# Tech Jobs, Talents, and the Local Economy

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This report provides three analyses: (1) A summary of statistics of tech job growth by metro. (2) The relationship among tech job growth and local economic growth and low-skill job growth. (3) The association between human capital and tech job density.

It is well known that the tech industry has been doing well over the past several years. Google, Facebook, Apple, Amazon, and Microsoft are among the most valuable companies in the world. They inspire many startups and venture capitalists to pursue the same dream and hope for a successful outcome. As a result, Silicon Valley, Silicon Beach, Silicon Forest, and other cities have become the envy of the world for their explosive growth. Furthermore, here we investigate how much the tech industry impacts the rest of the local economy in these cities, particularly for low-skilled workers.

We begin our analysis by using occupational data in which we can obtain the median wage of each occupation. We believe that this skill-based statistic will provide more detailed insights than an industry-based one. Figure 1 shows the median wages of 22 major occupations in the U.S. in May 2018. The highest-paid occupation is management, receiving a median of $104,000, followed by computer and mathematical at $86,000, legal at $80,800, and architecture and engineering at $80,000. The two lowest-paid occupations are personal care and service at $24,400 and food preparation and serving related at $23,000.

Figure 1    Median Wage of 22 Major Occupations in the U.S. in May 2018
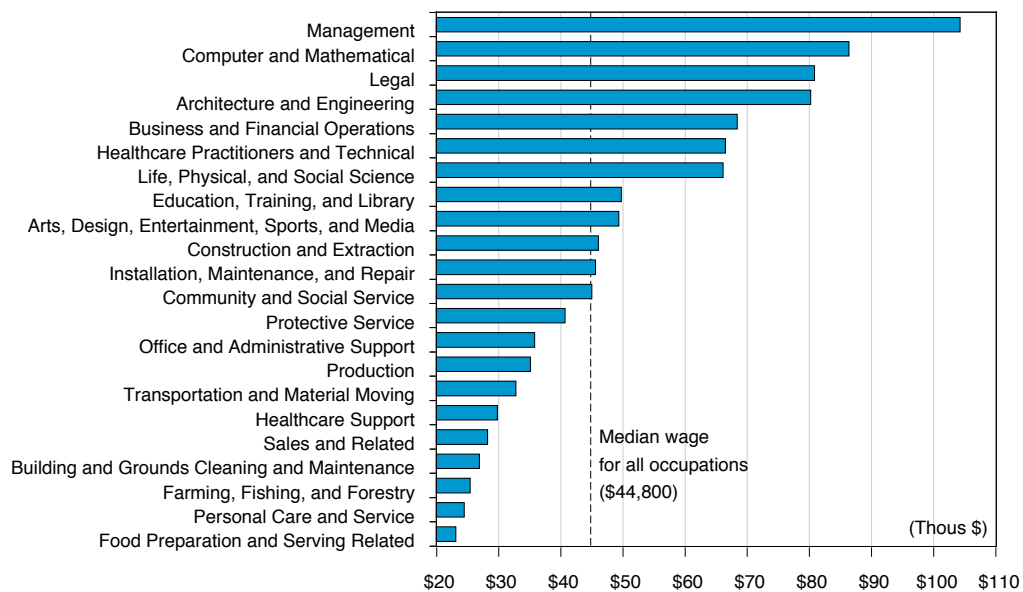


*Source: Occupational Employment Statistics*

Figure 2    Employment of 22 Major Occupations in the U.S. in
            May 2018
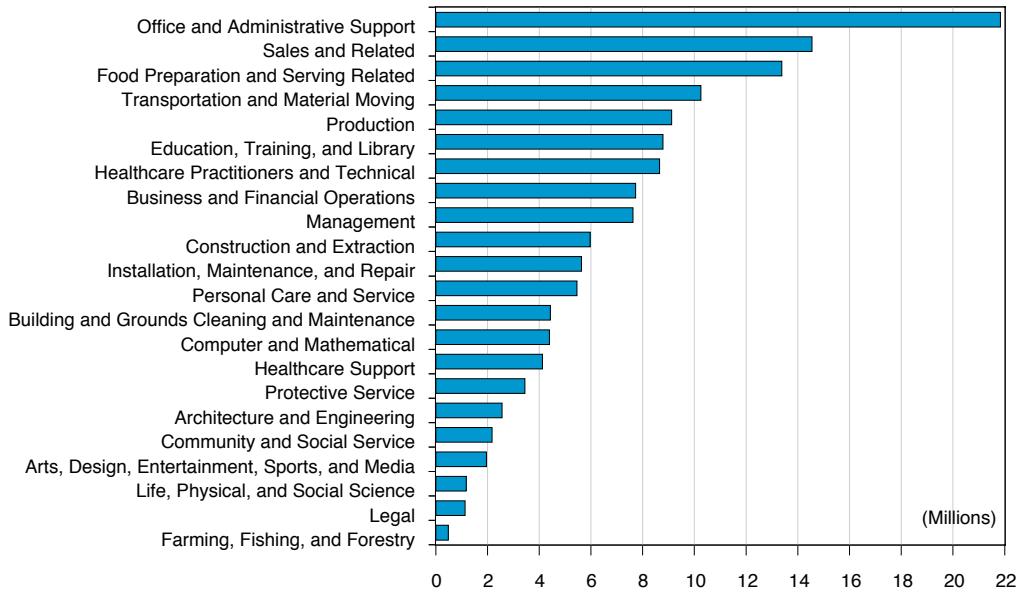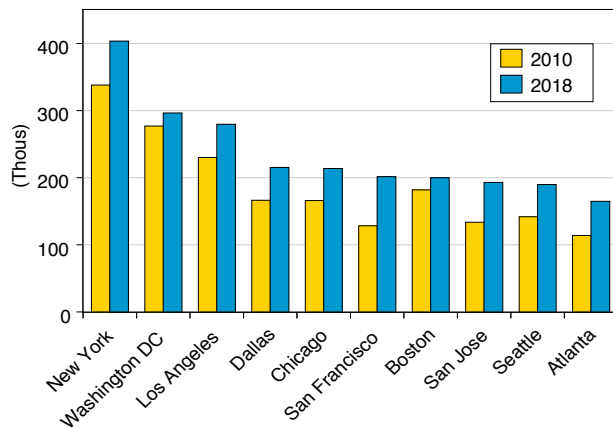


*Source: Occupational Employment Statistics*

Though it is far from perfect, to simplify the calculation, we define the high-tech workforce as those who are in the computer/mathematical and architecture/engineering categories, which are the two highest skill and highest wage occupations besides management and legal. Figure 2 displays the total employment of these 22 occupations. Across the U.S., there are about 6.9 million people in the high-tech workforce. In contrast, there are about 18 million Americans in the two lowest wage sectors – food preparation (e.g. restaurants) and personal care.

## Tech Jobs by Metro

Where are those tech jobs allocated in the U.S.? How much have they been growing over the past decade? Based on the above methodology, Figure 3 lists the top ten metros (MSA) with the largest tech workforce in 2018 along with the number of jobs in 2010 as a comparison. In 2018, New York had the largest tech workforce with 403,000 tech jobs followed by Washington DC (296,000), Los Angeles (280,000), Dallas, Chicago, San Francisco, Boston, San Jose (Silicon Valley), Seattle, and Atlanta.

Furthermore, from 2010 to 2018, San Francisco has seen the biggest tech job increase - 73,000 new jobs, followed by New York (66,000), San Jose (59,000), Atlanta (51,000), and Los Angeles (50,000). It is natural to see a large metro with a large tech workforce, so it is also useful to look at the density

Figure 3    Top 10 Metros with Most Tech Jobs in 2018



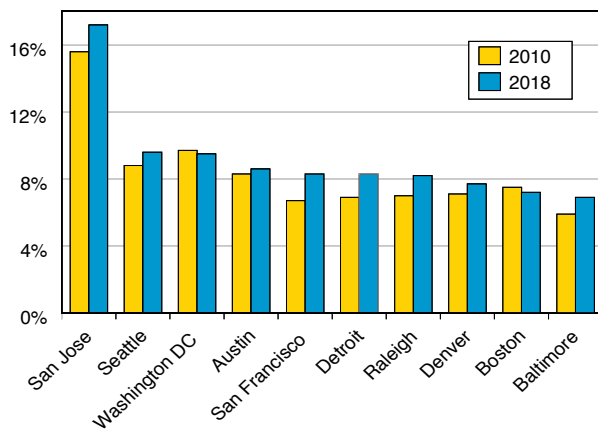*Source: Occupational Employment Statistics*

of those jobs. Figure 4 displays the top 10 metros with the highest percentage of jobs in tech occupations, excluding those smaller metros with less than 50,000 tech jobs. By this measure, San Jose is the number one "tech city" with 17.2% of jobs in tech occupations. Seattle is number two (9.6%), followed by Washington DC (9.5%), Austin (8.6%), San Francisco (8.3%), Detroit (8.3%), Raleigh (8.2%), Denver (7.7%), Boston (7.2%), and Baltimore (6.9%).

Figure 5 presents the top 10 metros with the highest median wages in the tech occupations in 2018, which could reveal the skills and quality of these tech jobs by metros. It is not surprising that San Jose is number one with the median wage of $120,000, followed by San Francisco's $112,000, and Seattle's $108,000.

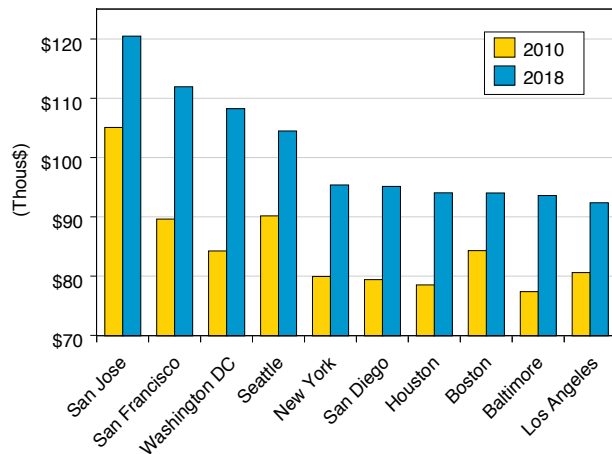## Tech Jobs and Local Economy

Since the tech industry scales and exports its high value-added goods and services for national and international markets, it produces high salaries and high wages. This, in turn means that tech employees often have much greater income and purchasing power than the majority of residents in the area where their company is based. As a result, these tech jobs could be called a "foundation" for a local economy. On the one hand, they can be an economic driver and create a positive spillover impact on the local economy. However, they can also create a negative impact. For instance, high growth pushes up home prices, which drives local residents out of town or may even drive them to homelessness. But which effect is greater?

Let's take a look at the correlation between the growth of tech jobs and the local economy to begin to understand the effect. Figure 6 shows the correlation between the changes of tech jobs and total payroll jobs among 387 metros from 2010 to 2018. The strong correlation and a steep slope suggest that tech job growth could lead to higher total job growth in a local area despite its accompanying negative externalities. Note that in Figure 6, some metros, such as New York, L.A. and Dallas, have a higher ratio than the average of total job growth to tech job growth. One possible reason could be that these metros have other foundation jobs as local economy drivers. For example, New York has finance jobs and L.A. has entertainment jobs.

Figure 4     Top 10 Metros with Highest Tech Job Percentages in 2018, with Tech Jobs Over 50,000
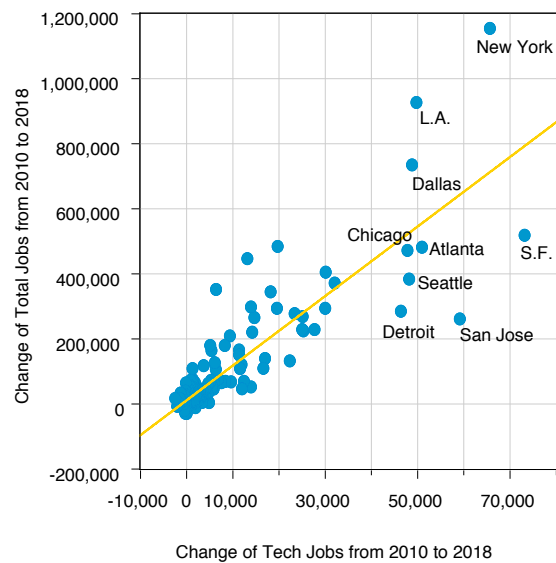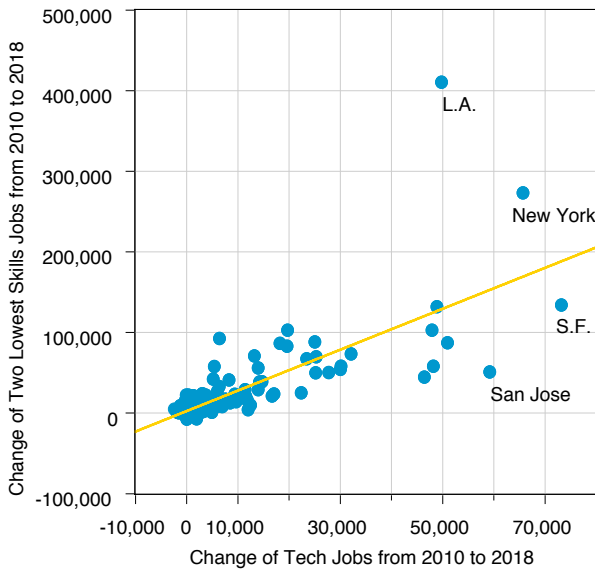


*Source: Occupational Employment Statistics*

Figure 5     Top 10 Metros with Highest Tech Job Wages in 2018, with Tech Jobs Over 50,000



*Source: Occupational Employment Statistics*

Figure 6     Correlation Between Changes of Tech Jobs and Total Jobs Among 387 Metros in the U.S. from 2010 to 2018



*Source: Occupational Employment Statistics*

In theory, high-skill jobs that lead to a prosperous local economy will boost low-skill jobs as well. Figure 7 presents the correlation between the changes of tech jobs and the two lowest skill jobs (food preparation and personal care) among 387 metros from 2010 to 2018. Again, we can see a strong correlation between the high-skill and low-skill job growth.

Figure 8 shows the correlation between the median wages of tech jobs and low-skill jobs in 2018. We can see a strong positive correlation. By and large, a metro with a $10,000 higher wage in tech industry could predict a $1,000 higher wage in low-skill jobs. Figure 9 displays the correlation between changes of median wages of tech jobs and low-

Figure 7    Correlation Between Changes of Tech Jobs and Low-Skill Jobs Among 387 Metros in the U.S. from 2010 to 2018



*Source: Occupational Employment Statistics*

Figure 9    Correlation Between Changes of Median Wages of Tech Jobs and Low-Skill Jobs Among 387 Metros in the U.S. from 2010 to 2018
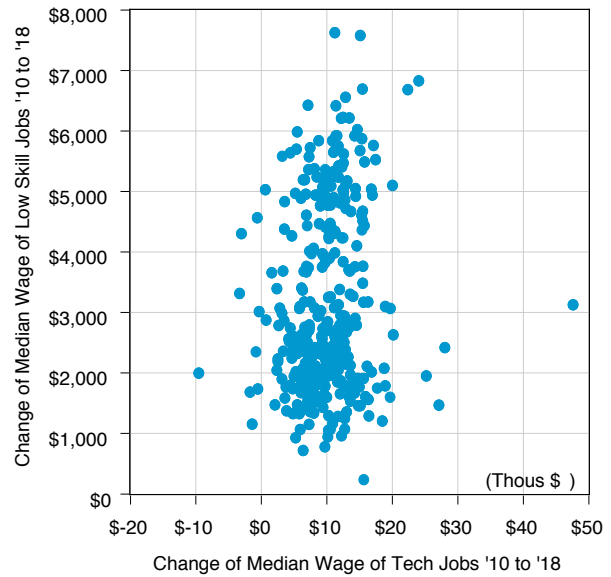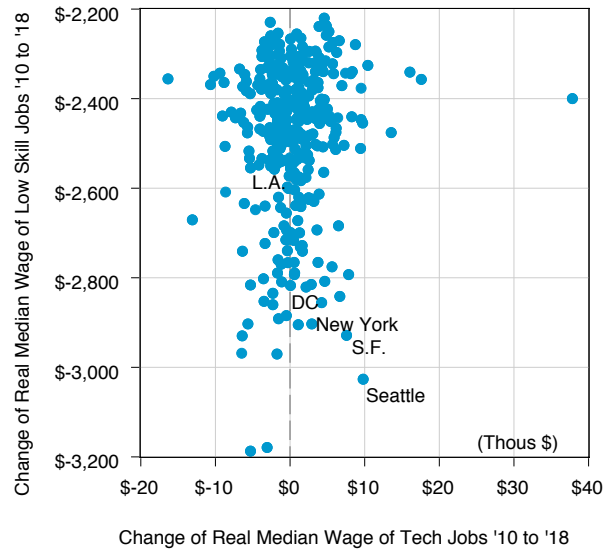


*Source: Occupational Employment Statistics*

Figure 8    Correlation Between Median Wages of Tech Jobs and Low-Skill Jobs Among 387 Metros in the U.S. in 2018
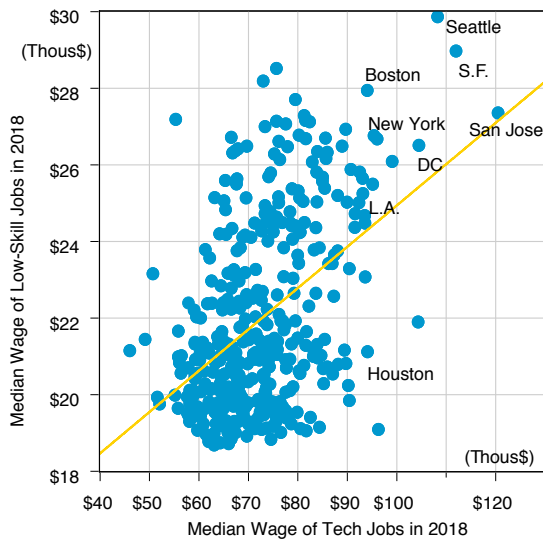


*Source: Occupational Employment Statistics*

Figure 9A    Correlation Between Changes of Real Median Wages of Tech Jobs and Low-Skill Jobs Among 387 Metros in the U.S. from 2010 to 2018



*Source: Occupational Employment Statistics*

skill jobs from 2010 to 2018. Here, we cannot see a clear correlation between wage growth of these two jobs over the past decade. This implies that the wage linkage between high-skill and low-skill jobs is less straightforward than the employment linkage. This might also explain the rising anxiety about income inequality, in particular at bi-coastal cities facing higher cost of living. Figure 9A shows the real median wage change by adjusting the cost of living increase (using a national consumer price index) from 2010 to 2018. It suggests that only half of tech jobs have seen the real wage growth from 2010 to 2018; even worse, the real wage of low-skill jobs declined by $2,000 to $3,000 during this period.

## Human Capital and Tech Jobs

Tech jobs, with high productivity and income, seem to propel local economies and boost low-skill jobs as well. So, how can a municipality create and attract more tech jobs? That is the question the whole world is asking with admiration and ambition to become the next Silicon Valley. Among several possible ways, we here focus on one: human capital. In theory, the tech industry requires highly skilled laborers (a high human capital workforce) to foster a creative and productive place. Plus, a high-human capital metro will attract a more educated workforce to a town and therefore reinforce its talent pool. This is a trend explained by economist Enrico Moretti in his book: "The New Geography of Jobs."

Figure 10 displays a clear positive correlation between the City Human Capital Index (CHCI)[1] of a metro in 2015 and its fraction of tech jobs (tech jobs over total payroll jobs) in 2018. The reason we use CHCI in 2015 is to demonstrate

Figure 10   Correlation Between City Human Capital Index in 2015 and Tech Job Fraction in 2018



*Source: Occupational Employment Statistics*

*Note: The chart excludes one outlier observation: California-Lexington, MD, which has 26% of tech jobs due to a military base employing many aerospace engineers.*

that the relationship is more from human capital to tech jobs than the other way around. Note that there seem to be two outliers in Figure 10: San Jose and Huntsville, AL. The former is the high-tech capital of the world. The latter is home of an air-defense military base with many rocket engineers.

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1. An index calculated based on the weighted average educational attainment of local adult resident (age above 25). For details, see https://www.anderson.ucla.edu/centers/ucla-anderson-forecast/projects-and-partnerships/city-human-capital-index

## Tech Jobs and Migration

Despite having high human capital, however, a metro might not find a sufficient supply of tech laborers to meet high growth demand. What should be done? The answer is that the city will hire people outside its region with a bit higher recruitment and relocation costs. The migration data is scarce. Here we use perhaps the best and most accurate migration data related to migrants' income from the IRS. The latest data for county-to-county migration data is from 2015-2016. Figure 11 shows the average adjusted gross income (AGI per federal tax return) in 2016 of those who lived outside that county in 2015, or in other words, the AGI of migrants. In the vertical axis, we show the percentage of total migration inflow population over non-migrants for these selected counties. It is clear that there is a positive correlation between average income of migrants and the tendency of migration. That said, high-skill talents are mobile and the tech cities need them.

Figure 11    Migration Inflow's Average AGI and the Fraction of Migration Population, 2015 to 2016
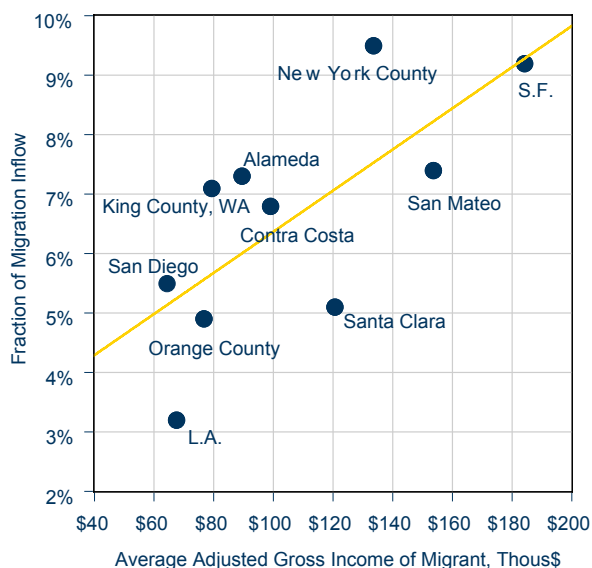


*Source: IRS*

## Silicon Beach

As shown in Figure 3, Los Angeles is one of the largest clusters for tech jobs. Although it doesn't have the highest nominal wages, its vibrancy and growth are still among the most competitive. Its nomenclature, Silicon Beach, references the proximity of the many startups that are located near Santa Monica and Venice Beaches. Figure 12 presents the number of tech jobs by zip code in Los Angeles County. Due to data availability, we define a tech job as one in the information sector or the professional, scientific, and technical services sector here.

The dark red color represents a high number of tech jobs in a zip code. The dark blue color represents a low number of tech jobs. Figure 13 displays a different measurement: the ratio of tech jobs over the total payroll jobs by zip code, or the tech job density. We get a similar picture. Tech jobs are concentrated along the Pacific Ocean, from South Bay to West L.A., Culver City, Beverly Hills, West Hollywood, Hollywood, North Hollywood, and Burbank.

In contrast, a vast area in South L.A. is covered with a deep blue color, meaning it has a low density of tech jobs. Why? Similar to the positive association between human capital and tech job share by metro as shown in Figure 10, we can see a positive correlation between human capital and tech job share even within a county. An area/zipcode with high human capital will create and attract more high-paid tech jobs than other part of a metro. Figure 14 exhibits the City Human Capital Index in 2013[2] by zip code, in which a red-colored area represents a high-human capital region while a blue area represents a low-human capital one.

The similarity of the maps implies the idea that the key to building a vibrant city with shared prosperity for all in the 21st century hinges on increasing human capital, both by investing in local education and by attracting talents from all over the country.
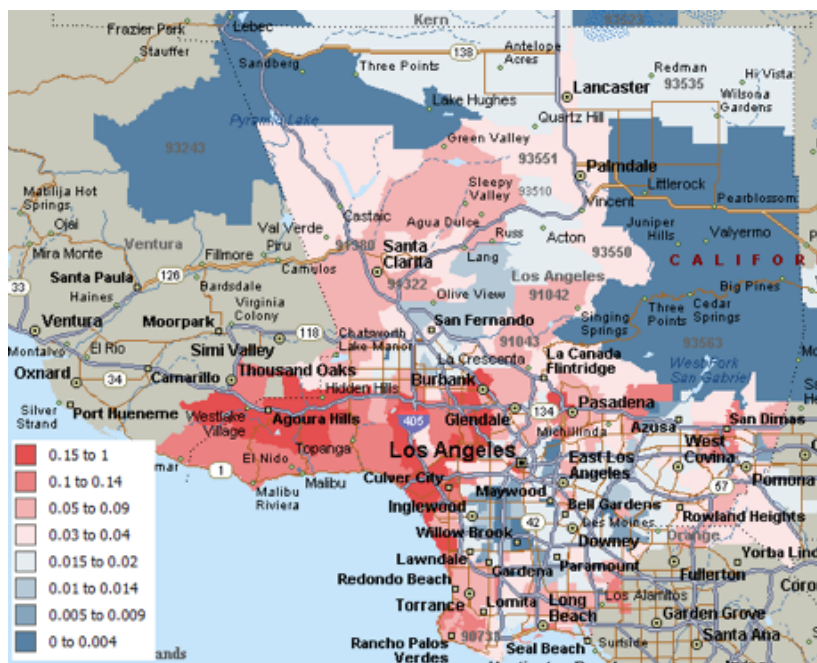
Figure 12          Number of Tech Jobs by Zip Code in Los Angeles County in 2018
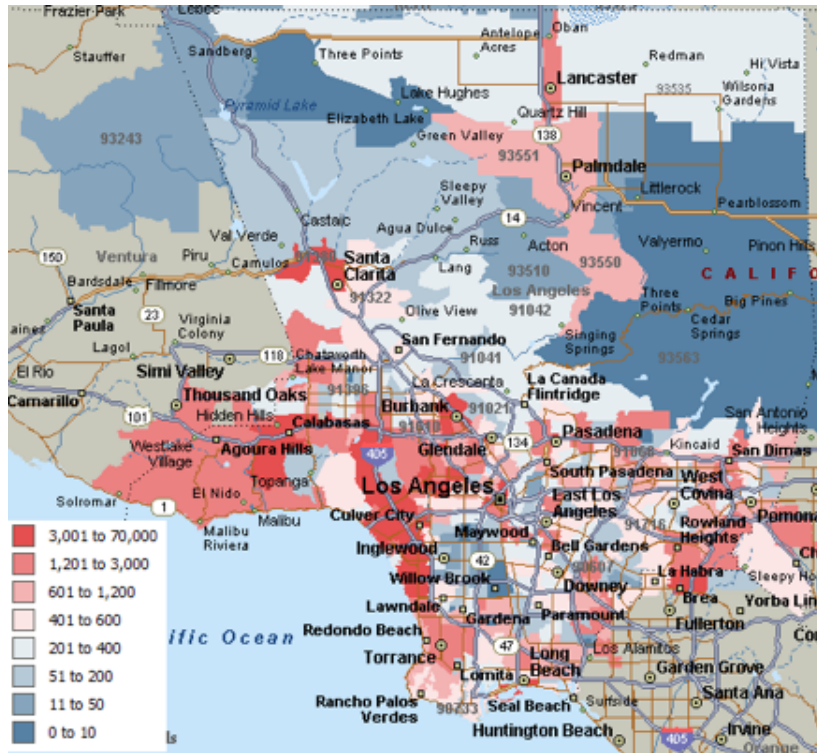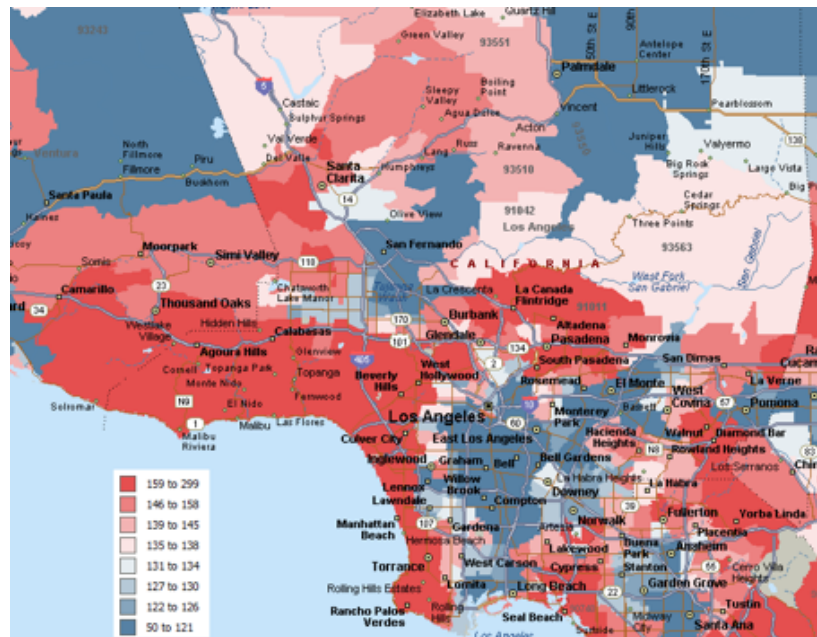


*Source: California Employment Development Department*

Figure 13          Density of Tech Jobs by Zip Code in Los Angeles County in 2018



*Source: California Employment Development Department*

Figure 14        City Human Capital Index in Los Angeles County in 2013



*Source: American Community Survey*

## Conclusions

The takeaways of the report are as follows:

- The tech industry and its jobs are a driver of the local economy: its high wages will propel overall job growth as well as low-skill job growth. But the high-skill job growth does not guarantee wage growth of low-skill jobs.

- High human capital metros and regions are more likely to become tech clusters. A region with high human capital and tech jobs tends to attract and recruit talents from outside the region. That said, to build a city with shared prosperity full of high-paid jobs in the 21st century, it should invest in its local education well and meanwhile create an environment, e.g. high quality of living, to appeal and attract the talents to town from the rest of the country and the world.