



Illustration by Adam Simpson.

Welcome to Nerdopolis

How knowledge workers are reshaping the map of the global economy

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Zurich, Switzerland's largest city, may be, for many, a perfect place to live. Residents can enjoy modern art in the Kunsthaus and shop along Bahnhofstrasse while eating macarons from a shop in Paradeplatz, one of the country's most famous squares. On nice days, they picnic in parks, reached using the city's fast-moving ZVV transit or the free bike-sharing system. At night, they can sample from the city's 500 bars and clubs, some of which even have their own swimming pools.

The backdrop for all of this is the Alps—and a skills-based economy. With about 400,000 residents, Zurich is a global financial center, but its real economic might also comes from cutting-edge industries beyond finance. Zurich has Google's largest engineering office in Europe (dubbed "the real Mountain View" for the panoramic vistas visible from its windows) and two of the world's top universities. Switzerland ranks among the global leaders in patent applications per capita and percentage of its gross domestic product spent on research. Zurich's GDP per capita is \$82,000, more than any other city worldwide, according to the Brookings Institution. All this makes Zurich a magnet for brainpower—a Nerdopolis.

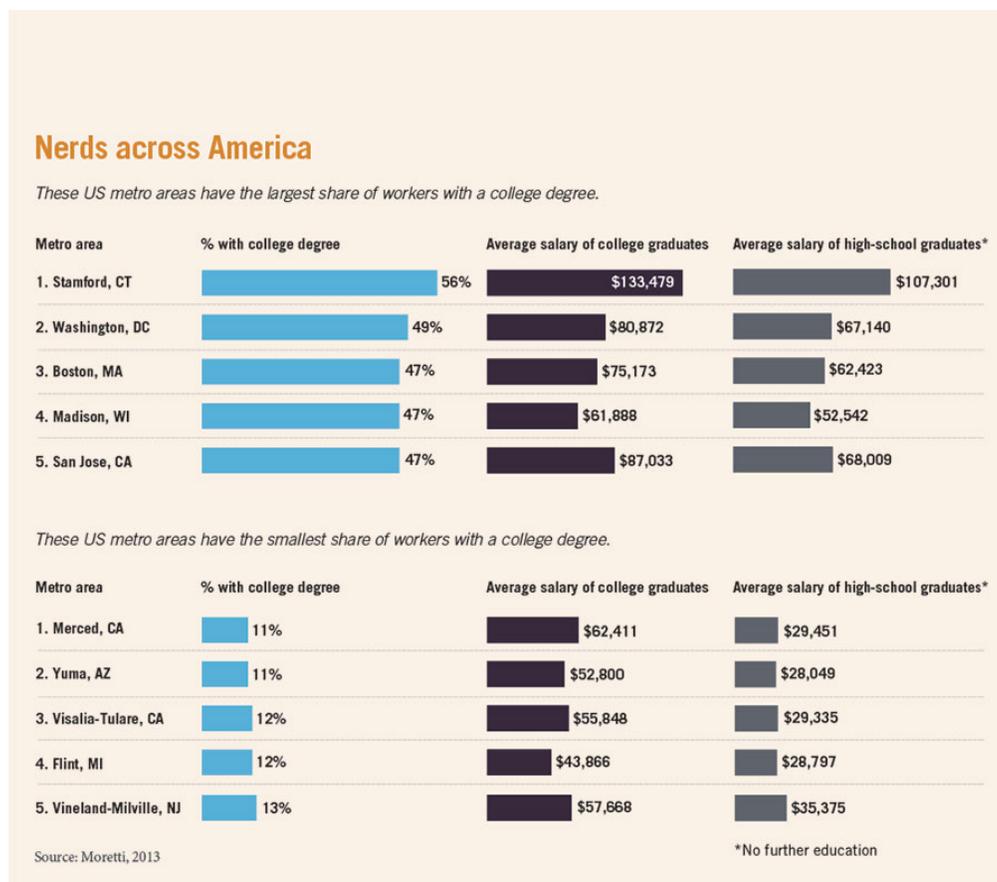
In the 19th century, cities in Europe drew unskilled, cheap labor from the countryside to operate the machinery in their burgeoning factories. In the 20th century, cities fostered the multinational corporations that encouraged the spread of global capitalism. This is

the century of global cities as brain hubs. Zurich is one such city, but the same rising tide is lifting workers in Oslo, Norway; San Jose, California; Paris; and Washington, DC, among other places. These cities are attracting fast-growing industries such as information technology, software, life sciences, digital entertainment, and finance.

In the 1970s, most new jobs involved routine tasks that could be performed by lower-skilled workers, according to Thor Berger of Lund University in Sweden and Carl Benedikt Frey of the University of Oxford. Since the 1980s, however, most new jobs—the kind that drive economic growth—are being performed by highly skilled workers, they say.

Those workers are increasingly gathering in urban centers. In his book *Triumph of the City*, Harvard economist Edward Glaeser writes that the central paradox of the modern city is that “proximity has become ever more valuable as the cost of connecting across long distances has fallen.” As a result, a Nerdopolis tends to bring together the brightest minds and the most productive employees. There, they share ideas that can generate value relatively quickly—by being turned into software code, for example, that costs almost nothing to distribute around the world. No factory, freight, or port is required.

High-skilled jobs raise average wages throughout a city, and spur the growth of a host of other jobs. Cracking the code means surging ahead, which is why cities around the world are trying to turn themselves into the next Nerdopolis, and cities that are already nerd magnets want to stay that way.



How cities poach educated workers

The notion that cities play a key role in producing knowledge is, of course, not new. In 1776, Adam Smith touted the productivity advantages of cities and urban clusters with a high density of companies. Smith argued that people become more productive when they are able to specialize, which occurs more easily in cities than in rural areas. “The greatest improvements in the productive powers of labour, and the greater part of the skill, dexterity, and judgment, with which it is anywhere directed, or applied, seem to have been the effects of the division of labour,” he wrote in *The Wealth of Nations*. Later, in 1890, British economist Alfred Marshall noted the role cities play in concentrating workers with a particular set of skills. Marshall referred to “localized industries”; today, economists use the term “agglomeration effects” to describe the benefits of having more people in the same place.

What is new is the importance of skilled workers to economic productivity and growth. Over the past three decades, economists have been quantifying the advantages particular cities have by providing evidence—some based on data at the level of individual plants and workers—that productive activities are much more clustered than might be expected.

Donald R. Davis of Columbia and [Jonathan Dingel](#), assistant professor of economics at Chicago Booth, propose that larger cities attract college graduates at a faster rate than they do workers with less education. That’s partly because cities offer advantages, they say, and partly because skilled workers choose to live there. In essence, the researchers describe a virtuous circle: the agglomeration effects explained by Marshall make cities with larger, more skilled populations more productive. Because of this productivity advantage, a larger city becomes a more attractive place to live than a similar location in a smaller city. And highly skilled workers, who gain the greatest benefits from living in these larger cities, tend to earn the highest incomes, and thus are more willing to pay to live in these attractive places. The result is that larger cities become, in economics parlance, “skill-abundant,” with workers specializing in skill-intensive activities.

Davis and Dingel demonstrate this phenomenon using US Census data from 2000 on US metropolitan areas, covering three to nine educational categories, 22 occupations, and 21 manufacturing industries. They find that the number of workers with a bachelor’s degree rises with city size faster than the number of college dropouts. The same pattern holds when they slice the data more finely: the number of workers with a master’s degree rises with city size faster than the number of those with a four-year degree, and so on. As cities get bigger, the number of high-skilled jobs increases disproportionately quickly. Positions in computer science, software engineering, mathematics, and statistics increase faster than those in office and administrative roles—which, in turn, rise faster than jobs for workers in installation, maintenance, and repair.

Technology could, in theory, diminish the importance of cities. It allows us to exchange ideas with other people without being physically in the same place. In his 2005 book *The*

World Is Flat, the *New York Times* columnist Thomas L. Friedman gives the example of the IT company Infosys, whose teleconferencing room in Bangalore allows American designers to speak with Indian software writers and Asian manufacturers. “Clearly, it is now possible for more people than ever to collaborate and compete in real time with more other people on more different kinds of work from more different corners of the planet and on a more equal footing than at any previous time in the history of the world—using computers, e-mail, networks, teleconferencing, and dynamic new software,” Friedman writes.

Although high-skilled jobs have spread more evenly around the world, they still tend to clump in Nerdopolises such as London, San Francisco, and Oslo, rather than disperse to suburbs and rural areas where rents are cheaper. Dingel says the internet has only strengthened the appeal of cities as hubs for exchanging ideas, and social and cultural exploration. Technology and the city feed off each other. “Cheaper communications costs make the face-to-face relationships that I establish more valuable,” Dingel says. “In theory, email and Skype could connect me to distant partners and let me neglect my colleagues. In practice, while I do get email from the other side of the globe, most of my electronic exchanges are part of ongoing relationships with nearby people.”

He notes that high-tech companies such as Google have opened offices in Manhattan and Zurich, where land is very expensive, rather than outsource to low-rent locations. “The world is spiky, not flat, despite cheaper communication,” he says. That view echoes Richard Florida of the University of Toronto, who authored the bestseller *The Rise of the Creative Class*. In a response to Friedman, Florida observed, “The empirical evidence suggests that the global economy is increasingly being driven by urban clusters and, if anything, becoming more instead of less ‘curved.’”

You’re far more likely to meet a mentor or an industry leader who can help jump-start your career if you’re in a global city, research suggests. Larger cities generate more meetings between experts and entrepreneurs, resulting in more learning and better matches, according to the University of California, Berkeley’s Victor Couture. In 1993, Adam B. Jaffe, now of Brandeis, Manuel Trajtenberg of Tel Aviv University, and Rebecca Henderson, now of Harvard, published a study tracking patent citations that suggested inventors are more likely to cite previous inventions from those who live nearby, which the researchers argue demonstrates a tendency to build on local knowledge.

In terms of wages, highly educated workers reap greater benefits from exchanging ideas than those without a college degree. Therefore, they’re more willing to put up with living in smaller, more expensive apartments in big cities, in hopes of having these meetings. And larger cities tend to reward cognitive and social skills rather than motor skills and physical strength. Wage premiums for college graduates, or the gap between what college graduates and nongrads earn, range from 47 percent in metropolitan areas with 100,000 residents, up to 71 percent in cities with 10 million residents. “There is a complementarity between big cities and high-skilled activities,” Dingel says. “Skilled people are most willing to pay to talk to other high-skilled people.”

The link between city size and individuals’ abilities is also evident within narrowly defined educational categories. Dingel has examined data from a longitudinal study by

the National Center for Education Statistics that followed a cohort of people who graduated college in 1993. Looking at those bachelor's degree holders in 2003, Dingel found systematic differences in standardized test scores across cities of different sizes. Average SAT scores are higher in bigger cities. That difference may reflect both differences in educational opportunities across different cities and differential migration, in which people who score well on standardized tests are more attracted to larger cities.

It's long been known that people are likely to move if they have a college degree, but Davis and Dingel say that prime-working-age people born in the United States who change residences are more than 50 percent more likely to change metropolitan areas if they've graduated from college. A college graduate is likely to move about 80 percent farther away from home than a high-school graduate, and the data reveal that SAT scores are higher among people who switch states. In Dingel's view, talented people will continue to move to large cities to pursue their career goals.

Riding on the coattails of nerds

The Nerdopolis benefits the nerds, of course—but not only them. In brain hubs, less-educated workers have opportunities to work with highly educated people, and they also become more productive and creative. Enrico Moretti, an economist at the University of California, Berkeley, argues that between 1980 and 2013, the best predictor of a city's future economic growth was its human capital. That differs from what had been true for 1945 to 1980, he says, when the best growth predictor was a city's physical capital.

Moretti writes in his book *The New Geography of Jobs* that high-skilled people raise the wages of less-skilled workers in several ways. "In the same way that working with better machines increases a worker's productivity, working with better-educated colleagues increases the productivity of an unskilled worker," he writes. "Second, a better-educated labor force facilitates the adoption of newer and better technologies by local employers. Third, an increase in the overall level of human capital in a city generates what economists call human capital externalities." He equates these externalities to "a financial windfall that people collect simply because they're surrounded by many educated people."

Even in a Nerdopolis, most jobs are still in services, not high tech. Using data on 11 million workers in US metropolitan areas, Moretti finds that for every new high-tech job in a city, five additional jobs are created outside tech in that city over the subsequent decades. When those highly paid nerds get time off, they're eating kale salads in farm-to-table restaurants, drinking fancy cocktails, and going to concerts. (It's less effective for cities to specialize in manufacturing, Moretti argues, because manufacturing industries don't beget as many low-skilled jobs as tech industries do.)

Moretti finds that high-school graduates who live in a Nerdopolis tend to have higher incomes than high-school graduates in other cities. In the brain hubs of Raleigh-Durham, North Carolina, or Austin, Texas, for example, high-school graduates earn an average of \$33,000 a year more than high-school graduates in the former automotive center of Flint, Michigan, or the agribusiness city of Merced, California.

What's more surprising is that high-school graduates in Nerdopolises often earn more than college graduates in laggard cities. The average Boston worker with a high-school education earns \$62,423 a year, or 44 percent more than a college graduate in Flint, Moretti notes.

Naturally, higher living costs offset some of these differences. In cities where labor markets are strongest, housing costs tend to be high. Moretti finds that when average earnings of US cities are adjusted for cost of living, the gap between average incomes in high-skilled and lower-skilled cities shrinks by about one-quarter. And homeowners are better off than renters in areas experiencing strong economic growth, because homeowners benefit from rising property values.

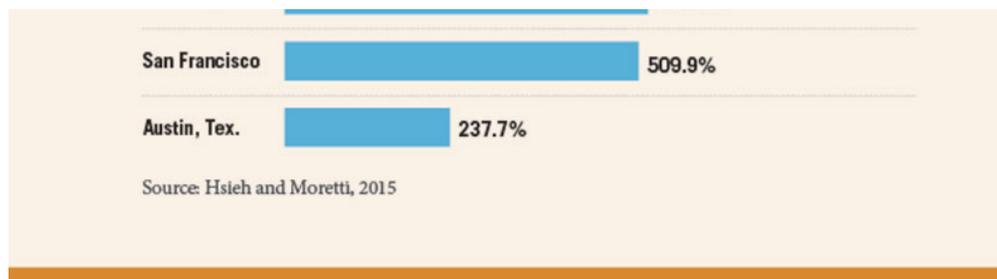
Moretti is concerned that as global economic growth shifts toward high-skilled industries, Nerdopolises are outpacing their less-educated counterparts to an unsettling degree. He points out that Stamford, Connecticut, with one of the highest US college graduation rates among its residents, has five times as many college graduates per capita as Merced, California, with one of the lowest rates. That's a greater gap than the difference between the total number of college graduates in the US and South Africa (the US has four times as many college graduates per capita). "It is almost as if, starting in the 1980s, the American economy bifurcated," he writes. "On one side, cities with little human capital and traditional economies started experiencing diminishing returns and stiff competition from abroad. On the other, cities rich in human capital and economies based on knowledge-intensive sectors started seeing increasing returns and took full advantage of globalized markets."

Another method of measuring quality of life in a Nerdopolis suggests that when you couple higher wages with better amenities, brain hubs pull further away from less-skilled cities, even after accounting for higher housing costs, argues Rebecca Diamond of Stanford. She finds that between 1980 and 2000, cities that attracted a higher share of college graduates became more desirable places to live for a host of reasons beyond wages—including better schools, improved air quality, lower crime rates, higher government spending on parks, and more bars and restaurants per capita. Not only do local governments try to improve their amenities to attract more college graduates, but the data suggest that having more college graduates predicts that residents' quality of life will continue to improve along many dimensions. Add it all up, and cities that are already lagging fall even more behind. "The combined effect of amenity changes and housing-price changes leads to more inequality," Diamond says.

The rent is too damn high!

Research suggests that in some Nerdopolises, housing restrictions are holding back economic growth. If those restrictions were not in place, how much would employment grow?





Local policies inhibit growth

Diamond and other researchers contend that some high-skilled cities could provide even greater economic benefits to workers if local government policies didn't hold them back. In the US, in particular, the denizens of a few Nerdopolises are effectively barring the gates against others who would like to move there. Rigid local land-use regulations, for example, limit new development in places such as Manhattan and San Francisco, restricting the housing supply and pricing many workers out of the market. That housing squeeze prevents many workers from taking advantage of the productivity gains they would realize in a Nerdopolis, hurting US economic growth as a whole, argues [Chang-Tai Hsieh](#), who is Phyllis and Irwin Winkelried Professor of Economics at Chicago Booth, in a paper co-written with Moretti.

Hsieh and Moretti calculate that housing restrictions in certain high-productivity cities such as New York, San Francisco, and San Jose decreased US GDP in 2009 by as much as 13.5 percent—equivalent to more than \$2 trillion a year—from what it otherwise would have been. “This is a serious constraint to US growth,” says Hsieh.

In an ideal world, Hsieh explains, a company in a Nerdopolis such as San Francisco would expand and hire more workers. People would leave other cities and move to San Francisco to take advantage of the new jobs. Wages in San Francisco would rise, because demand for workers would increase. But wages would also rise in the cities that workers are leaving, because those firms would need to pay more to attract employees from a smaller labor pool.

What happens instead, Hsieh says, is that demand in San Francisco increases, and workers want to move in, but many can't because of a lack of housing. For those few who will earn enough to live in the city, their increased wages will be largely eaten up by the higher housing costs. “There's been all this innovation, but the consequence is that the landowners have gotten rich,” Hsieh says. “There's not a real increase in the standard of living.”

Contrast this dilemma with the cycle in US cities such as Minneapolis and Denver, which have experienced their own innovation booms, though they are less extreme than in Silicon Valley. In these cities, there is plenty of housing, so more workers can come in without pushing up local home prices very much, Hsieh says. Here, wages increase because the demand for labor is expanding, and as people move in to take advantage of those

higher wages, their standard of living goes up. In the places those workers have left, meanwhile, the labor pool shrinks, and wages also go up there to retain the remaining employees. The overall economy expands.

Policies in a few Nerdopolises are therefore holding back growth in the US economy overall, according to Hsieh and Moretti. Yet the solutions aren't easy. One option would be to change zoning laws, but current residents are likely to balk. "The San Francisco Bay Area would have to be dramatically transformed," Hsieh says. "I can understand why that might be really hard."

Another avenue would be to develop better transportation infrastructure, as Nerdopolises elsewhere have chosen, Hsieh suggests. London's network of high-speed trains, for example, allows people to live 80 miles outside of the city and still be at work in 40 minutes. Zurich, Madrid, and Tokyo also have effective public-transportation systems that allow the benefits of innovation to be shared more broadly. At a time when citizens of the US and many other countries are concerned about increasing inequality, public investments such as these could help to spread economic growth.

Wharton's Jessie Handbury uncovers another reason that life is easier for wealthy people in a Nerdopolis. Using the Nielsen shopping data for 40,000 US households held by Chicago Booth's Kilts Center for Marketing, Handbury finds that grocery prices of identical products are about 20 percent higher in cities such as San Francisco and New York compared to lower-income cities such as New Orleans. But when she adjusts the price index for the variety and quality of goods available in higher-income cities, she finds that the cost of living for wealthy people is actually lower than it would be in a less-affluent city, where, for example, you can't buy the French Lorina all-natural artisan sodas that are available at Citarella on Manhattan's Upper East Side.

"High-income households are willing to pay a lot, essentially, to have the opportunity to consume those products," Handbury says. "They're compensated for that additional expense by the fact that they're getting what they want."

The reverse is true for low-income residents: the variety and quality of high-end merchandise doesn't provide poorer people much of a benefit, and therefore they suffer from the higher cost of living. Grocery costs are relatively higher for poorer people in a Nerdopolis than they are for poorer people in other cities.

As high-skilled, high-wage workers are disproportionately attracted to innovative cities, for everything from job opportunities to fancy groceries to live theater, poorer people can be pushed to the margins. Veronica Guerrieri, Ronald E. Tarrson Professor of Economics, and Erik Hurst, V. Duane Rath Professor of Economics and John E. Jeuck Faculty Fellow, both of Chicago Booth, with Daniel Hartley of the Federal Reserve Bank of Cleveland, have examined about 30 metropolitan areas to document this pattern of gentrification, or the process that forces out poorer residents of a neighborhood to make way for richer ones. The researchers find that when a city becomes a more attractive place to live, the neighborhoods that border the wealthiest areas can see the fastest appreciation in home prices. They suggest that when housing demand increases unexpectedly, perhaps because of new jobs in a city, people seek to live in neighborhoods where they can experience the amenities enjoyed by the wealthy, without having to share the highest

housing prices. As gentrification advances, less-affluent workers are isolated to the margins, enduring ever-longer commutes to their jobs. In cities with few undeveloped areas, it's possible that over time, gentrification could essentially push out low-income people entirely—leaving the Nerdopolis to the nerds, and wiping out the diversity that makes cities exciting places to live.

Making a Nerdopolis

Many cities around the world are trying a number of strategies to become the next Nerdopolis. Some, such as Chicago, are launching tech incubators. Others, such as Spain's Bilbao, are betting on tourism, hoping that attracting smart, creative people to its amenities will eventually bring new residents and businesses.

Such strategies have yet to prove themselves. Many existing Nerdopolises became so at least partly by accident. After Microsoft relocated from Albuquerque, New Mexico, to Seattle in 1979, when Bill Gates and Paul Allen decided to return to the place where they had grown up, the fortunes of those two cities diverged. In his book, Moretti recounts an anecdote about the physicist William Shockley moving to a sleepy region of orchards in northern California, where he invented the transistor. His technology drew other engineers and educated workers to the area. Add support for research from Stanford University, throw in some great weather, and after a few decades, the area became Silicon Valley.

No one knows where the next William Shockley will come from, but there are some elements of the Silicon Valley success story, such as an emphasis on education, that cities can learn from. Glaeser points out that Tokyo succeeded because of a long tradition of education, and because firms wanted to locate near Japan's Ministry of International Trade and Industry, which supported many companies. Singapore also invested in education, and it has a more consistent government than nearby states, with fairly applied rules that favor investment. In colonial Boston, reading the Bible was regarded as the surest means of knowing God's will, so schooling was very important. Glaeser traces a line from that history to the city's later success in industries such as engineering, computers, financial services, and biotechnology, which has been widely linked to the city's focus on education.

Staying ahead of the innovation cycle also requires investing in basic research that will spur tomorrow's commercialized technologies. Moretti and others argue that because of tight budgets and shifting priorities, the US isn't investing enough to remain a global leader. Instead, Moretti notes, although states and cities are spending \$15 billion–\$18 billion a year on subsidies to attract employers, much of this spending is simply shifting jobs from one locale to another, rather than creating new types of work.

Moretti argues that if a city wants to become a brain hub, it needs to go big or, well, go home. "The only way to move a city from a bad equilibrium to a good one is with a big push: a coordinated policy that breaks the impasse and simultaneously brings skilled workers, employers, and specialized business services to a new location," he writes. He cites the example of the US government creating the Tennessee Valley Authority during the Great Depression, sparking an industrial revolution in an underdeveloped, rural area.

He also points to the success of “empowerment zones” in neighborhoods such as New York’s Harlem, which bring together federal subsidies for jobs and training programs, business assistance, infrastructure investment, and other types of aid.

While Glaeser also praises empowerment zones, he concludes that it’s difficult to force a city to become more innovative through policy choices and investment, since the same strategies have succeeded in some places and failed in others. Because it can be so difficult to predict the winning approach, he, unlike Moretti, argues that government intervention should be modest.

Yet in a spiky world, it’s also precarious to be perched on top. There’s no guarantee that today’s Nerdopolises will maintain their advantages. As high-tech industries mature, the new jobs they created in this decade will become easier to outsource to lower-cost regions. This is exactly what Detroit experienced as it failed to diversify beyond car manufacturing, while other cities were inventing new forms of knowledge work. Glaeser notes in *Triumph of the City* that six of the 16 largest US cities in 1950—Buffalo, Cleveland, Detroit, New Orleans, Pittsburgh, and Saint Louis—have since lost more than half their population.

San Jose, if it doesn’t ride the next wave of innovation, could face the same fate. In *The New Geography of Jobs*, Moretti cites the research of Carnegie Mellon’s Steven Klepper, which indicates that the rise of Silicon Valley has mirrored the earlier boom in Detroit in terms of population, employment, start-up creation, and innovation.

What’s clear is that in the 21st century, brainpower is the engine that drives growth. And as long as highly educated people continue to value exchanging ideas and starting new businesses together, Nerdopolises will be the expensive, dynamic, innovative, crowded, creative places leading the global economy.

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