



Technology and Tolerance: The Importance of Diversity to High-Technology Growth

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“People in technology businesses are drawn to places known for diversity of thought and open-mindedness.”

Findings

An analysis comparing measures of tolerance, diversity, and high-technology success in 50 metropolitan areas found:

- **The leading indicator of a metropolitan area’s high-technology success is a large gay population.** The five metropolitan areas with the highest concentration of gay residents are all among the nation’s top 15 high-technology areas: San Francisco, Washington D.C., Austin, Atlanta, and San Diego. Gays not only predict the concentration of high-tech industry, they are also a predictor of its growth.
- **Metropolitan areas with high concentrations of foreign-born residents also rank high as technology centers.** Eight out of the top ten metropolitan areas with the highest percentage of foreign-born residents were also among the nation’s top 15 high-technology regions: Los Angeles, New York, San Francisco, San Diego, Chicago, Houston, Boston, and Washington D.C.
- **A high concentration of artists or “bohemians” follows gays as a significant indicator of a metropolitan area’s high-technology success.** Ten of the top 15 “bohemian” metropolitan areas (those with the highest concentration of artists, writers, musicians, actors, etc.) also number among the nation’s top 15 technology regions. These areas include: Seattle, Los Angeles, New York, Washington D.C., San Francisco, and Boston.
- **Overall diversity is a strong indicator of a metropolitan area’s high-technology success.** Eleven metropolitan areas with the highest levels of overall diversity (based on gays, bohemians and foreign-born people) are among the top 15 high-technology areas. San Francisco, Boston, Seattle, and Washington D.C. are the top four high-tech regions and rank in the top six regions on the composite diversity index. The composite diversity index also strongly predicts high-tech growth.





I. Introduction

The rules of the economic development game have changed. Companies were the force behind the old game.

Cities and suburbs gauged their status by the number of corporate headquarters within their borders. Economic developers used financial and other incentives to lure companies to their communities. Now, however, people are the center of the action. High human capital individuals—or as we like to call them, talent—are the key to success in this new era of economic growth. Their ideas and creativity are the most important ingredients in the economic success of a firm or region.

Firms have always located near their key factors of production. In the past, companies located near raw materials, good transportation, or low costs. So, it is not surprising that firms in today's knowledge-based economy are increasingly making location decisions based on where the talent pool is located. According to the management-consulting firm, McKinsey and Company, the "war for talent" is the number one competitive issue facing companies in the United States and around the world, and it remains so even though the Internet bubble has burst.² As Hewlett Packard CEO Carly Fiorina told a conference of governors recently: "Keep your tax incentives and highway interchanges, we will go where the highly skilled people are."

The Nobel prize-winning economist Robert Lucas argues that the driving forces in the growth and development of cities and regions can be found in the productivity gains associated with the clustering of talented people or human capital.³ Research by Harvard University economist Edward Glaeser and his collaborators provides ample empirical evidence of the close association between human capital and regional economic growth.⁴ Glaeser finds considerable empirical evidence that firms gather in particular regions to gain advantages from common labor

pools—not, as is more frequently argued, to gain advantages from linked networks of customers and suppliers. Related research by Spencer Glendon finds that a good deal of city growth over the course of the entire 20th century can be traced to levels of human capital at the turn of the century.⁵ Places with talented people both grow faster and are better able to attract other talented people.

Not surprisingly, high-technology metropolitan areas contain more talent than other metropolitan areas. The statistical correlations between the percentage of the population with at least a college education and the strength of the high-tech economy are uniformly high and significant.⁶ (See Appendix A for a more detailed discussion).

What, then, brings talented workers to a particular metropolitan area? How do they make their residential decisions? What sets high-technology centers such as San Francisco, Boston, and New York apart from other metropolitan areas? Why have some metropolitan areas—many home to some of the nation's most prestigious university research centers and college graduates—been unable to attract a significant number of talented technology workers?

Our theory is that a connection exists between a metropolitan area's level of tolerance for a range of people, its ethnic and social diversity, and its success in attracting talented people, including high-technology workers. People in technology businesses are drawn to places known for diversity of thought and open-mindedness. These places possess what we refer to as low barriers to entry for human capital. Diverse, inclusive communities that welcome gays, immigrants, artists, and free thinking "bohemians" are ideal for nurturing creativity and innovation, both keys to success in the new technology.

This study examines the relationship between our measures of diversity and tolerance and high-technology

success in the 50 most populated metropolitan areas in the United States.⁷

II. Methodology

We constructed four indices to attempt to capture the level of diversity and tolerance within the nation's most populous metropolitan areas. All indices utilize the 1990 U.S. Decennial Census Public Use Microdata Sample:⁸

■ **Gay Index:** This index measures the over—or under-representation of gay male couples in a metropolitan area relative to the population.⁹ The index is constructed as the fraction of gays who live in a metropolitan area divided by the fraction of the U.S. population who live in that area. The value takes on the properties of an odds ratio whereby a value over one says that a gay couple is more likely to locate in the area than the population in general while values below one suggest that gays are under-represented.

■ **Bohemian Index:** Calculated in the same fashion as the gay index, this measures the over- or under-representation of artists and musicians in a metropolitan area. The index is based on the number of writers, designers, musicians, actors and directors, painters and sculptors, photographers, and dancers. Regions in which these "bohemians" are over-represented possess a milieu that favors openness to creativity and artistic expression.

■ **Foreign-Born Index:** The percentage of those within a metropolitan area who were not born in the United States or one of its territories.

■ **Composite Diversity Index:** This index is a sum of the rankings of the three individual diversity measures:





the gay index, bohemian index, and foreign-born index.

We compare our diversity measures to a measure of high-technology industry concentration and growth developed by the Milken Institute. In a July 1999 study titled *America's High-Tech Economy*, an index called the "Tech-Pole" was calculated to rank metropolitan areas (using 1998 data) based on a combination of two factors: (1) the output of an area's high-tech industries expressed as a percentage of the output of the nation's high-tech industries; and (2) a ratio of the amount of a metropolitan area's output from high-tech industries to the amount of the nation's output from high-tech industries.¹⁰

The first measure favors large metropolitan areas; the second favors small areas with large technology sectors. By multiplying them, the Milken Index creates a measure that favors neither. The term "tech-pole" refers to the relative technology gravitational pull that a metropolitan area exerts on high-tech industries. This measure is used throughout the study to compare a metropolitan area's technology prowess with our measures of talent, tolerance, and diversity.

We also compare our measures with the Milken Institute's Tech-Growth Index.¹¹ This measures growth in output of high-tech industries within metropolitan areas from 1990 to 1998 relative to the national growth rate in output of high-tech industries during the same period.

All 50 metropolitan areas, ranked by our indices and the Milken measures, are shown in Appendix B. Appendix C details statistical techniques and modeling.¹²

III. Findings

A. The leading indicator of a metropolitan area's high-technology success is a large gay population.

Gays can be thought of as canaries of the knowledge economy because they signal a diverse and progressive environment that fosters the creativity and innovation necessary for success in high tech industry. Gays are frequently cited as harbingers of redevelopment and gentrification in distressed urban neighborhoods. Studies also suggest that the presence of gays in a metropolitan area provides a barometer for a broad spectrum of amenities attractive to adults, especially those without children.¹³ To some extent, the gay and lesbian population represents what might be called the "last frontier" of diversity in our society.

Utilizing 1990 Census data, we constructed a measure of the concentration of gays in a community relative to the population in general.¹⁴ We call this measure the Gay Index. Eleven of the top 15 high-tech metropolitan areas also appear in the top 15 of the Gay Index (see Table 1). The five metropolitan areas with the highest concentration of gay residents are all among the nation's top 15 high-technology areas: San Francisco, Washington D.C., Austin, Atlanta, and San Diego.

In all of our statistical analyses, the Gay Index does better than other individual measures of social and cultural diversity as a predictor of high-tech location (see Appendix B). The correlations are exceedingly high and consistently positive and significant.¹⁵ The results of a variety of multivariate regressions analyses back this up. The Gay Index is positively and significantly associated with both the ability of a region to attract talent and to generate high-tech industry.¹⁶

Gays not only predict the concentration of high-tech industry, they are also a predictor of its growth. Five of the cities that rank in the top ten for high-technology growth from 1990 to

**Table 1:
Tech Ranking
and Gay Index.**

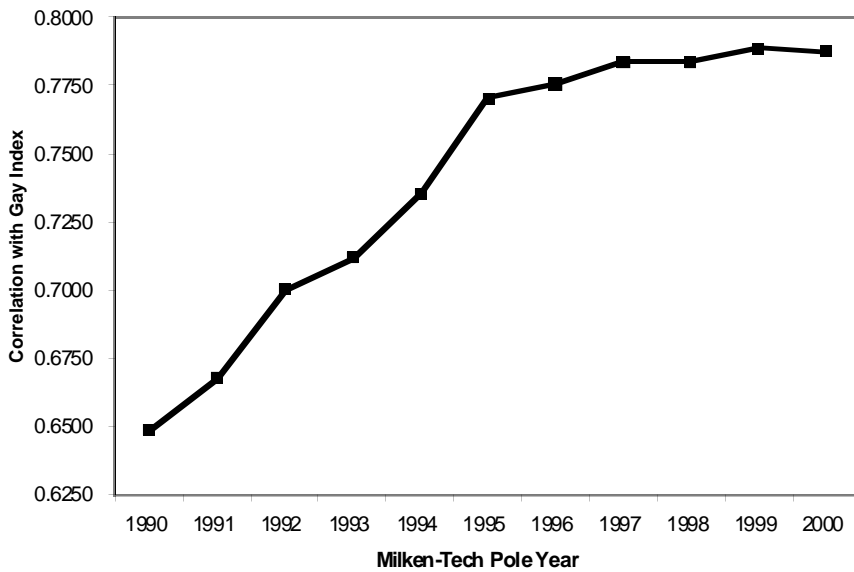
Milken Tech-Pole Ranking	Metropolitan Area	Gay Index Ranking
1	San Francisco	1
2	Boston	8
3	Seattle	6
4	Washington D.C.	2
5	Dallas	19
6	Los Angeles	7
7	Chicago	15
8	Atlanta	4
9	Phoenix	22
10	New York	14
11	Philadelphia	36
12	San Diego	5
13	Denver	10
14	Austin	3
15	Houston	21
36	Cleveland	47
37	Miami	12
38	Rochester	13
39	Albany	30
40	Nashville	28
41	Greensboro	46
42	Oklahoma City	27
43	Las Vegas	48
44	Norfolk	37
45	Richmond	29
46	Buffalo	50
47	New Orleans	24
48	Honolulu	20
49	Memphis	33
50	Louisville	42

Source: Milken Institute "Tech-Pole" Ratings; Gay Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)

1998 rank in the top ten for the Gay Index. In addition, the correlation between the Gay Index (measured in 1990) and the Milken Tech-Pole Index calculated for 1990-2000 increases over time, as shown in Figure 1. Figure 1 also suggests that the bene-



Figure 1. Pearson Correlation of the Milken Tech-Pole Index over time and the 1990 Gay Index.



Source: Milken Institute "Tech-Pole" Ratings; Gay Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)

fits of diversity may actually compound over time by increasing a region's high-tech prosperity.

We also examine how the concentration of gays in combination with other factors affects high-tech growth. A metropolitan area's percentage of gay residents provides the only significant predictor of high-tech growth in a region when we factor in other regional characteristics such as talent, foreign-born residents, bohemians, several measures of lifestyle amenities, and population.¹⁷

Statistically, one might be concerned that the influence of San Francisco (which ranks unusually high, first in fact, on both the high-tech and gay indices) may create a false association between the two measures. To check for this, we removed San Francisco from the data and repeated the analyses. The basic findings remain virtually the same.¹⁸ In fact, the influence of the Gay Index on high-tech growth strengthens slightly when San Francisco is not included.

This increases our confidence in the strength of the concentration of gays as a predictor of high-technology concentration and growth.

While our findings on the link between the Gay Index and high-tech growth cannot be viewed as conclusive, the results are quite consistent with our theory that social and cultural diversity attracts talent and stimulates high-tech growth.¹⁹ These findings support the view that encouraging diversity and lowering barriers to entry can help to attract human capital and generate technology-based growth.

B. High concentrations of creative people or "bohemians" are also an indicator of a metropolitan area's high-technology success.

It has long been thought that talented people are attracted to amenities or a better quality of life. Terry Clark and Richard Lloyd argue that amenities are an increasingly important part of what cities have to offer, dubbing the new

amenity-rich city "the Entertainment Machine."²⁰ The city as an entertainment machine is defined by a whole new cluster of amenities mainly revolving around a vibrant street level culture—from outdoor cafes and hip restaurants to art galleries and a pulsating music scene.

To get at the relationship between creativity and technology, we examine a metropolitan area's receptiveness to bohemians and artistic creativity. Again, we construct a new measure of our own.²¹ We call it the Bohemian Index—or the "Boho Index." The index is based on the number of writers, designers, musicians, actors and directors, painters and sculptors, photographers, and dancers found in a metropolitan area. We believe this measure offers considerable improvement over traditional measures of amenities (such as restaurants, museums, symphonies and the like) in that it provides a direct measure of the producers of those amenities. Metropolitan areas that are over-represented by these "bohemians" are those with an appreciation of amenities that support and showcase creativity and artistic expression.

So what do we find? There is a strong correlation between our Boho Index and the concentration and strength of high-tech industry.²² Ten of the top 15 bohemian metropolitan areas also number among the nation's top 15 high-technology areas, notably Seattle, Los Angeles, New York, Washington D.C., San Francisco, and Boston (see Table 2).²³ Thirteen out of the bottom 15 high-tech metropolitan areas fail to appear in the top 15 of the Boho Index.

C. Metropolitan areas with high concentrations of foreign-born residents rank high as technology centers.

The growth and development of great cities comes from their ability to harness diversity, welcome newcomers, and turn their energy and ideas into innovations and wealth. The Milken

**Table 2:
Tech Ranking
and Boho Index.**

Milken Tech-Pole Ranking	Metropolitan Area	Boho Index Ranking
1	San Francisco	8
2	Boston	9
3	Seattle	1
4	Washington D.C.	6
5	Dallas	15
6	Los Angeles	2
7	Chicago	20
8	Atlanta	13
9	Phoenix	24
10	New York	3
11	Philadelphia	35
12	San Diego	18
13	Denver	14
14	Austin	10
15	Houston	30
36	Cleveland	47
37	Miami	27
38	Rochester	31
39	Albany	45
40	Nashville	4
41	Greensboro	21
42	Oklahoma City	49
43	Las Vegas	11
44	Norfolk	37
45	Richmond	26
46	Buffalo	48
47	New Orleans	41
48	Honolulu	17
49	Memphis	40
50	Louisville	33

Source: Milken Institute "Tech-Pole" Ratings; Bohemian Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)

Institute identifies immigration as one of the two most powerful demographic trends reshaping the nation's cities and regions. Its list of "Melting Pot Metros" ranks the most ethnically diverse regions in the country. Sure enough, highly ranked regions in Cali-

**Table 3:
Tech Ranking and
Foreign-Born Index.**

Milken Tech-Pole Ranking	Metropolitan Area	Foreign- Born Index Ranking
1	San Francisco	4
2	Boston	9
3	Seattle	15
4	Washington D.C.	10
5	Dallas	16
6	Los Angeles	2
7	Chicago	7
8	Atlanta	31
9	Phoenix	21
10	New York	3
11	Philadelphia	25
12	San Diego	6
13	Denver	29
14	Austin	19
15	Houston	8
36	Cleveland	22
37	Miami	1
38	Rochester	24
39	Albany	30
40	Nashville	47
41	Greensboro	48
42	Oklahoma City	36
43	Las Vegas	13
44	Norfolk	32
45	Richmond	39
46	Buffalo	27
47	New Orleans	26
48	Honolulu	5
49	Memphis	46
50	Louisville	49

Source: Milken Institute "Tech-Pole" Ratings; Foreign-Born Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)

fornia and Texas, as well as Chicago, Washington D.C., and New York City are also hot spots of economic growth.²⁴ Not surprisingly, these metropolitan areas are also ranked

highly as regions of technology and technological growth.

Leading high-tech centers are places where people from virtually any background can settle and thrive. In Silicon Valley, the world's leading high-tech center, nearly a quarter of the population is foreign born; and almost one-third of the Valley's high-tech scientists and engineers hail from foreign countries, according to research by Annalee Saxenian of the University of California at Berkeley.²⁵ Roughly one-quarter of new Silicon Valley businesses established since 1980 had a Chinese or Indian-born founder, according to Saxenian's study. That figure increased to more than 30 percent between 1995 and 1999. And, these figures may actually underestimate the extent of immigrant influence, because firms started with a non-Asian co-founder are not counted.

Economists have long argued that diversity is important to economic performance. Generally speaking, they have been talking about the diversity of firms or regional industrial structures. John Quigley argues that regional economies benefit from the location of a diverse set of firms and industries.²⁶ In the knowledge-economy, ethnic, social, and cultural diversity is likely to be even more important.

To look more closely at the role of ethnic diversity in high-technology concentration, we examine the relationship between high-tech industry and the percent of a region's population that is foreign born. Nine of the top 15 (and eight out of the top ten) metropolitan areas in terms of foreign-born residents were also among the nation's top 15 high-technology areas: Los Angeles, New York, San Francisco, San Diego, Chicago, Houston, Boston, Washington D.C., and Seattle (see Table 3). Twelve of the bottom 15 high-tech areas do not rank in the top 15 on the Foreign-Born Index (although Miami ranked number one). The statistical correlation between



percentage foreign-born and high-technology success was quite strong.²⁷

While the relationship between immigrants and high technology is encouraging, it is often said that diversity in high-tech industry is somewhat narrow and that it does not include members of traditional racial minorities, such as African-Americans. To get at this issue, we explored the relationship between high-tech industry and the percentage of population that is non-white. The results here are frankly disturbing. We find no significant correlation here whatsoever.²⁸

D. Social, cultural, and ethnic diversity are strong indicators of a metropolitan area's high-technology success.

Our argument about diversity is simple and straightforward. Diversity of human capital is a key component of the ability to attract and retain high-technology industry. To demonstrate this, we constructed a Composite Diversity Index (CDI) measure based on the three diversity indicators that we discussed earlier—the gay and bohemian indices and the percent of foreign-born residents. We ranked our 50 metropolitan areas by each indicator (low to high) and summed the three rankings.

The CDI strongly correlates with the Milken Tech-Pole Ranking. As Table 4 demonstrates, the top 11 metro areas on the CDI are also among the top 15 Milken Tech-Pole regions. The statistical correlation between the Milken Tech-Pole rankings and CDI rankings is higher than the same correlation with rankings by any of our individual diversity measures, or by simpler measures such as the percentage of college graduates in the population.²⁹

Even more compelling, the CDI strongly predicts high-tech growth. When we estimate the effect of the CDI on high-tech growth and factor in the percentage of college graduates in the region, population, and measures of culture, recreation, and climate, we

find that our diversity measure has a positive and significant effect on high-tech growth from 1990 to 1998 (see Appendix C). These results offer strong evidence of the importance of the combined effects of social, cultural, and ethnic diversity for both high-tech location and growth.

VI. Key Findings and Policy Implications

The bottom line of our analysis is basic: tolerance and diversity clearly matter to high-technology concentration and growth. Of our individual measures of diversity and tolerance, the top factor that correlates with a metropolitan area's high-technology success is a large gay population. Other significant factors include high concentrations of foreign-born people and bohemians. When we use a composite measure of overall social, cultural, and ethnic diversity, the results are even stronger.

We do not mean to imply that these results prove that a large gay population or concentration of bohemians directly causes the development of a technology industry; the theory is that people in technology businesses are drawn to places known for diversity of thought and open-mindedness, and that our measures potentially get at a broader concept of diversity and inclusiveness.

In this study, six metropolitan areas ranked in the top 15 for each of our three individual indices of diversity. Four of these six metro areas were the top ranked high-tech regions on the Milken Index—San Francisco, Boston, Seattle, and Washington D.C. The two remaining metros—Los Angeles and New York—also ranked in the top ten on the Milken Index.

While more research is certainly required to get at the causal linkages between diversity and high-tech industry, we feel confident in the nature of the relationship our analysis has uncovered. We are convinced that tolerance and low entry barriers to

**Table 4:
Tech Ranking and
Composite Diversity Index.**

Milken Tech-Pole Ranking	Metropolitan Area	Composite Diversity Ranking
1	San Francisco	2
2	Boston	6
3	Seattle	5
4	Washington D.C.	3
5	Dallas	15
6	Los Angeles	1
7	Chicago	11
8	Atlanta	14
9	Phoenix	21
10	New York	4
11	Philadelphia	32
12	San Diego	7
13	Denver	17
14	Austin	8
15	Houston	18
36	Cleveland	43
37	Miami	10
38	Rochester	22
39	Albany	36
40	Nashville	25
41	Greensboro	42
42	Oklahoma City	39
43	Las Vegas	24
44	Norfolk	37
45	Richmond	30
46	Buffalo	48
47	New Orleans	27
48	Honolulu	12
49	Memphis	44
50	Louisville	47

Source: Milken Institute "Tech-Pole" Ratings; Composite Diversity Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)

human capital helps to attract talent and that talent is in turn associated with high-technology industry and regional growth. We certainly welcome more research designed to address this important issue.



The basic message to city leaders and economic developers is clear. Talented people go to places that have thick labor markets, are open and tolerant, and offer a quality of life they desire. Places that attract people attract companies and generate new innovations, and this leads to a virtuous circle of economic growth. Cities must begin to combine their goal of providing a better business environment with strategies aimed at improving their diversity and tolerance.

Austin is at the cusp of an integrated approach to capture high-technology talent. The region has made significant investments in research and development, higher education, and business incubation with major facilities like Sematech and MCC. But alongside this, the region has also made considerable investments in its lifestyle and music scene—from the clubs and bars of Sixth Street to Austin City Limits and the South-by-Southwest film and music festival. When a high-tech company, Vignette, recently expanded into a new facility in downtown Austin, a part of its deal was to establish a million-dollar fund to support the local music scene.

Austin Mayor Kirk Watson has been the driving force between a powerful and progressive strategy that aims to capitalize on the “convergence” between technology, talent, and tolerance, as he puts it. Watson was recently re-elected with 84 percent of the vote. “Austin has benefited from a convergence between technology and our laid back, progressive, creative, lifestyle and music scene,” he says. “The key is that we continue to preserve the lifestyle and diversity, which enables us to lure companies and people from places like Silicon Valley. We are building the habitat to do that.”

That is a message other cities and regions should heed. Talent powers economic growth, and diversity and openness attract talent. Companies remain important, but no longer call the shots. The location decisions of people are just as important—potentially more important—than those of firms. In fact, companies increasingly will go where talented people are located.

Building a vibrant technology-based region requires more than just investing in R&D, supporting entrepreneurship, and generating venture capital. It requires creating lifestyle options that attract talented people, and supporting diversity and low entry barriers to human capital. These attributes make a city a place where talented people from varied backgrounds want to live and are able to pursue the kind of life they desire.

Appendix A: The Talent Index

Twelve of the top 15 metropolitan areas in the Tech-Pole Index ranking are among the top 15 areas with the highest concentration of talent. San Francisco, Boston, Washington D.C., and Atlanta are among the top cities for technology concentration and high human capital. Seven areas (Cleveland, Miami, Greensboro, Las Vegas, Norfolk, Buffalo, and Louisville) that rank in the bottom 15 of our Talent Index also rank in the bottom 15 of the Tech-Pole rankings. Our estimates suggest that a 1 percent increase in the percentage of college graduates in a metropolitan area would result in an increase of its Tech-Pole ranking by nearly two places. Using the Milken Institute’s Tech-Growth Index, we also examine the relationship between talent and the growth of high-technology industry. The results suggest that talent is associated with growth of high-technology industry, but not as strongly as its association with the Tech-Pole index.³⁰

Tech Ranking and Talent Index.

Milken Tech-Pole Ranking	Metropolitan Area	Talent Index Ranking
1	San Francisco	3
2	Boston	2
3	Seattle	6
4	Washington D.C.	1
5	Dallas	10
6	Los Angeles	23
7	Chicago	13
8	Atlanta	5
9	Phoenix	35
10	New York	9
11	Philadelphia	20
12	San Diego	14
13	Denver	7
14	Austin	4
15	Houston	12
36	Cleveland	42
37	Miami	46
38	Rochester	19
39	Albany	15
40	Nashville	29
41	Greensboro	41
42	Oklahoma City	27
43	Las Vegas	50
44	Norfolk	45
45	Richmond	11
46	Buffalo	44
47	New Orleans	34
48	Honolulu	16
49	Memphis	26
50	Louisville	47

Source: Milken Institute “Tech-Pole” Ratings; Talent Index constructed by Richard Florida and Gary J. Gates using data from 1990 U.S. Decennial Census Public Use Microdata Sample (5%)





Appendix B: Rankings of Top 50 Metropolitan Areas by Various Indices

Metropolitan Area	Rankings						Talent Index % College Degree
	Milken Tech-Pole	Milken Tech-Growth Index	Composite Diversity	Gay Index	Foreign Born Index	Bohemian Index	
San Francisco	1	10	2	1	4	8	3
Boston	2	36	6	8	9	9	2
Seattle	3	20	5	6	15	1	6
Washington D.C.	4	24	3	2	10	6	1
Dallas	5	9	15	19	16	15	10
Los Angeles	6	50	1	7	2	2	23
Chicago	7	13	11	15	7	20	13
Atlanta	8	5	14	4	31	13	5
Phoenix	9	3	21	22	21	24	35
New York	10	37	4	14	3	3	9
Philadelphia	11	27	32	36	25	35	20
San Diego	12	25	7	5	6	18	14
Denver	13	8	17	10	29	14	7
Austin	14	1	8	3	19	10	4
Houston	15	7	18	21	8	30	12
Portland	16	2	16	23	23	5	17
Indianapolis	17	40	40	34	44	34	31
Kansas City	18	11	34	35	42	22	24
Minneapolis	19	29	19	17	35	7	8
St. Louis	20	45	49	45	43	38	36
Orlando	21	38	9	11	17	12	32
Sacramento	22	6	20	9	14	39	22
Detroit	23	33	26	44	20	25	48
San Antonio	24	4	31	32	12	50	40
Pittsburgh	25	26	46	39	37	46	39
West Palm Beach	26	34	13	16	11	16	33
Tampa	27	18	23	18	18	32	49
Columbus	28	28	29	25	38	29	21
Salt Lake City	29	19	28	41	28	23	25
Birmingham	30	35	50	49	50	42	38
Baltimore	31	44	38	31	33	44	18
Cincinnati	32	46	33	38	40	19	28
Charlotte	33	12	45	43	41	36	37
Dayton	34	39	41	26	45	43	43
Milwaukee	35	43	35	40	34	28	30
Cleveland	36	49	43	47	22	47	42
Miami	37	30	10	12	1	27	46
Rochester	38	31	22	13	24	31	19
Albany	39	41	36	30	30	45	15
Nashville	40	17	25	28	47	4	29
Greensboro	41	14	42	46	48	21	41
Oklahoma City	42	42	39	27	36	49	27
Las Vegas	43	21	24	48	13	11	50
Norfolk	44	15	37	37	32	37	45
Richmond	45	22	30	29	39	26	11
Buffalo	46	48	48	50	27	48	44
New Orleans	47	32	27	24	26	41	34
Honolulu	48	47	12	20	5	17	16
Memphis	49	23	44	33	46	40	26
Louisville	50	16	47	42	49	33	47

Appendix C: Statistics

Correlations utilized both a Pearson and a Spearman rank order correlation. The Pearson statistic measures the correlation between the values of two variables while the Spearman

statistic measures the correlation between the relative rankings of the two variables. As such, the Spearman correlation tends to be less influenced by outliers in the data. All regression analysis utilized Ordinary Least Squares estimation techniques:

Correlations Utilized in the Analysis

Pearson Correlations Between Milken Tech-Pole and Growth Measures with Talent and Diversity Measures.^a

	High-Tech Growth	% College Graduates	Composite Diversity Indicator	Boho Index	% Foreign Born	Gay Index
Milken Tech-Pole	0.23 (0.10)	0.72 (0.001)	0.68 (0.001)	0.62 (0.001)	0.43 (0.002)	0.77 (0.001)
High-Tech Growth	-	0.25 (0.08)	0.27 (0.06)	0.19 (0.19)	-0.04 (0.78)	0.31 (0.03)

^aSignificance level shown in parenthesis. Bold cells are significant at 0.10 level or higher.

Spearman Rank Order Correlations Between Milken Tech-Pole and Growth Measures with Talent and Diversity Measures.^a

	High-Tech Growth	% College Graduates	Composite Diversity Indicator	Boho Index	% Foreign Born	Gay Index
Milken Tech-Pole	0.30 (0.03)	0.60 (0.001)	0.63 (0.001)	0.54 (0.001)	0.48 (0.001)	0.60 (0.001)
High-Tech Growth	-	0.20 (0.15)	0.23 (0.10)	0.24 (0.09)	0.07 (0.63)	0.26 (0.07)

^aSignificance level shown in parenthesis. Bold cells are significant at 0.10 level or higher.

Regression Estimation Utilized in the Analysis

OLS Estimation of the effects of various metropolitan area traits on the Milken Tech-Pole Index and Ranking.^a

Independent variables:	(1) Dependent Variable: Milken Tech-Pole	(2) Dependent Variable: Milken Tech-Pole Ranking	(3) Dependent Variable: Milken Tech-Pole	(4) Dependent Variable: Milken Tech-Pole
% College graduates	27.2* (7.25)	1.9* (5.46)		21.5* (4.99)
Bohemian Index			4.4* (5.43)	2.3** (2.90)
R-squared	0.52	0.38	0.38	0.59
N=50				

^aAbsolute value of t-statistics are shown in parentheses.

*Significance < 0.001 level.

**Significance < 0.01 level.

OLS Estimation of the effects of various metropolitan area traits (measured in 1990) on high-technology growth from 1990 to 1998.^a

Independent variables:	Dependent Variable: High-tech growth	
Composite diversity index	0.005*** (2.91)	-
Gay Index	-	0.15* (1.70)
% College Graduate	-0.41 (0.29)	-0.24 (0.15)
% Foreign Born	-	-0.28 (0.34)
Bohemian Index	-	0.26 (1.23)
Culture	-0.00002 (0.27)	-0.00005 (0.69)
Recreation	-0.0002** (2.56)	-0.0001 (1.54)
Climate	-0.0001 (0.27)	-0.0004 (1.13)
Population	0.00 (0.80)	0.00 (0.001)
R-squared	0.32	0.28
N=50		

^aAbsolute value of t-statistics are shown in parentheses.

*Significance < 0.10 level.

**Significance < 0.05 level.

***Significance < 0.01 level.

Endnotes

- 1 Richard Florida is Heinz Professor of Regional Economic Development and Director of the Software Industry Center at Carnegie Mellon University. Gary Gates is a Research Associate at the Urban Institute in Washington D.C.
- 2 Chambers, Elizabeth G., et al, 1998. "The War for Talent," *The McKinsey Quarterly*, Number 3.
- 3 Lucas, Robert E., 1998. "On the Mechanics of Economic Development," *Journal of Monetary Economics*, p. 38-9. Lucas says: "If we postulate only the usual list of economic forces, cities should fly apart. The theory of production contains nothing to hold a city together. A city is simply a collection of factors of produc-

tion—capital, people and land—and land is always far cheaper outside cities than inside... It seems to me that the 'force' we need to postulate account for the central role of cities in economic life is of exactly the same character as the 'external human capital'...What can people be paying Manhattan or downtown Chicago rents for, if not for being near other people?"

- 4 Glaeser, E.L., 2000. "The New Economics of Urban and Regional Growth". In Gordon Clark, Meric Gertler, and Maryann Feldmen (eds). *The Oxford Handbook of Economic Geography*. Oxford: Oxford University Press, 83-98. Glaeser, E.L. 1999. "The Future of Urban Research: Non-Market Interactions," working paper, Harvard University. Glaeser, E.L. 1998. "Are Cities Dying?" *Journal of Economic Perspectives*, 12: 139-

160. Glaeser, E.L. 1997. "Learning in Cities," NBER working paper, 6271. Glaeser, E.L., J.A. Sheinkman, and A. Sheifer, 1995. "Economic Growth in a Cross-Section of Cities." *Journal of Monetary Economics*, 36, 117-143.

- 5 Glendon, Spencer, 1998. "Urban Life Cycles," working paper, Harvard University.
- 6 The analysis indicated a Pearson correlation between the Milken Tech Pole and the population with a college degree at 0.72. The Spearman rank order correlation was 0.60—that is the relationship between the rank number of a region on the Tech Pole and the rank on the percentage of the population with a BA or above. Interestingly, talent explains more than 50% percent of the variation in high-technology concentration.
- 7 We combine any MSAs that are also part of a Consolidated Metropolitan Statistical Area (CMSA) as defined by the U.S. Census Bureau. As a result, the following areas are constituted as a single metropolitan area:
San Francisco: San Francisco, Oakland, San Jose
Los Angeles: Los Angeles, Anaheim, Riverside
Miami: Miami, Fort Lauderdale
New York: New York, Bergen County, Newark, Middlesex County, Nassau County, Suffolk County, Monmouth County
- 8 The Census Bureau releases two public use samples of decennial census person-level data, the 1 percent and 5 percent PUMS. The 5 percent PUMS is a representative sample (3 in 10) drawn from the 1 in 6 sample of people who filled out a census long-form, which amounts to 5 percent of the U.S. population or approximately 12 million observations. The sample is representative of the entire U.S. population and also is considered representative within metropolitan statistical areas, the unit of analysis utilized for this work.

- 9 Black, Dan, Gary Gates, Seth Sanders, and Lowell Taylor. 2000 "Demographics of the Gay and Lesbian Population in the United States: Evidence from Available Systematic Data Sources," *Demography* 37:2, 139-154. They demonstrate that unmarried same-sex partners in the Census are comprised primarily of gay and lesbian couples.
- 10 DeVol, Ross C., Perry Wong, John Catapano, and Greg Robitshek, 1999. "America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas," Milken Institute.
- 11 DeVol et al (1999.)
- 12 In addition to statistical research on the 50 metropolitan areas, the study was informed by interviews, focus groups and case studies the authors have conducted separately or together over the past several years.
- 13 There are a number of reasons why this conclusion makes sense. Gay males are less likely to have children. In addition, if they couple with another male, their household income will be on average higher than the income of male/female households since males on average earn more than females in our economy. With no children in the household and relatively high incomes, gay couples can devote larger portions of their income to the purchase and development of amenities. See: Black, Dan, Gary Gates, Seth Sanders, Lowell Taylor, 2001. "Why Do Gay Men Live in San Francisco," forthcoming, *Journal of Urban Economics*. Research has shown that gay male couples live in some of America's most sought after urban areas and are more likely to live in distressed areas within cities and gentrify their surroundings more than any other household type. See: Gates, Gary, 2000. "Essays on the Demographics and Location Patterns of Coupled Gay Men," Doctoral dissertation, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University.
- 14 Several cautions must be noted regarding the Census data and gays and lesbians. We are measuring only individuals in same-sex unmarried partner relationships. As such, these figures do not take into account non-partnered gays. In addition, we estimate that the Census only captured approximately 35% of all gay/lesbian partnerships (see Black, Gates, Sanders, and Taylor, 2000).
- 15 The Pearson correlation between the Gay Index and the Tech-Pole index was 0.77 while the Spearman rank-order correlation was 0.60 (both are significant at the 0.001 level). The growth index measures change in high-tech output within metropolitan areas from 1990 to 1998 relative to national change in output during the same period.
- 16 The high correlation observed between the gay concentration and the high-technology index could in part be a result of a limited sample of the 50 largest metropolitan areas in the country. Therefore, further studies examined if this positive association remains when a broader cross-section of metropolitan areas is utilized. Indeed, while the correlation does weaken when 242 metropolitan statistical areas are examined, it is still positive and significant at 0.23.
- 17 The overall F-statistic for the model is also only significant at the 0.07 level. This means that the total predictive power of the combined variables is significant, but somewhat weak. There is also a strong relationship between the concentration of gays in a metropolitan area and other measures of diversity, notably the percent of foreign-born residents: San Francisco, Washington D.C., and Los Angeles all ranked highly. These results reiterate the impact of diversity on a broad section of society. Low barriers to entry seem to be good for the whole economy, not just high-skilled labor.
- 18 The only qualitative difference was that the Pearson correlation between percent college graduate and the Tech-Pole index was slightly higher than the same correlation with the gay index. However, the Spearman rank order correlation with the Tech-Pole index was higher for the gay index.
- 19 One question raised by this strong connection between gays and high-technology is the extent to which gays and lesbians are over-represented in the industry. If gays and lesbians make up large fractions of this industry, then it could be that the location of high-technology firms brings about a larger concentration of gays in a region. To look at this, we analyzed 1990 Census data to assess the extent to which gays and lesbians are over-represented in some high-technology fields and industries. Gay men are about 1.3 times more likely to be scientists and engineers than the population in general. Lesbians are as likely as the rest of the population to be in these occupations. If the gay men and lesbians are combined, the result shows that they are 1.2 times more likely than the population to be scientists and engineers. We also examined those employed in the computer and data processing services industry. Gay men are 2.3 times and lesbians are 1.3 times more likely than the population to be employed in this industry. Together, gays and lesbians are 1.9 times more likely than the population to be employed in the computer services industry. While some of the correlation between gays and high-technology might result from their over-representation in the industry, it seems difficult to explain how their over-representation would predict growth. To do so would be to suggest that that gays and lesbians are somehow on average more productive or entrepreneurial than their heterosexual counterparts.
- 20 Clark, Terry, and Richard Lloyd, 2000. "The Entertainment Machine," University of Chicago.



- 21 Originally, we undertook a series of analyses using various measures of amenities. We looked at things like climate, and professional sports, and arts and culture, and many others. In most of this work, we found only a loose relationship between amenities, talent, and technology. A large part of the reason, we came to believe, was due to the measures themselves. They were based on combinations of different factors and were not very consistent or reliable. And many of the things we would have liked to measure—such as a city’s music or art scene were simply unavailable.
- 22 The two measures are correlated at 0.62 using a Pearson correlation and 0.54 using a Spearman rank-order correlation. Both are significant at the 0.001 level.
- 23 While an association between the Bohemian index and the Tech-Pole index is observed, a similar connection between growth and this index is not noted. Alone, the Boho Index can explain nearly 38% of the variation in high-tech concentration. The combination of the Boho Index and our measure of talent account for nearly 60% of the high-tech concentration measure.
- 24 Frey, William, and Ross DeVol, 2000. “America’s Demography in the New Century: Aging Baby Boomers and New Immigrants as Major Players,” Milken Institute.
- 25 Saxenian, Annalee, 1999. “Silicon Valley’s New Immigrant Entrepreneurs,” Public Policy Institute of California.
- 26 Quigley, John Q., 1998. “Urban Diversity and Economic Growth.” *Journal of Economic Perspectives*. 12:2, 127-138.
- 27 The Pearson correlation between percent foreign born and the Tech-Pole index was 0.43 (significant at the 0.01 level) and the Spearman rank-order correlation with 0.48 (significant at the 0.001 level). We did not find a similar correlation with high-technology growth.
- 28 The Pearson correlation was –0.11 and the Spearman rank-order correlation was –0.20. Neither were statistically significant.
- 29 The Spearman rank order correlation between the Milken Tech-Pole and the composite diversity measure was 0.63. See Appendix C for other correlations.
- 30 The Pearson correlation between the percentage of college graduates in a region in 1990 and growth in high-technology from 1990 to 1998 was 0.25 (significant at the 0.10 level).

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