THE UNIVERSITY AND THE CREATIVE ECONOMY

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Introduction

Most who have commented on the university's role in the economy believe the key lies in increasing its ability to transfer research to industry, generate new inventions and patents, and spin-off its technology in the form of startup companies. As such, there has been a movement in the U.S. and around the world to make universities "engines of innovation," and to enhance their ability to commercialize their research.

Universities have largely bought into this view, both because it makes their work more economically relevant and as a way to bolster their budgets. Unfortunately, not only does this view oversell the immediately commercial function of the university; it also misses the deeper and more fundamental contributions made by the university to innovation, the larger economy, and society as a whole.

This report examines the university's role in the Creative Economy through the lens of the "3T's" of economic development: Technology, Talent, and Tolerance. To do so, it examines a wide range of data and trends on technology transfer, startup companies, talent, brain drain, tolerance, and creativity for U.S. metro regions.[1]

Its main findings show that the university plays an important role across all 3 T's.

• **Technology:** As major recipients of both public and private R&D funding, and as important hotbeds of invention and spin-off companies, universities are often at the cutting edge of technological innovation.

• **Talent:** Universities affect talent in both directly and indirectly. They directly attract faculty, researchers and students, while also acting as indirect magnets that encourage highly educated, talented and entrepreneurial people and firms to locate nearby, in part to draw on the universities' many resources.

• **Tolerance:** Large research universities help shape a regional environment open to new ideas and diversity. They attract students and faculty from a wide variety of racial and ethnic backgrounds, economic statuses, sexual orientations, and national origins. University communities are meritocratic and open to difference and eccentricity; they are places where talented people of all stripes interact in stimulating environments that encourage open thought, self-expression, new ideas, and experimentation.

Until now, the university's role in the first T, technology, while important, has been overstressed. Both experts and policymakers have neglected the university's even more powerful role across the two other axes of economic development—in generating, attracting, and mobilizing talent, and in establishing a tolerant social climate—that is open, diverse, meritocratic and proactively inclusive of new people and new ideas.

The university thus comprises a powerful *creative hub* in regional development. Alone, though, the university is a necessary but insufficient component of successful regional economic development. To harness the university's capability to generate innovation and prosperity, it must be integrated into the region's broader creative ecosystem.

The University's Role in Economic Development

Universities have long played an important role in research, development, and technology generation. Recently, they have proven key contributors to regional development, too. Any discussion of the university's role in innovation and economic development quickly circles back to the now classic cases of Stanford University and MIT, which played critical roles in the development of Silicon Valley and the greater Boston area. Something similar has emerged in Austin, Texas, and the North Carolina Research Triangle. [2] From these cases, many have concluded that the university serves as an innovative en-

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gine of economic development. One entrepreneur, when asked yet again for "the secret of Silicon Valley's success," responded: "Take one great research university. Add venture capital. Shake vigorously."

But there is a broader theoretical underpinning for the view of the university as an "engine of innovation." It traces back to the Nobel prize-winning studies of MIT economist Robert Solow in the late 1950s. Solow argued that productivity growth was only partly attributable to the traditional explanatory factors, gains to capital and labor. The unexplained "residual" productivity growth, he surmised, must have been due to technological change, which he defined broadly.[3] More recent studies suggest that universities have significant effects on both corporate innovation and regional economic development. Investments in academic research yield significant returns to the economy and society, according to the studies of the economist, Edwin Mansfield.[4]

University research has also been found to make corporate innovation more efficient, according to Adam Jaffe; businesses that are located in close proximity to university research generate greater numbers of patents.[5] University research also tends to attract corporate research labs, according to other studies.[6] A 2005 study by the regional economists, Harvey Goldstein and Joshua Drucker examined the contribution of universities to economic development broadly across more than 300 metropolitan regions in the United States. They found that universities tend to increase average annual earnings, but that the biggest effects were in small and medium-size regions, those with less than 200,000 jobs.[7]

Many have argued that the university plays a key role at the front-end of the innovation process. According to the so-called "linear model of innovation" ideas flow naturally from university science and technology that can be commercially exploited and turned into economic growth. The key thus lies in developing new and better mechanisms to make this transfer of university science and technology to the commercial sector more effective and efficient, increasing the output of university "products" that are of commercial value to the economy.

The university as engine of innovation has been criticized as oversimplified because it sees the steps of innovation as distinct and occurring in discrete institutions. It assumes there is one-way path from university-based science and R&D, to commercial innovation (either within large companies or via spin-offs) and ultimately resulting in job generation and economic growth[8]

This perspective has been criticized by some as distorting the fundamental scientific mission of the university. The sociologist Robert Merton long ago contended that academic science should be an open project because it is firmly centered on the efficient creation of knowledge and movement of frontiers. Firms, on the other hand, seek scientific advance in order to increase profits and acquire intellectual property. [9]

The economists Partha Dasgupta and Paul David have argued strongly for keeping academic science separate from industry.[10] They feel that due to the inherently different motivations for undertaking university and industry science, that any intermixing of the two would negatively impact social welfare. Close ties between industry and university might, they argue, draw academic scientists toward research enterprises with immediate short-term benefits to industry, but away from research with broader and long-term impacts to society and the economy.

Conversely, Nathan Rosenberg and Richard Nelson, two leading students of the history of technology, argue forcefully that university and industry research, basic science and applied science have always been intertwined, and that it is difficult to even discern the divide between science and technology.[11] Wherever one falls between the two poles, the "engine of innovation" paradigm remains predominant, and continues to drive contemporary thinking about the university's role in economic development.

The university's increasing role in innovation and economic growth stems from deeper and more fundamental forces. The changing role of the university is bound up with the broader shift from an older industrial economy to an emerging Creative Economy. The past few decades have been one of profound economic transformation. In the past, natural resources and physical capital were the predominant drivers of economic growth. Now, human creativity is the driving force of economic growth. Innovation and economic growth accrue to those places that can best mobilize humans' innate creative capabilities from the broadest and most diverse segments of the population, harnessing indigenous talent and attracting it from outside.

The creative sector is the propulsive sector of economic growth. It has generated roughly 20 million new jobs between 1980 and 2000, and is projected to add another 10 million between 2004 and 2014. This creative sector currently employs some 40 million Americans, accounting for approximately one-third of total employment and more than $2 trillion dollars in wages and salaries – as much as the manufacturing and service sectors combined.

Economic growth in the Creative Economy is driven by 3 T's: Technology, Talent and Tolerance. Since the early writings of Joseph Schumpeter, economists have noted the role of the first T, technology, in economic growth.[12] More recently, there has

been increased interest in the role of the 2nd T, talent or human capital in economic growth.[13] But technology and talent have been mainly seen as *stocks* that accumulate in regions or nations. In reality, both technology and talent are flows. The ability to capture these flows requires understanding the third T, tolerance, the openness of a place to new ideas and new people. Places increase their ability to capture these flows by being open to the widest range of people across categories of ethnicity, race, national origin, age, social class, and sexual orientation. The places that can attract the widest pool of creative talent--harnessing the creative contributions of the most diverse range of people--gain considerable economic advantage emerging as creativity magnets. They simultaneously mobilize talent from within and draw in talent from the outside environment. With the rise of the Creative Economy, the university – as a center for research and technology generation, a hub for talent production and attraction, and a catalyst for establishing an open and tolerant regional milieu—becomes increasingly essential to both innovation and economic growth.

We can think of the relationship between the university and regional economy in terms of a simple transmitter-receiver system, with the university transmitting a signal that the regional economy must be able to absorb. Increasing the volume of the signal will not necessarily result in effective absorption or transmission if the region's receivers are not on or functioning properly. To borrow from Wesley Cohen and Daniel Levinthal, regions require an "absorptive capacity" – to effectively absorb and utilize the scientific and technological capabilities coming out of the university.[14]

The economist Michael Fogarty has found a consistent pattern in the flow of patented information from universities. Intellectual property migrates from universities in older industrial regions such as Detroit and Cleveland to high-technology regions such as the greater Boston, San Francisco Bay, and New York metropolitan areas. Fogarty finds that, although new knowledge is generated in many places, relatively few actually absorb and apply those ideas. [15]

The university is thus a necessary but insufficient element of economic growth. The region must have the will and capacity to transform and capitalize on what the university produces. It requires a geographically defined ecosystem that can mobilize and harness creative energy. In order to be an effective contributor to regional creativity, innovation, and economic growth, the university must be seamlessly integrated into that broader creative ecosystem.

In this report, we examine the effects of the university on all 3Ts of economic development. We look at these university effects across all 331 metropolitan regions, analyzing its impacts on technology, talent, and tolerance. To do so, we utilize a variety of indicators of university strength, including measures of students, faculty, research and development, technological innovation, and commercialization.

Our measures of university technology outputs are from the annual survey of the Association of University Technology Managers (AUTM) and the National Science Foundation science and engineering indicators. Our measures of university talent (students and faculty) are from Integrated Post-Secondary Education Dataset (IPEDS) from the Department of Education. We use a variety of demographic measures for tolerance including indexes of integration (Integration Index), foreign-born people (Melting Pot Index), artistic communities (Bohemian Index), and the gay and lesbian population (Gay Index). (See Appendix A for a full description of all variables and data sources).

We introduce a new measure of talent, the *Brain Drain/Gain Index* – a measure of the extent to which a region is gaining or losing college educated talent. We also introduce a new comparative measure of the university in the Creative Economy, the *University-Creativity Index*, a combined ranking of a region's university strength *and* its creative class. We employ a variety of statistical methods and tests to further illuminate the university's role in the 3Ts of economic growth, and which we believe can help shed new light on the broad and fundamental role universities play in economic growth and development.

Technology

Technology is the first T. As discussed, universities play a powerful role in conducting research and development and generating new scientific information, which can then lead to inventions, patents, or spin-off companies. Table 1 provides rankings for the university research intensity (measured as university R&D per capita).

- Among large regions, the leaders are several noted high—tech regions such as North Carolina's Research Triangle (Raleigh-Durham-Chapel Hill), Boston, San Jose, Seattle and Austin.

- Also notable here are older industrial regions which are home to significant research universities such as Baltimore, Pittsburgh and Rochester, NY.

- Classic college towns, particularly those that are home to large state research universities – Ann Arbor, MI (University of Michigan); Tucson, AZ (University of Arizona); Madison, WI (University of Wisconsin); Fort Collins, CO (Colorado State University); State College, PA (Penn State); Bryan-College Station, TX (Texas A&M); and Iowa City, IA (University of Iowa) – top the lists of small- and medium-size regions.

Table 1:
R&D per capita*

1 million people and above

Rank, R&D per capita	Region	Overall R&D per capita Rank	Total R&D size class rank	Total R&D Overall Rank
1	Raleigh-Durham-Chapel Hill	15	4	4
2	Boston	19	1	1
3	Baltimore	25	2	2
4	Seattle	36	9	9
5	San Jose	37	13	15
6	Austin	39	19	25
7	Pittsburgh	40	10	11
8	Rochester, New York	41	23	34
9	Columbus, Ohio	46	20	27
10	Sacramento	47	18	24

500,000 to 1,000,000 people

Rank, R&D per capita	Region	Overall R&D per capita Rank	Total R&D size class rank	Total R&D Overall Rank
1	Ann Arbor	14	1	13
2	Tucson	27	2	21
3	Springfield, Massachusetts	29	3	40
4	Knoxville, Tennessee	38	4	46
5	Birmingham, Alabama	44	5	47
6	Albuquerque	45	6	55
7	Charleston, South Carolina	50	11	70
8	Baton Rouge	52	10	66
9	Columbia, South Carolina	57	12	78
10	Wilmington, Delaware	61	13	79

250,000 to 500,000 people

Rank, R&D per capita	Region	Overall R&D per capita Rank	Total R&D size class rank	Total R&D Overall Rank
1	Madison, Wisconsin	13	1	10
2	Fort Collins	18	4	50
3	Santa Barbara	21	2	35
4	Lincoln, Nebraska	22	6	54
5	Santa Cruz	23	7	56
6	Lansing	24	3	36
7	Tallahassee	26	5	53
8	Galveston	30	10	74
9	Trenton	33	8	64
10	Lexington	42	9	67

250,000 and below

Rank, R&D per capita	Region	Overall R&D per capita Rank	Total R&D size class rank	Total R&D Overall Rank
1	State College, Pennsylvania	1	1	16
2	Bryan-College Station, Texas	2	2	18
3	Iowa City	3	8	33
4	Rochester, Minnesota	4	5	29
5	Lawrence, Kansas	5	11	42
6	Champaign-Urbana, Illinois	6	3	22
7	Bloomington, Indiana	7	9	38
8	Corvallis, Oregon	8	12	52
9	Athens, Georgia	9	7	31
10	Lafayette, Indiana	10	6	30

N = 107 MSAs for which AUTM data are available.

While research intensity can contribute to regional innovation and ultimately growth, the ability of universities to translate their research capabilities into commercial innovation varies significantly. Table 2 provides regional rankings for university-based patenting.

- The top 10 large regions include several noted technology centers like Boston, the Research Triangle, and San Jose; but regions like Baltimore, Salt Lake City, Los Angeles. Atlanta and Houston also number among the top 10.
- Among small and medium-size regions, state university centers again rank highly, but regions like Omaha, Akron, Galveston, also do well.

Table 2:
Patent Applications*

1 million and above

Rank, Patent App. per faculty	Region	Overall Rank, Patent App. per faculty	Invention Disclosures, size class rank	Invention Disclosures, overall rank
1	Boston	7	1	1
2	Raleigh-Durham-Chapel Hill	8	4	4
3	Baltimore	10	3	3
4	San Jose	14	9	10
5	Salt Lake City	15	14	16
6	Middlesex-Somerset-Hunterdon, NJ	17	17	23
7	Los Angeles	19	2	2
8	Atlanta	21	7	8
9	Houston	24	8	9
10	Orange County, California	28	24	39

500,000 to 1 million

Rank, Patent App. per faculty	Region	Overall Rank, Patent App. per faculty	Invention Disclosures, size class rank	Invention Disclosures, overall rank
1	Birmingham, Alabama	3	2	31
2	Ann Arbor	23	1	17
3	Richmond	27	5	42
4	Albuquerque	30	11	69
5	Knoxville, Tennessee	41	9	58
6	Tucson	43	4	40
7	Charleston, South Carolina	46	6	53
8	Omaha	51	13	77
9	Wilmington, Delaware	55	17	90
10	Akron	56	8	56

250,000 to 500,000

Rank, Patent App. per faculty	Region	Overall Rank, Patent App. per faculty	Invention Disclosures, size class rank	Invention Disclosures, overall rank
1	Galveston	2	6	49
2	Madison	6	1	7
3	Santa Cruz	11	8	54
4	Santa Barbara	16	3	36
5	Trenton	20	5	38
6	Lansing	34	4	37
7	Fort Collins	36	9	60
8	Tallahassee	47	10	80
9	Reno	49	12	92
10	Provo	59	2	20

250,000 and below

Rank, Patent App. per faculty	Region	Overall Rank, Patent App. per faculty	Invention Disclosures, size class rank	Invention Disclosures, overall rank
1	Rochester, Minnesota	1	3	21
2	State College, Pennsylvania	4	1	15
3	Charlottesville, Virginia	5	5	27
4	Greenville, North Carolina	9	19	100
5	Iowa City	12	8	43
6	Gainesville	13	2	19
7	Bryan-College Station, Texas	18	4	24
8	Lafayette, Indiana	22	6	28
9	Bloomington, Indiana	25	10	50
10	Athens, Georgia	26	9	47

N = 107 MSAs for which AUTM data are available.

Table 3:
University R&D, Inventions and Patent Applications

Rank	Regions	R&D per Capita	Total R&D ($ M)	Invention Disclosures per Faculty	Patent Applications per Faculty
1	State College	3242.97	440.26	0.104	0.149
2	Bryan-College Station	2606.49	397.27	0.085	0.057
3	Iowa City	2259.52	250.82	0.081	0.081
4	Rochester MN	2146.82	266.80	1.434	0.717
5	Lawrence KS	1932.31	193.16	0.054	0.012
6	Champaign-Urbana	1913.54	343.80	0.062	0.031
7	Bloomington IN	1858.77	224.10	0.047	0.042
8	Corvallis	1775.23	138.74	0.044	0.034
9	Athens	1684.50	258.48	0.041	0.041
10	Lafayette IN	1440.97	263.44	0.076	0.046
11	Gainesville	1352.11	294.70	0.099	0.080
12	Charlottesville	1312.92	209.51	0.116	0.137
13	Madison	1299.71	554.36	0.194	0.109
14	Ann Arbor	863.43	499.70	0.054	0.045
15	Raleigh-Durham	805.49	956.87	0.143	0.093
16	Auburn	769.90	88.61	0.020	0.019
17	Columbia MO	695.05	94.15	0.024	0.012
18	Fort Collins	609.12	153.19	0.049	0.029
19	Boston	591.68	2015.74	0.103	0.098
20	Bangor	583.29	53.00	0.005	0.003
21	Santa Barbara	582.07	232.45	0.079	0.069
22	Lincoln	543.46	136.02	0.013	0.016
23	Santa Cruz	510.79	130.56	0.095	0.083
24	Lansing	508.64	227.73	0.044	0.032
25	Baltimore	489.39	1249.40	0.096	0.089

N = 107 MSAs for which AUTM data is available

Table 3 ranks the top 25 regions overall in terms of university research intensity, along with providing their data on university invention disclosures and patent applications.

- The top 5 regions are State College, PA (Penn State); Bryan-College Station, TX (Texas A&M); Iowa City, IA (University of Iowa); Rochester, MN; and Lawrence, KS (University of Kansas). Rounding out the top 10 are Champaign-Urbana, IL (University of Illinois); Corvallis, OR (University of Oregon); Athens, GA (University of Georgia); and Lafayette, IN (Indiana University). In fact, the entire list is dominated by regions home to large state universities.

- Of leading high-tech centers, only Boston and Raleigh-Durham-Chapel Hill make the list. Baltimore is the only larger region that is not a noted high-tech center to rank among the top 25.

Table 4:
License Income*

1 million and above

Rank, License Income per Faculty	Region	Overall rank, License Income per Faculty	Total License Income, size class rank	Total License Income, overall rank
1	Orange County, California	7	10	12
2	Sacramento, California	8	5	6
3	Oakland, California	9	4	5
4	San Jose, California	11	6	7
5	New York New York	12	1	1
6	Los Angeles	13	2	2
7	Seattle	14	7	8
8	Boston	15	3	3
9	San Diego	16	9	11
10	Rochester, New York	17	17	23

500,000 to 1 million

Rank, License Income per Faculty	Region	Overall rank, License Income per Faculty	Total License Income, size class rank	Total License Income, overall rank
1	Birmingham, Alabama	18	4	44
2	Springfield, Mass.	23	1	25
3	Greenville, SC	38	2	39
4	Ann Arbor	50	3	42
5	Knoxville	51	6	57
6	Albany	61	5	54
7	Richmond	67	9	67
8	Baton Rouge	70	8	65
9	Syracuse	72	7	63
10	Mobile	75	13	83

250,000 to 500,000

Rank, License Income per Faculty	Region	Overall rank, License Income per Faculty	Total License Income, size class rank	Total License Income, overall rank
1	Tallahassee	2	1	4
2	Santa Cruz	3	5	19
3	Santa Barbara	4	2	10
4	Madison	5	4	17
5	Lansing	10	3	15
6	Galveston	20	11	71
7	Provo	30	6	37
8	Binghamton, New York	44	10	68
9	Trenton	47	8	52
10	Lexington	54	7	51

250,000 and below

Rank, License Income per Faculty	Region	Overall rank, License Income per Faculty	Total License Income, size class rank	Total License Income, overall rank
1	Rochester, Minnesota	1	3	33
2	Gainesville	6	1	14
3	Iowa City	19	4	38
4	Charlottesville	25	5	41
5	Bryan-College Station, Texas	26	2	29
6	Athens	40	6	43
7	Fargo	41	11	69
8	Bloomington, Indiana	43	8	49
9	Champaign-Urbana, Illinois	46	7	46
10	Jamestown, New York	48	15	82

N = 107 MSA for which AUTM data is available.

Table 4 ranks regions on university licensing income.

- The 5 leading large regions are Orange County, Sacramento, Oakland, San Jose, and New York. Los Angeles, Seattle, Boston, San Diego and Rochester, NY, round out the top 10.

- Again, major state university centers dominate the rankings for small and medium-size regions.

The ability of universities to generate new startup companies has frequently been noted as a key spur to regional growth of high-tech industry. The roles played by Stanford University in the Silicon Valley and of MIT in the growth of the greater Boston-Route 128 corridor are legendary. Table 5 provides regional rankings for university spin-offs.

- Silicon Valley (San Jose) and Boston are among the top 5 large regions in generating university spin-off companies. Salt Lake City is first, while the North Carolina Research Triangle area and Baltimore also make the top 5. Rounding out the top 10 are Los Angeles, Central New Jersey, Houston, Minneapolis and Providence, Rhode Island.

- Again, major state university centers lead the small- and medium-size regions.

Table 5:
Start-ups*

1 million and above

Rank, Start-ups per faculty	Region	Overall Rank, Start-ups per faculty	Total Start-ups (2000), size class rank	Total Start-ups (2000), overall rank
1	Salt Lake City	5	7	7
2	Boston	6	1	1
3	Raleigh-Durham-Chapel Hill	7	4	4
4	San Jose	16	10	11
5	Baltimore	19	5	5
6	Los Angeles	22	2	2
7	Middlesex-Somerset-Hunterdon	24	19	27
8	Houston	25	8	9
9	Minneapolis	27	5	5
10	Providence	29	15	21

500,000 to 1 million

Rank, Start-ups per faculty	Region	Overall Rank, Start-ups per faculty	Total Start-ups (2000), size class rank	Total Start-ups (2000), overall rank
1	Birmingham	4	2	21
2	Mobile	10	3	33
3	Ann Arbor	14	1	11
4	Albuquerque	18	3	33
5	Akron	28	3	33
6	Knoxville	36	6	43
7	Tucson	43	6	43
8	Baton Rouge	52	6	43
9	Charleston	55	10	59
10	Springfield, Massachusetts	56	6	43

Appendix Two

Regional Rankings on the University–Creativity Index by Size

Regions with population 1 million and above

Rank	Region	Overall Rank	University/Creativity Interaction
1	San Jose	6	0.924
2	San Francisco	11	0.896
3	San Diego	19	0.856
3	Austin	19	0.856
5	Boston	24	0.841
6	Sacramento	26	0.837
7	Oakland	29	0.814
8	Seattle	34	0.801
9	Denver	35	0.795
10	Los Angeles	42	0.772
10	Chicago	42	0.772
12	Minneapolis	45	0.770
13	Washington DC	46	0.766
14	Raleigh-Durham	47	0.763
15	Oklahoma City	63	0.719
16	Rochester NY	66	0.713
17	Hartford	70	0.702
18	Orange County	75	0.686
19	St. Louis	76	0.684
20	New York	82	0.675
21	Baltimore	84	0.672
22	Philadelphia	86	0.666
23	Phoenix	92	0.645
24	Middlesex	94	0.644
25	Columbus OH	97	0.636

1 million and above (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
26	Pittsburgh	99	0.634
27	Kansas City	107	0.616
28	Cleveland	115	0.595
29	Milwaukee	119	0.589
30	Newark	122	0.585
31	Houston	124	0.583
32	Tampa	129	0.579
32	Providence	129	0.579
34	Salt Lake City	136	0.556
35	Dallas	138	0.551
36	Miami	140	0.550
36	Detroit	140	0.550
38	Buffalo	142	0.548
39	Atlanta	143	0.545
40	San Antonio	145	0.544
41	Portland OR	148	0.542
42	West Palm Beach	151	0.538
42	Norfolk	151	0.538
44	Monmouth	156	0.532
45	Fort Lauderdale	167	0.512
46	Nassau	173	0.494
47	Nashville	174	0.492
48	Orlando	181	0.479
49	New Orleans	186	0.464
50	Cincinnati	187	0.462

1 million and above (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
51	Charlotte	188	0.458
52	Riverside	197	0.441
53	Jacksonville FL	202	0.437
54	Greensboro	219	0.402
55	Louisville	231	0.391
56	Bergen	239	0.381
56	Indianapolis	239	0.381
58	Fort Worth	252	0.340
59	Memphis	256	0.310
60	Grand Rapids	263	0.293
61	Las Vegas	301	0.168

Regions with population between 500,000 and 1,000,000

Rank	Region	Overall Rank	University/Creativity Interaction
1	Albany NY	15	0.876
2	Ann Arbor	21	0.855
3	Columbia SC	37	0.789
4	Omaha	42	0.772
5	Albuquerque	48	0.761
6	Springfield MA	51	0.754
7	Dayton	54	0.748
8	New Haven	59	0.745
9	Syracuse	61	0.737
10	Baton Rouge	68	0.71

500,000 and 1,000,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
11	Tucson	81	0.677
12	Charleston SC	85	0.668
13	Worcester	87	0.662
14	Scranton	95	0.64
15	Akron	96	0.637
16	Richmond	100	0.631
17	Jersey City	103	0.624
18	Ventura	103	0.624
19	Wilmington DE	112	0.603
20	Bakersfield	113	0.598
21	Wichita	125	0.582
21	Honolulu	125	0.582
23	Colorado Springs	132	0.565
24	Birmingham	134	0.559
25	El Paso	138	0.551
26	Harrisburg	150	0.541
27	Toledo	158	0.529
28	Tacoma	161	0.526
29	Little Rock	162	0.523
30	Allentown	180	0.483
31	Tulsa	197	0.441
31	Knoxville	197	0.441
33	Mobile	214	0.411
34	Greenville SC	219	0.402
35	McAllen	224	0.397

500,000 and 1,000,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
36	Fresno	225	0.396
37	Fort Wayne	258	0.307
38	Stockton	263	0.293
39	Vallejo	277	0.251
40	Youngstown	292	0.204
41	Gary	294	0.195
42	Sarasota	296	0.189

Regions with population between 250,000 and 500,000

Rank	Region	Overall Rank	University/Creativity Interaction
1	Lansing	4	0.926
2	Madison	8	0.917
3	Montgomery	9	0.914
4	Provo	11	0.896
5	Trenton	13	0.893
6	Tallahassee	14	0.891
7	Huntsville	22	0.853
8	Lincoln	28	0.828
9	Des Moines	36	0.79
10	Spokane	38	0.787
11	Santa Rose	49	0.758
12	Melbourne	54	0.748
13	Santa Barbara	60	0.742
14	Santa Cruz	62	0.73
15	Fort Collins	63	0.719

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
16	Pensacola	65	0.715
17	Brockton	66	0.713
18	South Bend	69	0.704
19	Dutchess County	71	0.701
20	Binghamton	73	0.698
21	Daytona Beach	74	0.692
22	Eugene	76	0.684
23	Lexington	82	0.675
24	Huntington	88	0.659
25	Jackson MS	91	0.653
26	Springfield MO	97	0.636
27	Anchorage	100	0.631
28	Lowell	106	0.618
29	Lawrence MA-NH	110	0.609
30	Killeen	111	0.607
31	Kalamazoo	114	0.597
32	Macon	118	0.592
33	Corpus Christi	120	0.588
34	Boulder	143	0.545
35	Erie	145	0.544
36	Salem	159	0.527
37	Fayetteville NC	163	0.521
38	Stamford	165	0.517
39	Peoria	174	0.492
40	Boise City	177	0.488

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
41	Utica	185	0.467
42	Quad Cities	188	0.458
43	Salinas	190	0.453
44	Flint	194	0.444
45	Appleton	195	0.443
46	Bridgeport	200	0.44
47	Charleston WV	205	0.435
48	Fort Pierce	208	0.427
49	Brownsville	209	0.426
50	Beaumont	213	0.417
51	Augusta	217	0.405
52	Chattanooga	222	0.4
53	Hamilton	229	0.393
54	Fayetteville AR	231	0.391
55	Johnson City	234	0.387
56	Saginaw	239	0.381
57	Reno	244	0.376
58	Savannah	246	0.364
59	Evansville	248	0.36
60	Rockford	249	0.352
61	New London	253	0.335
62	Lafayette LA	260	0.295
63	Biloxi	272	0.273
64	Fort Myers	273	0.267
65	Modesto	282	0.236
66	Newburgh	283	0.234
67	Canton	286	0.225

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
68	Visalia	289	0.218
69	Columbus GA	297	
0.187			
70	Reading	302	0.15
71	Shreveport	303	0.147
72	Lakeland	303	0.147
73	Lancaster	305	0.142
74	Naples	311	0.119
75	Hickory	313	0.118
76	York	315	0.109
77	Atlantic City	316	0.106
78	Galveston	320	0.095
79	Ocala	327	0.057

Regions with population below 250,000

Rank	Region	Overall Rank	University/Creativity Interaction
1	Gainesville	1	0.98
2	Bryan-College Station	2	0.976
3	Bloomington IL	3	0.965
4	Corvallis	4	0.926
5	Missoula	7	0.923
6	Lafayette IN	10	0.899
7	Charlottesville	15	0.876
8	Muncie	17	0.869
9	Santa Fe	18	0.861
10	Portland ME	23	0.849

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
11	Las Cruces	24	0.841
12	Bangor	27	0.832
13	Manchester	29	0.814
13	La Crosse	29	0.814
15	Monroe	32	0.808
16	Kankakee	33	0.804
17	Springfield IL	39	0.779
18	Iowa City	40	0.778
18	Lawrence KS	40	0.778
20	State College	50	0.755
21	Duluth	52	0.751
22	Redding	53	0.749
23	Cedar Rapids	54	0.748
24	Columbia MO	57	0.746
24	Dover	57	0.746
26	Eau Claire	72	0.699
27	Tyler	78	0.681
27	Tuscaloosa	78	0.681
29	Pocatello	80	0.678
30	Fitchburg	88	0.659
31	Champaign-Urbana	90	0.656
32	Auburn	92	0.645
33	Wilmington NC	102	0.628
34	Portsmouth	105	0.619
35	Chico	108	0.615
36	Burlington	109	0.61
37	Parkersburg	115	0.595
38	Longview	117	0.594

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
39	San Luis Obispo	120	0.588
40	Janesville	122	0.585
41	San Angelo	125	0.582
42	Amarillo	128	0.58
43	Gadsden	131	0.577
44	Bellingham	133	0.563
45	Yuba City	134	0.559
46	Waterloo	137	0.553
47	Brazoria	145	0.544
48	Fort Walton	148	0.542
49	Abilene	153	0.533
49	Waco	153	0.533
51	Terre Haute	153	0.533
52	Athens	157	0.53
53	Williamsport	159	0.527
54	Nashua	163	0.521
55	Mansfield	166	0.514
56	Jonesboro	167	0.512
57	Bloomington IN	169	0.509
58	Florence SC	170	0.506
59	Grand Forks	171	0.502
60	Fargo	172	0.497
61	Dothan	176	0.489
62	Florence AL	177	0.488
63	Roanoke	179	0.485
64	Asheville	182	0.474
65	Cheyenne	183	0.471
66	Jackson MI	184	0.468

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
67	Sumter	191	0.45
67	Pueblo	191	0.45
69	Topeka	193	0.449
70	Albany GA	195	0.443
71	Cumberland	200	0.44
72	Richland	202	0.437
72	Lubbock	202	0.437
74	Odessa	205	0.435
75	Sherman	207	0.429
76	Billings	210	0.424
77	Danbury	211	0.421
78	Wheeling	212	0.42
79	Jackson TN	215	0.409
80	Altoona	216	0.406
81	Casper	218	0.403
82	Lewiston	219	0.402
83	Great Falls	222	0.4
84	Lynchburg	225	0.396
84	Pine Bluff	225	0.396
86	Green Bay	228	0.394
87	Kenosha	229	0.393
88	Anniston	233	0.39
89	Hattiesburg	234	0.387
90	Clarksville	236	0.385
91	Lima	237	0.384
91	Olympia	237	0.384
93	New Bedford	242	0.379
94	Fort Smith	243	0.378

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
95	Bismarck	245	0.367
96	Kokomo	247	0.361
97	Victoria	249	0.352
98	Danville	251	0.343
99	Waterbury	254	0.32
100	Sioux City	255	0.313
101	Wichita Falls	257	0.308
102	Greeley	259	0.299
103	Rochester MN	260	0.295
103	Joplin	260	0.295
105	Rocky Mount	265	0.292
106	Grand Junction	266	0.289
107	Yuma	267	0.285
108	Jamestown	268	0.282
109	Lawton	269	0.279
109	Benton Harbor	269	0.279
111	Vineland	271	0.278
112	Lake Charles	274	0.264
113	St. Joseph	275	0.26
114	Decatur IL	276	0.257
115	Rapid City	278	0.249
116	Laredo	279	0.248
117	Pittsfield	280	0.243
118	Hagerstown	281	0.242
119	Dubuque	284	0.233
120	Sharon	285	0.231
121	Johnstown	287	0.224
122	Wausau	288	0.222

250,000 and 500,000 (cont.)

Rank	Region	Overall Rank	University/Creativity Interaction
123	Yakima	290	0.207
124	Sioux Falls	291	0.205
125	Texarkana	293	0.198
126	Alexandria	295	0.193
127	Steubenville	298	0.184
128	Panama City	299	0.18
129	Elmira	300	0.175
130	Decatur AL	306	0.139
131	Punta Gorda	307	0.133
132	Goldsboro	308	0.131
133	Flagstaff	309	0.13
134	Barnstable	310	0.122
135	Glens Falls	311	0.119
136	St. Cloud	314	0.112
137	Bremerton	317	0.103
138	Merced	318	0.1
139	Sheboygan	318	0.1
140	Medford	321	0.082
141	Greenville NC	322	0.074
142	Enid	323	0.073
142	Myrtle Beach	323	0.073
144	Owensboro	325	0.069
145	Racine	326	0.063
146	Yolo	328	0.036
147	Elkhart	329	0.021
147	Jacksonville NC	329	0.021
149	Houma	331	0.02

Endnotes

[1] Richard Florida, *The Rise of the Creative Class*, (Basic Books, 2002; updated paperback edition 2004); Florida, *Cities and the Creative Class*, (Routledge, 2004); and Florida, *The Flight of the Creative Class,* (Harper Business, 2005).

[2] There is a large literature on the subject; see for example. Roger Geiger, To Advance Knowledge: The Growth of American Research Universities, 1900-1940, (New York: Oxford University Press, 1986); Geiger, Research and Relevant Knowledge, (New York: Oxford University Press, 1993); Stuart Leslie, "Profit and Loss: The Military and MIT in the Postwar Era," Historical Studies in The Physical and Biological Sciences, 21, 1, (1990), pp. 59-86; Leslie, The Cold War and American Science, (New York: Columbia University Press, 1993; Henry Etzkowitz, "Entrepreneurial Science in the Academy: A Case for the Transformation of Norms," Social Problems, 36, (February 1989), pp. 14-29.

[3] Robert Solow, "Technical Change and the Aggregate Production Function," R*eview of Economics and Statistics*, 39, (August 1957), pp. 312-320.

[4] Edwin Mansfield," Academic Research and Industrial Innovation," Research Policy, 20, (1991), pp. 1-12.

[5] Adam Jaffe,"Real Effects of Academic Research," *American Economic Review*, 76, (December 1989), pp. 984-1001.

[6] Luc Anselin, A. Vargas, and Zoltan Acs, "Local Geographic Spillovers between University Research and High Technology Innovations, *Journal of Urban Economics,* 42, (1997), pp. 422-48

[7] Harvey Goldstein and Joshua Drucker," The Economic Development Impacts of Universities on Regions: Do Size and Distance Matter?". *Economic Development Quarterly*, 20, 1, (2006), pp. 22-43.

[8] See for example, Richard Florida and Wesley Cohen, "Engine or Infrastructure? The University Role in Economic Development. in Lewis M. Branscomb, Fumio Kodama, and Richard Florida (Eds.), *Industrializing Knowledge: University – Industry Linkages in Japan and the United States. (*Cambridge, MA: MIT Press, 1999), pp. 589-610.

[9] See his classic book, The Sociology of Science, (Chicago: University of Chicago Press, 1973).

[10] Partha Dasgupta and Paul David, "Toward a New Economics of Science," Research Policy 23, 3 (May 1994), pp. 487-521.

[11] Nathan Rosenberg and Richard Nelson, "American Universities and Technical Advance in Industry," Research Policy, Volume 23, (1994), pp. 323-348.

[12] Joseph Schumpeter, The Theory of Economic Development, (Transaction, 1982); Schumpeter, Capitalism Socialism and Democracy (Harper Perennial, 1962); Paul Romer, "Increasing Returns and Long-Run Growth," Journal of Political Economy, 94, 5 (October 1986), pp. 1002-1037; and Romer, "Endogenous Technological Change," Journal of Political Economy, 98, 5 (1990), pp. S72-S102.

[13] See Robert Lucas, "The Mechanics of Economic Development," *Journal of Monetary Economics*, 22, (1988), pp. 3-42.

[14] Wesley Cohen and Daniel Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly,* 35 (1990), pp. 128-152.

[15] Michael Fogarty and Amit Sinha, "University-Industry Relationships and Regional Innovation Systems—Why Older Industrial Regions Can't Generalize From Route 128 and Silicon Valley," in Lewis M. Branscomb, Fumio Kodama, and Richard Florida (Eds.), *Industrializing Knowledge: University-Industry Linkages in Japan and the United States. (*MIT Press, 1999).

[16] See Robert Lucas, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, (1998), pp. 38-9.

[17] See for example, Edward Glaeser, "The New Economics of Urban and Regional Growth." In Gordon Clark, Meric Gertler, and Maryann Feldmen (eds.), *The Oxford Handbook of Economic Geography*. (Oxford University Press, 2000), pp. 83-98. Glaeser, "The Future of Urban Reseach: Non-Market Interactions". In William G. Gale and Janet Rothenberg Pack (eds.), *Brookings – Wharton Papers on Urban Affairs,* (2000), *pp.* 101-149. Christopher Berry and Edward Glaesar, "The Divergence of Human Capital across Cities," (Harvard Institute of Economic Research, September 2005).

[18] See, Spencer Glendon, "Urban Life Cycles," (Harvard University, Department of Economics, unpublished working paper, 1998).

[19] See Goldstein and Drucker (2005), pp. 34-5.

[20] It is important to point out that the numerator does not count people under 25 who already have a degree and are working, while it does count those who have a degree but are not working. These however should tend to balance out in comparison among regions. Another caveat is that regions with more university students actually tend to score lower on the BDGI because the denominator (percent of younger people currently in school) is so large.

[21] See for example, Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press, 1990; Dean Keith Simonton, *Origins of Genius: Darwinian Perspectives on Creativity*. (Oxford University Press, 1999).

[22] See, Richard Florida, *The Flight of the Creative Class; The Global Competition for Talent,* (Harper Business, 2005).

[23] See, Dan Black, Gary Gates, Seth Sanders, and Lowell Taylor, " Demographics of the Gay and Lesbian Population in the United States: Evidence from Available Systematic Data Sources," *Demography* 37, 2, (May 2000), pp. 139-154.

[24] See especially, Florida, *The Rise of the Creative Class,* (2002).

[25] See for example, B.H. Hall, Adam Jaffe, and Manuel Tratjenberg,"The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools." NBER Working Paper 8498, (2000).

[26] See Florida (2002, 2005).

[27] See, Black, et al, "Demographics of the Gay and Lesbian Population in the United States," (May 2000).

[28] See the paperback edition of *The Rise of the Creative* Class (Basic Books, 2004) for further definition of the Integration and Tolerance indices.