COMMUNITY
LEGAL SERVICES IN
EAST PALO ALTO

August 1, 2016

VIA ELECTRONIC MAIL: DMChow@menlopark.org
Deanna Chow
City of Menlo Park
Planning Division
701 Laurel Street
Menlo Park, CA 94025

Re: Draft EIR for General Plan Update

Dear Ms. Chow:

Thank you for the opportunity to comment on the Draft Environmental Impact Report (DEIR) for the General Plan Update. On behalf of and in partnership with Envision-Transform-Build East Palo Alto (ETB-EPA) and several of its organizational members including Youth United for Community Action (YUCA), Faith in Action – Bay Area, and El Comité de Vecinos del Lado Oeste, Community Legal Services in East Palo Alto (CLSEPA) submits this letter in response to the Notice of Availability for Public Review published on June 1, 2016. CLSEPA's mission is to provide transformative legal services that enable diverse communities in East Palo Alto and neighboring communities to achieve a secure and thriving future. CLSEPA's housing program strives to preserve decent and affordable housing for low- and moderate-income residents. As a local agency with a focus on housing related issues and a client population living around the M-2 area, CLSEPA has participated in the ConnectMenlo process for the past year. We submitted a comment to the NOP of the DEIR on July 20, 2015 and have attended and participated in many GPAC and other city meetings since that time. Similarly, ETB-EPA, as a coalition of nonprofit, community and faith-based organizations, residents, architects, planners and youth, has worked on land use, planning, and development issues in southern San Mateo County for over 10 years. ETB-EPA was an active participant and respondent in the Facebook/1601 Willow Road East Campus and 312-314 Constitution Drive West Campus EIR process in 2011-12 and remains extremely interested and highly engaged in the present ConnectMenlo process. We now present our comments for your consideration and response.

The General Plan DEIR concludes that the proposed Project plus cumulative projects, including the Facebook Expansion, could create 22,350 jobs, while increasing population by 17,450 and housing stock by 6,780 units over the next 24 years. Housing and employment are among the most important factors that will determine the General Plan's environmental impacts. The levels of impact on traffic, air quality, greenhouse gases and other impacts will be determined by the level of affordability of the homes planned for the area, the wages of new jobs, and the displacement of lower-income families.

Full and accurate environmental review is essential to ensure that the public and decision-makers have all the information before making choices about the direction of the General Plan. After review, it is clear that the DEIR does not comport with CEQA because it fails to analyze significant environmental impacts of the Project on population and housing, traffic and transportation, greenhouse gas emissions and water. The DEIR also fails to propose adequate measures to assess and mitigate the cumulative impacts of the Project. As a result of this inadequate analysis of impacts, the DEIR omits a legally adequate consideration and adoption of mitigation measures.

As detailed below, we highlight the following areas in which the DEIR analysis is deficient under the California Environmental Quality Act (CEQA):

1. The DEIR does not properly analyze displacement of people,
2. the DEIR does not properly analyze cumulative impacts,
3. the DEIR does not analyze how the mismatch between timing of commercial development and housing construction would greatly exacerbate environmental impacts,
4. the DEIR does not account for indirect job growth,
5. the DEIR does not properly analyze vacancy rate,
6. the DEIR does not properly analyze employees per household,
7. the DEIR's analysis of Vehicle Miles Traveled is insufficient because it does not account for indirect job growth and disaggregation of employees by income,
8. the DEIR does not account for environmental impacts on neighboring communities, *and*
9. the DEIR does not study or adopt adequate mitigation measures to address significant impacts that are identified and that would be identified through proper analysis.

The City of Menlo Park has repeatedly asserted over the past several years its desire to formulate a General Plan and M-2 area update that will provide opportunities for existing residents and newcomers. A complete and legally sufficient environmental review process is essential to meeting these goals. We provide these comments in hopes that the City will reexamine its analysis and provide supplemental findings to provide full and accurate information for the public and decision-makers. We continue to desire to work cooperatively with the City to achieve the best results for the residents of Menlo Park and for the environment.

To fulfill its fundamental purpose, an EIR must "identify and focus on the significant environmental effects of the proposed project," including "changes induced in population distribution, population concentration, [and] the human use of the land (including commercial and residential development)…." 14 CCR §15126.2(a); see also Pub. Res. Code §21002.1(a).

The following discussion identifies several areas in which the DEIR does not provide full and accurate analysis of changes in population and housing, employment, and traffic and greenhouse gas emissions, and therefore does not give the public and decision-makers sufficient information on which to analyze the Project's environmental effects.

I. The DEIR Fails to Properly Analyze Displacement of People

The DEIR concludes that implementation of the proposed Project would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. DEIR at 4.11-20. The complete analysis states that:

> "development under the proposed project would result in 14,150 new residents, 5,500 new housing units, and 9,900 new jobs in the study area, which would occur incrementally over a 24-year build out period. There are no plans for removal of existing housing under the proposed project, thus displacement of people would not occur. Therefore, the construction of replacement housing elsewhere would not be warranted and the impact would be less than significant." *Id.*

This DEIR's displacement analysis is inadequate because it ignores indirect displacement, i.e., displacement of mostly lower income families that occurs when property values and rents increase due to a new influx of higher wage earners. The General Plan update envisions extremely significant development in terms of office space, housing development and community amenities. The General Plan update would involve new services to be located in Belle Haven and/or the surrounding M-2 area. These services include a grocery store, pharmacy, a hotel and bar, a bayshore pedestrian and bicycle flyover, and bike paths that do not currently exist in the area. The implementation of these services, which the community desires, along with the 6,550 jobs proposed by the Facebook Expansion Project, will surely result in increased demand for housing both from Facebook workers and other workers employed at local tech and R&D companies envisioned through this General Plan process. This substantial increase in demand will foreseeably lead to an increase in rental prices that will displace lower-income tenants. The DEIR analysis is insufficient because it lacks even a conservative analysis of how this increase in jobs and amenities will increase housing demand in the immediate area. In addition, low-income families will suffer the brunt of an exacerbated housing crunch. Increased demand without appropriate mitigating measures (e.g., creation and preservation of affordable housing) will lead to displacement of low-income families that will have significant environmental impacts. As noted here and discussed in more detail below, a lack of affordable housing and displacement will impact commuting patterns and air quality and greenhouse gas emissions. Longer commutes by families displaced and/or unable to afford to live near their employment will have significant environmental impacts.

The General Plan provides aspirational language about the creation of affordable housing[1], but the commitment to policies that will actually require affordable housing creation is uncertain. Moreover, DEIR fails to analyze how much affordable housing is required to offset the environmental impacts of displacement, especially displacement of lower-income families, which makes it impossible to know whether the housing goals contained in the Plan are of sufficient magnitude and targeted to the appropriate income levels. To properly address these potential impacts, the DEIR should analyze how implementation of the Project will create market pressures that might displace people and thereby necessitate replacement housing. Specifically, this analysis should include a discussion of the Project's impact on the availability of affordable housing in relation to the jobs created by the Project. As discussed below, this also requires a discussion of the proposed timelines with respect to anticipated job growth and residential growth, and should include robust discussion of mitigation measures related to this timing.

In addition, we note that the General Plan DEIR's analysis is insufficient because it fails to disaggregate new employees by income. As a result, the analysis does not provide insight as to impacts on the environment. If affordable housing construction and preservation is insufficient to house current lower-income residents and new lower-wage workers, significant impacts on the physical environment may occur from transit.

Last, the Project Description defines the "full" development potential for the 2040 horizon year as 4.1 million square feet of office space, 9,900 new employees, 5,500 residential units and 14,150 new residents. DEIR at 3-30. Yet this "full" development potential definition in the General Plan specifically excludes the 6,550 new jobs proposed in the separate Facebook Expansion Project, a project that plans for 0 new housing units but that states it will induce need for 3,638 units (a very large figure that nonetheless incorrectly under-states the real need). *See* Facebook DEIR at 3.12-10 & 3.12-11 n. 32.

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[1] General Plan Goal H-4 envisions efficient land use "to meet housing needs for a variety of income levels," and Policy H-2.3 states that "[t]he City will also encourage limited equity cooperatives and other innovative housing proposals that are affordable to lower income households."

The Facebook Expansion Project DEIR notes that the General Plan proposal for 4,500 new housing units will help provide for the housing need created by that project. If this is true, fewer units will be left to accommodate housing need created by implementation of the General Plan Project itself. In other words, these two environmental review documents rely on each other in a circular fashion that results in a dramatic understatement of new housing need and over-estimation of the availability of new housing to meet that need. This will exacerbate indirect displacement effects and the resultant environmental impacts. To give the public a fair and accurate view of the potential environmental impacts of the Project, the DEIR should analyze its projections for housing units needed in light of the Facebook Expansion project.

II. The DEIR Fails to Properly Analyze the Cumulative Impacts of the Project

CEQA requires the lead agency to analyze and mitigate a Project's potentially significant cumulative impacts. CEQA defines cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." CEQA Guidelines Section 15355; *see also Communities for a Better Env't v. Cal. Res. Agency* (2002) 103 Cal.App.4th 98, 120. With respect to cumulative growth, the DEIR projects increases in employment that far outpace increases in number households/population. The DEIR projections also far exceed current ABAG projections: they predict that population and the number of households will each increase by 53% by 2040, in comparison to ABAG's projection of 15% population growth and 13% household growth. In addition, the general plan expects that the number of employees will increase by 73%, whereas ABAG projects that number to increase by only 13%.

The DEIR admits that, cumulatively, "impacts related to exceeding regional growth without adequate regional planning would be *significant*." The DEIR attempts to assure the reader that the disparity between the general plan's growth projections and the ABAG projections will be resolved when "regional forecasts … [are] updated to take into account the new growth potential for Menlo Park." This ignores the legal standard, however, as some theoretical future revision to regional growth projections does nothing to illuminate the environmental impacts of that new growth. Menlo Park's DEIR cannot avoid analysis of cumulative impacts on this basis.

First, for the DEIR to conclude that all will be well because ABAG will update its numbers to reflect the general plan avoids analysis of the absolute disparity between job creation and population/households increase. This absolute disparity must be studied so that the public and decision-makers can have full opportunity to understand and weigh in on the potential environmental impacts of the project. In particular, the General Plan's growth figures would exacerbate the jobs-housing imbalance by increasing employment by 73%. The DEIR should study and account for housing need based on that absolute increase in employment. The DEIR should include study of affordable housing need in order to mitigate the environmental impacts discussed above.

Second, the assurance that the Project's environmental impacts will not be a problem because ABAG will update its numbers reflects unsound circular reasoning that will likely mean that the impacts of this massive increase in growth would not be studied or mitigated in any city or regional EIR. The DEIR suggests that the general plan can increase its growth forecasts at will, despite conflicting with ABAG projections, because ABAG uses general plan forecasts to make their projections. But, as implied by the very discussion of ABAG projections, general plan growth forecasts use and are required to use ABAG projections. In fact, ABAG projections are meant to guide the more local planning efforts of counties and cities. If a city's general plan can predict and prepare for growth far in excess of ABAG projections, ABAG projections would lose their utility altogether, environmental review for the regional Sustainable Communities Strategy would become meaningless, and cities would have no real restraint or requirement in their planning process.

III. The DEIR Fails to Account for How the Mismatch between Timing of Commercial Development and Housing Construction Would Greatly Exacerbate Environmental Impacts

The DEIR plans for a timeline of 24 years, but it is already known that a significant portion of the office development discussed in the Project is proposed for 2018 and 2022, as a direct result of the Facebook Expansion Project. Meanwhile there are no guarantees or timelines given for the housing development – particularly affordable housing development – imagined by the Plan. The DEIR states:

> "[g]iven the proposed project consists of a long-term policy document that is intended to guide future development activities and City actions, and because no specific development projects are proposed as part of the project, it is reasonable to assume that future development in the study area would occur incrementally or gradually over the 24-year buildout horizon (e.g., 2016 to 2040). However, while this assumption describes the long-range nature of the proposed project, it does not prohibit or restrict when development can occur over the horizon period." *See* DEIR at 4-3.

Even if the General Plan housing projections are met, there is no guarantee they will be met along a near-term timeline that coincides with need created by such rapid and sizeable commercial development. For example, the General Plan DEIR does not account for the immediate housing demand that would be created by 6,550 new employees (or roughly 30% of total growth envisioned by 2040 under all cumulative projects and *more* than the 5,500 jobs envisioned by the General Plan update without the Facebook Expansion) if the Facebook Expansion Project is approved. The DEIR is inadequate because nowhere does it provide sufficient analysis of the timing of the envisioned job creation in relation to the timing of housing creation. Unless housing, and affordable housing in particular, is built at the same time that demand is generated by job growth, thousands of workers could spend decades in lengthy commutes due to the lack of locally available housing. Displacement pressures on existing low-income residents would also be extreme and unmitigated. Because the Facebook Expansion project provides for zero housing units, failure in the General Plan DEIR to analyze when job growth will occur as compared to when the residential growth will occur between now and 2040 results in a failure of the cumulative impacts analysis to address all possible environmental impacts. The General Plan EIR should account for the disproportionately high rate of population, housing, and employment increase that will likely take place in the next 2 to 6 years by incorporating concrete policies to guarantee the construction of sufficient affordable housing over that same period.

Without a practical, rapid-response mechanism by which to halt or postpone commercial development if housing needs are not being met commensurate with commercial development, there is no guarantee that the commercial development envisioned by the General Plan update and analyzed in the DEIR will occur before or at the same time as housing development rather than far outpacing any such potential housing development, causing substantial and unplanned for environmental impacts, as well as displacement through the indirect mechanisms discussed above.

IV. The DEIR's failure to include the multiplier for job growth means that the environmental impacts of the Project cannot be properly analyzed

The General Plan DEIR's analysis is insufficient because it does not include discussion of the multiplier for indirect growth, that is, that for every one new high tech job about 4 new service sector jobs are created. *See* Attachment 1, "Technology Works: High-Tech Employment and Wages in the United States," Bay Area Council Economic Institute (2012), p. 25. The analysis is incomplete because it does not account for the housing needs generated by this indirect job growth. In light of the discussion above, the public and decision-makers need to have access to a reasonable estimate of the number of new jobs that would result indirectly from the Facebook Expansion project as well as other projected tech employment in order to properly analyze whether the new job growth anticipated under the General Plan Project plus cumulative development presents a full and accurate forecast. Without this information and analysis, the General Plan DEIR's conclusions regarding environmental impacts of the Project are undermined.

V. The DEIR's Analysis of Vacancy Rate is Insufficient for Proper CEQA Analysis

The DEIR's analysis of residential vacancy rate is insufficient. First, the City relies on vacancy rate data from 2010, where ACS survey data from 2015 is readily available. The City should use the most current data practicable, both to reflect existing conditions at the time of the NOP and to avoid basing analysis on outdated information. We note that the housing market has changed dramatically since 2010, which was the low point of the foreclosure crisis. Since then, the housing market has heated up and tightened. Second, the DEIR concludes, without explaining why, that these vacancies will absorb much of the housing demand created by the Project. What remains unclear from the DEIR is whether the purportedly vacant units are available as residences and whether they can be relied on to absorb housing demand generated by the Project.

VI. The DEIR's Analysis of Employees per Household Does Not Provide Sufficient Information for Proper CEQA Analysis

The DEIR's analysis of employees per household does not provide sufficient information to determine whether the Project proposes housing sufficient to meet project goals and mitigate displacement, traffic and greenhouse gas emission impacts. The DEIR projections and analysis rely on a calculation of 2.6 employees per housing. In contrast, we note that the Facebook DEIR assumes 1.8 employees per household. *See* Facebook DEIR at 3.12-10 & 3.12-11 n. 32 (6,550 / 1.8 persons per household = 3,638 units). Because the Facebook Expansion project is projected to rely on housing to be zoned and approved through the General Plan process, and because the Facebook Expansion project is expected to house about 30% less employees per unit than the overall General Plan anticipates, the General Plan DEIR must take into account the Facebook Expansion numbers when reviewing cumulative impacts. The DEIR should analyze its projections for housing units needed in light of the Facebook Expansion project.

VII. The DEIR's Vehicle Miles Traveled Analysis Is Inadequate

The DEIR conclusion that Vehicle Miles Traveled ("VMT") per capita will be reduced is based on incomplete and faulty analysis. The DEIR states, "[t]he reduction in VMT per capita under the 2040 Plus Project scenario is due to the planned addition of housing in a jobs-rich area, which results in changes in tripmaking behavior, travel characteristics and resulting trip lengths." DEIR at 4.13-73. First, because the DEIR fails to disaggregate the housing needs across income, the DEIR cannot analyze whether the 2040 Plus Project scenario might actually increase VMTs per capita substantially. If lower income workers travel from afar, which is certain to result if the housing created near to their jobs is priced at levels they cannot afford, VMTs will increase. *See*

Attachment 2, “Bay Area Workers Commuting from Edges of ‘Megaregion’”, by Erin Baldassari, The Mercury News, June 30, 2016. Second, because the DEIR fails to incorporate the multiplier effect, and for the reasons stated above, VMTs are likely much higher than estimated in the DEIR.

VIII. The DEIR Does Not Account for Environmental Impacts Beyond the Borders of Menlo Park, Including Impacts on Housing and Water

The DEIR limits its analysis of Project impacts to Menlo Park. We augment our comments above to note that the City should evaluate the displacement impacts, affordable housing impacts, and environmental impacts of the Project on surrounding jurisdictions. This analysis should be included in the DEIR’s discussion to fully analyze the Project’s impacts on inducing population growth, on the need for construction of new housing due to the indirect displacement of people, and on cumulative impacts to population and housing.

The impact on surrounding jurisdictions also includes demand for future water. The DEIR discusses future water demand but fails to adequately assess that demand by not including the future water demand needs of the Facebook Expansion project. The City of East Palo Alto will likely feel these impacts most significantly. These impacts are directly related to housing development. The housing impacts resulting from the Facebook expansion and the General Plan Update will occur in East Palo Alto (due to EPA’s proximity to the Facebook campus and the project area, and the cost of real estate in East Palo Alto relative to the salaries of Facebook and future project area employees) and those impacts will be significant. The DEIR’s failure to properly study water impacts could constrain future housing development in East Palo Alto.

In this situation where Menlo Park’s future development pattern has unintended induced housing impacts on its neighboring cities, Menlo Park would typically not have any leverage or influence over its neighboring cities to plan for, develop and construct housing, especially affordable housing. However, the City of Menlo Park and East Palo Alto are in a unique situation due to previous water allocation agreements between the City of Menlo Park, City of East Palo Alto, San Francisco Public Utilities Commission and the (now defunct) East Palo Alto County Waterworks District. East Palo Alto is unable to build additional housing without any water allocations from its water-rich neighbor.

We note that after the East Palo Alto County Waterworks District dissolved in 2001, water allocations were transferred from East Palo Alto to Menlo Park. We are asking now, due to the impending housing impacts from the Facebook Expansion and the development envisioned in the General Plan update, that the EIR study a transfer of an adequate amount of Menlo Park's water allocation to East Palo Alto. Such an allocation would allow the development of homes, especially those affordable to all income spectrums from janitors and cooks all the way to C-level staff, resulting from the induced housing demand generated from the development envisioned by the General Plan and the Facebook Expansion.

Such a transfer could occur based on the following: number of residents served by the Menlo Park Municipal Water District (16,000 according to menlopark.org) and the projected million-gallons of water to be used annually by residents according to Table 6: Projected Future Water Demands of Current General Plan Buildout for Menlo Park Municipal Water District, from the Water Supply Assessment Study prepared for the City Menlo Park by Erler & Kalinowski, dated February 3, 2016:

Table 6
Projected Future Water Demands of Current General Plan Buildout for MPMWD
Facebook Campus Expansion, Menlo Park, California

	Projected Annual Water Demand of Current General Plan Buildout (MG) (a)				
Customer Category	**2020**	**2025**	**2030**	**2035**	**2040**
Single Family Residential	447	438	430	425	422
Multi-family Residential	119	117	115	114	113
Commercial/Institutional	150	158	166	174	182
Industrial	315	289	264	241	221
Institutional/Governmental	86	86	87	87	88
Landscape Irrigation (b)	128	133	139	145	151
Other (Temporary Meters) (c)	3	3	3	3	3
Total Water Use	1,248	1,224	1,204	1,189	1,179
Non-Revenue Water (d)	*62*	*62*	*61*	*61*	*61*
Total Water Demand (e)	**1,310**	**1,286**	**1,265**	**1,251**	**1,240**

IX. The DEIR Does Not Study or Adopt Adequate Mitigation Measures to Address Significant Impacts that are Identified and that Would Be Identified through Proper Analysis

Public agencies are required to describe and discuss mitigation measures that could minimize each significant environmental effect identified in an EIR. Mitigation measures are "the teeth of the EIR" because "[a] gloomy forecast of environmental degradation is of little or no value without pragmatic, concrete means to minimize the impacts and restore ecological equilibrium." *Environmental Council of Sacramento v. City of Sacramento* (2006) 142 Cal. App. 4th 1018, 1039. Such measures must be at least "roughly proportional" to the impacts of the project, and must not be remote or speculative. Indeed, a project should not be approved "as proposed if there are feasible mitigation measures available which would substantially lessen the significant environmental effects of the project." Cal. Pub. Res. Code §21002; see also 14 CCR §15002(a)(3) (agencies must prevent avoidable damage "when [it] finds [mitigation measures] to be feasible").

Here, for the reasons stated above, the environmental impacts of the Project are inadequately described in the DEIR, which makes a proper consideration of mitigation measures impossible. Moreover, mitigation measures that would address significant impacts that *are* already identified in the DEIR are not considered. These mitigation measures would include more aggressive and certain policies to create affordable housing for lower-income households in the near term, policies to allow existing low-income households to remain in their rented or owned homes, and other community stabilization policies. These mitigation measures should be studied and incorporated into the Project before it can be approved.

CONCLUSION

In conclusion, we note that the General Plan update is ambitious in many ways, including in its desire to streamline future projects. Doing so requires that the City get it right, right now, regarding complex calculations. We hope that the City's review of our comments and attachments[2] will elicit thoughtful consideration and responses, and we stand by willing to work with the City to develop appropriate mitigation measures to counteract the impacts we've discussed.

Thank you in advance for your time and consideration,

Keith Ogden
CLSEPA

/s/
Tameeka Bennett
on behalf of ETB-EPA and YUCA

/s/
Jennifer Martinez, Ph.D
on behalf of Faith in Action-Bay Area

/s/
Doroteo Garcia
on behalf of El Comité de Vecinos del Lado Oeste

[2] We have attached two documents to our email containing our comment letter: "Technology Works: High-Tech Employment and Wages in the United States," Bay Area Council Economic Institute (2012), and "Bay Area Workers Commuting from Edges of 'Megaregion'", by Erin Baldassari, The Mercury News, June 30, 2016

Technology Works:

High-Tech Employment and Wages in the United States

A Bay Area Council Economic Institute Report
commissioned by Engine Advocacy

December 2012

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ECONOMIC
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Connecting business, labor,
government and education

Acknowledgments

This report was prepared for Engine Advocacy (www.engine.is) by the Bay Area Council Economic Institute.

Ian Hathaway, Research Manager of the Economic Institute, authored the report. Patrick Kallerman of the Economic Institute provided research and analytical support.

Bay Area Council Economic Institute

201 California Street, Suite 1450, San Francisco, CA 94111
www.bayareaeconomy.org | bacei@bayareacouncil.org

"This study addresses an important question: how important is high-tech employment growth for the U.S. labor market? As it turns out, the dynamism of the U.S. high-tech companies matters not just to scientists, software engineers and stock holders, but to the community at large. While the average worker may never be employed by Google or a high-tech startup, our jobs are increasingly supported by the wealth created by innovators. The reason is that high-tech companies generate a growing number of jobs outside high-tech in the communities where they are located. My research shows that attracting a scientist or a software engineer to a city triggers a multiplier effect, increasing employment and salaries for those who provide local services. This study confirms and extends this finding using a broader definition of the high-tech sector. It is a useful contribution to our understanding of job creation in America today."

- Enrico Moretti, Professor of Economics at the University of California, Berkeley and author of *The New Geography of Jobs*

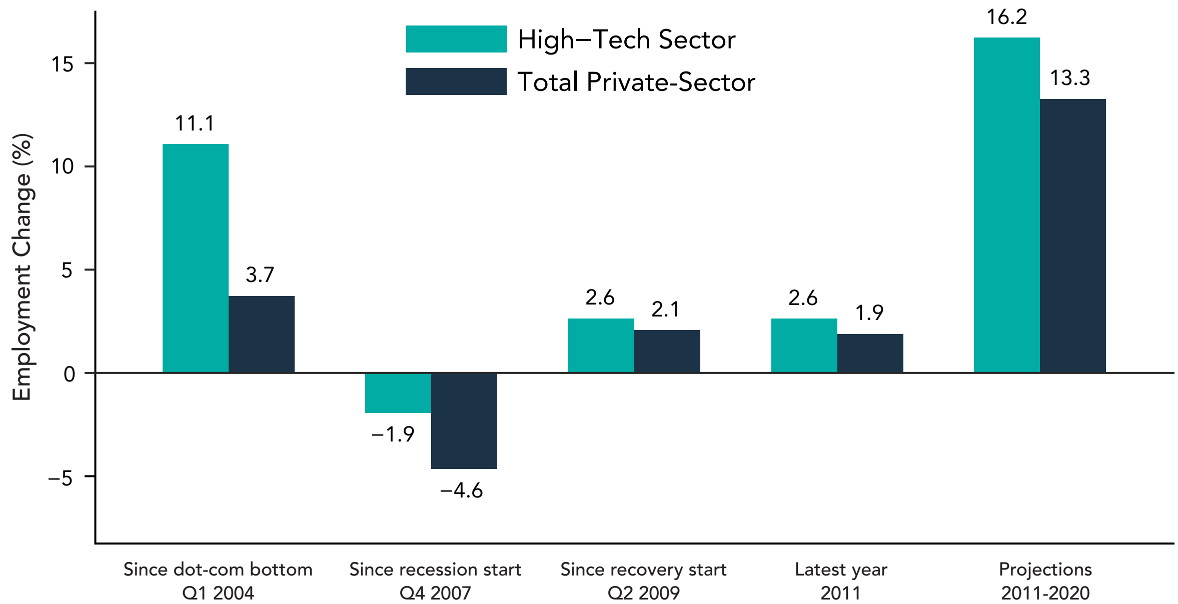
Contents

Executive Summary

This report analyzes patterns of high-technology employment and wages in the United States. It finds not only that high-tech jobs are a critical source of employment and income in the U.S. economy, but that growth in the high-tech sector has increasingly been occurring in regions that are economically and geographically diverse. This report also finds that the high-tech sector—defined here as the group of industries with very high shares of workers in the STEM fields of science, technology, engineering and math—is an important source of secondary job creation and local economic development. The key findings are as follows:

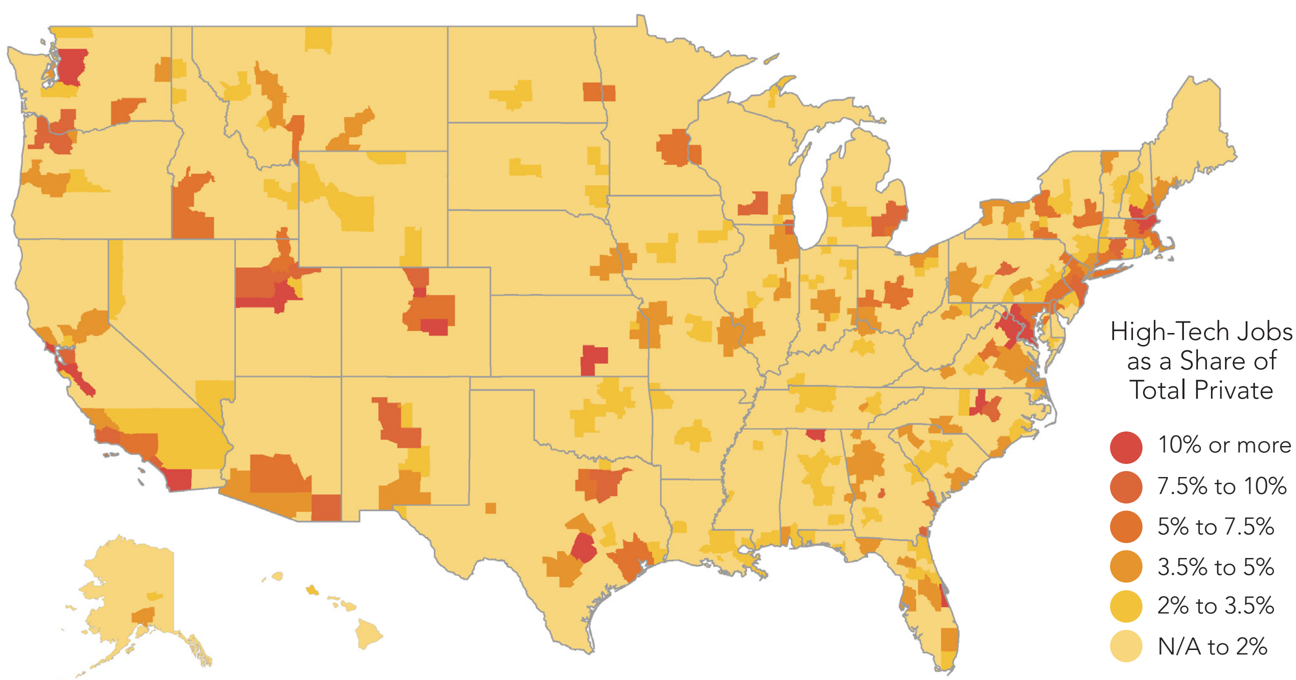
- Since the dot-com bust reached bottom in early 2004, employment growth in the high-tech sector has outpaced growth in the private sector as a whole by a ratio of three-to-one. High-tech sector employment has also been more resilient in the recent recession-and-recovery period and in the last year. The unemployment rate for the high-tech sector workforce has consistently been far below the rate for the nation as a whole, and recent wage growth has been stronger.
- Employment growth in STEM occupations has consistently been robust throughout the last decade, outpacing job gains across all occupations by a ratio of 27 to 1 between 2002 and 2011. When combined with very low unemployment and strong wage growth, this reflects the high demand for workers in these fields.
- Employment projections indicate that demand for high-tech workers will be stronger than for workers outside of high-tech at least through 2020. Employment in high-tech industries is projected to grow 16.2 percent between 2011 and 2020 and employment in STEM occupations is expected to increase by 13.9 percent. Employment growth for the nation as a whole is expected to be 13.3 percent during the same period.
- Workers in high-tech industries and STEM occupations earn a substantial wage premium of between 17 and 27 percent relative to workers in other fields, even after adjusting for factors outside of industry or occupation that affect wages (such as educational attainment, citizenship status, age, ethnicity and geography, among others).
- The growing income generated by the high-tech sector and the strong employment growth that supports it are important contributors to regional economic development. This is illustrated by the local multiplier, which estimates that the creation of one job in the high-tech sector of a region is associated with the creation of 4.3 additional jobs in the local goods and services economy of the same region in the long run. That is more than three times the local multiplier for manufacturing, which at 1.4, is still quite high.

FIGURE E1
Employment Change and Projections During Key Intervals



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute
Note: Data excludes public sector workers, except for projections, which include them.

FIGURE E2
High-Tech Employment Concentration by Metro, 2011



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Introduction

One consistent bright spot in the U.S. economy has been the high-tech sector. Employment in high-tech industries has grown at a rate three times that of the private sector as a whole since early 2004, when the dot-com bust reached bottom. It has also performed better during the recent recession-and-recovery period and in the last year. The high-tech unemployment rate has consistently been well below the rate for the broader U.S. economy.

As the innovative engine of the economy, the high-tech sector is responsible for a disproportionate share of productivity gains and national income growth. Income generation is reflected in employment wages, where a typical high-tech worker earns between 17 and 27 percent more than a comparable worker in another field. This income also makes high-tech an important source of support for local services jobs and economic development in communities throughout the country.

Perhaps most important, high-tech employment has been spread broadly across the country. While some regions—such as San Francisco, Silicon Valley, Seattle, Boston and Austin—are well-known tech hubs, an investigation into the data reveals that high-tech employment exists in nearly all communities throughout the country. For example, almost 98 percent of U.S. counties had at least one high-tech business establishment in 2011. Furthermore, growth in high-tech employment is occurring in regions across the nation.

This report analyzes patterns of high-tech employment and wages in the United States. It finds not only that high-tech jobs are an important source of employment and income in the U.S. economy, but that growth in this sector has increasingly been occurring in regions that are economically and geographically diverse. This report also finds that high-tech industries are an important source of secondary job creation and local economic development.

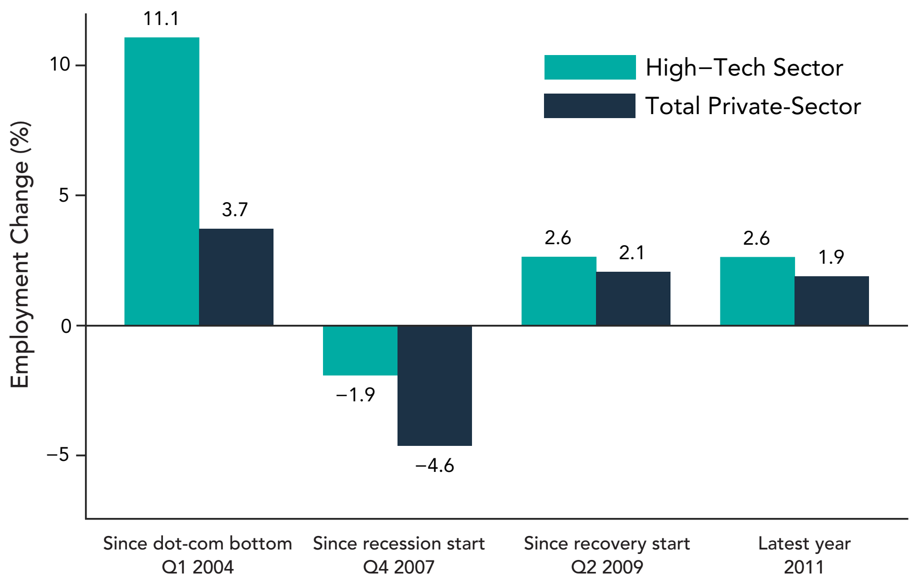
High-Tech Industry Employment

The high-tech sector is defined here as the group of industries with very high shares of technology oriented workers—those in the STEM fields of science, technology, engineering and math. This definition includes a set of industries in what is traditionally thought of as high-tech—manufacturing and services in computers, advanced communications and electronics—as well as the medical and aerospace manufacturing, engineering services, and scientific research and development industries (see **Appendix 1**).

Figure 1 shows the percentage change in high-tech sector employment compared to total private-sector employment during several key time periods.[1]

FIGURE 1

Employment Change During Key Time Periods Through 2011



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute
Note: Data excludes public-sector workers.

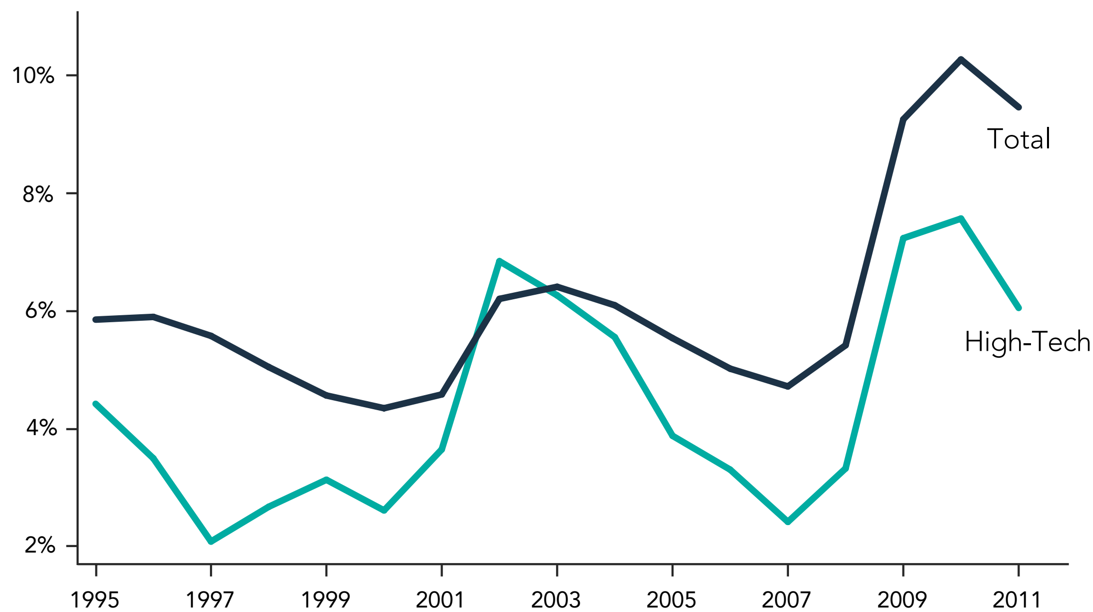
Since the bottom of the dot-com bust in early 2004, employment in the high-tech sector grew 11.1 percent—three times the 3.7 percent growth seen across the entire private sector. Jobs in the high-tech sector have fallen less since the recession began in December 2007 than have jobs across the entire private sector. They have also gained more since the recession ended in June 2009, and in 2011, the latest year the data are available.

[1] The Quarterly Census of Employment and Wages (QCEW) published by the Bureau of Labor Statistics (BLS) produces detailed industry data on business establishments, employment and wages. The data is available at the county, metro area, state and national levels. The data is based on administrative records of employer payrolls and includes nearly all non-self-employed workers in non-agricultural sectors of the economy.

The unemployment rate for the high-tech sector workforce has tended to stay far below the rate for the broader U.S. economy.[2] The unemployment rate in high-tech was higher than the rate across all industries in just one year between 1995 and 2011. The unemployment rate subsequently fell more quickly and to much lower levels, indicating that high-tech workers who were laid-off during the dot-com bust were able to find work with greater ease. In the most recent cycle, the unemployment rate in high-tech rose more in percentage terms than the broader U.S. rate. However, high-tech unemployment also peaked at a much lower level and has declined more rapidly since.

FIGURE 2

Unemployment Rate by Industry Group, 1995-2011



Source: U.S. Census Bureau; calculations by Bay Area Council Economic Institute

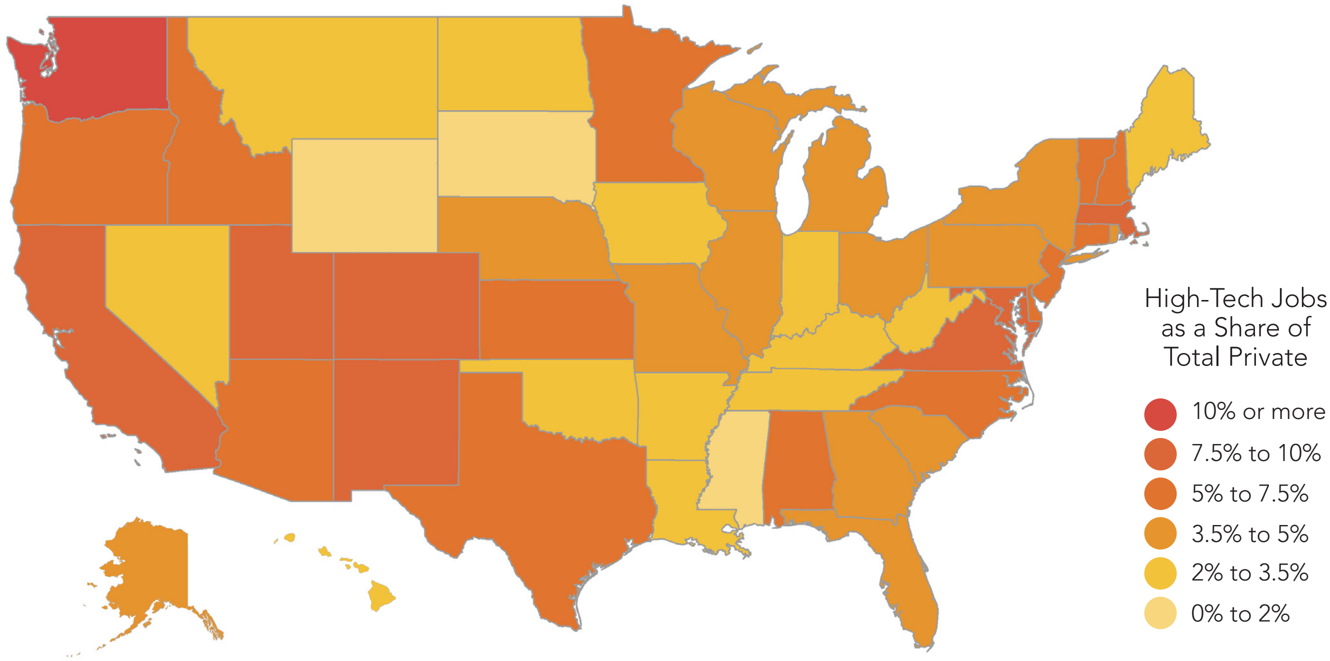
Local Employment Concentration

Some regions—such as San Francisco, Silicon Valley, Seattle, Boston and Austin—are well-known tech hubs. Others, like Huntsville, AL and Wichita, KS may come as a surprise. Identifying where high-tech employment is concentrated and where job growth in this sector is occurring is important for policymakers, because it is precisely these types of jobs that have large impacts on local economic growth.

[2] The unemployment rate is calculated as the number of individuals without jobs who are actively looking for work (the unemployed) as a percentage of the labor force (the unemployed plus the employed).

FIGURE 3

High-Tech Employment Concentration by State, 2011



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Figure 3 and **Figure 4** map the share of employment in the high-tech sector across the U.S. in 2011, by state and by metro area.[3] Comparison maps of high-tech employment concentrations in 1991, which show significant dispersion of high-tech jobs in the last two decades, are contained in **Appendix 2**. The maps here are accompanied by tables that highlight some of the regions with the greatest concentrations of high-tech employment. Detailed information on employment for each state and selected U.S. metro areas is provided in **Appendix 3**.

As **Figure 3** shows, Western, Mid-Atlantic and some Northeastern states had the highest concentrations of high-tech employment in 2011. Washington was the highest at 11.4 percent. Massachusetts, Virginia, Maryland, Colorado and California were each above 8 percent. The high-tech employment concentration of the entire United States was 5.6 percent.

TABLE 1

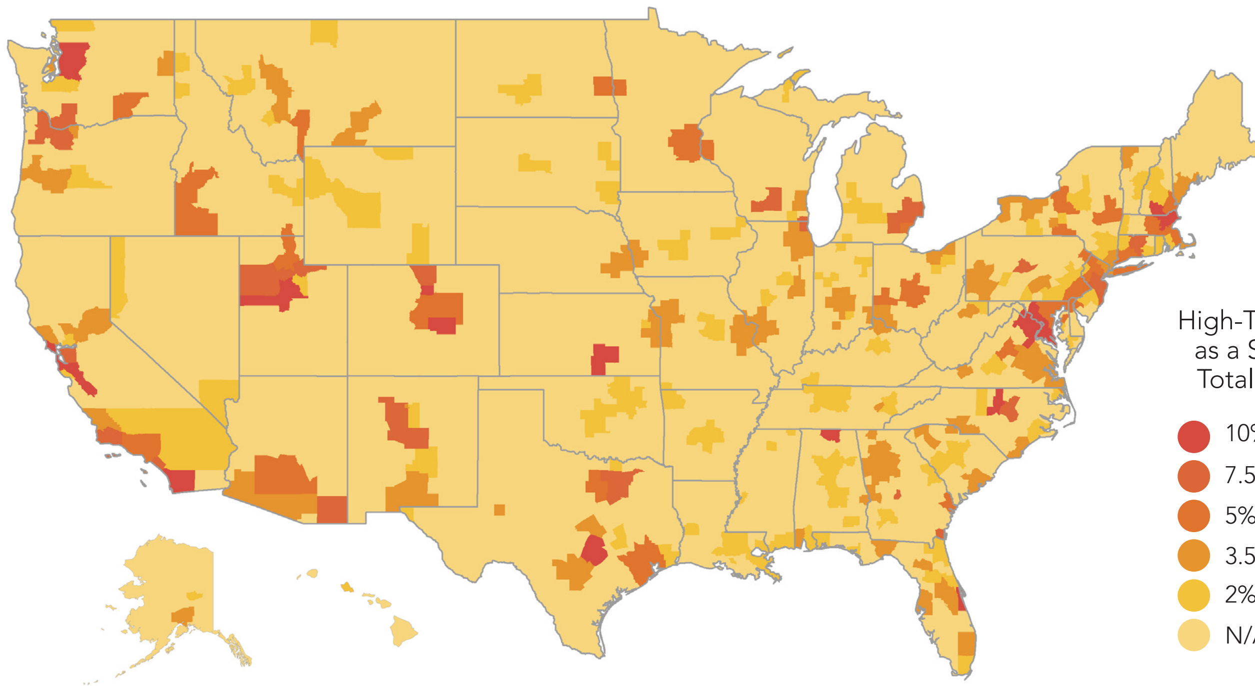
Top 10 States for High-Tech Employment Concentration, 2011

State	Tech Jobs (%)
Washington	11.4
Massachusetts	9.4
Virginia	9.3
Maryland	8.9
Colorado	8.4
California	8.2
New Mexico	7.6
Utah	7.5
Connecticut	6.9
New Hampshire	6.9
United States	5.6

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

3 Unless otherwise noted, this report defines metros as Core Based Statistical Areas (CBSAs) and Metro Divisions (MDs) as determined by the U.S. Census Bureau and the Office of Management and Budget.

FIGURE 4
High-Tech Employment Concentration by Metro, 2011



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

TABLE 2
Top 25 Metros for High-Tech Employment Concentration, 2011

Metro	Tech Jobs (%)	Metro	Tech Jobs (%)
San Jose-Sunnyvale-Santa Clara, CA	28.8	Austin-Round Rock, TX	10.7
Boulder, CO	22.7	Peabody, MA	10.3
Huntsville, AL	22.4	Provo-Orem, UT	10.1
Cambridge-Newton-Framingham, MA	20.3	Colorado Springs, CO	10.1
Seattle-Bellevue-Everett, WA	18.2	Oakland-Fremont-Hayward, CA	9.7
Wichita, KS	14.8	Raleigh-Cary, NC	9.6
Washington-Arlington-Alexandria, DC-VA-MD-WV	13.3	Santa Barbara-Santa Maria-Goleta, CA	8.9
Palm Bay-Melbourne-Titusville, FL	13.3	Trenton-Ewing, NJ	8.8
Bethesda-Frederick-Rockville, MD	12.6	Madison, WI	8.5
San Francisco-San Mateo-Redwood City, CA	12.2	Albuquerque, NM	8.5
Durham-Chapel Hill, NC	11.4	Lake County-Kenosha County, IL-WI	8.3
Manchester-Nashua, NH	11.3	Santa Ana-Anaheim-Irvine, CA	8.2
San Diego-Carlsbad-San Marcos, CA	11.1	United States	5.6

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

While significant, data aggregated at the state level may obscure important insights gained by looking at local economies. **Figure 4** shows the concentration of high-tech employment at the metro area level. As the map illustrates, high-tech jobs are distributed throughout the country.

Many of the metro areas with large shares of high-tech workers will not come as a surprise. The San Jose, CA metro area, which encompasses most of Silicon Valley, had a high-tech employment concentration of 28.8 percent in 2011. The Cambridge, MA area, home of a booming tech cluster, also had a share of high-tech employment in excess of 20 percent. But so too did Boulder, CO and Huntsville, AL—places that may be less well-known as hubs of high-tech activity. Nearly 15 percent of private-sector employment in Wichita, KS was generated by high-tech.

Local Employment Growth

One might expect tech hubs to be the same places where the greatest high-tech employment growth is occurring. A deeper examination of the data, however, reveals a few surprises.

TABLE 3

Top 10 States for High-Tech Employment Growth, 2010-2011

State	Change (%)
Delaware	12.8
South Carolina	8.6
Michigan	6.9
Kansas	6.0
Washington	5.8
Texas	4.7
Ohio	4.6
North Carolina	4.3
Alabama	4.3
Colorado	4.3
United States	2.6

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Delaware topped the list in 2011 with high-tech employment growth at 12.8 percent. South Carolina, Michigan, Kansas and Washington each had high-tech employment growth in excess of 5 percent. Nine additional states had growth of 4 percent or more and a total of 41 states increased high-tech employment in 2011. Twenty-eight of the 50 states had high-tech employment growth outpace employment growth across the private sector as a whole.

Of the 25 metros with the greatest high-tech employment growth, just seven had high-tech employment concentrations above the national average. When taken from a smaller base, high growth in percentage terms naturally translates to fewer absolute job gains. But it is also true that because this report primarily focuses on the 150 largest U.S. metros, the annual changes are still significant and are in the thousands.[4]

4 It is important to note that employment and wage data in the QCEW are suppressed when the confidentiality of individual companies may be compromised. This situation typically occurs in sparsely populated regions or when fewer than four companies comprise a particular industry classification in a local economy. It can especially be the case when focusing on detailed industry classifications, as is done in this report. As a result, data for some regions is incomplete or understated. In spite of these limitations, the QCEW is a valuable and widely-used resource. A comparison of national and county data reveals that 13 percent of high-tech sector employment is suppressed in the local analyses nationwide. To mitigate these effects when measuring employment growth, this report generally focuses on the 150 metros with at least 126,000 private-sector workers on employer payrolls. In addition, data for Lancaster, Pennsylvania has also been excluded because of an obvious data suppression issue that is inconsistently applied across years and therefore skews employment growth results.

For example, the explosive growth of 36.3 percent for the high-tech sector of the Greensboro-High Point, NC metro in 2011 was achieved through the addition of nearly 2,000 jobs. Though the Greensboro-High Point metro has a relatively low concentration of high-tech jobs and therefore grew from a smaller base, the job gains seen there are non-trivial. At the other end of the concentration spectrum, the San Francisco-San Mateo-Redwood City, CA metro increased high-tech employment at an impressive rate of 20.1 percent in 2011 with the addition of more than 17,600 jobs.

Columbia, SC added more than 1,400 high-tech jobs, Dayton, OH added nearly 3,500 and Ogden-Clearfield, UT added almost 1,500. Of the five metros with the top high-tech employment growth rates, Greensboro-High Point and Columbia had relatively low concentrations of high-tech employment: both were around 2.5 percent. The Dayton, San Francisco-San Mateo-Redwood City and Ogden-Clearfield metros each had above-average concentrations of high-tech workers.

Many of the other metros with the greatest high-tech employment growth rates are spread throughout the country—in the Midwest, South, West, Northeast and along both coasts. These metros are in places known for high-skilled workforces as well as in places that are associated with industrial decay. Beyond the 25 metros in **Table 4**, 16 additional metros saw high-tech employment growth above 5 percent.

TABLE 4

Top 25 Metros for High-Tech Employment Growth, 2010-2011

Metro	Change (%)
Greensboro-High Point, NC	36.3
Columbia, SC	28.2
Dayton, OH	24.2
San Francisco-San Mateo-Redwood City, CA	20.1
Ogden-Clearfield, UT	19.3
Lansing-East Lansing, MI	17.6
Lake County-Kenosha County, IL-WI	13.5
Wilmington, DE-MD-NJ	13.4
Beaumont-Port Arthur, TX	12.8
Deltona-Daytona Beach-Ormond Beach, FL	12.5
Boise City-Nampa, ID	11.9
Augusta-Richmond County, GA-SC	11.7
Warren-Troy-Farmington Hills, MI	10.6
Asheville, NC	10.2
Canton-Massillon, OH	10.1
Cleveland-Elyria-Mentor, OH	9.1
Evansville, IN-KY	8.8
Davenport-Moline-Rock Island, IA-IL	8.7
Fayetteville-Springdale-Rogers, AR-MO	8.6
Kansas City, MO-KS	8.4
San Antonio, TX	8.4
Harrisburg-Carlisle, PA	8.2
Spokane, WA	7.7
Tulsa, OK	7.6
Louisville/Jefferson County, KY-IN	7.6
United States	2.6

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

TABLE 5

Top 25 Metros for High-Tech Employment Growth, 2006-2011

Metro	Change (%)
Boise City-Nampa, ID	82.9
Augusta-Richmond County, GA-SC	81.9
Peoria, IL	41.0
Columbia, SC	40.1
Charleston-North Charleston-Summerville, SC	39.2
Little Rock-North Little Rock-Conway, AR	34.7
Albany-Schenectady-Troy, NY	29.9
San Francisco-San Mateo-Redwood City, CA	27.8
Anchorage, AK	27.2
Ogden-Clearfield, UT	25.6
Madison, WI	25.4
Lafayette, LA	24.2
San Antonio, TX	23.6
Sacramento-Arden-Arcade-Roseville, CA	23.4
Charlotte-Gastonia-Concord, NC-SC	22.3
Davenport-Moline-Rock Island, IA-IL	20.2
Mobile, AL	20.0
Green Bay, WI	20.0
Seattle-Bellevue-Everett, WA	17.1
Dayton, OH	16.0
Evansville, IN-KY	15.6
Columbus, OH	14.7
Canton-Massillon, OH	13.0
Raleigh-Cary, NC	12.6
Wilmington, DE-MD-NJ	12.4
United States	1.4

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

These results are robust even when looking back over a longer time period. **Table 5** shows the metros with the highest growth rates between 2006 and 2011. Over that five-year span, 17 of the 25 metros with the greatest high-tech employment growth rates had below average high-tech employment concentrations in 2011.

Eighty of the 150 metros analyzed, or 53.3 percent, had stronger growth in high-tech employment than in the private sector as a whole in 2011. That trend was more pronounced in the five-year period between 2006 and 2011, when high-tech employment growth in 95 metros, or 63.3 percent, outpaced employment growth across local private-sector economies.[5]

Another way to illustrate the point that recent growth in high-tech employment stretches beyond the well-known tech centers is by using scatter plot charts. The charts in **Figure 5** show the correlation between high-tech employment concentration in a state or metro area with its one-year (2010-2011) and five-year (2006-2011) high-tech employment growth.

As these scatter plot charts show, there has not been a strong relationship between high-tech employment concentration and high-tech employment growth in recent years. With the exception of the one-year growth rate for states, the relationships between high-tech employment concentration and employment growth are not statistically significant. This is true both for the states and metros analyzed, as well as for the one-year and five-year time periods. In other words, high-tech employment growth stretches beyond the well-known tech centers.

[5] A systematic comparison of these 150 metros reveals that there are no significant differences in terms of labor availability (average age, average educational attainment, etc.) in those metros where high-tech employment growth was stronger than total private-sector growth, versus those metros where it was weaker.

FIGURE 5a

State High-Tech Concentration vs. One Year Job Change, ***statistically significant***

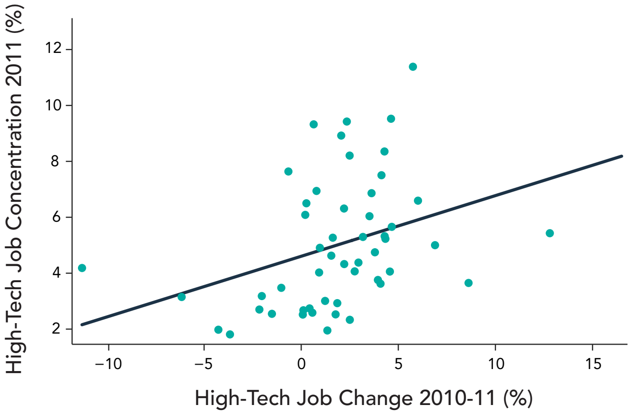


FIGURE 5b

State High-Tech Concentration vs. Five Year Job Change, ***not statistically significant***

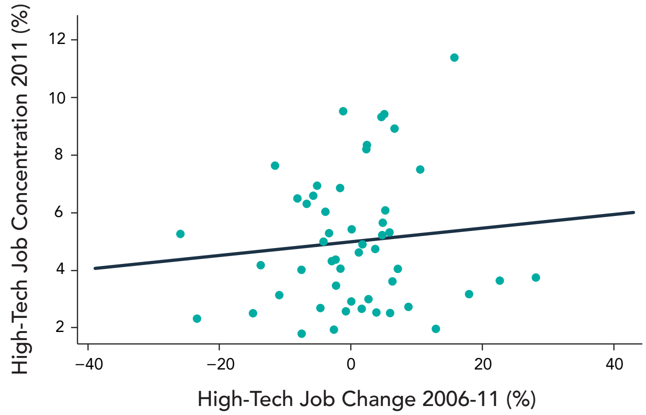
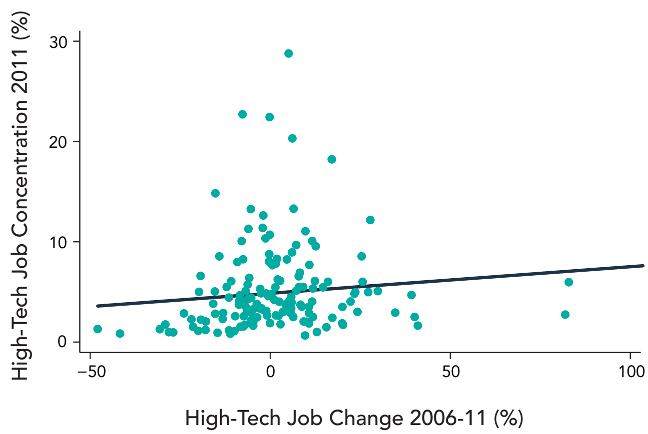


FIGURE 5c

Metro High-Tech Concentration vs. One Year Job Change, ***not statistically significant***

FIGURE 5d

Metro High-Tech Concentration vs. Five Year Job Change, ***not statistically significant***



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Taken together, the figures and tables displayed in this section tell a simple, yet perhaps surprising story. High-tech jobs tend to be concentrated in well-known tech hubs. They are also concentrated in a few, smaller, less well-known regions. High-tech employment growth, on the other hand, is happening in a more geographically and economically diverse set of regions. Growth is occurring in the Rust Belt and the South, as well as along the coasts and in regions with many high-skilled workers.

Overall, employment growth in the high-tech sector has been robust, outpacing employment growth in the broader private sector at regular intervals in the recent past. Unemployment in the high-tech sector workforce has generally been low, particularly when compared to the broader national unemployment rate. Finally, the distribution of high-tech jobs around the country has increased significantly during the last two decades.

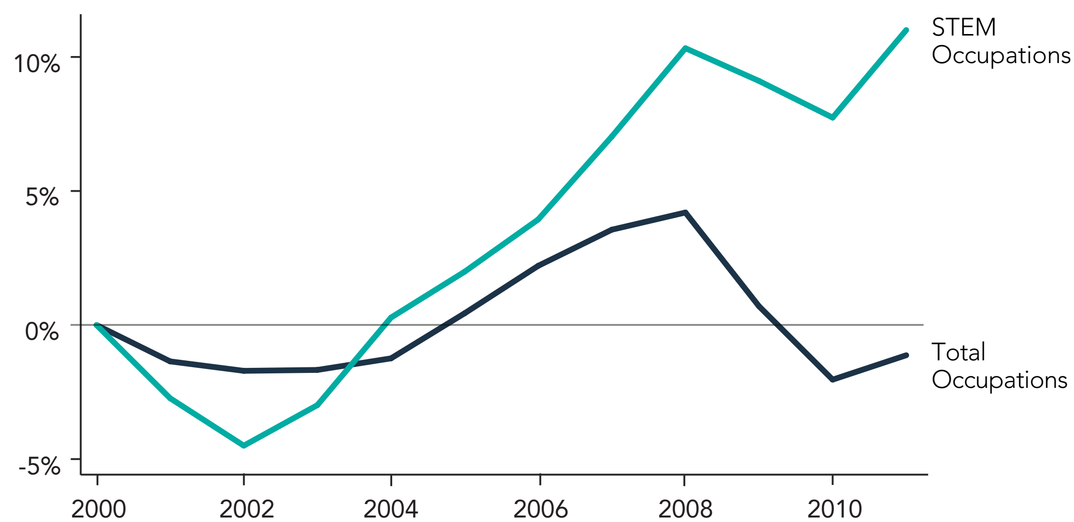
STEM Occupation Employment

After examining patterns in employment within high-tech industries irrespective of occupation, this report next analyzes employment trends in high-tech occupations irrespective of industry. Whereas industry data classifies workers by the goods and services their companies produce, occupational data classifies workers by what activity they are engaged in. High-tech occupations are defined here as those in the STEM fields of science, technology, engineering and math (see **Appendix 1**). Within STEM occupations as a whole, three broad occupational subgroups can be defined: computer and math sciences; engineering and related; and physical and life sciences.

Figure 6 compares the percentage change in employment in the STEM occupations as a whole to the percentage change in all occupations between 2000 and 2011.[6]

FIGURE 6

STEM Employment Change Since 2000



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

In the two years that followed the peak of the dot-com bubble in 2000, employment in STEM occupations fell more than employment across all occupations. But since 2002, the story has been remarkably different. Employment grew 16.2 percent in STEM occupations between 2002 and 2011, while employment across the economy grew by just 0.6 percent. A similar trend has been true during the recent recession-and-recovery period. Since 2007, STEM employment has increased by 3.7 percent, and never fell below pre-recession levels during that period. Total employment went in the opposite direction, falling by 4.5 percent. So far, a similar trend appears in the economic recovery.

[6] The data source is the Occupational Employment Statistics (OES) published by the Bureau of Labor Statistics. The OES provides data on employment and wages for more than 800 occupations and includes the public and private sectors. Data can be analyzed by industry and occupation at the national level, and by occupation alone at the state and metro levels.

In terms of unemployment, a similar trend seen in the previous section can also be observed in the comparison of STEM occupations with total occupations, but it is even more pronounced.

FIGURE 7

Unemployment Rate by Occupation Group, 1995-2011

Source: U.S. Census Bureau; calculations by Bay Area Council Economic Institute

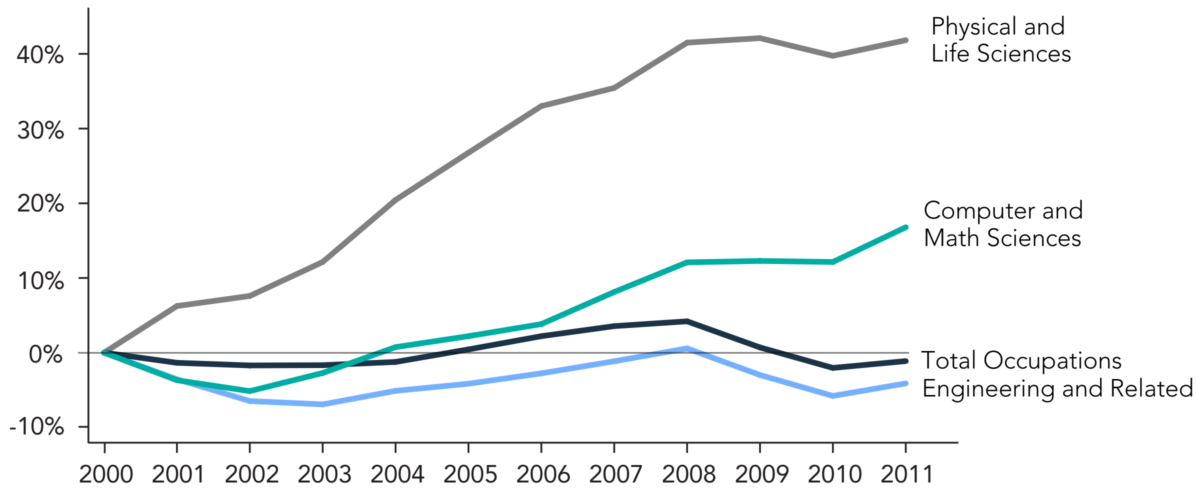
Figure 7 shows the unemployment rates for STEM occupations and for all occupations between 1995 and 2011. At no point during that time span did the unemployment rate for STEM workers exceed the rate for the broader U.S. labor force. Although the STEM unemployment rate was elevated during the periods associated with the 2001 and 2007–2009 recessions, those levels were significantly below the overall unemployment rate. Outside of those periods, the unemployment rate for STEM occupations has been exceptionally low—hovering just below 2 percent throughout most of the late 1990s and dipping below that mark again in 2007. At 9.5 percent, the total unemployment rate in 2011 was more than twice the 4.2 percent rate seen among the STEM workforce.

A look at more detailed subgroups of STEM occupations reveals some important insights. **Figure 8** compares the percentage employment change for three high-tech occupational subgroups—computer and math sciences; engineering and related; and physical and life sciences—to the percentage change for total occupations between 2000 and 2011.

Between 2000 and 2008, job growth in physical and life sciences occupations expanded rapidly by 42.1 percent. By comparison, total occupations grew by 4.1 percent during the same period. That impressive growth trend has at least temporarily been put on hold since 2008. By a wide margin, medical scientists were the largest contributors to this growth, accounting for more than one quarter of the employment gains in the physical and life sciences subgroup.

FIGURE 8

Detailed STEM Employment Change Since 2000



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

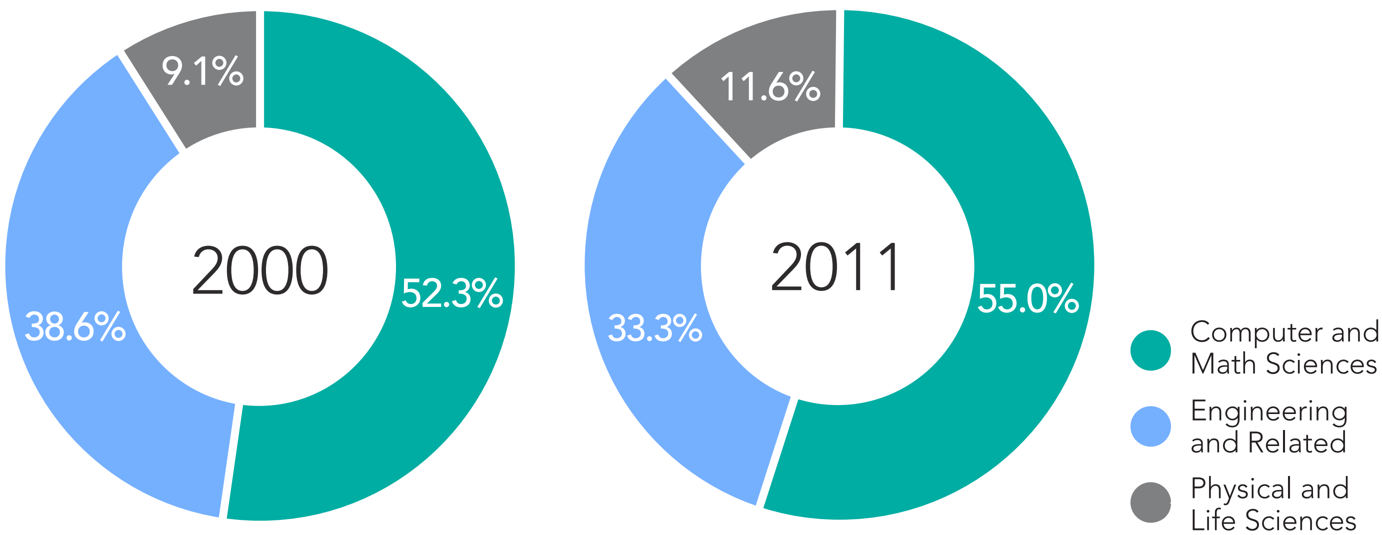
After dipping more than 5 percent between 2000 and 2002, employment in the computer and math sciences occupations expanded at a strong pace. Employment in this subgroup increased 23.1 percent between 2002 and 2011. The growth rate for all occupations was essentially flat during that same period. Employment in the computer and math sciences subgroup has grown by an impressive 8 percent since the beginning of the recession, a period when total employment has fallen by nearly 5 percent.

In contrast to that, employment change in the engineering and related occupations was actually negative between 2000 and 2011. A deeper look at the data reveals that employment for engineers gained across disciplines (civil, electrical, industrial, etc.) by 16 percent over that eleven-year period. The job losses seen across the engineering and related segment were driven entirely by steep declines in the "related" component—drafters, surveyors and technicians—which declined by 23 percent. Workers in this segment of engineering and related occupations are in the low-to-middle end of the skill distribution, whereas engineers are high-skilled.[7] In other words, employment in engineering and related occupations has been rising for the high-skilled workers (engineers) regardless of subject matter, and falling for workers with lower skill levels (drafters, surveyors and technicians).

[7] For information on minimum education and experience requirements for occupations, see the "Occupational Employment, Job Openings and Worker Characteristics" table in the Occupations section of the Employment Projections subject area of the Bureau of Labor Statistics website at http://www.bls.gov/emp/ep_table_107.htm

FIGURE 9

STEM Subgroup Employment Shares, 2000 and 2011



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Of the 635,510 net STEM jobs that were added between 2000 and 2011, computer and math sciences occupations accounted for 79.8 percent. This rise increased the computer and math sciences occupations share of total STEM jobs to 55 percent in 2011, up from 52.3 percent in 2000. Physical and life sciences occupations accounted for 34.6 percent of total STEM job gains. During the 2000–2011 period, physical and life sciences occupations increased their share of STEM jobs from 9.1 percent to 11.6 percent. The engineering and related occupations subgroup subtracted 14.4 percent from the net STEM job change.

Overall, employment growth in STEM occupations has been consistently robust throughout the last decade. It has been less volatile than—and has reliably outperformed—employment growth across all occupations. The substantial majority of that growth has been driven by computer and math sciences occupations, which have seen impressive growth since 2002. Physical and life sciences occupations were the second highest contributors as the result of explosive growth in percentage terms, yet from a smaller base. Employment in engineering and related occupations has declined since 2000, as jobs fell substantially after the dot-com bust, and has mimicked the anemic job growth in the broader economy since then. Job losses in engineering and related occupations have been entirely concentrated in the "related" occupations that employ workers with lower or mid-range skill levels.

High-Tech Employment Projections

The Bureau of Labor Statistics publishes ten-year employment and economic output projections bi-annually through its Employment Projections program. The latest projections are for the ten-year period between 2010 and 2020 and were published in early 2012. Projections are calculated for industries and occupations at the national level.

The projections estimate the number of jobs that will be needed in each occupation and industry in order to meet the demands of an optimally-performing economy in 2020. As a result, the projections may be interpreted not as a forecast that predicts what will occur, but instead, as an estimate of the employment growth that will need to occur to meet potential economic output in 2020.[8]

Using these employment projections, it is possible to calculate the estimated employment demand for high-tech industries and STEM occupations in 2020. Comparisons can be made to the broader economy and to non-high tech industries and non-STEM occupations. Adjustments are made to incorporate the existing data for 2011.

TABLE 6

Employment Levels and Shares, 2011 and 2020

Industry	Occupation	Employment (2011)	Share of Total (%)	Employment (2020)	Share of Total (%)
Total	Total	128,278,550	100.0	145,281,072	100.0
Total	STEM	6,410,180	5.0	7,303,482	5.0
High-Tech	Total	5,984,300	4.7	6,955,458	4.8
High-Tech	STEM	2,804,160	2.2	3,381,999	2.3
Non-High Tech	Total	122,294,250	95.3	138,325,616	95.2
Non-High Tech	STEM	3,606,020	2.8	3,921,483	2.7

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

To begin, **Table 6** provides some important scope-defining information on high-tech industries and STEM occupations. At nearly 6 million, high-tech industries provide 4.7 percent of jobs across the U.S. economy.[9] STEM occupations account for more than 6.4 million jobs, or 5 percent of the total. The combined set of high-tech workers—all workers employed in high-tech industries and those in STEM occupations outside of high-tech industries—constitutes almost 9.6 million jobs, or 7.5 percent of the U.S. workforce. The projections indicate that this combined group will need to add 1.3 million jobs to reach 10.9 million by 2020.

[8] For more on the BLS Employment Projections, see **Appendix 4** and Dixie Sommers and James C. Franklin, "Employment outlook: 2010-2020, Overview of projections to 2020," Monthly Labor Review (U.S. Dept. of Labor and U.S. Bureau of Labor Statistics), Volume 135, Number 1, January 2012.

[9] Note that the data used here is from the OES, which includes private- and public-sector workers, whereas the QCEW data contains only workers in the private sector. These sources also employ different methods and therefore naturally have slightly different estimates for the workforce.

FIGURE 10a

Employment Projections by Industry, 2011-2020

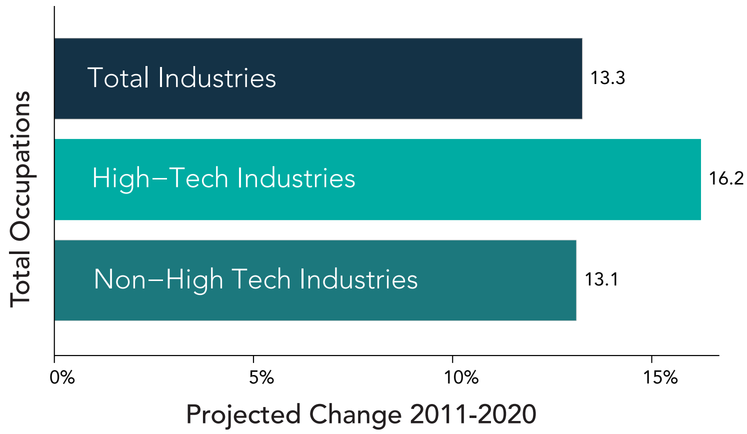
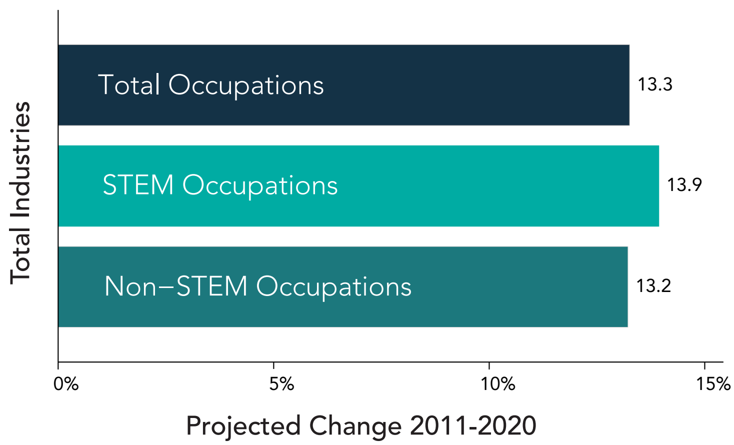


FIGURE 10b

Employment Projections by Occupation, 2011-2020



Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

As **Figure 10** makes clear, demand for jobs in high-tech is expected to surpass demand for jobs across the U.S. economy through at least 2020. High-tech industries are projected to grow by 16.2 percent between 2011 and 2020, for a 1.7 percent average annual rate of growth. Employment in the remaining industries of the U.S. economy is projected to grow 13.1 percent, or 1.4 percent on average each year.

A similar, though less pronounced story can be told about STEM occupations compared to all others. Employment in STEM occupations, irrespective of industry, is projected to grow by 13.9 percent in the nine years between 2011 and 2020, for an average annual rate of 1.5 percent. Employment in the remaining occupations is expected to grow by 13.2 percent, or 1.4 percent on average each year.

Though not pictured in **Figure 10**, employment in STEM occupations within high-tech industries is projected to grow 20.6 percent. This amounts to an average annual growth rate of 2.1 percent, or 50 percent more than the 1.4 percent total annual employment growth expected each year across the entire economy. Employment in STEM occupations is expected to grow more slowly outside of high-tech industries, by 8.7 percent, or about 0.9 percent on average each year.

Several conclusions can be drawn from this section. First, the strong employment growth seen in the recent past in high-tech industries is expected to continue and to accelerate over this decade. Employment growth in high-tech industries is projected to outpace growth in the remaining industries; the same is true of STEM occupations compared to all other occupations. Much of the growth within high-tech industries is expected to be driven by workers in technical occupations, as the composition of STEM and non-STEM workers in those industries becomes more balanced. The demand for STEM workers outside of high-tech industries is also expected to grow, but at a much slower pace.

High-Tech Wages

Though the job numbers and employment growth trends are important, perhaps nothing is more meaningful to workers and households than income. Employment wages reflect the share of national income that is captured by workers. As a result, wages are partially reflective of value-added economic output by sector. Wages also reflect the relative supply and demand of workers in their respective fields and regions.

Table 7 shows average annual wages for workers across industry and occupation groups. Workers in high-tech industries (across all occupations) earn almost three-quarters more per year than workers in the remaining industries. In STEM occupations (across all industries), workers earn nearly double. Workers with STEM jobs in high-tech industries earned almost 12 percent more than did STEM workers outside of high-tech industries. They also earned nearly one-third more than their non-STEM colleagues within high-tech industries in 2011.

TABLE 7

Average Annual Wages (2011) and Five-Year Percentage Change (2006-2011)

Industry	Occupation	Avg. Wage ($)	5-Year Change (%)
Total	Total	45,230	3.4
Total	STEM	81,008	3.7
Total	Non-STEM	43,348	3.0
High-Tech	Total	75,431	5.7
High-Tech	STEM	86,173	3.8
High-Tech	Non-STEM	65,959	5.8
Non-High Tech	Total	43,752	3.1
Non-High Tech	STEM	76,992	3.5
Non-High Tech	Non-STEM	42,742	2.9

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

The five-year inflation-adjusted wage change in high-tech industries was almost twice the wage change for other industries. For STEM occupations, the five-year change was one-quarter greater than for non-STEM workers. STEM workers in high-tech industries also saw their wages grow more than did STEM workers outside of high-tech industries. Interestingly, wage growth for non-STEM occupations within high-tech industries was much stronger than was wage growth for their high-tech industry colleagues in STEM positions.

Since most STEM occupations require a college degree at minimum, and since many of the jobs in high-tech industries require high-skilled workers, it shouldn't come as a surprise that wages for these groups are greater than wages for workers in other segments of the economy.[10] However, a deeper examination of the data reveals that wages for high-tech workers are still higher than wages for other workers, even after accounting for factors outside of industry or occupation that influence wages.

[10] For information on minimum education and experience requirements for occupations, see the "Occupational Employment, Job Openings and Worker Characteristics" table in the Occupations section of the Employment Projections subject area of the Bureau of Labor Statistics website at http://www.bls.gov/emp/ep_table_107.htm

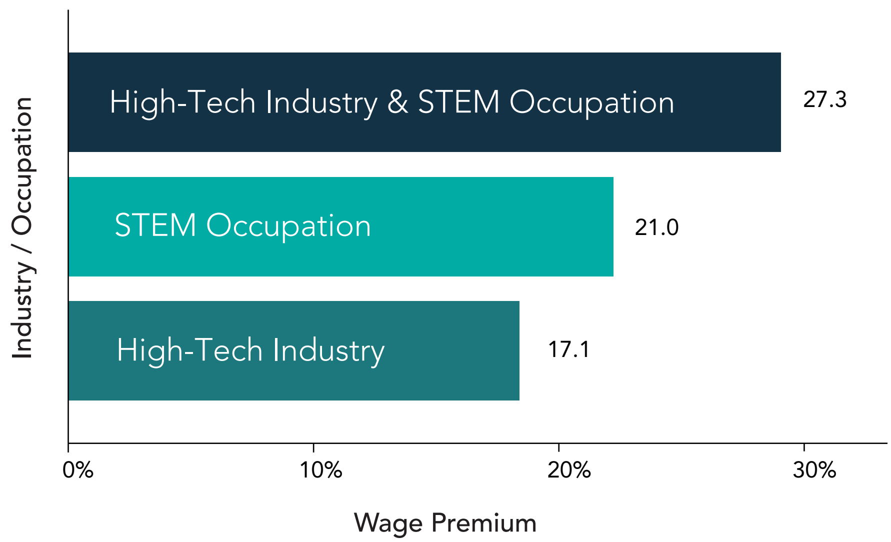
A statistical regression is used to isolate the impact that employment in a high-tech industry or STEM occupation alone has on wages. The regression estimates the effect that employment in a high-tech industry or STEM occupation has on wages after accounting for all other factors that influence workers' earnings, including age, gender, education, race, ethnicity, marital status and geography, among others.[11] The Current Population Survey, published by the U.S. Census Bureau, was used to conduct the analysis.[12]

As **Figure 11** shows, even after adjusting for these factors, workers in high-tech still earn a substantial wage premium relative to other fields. On average, workers in high-tech industries earned 17.1 percent more than comparable workers in other industries between 1995 and 2011. A similar wage premium exists for workers in STEM occupations, who earned on average 21 percent more than their non-STEM counterparts. The impact was greatest for STEM workers within high-tech industries. They earned 27.3 percent more than workers with comparable characteristics in other industries and occupations.

The existence of the substantial wage premium in high-tech industries at least partially reflects the fact that, as drivers of innovation and productivity, high-tech industries are among the highest value-adding industries across the economy. Income gains, shared among workers, shareholders and governments, have followed accordingly. When combined with very low unemployment rates and strong job growth, rapidly increasing wages also reflect the fact that these workers are in high demand. The same is true of workers in STEM occupations.

FIGURE 11

High-Tech Wage Premium, 1995-2011



Source: U.S. Census Bureau; calculations by Bay Area Council Economic Institute

[11] A regression was run on the log of annual wages of workers aged 25 or more against a set of worker characteristic variables: age (including polynomials up to the fourth degree), educational attainment, race and Hispanic origin, gender, marital status, nativity and citizenship status, union representation, metropolitan area, region, major industry, major occupation and year. The data set is the March supplement to the Current Population Survey and spans the years 1995 to 2011. See also David Langdon, George McKittrick, David Beede, Beethika Khan, and Mark Doms, "STEM: Good Jobs Now and for the Future," ESA Issue Brief (U.S. Department of Commerce), #301-11, July 2011.

[12] The Current Population Survey (CPS) is a jointly sponsored series by the U.S. Census Bureau and the Bureau of Labor Statistics. It is the primary source for workforce statistics and contains a host of demographic information on individual workers and households.

High-Tech Jobs Multiplier

Why should local authorities care about attracting high-tech jobs when they represent a small share of total employment nationally? The answer is that these jobs provide a lot of economic bang for the buck. This occurs through two channels—first through income gains generated by innovation, productivity and a global marketplace, and second from the local jobs that are supported by that income generation.

Having long understood that well-paying jobs are critical to economic development, regional authorities have used large-scale tax incentives to attract companies that provide them. For example, officials in Alabama, Kentucky, South Carolina and Tennessee have devoted considerable effort to attracting foreign auto manufacturing facilities to their states. Doing so created jobs for many low and middle-skilled workers that pay well in excess of what those same workers might have earned in other positions.

Like auto manufacturing, high-tech industries generally fall into the "tradable" segment of the U.S. economy. The tradable sector produces goods and services that can be consumed outside of the region where they are produced. For example, manufactured goods can be bought or sold around the world and web searches can be conducted anywhere with an Internet connection. Because companies in the tradable sector have access to markets outside their home region, this also means they must compete nationally and globally.

As a result, the tradable sector drives innovation and productivity, fueling economic growth. As evidence of this, economic output on a per-worker basis (a broad measure of labor productivity) increased by an inflation-adjusted 95 percent in the tradable sector between 1990 and 2010, compared with just 15 percent in the rest of the economy. Furthermore, despite accounting for 29 percent of U.S. economic output in 1990, the tradable sector was responsible for 40 percent of economic growth during the next two decades.[13]

High-tech industries are emblematic of this, having been among the fastest growing in terms of economic output and productivity in recent decades.[14] High-tech industries were also responsible for at least 53.8 percent of total private sector research and development between 1990 and 2007, despite accounting for only 5.4 percent of private-sector employment and 3.9 percent of private-sector business establishments during the same period.[15,16]

The large and growing income generated by the tradable sector has an important secondary effect of supporting other local jobs. The "non-tradable" sector produces goods and services that are consumed

13 Bureau of Economic Analysis, Industry Economic Accounts; and Ian Hathaway, "Globalization and the U.S. Economy: Diverging Income and Employment," Bloomberg Government Study, 2011.

14 Bureau of Economic Analysis, Industry Economic Accounts; and Michael Spence and Sandile Hlatshwayo, "The Evolving Structure of the American Economy and the Employment Challenge," a Council on Foreign Relations Working Paper. March 2011.

15 Bureau of Economic Analysis, 2010 Research and Development Satellite Account, Table 5.1 Private Business Investment in R&D by Industry, 1987–2007. This is a minimum, because data is not available for some industries included in the high-tech sector.

16 Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

in the same region where they are produced. This primarily includes localized services such as health care, restaurants, hotels and personal services, but it also includes the goods-producing construction sector as well.

Businesses in the non-tradable sector serve the local economy and are generally shielded from competition outside of the region. As a result, innovation and productivity growth in the non-tradable sector are low. Non-tradable jobs are precisely the types of jobs that are supported by the innovative tradable sector, which captures income from other regions of the country or the world.

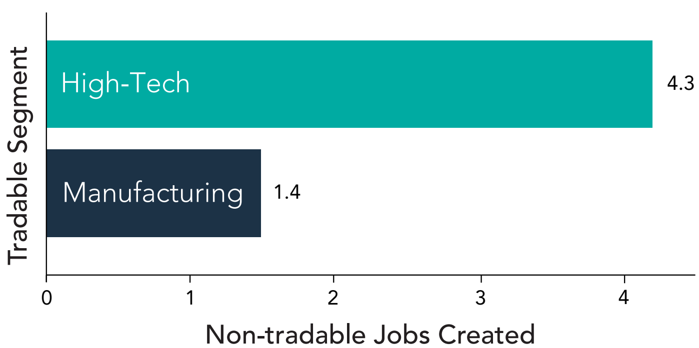
Moretti (2010) provides the framework for quantifying this "local multiplier" effect.[17] That methodology is applied here to estimate the secondary job creation stemming from economic activity in high-tech industries as defined in this report. In particular, it provides a long run estimate of the number of jobs that are created in the local non-tradable sector by the creation of one job in the local high-tech sector (see **Appendix 5**). For comparison, a local non-tradable job creation estimate is also tabulated for manufacturing.

As **Figure 12** makes clear, the local multiplier effect for high-tech is large. For each job created in the local high-tech sector, approximately 4.3 jobs are created in the local non-tradable sector in the long run.[18] These jobs could be for lawyers, dentists, schoolteachers, cooks or retail clerks. In short, the income generated by high-tech industries spurs a high rate of economic activity that supports local jobs.

While also large, the local multiplier for the manufacturing sector is much smaller than the multiplier for high-tech. The creation of one job in manufacturing creates an estimated 1.4 additional jobs in the local non-tradable sector, about one-third as many as created by high-tech.

FIGURE 12

Local Jobs Multipliers



Source: U.S. Census Bureau; calculations by Bay Area Council Economic Institute

The especially large local multiplier for high-tech reflects the fact that workers in these industries have higher levels of disposable income, which is spent on meals, transportation, housing and other services in the local community. It also reflects the fact that high-tech companies tend to cluster around one another, which attracts additional high-tech firms and the local service-providers that support their business activities.[19]

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[17] Enrico Moretti, "Local Multipliers," American Economic Review: Papers & Proceedings, Volume100, Issue 2, May 2010: 373–377.

[18] Note the multiplier of 4.3 differs from Moretti's (2010) estimate of 4.9 for high-tech. This is the result of differences in the definition of sectors and periods of analysis. Either result points to a large local multiplier effect for high-tech. For more on the local multiplier methodology, see **Appendix 5**.

[19] For more on this, see Enrico Moretti, The New Geography of Jobs (New York: Houghton Mifflin Harcourt Publishing Company, 2012), 55-63.

Conclusions

This report tells a simple yet compelling story about high-tech employment and wages in the U.S. economy. First, since the bottom of the dot-com bust was reached in early 2004, employment growth in high-tech industries outpaced employment growth in the entire private sector by a ratio of three-to-one. High-tech employment has also been more resilient in the recent recession-and-recovery period and in the latest year for which data is available. The unemployment rate for the high-tech workforce has consistently been lower than for the nation as a whole.

Second, high-tech employment concentration and job growth are occurring in a geographically and economically diverse set of regions throughout the country. Beyond the well-known tech hubs that tend to coalesce around both coasts, pockets of high-tech clusters also exist throughout the Rocky Mountains, Great Plains, Midwest and South. High-tech job growth is taking place in regions across the country, irrespective of whether a tech cluster exists there. Furthermore, high-tech employment is increasingly being distributed across the country. This may be evidence that some regions are playing catch-up as technological advances allow for a wider dispersion of production in high-tech goods and services.

Third, employment in high-tech occupations, or STEM fields, has consistently been robust throughout the recent decade. When combined with very low unemployment and strong wage growth, this reflects the high demand for workers in these fields. The substantial majority of that growth was driven by gains in computer and math sciences occupations, followed by physical and life sciences occupations at a distant second. Employment in engineering and related occupations actually fell, driven by declines in jobs for workers with lower skill levels.

Fourth, employment projections indicate that demand for workers in both high-tech industries and high-tech occupations will be stronger than the demand for workers outside of high-tech at least through 2020. This reflects the economic growth that is occurring within high-tech industries and the increasing demand for workers with technical skills to support that growth. Within high-tech industries, demand for STEM workers is expected to grow by two-thirds more than demand for non-STEM workers.

Fifth, workers in high-tech industries and occupations earn a substantial wage premium relative to workers in other fields, even after accounting for factors that affect wages outside of industry or occupation. The high wage levels seen in high-tech industries and STEM occupations reflect the substantial value-add that high-tech brings to production. They also reflect the high demand for workers in technical fields. As an important driver of innovation and productivity, high-tech industries are capturing a growing share of national income, which then makes its way to workers through wages.

Finally, the growing income generated by the high-tech sector and the strong employment growth that supports it are important contributors to regional economic development. This is shown by the local multiplier effect, which is especially large for high-tech, where the creation of one local high-tech job is associated with more than four additional jobs in the non-tradable sector of the local economy in the long run. The local multiplier for high-tech is more than three times as large as the multiplier for manufacturing, which has been a favorite target for the economic development strategies of regional authorities.

In sum, this report shows the importance of the high-tech sector to employment and income in the U.S. economy. Perhaps more importantly, it shows that this high-tech prosperity is increasingly reaching beyond the well-known tech centers to a broader range of regions around the nation. This economic activity supports a wide range of jobs outside of high-tech.

Appendices

Appendix 1: Defining High-Tech

In 2004, the Bureau of Labor Statistics conducted an interagency seminar to evaluate the methodology for identifying high-tech industries. According to a study published the following year, the committee determined that the presence of four major factors constitute a high-tech industry: a high proportion of scientists, engineers, and technicians; a high proportion of R&D employment; production of high-tech products, as specified on a Census Bureau list of advanced-technology products; and the use of high-tech production methods, including intense use of high-tech capital goods and services in the production process.[20]

The study also concluded that because of "data and conceptual problems," the intensity of "science, engineering, and technician" employment would be the basis for identifying high-tech industries. Seventy-six "technology-oriented occupations" were used to conduct the employment intensity analysis. A condensed list is outlined in **Table 8**.[21] Broadly speaking, these occupations coalesce around three groups—computer and math scientists; engineers, drafters and surveyors; and physical and life scientists.

TABLE 8

Technology-Oriented Occupations

SOC Code	Occupation
11-3020	Computer and information systems managers
11-9040	Engineering managers
11-9120	Natural sciences managers
15-0000	Computer and mathematical scientists
17-2000	Engineers
17-3000	Drafters, engineering, and mapping technicians
19-1000	Life scientists
19-2000	Physical scientists
19-4000	Life, physical, and social science technicians

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

[20] Daniel E. Hecker, "High-technology employment: a NAICS-based update," Monthly Labor Review (U.S. Dept. of Labor and U.S. Bureau of Labor Statistics), Volume 128, Number 7, July 2005: 58.

[21] For the detailed list, see Table 3 in Hecker, "High-technology employment: a NAICS-based update," 63.

After this group of occupations was identified, an intensity analysis was conducted to determine which industries contained large shares of these technology-oriented workers. Of the more than 300 industries at the level of granularity used, the fourteen shown in **Table 9** had the highest concentrations of technology-oriented workers. Each of these fourteen "Level-1" industries had concentrations of high-tech employment at least 5 times the average across industries.[22]

TABLE 9

High-Technology Industries

NAICS Code	Industry
3254	Pharmaceutical and medicine manufacturing
3341	Computer and peripheral equipment manufacturing
3342	Communications equipment manufacturing
3344	Semiconductor and other electronic component manufacturing
3345	Navigational, measuring, electromedical, and control instruments manufacturing
3364	Aerospace product and parts manufacturing
5112	Software publishers
5161	Internet publishing and broadcasting
5179	Other telecommunications
5181	Internet service providers and Web search portals
5182	Data processing, hosting, and related services
5413	Architectural, engineering, and related services
5415	Computer systems design and related services
5417	Scientific research-and-development services

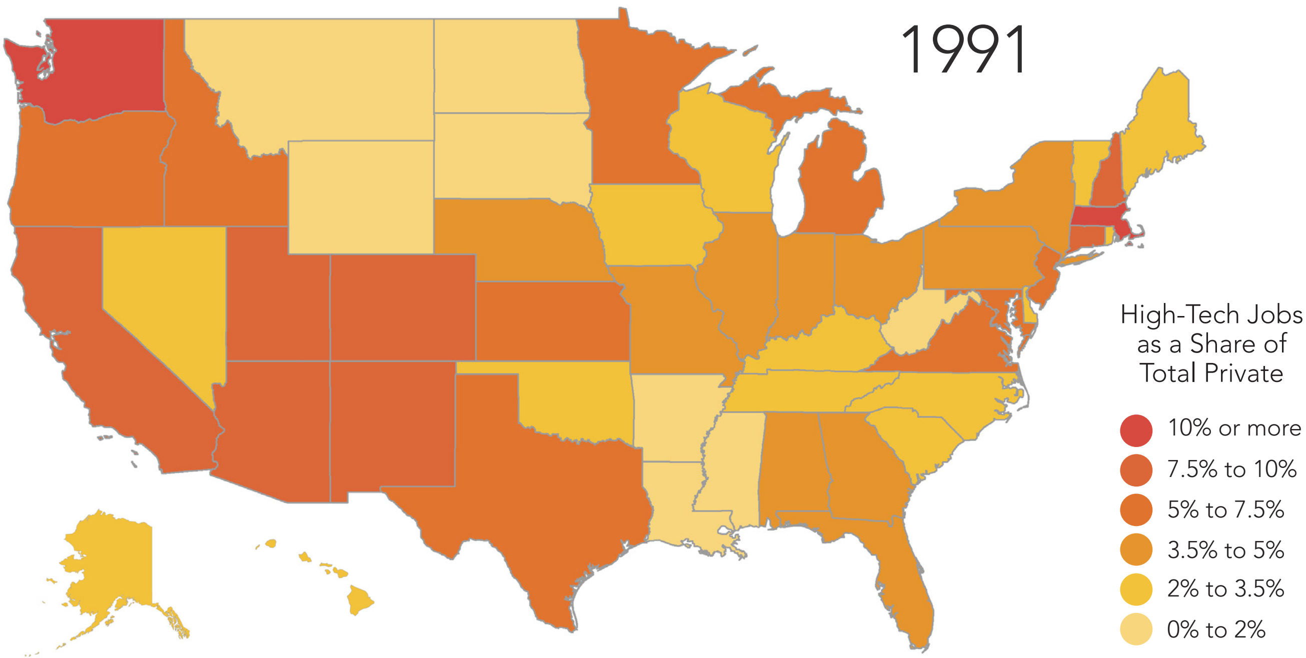
Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

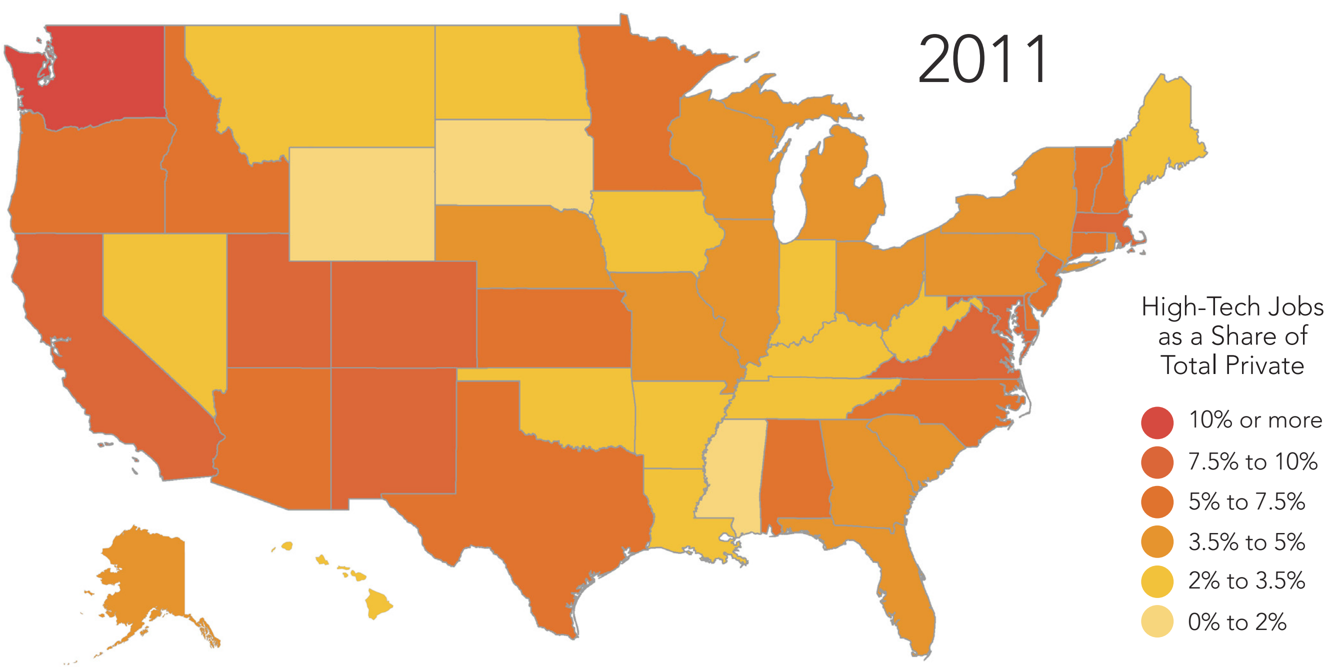
This report uses the method described above to define the high-tech sector of the U.S. economy. Checks were made to ensure that the identifying conditions held in the latest available data, and crosswalks were performed to account for changes in industry and occupation classifications over time. Though the Bureau of Labor Statistics report ultimately concluded that a wider group of industries could be considered high-tech, this report uses a more conservative approach by analyzing just the fourteen Level-1 industries with very high concentrations of technology-oriented workers in the STEM fields of science, technology, engineering and math.

[22] See the Level-I Industries section of Table 1 in Hecker, "High-technology employment: a NAICS-based update," 60.

Appendix 2: High-Tech Employment Concentration Maps

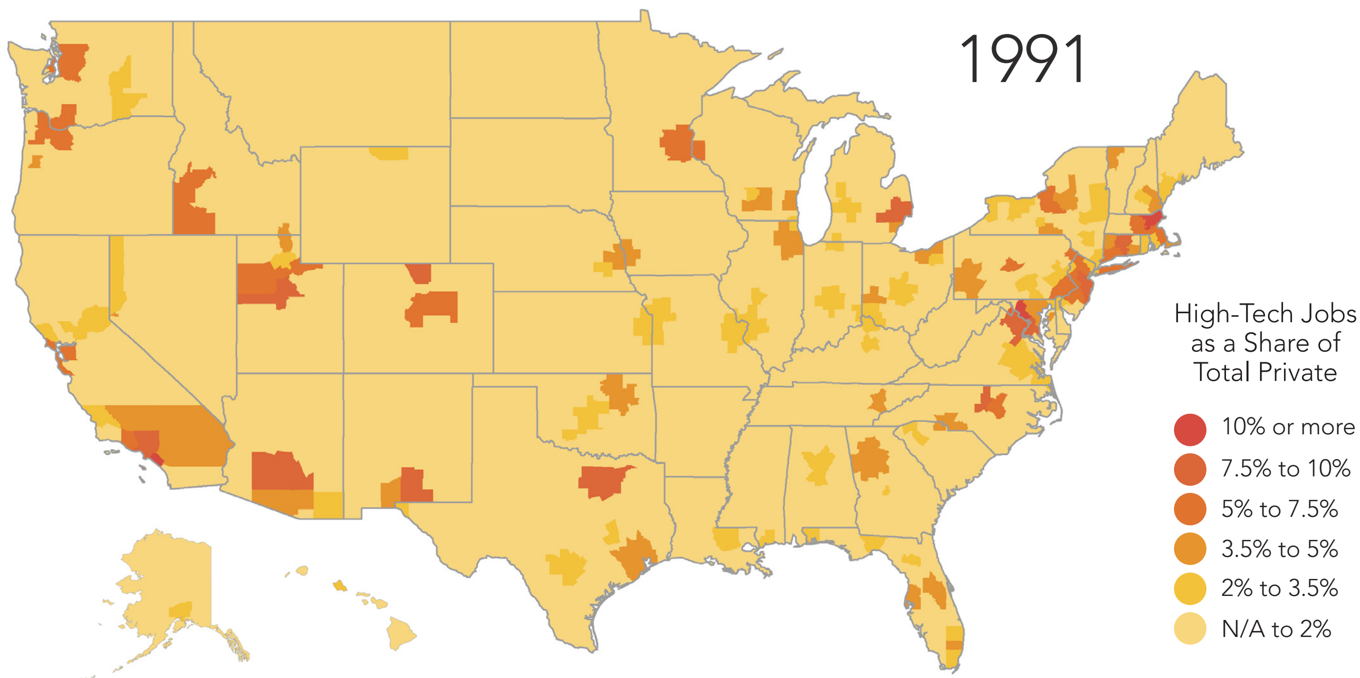
High-Tech Employment Concentration by State

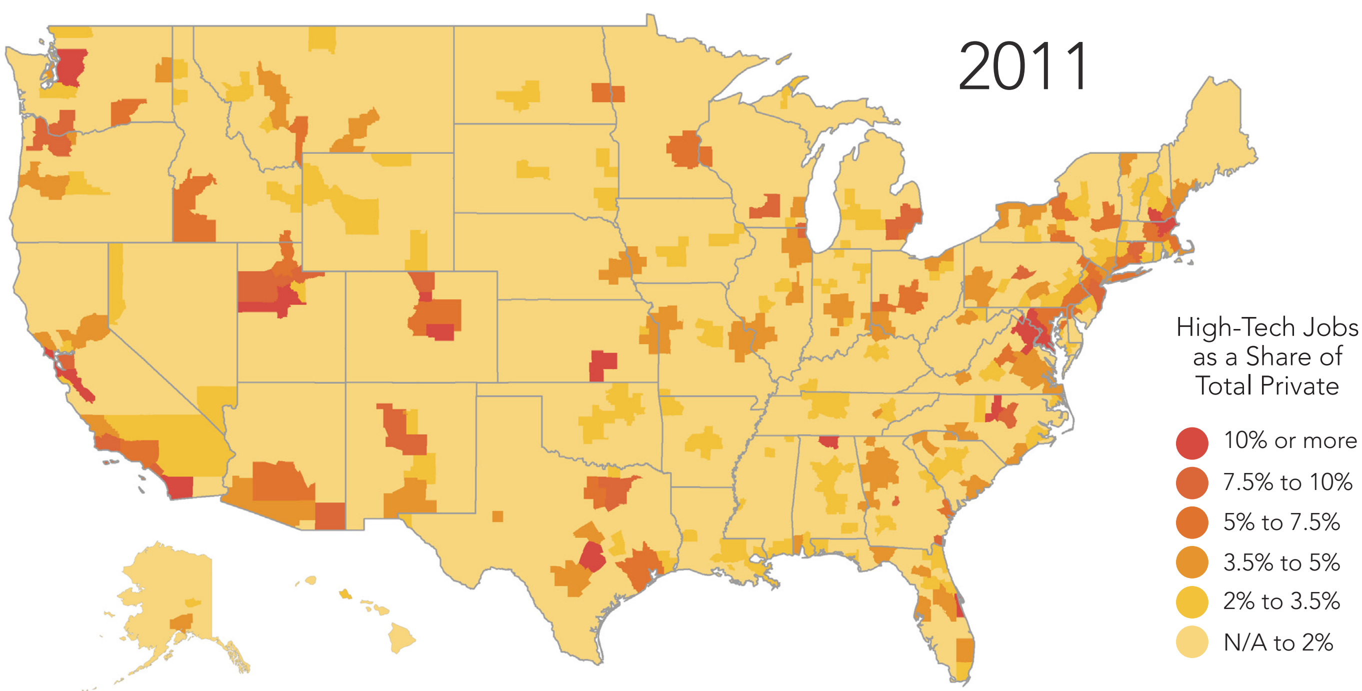




Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

High-Tech Employment Concentration by Metro





Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Appendix 3: High-Tech Industry Employment and Wages

Summary of High-Tech Industry Employment and Wages by State (2011)

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Metro	High-Tech Share (%)	High-Tech Jobs ('000s)	One Year Percent Change	Five Year Percent Change	Average Wage ($)
Alabama	5.3	77.7	4.3	5.9	78,493
Alaska	3.8	8.8	4.0	28.1	80,911
Arizona	6.3	128.6	2.2	-6.7	88,566
Arkansas	2.6	24.5	0.6	-0.7	63,408
California	8.2	1,020.5	2.5	2.4	121,249
Colorado	8.4	155.5	4.3	2.5	98,806
Connecticut	6.9	96.5	0.8	-5.1	98,198
Delaware	5.4	18.7	12.8	0.1	92,175
Florida	4.0	250.8	0.9	-7.5	79,828
Georgia	4.9	155.5	1.0	1.8	85,064
Hawaii	2.7	12.9	-2.2	-4.6	79,669
Idaho	5.3	26.5	1.6	-25.9	86,039
Illinois	4.3	208.9	2.2	-2.9	91,559
Indiana	3.5	83.1	-1.0	-2.2	80,433
Iowa	2.3	28.7	2.5	-23.4	68,415
Kansas	6.6	70.6	6.0	-5.7	74,754
Kentucky	2.7	39.7	0.4	8.8	60,821
Louisiana	2.5	38.5	1.8	6.0	77,988
Maine	3.1	15.3	-6.2	-10.9	68,475
Maryland	8.9	179.2	2.1	6.6	100,054
Massachusetts	9.4	264.6	2.3	5.1	117,737
Michigan	5.0	167.2	6.9	-4.2	82,960
Minnesota	5.3	120.0	3.2	-3.3	85,754
Mississippi	2.0	16.5	1.3	-2.6	64,593
Missouri	4.4	95.6	2.9	-2.3	88,698
Montana	3.0	10.3	1.2	2.7	68,875
Nebraska	4.1	30.6	2.7	-1.6	67,660
Nevada	2.5	24.7	0.1	-14.9	78,507
New Hampshire	6.9	35.9	3.6	-1.7	93,958
New Jersey	6.5	207.8	0.3	-8.1	109,490
New Mexico	7.6	45.7	-0.7	-11.5	80,876
New York	4.8	340.7	3.8	3.7	92,456
North Carolina	5.2	166.9	4.3	4.8	86,446
North Dakota	3.2	10.4	-2.0	18.0	71,377
Ohio	4.1	174.8	4.6	7.1	76,825
Oklahoma	2.9	35.1	1.9	0.1	67,182
Oregon	6.0	82.0	3.5	-3.8	89,625
Pennsylvania	4.6	225.7	1.5	1.2	87,738
Rhode Island	4.2	16.4	-11.3	-13.7	74,282
South Carolina	3.7	53.3	8.6	22.7	72,142
South Dakota	2.0	6.4	-4.3	12.9	55,714
Tennessee	2.7	59.4	0.1	1.6	86,933
Texas	5.7	496.3	4.7	4.9	95,848
Utah	7.5	74.2	4.1	10.5	74,024
Vermont	6.1	15.0	0.2	5.2	75,629
Virginia	9.3	272.2	0.6	4.7	104,602
Washington	11.4	267.5	5.8	15.8	100,463
West Virginia	2.5	14.5	-1.5	3.9	60,743
Wisconsin	3.6	83.7	4.1	6.3	74,010
Wyoming	1.8	3.8	-3.7	-7.5	65,217
United States	5.6	6,133.5	2.6	1.4	95,832

Summary of High-Tech Industry Employment and Wages by Metro (2011)

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Metro	High-Tech Share (%)	High-Tech Jobs ('000s)	One Year Percent Change	Five Year Percent Change	Average Wage ($)
Akron, OH	3.0	8.1	-1.2	3.6	73,084
Albany-Schenectady-Troy, NY	5.1	16.3	-1.5	29.9	81,299
Albuquerque, NM	8.5	23.9	0.5	-14.1	76,152
Allentown-Bethlehem-Easton, PA-NJ	2.7	7.7	-2.1	1.6	70,117
Anchorage, AK	5.0	6.8	2.9	27.2	84,162
Asheville, NC	1.6	2.3	10.2	-4.8	58,325
Atlanta-Sandy Springs-Marietta, GA	4.9	91.9	4.7	-2.5	93,312
Augusta-Richmond County, GA-SC	2.7	4.4	11.7	81.9	77,566
Austin-Round Rock, TX	10.7	67.2	4.9	-0.1	101,281
Bakersfield, CA	2.6	6.1	-10.7	2.3	77,345
Baltimore-Towson, MD	6.6	66.1	4.1	7.9	100,562
Baton Rouge, LA	3.3	9.6	3.9	5.8	87,340
Beaumont-Port Arthur, TX	2.8	3.8	12.8	-15.3	82,975
Bethesda-Frederick-Rockville, MD	12.6	55.6	-0.4	-1.9	103,569
Birmingham-Hoover, AL	2.6	9.9	-2.7	-7.3	76,552
Boise City-Nampa, ID	6.0	12.9	11.9	82.9	90,609
Boston-Quincy, MA	5.1	48.5	6.0	7.2	120,454
Boulder, CO	22.7	29.9	3.3	-7.7	105,770
Bradenton-Sarasota-Venice, FL	2.2	4.8	-1.3	-19.3	73,348
Bridgeport-Stamford-Norwalk, CT	5.3	19.2	2.7	-2.8	112,871
Buffalo-Niagara Falls, NY	4.1	18.1	-0.8	5.7	63,488
Cambridge-Newton-Framingham, MA	20.3	149.4	1.5	6.1	127,345
Camden, NJ	2.9	11.6	-9.1	-24.0	90,508
Canton-Massillon, OH	1.0	1.4	10.1	13.0	55,455
Cape Coral-Fort Myers, FL	1.8	2.9	3.8	-29.2	63,099
Charleston-North Charleston-Summerville, SC	4.7	10.4	5.2	39.2	76,599
Charlotte-Gastonia-Concord, NC-SC	4.0	28.7	3.9	22.3	84,584
Chattanooga, TN-GA	1.2	2.2	-7.7	-18.0	77,875
Chicago-Naperville-Joliet, IL	4.1	128.0	0.0	-8.6	91,630
Cincinnati-Middletown, OH-KY-IN	4.2	35.4	4.1	1.1	84,095
Cleveland-Elyria-Mentor, OH	3.8	31.9	9.1	4.3	73,720
Colorado Springs, CO	10.1	19.6	-1.3	-8.0	89,570
Columbia, SC	2.5	6.4	28.2	40.1	74,500
Columbus, OH	5.5	41.0	6.9	14.7	76,431
Corpus Christi, TX	1.8	2.6	-7.0	2.8	74,313
Dallas-Plano-Irving, TX	7.7	137.5	6.5	0.6	100,507
Davenport-Moline-Rock Island, IA-IL	1.7	2.6	8.7	20.2	77,830
Dayton, OH	6.0	18.0	24.2	16.0	77,638
Deltona-Daytona Beach-Ormond Beach, FL	2.1	2.6	12.5	9.3	51,445
Denver-Aurora-Broomfield, CO	6.9	71.6	7.3	8.2	98,137
Des Moines-West Des Moines, IA	3.0	8.4	6.6	3.6	73,245
Detroit-Livonia-Dearborn, MI	5.1	30.3	3.6	-6.9	98,013
Durham-Chapel Hill, NC	11.4	24.1	-3.0	-2.1	100,576
Edison-New Brunswick, NJ	8.0	64.6	-2.1	-9.1	106,319
El Paso, TX	2.2	4.5	-8.7	-5.3	50,543
Evansville, IN-KY	1.5	2.3	8.8	15.6	73,448
Fayetteville-Springdale-Rogers, AR-MO	2.9	4.9	8.6	5.7	64,770
Fort Lauderdale-Pompano Beach-Deerfield Beach, FL	4.2	24.9	0.8	5.4	79,556
Fort Wayne, IN	3.4	5.9	-9.5	-2.4	72,872
Fort Worth-Arlington, TX	6.3	46.2	2.7	2.1	93,007
Fresno, CA	1.0	2.7	-0.9	-28.2	64,718
United States	5.6	6,133.5	2.6	1.4	95,832

Summary of High-Tech Industry Employment and Wages by Metro (2011), continued

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Metro	High-Tech Share (%)	High-Tech Jobs ('000s)	One Year Percent Change	Five Year Percent Change	Average Wage ($)
Gary, IN	1.1	2.4	5.3	-10.0	66,841
Grand Rapids-Wyoming, MI	2.4	8.2	-1.0	-4.6	74,107
Green Bay, WI	1.9	2.7	-2.5	20.0	67,347
Greensboro-High Point, NC	2.5	7.2	36.3	-3.7	82,389
Greenville-Mauldin-Easley, SC	4.0	9.9	-1.3	2.5	71,460
Harrisburg-Carlisle, PA	3.7	9.2	8.2	8.4	67,975
Hartford-West Hartford-East Hartford, CT	8.2	39.2	0.3	4.6	91,194
Honolulu, HI	3.3	11.3	-1.2	-2.3	80,436
Houston-Sugar Land-Baytown, TX	5.5	122.5	5.2	9.1	107,194
Huntsville, AL	22.4	33.8	-3.9	-0.2	88,291
Indianapolis-Carmel, IN	4.0	29.3	4.8	5.9	83,823
Jackson, MS	1.9	3.4	4.9	10.7	68,796
Jacksonville, FL	3.4	16.4	-3.3	-3.1	82,590
Kansas City, MO-KS	4.8	38.2	8.4	0.4	90,703
Knoxville, TN	3.2	8.6	-10.7	-6.4	88,630
Lafayette, LA	3.0	4.0	-0.3	24.2	73,260
Lake County-Kenosha County, IL-WI	8.3	26.5	13.5	1.8	115,684
Lakeland-Winter Haven, FL	1.1	1.8	4.1	-20.0	66,162
Lansing-East Lansing, MI	2.7	4.0	17.6	-0.9	76,781
Las Vegas-Paradise, NV	2.1	14.7	-0.7	-17.9	79,974
Lexington-Fayette, KY	2.9	5.7	-28.0	-13.1	72,310
Lincoln, NE	3.7	4.8	-15.2	-8.7	62,529
Little Rock-North Little Rock-Conway, AR	2.9	7.5	6.1	34.7	66,817
Los Angeles-Long Beach-Glendale, CA	5.7	193.9	-0.1	-6.3	95,635
Louisville/Jefferson County, KY-IN	2.0	9.9	7.6	-4.7	70,428
Madison, WI	8.5	22.0	7.2	25.4	82,280
Manchester-Nashua, NH	11.3	18.8	2.2	-6.1	98,971
McAllen-Edinburg-Mission, TX	0.6	1.1	-0.7	9.6	45,067
Memphis, TN-MS-AR	1.5	7.6	-0.9	-7.4	78,144
Miami-Miami Beach-Kendall, FL	2.6	21.9	1.5	-9.8	73,130
Milwaukee-Waukesha-West Allis, WI	4.3	30.1	4.8	-6.2	81,595
Minneapolis-St. Paul-Bloomington, MN-WI	6.1	91.4	4.6	2.7	88,721
Mobile, AL	3.5	4.9	2.0	20.0	66,961
Modesto, CA	1.0	1.3	5.6	-27.0	50,981
Nashville-Davidson-Murfreesboro-Franklin, TN	2.5	15.9	-2.5	11.9	104,198
Nassau-Suffolk, NY	5.5	56.2	5.1	1.4	82,518
Newark-Union, NJ-PA	6.6	50.9	-1.1	-19.4	124,727
New Haven-Milford, CT	5.0	15.4	-0.4	-15.4	97,229
New Orleans-Metairie-Kenner, LA	2.9	12.5	2.1	10.8	87,836
New York-White Plains-Wayne, NY-NJ	4.0	176.4	5.3	11.6	108,771
Oakland-Fremont-Hayward, CA	9.7	79.3	4.0	7.2	107,668
Ogden-Clearfield, UT	6.0	9.2	19.3	25.6	68,415
Oklahoma City, OK	2.9	12.9	1.4	-5.3	69,646
Omaha-Council Bluffs, NE-IA	4.6	17.3	3.1	-0.6	74,554
Orlando-Kissimmee, FL	4.1	35.2	-2.3	-8.2	82,621
Oxnard-Thousand Oaks-Ventura, CA	5.5	14.2	-4.3	-12.1	88,044
Palm Bay-Melbourne-Titusville, FL	13.3	21.1	-3.3	-5.4	78,962
Peabody, MA	10.3	27.1	0.1	-1.3	99,704
Peoria, IL	1.6	2.6	-2.7	41.0	62,930
United States	5.6	6,133.5	2.6	1.4	95,832

Summary of High-Tech Industry Employment and Wages by Metro (2011), continued

Source: Bureau of Labor Statistics; calculations by Bay Area Council Economic Institute

Metro	High-Tech Share (%)	High-Tech Jobs ('000s)	One Year Percent Change	Five Year Percent Change	Average Wage ($)
Philadelphia, PA	6.1	96.3	-0.8	-10.8	104,380
Phoenix-Mesa-Scottsdale, AZ	6.4	95.5	4.7	-5.9	89,419
Pittsburgh, PA	4.5	44.1	3.1	5.8	79,283
Portland-South Portland-Biddeford, ME	3.8	8.3	-8.1	-3.7	78,157
Portland-Vancouver-Beaverton, OR-WA	8.0	68.5	4.6	-0.4	92,928
Poughkeepsie-Newburgh-Middletown, NY	2.0	4.0	-3.8	10.1	80,620
Providence-New Bedford-Fall River, RI-MA	3.5	19.8	1.0	5.6	70,300
Provo-Orem, UT	10.1	15.1	4.3	11.6	72,416
Raleigh-Cary, NC	9.6	39.6	4.3	12.6	91,053
Reading, PA	2.5	3.6	2.3	6.3	76,412
Reno-Sparks, NV	3.3	5.3	3.0	-4.9	78,059
Richmond, VA	3.5	16.9	4.7	10.8	85,437
Riverside-San Bernardino-Ontario, CA	2.3	21.2	1.8	-21.9	71,740
Rochester, NY	4.1	17.1	0.5	-7.1	73,395
Rockingham County-Strafford County, NH	5.5	8.5	0.9	8.0	86,964
Sacramento-Arden-Arcade-Roseville, CA	4.8	29.4	-7.9	23.4	93,341
St. Louis, MO-IL	3.7	40.4	1.2	-7.2	91,205
Salinas, CA	1.7	2.4	-6.9	-7.1	77,490
Salt Lake City, UT	7.7	40.3	3.8	10.9	74,412
San Antonio, TX	5.0	34.2	8.4	23.6	74,254
San Diego-Carlsbad-San Marcos, CA	11.1	115.2	-0.5	9.8	110,408
San Francisco-San Mateo-Redwood City, CA	12.2	105.5	20.1	27.8	152,136
San Jose-Sunnyvale-Santa Clara, CA	28.8	232.0	5.6	5.1	170,203
Santa Ana-Anaheim-Irvine, CA	8.2	102.9	0.2	-7.6	96,291
Santa Barbara-Santa Maria-Goleta, CA	8.9	13.2	5.7	6.0	91,143
Santa Rosa-Petaluma, CA	4.4	6.8	-1.1	-11.5	99,814
Scranton-Wilkes-Barre, PA	1.2	2.5	-8.2	-11.5	62,341
Seattle-Bellevue-Everett, WA	18.2	220.7	6.5	17.1	105,115
Shreveport-Bossier City, LA	1.3	1.8	2.1	-47.9	56,701
Spokane, WA	3.5	5.8	7.7	8.8	70,030
Springfield, MA	1.5	3.5	-3.8	-21.4	85,072
Springfield, MO	0.9	1.3	-23.0	-41.7	61,992
Stockton, CA	0.9	1.5	-12.0	-14.7	64,106
Syracuse, NY	5.4	13.0	0.3	11.8	74,224
Tacoma, WA	3.1	6.3	-1.5	-1.1	82,999
Tampa-St. Petersburg-Clearwater, FL	4.4	42.3	4.2	-5.3	85,390
Toledo, OH	1.9	4.7	0.8	-0.1	76,884
Trenton-Ewing, NJ	8.8	14.2	3.7	-0.3	114,723
Tucson, AZ	4.7	12.9	2.9	-8.4	86,802
Tulsa, OK	3.4	12.0	7.6	-6.6	70,595
Virginia Beach-Norfolk-Newport News, VA-NC	4.8	26.6	-4.5	-1.1	74,209
Warren-Troy-Farmington Hills, MI	7.8	74.3	10.6	1.5	82,039
Washington-Arlington-Alexandria, DC-VA-MD-WV	13.3	239.6	2.4	6.5	112,081
West Palm Beach-Boca Raton-Boynton Beach, FL	3.8	16.9	3.0	-15.9	84,955
Wichita, KS	14.8	35.4	-0.5	-15.2	72,082
Wilmington, DE-MD-NJ	6.1	16.7	13.4	12.4	94,578
Winston-Salem, NC	1.3	2.2	-1.0	-30.7	72,620
Worcester, MA	5.0	13.5	-5.0	-19.8	95,938
York-Hanover, PA	2.3	3.5	-0.4	-13.2	65,033
Youngstown-Warren-Boardman, OH-PA	0.8	1.6	-6.0	-11.1	62,161
United States	5.6	6,133.5	2.6	1.4	95,832

Appendix 4: Employment Projections Methodology

The Bureau of Labor Statistics (BLS) publishes ten-year employment and economic output projections bi-annually through its Employment Projections program. The latest projections are for the ten-year period between 2010 and 2020 and were published in 2012. Projections are calculated for industries and occupations at the national level. The approach involves several steps.

First, the BLS determines the size and characteristics of the labor force ten years forward from a simple extrapolation of its composition in 2010, the base year. This works as a labor supply constraint. From there, one additional assumption is made about the economy in 2020—that full employment has been achieved. In other words, the economy is operating at maximum sustainable output.[23] With these two assumptions in hand, a macroeconomic simulation is run to project the size and composition of gross domestic product (GDP) in 2020. When that projection is combined with industry input-output tables, it is then possible to estimate what the output level for each industry would be under that estimate of economy-wide production.

Once the potential economic output of each industry is projected for 2020, the BLS then works backward to project industry employment needs to meet that output level. This is done by utilizing data on employment and labor productivity leading into the base year. Then the BLS translates the industry employment estimates into occupational employment estimates by utilizing the National Employment Matrix (NEM). The NEM contains detailed data on occupational employment distribution within detailed industries. By combining the NEM along with trends in industry-occupational mixes due to such factors as technology and changes in business practices, the BLS is then able to project the number of jobs in each occupation that it would take to meet each industry's projected employment needs. [24]

This report utilizes these employment projections for detailed industries and occupations and applies them to the list of high-tech industries and STEM occupations.

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23 Maximum sustainable output refers to an economy that is operating at optimal capacity, where full employment is reached and inflation is stable.

24 For more on the BLS employment projections, see: Dixie Sommers and James C. Franklin, "Employment outlook: 2010-2020, Overview of projections to 2020," Monthly Labor Review (U.S. Dept. of Labor and U.S. Bureau of Labor Statistics), Volume 135, Number 1, January 2012.

Appendix 5: Jobs Multiplier Methodology

Moretti (2010) provides the framework for estimating local multipliers.[25] This framework captures the long-term local job-creating effect of the addition of one job in the tradable sector, which is channeled primarily through increased demand for local goods and services. However, it also accounts for the partial offset of this positive effect on employment by general equilibrium effects that are induced by changes in local wages and prices. More specifically, it quantifies "the long-term change in the number of jobs in a city's tradable and non-tradable sectors generated by an exogenous increase in the number of jobs in the tradable sector, allowing for the endogenous reallocation of factors and adjustment of prices."

Using data from the Census of Population in 1990 and 2000, and the 2010 American Community Survey, variants of the following two models are estimated:

$$(1) \quad \Delta E_{mt}^{NT} = \alpha + \beta_1 \Delta E_{mt}^{T1} + \beta_2 \Delta E_{mt}^{T2} + \gamma d_t + \varepsilon_{mt}$$

$$(2) \quad \Delta E_{mt}^{NT} = \alpha' + \beta'_1 \Delta E_{mt}^{*T1} + \beta'_2 \Delta E_{mt}^{*T2} + \gamma' d_t + \varepsilon'_{mt}$$

where ΔE_{mt}^{NT} is the log-change of employment in the non-tradable sector in metro m over a specified period of time t (ten years); E_{mt}^{T1} is the log-change in employment in a segment of the tradable sector (e.g. high-tech); E_{mt}^{T2} is the log-change in employment in the remainder of the tradable sector (e.g. non-high-tech); and E_{mt}^{*T1} and E_{mt}^{*T2} are the log-changes of employment in both segments of the tradable sector combined with an instrument that accounts for exogenous shifts in demand for labor in the tradable sector. The sample period includes two observations per metro, 1990–2000 and 2000–2010. The variable d is a dummy for each time period. Standard errors are tabulated at the metro level.

To isolate exogenous shifts in the demand for labor in the high-tech sector (or manufacturing), an instrument of the weighted average of nationwide employment growth within the sector is combined with metro-specific employment weights in the sector at the beginning of the period in the following specification:

$$\Delta E_{mt}^{*T} = \Sigma \omega_{m,t-1} \Delta N_t^T$$

where $\omega_{m,t-1}$ is the share of tradable jobs in metro m in the prior period (for example, in 1990); and ΔN_t^T is the log-change in the tradable sector nationally (for example, between 1990 and 2000).

Whereas Moretti defines the theoretical construct of the tradable sector principally as manufacturing, and the non-tradable sector as the rest of the economy outside of agriculture, mining, government and military, this report uses a different approach to define the two segments of the U.S. economy. Jensen (2011) provides the weighting for tradability of sectors at the level of two-digit NAICS.[26]

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25 Enrico Moretti, "Local Multipliers," American Economic Review: Papers & Proceedings, Volume100, Issue 2, May 2010: 373–377.

26 See Table 2.3 on page 59 of J. Bradford Jensen, Global Trade in Services: Fear, Facts, and Offshoring (Peterson Institute of International Economics, 2011); adjustments made by Bay Area Council Economic Institute.

TABLE 10

Tradability of Industries

NAICS Code	Industry	Tradability (%)
11	Agriculture, Forestry, Fishing and Hunting	100.0
21	Mining, Quarrying, and Oil and Gas Extraction	100.0
22	Utilities	19.1
23	Construction	0.0
31	Manufacturing	100.0
32	Manufacturing	78.0
33	Manufacturing	85.6
42	Wholesale Trade	54.2
44	Retail Trade	18.3
45	Retail Trade	11.3
48	Transportation and Warehousing	57.2
49	Transportation and Warehousing	100.0
51	Information	66.7
52	Finance and Insurance	67.9
53	Real Estate and Rental and Leasing	90.9
54	Professional, Scientific, and Technical Services	86.0
55	Management of Companies and Enterprises	100.0
56	Administrative and Support and Waste Management and Remediation Services	40.5
61	Educational Services	1.0
62	Health Care and Social Assistance	2.2
71	Arts, Entertainment, and Recreation	32.6
72	Accommodation and Food Services	18.1
81	Other Services (except Public Administration)	20.2
--	Government	0.0

Source: Jensen (2011) and Bay Area Council Economic Institute

Through the use of these weights, the tradable and non-tradable segments of local economies are estimated. Once those are established, the tradable segments of high-tech and manufacturing are estimated as subsets of the local tradable sector. Their impact is measured on the entire local non-tradable sector. Multipliers are generated through sector employment-shares and regression coefficients. The results for both high-tech and manufacturing are statistically significant.

Note that the local multiplier for high-tech in this report differs from the high-tech multiplier in Moretti (2010). While the framework is identical, the data differ in three ways: the definitions of high-tech; the definitions of tradable and non-tradable; and the years used in the analysis. Still, the differences—4.3 versus 4.9—are minor and entirely within the margin of error. The fact that these different approaches yield what is essentially the same result signals the robustness of this framework to estimate local multipliers for high-tech.

201 California Street, Suite 1450, San Francisco, CA 94111
www.bayareaeconomy.org • bacei@bayareacouncil.org

The Bay Area Council Economic Institute is a public-private partnership of business with labor, government and higher education that works to foster a competitive economy in California and the San Francisco Bay Area, including San Francisco, Oakland and Silicon Valley. The Economic Institute produces authoritative analyses on economic policy issues in the region and the state, including infrastructure, globalization, energy, technology, science, innovation and governance, and mobilizes California and Bay Area leaders around targeted policy initiatives.

BAY AREA COUNCIL ECONOMIC INSTITUTE

Engine

414 Brannan Street, San Francisco, CA 94107
www.engine.is • info@engine.is

Engine Advocacy connects startups and government. Engine's mission is to give our community of entrepreneurs, investors, and technologists a voice in policymaking. We aim to create an environment where technological innovation and entrepreneurship thrive by providing knowledge about the startup economy and helping to construct smarter public policy. Based in San Francisco with a growing group of members across the United States, Engine is a nonprofit whose advisory board includes early-stage investors in Silicon Valley's most successful companies, leading tech policy thinkers, and prominent startup entrepreneurs.

This report was designed by Bianca Flores of the Bay Area Council

Bay Area Council Economic Institute
201 California Street, Suite 1450
San Francisco, CA 94111
Phone: (415) 981-6600
Email: bacei@bayareacouncil.org

www.bayareaeconomy.org

Bay Area workers commuting from edges of 'megaregion,' new report says

By Erin Baldassari, ebaldassari@bayareanewsgroup.com
The Mercury News

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OAKLAND -- Over the past decade or more, the Bay Area's boundaries have been bleeding into surrounding counties as skyrocketing housing prices push residents farther from jobs centered in Silicon Valley and San Francisco.

Those residents are still employed in the Bay Area though, leading to longer commutes and mounting pressure on the region's roads and rails. While that trend has been ongoing for some time, the problems resulting from it have become particularly acute, according to a new report released Thursday by the Bay Area Council, a business-sponsored public policy advocate.

"All these people are moving around on the most congested corridors," said Jeff Bellisario, the research manager for the Bay Area Council Economic Institute, "and there's no great transit options for these commuters."

Approximately 602,000 vehicles enter and exit the nine-county Bay Area from other parts of what the council has dubbed the "Northern California Megaregion," an area comprising six counties in and around Sacramento, three Northern San Joaquin Valley area counties, and three Monterey Bay area counties.

The Northern San Joaquin Valley area is leading the region in the number of workers it is sending to Bay Area companies. Between 1990 and 2013, the number of people commuting from the valley to job centers in the Bay Area more than doubled, growing around 32,000 commuters to nearly 65,000, according to the report.

"Silicon Valley really likes our labor force, but our labor force really doesn't like the Silicon Valley's housing costs," said Mike Ammann, president and CEO of San Joaquin Partnership, a nonprofit economic development corporation.

San Joaquin Valley was also one of the hardest hit in the housing market crash that spurred the Great Recession, but Ammann said the double-digit unemployment numbers in the area have since come down. Manufacturing has picked up, as has the county's distribution and transportation industries, and more housing is being built in the region again, he said.

However, this uneven growth in jobs and housing has caused gridlock on Interstate 580, and while the Altamont Corridor Express train, or ACE, is not yet at capacity, it soon will be, said Dan Leavitt, the transit agency's manager of regional initiatives.

The agency's ridership has roughly doubled in the past five years, and ACE is looking for ways to expand, Levitt said. It's currently in the process of drafting an environmental impact report, set to be released in the fall, that would study an increase in the number of round trips from four to six, and within the next decade, Leavitt said the agency hopes to offer 10 round trips.

To do that, the passenger service needs to add a second set of railroad tracks in some places, as well as make other improvements, Leavitt said, a roughly $200 million investment for the first phase and another $200 million for the second. ACE already has funding for the planning and preconstruction phase of the project, but not the actual construction, he said.

"In order for us to (expand service), we would need more infrastructure along our lines, but also other things like equipment and more parking," Leavitt said. "First and foremost, the biggest hurdle is funding."

While the state has some cap-and-trade funds available for commuter rail projects, Leavitt said the project will require investment from counties along the rail line serves.

Encouraging local governments to think regionally has never been easy, said Randy Rentschler, the legislation and public affairs director of the Metropolitan Transportation Commission, but encouraging municipal and county governments to do so has never been more critical, he said.

He pointed to the express lane on Interstate 580, which opened earlier this year, as an example of regional collaboration that provided some relief to drivers stuck in gridlock.

"The planning and the fight ... to get that money on those lanes; we had to take on most of the rest of the state to make sure that these congested areas were prioritized," Rentschler said. "We succeeded in part because we worked closely with our friends in the San Joaquin Valley area."

As people continue to move further from job centers in search of cheaper housing, Rentschler said the problems will only get worse.

"Being the repository for your neighbor's housing stock can only go so far," he said.

The report recommends, among other things, investing in regional rail lines, streamlining permitting for housing construction so it can be built closer to job centers, and encouraging job growth in the San Joaquin Valley and Sacramento areas to help relieve the daily migration to the Bay Area. Coupled with that is a long-term strategy to invest in education in places like Sacramento and Merced, so that companies can more readily access a high-skilled labor pool, Bellisario said.

"Part of the conversation is about transportation, part is about the economy, but really, they both go together," Bellisario said. "We need to spread the economic footprint more evenly across the entire megaregion."

Contact Erin Baldassari at 510-208-6428. Follow her at Twitter.com/e_baldi.