Leaving a Legacy of a Research University to Enhance Nevada's Future

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Executive Summary

The quickening pace of the global environment and the increased economic competition to Nevada highlights the need for current action to leave a legacy for the future. An educated populace, promoted by high-quality research universities, offers preparation for this future. Research universities provide skilled people and innovative ideas that play many roles in sustaining economic well-being and Nevada values. The key economic roles they play are: (1) creating new industries; (2) transplanting an industry; (3) diversifying old industries into new ones; and (4) upgrading a mature industry. Research universities strengthen local firms in these key roles by helping them take up new technology and market their expertise productively. We find that Nevada universities lag other western states' universities in key competitive measures.

- In spite of its relative wealth compared to other states, Nevada remains one of three western states without a Tier I university.
- In 2011, Nevada's overall expenditures on Research and Development ranked it 3rd from the bottom. However, on a per capita basis, Nevada ranked last.
- Out of 11 western states, Nevada ranked 8th and 11th in PhD's granted in numerical and per capita terms, respectively.
- For patents granted to the Universities, Nevada ranked 8 out of 11 for the period of 2008 to 2012. Reflecting an associated ability to attract research funding, if Nevada attracted research and development expenditures at, for example, the level of Utah, the additional economic impact would conservatively exceed $1 billion.

This poor performance reflects past funding and priorities. Nevada funds its two major universities at lower rates than other states. For example, Nevada's major universities are funded at about two-thirds of the level of California universities. Other western states (Wyoming, New Mexico, Idaho, Utah, and Washington), without the overall high-rating measures of the top-tier California universities, have nonetheless reached excellence in specific areas of importance with support at higher levels than occur in the Silver State. Some of Nevada's neighboring states have about the same or fewer resources than Nevada, but have sought excellence by support of their research universities:

- Nevada is one of only three western states that do not provide local tax support to higher education (i.e., community colleges).
- Including both state and local support, Nevada ranks second to last in per capita support to higher education.

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Nevada will require catching up to remain competitive nationally and in the global economy. Nevada needs to fashion and maintain a research agenda aligned with the well-being of its citizens, both current and future, if it wishes to do its part. Increased funding will be needed. Leaving a legacy of strong research universities will help preserve the ability for future Nevadans to address problems better and exploit opportunities more easily.

Introduction

The 20th century brought waves of technological discoveries and innovations.[1] These advances improved human conditions, particularly for regions of the world with high rates of literacy and human capital.[2] Changes of note during the early part of the 20th century included the invention of the automobile, airplane, and electricity (to name but a few advances). These waves of innovation and technological improvements came within a short period and transformed national economies—sharply increasing per capita income.[3] Nowhere was economic well-being improved more among the major countries of the world than in the United States.[4] The nation's rich endowment of natural and human resources enabled what became known as the second industrial revolution.[5] The United States flourished and emerged as the dominant economic power in the 20th century.

Over a decade into the 21st century, however, one sees continued growth and global economic change, but with a different location perspective. The change we see is the movement of China, India, and Brazil from low-income levels to significant economic powers. This opens up questions of where the U.S. and its states are headed. To be sure, the global landscape shifted earlier at the turn of the 20th century. U.S. economic fortunes rose and Great Britain slipped into a period of highly disruptive changes.[6] This experience shows that shifting the location of economic fortunes can be highly disruptive. Already, we've seen substantial disruptions associated with the U.S. automobile industry as it lost global market share. The automobile industry suffered job losses and declines that pushed Michigan and the states heavily dependent on related manufacturing into searching for alternative paths to economic growth. In short, as a country or region matures, such as seen in the recent Upper Midwest region experience, the prospect of lost markets sets in motion difficult realignments for firms and workers alike.

Those industries and regions that adjust their human capital run a higher probability of returning to more prosperous conditions than those that do not. Using a rich historical base, one can assess successes and failures in nurturing prosperity. For example, Argentina ranked in the top 10 in income per capita as a major economic power in 1900, but failed to nurture human capital aligned with changing economic circumstances and technology, and today is not a major economic player, ranking 74th in the world in terms of per capita GDP and 138th in terms of its GDP real growth rate.[7] Another example over a shorter period shows Singapore and Jamaica with markedly different well-being in 2012 (2012 estimated per capita GDP in U.S. dollars of $61,400 for Singapore[8] and $9,300 for Jamaica) though they had the same GDP in 1960 of $1,900.[9] Human capital development explains much of this difference.[10] The collection of skills and knowledge to sustain an efficient and growing economy, that is, human capital formation, rests on education. It is imperative for Nevada and the U.S. not to fall behind other countries in these efforts to create human capital.

Today, we can point to the different fortunes of U.S. regions, such as Michigan and Nevada. It can be said that the same global and national change that had adversely affected Michigan also derailed Nevada's growth. How could a state that has top rankings in population and job-growth rates over the past 25 years fall from its favorable perch? Economic vibrancy in travel and tourism and rising commodity prices, which account for Nevada's prosperity, do not depend on the same economic fundamentals depressing U.S. manufacturing. Indeed, outsourcing and off-shoring, forces dragging down the performance of U.S. manufacturing regions, do not apply in Nevada. However, increased competition from tribal gaming in California, across the nation, and globally, combined with high unemployment rates and economic uncertainty created by the Great Recession and shifting demographics, initially reduced the number of visitors to the State (including their spending). These visitors fueled Nevada's economic growth for decades. With an

unemployment rate of 8.7 percent,[11] Nevada may not have been hurt by the same forces as Michigan, but there is no argument its economy is struggling and is still in need of help.

Nevada's future success in meeting its challenges will depend on a host of factors for which a research university may play a useful role. Universities help economic realignment and provide special talents and information in efforts to increase the economic well-being of state economies. One finds many examples among U.S. states and their research universities. Indeed, even in Nevada where its state universities (University of Nevada, Reno and the University of Nevada, Las Vegas) have not ranked among the top U.S. research universities, one can find examples of collaborative efforts.

The Nevada economy relies heavily on gaming and mining. The state's economic-base is narrower than other states with more diversified economies. Still, one can point to the strength of Nevada's university scholars' understanding of gaming and mining industries and engaging in fruitful conversations about critical issues with business executives, community leaders, and State residents. But, beyond a few areas, one finds the Silver State's universities not up to the levels associated with universities referred to as research universities.

Simple cost comparisons show why Nevada lags other western states. Though California's state support for research universities declined from an average rate of $14,910 per student in 2002 to $12,495 per student in 2010, this support remained much higher than that for Nevada's universities. Average state support for Nevada's research institutions declined from $10,205 in 2002 to $8,800 in 2010.[12] This is lower than the average national support in 2010 of $9,082, and six out of the 10 other western states.[13] As a result, Nevada is not fostering the knowledge and talent that might make a difference in future efforts to grow the state's economic-base. Without flourishing research universities Nevada's economy is at a disadvantage, other things being equal, in meeting future competitive challenges. These data are published by the National Science Foundation in its "Science and Engineering Indicators 2012" report. Table B-29 in that report provides a comparison of state funding for major research universities per enrolled student for 2002, 2008 and 2010.

This white paper reviews the current state of understanding about the role of the research university in regional economies. This review identifies the attributes of a research university in growing Nevada's opportunity to compete in the developing global economy. These future opportunities rest on two simple concepts--import substitution and export-base. Import substitution arises when there are new business opportunities in the Silver State that were not previously available, that is, products and services, which were provided by other regions. For example, having not reached a critical size and quality threshold for needed medical services, a string of Nevada governors sought medical care elsewhere, leaving a clear record that Nevada services did not meet the test of the market. Import substitution occurs when you have the quantity and quality of given products and services, such as high-quality medical care, available such that residents no longer travel elsewhere. Other things equal, a larger regional economy supports a greater breath of products and services, a result of greater import substitution as an economy grows. Critical-size issues may also play a role.

Export-base opportunities arise from creating new goods and services in the Silver State for which people outside the state will buy. A research university provides inputs helping import substitution and export-base business opportunities. All in all, a research university may be the critical difference in attracting and maintaining economic muscle to compete in global markets. The paper moves from a review of the role of a research university to the current state of research universities in nearby western U.S. states.

The Influence of a Research University on Economic Sustainability

There are no guarantees that Americans or the countries of Western Europe will continue their lead in technology, innovation, economic performance, or economic pre-eminence.[14] Indeed, the steady decline in the U.S. trade balance over the past decade largely shows a drop in U.S. competitiveness across a range of manufactured goods. There is reason to believe that this is likely to continue. We face the prospects of a rapidly changing global economy which may bring adjustments. Periods of adjustment increase the prospects for research universities increasing their partnering activities with key players in regional economies. Increasingly, we may see regional economies coming to see research universities as drivers of growth, development, and innovation.

A research university plays many roles in economic development. These roles include the university providing skilled people and ideas for innovative activities. As a source of key assets, universities more easily attract key development resources than others.[15] That is, universities more easily attract skilled people.[16] The work of Edward Glaeser, Richard Florida, Michael Porter and others offers a broad sweep of findings useful for our work in Nevada. They point to universities creating new information, attracting talented people, and serving as engines of regional growth. In short, universities strengthen local firms by helping them take up new technology and marketing knowledge productively.

The research university contributes to local economies by (1) educating people across the full spectrum of a person's work-life (undergraduate, graduate, midcareer, and executive), (2) conducting research and disseminating findings, (3) undertaking problem solving activities, and (4) offering public space for conversations to occur. The teaching mission has grown beyond undergraduate and graduate education, to creating and sharing of new knowledge and to educating those who would take up the instruction of future professors, to midcareer education to help ease the many job changes that are common in a modern, dynamic economy.

More recently, the breadth of knowledge needed for a successful executive has given rise to midcareer programs for those destined to become executives. The research university offers a full complement of instruction across these areas. Research traditionally has differentiated the activities of a university from a college. Colleges, at least the traditional liberal arts college as defined in the early years of our nation's history, focused on the education for the ministry.[17] Other specialized education developed for law and medicine. The state university supported by the land-grant system, increased research interest to include engineering and agriculture.[18] The research university has developed.[19] No doubt, further evolution will occur.[20]

The faculty of a university may serve the community and state through public space and problem-solving activities. The tradition of free and open inquiry and the space to do so has long created a pleasant environment for creative people to want to be associated with a research university. University space and the supportive environs of nearby spaces, such as restaurants and other commercial meeting places, add to the attractiveness of a university. To be sure, such environs stretch beyond the university, but a research university almost always offers space for events.

Problem-solving occurs through a myriad of activities. These activities arise from contract research, faculty consulting, and access to specialized instruments and equipment. The research university fosters discussion through meetings, conferences, and extensive networks. In short, the research university offers an enriched environment staying current and meeting future changes.

Richard Lester has identified four pathways for research university-supported growth.[21] These pathways are (1) creating new knowledge, for example, the research universities of the Bay Area supporting the computer based growth of the Silicon Valley; (2) transplanting new industry into a new region, for example, the I-85 corridor in North and South Carolina; (3) moving from industries into new ones, for example, Akron, Ohio's evolution from tires to advanced polymers; and (4) upgrading of an industry, for example, the upgrading of motor sports in Charlotte, North Carolina. Most notably, one sees each pathway involving different roles for the research university.

Even recognized universities of high standing, which have heretofore not concerned themselves with growth-supported roles, now actively seek to follow along the pathways that provide their state the most desired outcomes. For example, major research universities in Michigan, a state which has suffered economic decline and job losses since 2000, increasingly have taken on a key role in providing support for the state and its key industries in addressing its problems and opportunities. Pathways by which a research university supports policy activities are shown in the bold-faced column headings of Table 1 with key roles shown below.

Table 1 - Pathways of the Research University and Some Key Economic Roles

Creating New Industry	**Transplanting an Industry**	**Diversifying Old Industries into New Ones**	**Upgrading a Mature Industry**
Cutting-edge science and engineering research	Education/ Manpower	Bridging disconnected economic players	Problem-solving through contract research
Technology transfer	Responsive curricula	Addressing structural weaknesses	Education/Manpower Development
Entrepreneurial business, incubation, and economic analysis	Technical assistance	Creating forums to promote local conversation	Best practice/ Planning
Cultivating research and entrepreneurial interface		Creating industry identity	Forums

Source: Richard Lester, "Framework for Understanding How Higher Education Influences Regional Economic Growth," Federal Reserve Bank of Chicago, October 30, 2006.

Looking to the future, one sees the need for economic development and diversity. But, let's be clear, economic development and economic diversity are not necessarily the same time thing. Development speaks to the "quality" (e.g., high-wage, high-education jobs"), while diversity speaks to a broadening of the economic-base but not necessarily its quality. In other words, an economy can "diversify" by broadening the base of low-wage, low skill jobs. This does not necessarily prepare a region to compete effectively in the global innovation economy. Only development reduces the risks associated with socio-economic changes. In Nevada, economic development points to a research university following the roles shown in Table 1 along the pathway of "Creating New Industry." But, addressing and maintaining the economic vibrancy of the state's major industries will also call for offering services shown in the "Upgrading a Mature Industry."

One take away from Table 1 is that a research university in Nevada would not necessarily emulate a specific example, such as Stanford University, or follow a successful trend elsewhere such as biotech or exclusively software development. Rather, research

universities in Nevada would need to pursue different ways to contribute to innovation and avoid a one-size-fits-all approach. The quickly changing global economic environment calls for bringing resources to bear on different pathways and aligning the research mission for Nevada universities to what is happening in the Silver State. In a fast pace environment with evolving future needs, Nevada must set the foundation for the future by what Newton referred to as "standing on the shoulders of earlier researchers." Focused research efforts, rather than trying to replicate other mature research universities, offer the best opportunity to set a base for future generations of Nevadans.

The Research University in Other Western States

An important question about the role of research universities and Nevada's future is: *Are other western states supporting research universities?* The answer is YES. The specifics for key western states are shown in the following table.

Table 2: Key Research Universities, Population and Resources among Selected Western States*

State	Per Capita Income 2012[a]	Population (millions) 2012[b]	Number of Research Universities				
			Level I (Tier)	Level II (Tier)	Level III (Tier)	Total	Per Capita (millions)
1. Arizona	$36,243	6.55	2	1	2	5	0.7630
2. California	$46,477	38.04	11	2	13	26	0.6835
3. Colorado	$45,775	5.19	2	3	2	7	1.3494
4. Idaho	$34,481	1.60	0	2	0	2	1.2533
5. Montana	$38,555	1.01	1	1	0	2	1.9898
6. Nevada	***$38,221***	***2.76***	***0***	***2***	***0***	***2***	***0.7249***
7. New Mexico	$35,682	2.09	1	1	0	2	0.9590
8. Oregon	$39,166	3.90	2	1	0	3	0.7694
9. Utah	$35,430	2.86	1	2	0	3	1.0507
10. Washington	$46,045	6.90	2	0	0	2	0.2900
11. Wyoming	$50,567	0.58	0	1	0	1	1.7349

*See Appendix A for more detailed information.
Note: Calculations my not be exact due to rounding.

Sources:
a) Bureau of Economic Analysis
http://www.bea.gov/iTable/index_regional.cfm
accessed as of October 19, 2013.

b) U.S. Census Bureau, American FactFinder
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
accessed as of October 19, 2013.

c) Carnegie Foundation for the Advancement of Teaching
http://classifications.carnegiefoundation.org/resources/
accessed as of October 19, 2013.

d) Carnegie classification for Doctorate-granting Universities includes institutions that awarded at least 20 research doctoral degrees during the update year (excluding doctoral-level degrees that qualify recipients for entry into professional practice, such as the JD, MD, PharmD, DPT, etc.).

e) Number of Research Universities per capita is estimated by dividing the total number of Research Universities by the each state's population.

Level I-RU/VH: Research Universities (very high research activity)
Level II-RU/H: Research Universities (high research activity)

Level III-DRU: Doctoral/Research Universities

In 2005, Nevada ranked among the top seven states in terms of per capita income among western states, higher than Arizona, Idaho, New Mexico, and Utah. Compared to higher income states, Nevada's relative lack of economic prosperity seems to translate directly into the low amount of investment in its youth. This assessment follows from the work of the Carnegie Foundation. The Carnegie classification system looks at the number of graduate degrees awarded, the number of fields, and the mix of degrees awarded. Generally, the quality ratings are from I to III, with the lower number ratings being the more prestigious. To be sure, quality is difficult to measure, but these rankings offer a rough first approximation.

Degree program offerings, expenditure levels, and other objective measures of academic output offer addition collaboration about the quality rankings. When compared to other western states, Nevada has a number of research institutions per million population lower (ranking of 9 of 11) than all but two other states, California and Washington even recognizing the much more developed California economy as a special case. Additionally, Nevada has no Level I institutions. All other states have a higher number of research universities per capita. As such, the Silver State does not offer as many opportunities for advanced degrees and the associated high-paying career paths that are found in other neighboring states.

For example, Montana with approximately the same level of income per capita and almost one-third the population of Nevada has the same number of research universities as Nevada, but one is a Tier 1. Therefore, ignoring these ratings and introspective assessment, as difficult as it may be to assess quality and as painful as it might be to find things wanting, is no formula for addressing the legacy we leave future generations.

The available evidence suggests that other western states are supporting research universities shown in Table 2 more than Nevada. See the appended tables and charts showing information on funding levels and sources, patents and copyrights given to these universities, and other general information. Additionally, most western states make use of local resources as well to support higher education. When comparing Nevada to its peers on state support alone, as is often the case, the results can be misleading. Often, states use local support as a funding mechanism for community colleges, leaving more state resources for research universities.

Table 3 below provides a comparison of per capita support levels by government resource type. This data provides further evidence for Nevada's woeful position in per capita expenditures for Research and Development by Higher Education. While Research and Development expenditures come from a variety of sources, state and local support is used to build the infrastructure necessary to compete for those dollars.

Table 3: Per Capita State and Local Support for Higher Education, 2012

State	Net Total Support	Net State Support	Net Local Support
Arizona	$241	$127	$114
California	$301	$249	$52
Colorado	$137	$127	$11
Idaho	$225	$211	$14
Montana	$209	$203	$6
Nevada	***$174***	***$174***	***$0***
New Mexico	$441	$384	$56
Oregon	$198	$146	$52
Utah	$259	$259	$0
Washington	$200	$200	$0
Wyoming	$649	$596	$53

*State and local support data from SHEEO/SHEF, population data estimates for July 1, 2011 from the US Census, and all calculations made by project consultants.

As illustrated in Table 4, every western state exceeds Nevada's Research and Development expenditures in relative terms. As is evident, the range runs from Idaho at 48% more per capita R & D expenditures to Colorado's whopping 313%. Understating the significance of these expenditures is difficult to do. For example, if Nevada attracted R & D expenditures at the level of Utah, the additional annual economic impact would exceed **$1 billion**. (Note: R & D expenditures by Higher Education in 2011 for Nevada and Utah were $165,437,000 and $627,180,000, respectively. Using an economic multiplier of 2.21 to reflect this variance in expenditure yields differential of $1,020,452,000 per year between the two states. The economic multiplier for Nevada was calculated using Economic Modeling Specialists Intl.'s ("EMSI") multiplier for scientific research and development services.)

Table 4: Per capita and relative Research and Development Expenditures by Higher Education, 2011

State	$ Per Capita	State to Nevada Ratio
Arizona	$154	2.54
California	$218	3.59
Colorado	$252	4.15
Idaho	$90	1.48
Montana	$196	3.22
Nevada	***$61***	***1.00***
New Mexico	$195	3.21
Oregon	$191	3.14
Utah	$223	3.66
Washington	$230	3.78
Wyoming	$101	1.67

Sources:

a) R&D Funding from National Science Foundation. Higher Education Research and Development: Fiscal Year 2011. Ronda Britt, Project Officer. Arlington, VA. http://www.nsf.gov/statistics/nsf13325/.

b) Population from U.S. Census Bureau, Population Estimates, Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012. http://www.census.gov/popest/data/state/totals/2012/index.html.

Generally, we find that Nevada falls behind the other western states and will require a significant amount of catching up to be competitive with them. As such, today, the state is not well-positioned to be economically competitive. Future challenges are likely to be great since Nevada's economy is not well-developed. As we have seen, economic adversity, such as marked by volatile fuel prices, long-term climate change-induced drought conditions, fractured tax policy, challenges in the Nevada's K-12 school system, and increased competition are contesting the Silver State's economic landscape.

Leaving a legacy to address what the future may hold requires raising Nevada's higher education's performance levels. Lester's work suggests that Nevada will not probably want to copy the research agendas of other states, but to focus on alternative pathways for which Nevada has the likelihood of being a future leader. To be sure, our current economic-base and the resources at our disposal are very important. Still, objective and clear-headed economic analysis will be needed to pragmatically evaluate a range of strategic options before Nevada will want to commit to specific large funding programs that other states, for example, California have. Our conclusion is that preserving the possibility of having a research university educational system that is appealing to the state's future citizens in order for them to compete in the expanding global economy will surely be a legacy that the current generation of Nevadans can bequeath to those who follow.

Other western states have determined that investment in higher education is essential.[22] They have identified shortcomings and strengths and moved to position to meet a significant amount of rigorous competition; and they are investing heavily in higher education. They are taking positive steps to ensure future economic opportunity. Nevada remains well behind other western states, and to remain so runs a substantial risk to its economy and the well-being of its residents.

Conclusion

For better or worse, technology, innovation, economic growth, and social change centered supported research universities have proved effective. Still, one finds both resistance to and concern for education, knowledge, and the associated public investment that is required. There is no fundamental reason that the Silver State's leaders cannot address efforts for its universities to catch up and become competitive with those of other western states. It seems appropriate for a future perspective to return to the issue of growth, knowledge, and the status of research in the Silver State.[23] In the final analysis, the task of this generation of Nevadans is to keep the door open and lay the foundation for the future. That is why, for Nevada to remain competitive on the world economic stage, that the "Three Ts" (talent, time and treasure) must be consistently applied in large doses for an extended period of time to the state's higher education system.

The future will be different, to be sure. Globalization and technology will continue to change Nevada's economic climate. Future challenges will have to be met with new business models and new patterns of social awareness and organization. Meeting these challenges requires a more sophisticated and "developed" work force. A crowded world, perhaps environmentally stressed, will place a premium on high-valued activities, intellectual rigor, and imagination. A creative and flexible citizenry working together offers the best opportunity to get things done—a research university must play a key, if not essential, role in meeting future challenges. A Tier 1 research university will enable future Nevadans to more easily meet

these global challenges and to exploit currently known and unknown opportunities in the face of rapidly changing economic demands. Against this backdrop, this current generation of Nevadans must leave a legacy for future Nevadans.

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Appendix A

According to the Carnegie Foundation for the Advancement of Teaching university classification system, doctorate-granting institutions are differentiated based on an explicit measure of research activity. They currently use a multi-measure index rather than the single measure of federal funding used in previous editions of the Carnegie Foundation's university classifications. This approach incorporates several improvements: it is not limited to funding; the funding measures used are not limited to federal funding; and the analysis considers both aggregate and per-capita measures of research activity. Using the new methodology, they have created three categories of doctorate-granting research institutions: (1) Research universities with very high research activity; (2) Research universities with high research activity; and (3) Doctoral/research universities.

Table A-1 - Research Levels for Universities in Western States

State	University/Institution	Level
AZ	Arizona State University	I
	Northcentral University	III
	Northern Arizona University	II
	University of Arizona	I
	University of Phoenix-Online Campus	III
CA	Alliant International University	III
	Argosy University-Orange County	III
	Azusa Pacific University	III
	Biola University	III
	California Institute of Integral Studies	III
	California Institute of Technology	I
	Claremont Graduate University	II
	Fielding Graduate University	III
	Pacifica Graduate Institute	III
	Pepperdine University	III
	San Diego State University	II
	Stanford University	I
	TUI University	III
	University of California-Berkeley	I
	University of California-Davis	I
	University of California-Irvine	I
	University of California-Los Angeles	I
	University of California-Riverside	I
	University of California-San Diego	I
	University of California-Santa Barbara	I
	University of California-Santa Cruz	I
	University of La Verne	III
	University of San Diego	III
	University of San Francisco	III
	University of Southern California	I
	University of the Pacific	III

Table A-1 - Research Levels for Universities in Western States-(Continued)

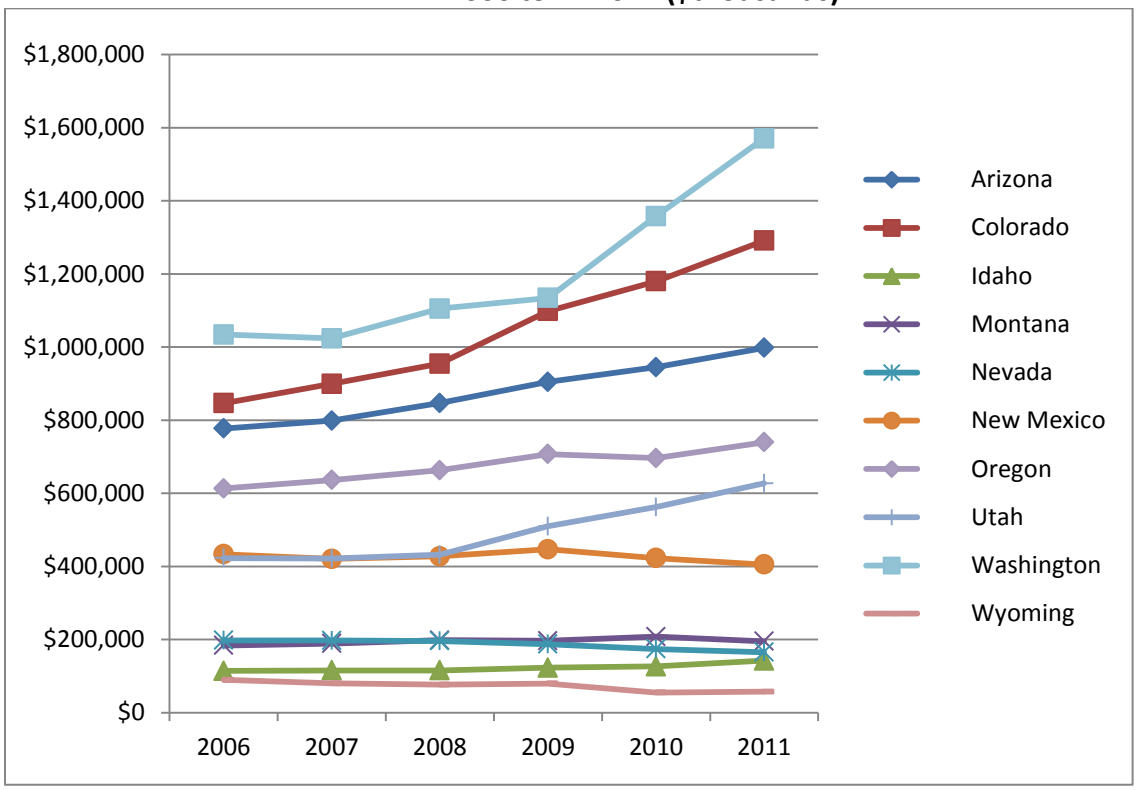
State	University/Institution	Level
CO	Colorado School of Mines	II
	Colorado State University	I
	Colorado Technical University	III
	University of Colorado at Boulder	I
	University of Colorado Denver	II
	University of Denver	II
	University of Northern Colorado	III
ID	Idaho State University	II
	University of Idaho	II
MT	Montana State University	I
	The University of Montana	II
NM	New Mexico State University-Main Campus	II
	University of New Mexico-Main Campus	I
NV	***University of Nevada-Las Vegas***	***II***
	University of Nevada-Reno	***II***
OR	Oregon State University	I
	Portland State University	II
	University of Oregon	I
UT	Brigham Young University	II
	University of Utah	I
	Utah State University	II
WA	University of Washington-Seattle Campus	I
	Washington State University	I
WY	University of Wyoming	II

Source: Carnegie Foundation for the Advancement of Teaching.
http://classifications.carnegiefoundation.org/resources/. accessed as of October 19, 2013.

Appendix B

We find that Nevada universities lag other western states' universities in research activity and graduate degrees granted. Nevada is higher only than Idaho and Wyoming in terms of its R&D funding and is last in terms of R&D funding per capita. It is higher than Idaho, Montana and Wyoming in terms of total PhD degrees granted, but lowest in PhD degrees per capita. It is also low in total patents received by state, ahead of only Idaho, Montana, and Wyoming - all states with lower population than Nevada.

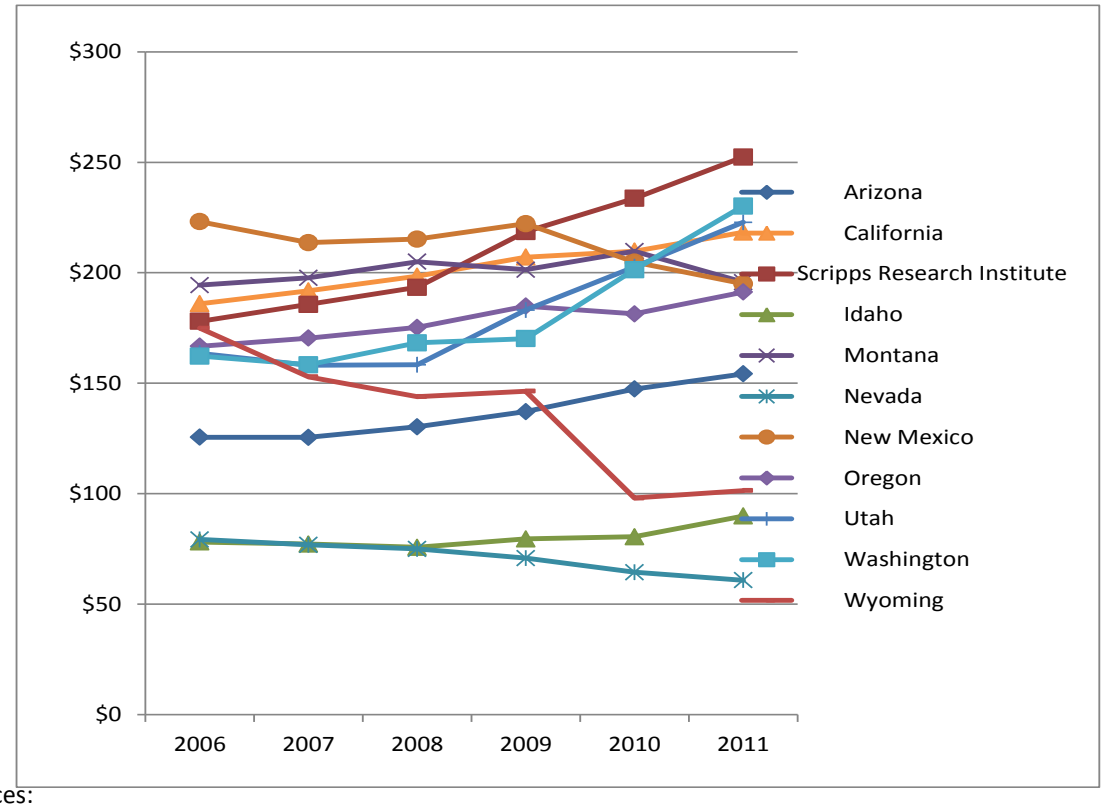
Figure B-1: Higher Education Research and Development Funding FY 2006 to FY 2011 ($thousands)*



*Excludes funding data for California as it significantly exceeds funding for other states, ranging from $6.7 billion in FY 2006 to $8.2 billion in FY 2011.

Source: National Science Foundation. Higher Education Research and Development: Fiscal Year 2011. Ronda Britt, Project Officer. Arlington, VA. http://www.nsf.gov/statistics/nsf13325/.

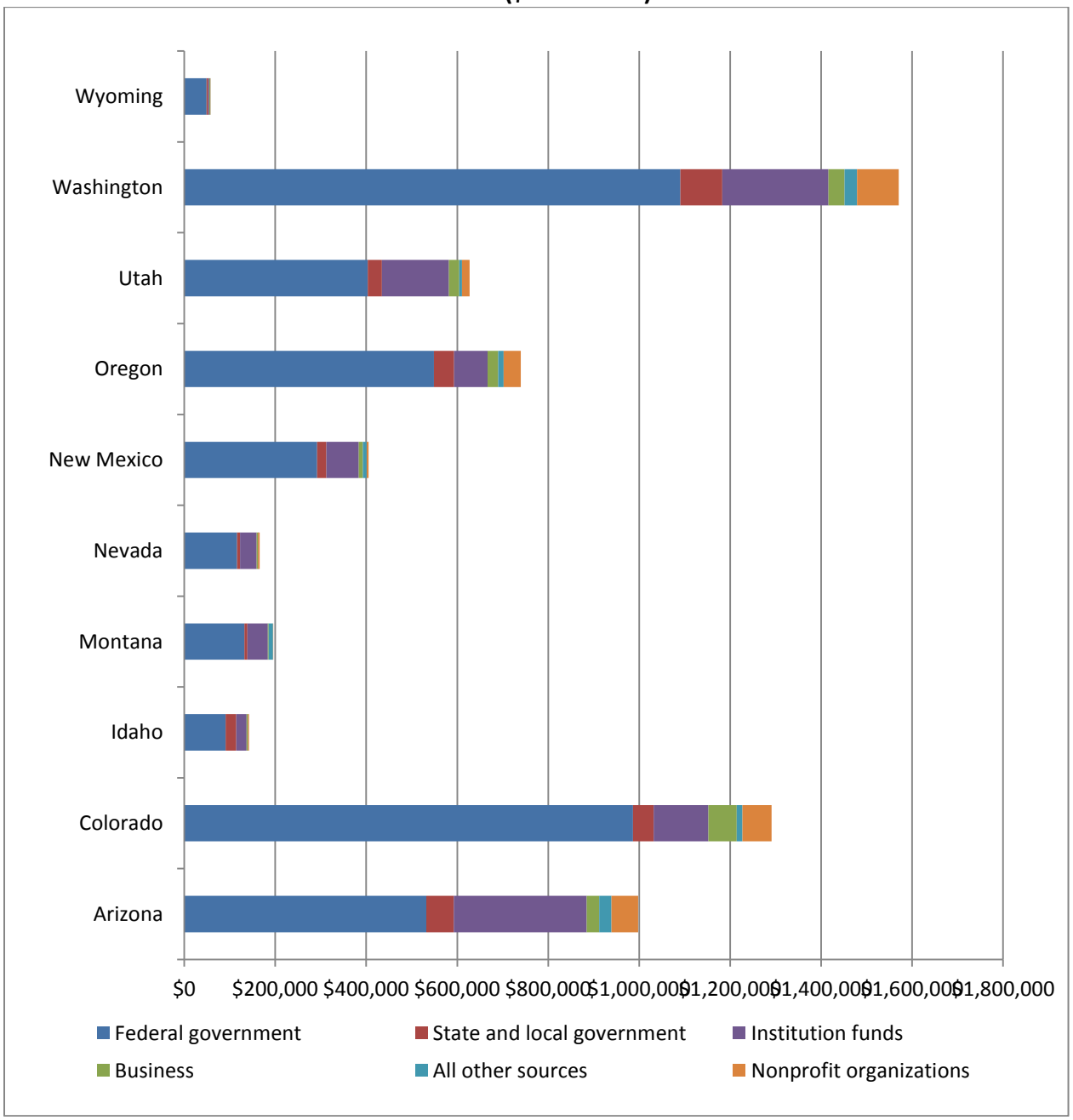
Figure B-2: Per Capita Higher Education R&D Funding
FY 2006 to FY 2011



Sources:
a) R&D Funding from National Science Foundation. Higher Education Research and Development: Fiscal Year 2011. Ronda Britt, Project Officer. Arlington, VA. http://www.nsf.gov/statistics/nsf13325/.

b) Population from U.S. Census Bureau, Population Estimates. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009. http://www.census.gov/popest/data/historical/2000s/index.html and Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012. http://www.census.gov/popest/data/state/totals/2012/index.html.

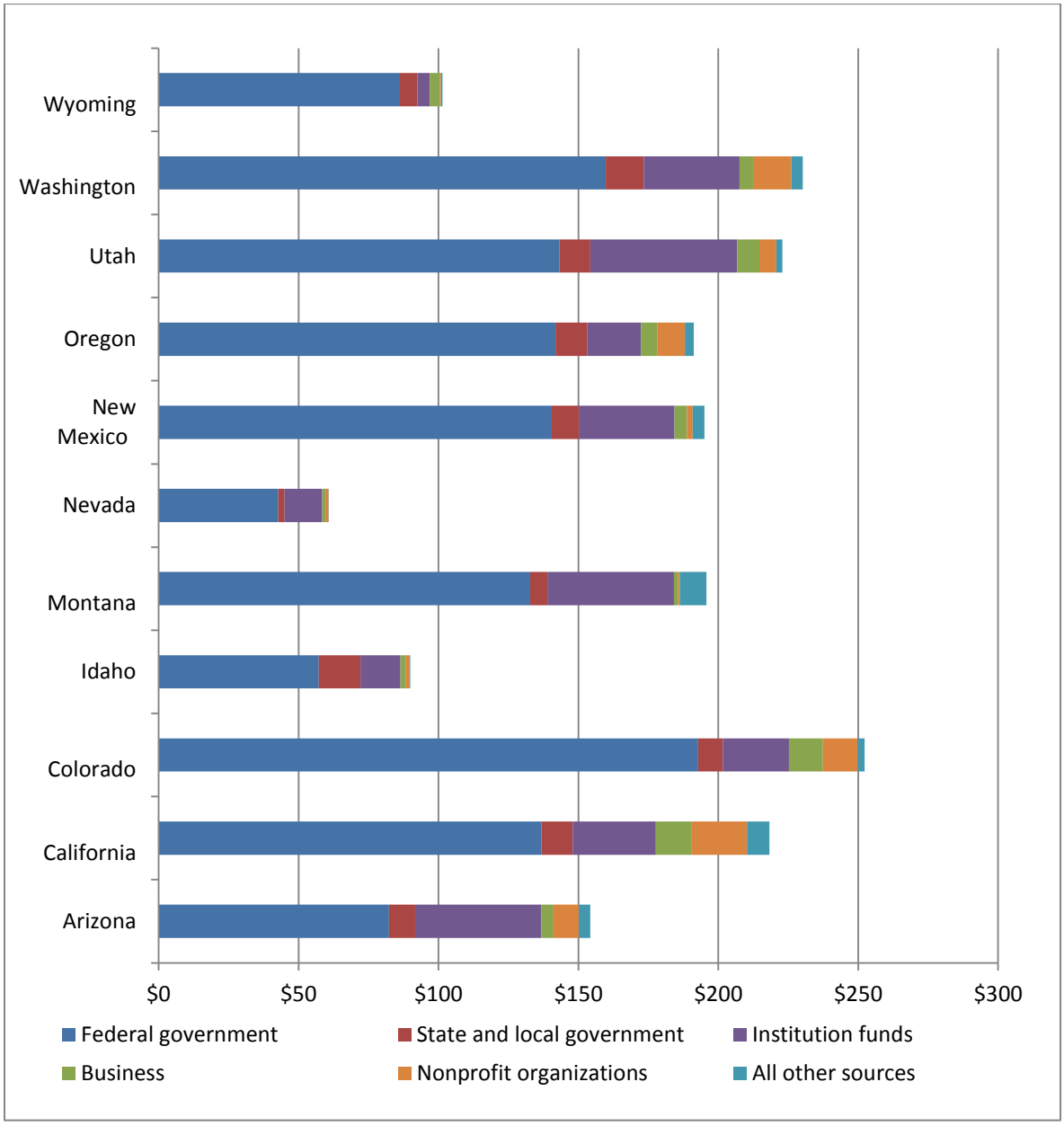
Figure B-3: Higher Education R&D Funding By Source
FY 2011 ($thousands)*



*Excludes funding data for California as it significantly exceeds funding for other states, with R&D expenditures of $8.2 billion in FY 2011.

Source: National Science Foundation. Higher Education Research and Development: Fiscal Year 2011. Ronda Britt, Project Officer. Arlington, VA. http://www.nsf.gov/statistics/nsf13325/.

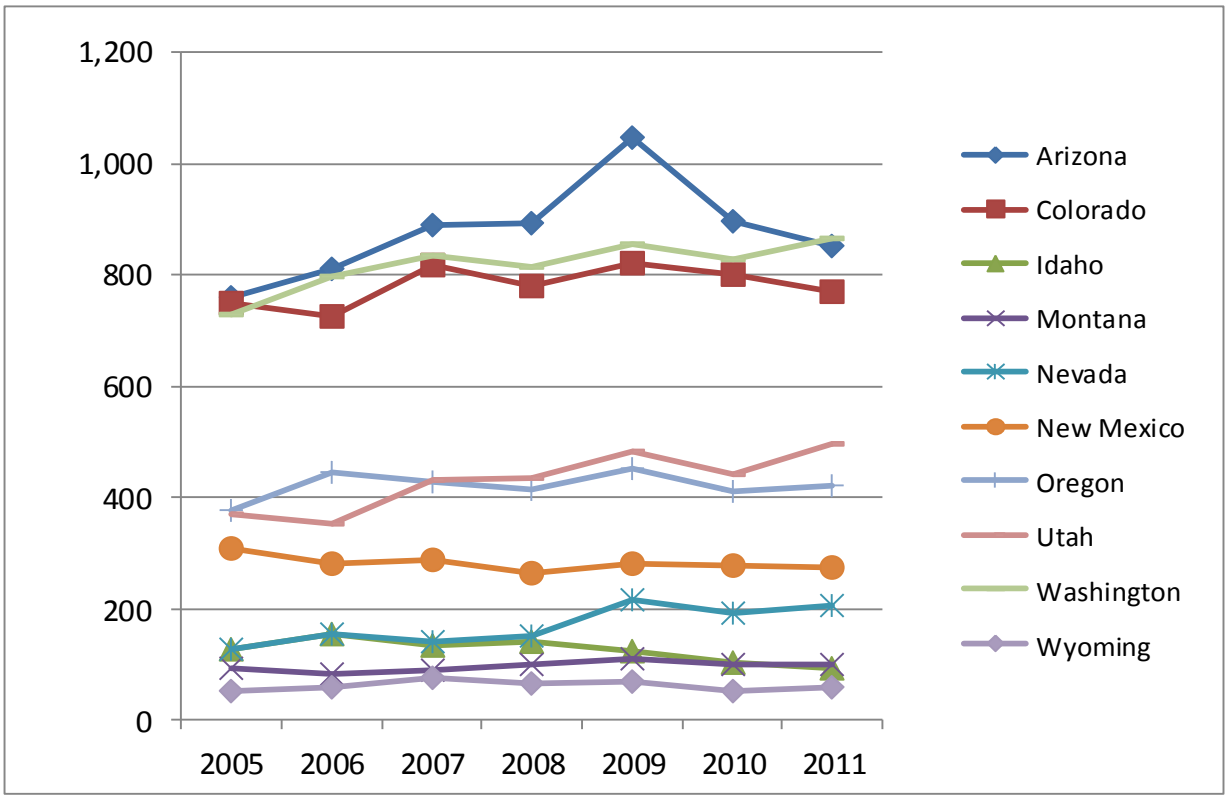
Figure B-4: Per Capita Higher Education R&D Funding By Source
FY 2011



Sources:
a) R&D Funding from National Science Foundation. Higher Education Research and Development: Fiscal Year 2011. Ronda Britt, Project Officer. Arlington, VA. http://www.nsf.gov/statistics/nsf13325/.

b) Population from U.S. Census Bureau, Population Estimates. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009. http://www.census.gov/popest/data/historical/2000s/index.html and Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012. http://www.census.gov/popest/data/state/totals/2012/index.html.

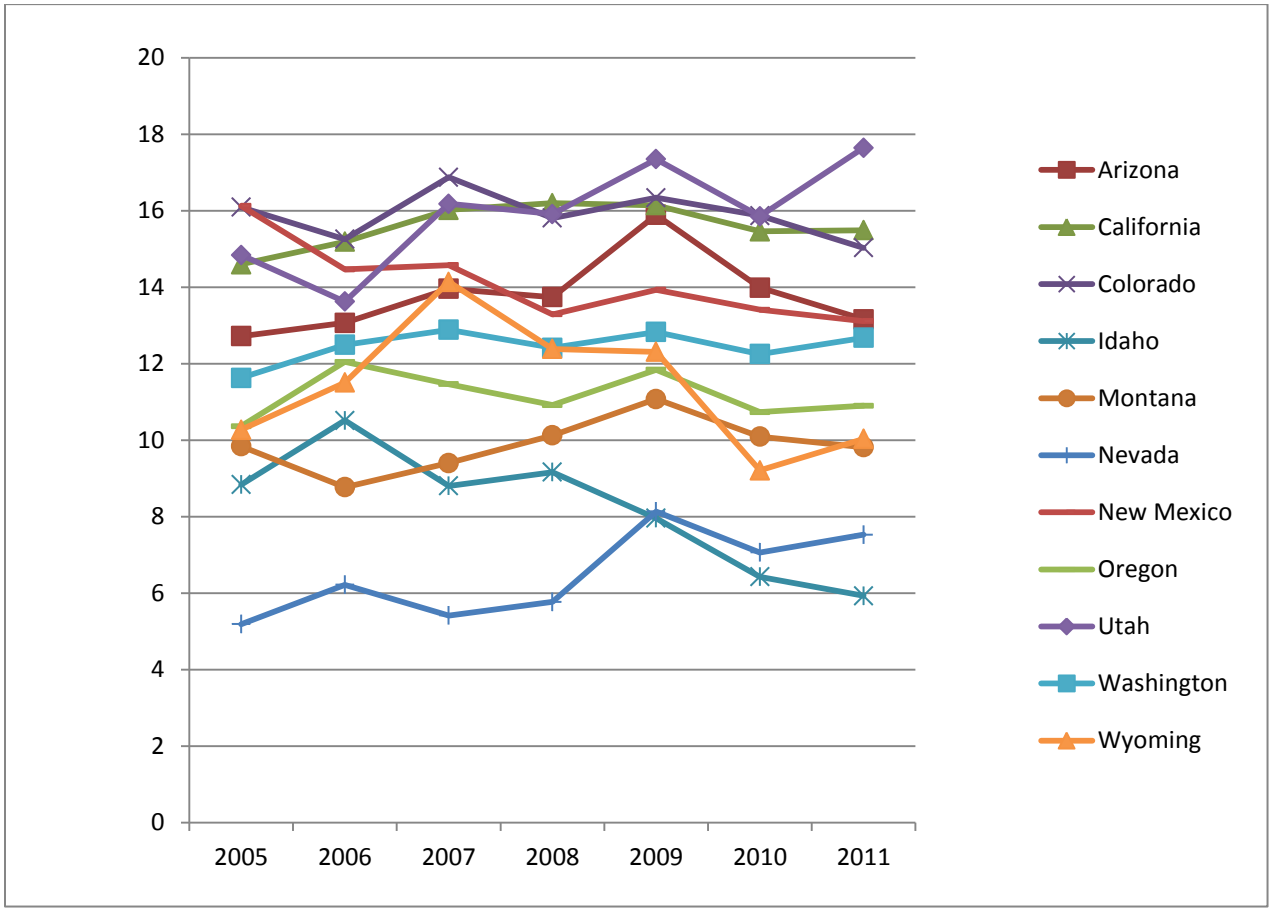
Figure B-5: Total Doctorate Degrees Granted
2005 to 2011*



*Excludes degree data for California as it significantly exceeds data for other states, ranging from 5,225 degrees in 2005 to 5,838 in 2011.

Source: National Science Foundation, Division of Science Resources Statistics. Doctorate Recipients from U.S. Universities. Annual reports for 2005 through 2011. http://www.nsf.gov/statistics/doctorates/.

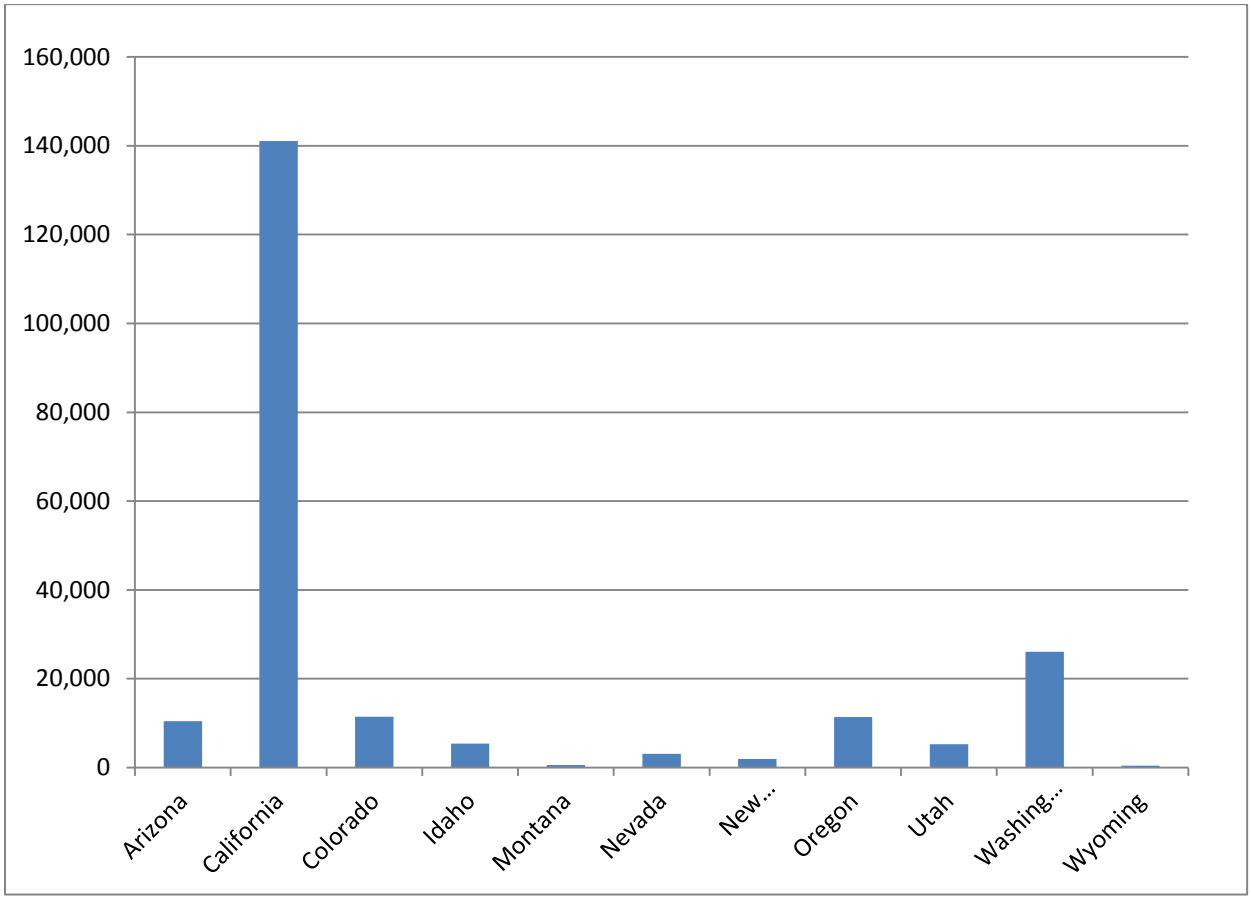
Figure B-6: Per Capita Doctoral Degrees Granted
2005 to 2011



a) Doctoral degrees awarded from National Science Foundation, Division of Science Resources Statistics. Doctorate Recipients from U.S. Universities. Annual reports for 2005 through 2011. http://www.nsf.gov/statistics/doctorates/.

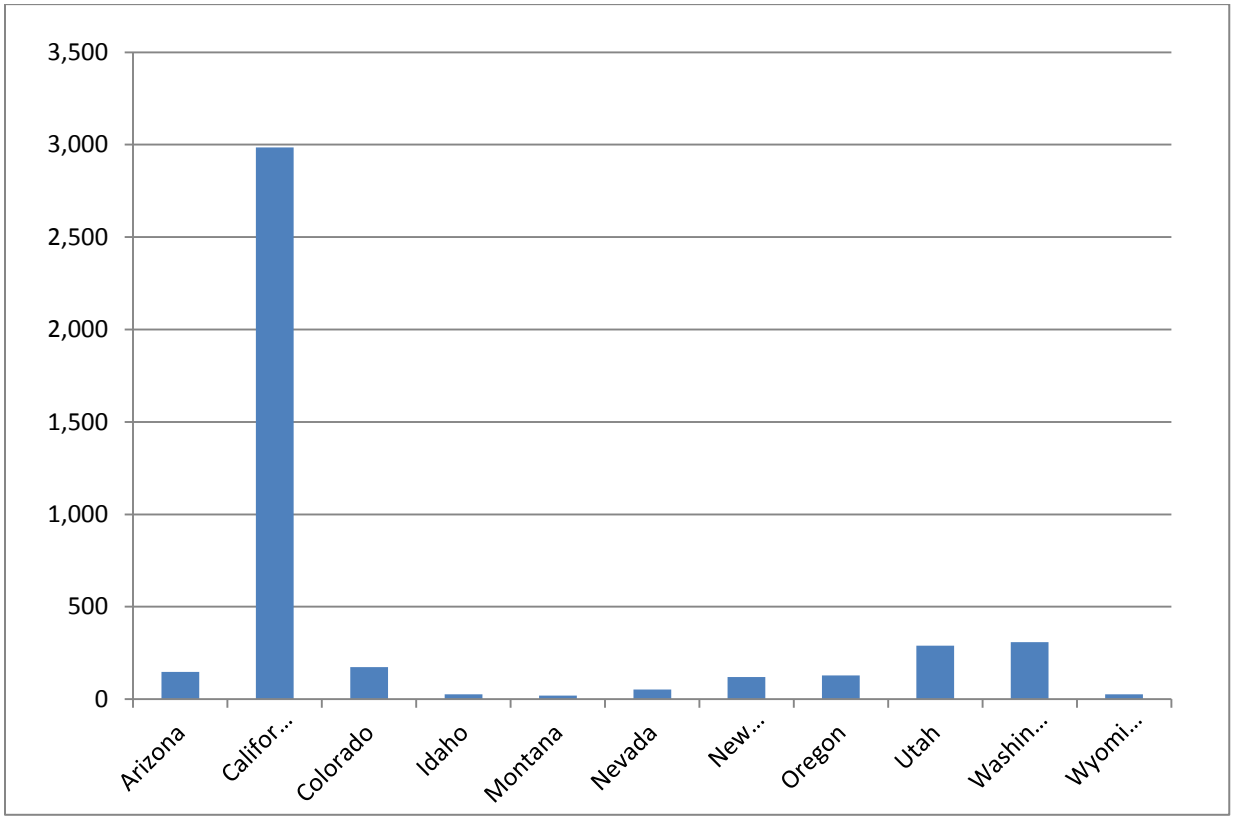
b) Population from U.S. Census Bureau, Population Estimates. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009. http://www.census.gov/popest/data/historical/2000s/index.html and Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012. http://www.census.gov/popest/data/state/totals/2012/index.html.

Figure B-7: Patents Granted, by State
2008 to 2012



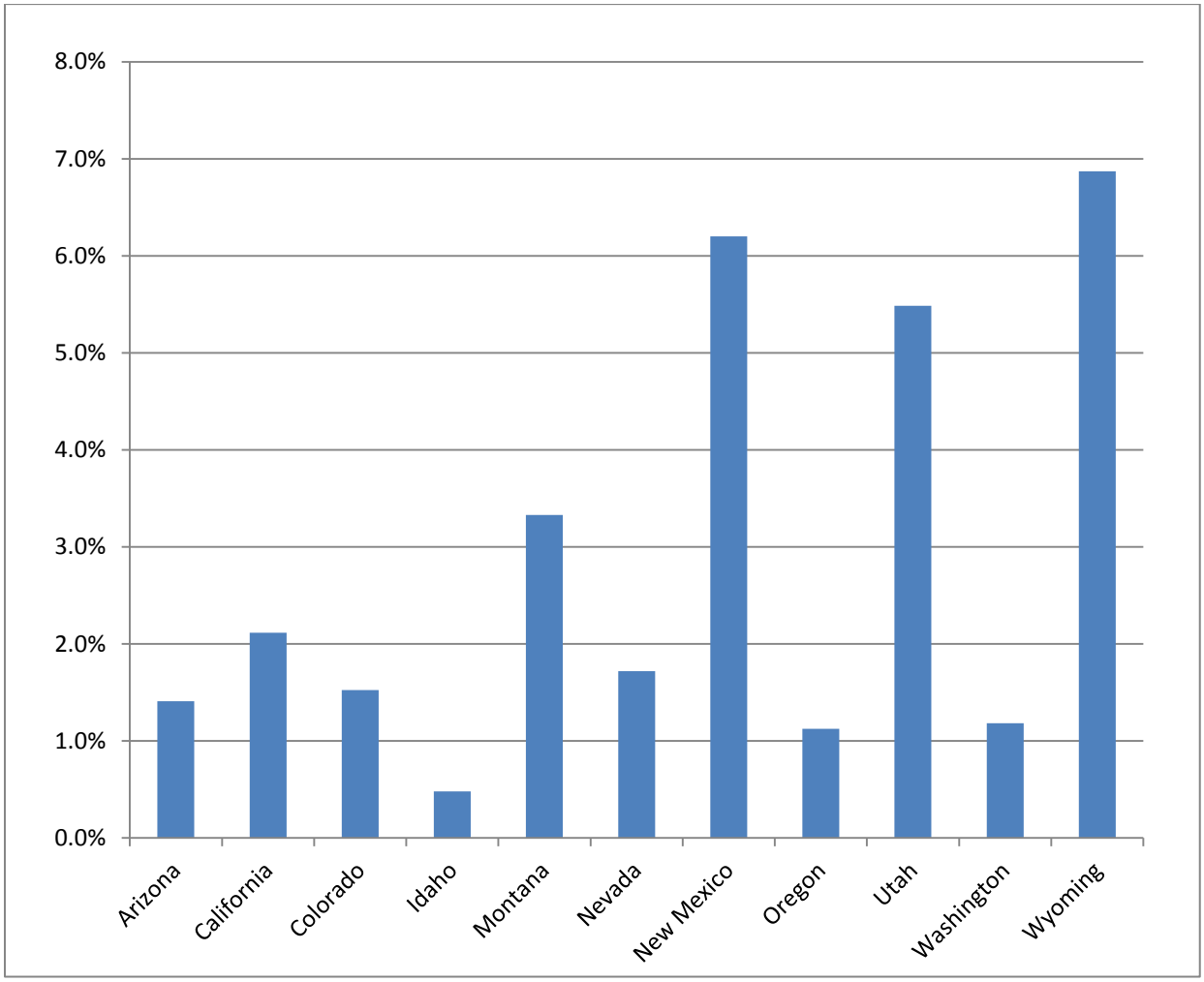
Source: U.S. Patent and Trademark Office, Patent Technology Monitoring Division. Calendar Year Patent Statistics.
http://www.uspto.gov/web/offices/ac/ido/oeip/taf/reports.htm#by_geog

Figure B-8: Patents Granted to Universities, by State
2008 to 2012



Source: U.S. Patent and Trademark Office, Patent Technology Monitoring Division. Calendar Year Patent Statistics.
http://www.uspto.gov/web/offices/ac/ido/oeip/taf/reports.htm#by_geog

Figure B-9: Percent of Total State Patents Granted to Universities
2008 to 2012



Source: U.S. Patent and Trademark Office, Patent Technology Monitoring Division. Calendar Year Patent Statistics. http://www.uspto.gov/web/offices/ac/ido/oeip/taf/reports.htm#by_geog

Table B-1: Ph.D. Degrees Granted, by Institution, 2011

State/location and institution	All fields	Agricultural sciences, natural resources	Biological, biomedical sciences	Health sciences	Chemistry	Computer and information sciences	Earth, atmospheric, and ocean sciences	Mathematics	Physics and astronomy	Anthropology	Economics	Political science	Psychology	Sociology	Other social sciences	Engineering	Education	Humanities	Business and management	Communication	Other Fields
All institutions	49,010	1,209	8,135	2,123	2,439	1,711	856	1,607	2,065	555	1,124	686	3,594	656	1,505	8,004	4,691	5,214	1,328	651	857
Arizona	853	23	102	28	34	28	24	27	45	16	10	11	58	10	41	137	97	104	33	12	13
AZ State U.	408	3	35	10	5	21	10	17	11	9	5	5	26	2	16	90	47	61	13	10	12
Northern AZ U.	28	3	12	0	0	0	0	0	0	0	0	3	0	0	5	0	4	1	0	0	0
Prescott C.	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
U. AZ	409	17	55	18	29	7	14	10	34	7	5	3	32	8	20	47	38	42	20	2	1
California	5,838	59	1,008	142	323	254	121	205	295	81	185	112	526	90	195	1,040	301	693	88	44	76
Alliant International U.-Alameda	22	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	1	0	0
Alliant International U.-Alhambra	36	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0
Alliant International U.-Fresno	21	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0
Alliant International U.-San Diego	38	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0
Azusa Pacific U.	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Biola U.	31	0	0	0	0	0	0	0	0	0	0	0	9	0	3	0	7	5	1	0	6
CA Institute Integral Studies	34	0	0	1	0	0	0	0	0	2	0	0	8	0	2	0	3	17	1	0	0
CA Institute of Technology	168	2	24	0	29	6	9	13	35	0	1	0	0	0	0	49	0	0	0	0	0
City of Hope Graduate School of Biological Science	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Claremont Graduate U.	117	1	2	0	0	5	0	3	0	0	11	8	14	0	4	0	23	41	4	0	1
Claremont School of Theology	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
Fielding Graduate Institute	78	0	0	0	0	0	0	0	0	0	0	0	59	0	4	0	1	0	11	0	3
Fuller Theological Seminary	35	0	0	0	0	0	0	0	0	1	0	0	11	0	3	0	0	12	0	0	8
Graduate Theological Union	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	6

Table B-1: Ph.D. Degrees Granted, by Institution, 2011 (Continued)

State/location and institution	All fields	Agricultural sciences, natural resources	Biological, biomedical sciences	Health sciences	Chemistry	Computer and information sciences	Earth, atmospheric, and ocean sciences	Mathematics	Physics and astronomy	Anthropology	Economics	Political science	Psychology	Sociology	Other social sciences	Engineering	Education	Humanities	Business and management	Communication	Other Fields
Keck Graduate Institute	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
La Sierra U.	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0
Loma Linda U.	39	0	14	1	0	0	0	0	0	0	0	0	17	0	1	0	0	0	0	0	6
Palo Alto U.	28	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0
Pardee RAND Graduate School	14	0	0	0	0	0	0	0	0	0	1	0	0	0	11	0	2	0	0	0	0
San Diego State U.	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Santa Clara U.	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Saybrook Graduate School	64	0	1	1	0	0	0	0	0	0	0	0	49	0	0	0	1	0	12	0	0
Scripps Research Institute, The	39	0	23	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stanford U.	703	2	120	0	31	27	21	28	51	10	27	15	13	14	8	232	21	61	14	6	2
U. CA, Berkeley	878	18	128	20	55	38	11	31	42	24	41	25	22	12	37	173	37	128	14	1	21
U. CA, Davis	491	25	147	13	28	25	14	18	23	5	21	8	13	6	14	86	9	33	0	1	2
U. CA, Irvine	374	2	80	0	32	32	6	13	20	5	8	6	16	8	12	61	11	58	3	0	1
U. CA, Los Angeles	683	0	121	24	26	29	10	37	24	10	22	17	32	11	40	106	40	114	5	8	7
U. CA, Merced	8	0	3	0	0	1	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0
U. CA, Riverside	235	4	47	0	21	7	2	17	14	4	7	2	16	12	2	38	10	32	0	0	0
U. CA, San Diego	484	1	117	12	23	24	25	18	23	6	21	15	22	6	5	101	25	38	0	2	0
U. CA, San Francisco	120	0	77	22	5	0	0	0	1	0	0	0	1	1	0	12	0	1	0	0	0
U. CA, Santa Barbara	343	3	17	0	29	16	6	11	31	4	4	5	29	12	18	62	30	59	0	7	0
U. CA, Santa Cruz	145	1	22	0	9	8	10	8	19	9	6	3	7	3	4	16	5	15	0	0	0
U. San Diego	34	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	14	0	2	0	0
U. San Francisco	48	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	43	0	3	0	0
U. Southern CA	431	0	61	25	18	36	7	8	10	1	15	8	10	5	26	97	2	58	17	19	8
U. of the Pacific	7	0	1	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B-1: Ph.D. Degrees Granted, by Institution, 2011 (Continued)

State/location and institution	All fields	Agricultural sciences, natural resources	Biological, biomedical sciences	Health sciences	Chemistry	Computer and information sciences	Earth, atmospheric, and ocean sciences	Mathematics	Physics and astronomy	Anthropology	Economics	Political science	Psychology	Sociology	Other social sciences	Engineering	Education	Humanities	Business and management	Communication	Other Fields
Colorado	769	17	123	25	30	22	45	33	49	6	23	10	50	11	11	141	90	50	19	11	3
CO School of Mines	48	1	0	0	2	0	11	0	4	0	2	0	0	0	0	28	0	0	0	0	0
CO State U.	206	15	39	6	16	7	9	10	7	0	7	2	20	1	1	36	21	0	8	1	0
U. CO	353	1	30	3	12	14	25	13	37	5	14	8	17	10	6	72	16	50	10	10	0
U. CO Health Sciences Ctr.	64	0	54	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U. CO-Colorado Springs	11	0	0	0	0	0	0	0	1	0	0	0	3	0	0	3	4	0	0	0	0
U. CO-Denver	29	0	0	2	0	1	0	6	0	1	0	0	0	0	3	2	10	0	1	0	3
U. Denver	7	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	3	0	0	0	0
U. Northern CO	51	0	0	4	0	0	0	2	0	0	0	0	8	0	1	0	36	0	0	0	0
Idaho	94	9	13	2	9	1	5	1	5	0	0	1	8	0	2	8	28	1	1	0	0
Boise State U.	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0
ID State U.	32	0	5	1	0	1	1	0	4	0	0	0	7	0	0	3	9	1	0	0	0
U. ID	59	9	8	1	9	0	3	1	1	0	0	1	1	0	2	3	19	0	1	0	0
Montana	98	10	30	2	3	2	3	3	13	1	0	0	6	0	1	6	17	1	0	0	0
MT State U.	55	5	18	0	0	2	3	1	13	0	0	0	0	0	1	6	6	0	0	0	0
U. MT	43	5	12	2	3	0	0	2	0	1	0	0	6	0	0	0	11	1	0	0	0
Nevada	***205***	***4***	***33***	***5***	***11***	***2***	***9***	***2***	***14***	***1***	***3***	***1***	***28***	***1***	***0***	***24***	***43***	***19***	***5***	***0***	***0***
U. NV, Las Vegas	***103***	***2***	***9***	***2***	***6***	***1***	***4***	***2***	***5***	***0***	***0***	***1***	***13***	***1***	***0***	***11***	***28***	***13***	***5***	***0***	***0***
U. NV, Reno	***102***	***2***	***24***	***3***	***5***	***1***	***5***	***0***	***9***	***1***	***3***	***0***	***15***	***0***	***0***	***13***	***15***	***6***	***0***	***0***	***0***
New Mexico	273	9	40	10	12	4	7	10	29	4	1	1	14	4	2	40	43	31	5	7	0
NM Institute of Mining & Technology	10	0	0	0	2	0	4	0	3	0	0	0	0	0	0	1	0	0	0	0	0
NM State U.	100	9	15	1	3	1	1	4	13	0	0	0	6	0	0	14	26	3	4	0	0
U. NM	163	0	25	9	7	3	2	6	13	4	1	1	8	4	2	25	17	28	1	7	0

Table B-1: Ph.D. Degrees Granted, by Institution, 2011 (Continued)

State/location and institution	All fields	Agricultural sciences, natural resources	Biological, biomedical sciences	Health sciences	Chemistry	Computer and information sciences	Earth, atmospheric, and ocean sciences	Mathematics	Physics and astronomy	Anthropology	Economics	Political science	Psychology	Sociology	Other social sciences	Engineering	Education	Humanities	Business and management	Communication	Other Fields
Oregon	422	43	93	10	23	11	16	11	23	3	9	3	33	3	17	48	32	21	9	6	8
OR Health & Science U.	57	1	44	2	0	2	0	0	0	0	0	0	1	0	0	7	0	0	0	0	0
OR State U.	173	41	27	8	8	3	7	8	6	0	4	0	2	1	5	35	16	0	0	0	2
Portland State U.	50	1	7	0	2	4	2	0	3	0	0	0	13	0	5	6	0	0	1	0	6
U. OR	142	0	15	0	13	2	7	3	14	3	5	3	17	2	7	0	16	21	8	6	0
Utah	497	7	82	17	39	20	9	17	12	3	16	7	53	7	11	97	51	19	9	8	13
Brigham Young U.	92	0	10	0	12	4	0	3	3	1	0	0	26	1	0	18	13	0	0	0	1
U. UT	300	0	55	16	23	12	5	13	9	2	11	7	10	3	10	61	21	17	6	8	11
UT State U.	105	7	17	1	4	4	4	1	0	0	5	0	17	3	1	18	17	2	3	0	1
Washington	866	33	153	67	46	31	31	23	40	22	16	10	52	14	30	111	49	68	39	19	12
Gonzaga U.	16	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	11	0	0
Seattle Pacific U.	16	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	5	0	0	0	0
U. WA	637	15	128	54	37	25	27	19	33	18	8	5	20	11	25	88	31	54	13	14	12
WA State U.	197	18	25	13	9	6	4	4	7	4	8	5	18	3	5	23	11	14	15	5	0
Wyoming	57	5	5	0	4	3	2	5	2	0	3	0	11	0	1	8	7	0	0	0	1
U. WY	57	5	5	0	4	3	2	5	2	0	3	0	11	0	1	8	7	0	0	0	1

Source: National Science Foundation, Division of Science Resources Statistics. Doctorate Recipients from U.S. Universities. Annual reports for 2005 through 2011. http://www.nsf.gov/statistics/doctorates/.

Notes

[1] Joel Mokyr, "The Second Industrial Revolution, 1870-1914," referenced October 19, 2013, at http://faculty.wcas.northwestern.edu/~jmokyr/castronovo.pdf.

[2] Claudia Goldin and Lawrence F. Katz, "Human Capital and Social Capital: The Rise of Secondary Schooling in America, 1910 to 1940," NBER Working Paper No. 6439 (March, 1998) referenced October 19, 2013, at http://www.economics.harvard.edu/faculty/katz/files/hcap_jih_99.pdf.

[3] Stephen Broadberry, "How Did the United States and Germany Overtake Britain? A Sectoral Analysis of Comparative Productivity Level, 1870-1990," *The Journal of Economic History*, Vol. 8, No. 2 (June 1998), 375-407.

[4] The great transformation is reflected in the time a worker earning the average wage could purchase items. A simple one-speed bicycle required 260 hours of labor in 1895, but only 7.2 hours in 1997—a productivity factor of 36.1. See Brad De Long, "Slouching Towards Utopia?: The Economic History of the Twentieth Century," referenced October 19, 2013, at http://www.j-bradford-delong.net/TCEH/Slouch_wealth2.html.

[5] The U.S. was able to lead the world in education and human capital through the virtues of its educational system which were in place before the American Civil War. These virtues were common schools, decentralization of control, public funding, nonsectarian schools, gender neutrality, and openness and forgiving in comparison with other educational systems. See Claudia Goldin and Lawrence Katz, "The 'Virtues' of the Past: Education in the First One Hundred Years of the New Republic," NBER Working Paper No. 9958 (September 2003) referenced October 19, 2013.

[6] Beaudreau, Bernard C. *The Economic Consequences of Mr. Keynes: How the Second Industrial Revolution Passed Great Britain By,* (New York, NY: Universe, 2006).

[7] CIA, *The World Factbook*, https://www.cia.gov/library/publications/the-world-factbook referenced October 19, 2013.

[8] CIA, *The World Factbook*, https://www.cia.gov/library/publications/the-world-factbook referenced on October 19, 2013.

[9] CIA, *The World Factbook*, https://www.cia.gov/library/publications/the-world-factbook referenced on October 19, 2013.

[10] The literacy rate in Singapore is 95.9 percent and the rate is 87.0 percent in Jamaica according to CIA, *The World Factbook,* https://www.cia.gov/library/publications/the-world-factbook referenced on October 19, 2013.

[11] http://www.bls.gov/web/laus/laumstrk.htm referenced March 17, 2014, data for January 2014.

[12] National Science Foundation. *Science and Engineering Indicators 2012.* http://www.nsf.gov/statistics/seind12/tables.htm referenced October 19, 2013.

[13] Wyoming-$18,901, California-$12,495, New Mexico-$11,672, Idaho-$9,908, Utah-$8,826, Washington-$8,815, Arizona-$7,126, Montana-$5,170, Oregon-$4,820, Colorado-$3,803.

[14] Thomas L. Friedman, *The World is Flat: A Brief History of the Twenty-first Century* (New York: Farrar, Straus and Giroux, 2005).

[15] Examples of the breadth of contribution that research universities make to state and local economic development may be found in issues of popular and academic publications such as the *Economic Development Quarterly.*

[16] Richard Florida, *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life* (New York : Basic Books, 2002).

[17] Rebecca W. Bushnell, *A Culture of Teaching: Early Modern Humanism in Theory and Practice* (Ithaca, NY: Cornell Univ. Press, 1996).

[18] Allan Nevins, *The Origins of the Land-Grant Colleges and State Universities; A Brief Account of the Morrill Act of 1862 and Its Results* (Washington, D.C.: Civil War Centennial Commission, 1962).
[19] Laurence Veysey, *The Emergence of the American University* (Chicago: U. Chicago Press, 1965).
[20] Clark Kerr, *The Great Transformation in Higher Education, 1960-1980* (Albany, N.Y.: State University of New York Press, 1991).
[21] Richard K. Lester, "Universities, Innovation, and the Competitiveness of Local Economies," Industrial Performance Center Working Paper 05-010, Massachusetts Institute of Technology, December 2005.
[22] K. Conklin, *Arizona Governor's task force on higher education issues report*. References October 19, 2013. http://www.nga.org.
[23] Joel Mokyr, *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Princeton University Press: Princeton, N.J., 2002).