



Patterns of Mobility of New S&E PhDs into the Business Sector

About half of the 500,000 new S&E doctorate recipients during the 2001–15 period reported postgraduation plans for employment, and of those, a quarter were going into the business sector. Data from the Survey of Earned Doctorates (SED) can track the geographic mobility of newly minted S&E PhDs from training to industry employment, which not only informs the understanding of geographic patterns of R&D activity but is also an important indicator of local knowledge spillovers from academia to the business sector (Stephan 2007). Firms hire new S&E PhDs for their ability to contribute to R&D and other innovative activities within the organization. Where they are placed is an important indicator of regional innovative capacity. In addition, the resulting knowledge flows from academia to industry via employment of new S&E doctorate holders are related to the innovative capacity of a region. Following Stephan (2007), SED data from 2001–15 were examined to analyze the geographic mobility of new PhDs with postgraduation plans for business-sector employment in the United States.

From 2001 to 2015, nearly 57,000 new doctorate recipients in S&E fields had postgraduation plans for non-postdoc employment in industry in the United States (Table 3-B). The rate at which these newly graduated students entered into business-sector employment in the region in which they trained is an indicator of local knowledge spillover effects from academia to the business sector. These rates vary substantially by region, ranging from a high of 77% remaining in the Pacific and Insular region, which includes the Pacific states and Puerto Rico and outlying territories (see Table 3-C for a list of states and territories included in each region), to nearly one-third (32%) in the East South Central United States. States vary considerably in terms of economic and employment opportunities. The Pacific and Insular region attracted the most S&E PhDs overall for business-sector employment (17,332), regardless of where training occurred, followed by the Middle Atlantic region (9,601). In comparison, the East South Central region attracted the lowest number of S&E PhDs to work in industry (951) during this time period.

TABLE 3-B

Doctorate recipients in S&E fields with postgraduation plans for non-postdoc employment in the United States in the business or industry sector, by region of doctoral institution and region of employment: 2001–15 combined

(Number and percent distribution)

Region of employment	Region of doctoral institution									
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific and Insular	All doctoral institutions
Number										
All employment ^a	4,566	9,106	10,212	3,756	9,325	1,652	5,110	2,979	10,119	56,825
New England	2,212	722	545	176	495	71	150	98	293	4,762
Middle Atlantic	786	4,700	1,256	368	1,084	150	297	178	782	9,601
East North Central	176	411	3,867	454	566	190	244	96	245	6,249
West North Central	59	112	386	1,342	180	60	109	58	97	2,403
South Atlantic	262	640	675	287	4,149	229	268	125	311	6,946
East South Central	19	45	89	54	116	525	62	19	22	951
West South Central	162	329	574	248	595	136	2,910	249	311	5,514
Mountain	75	202	285	143	253	53	142	1,438	225	2,816
Pacific and Insular	786	1,900	2,491	666	1,839	233	906	706	7,805	17,332
Percent distribution of region of doctoral institution across regions of employment										
All employment ^b	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
New England	48.4	7.9	5.3	4.7	5.3	4.3	2.9	3.3	2.9	8.4

Region of employment	Region of doctoral institution									
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific and Insular	All doctoral institutions
Middle Atlantic	17.2	51.6	12.3	9.8	11.6	9.1	5.8	6.0	7.7	16.9
East North Central	3.9	4.5	37.9	12.1	6.1	11.5	4.8	3.2	2.4	11.0
West North Central	1.3	1.2	3.8	35.7	1.9	3.6	2.1	1.9	1.0	4.2
South Atlantic	5.7	7.0	6.6	7.6	44.5	13.9	5.2	4.2	3.1	12.2
East South Central	0.4	0.5	0.9	1.4	1.2	31.8	1.2	0.6	0.2	1.7
West South Central	3.5	3.6	5.6	6.6	6.4	8.2	56.9	8.4	3.1	9.7
Mountain	1.6	2.2	2.8	3.8	2.7	3.2	2.8	48.3	2.2	5.0
Pacific and Insular	17.2	20.9	24.4	17.7	19.7	14.1	17.7	23.7	77.1	30.5

^a Total employment counts include doctorate recipients reporting unknown U.S. location.

^b Employment percentages do not sum to 100% because total counts include doctorate recipients reporting unknown U.S. location.

Note(s)

Numbers are based on doctorate recipients reporting definite commitments for non-postdoc employment in the year after doctoral degree award. S&E fields include life sciences, physical and earth sciences, mathematics and computer sciences, psychology and social sciences, and engineering. Business or industry sector includes self-employment and excludes not-for-profit organizations.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2017), Survey of Earned Doctorates (SED) (2015).

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TABLE 3-C 
Region and state of doctoral institution and employment of doctorate recipients in S&E fields with postgraduation plans for non-postdoc employment in the United States in the business or industry sector: 2001–15 combined

(Number)

Region and state	PhDs trained in state or region	New PhDs working in state or region	Number of new PhDs produced that stay in state or region	Percent of new PhDs produced that stay in state or region
New England	4,566	4,762	2,212	48.4
Connecticut	669	859	171	25.6
Maine	40	57	16	40.0
Massachusetts	3,379	3,401	1,556	46.0
New Hampshire	159	195	32	20.1
Rhode Island	279	126	56	20.1
Vermont	40	124	19	47.5
Middle Atlantic	9,106	9,601	4,700	51.6
New Jersey	1,561	2,700	690	44.2
New York	4,273	4,741	1,744	40.8
Pennsylvania	3,272	2,160	879	26.9
East North Central	10,212	6,249	3,867	37.9
Illinois	3,291	2,149	929	28.2
Indiana	1,641	780	225	13.7
Michigan	2,100	1,502	701	33.4
Ohio	1,913	1,165	613	32.0
Wisconsin	1,267	653	290	22.9
West North Central	3,756	2,403	1,342	35.7
Iowa	761	274	142	18.7
Kansas	451	253	128	28.4
Minnesota	1,311	1,124	467	35.6
Missouri	820	527	236	28.8
Nebraska	242	134	77	31.8

Region and state	PhDs trained in state or region	New PhDs working in state or region	Number of new PhDs produced that stay in state or region	Percent of new PhDs produced that stay in state or region
North Dakota	109	55	32	29.4
South Dakota	62	36	18	29.0
South Atlantic	9,325	6,946	4,149	44.5
Delaware	395	320	61	15.4
District of Columbia	369	521	61	16.5
Florida	1,717	1,062	647	37.7
Georgia	1,772	806	427	24.1
Maryland	1,258	1,175	402	32.0
North Carolina	1,699	1,236	627	36.9
South Carolina	445	317	125	28.1
Virginia	1,505	1,415	526	35.0
West Virginia	165	94	39	23.6
East South Central	1,652	951	525	31.8
Alabama	483	292	143	29.6
Kentucky	340	179	91	26.8
Mississippi	233	87	45	19.3
Tennessee	596	393	178	29.9
West South Central	5,110	5,514	2,910	56.9
Arkansas	144	128	65	45.1
Louisiana	414	250	110	26.6
Oklahoma	379	261	108	28.5
Texas	4,173	4,875	2,348	56.3
Mountain	2,979	2,816	1,438	48.3
Arizona	961	1,010	360	37.5
Colorado	918	891	473	51.5
Idaho	99	205	44	44.4

Region and state	PhDs trained in state or region	New PhDs working in state or region	Number of new PhDs produced that stay in state or region	Percent of new PhDs produced that stay in state or region
Montana	59	36	20	33.9
Nevada	139	114	68	48.9
New Mexico	189	213	74	39.2
Utah	549	310	206	37.5
Wyoming	65	37	20	30.8
Pacific and Insular	10,119	17,332	7,805	77.1
Alaska	18	39	7	38.9
California	8,690	13,150	6,180	71.1
Hawaii	71	86	42	59.2
Oregon	416	2,088	207	49.8
Washington	847	1,878	401	47.3
Puerto Rico and outlying territories	77	91	66	85.7

Note(s)

Numbers and percentages are based on doctorate recipients reporting definite commitments for non-postdoc employment in the year after doctoral degree award, with response to location of employment. S&E fields include life sciences, physical and earth sciences, mathematics and computer sciences, psychology and social sciences, and engineering. Business or industry sector includes self-employment and excludes not-for-profit organizations.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2017), Survey of Earned Doctorates (SED) (2015).

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As S&E doctorate recipients become increasingly geographically concentrated by region of planned employment in the business sector, the share of where they are trained by region has remained fairly stable since 2001. Table 3-D and Table 3-E show the number and share of new S&E doctorate holders with postgraduation plans for employment in business or industry by region of doctoral institution and by location of employment, respectively, for three 5-year cohorts. While the Pacific and Insular region accounts for just under 20% of the training of the three graduating cohorts, between 27% and 34% of these cohorts are planning to work in the business sector in this region. This suggests that this region increasingly accounts for a larger share of new S&E PhD workers in the business sector, while the share trained there remains stable over this time period. The Middle Atlantic region has declined in its share of business-sector employment plans of these



new graduates, down from 19% in the first cohort to 15% in the most recent cohort. The South Atlantic region saw a slight decline in its share of those planning to be employed in the business sector there, while the West South Central region saw a modest increase.

TABLE 3-D

Doctorate recipients in S&E fields with postgraduation plans for non-postdoc employment in the United States in the business or industry sector, by region of doctoral institution: 5-year cohorts, 2001–15

(Number and percent)

Region	2001–05	2006–10	2011–15
Number			
All regions	16,328	19,584	20,913
New England	1,298	1,576	1,692
Middle Atlantic	2,673	3,159	3,274
East North Central	3,034	3,449	3,729
West North Central	1,111	1,287	1,358
South Atlantic	2,564	3,191	3,570
East South Central	453	574	625
West South Central	1,395	1,699	2,016
Mountain	850	1,040	1,089
Pacific and Insular	2,950	3,609	3,560
Percent			
All regions	100.0	100.0	100.0
New England	7.9	8.0	8.1
Middle Atlantic	16.4	16.1	15.7
East North Central	18.6	17.6	17.8
West North Central	6.8	6.6	6.5
South Atlantic	15.7	16.3	17.1
East South Central	2.8	2.9	3.0
West South Central	8.5	8.7	9.6
Mountain	5.2	5.3	5.2
Pacific and Insular	18.1	18.4	17.0

Note(s)

Numbers and percentages are based on doctorate recipients reporting definite commitments for non-postdoc employment in the year after doctoral degree award, with response to location of employment. S&E fields include life sciences, physical and earth sciences, mathematics and computer sciences, psychology and social sciences, and engineering. Business or industry sector includes self-employment and excludes not-for-profit organizations.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2017), Survey of Earned Doctorates (SED) (2015).

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TABLE 3-E 
Doctorate recipients in S&E fields with postgraduation plans for non-postdoc employment in the United States in the business or industry sector, by region of employment: 5-year cohorts, 2001–15

(Number and percent)

Region	2001–05	2006–10	2011–15
Number			
All regions ^a	16,328	19,584	20,913
New England	1,438	1,592	1,732
Middle Atlantic	3,132	3,325	3,144
East North Central	1,909	2,099	2,241
West North Central	703	790	910
South Atlantic	2,145	2,428	2,373
East South Central	269	333	349
West South Central	1,417	1,984	2,113
Mountain	858	1,002	956
Pacific and Insular	4,391	5,904	7,037
Percent			
All regions ^b	100.0	100.0	100.0
New England	8.8	8.1	8.3
Middle Atlantic	19.2	17.0	15.0
East North Central	11.7	10.7	10.7
West North Central	4.3	4.0	4.4
South Atlantic	13.1	12.4	11.3
East South Central	1.6	1.7	1.7
West South Central	8.7	10.1	10.1
Mountain	5.3	5.1	4.6
Pacific and Insular	26.9	30.1	33.6

^a Totals include doctorate recipients with unknown region of U.S. employment.

^b Percentages do not sum to 100% because total counts include doctorate recipients with unknown region of U.S. employment.

Note(s)

Numbers and percentages are based on doctorate recipients reporting definite commitments for non-postdoc employment in the year after doctoral degree award, with response to location of employment. S&E fields include life sciences, physical and earth sciences, mathematics and computer sciences, psychology and social sciences, and engineering. Business or industry sector includes self-employment and excludes not-for-profit organizations.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2017), Survey of Earned Doctorates (SED) (2015).

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The flow of new S&E PhDs with postgraduation plans for business-sector employment outside of the region in which they trained increased slightly from the turn of the century until 2015 (Table 3-F). The rate at which these students plan to remain in their region of training for postgraduation industry employment has declined overall from 53% in the earliest cohort to 49% in the most recent cohort. The only region that saw an increase in the rate at which new S&E PhDs remain for business-sector employment was the Pacific and Insular region, where the proportion rose slightly from 76% in both the 2001–05 and 2006–10 cohorts, respectively, to 79% in the most recent cohort overall. This proportion declined in the South Atlantic region from 49% in 2001–05 to 41% in 2011–15 and also in the Middle Atlantic region from 56% to 48%. Table 3-C breaks down these proportions by state for the entire period of 2001–15, showing that in the Pacific and Insular region, California accounts for the largest share of new S&E PhDs trained and employed there. Within this region, California has one of the highest rates at which those trained in that state also remain there for business-sector employment.

TABLE 3-F 
Doctorate recipients in S&E fields with postgraduation plans for non-postdoc employment in the United States in the business or industry sector, by region of doctoral institution: 5-year cohorts, 2001–15

(Number and percent)

Region	2001–05	2006–10	2011–15
Number of new doctorates trained in region			
All regions	16,328	19,584	20,913
New England	1,298	1,576	1,692
Middle Atlantic	2,673	3,159	3,274
East North Central	3,034	3,449	3,729
West North Central	1,111	1,287	1,358
South Atlantic	2,564	3,191	3,570
East South Central	453	574	625
West South Central	1,395	1,699	2,016
Mountain	850	1,040	1,089
Pacific and Insular	2,950	3,609	3,560
Number of new doctorates produced that stay in region			
All regions ^a	8,703	9,933	10,340
New England	639	744	829
Middle Atlantic	1,501	1,635	1,564
East North Central	1,246	1,273	1,348
West North Central	416	429	497
South Atlantic	1,246	1,442	1,461
East South Central	160	173	192
West South Central	790	995	1,125
Mountain	449	485	504
Pacific and Insular	2,245	2,743	2,817
Percent of new doctorates produced that stay in region			
All regions	53.3	50.7	49.4

Region	2001–05	2006–10	2011–15
New England	49.2	47.2	49.0
Middle Atlantic	56.2	51.8	47.8
East North Central	41.1	36.9	36.1
West North Central	37.4	33.3	36.6
South Atlantic	48.6	45.2	40.9
East South Central	35.3	30.1	30.7
West South Central	56.6	58.6	55.8
Mountain	52.8	46.6	46.3
Pacific and Insular	76.1	76.0	79.1

^a Totals include doctorate recipients with unknown region of U.S. employment.

Note(s)

Numbers and percentages are based on doctorate recipients reporting definite commitments for non-postdoc employment in the year after doctoral degree award, with response to location of employment. S&E fields include life sciences, physical and earth sciences, mathematics and computer sciences, psychology and social sciences, and engineering. Business or industry sector includes self-employment and excludes not-for-profit organizations.

Source(s)

National Science Foundation, National Center for Science and Engineering Statistics, special tabulations (2017), Survey of Earned Doctorates (SED) (2015).

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Overall, while the geographic distribution of S&E PhDs by educational institution has remained stable among all nine U.S. regions since 2001, the plans for industry employment of these new graduates has shifted toward the Pacific Coast—primarily California. The Middle Atlantic and South Atlantic regions seem to be the hardest hit by the shift, having the largest drops in the percentage of S&E doctorate holders who plan to remain and work in industries located in those regions after graduation. There is wide variation in the geographic distribution of S&E PhDs by both region of training and region of employment. Of the nearly 57,000 new S&E PhDs planning to work in the business sector, most are in the Pacific and Insular region, and the East South Central region has the fewest training and planning to work in industry in that area.