republic .....	1	(*)	(*)	(*)	0.1	(*)	26.1	2.6	0.1	(*)
United Kingdom Islands, Caribbean .....	4	0	0.0	0.0	0.2	0.0	3.6	0.0	0.1	0.0
Other .....	0	1	0.0	0.0	0.0	(*)	0.0	1.3	0.0	0.0
<b>Africa</b> .....	<b>18</b>	<b>36</b>	<b>0.2</b>	<b>(*)</b>	<b>0.2</b>	<b>(*)</b>	<b>3.6</b>	<b>1.4</b>	<b>0.1</b>	<b>(*)</b>
Egypt .....	3	3	(*)	(*)	0.3	(*)	2.6	8.1	0.3	(*)
Nigeria .....	0	(*)	0.0	(*)	0.0	(*)	0.0	(*)	0.0	(*)
South Africa .....	14	30	0.1	(*)	0.8	0.7	4.5	3.5	0.2	(*)
Other .....	1	2	(*)	(*)	(*)	(*)	1.0	1.9	(*)	(*)
<b>Middle East</b> .....	<b>389</b>	<b>826</b>	<b>2.6</b>	<b>6.4</b>	<b>7.3</b>	<b>10.8</b>	<b>56.5</b>	<b>51.0</b>	<b>4.9</b>	<b>11.8</b>
Israel .....	389	824	2.6	6.4	23.4	35.4	60.3	53.2	7.8	17.6
Saudi Arabia .....	(*)	(*)	(*)	(*)	(*)	(*)	0.2	(*)	(*)	(*)
United Arab Emirates .....	0	2	0.0	(*)	0.0	(*)	0.0	3.6	0.0	(*)
Other .....	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Asia and Pacific</b> .....	<b>3,226</b>	<b>4,934</b>	<b>20.8</b>	<b>32.0</b>	<b>3.2</b>	<b>3.1</b>	<b>11.0</b>	<b>10.1</b>	<b>1.4</b>	<b>1.7</b>
Australia .....	294	471	3.2	3.5	1.5	1.6	4.5	6.9	1.3	1.3
China .....	319	622	2.0	6.2	8.1	4.7	23.6	18.0	0.8	1.5
Hong Kong .....	214	220	1.2	1.2	2.7	2.6	32.1	20.3	1.3	1.0
India .....	20	163	0.2	1.6	1.8	4.1	6.3	15.6	0.3	1.0
Indonesia .....	1	4	(*)	(*)	(*)	(*)	0.4	2.1	(*)	(*)
Japan .....	1,523	1,742	7.5	9.3	5.0	3.7	14.9	7.1	3.6	4.1
Korea, Republic of .....	101	246	1.0	2.1	3.1	3.6	11.1	9.0	2.2	2.6
Malaysia .....	161	301	(D)	3.2	3.4	4.6	11.9	15.9	(D)	3.3
New Zealand .....	9	25	0.1	(*)	0.4	0.8	1.3	2.1	0.3	(*)
Philippines .....	31	44	0.5	0.7	1.1	1.4	3.1	5.9	0.6	0.8
Singapore .....	426	711	2.6	3.1	4.3	5.3	9.2	25.9	2.3	2.8
Taiwan .....	122	363	0.9	0.6	2.0	6.1	9.9	24.8	1.2	0.8
Thailand .....	7	23	0.1	(*)	0.2	(*)	3.4	2.5	0.1	(*)
Other .....	(*)	(*)	(D)	(*)	(*)	(*)	1.2	1.3	(D)	(*)

\* Less than \$500,000, fewer than 50 employees, or less than 0.05 percent (+/-).  
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n.m. Not meaningful

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