



## Indicators of R&D in Small Businesses: Data from the 2009–15 Business R&D and Innovation Survey

by Gary Anderson and Audrey Kindlon<sup>1</sup>

**S**mall businesses are often incubators of new technologies that will be important to future economic growth. Indeed, research shows that among companies engaged in research and development or in patenting, small and young firms are more innovative, more productive R&D performers, and perform research that is more radical<sup>2</sup> (Akcigit and Kerr 2018, Knott and Vieregger 2017).

This InfoBrief presents R&D data by company size for the years 2008–15.<sup>3</sup> The data are from the Business R&D and Innovation Survey (BRDIS), an annual survey of U.S.-based businesses with five or more employees that is developed and cosponsored by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation and by the Census Bureau. Rausch (2010) presents similar data for the years 2003–07 from the Survey of Industrial R&D, which preceded BRDIS. Rausch found that smaller firms performed an increasing share of business R&D between 2003 and 2007, had greater R&D intensity (i.e., R&D/sales), and had a greater proportion of employees who are scientists and engineers.

Such data have long been of interest to researchers and policymakers. Using NCSES microdata, Knott and Vieregger (2017) found that large and small firms differ in terms of the type of R&D performed and R&D productivity. Their paper is the most recent contribution to research showing that radical innovation decreases with firm size (Mansfield 1981), the likelihood of performing process R&D increases with firm size (Scherer 1991), and R&D productivity itself varies by firm size (Acs and Audretsch 1988 and 1990, Knott and Vieregger 2017).

In 2015, following international guidance (OECD 2015), NCSES implemented an updated size classification structure based on reported employment for business R&D. This revision is consistent with the size classification used to analyze micro enterprises (5–9 employees), and it allows additional detailed statistics for small and medium enterprises (10–49 and 50–249 employees, respectively). This InfoBrief presents data<sup>4</sup> for 2008–15 using this updated classification structure. This international classification scheme differs considerably from that used by the U.S. Small Business Administration

(SBA), which classifies businesses with fewer than 500 employees as small.

### Indicators of R&D Performance by Size of Company

In 2015, U.S. companies performed nearly \$356 billion in R&D. Large companies (those with 250 or more employees) accounted for 88% of this total. Micro and small companies (5–49 employees) accounted for just 5% of this total. Medium-sized companies (50–249 employees) accounted for the remaining 7% (table 1). Using the SBA definition of small business, these data indicate that companies with fewer than 500 employees accounted for 16% of business R&D in 2015. Rausch (2010) showed that companies with fewer than 500 employees accounted for 19% of the total industrial R&D in 2007. BRDIS data show that companies with fewer than 500 employees accounted for 20% of the total 2008 business R&D. Time series data for 2008–15 indicate changes in the level of R&D performed by particular size classes as well as in the distribution of R&D across size classes.

As the economy began to recover from the Great Recession in 2009, R&D

TABLE 1. Domestic R&D paid for by the company and others and performed by the company, by company size: 2008–15  
(Millions of U.S. dollars)

Company size (number of domestic employees)	2008	2009	2010	2011	2012	2013	2014	2015
Current \$millions								
All companies	290,680	282,393	278,977	294,093	302,250	322,528	340,728	355,821
Micro companies <sup>a</sup>								
5–9	3,947	4,078	3,851	4,202	2,926	3,402	3,295	2,988
Small companies								
10–19	8,433	5,198	5,721	4,441	5,011	5,078	5,063	5,680
20–49	11,525	12,211	11,626	13,199	9,099	9,758	10,542	10,249
Medium companies								
50–99	9,351	13,282	8,855	9,468	9,182	8,910	10,178	11,509
100–249	14,662	12,747	11,866	12,528	12,480	13,666	13,492	13,602
Large companies								
250–499	10,219	11,204	10,283	12,955	11,264	12,189	12,203	13,553
500–999	11,886	10,119	10,116	10,027	11,484	12,002	13,262	15,217
1,000–4,999	46,336	44,008	48,227	50,485	50,691	55,517	57,551	58,094
5,000–9,999	24,764	21,864	27,463	24,951	30,483	31,514	38,202	38,838
10,000–24,999	48,737	51,037	41,835	49,214	49,493	51,218	54,445	59,328
25,000 or more	100,820	96,645	99,133	102,623	110,138	119,275	122,495	126,763
Constant 2009 \$millions								
All companies	292,888	282,393	275,610	284,668	287,270	301,673	313,077	323,437
Micro companies <sup>a</sup>								
5–9	3,977	4,078	3,804	4,068	2,781	3,182	3,027	2,716
Small companies								
10–19	8,497	5,198	5,652	4,299	4,762	4,749	4,652	5,163
20–49	11,613	12,211	11,485	12,776	8,648	9,127	9,686	9,316
Medium companies								
50–99	9,422	13,282	8,748	9,164	8,727	8,334	9,352	10,462
100–249	14,773	12,747	11,723	12,126	11,862	12,782	12,397	12,364
Large companies								
250–499	10,296	11,204	10,159	12,540	10,705	11,401	11,212	12,319
500–999	11,976	10,119	9,994	9,706	10,915	11,226	12,185	13,832
1,000–4,999	46,688	44,008	47,645	48,867	48,179	51,927	52,881	52,807
5,000–9,999	24,952	21,864	27,132	24,151	28,972	29,476	35,102	35,303
10,000–24,999	49,107	51,037	41,331	47,637	47,040	47,906	50,027	53,928
25,000 or more	101,586	96,645	97,937	99,334	104,679	111,562	112,555	115,226

<sup>a</sup> Business R&D and Innovation Survey does not include companies with fewer than five domestic employees.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

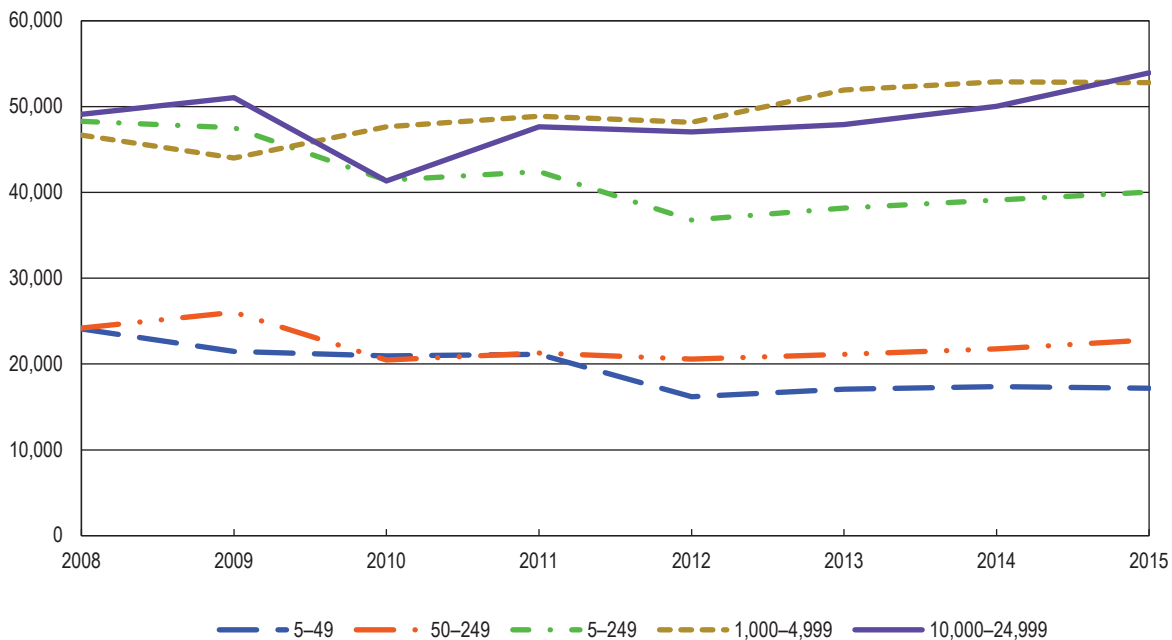
performance at large companies did as well. Over the 2009–15 time period, inflation-adjusted R&D performed by large companies (250 or more employees) grew at a rate of 3% per year. However, R&D performance diverged over this time period between micro, small, and medium companies (5–249 employees) and two classes of large companies (1,000–4,999 and

10,000–24,999 employees) (figure 1). In 2008, slightly less than \$50 billion in R&D was performed by micro, small, and medium companies combined and by each of these two classes of large companies. Following a period of decline, the recovery<sup>5</sup> of R&D performance began in 2011 for these two classes of large companies as well as for all large companies. For

micro, small, and medium companies, the effects of the recession were more persistent and recovery further delayed. By 2012, R&D performance for micro, small, and medium companies had fallen to \$37 billion, and recovery did not take hold until 2014. By 2015, companies with 10,000–24,999 employees performed \$54 billion in R&D, yet micro, small, and medium

FIGURE 1. Domestic R&D performance, by selected company size: 2008–15

Constant 2009 \$millions



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

companies performed just over \$40 billion in R&D and had not recovered beyond 2009 levels.

The data in figure 2 indicate that between 2009 and 2015, corresponding to the recovery from the Great Recession,<sup>6</sup> different size classes of businesses have fared differently with respect to inflation-adjusted R&D performance. Micro enterprises continued to perform significantly less R&D in 2015 than in 2009. Small and medium companies have not surpassed 2009 R&D performance. Large companies overall, as well as each size class of large companies other than 250–499, performed significantly more R&D in 2015 than 2009. The trends over 2008–15 for both the growth rate and share of R&D performance by micro, small, and medium companies stand in stark contrast to the 2003–07 trends. For 2003–07, Rausch (2010) showed

small firms had higher growth rates in R&D performance than larger companies and an increasing share of business R&D performance.

### Indicators of R&D Intensity of Small Businesses

Another perspective on business R&D performance is revealed by looking at the degree to which company revenues from sales are spent on R&D activities. This ratio, often termed the R&D intensity, is an indication of the firm’s commitment to and focus on R&D activities.

The 2008–15 data presented in table 2 show findings that are similar to those presented in Rausch (2010). For both these and earlier data, R&D intensity decreases with company size. R&D intensity, as measured by R&D as a percentage of sales, was nearly 11% for micro companies in 2015. For the

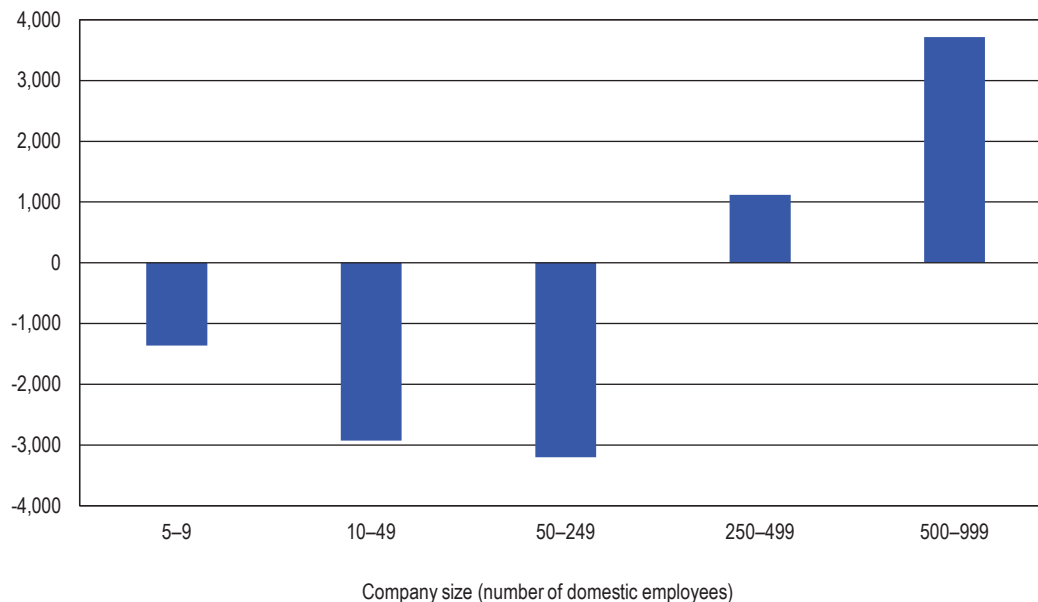
largest of companies (25,000 or more employees), the R&D intensity was just over 3%.

### Employment of R&D workers by Small Businesses

An indicator of innovative activity by companies, in particular smaller companies, is the proportion of employees that are working on R&D. According to BRDIS, the total number of employees at R&D-performing companies was 18.9 million in 2015 (table 3). In 2015, these same companies employed 1.5 million scientists, engineers, technicians, and support staff working on R&D, an 8% increase from 2008. In 2015, 15% of all employees from micro, small, or medium businesses were working on R&D, which is nearly identical to 16% in 2008 and results in no significant change during the 2008–15 time period.

FIGURE 2. Change in domestic R&D performance between 2009 and 2015, by selected company size

Constant 2009 \$millions



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

TABLE 2. Domestic R&D intensity for companies located in the United States that performed or funded R&D, by company size: 2008–15

Company size (number of domestic employees)	2008	2009	2010	2011	2012	2013	2014	2015
<b>Micro companies<sup>a</sup></b>								
5-9	27.9	9.7	12.9	11.6	7.0	6.8	10.1	10.7
<b>Small companies</b>								
10-19	19.4	10.1	11.6	7.6	7.5	6.6	9.1	8.7
20-49	12.8	8.6	8.0	6.9	5.3	5.8	6.3	5.7
<b>Medium companies</b>								
50-99	7.6	9.6	6.0	5.6	6.0	3.6	5.4	6.7
100-249	6.0	5.5	4.1	4.2	3.5	3.9	3.7	4.3
<b>Large companies</b>								
250-499	4.5	4.2	3.1	3.3	4.1	3.6	4.2	4.8
500-999	3.6	3.8	3.2	2.6	3.5	3.4	3.5	4.4
1,000-4,999	4.3	4.5	4.0	4.2	4.1	4.8	4.5	4.5
5,000-9,999	2.7	3.4	2.0	2.4	2.6	3.5	4.3	3.9
10,000-24,999	3.2	3.1	2.5	2.5	2.8	2.7	2.7	3.6
25,000 or more	3.1	3.2	3.0	3.0	3.0	2.9	3.0	3.4

<sup>a</sup> Business R&D and Innovation Survey does not include companies with fewer than five domestic employees.

NOTE: R&D intensity is the ratio of R&D to sales.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

After the Great Recession, R&D workforce indicators at micro, small, and medium companies differ from those at large companies. In 2009, micro, small, and medium companies employed 2.3 million people, including 387,000 employees working in R&D. In 2015, these firms employed 2.3 million, 350,000 of whom worked on R&D. In contrast, both total employment and the number of R&D employees by large firms increased by 8% and 15%, respectively, between 2009 and 2015, the post-recession years (table 3).

A decrease in R&D employment was most acutely experienced among the smallest firms (figure 3). During the post-recession years of 2009 to 2015, the number of personnel working on R&D at microbusinesses decreased by 40%. This compares with an 8% increase in R&D employment in all companies.

TABLE 3. Domestic total and R&D employment, by company size: 2008–15  
(Thousands)

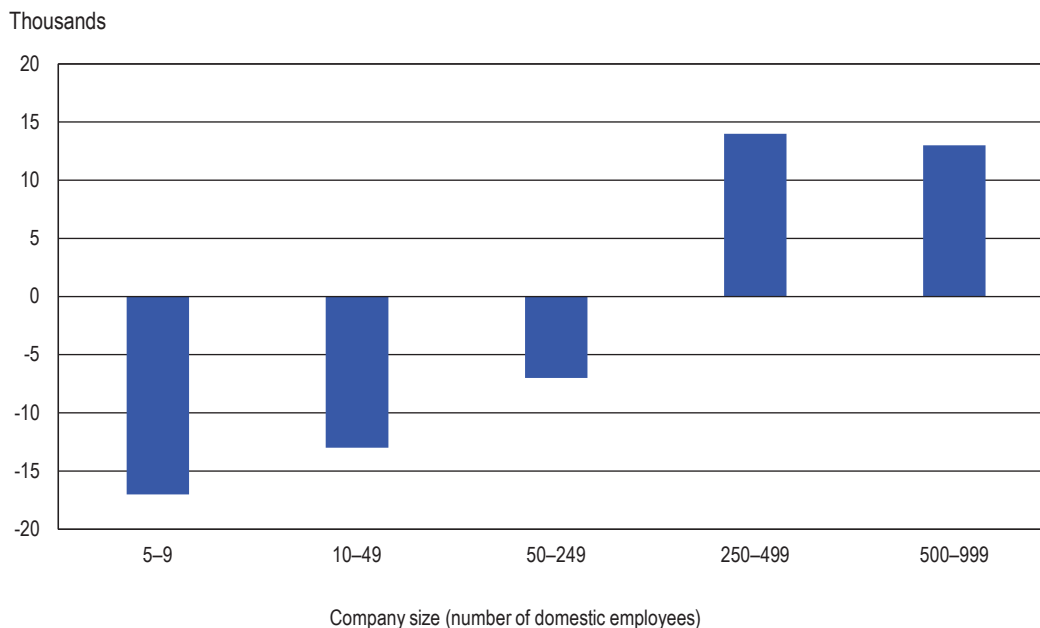
Company size (number of domestic employees)	2008	2009	2010	2011	2012	2013	2014	2015
Total employment for R&D performing companies								
All companies	18,516	17,787	18,636	19,286	18,293	20,046	21,540	18,913
Micro companies <sup>a</sup>								
5–9	72	129	124	129	130	167	118	99
Small companies								
10–19	208	208	233	214	239	293	219	220
20–49	373	532	599	584	558	685	521	534
Medium companies								
50–99	462	602	561	543	542	790	573	575
100–249	1,039	853	1,020	1,057	993	986	953	855
Large companies								
250–499	710	721	732	1,109	738	842	710	805
500–999	669	795	745	750	755	762	822	801
1,000–4,999	2,587	2,349	2,628	3,064	2,583	2,537	2,593	2,676
5,000–9,999	1,464	1,603	1,651	1,916	1,557	1,599	1,524	1,668
10,000–24,999	3,903	2,679	2,555	2,689	2,590	2,903	3,848	2,935
25,000 or more	7,029	7,316	7,788	7,231	7,608	8,482	9,659	7,745
R&D employment								
All companies	1,424	1,425	1,412	1,471	1,468	1,496	1,514	1,544
Micro companies <sup>a</sup>								
5–9	28	43	35	37	38	36	27	26
Small companies								
10–19	64	51	59	48	53	49	47	50
20–49	81	103	96	103	90	86	87	91
Medium companies								
50–99	70	99	79	86	77	81	81	83
100–249	106	91	102	113	101	112	100	100
Large companies								
250–499	61	72	70	94	79	79	76	86
500–999	63	64	58	61	67	68	70	77
1,000–4,999	224	204	217	233	226	240	254	254
5,000–9,999	125	112	130	113	138	141	150	147
10,000–24,999	191	212	176	204	198	201	219	228
25,000 or more	411	374	390	379	401	403	403	402
R&D employment % of total employment in R&D performing companies								
Micro companies <sup>a</sup>								
5–9	38.9	33.3	28.2	28.7	29.2	21.6	22.9	26.3
Small companies								
10–19	30.8	24.5	25.3	22.4	22.2	16.7	21.5	22.7
20–49	21.7	19.4	16.0	17.6	16.1	12.6	16.7	17.0
Medium companies								
50–99	15.2	16.4	14.1	15.8	14.2	10.3	14.1	14.4
100–249	10.2	10.7	10.0	10.7	10.2	11.4	10.5	11.7
Large companies								
250–499	8.6	10.0	9.6	8.5	10.7	9.4	10.7	10.7
500–999	9.4	8.1	7.8	8.1	8.9	8.9	8.5	9.6
1,000–4,999	8.7	8.7	8.3	7.6	8.7	9.5	9.8	9.5
5,000–9,999	8.5	7.0	7.9	5.9	8.9	8.8	9.8	8.8
10,000–24,999	4.9	7.9	6.9	7.6	7.6	6.9	5.7	7.8
25,000 or more	5.8	5.1	5.0	5.2	5.3	4.8	4.2	5.2

<sup>a</sup> Business R&D and Innovation Survey does not include companies with fewer than five domestic employees.

NOTE: R&D employment includes all scientists, engineers, technicians, and support staff working on R&D.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

FIGURE 3. Change in R&D employment at a company located in the United States performing R&D between 2009 and 2015, by selected company size



NOTE: R&D employment includes all scientists, engineers, technicians, and support staff working on R&D.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Business R&D and Innovation Survey.

## Conclusions

Generally speaking, when it comes to investing in R&D, smaller companies have not weathered the after effects of the recession as well as larger companies. From 2009, when the economy began to recover from the Great Recession, until 2015, micro, small, and medium companies showed decreased R&D performance and employment, whereas large companies demonstrated a return to growth. The R&D paid for and the sales generated by domestic R&D performers decreased for micro, small, and medium companies whereas large companies experienced growth in both areas. In addition, from 2009 to 2015, the number and the proportion of employees working on R&D decreased among smaller companies.

## Data Sources and Limitations

The samples for each year of BRDIS were selected to represent all for-profit, nonfarm companies that are publicly or privately held and have five or more employees in the United States. Estimates produced from the survey and presented in this InfoBrief are restricted to companies that perform or fund R&D, either domestically or abroad. Because the statistics from the survey are based on a sample, they are subject to both sampling and nonsampling errors (see technical notes in the data table reports at <https://www.nsf.gov/statistics/industry/>).

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## Notes

1. Gary Anderson ([ganderso@nsf.gov](mailto:ganderso@nsf.gov), 703-292-8572) and Audrey Kindlon ([akindlon@nsf.gov](mailto:akindlon@nsf.gov), 703-292-2332), Research and Development Statistics Program, National Center for Science and Engineering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314.

2. Akcigit and Kerr (2018) use prior art citations in patents to characterize the novelty of the research that resulted in the patented inventions. More radical, or exploration, research does not contain any prior art citations to earlier patents held by the assignee. In contrast, in exploitation research the majority of prior art patent citations are to earlier patents held by the assignee.

3. This InfoBrief uses constant dollars when discussing trend data. Current dollars are used for all other amounts and calculations.

4. Although NCSSES does release limited revised statistics that include adjustments based on information obtained after the original statistics were prepared, these data reflect the information available at the time of original release.

5. Recovery of R&D performance is indicated by a statistically significant increase measured from the post-recession minimum annual performance.

6. The National Bureau of Economic Research (NBER) dates the end of the 2007 recession as June 2009, which occurred during the 2009 BRDIS calendar year reporting period. Given that BRDIS collects annual data and 2009 corresponds to both the minimum annual real gross domestic product (GDP) over the 2007–15 period and the NBER recession date, we measure the recovery period relative to this trough.