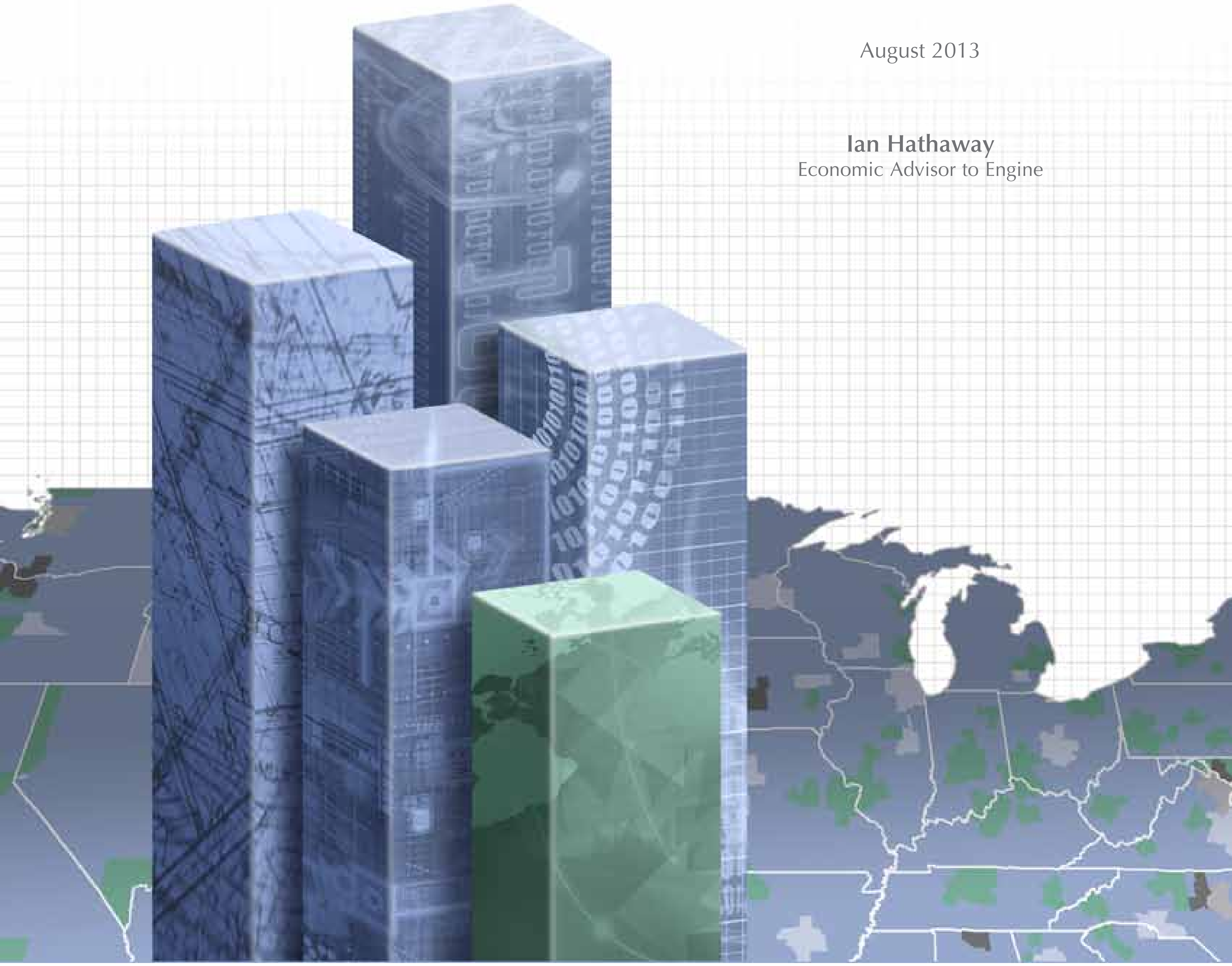
Kauffman Foundation Research Series:
Firm Formation and Economic Growth

Tech Starts: High-Technology Business Formation and Job Creation in the United States



August 2013

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Abstract

New and young businesses—as opposed to small businesses generally—play an outsized role in net job creation in the United States. But not all new businesses are the same—the substantial majority of nascent entrepreneurs do not intend to grow their businesses significantly or innovate, and many more never do. Differentiating growth-oriented "startups" from the rest of young businesses is an important distinction that has been underrepresented in research on business dynamics and in small business policy.

To advance the conversation, we contrast business and job creation dynamics in the entire U.S. private sector with the innovative high-tech sector—defined here as the group of industries with very high shares of employees in the STEM fields of science, technology, engineering, and math. We highlight these differences at the national level, as well as detailing regions throughout the country where high-tech startups are being formed each year. The major findings include:

- The high-tech sector and the information and communications technology (ICT) segment of high-tech are important contributors to entrepreneurship in the U.S. economy. During the last three decades, the high-tech sector was 23 percent more likely and ICT 48 percent more likely than the private sector as a whole to witness a new business formation.
- High-tech firm births were 69 percent higher in 2011 compared with 1980; they were 210 percent higher for ICT and 9 percent lower for the private sector as a whole during the same period. This is important because the productivity growth and job creation unleashed by these new and young firms—aged less than five years—require a continual flow of births each year.
- Of new and young firms, high-tech companies play an outsized role in job creation. High-tech businesses start lean but grow rapidly in the early years, and their job creation is so robust that it offsets job losses from early-stage business failures. This is a key distinction from young firms across the entire private sector, where net job losses resulting from the high rate of early-stage failures are substantial.
- Young firms exhibit an "up-or-out" dynamic, where they tend to either fail or grow rapidly in the early years. The job-creating strength of surviving young firms, while strong for young businesses across the private sector as a whole, is especially distinct for high-tech startups: the net job creation rate of these surviving young firms is twice as robust.
- High-tech and ICT firm formations are becoming increasingly geographically dispersed. As technological advancement allows for the production of high-tech goods and services in a wider set of areas, many regions are catching up. The opposite has been true for the private sector as a whole, where new business growth has been occurring most in regions with already higher rates of new business formation.

Introduction

Recent research highlights the importance of new and young businesses—as opposed to small businesses generally—to job creation in the United States. To summarize, while older and larger firms are the major source of employment levels, it is new and young businesses that are the primary source of net new jobs.[1] In fact, outside of new businesses, job creation in the United States has been negative over the last three decades.[2] This is because businesses aged one year or more, as a group, subtracted jobs from the economy. In other words, the forces of job destruction were greater than the forces of job creation for businesses over one year old as a group.

A key limitation to this research has been that publicly available business dynamics data do not allow a clear distinction between growth-oriented "startups" and other new businesses.[3]

1. Haltiwanger, Jarmin, and Miranda (2010), "Who Creates Jobs? Small vs. Large vs. Young," NBER Working Paper 16300; Kane (2010), "The Importance of Startups in Job Creation and Job Destruction," Kauffman Foundation; and Haltiwanger, Jarmin, and Miranda (2009), "Jobs Created from Business Startups in the United States," Kauffman Foundation.

2. U.S. Census Bureau, Business Dynamics Statistics; author's calculations by Engine.

3. One important exception is Stangler (2010), "High-Growth Firms and the Future of the American Economy," Kauffman Foundation; and for use of alternative data to analyze high-growth firms, see Motoyama, et al. (2012), "The Ascent of America's High-Growth Companies," Kauffman Foundation.

This distinction is important because painting all entrepreneurs with the same broad brush is an oversimplification.[4] It also has important implications for public policy.[5] Few new businesses will ever grow substantially or innovate. In fact, most nascent entrepreneurs actually report having no desire to build high-growth businesses. Instead, they intend to provide existing services to an existing customer base, and the decision to form a new business is driven more by non-economic reasons than on whether to grow a business or create a new market.[6]

This report moves the existing body of research forward by contrasting job creation and business formation dynamics in the entire U.S. private sector with those in the high-tech sector—defined here as the group of industries with very high shares of employees in the STEM fields of science, technology, engineering, and math. By doing so, we show how job creation emanating from startups in an innovative sector, with generally growth-oriented firms, behaves differently from new businesses across the economy as a whole—namely that new and young firms in this sector play an especially outsized role in net job creation.

We also show that high-tech startups are being founded across the country, fueling local and national economic growth. While well-known high-tech hubs like San Francisco, Silicon Valley, Seattle, Boston, and Austin still are important sources of technology entrepreneurship, we find that high-tech startups are a pervasive force in communities throughout the country. In other words, recent growth in high-tech startups is not simply a "tech center" phenomenon.

National Business Dynamics

To identify business and employment dynamics across the entire U.S. private sector, we analyzed the public-use files of the Census Bureau's Business Dynamics Statistics (BDS) database. The BDS is the definitive publicly available dataset that measures business and employment dynamics in the United States. Unlike other government data sources, the BDS ties business establishments (physical locations of business activity) back to the parent firm (in the case of multi-establishment enterprises).[7]

This is critical because decisions to expand, contract, open, or close are made at an enterprise-wide level. Much as it wouldn't be appropriate to term a small business establishment belonging to a large corporation a "small business," it also would be a misnomer to call an existing business's new location a "new business" or a "startup."

For example, if Starbucks hires a few dozen workers to open a new store in Chicago, the BDS would correctly classify that as a new business establishment of an old and large firm based in Seattle. Other data sources may consider that a small business, and others still would consider that a new business. While it is important to attribute the new business establishment and the related job creation to Chicago, it is equally important to classify the action as an existing business expansion rather than a new firm birth. The BDS solves this limitation.[8]

In addition to the public-use BDS data covering the entire private sector, a special tabulation of that data was provided to us by the Census Bureau for 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 (see Appendix 1).

Ten of the fourteen high-tech industries can be classified as information and communications technology (ICT), while the remaining four are in the disparate fields of pharmaceuticals, aerospace, engineering services, and scientific research and development. Throughout this report, the high-tech sector and the ICT segment of high-tech will be benchmarked against the entire private sector. Measures involving rates, percentages, and densities

4. For a broader discussion, see Aulet and Murray (2013), "A Tale of Two Entrepreneurs: Understanding the Differences in the Types of Entrepreneurship in the Economy," Kauffman Foundation.

5. Chatterji (2012), "Why Washington Has it Wrong on Small Business," *The Wall Street Journal*, November 12, 2012.

6. Hurst and Pugsley (2011), "What Do Small Businesses Do?" NBER Working Paper No. 17041.

7. Another important distinction is that these data are based on administrative records of the U.S. government.

8. For more on the BDS, see U.S. Census Bureau, Center for Economic Studies, Business Dynamics Statistics, http://www.census.gov/ces/dataproducts/bds/.

will be implemented to normalize for the different sizes of these three segments of the U.S. economy.

Job Creation and Firm Age

Though the substantial majority of employment existed in older firms during the past few decades (see Appendix 2), this report looks to the sources of new jobs. In particular, we look at net job creation: gross job creation (through business births and expansions) minus gross job destruction (through business closures and contractions). Employment changes are the net result of that dynamic process.[9] In other words, these flows are what drive future job growth.

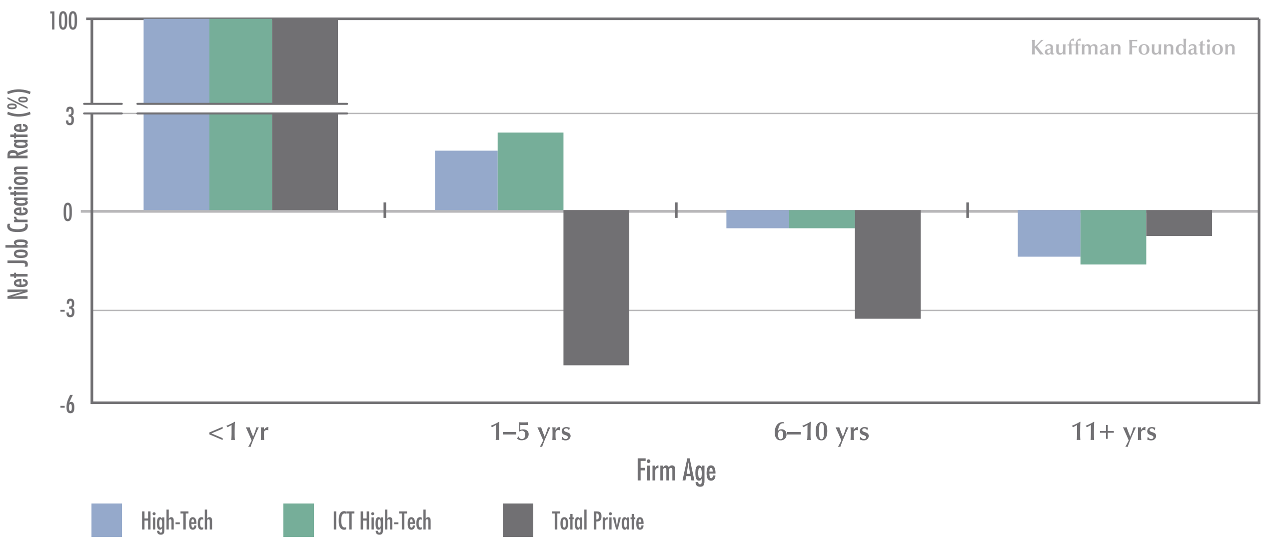
As mentioned before, the body of existing research has made it clear that outside of new firms—those aged less than one year—job creation as a whole has been negative over the past two decades. This is because the overall forces of job destruction were greater than the forces of job creation. Figure 1 illustrates this point, comparing that trend in the private sector with the net job creation patterns in the high-tech and ICT sectors.

New firms, by definition, can only add jobs so the net job creation rate is fixed here at about 100 percent.[10] But as Figure 1 also makes clear, there is an important distinction between net job creation for young firms—aged one to five years—in high-tech and ICT versus the private sector as a whole: net job creation for young high-tech and ICT firms has been positive, while young firms across the entire private sector have shed jobs at a high rate. This finding is an important departure from the body of existing research on this topic.

This trend somewhat extends to medium-aged firms—aged six to ten years. While high-tech and ICT firms overall shed jobs at a low rate, total private sector net job losses were more than six times greater. The trend is flipped for mature firms, however, with high-tech and ICT firms as a group cutting jobs at twice the rate of the private sector as a whole.

The significant net job losses for young firms across the entire private sector have been driven by the high early-stage failure rate. About half of all firms fail within their first five years—a trend

Figure 1: Average Annual Net Job Creation by Firm Age (1990–2011)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

9. Moving forward in this report, unless otherwise noted, the term "job creation" refers to "net job creation."

10. It's not exactly 100 percent because the rate is partially based on the prior year's level, which varies from year to year.

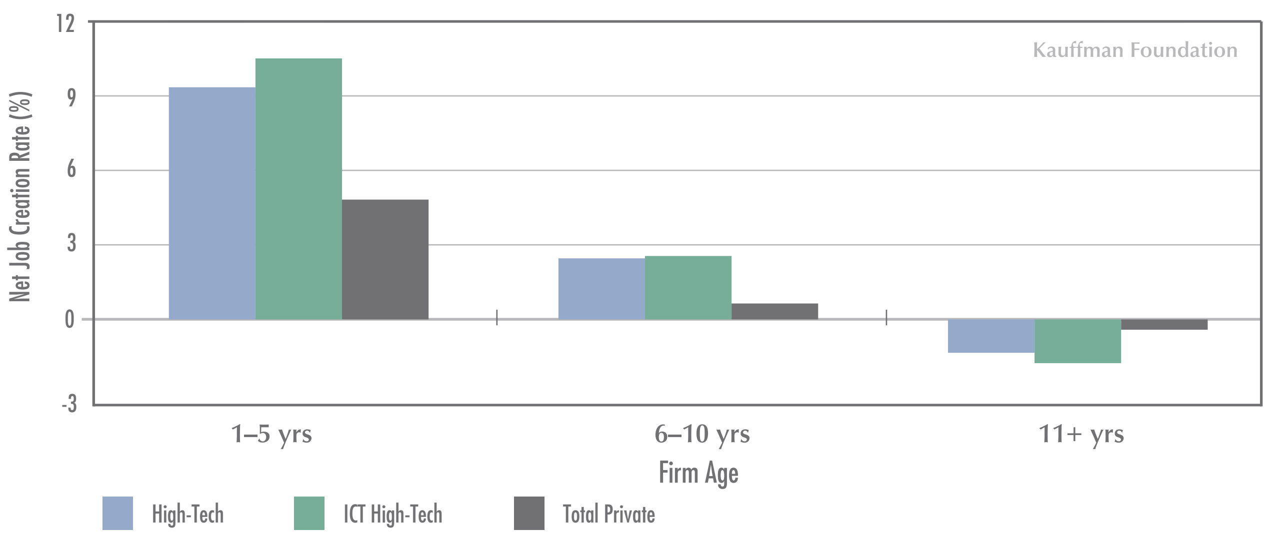
that has been remarkably consistent over time.[11] In short, the job destruction forces associated with firm failure have been strong enough to erase and exceed any job gains of surviving firms that grow in the private sector as a whole.

But what about the young companies that survive? At what rate do they create and destroy jobs? As it turns out, net job creation for surviving firms—after removing job destruction from failures—is quite robust. Earlier research has termed this the "up-or-out" dynamic: young firms tend either to fail or grow rapidly.[12]

After excluding the job destruction from business exits, Figure 2 confirms that net job creation among existing firms is strong among young companies. This has been especially true for high-tech and ICT, where surviving young firms create jobs at twice the average rate across the entire private sector. For medium-age firms, net job creation rates are lower, but the rates for high-tech and ICT are about four times the rate for the private sector as a whole. Surviving mature firms in each of the three industrial segments subtract jobs overall, and high-tech and ICT firms do so at a higher rate than the rest of the private sector.

Taken together, Figures 1 and 2, along with Appendix 2, show that, while older firms are the major source of employment, new and young companies are responsible for net new jobs. This has been especially true for high-tech and ICT firms where job gains among young businesses have been strong enough to offset job losses from early-stage firm failures. However, across the private sector as a whole, early firm failures result in substantial net job destruction.

Figure 2:
Average Annual Net Job Creation at Surviving Businesses by Firm Age (1990–2011)

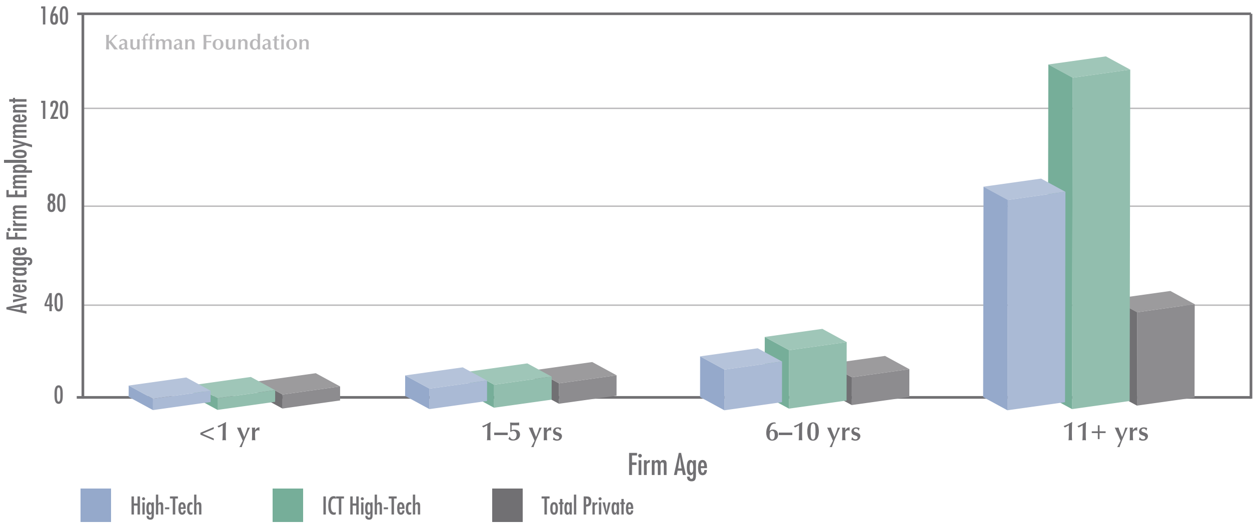


Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

11. Stangler (2009), "The Economic Future Just Happened," Kauffman Foundation. Outside of an extraordinary period of a high rate of failures associated with the dot-com bust, that trend has been similar for high-tech and ICT (see Appendix 2, Figures A3 and A4).

12. See Haltiwanger, Jarmin, and Miranda (2010), "Who Creates Jobs? Small vs. Large vs. Young," NBER Working Paper 16300; Haltiwanger, Jarmin, and Miranda (2009), "High Growth and Failure of Young Firms," Kauffman Foundation.

Figure 3: Average Firm Employment by Firm Age (1990–2011)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Even after removing the job destruction from business failures, young- and medium-aged high-tech and ICT firms create jobs at a rate that is well in excess of other businesses—highlighting the significant employment growth that occurs in the early years of companies. Illustrated differently, Figure 3 shows that average employment at high-tech and ICT firms is higher than for the private sector as a whole beyond the year of birth.

Recall too from Figures 1 and 2 that high-tech and ICT firms aged eleven years or more, as a group, are net job destroyers. This indicates that much of the substantial growth in average employment for high-tech and ICT firms seen in Figure 3 is driven by a disproportionately small number of these businesses. Still, the overall job-creating power of young- and medium-aged high-tech and ICT firms is evident.

Business Formation and Job Creation

Since net job creation at new and young firms relies on the continued formation of new firms each year, Figures 4–6 show new business formation patterns, job creation at new firms, and average employment at new businesses for the high-tech sector, the ICT subset of high-tech, and the U.S. private sector as a whole between 1980 and 2011.[13]

Figure 4 reveals a few key insights. First, new business formation for the high-tech sector has grown rapidly over the last three decades, driven by the explosive growth in the ICT segment. Some of this growth was excessive during the dot-com boom, but has dissipated. These sectors also experienced sizeable drops during the Great Recession of 2008 and 2009. Still, new high-tech business formations were up 69 percent in 2011 compared with 1980, while ICT increased by 210 percent over the same period. Assuming the 2011 rebound continued into 2012 and 2013, these sectors may have returned to levels of firm entry more aligned with longer-run trends.[14]

The same cannot be said of the private sector as a whole, where new firm formations were down

13. Note that when looking at firms across a broader range of ages, we only examined data between 1990 and 2011 instead of between 1980 and 2011. This is because it isn't possible to confirm the age of firms eleven or more years old until 1987, since the BDS data were first published in 1977.

14. For high-tech and related startup activity in recent years, see, for example: PricewaterhouseCoopers (2013), *MoneyTree Report, Historical Trend Data*; CB Insights (2013), *Venture Capital Activity Report*; Silicon Valley Bank, Angel Resource Institute, and CB Insights (2013), *2012 Halo Report: Angel Group Activity Year in Review*; Silicon Valley Bank, Angel Resource Institute, and CB Insights (2013), *Halo Report: Angel Group Update: Q1 2013*; Silicon Valley Bank (2012, 2013), *Startup Outlook*.

9 percent in 2011 compared with 1980—driven by the especially large declines during the latest recession. Despite this large drop, peak firm entry was just 24 percent above 1980 levels, which occurred in 2006. Since 2011, the limited information available indicates that the total private sector may have experienced flat to modest increases in entrepreneurship.[15]

Second, when expressed as a share of all firms in each sector, new business formation has consistently been higher for high-tech and ICT than for the private sector as a whole. Over this three-decade

Figure 4a: New Firm (<1 yr.) Formation Levels (1980–2011)

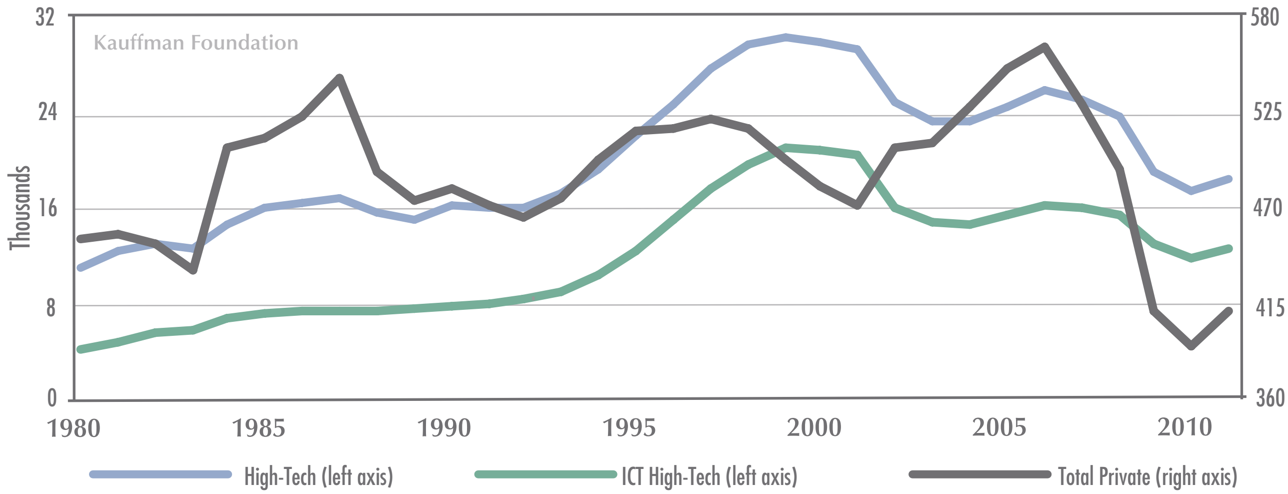
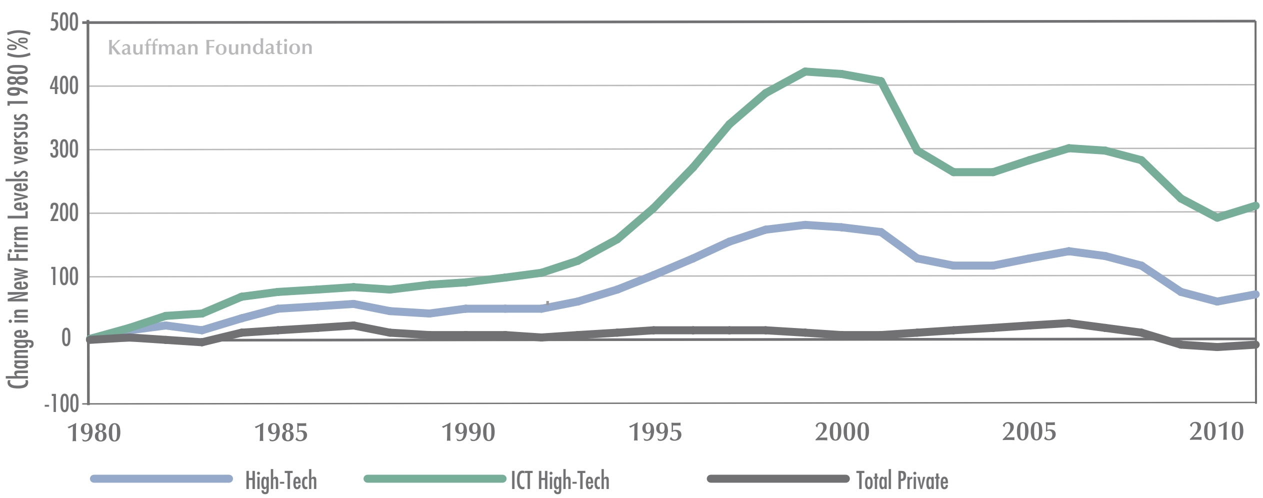


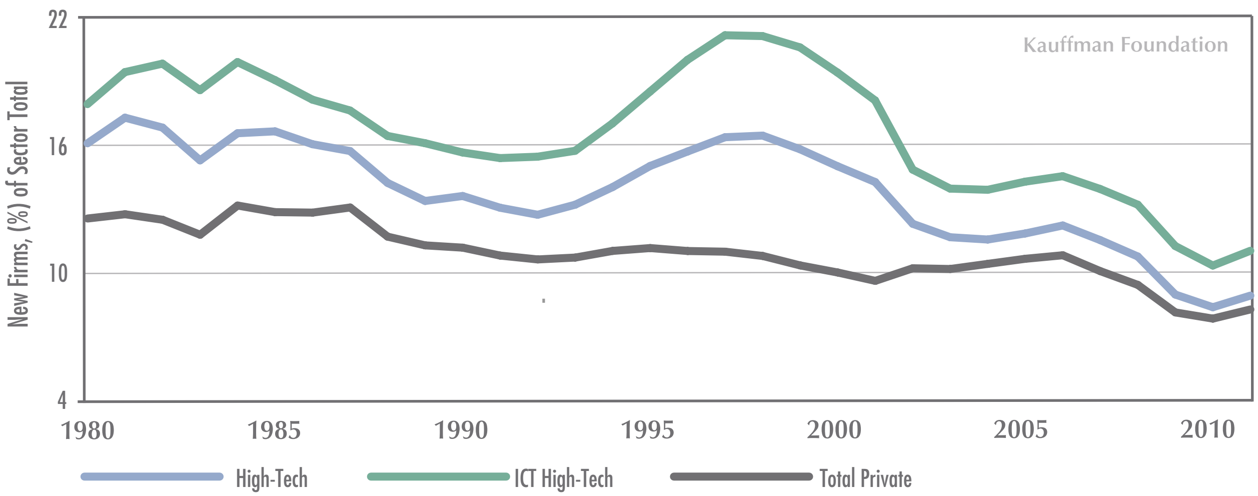
Figure 4b: New Firm (<1 yr.) Formation—Change versus 1980 (%)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

15. Fairlie (2013), "Kauffman Index of Entrepreneurial Activity (1996–2012)," Kauffman Foundation; and Bureau of Labor Statistics (2013), *Business Employment Dyanmics Summary Fourth Quarter 2012*.

Figure 4c: New Firm (<1 yr.) Formation Shares (1980–2011)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

period, new firm formations were 23 percent more likely for high-tech and 48 percent more likely for ICT than for the private sector as a whole.[16] High-tech and ICT firms had annual new business formation rates three to five percentage points higher than for the private sector on average. Some of this was driven by startup growth in the late-1990s dot-com boom, but even excluding those years, the firm formation rates are higher in these sectors.

However, this relationship has declined over time as the new business share of each sector has been steadily falling. In short, the impressive growth in firm entry for high-tech and ICT hasn't been sufficient to keep up with sector growth overall. This is largely driven by the maturing of a sector that recently came of age and therefore had a disproportionally high share of young firms in the early years of our data. As evidence of this, 26 percent of high-tech firms were aged eleven years or more in 1990, while 41 percent were in 2011. For ICT, those numbers are 21 percent and 33 percent. For the private sector as a whole, those shares were 35 percent and 47 percent, which marks a percentage increase of about half that of high-tech and ICT.

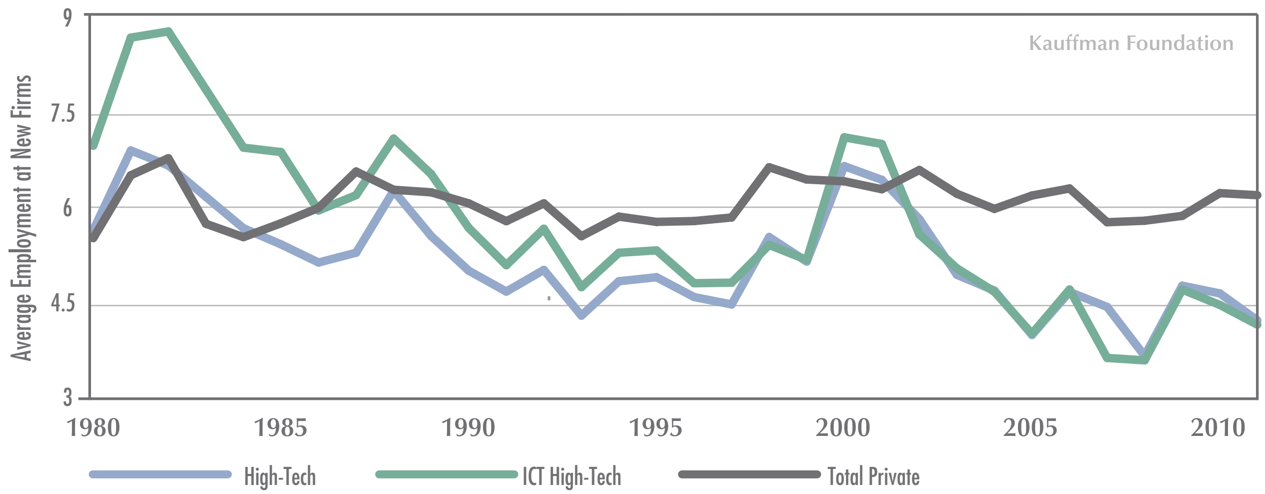
It may also reflect an underlying decline in business dynamism and entrepreneurship. While this appears to be the case for the private sector as a whole, it is too soon to apply this conclusion to high-tech and ICT based on this information alone. This is a non-trivial matter that should be explored in future research, because the job creation and economic growth unleashed by new and young firms requires a continued flow of births each year.[17]

Moving to employment at new firms, Figures 5 and 6 show average employment levels and job creation measures for new businesses each year during the past few decades.

16. High-tech accounted for 3.4 percent of all firms but 4.1 percent of new firms between 1980 and 2011. For ICT, those numbers were, respectively, 1.6 percent and 2.4 percent.

17. Haltiwanger, Jarmin, and Miranda (2010), "Who Creates Jobs? Small vs. Large vs. Young," *NBER Working Paper 16300*; Haltiwanger (2011), "Job Creation and Firm Dynamics in the U.S.," Innovation Policy and the Economy, Volume 12, *NBER*.

Figure 5: Average Employment at New Firms (<1 yr.) (1980–2011)

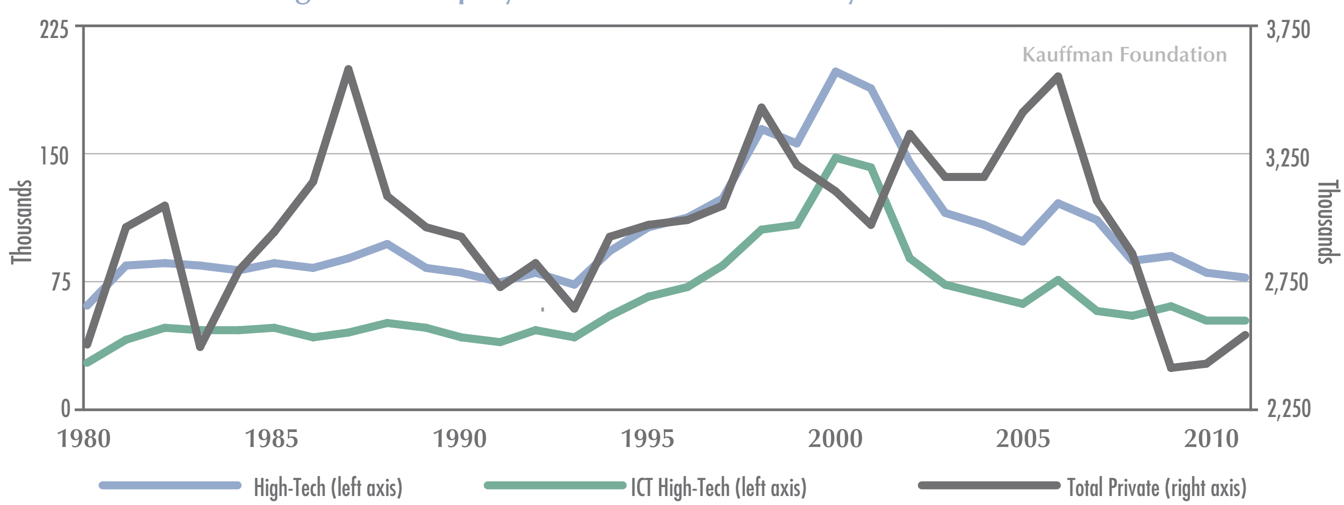


Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Taken together, Figures 5 and 6 provide some important insights. First, the average employment level at new high-tech and ICT firms has been on a steady decline during the last three decades, peaking between six and nine employees in the early 1980s to reach about 4.5 employees on average in 2011. In other words, high-tech and ICT firms are starting smaller. The entire private sector, on the other hand, has held steady with about six employees on average at new firms.

Figure 6 shows that, despite the decline in average employment for high-tech and ICT, elevated levels

Figure 6a: Employment at New Firms (<1 yr.) (1980–2011)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Figure 6b: Employment at New Firms (<1 yr.)—Change versus 1980 (%)

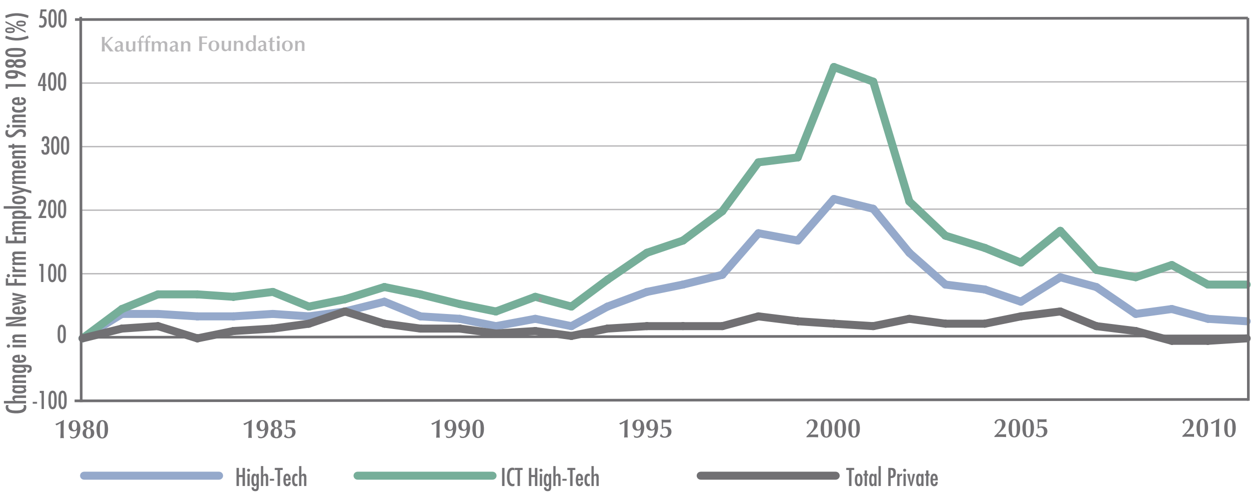
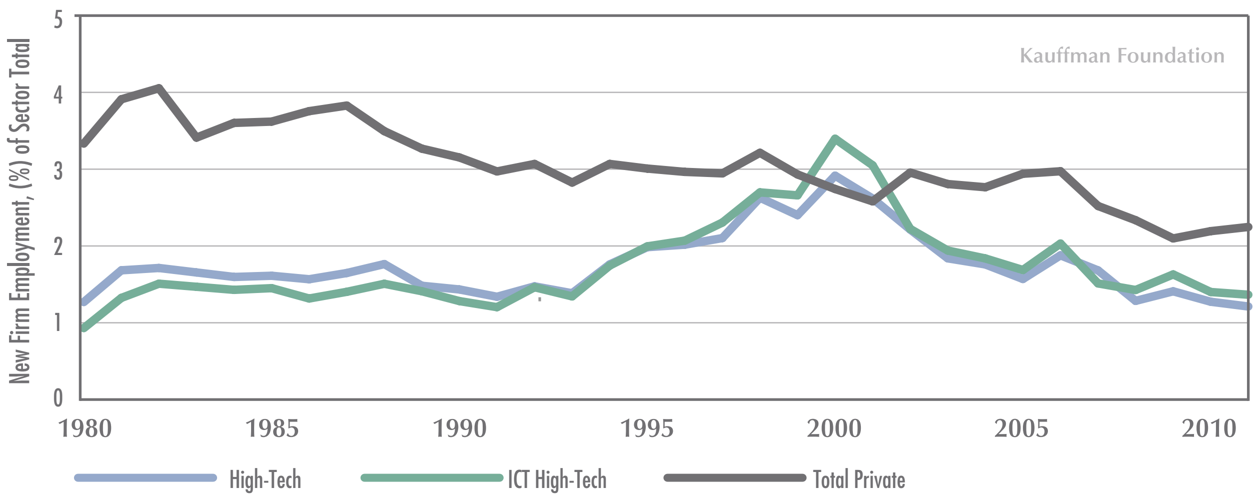


Figure 6c: Job Creation Contribution of New Firms (<1 yr.) (1980–2011)



Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

of firm entry compared with three decades ago was sufficient to increase annual job creation at these new firms—in absolute levels—as a percentage change, and a share of total sector employment. This was much less pronounced in all of high-tech—and in fact, held steady in certain places—compared with ICT, which was particularly strong. Overall, the increase in new high-tech and ICT firm formations has come along with healthy doses of new jobs.

The situation has been different for the private sector as a whole, where job creation at new firms essentially has been flat over the last three decades. Given that the average employment size at new firms held steady with a slight increase by 2011, the lack of increased job creation from new firms can be attributed to the decline in firm formation. New firm employment has been declining as a share of overall employment as a result.

When taken in context with the job-creating potential of new and young firms seen in Figures 1 to 4, we see a tale of two segments of the economy: the high-tech and ICT sectors, which create jobs at a high rate and contribute disproportionately to entrepreneurship, and the private sector as a whole, where business dynamism and job creation are on an overall decline.

Regional Business Dynamics

Next we turn to the regional dimensions of business dynamics for high-tech and ICT. Since the detailed industry data required to analyze the high-tech sector was not made available at geographic units smaller than for the entire United States, the BDS cannot be used for the regional analyses here. Instead, an alternative dataset is constructed.

The National Establishment Time Series (NETS) is a privately produced dataset that links annual snapshots of Dun & Bradstreet data on U.S. business establishments between 1990 and 2010.[18] The result is an establishment-level longitudinal dataset with information on industry, geography, and parent-firm structure of businesses, at the level of detail required for the regional analyses in this report.

It is important to note that an apples-to-apples comparison between NETS and BDS data is not possible. The BDS is based on administrative government data covering all private-sector non-farm employers with paid employees. The Dun & Bradstreet data underlying NETS are based on private market research. As a result, the coverage and scope of the two are different.[19]

To compensate for the differences between the two datasets, certain adjustments were made to the NETS data.[20] Still, two important differences persist here: business levels and formation rates generally are higher in the NETS relative to the BDS. Despite this, a systematic comparison of NETS and government sources indicates that the two reflect similar trends in business and employment dynamics over time.[21] That is sufficient for our purposes here.

Startup Density

After analyzing national trends of business and employment dynamics in the previous section, the following charts and tables show where new high-tech and ICT firms are founded. Figures 7 and 8 present a measure of startup density by comparing 384 metropolitan areas in the United States in 2010, the latest year these data are available.[22]

As a measure of startup density, we calculate location quotients for new high-tech and ICT firms. The location quotient measures the concentration of high-tech or ICT startups in a region relative to the average across the entire United States. More specifically, it places the ratio of high-tech (or ICT) firm births in a region to the population in the same region in the numerator, and that same ratio for the entire United States in the denominator. Values of one indicate that a region has the same density of startups as does the United States as a whole. Density measures greater than one indicate above-average densities. The opposite is true for values less than one.

The data provide a number of insights. First, each of the high-density metros has one of three characteristics, and some have a combination: they are well-known tech hubs or regions with highly skilled workforces; they have a strong defense or aerospace presence; they are smaller university cities. This isn't surprising, given the prevalence of high-tech industries in those areas, and the high-tech entrepreneurship prevalent in college towns and cities with highly educated workforces.[23]

18. For more on NETS, see http://youreconomy.org/downloads/NETSDatabaseDescription2011.pdf.

19. Two major coverage differences are that the BDS excludes non-employer firms and government establishments while NETS includes them, albeit seemingly to varying degrees. As a result, the scope of NETS is much broader than the BDS. For more on this, see Haltiwanger, Jarmin, and Miranda (2010), "Who Creates Jobs? Small vs. Large vs. Young," NBER Working Paper 16300, at Footnote 9. Further, NETS data is initially published as preliminary and is subject to revision for a period of approximately three years after first publication (e.g., 2010 data may be revised through the 2013 release).

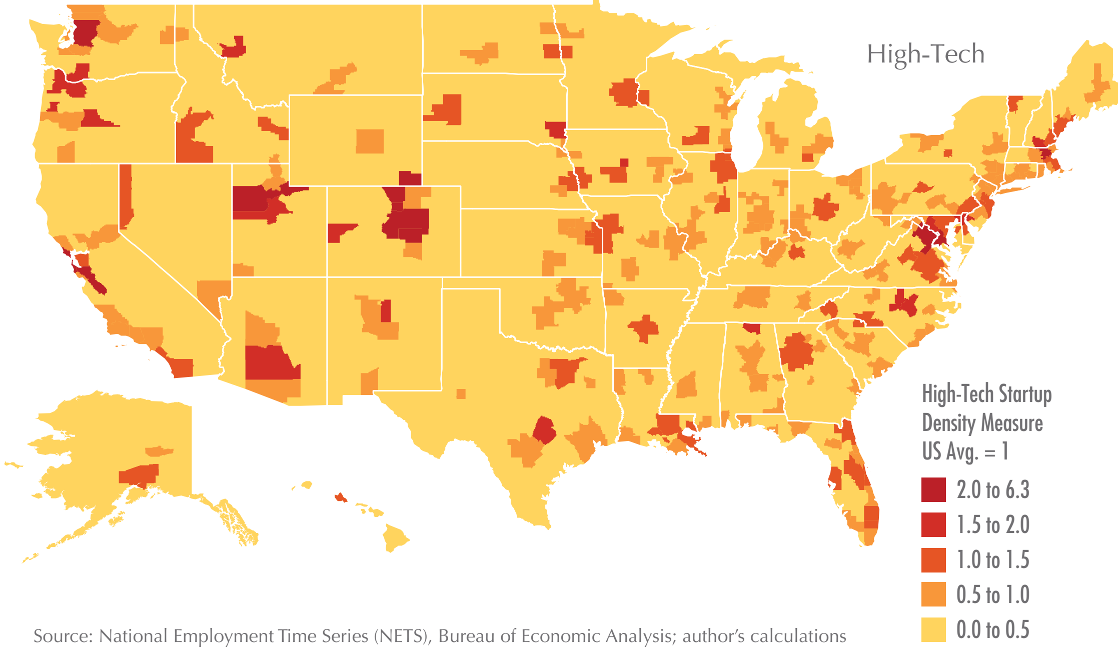
20. In particular, the self-employed were excluded (where possible). Overall, we expect high-tech and ICT firm levels and entry rates to be higher in our regional dataset than they would be if we had comparable BDS data. Still, the overall trends are likely to be similar.

21. Neumark, et al. (2005), "Employment Dynamics and Business Relocation: New Evidence from the National Establishment Time Series," NBER Working Paper 11647.

22. This report defines metros as Metropolitan Statistical Areas (MSAs) and Metro Divisions (MDs) as determined by the U.S. Census Bureau and the Office of Management and Budget.

23. Hathaway (2012), "Technology Works: High-Tech Employment and Wages in the United States," Bay Area Council Economic Institute; Chatterji, Glaeser, and Kerr (2013), "Clusters of Entrepreneurship and Innovation," NBER Working Paper 19013; Hausman (2013), "University Innovation, Local Economic Growth, and Entrepreneurship," Working Paper; Doms, Lewis, and Robb (2010), "Local Labor Force Education, New Business Characteristics, and Firm Performance," *Journal of Urban Economics* 67:1.

Figure 7: High-Tech Startup Density by Metro in 2010



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

Table 1: Top 25 Metros for High-Tech Startup Density (2010)

Metro Name	Density	Metro Name	Density
Boulder, CO	6.3	Huntsville, AL	1.9
Fort Collins-Loveland, CO	3.0	Provo-Orem, UT	1.9
San Jose-Sunnyvale-Santa Clara, CA	2.6	Bend, OR	1.8
Cambridge-Newton-Framingham, MA	2.4	Austin-Round Rock, TX	1.7
Seattle-Bellevue-Everett, WA	2.4	Missoula, MT	1.7
Denver-Aurora-Broomfield, CO	2.4	Grand Junction, CO	1.7
San Francisco-San Mateo-Redwood City, CA	2.4	Sioux Falls, SD	1.7
Washington-Arlington-Alexandria, DC-VA-MD-WV	2.3	Bethesda-Frederick-Rockville, MD	1.7
Colorado Springs, CO	2.3	Durham-Chapel Hill, NC	1.6
Cheyenne, WY	2.0	Portland-Vancouver-Beaverton, OR-WA	1.6
Salt Lake City, UT	2.0	Wilmington, DE-MD-NJ	1.6
Corvallis, OR	2.0	Ames, IA	1.6
Raleigh-Cary, NC	1.9	*53 Additional Metros > 1.0*	--
United States	**1.0**	**United States**	**1.0**

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

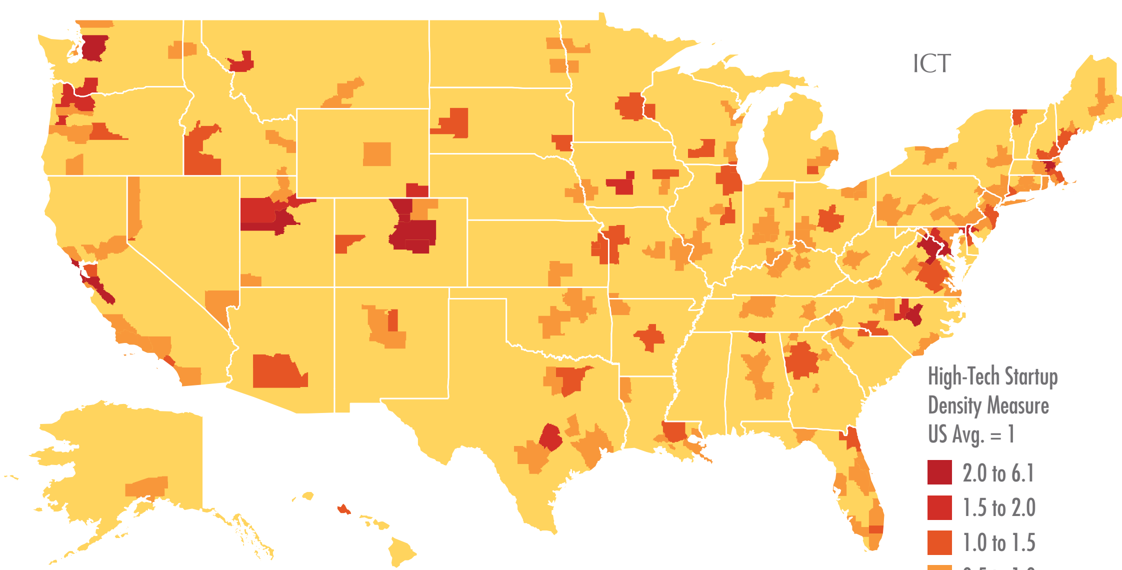
What may be surprising, however, is the magnitude of these densities—particularly at the top. High-tech startups were especially prominent in the local economies of Boulder, Fort Collins-Loveland, Colorado Springs, and Grand Junction in Colorado, in Corvallis and Bend in Oregon, and in Cheyenne, Wyo.; Huntsville, Ala.; Missoula, Mont.; Sioux Falls, S.D.; and Ames, Iowa. Because of their small size, these eleven regions represented just 2 percent of high-tech startups nationally, but their high densities illustrate the relative importance of high-tech startups to these local economies.

High-tech startup hubs are scattered throughout the country, with leading metros coming from the Rocky Mountains, West Coast, Sunbelt, Midwest, Mid-Atlantic, Southeast, Northeast, and Great Plains. A wide-range of sizes is represented, too. These twenty-five metros represent 19 percent of new high-tech firms nationwide. Another fifty-three metros had high-tech startup densities greater than the average for the United States overall. For comparison, the twenty-five most active metros in terms of absolute levels of startups accounted for 40 percent of high-tech startups nationwide.

Figure 8 and Table 2 show similar data for the ICT segment of high-tech. There is a good deal of overlap between the top high-tech and ICT startup hubs, but there are some key differences—namely that there are fewer above-average density ICT startup metros than for all of high-tech. Recall that our broader definition of high-tech includes more geographically dispersed activities like aerospace, scientific research and development, and, especially, engineering services.[24]

Similar to before, many of the top twenty-five metros here are small in size, which explains why they represent just 20 percent of the level of new

Figure 8: ICT High-Tech Startup Density by Metro in 2010



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

24. This also is compounded by the fact that some public-sector establishments can't be removed from the NETS dataset, which is more likely to be the case in the miscellaneous activities of high-tech (particularly aerospace and scientific research and development) relative to the ICT segment of high-tech.

Table 2: Top 25 Metros for ICT High-Tech Startup Density (2010)

Metro Name	Density	Metro Name	Density
Boulder, CO	6.1	Des Moines-West Des Moines, IA	1.9
San Jose-Sunnyvale-Santa Clara, CA	2.9	Austin-Round Rock, TX	1.8
Seattle-Bellevue-Everett, WA	2.7	Wilmington, DE-MD-NJ	1.8
Fort Collins-Loveland, CO	2.6	Huntsville, AL	1.7
Washington-Arlington-Alexandria, DC-VA-MD-WV	2.6	Portland-Vancouver-Beaverton, OR-WA	1.7
Denver-Aurora-Broomfield, CO	2.5	Durham-Chapel Hill, NC	1.6
San Francisco-San Mateo-Redwood City, CA	2.5	Corvallis, OR	1.6
Cambridge-Newton-Framingham, MA	2.3	Cheyenne, WY	1.6
Colorado Springs, CO	2.2	Bethesda-Frederick-Rockville, MD	1.5
Raleigh-Cary, NC	2.1	Ames, IA	1.5
Provo-Orem, UT	2.1	Boise City-Nampa, ID	1.5
Salt Lake City, UT	1.9	Manchester-Nashua, NH	1.5
Missoula, MT	1.9	*36 Additional Metros > 1.0*	--
United States	**1.0**	**United States**	**1.0**

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

ICT high-tech firms nationwide. For example, Missoula, Mont., had sixteen ICT startups in 2010 while there were eleven each in Corvallis, Ore., Cheyenne, Wyo., and Ames, Iowa. In addition to the top twenty-five, another thirty-six metros had ICT high-tech startup densities greater than the average for the United States overall. For comparison, the largest twenty-five metros in terms of absolute level of ICT startups constituted about 40 percent of all such new businesses in 2010.

Overall, Figures 7 and 8 and Tables 1 and 2 show that high-tech and ICT startups are being founded throughout the United States. They are forming in well-known tech hubs, in communities tied to technology-focused industries like aerospace and defense or research universities, and in large and small cities alike. While prior research would indicate that this isn't too surprising, in a few places the magnitude of these densities might be.

One additional finding that points to what's ahead is that the distribution of higher-density regions encompasses a wider group of metros over time. As we saw before, seventy-eight metros had high-tech startup densities above the U.S. average in 2010. But in 1990, only sixty-seven did. The same is true of ICT, where sixty-one metros had higher-than-average startup densities in 2010 compared with fifty in 1990. Figures A5 and A6 in Appendix 2 show that the distribution of startup densities has become less polarized and more evenly spread over time. The maps in Appendix 3 further illustrate this point by comparing startup density measures for high-tech and ICT in 1990 against 2010.

What's interesting is that the opposite is true for firms across the entire private sector—above-average densities exist in fewer metros today relative to two decades ago.[25]

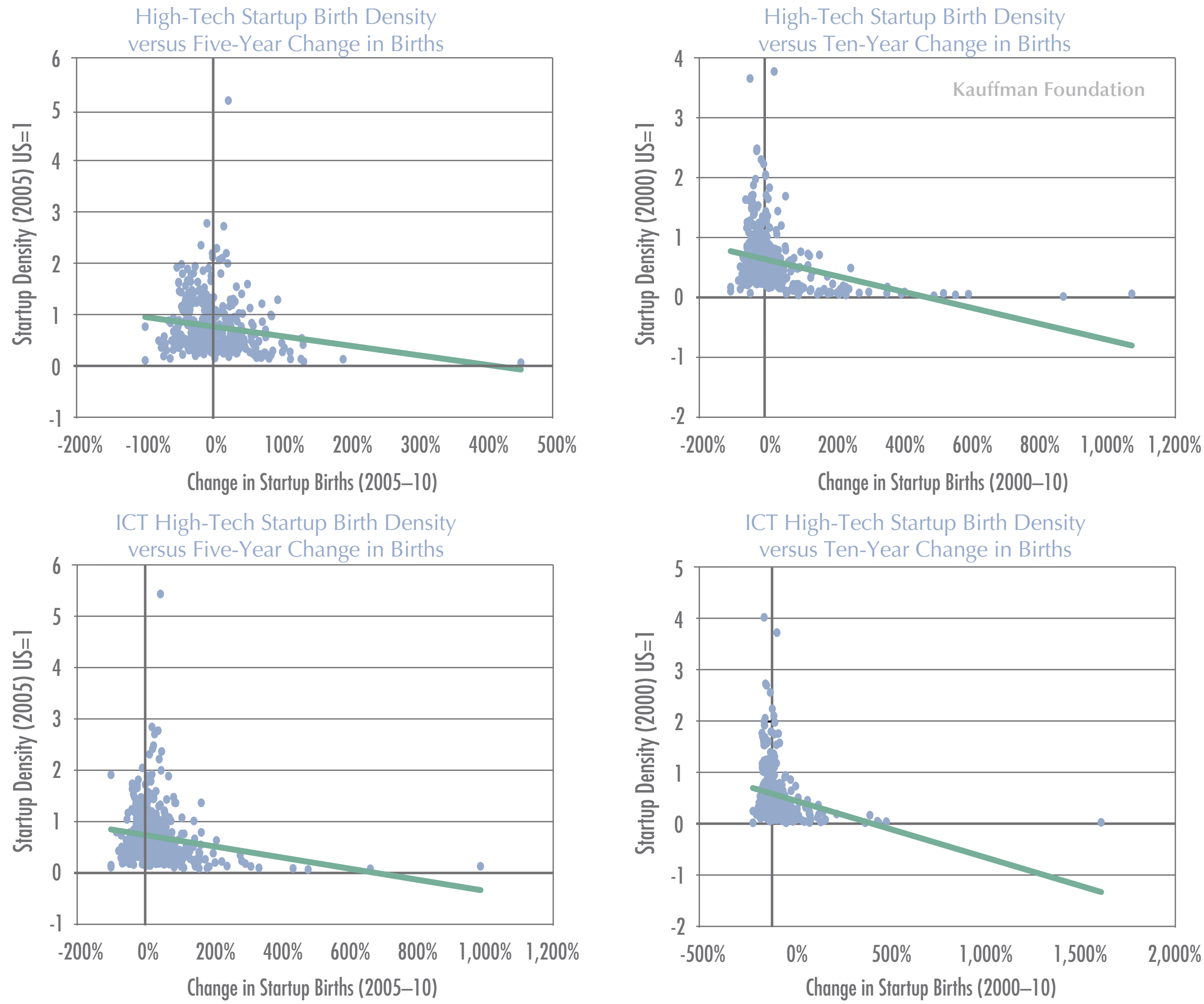
25. Twenty-two percent of metros in 1990 versus 15 percent in 2010. Source: U.S. Census Bureau, Business Dynamics Statistics.

Startup Growth

Now that we have established where high-tech and ICT startups are most concentrated, we can examine where annual growth occurs over time. To get a better understanding of this, we analyze the relationship between high-tech or ICT startup density in a given year, and the percentage change in the number of such startups in the same region five or ten years later. Since our data spans twenty years, this allows us to look at fifteen periods worth of data for five-year growth rates, and ten periods worth for ten-year growth rates.

First, however, we display this relationship visually by plotting the results for the latest periods of our data. Figure 9 shows the relationship between the startup density in a region in 2005, and the subsequent five-year change in startup levels in that same region in 2010. It also shows the same relationship using 2000 as a base year and the subsequent ten-year period ending in 2010.

Figure 9: Relationship Between Startup Density and Startup Growth



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

It's clear that there is a statistically significant negative relationship between the two base years and the subsequent periods of growth, both for high-tech and ICT. On average, the regions that experienced the highest rates of growth had relatively lower levels of high-tech or ICT startup density in the base year. The higher percent changes in lower density regions partially reflects the fact that they are working from smaller bases, but it is also true that many regions are playing catch-up as the production of technology goods and services is increasingly possible in a more dispersed set of locations.

Next, to estimate this relationship over the entire period of our data, we implement a simple linear regression. After doing so, we find that a statistically significant negative relationship exists between startup density and subsequent growth.[26] This means that, on average, regions with lower high-tech and ICT startup densities exhibited higher rates of subsequent growth. Again, though in many cases lower-density areas were working from smaller bases, these higher growth rates would indicate that high-tech and ICT startups are dispersing geographically.

As was hinted at before, this relationship is the opposite across the private sector as a whole, where growth in new firms historically has occurred in regions with an already higher share of new firm density. The reasons for the difference between high-tech and the entire private sector aren't immediately clear, but could be an important area for future research.

Conclusions

Job creation and business formation dynamics in the innovative high-tech and ICT sectors differ from new and young businesses as a whole. High-tech and ICT firms have played outsized roles in entrepreneurship in the United States, as business formation rates and new firm growth have far outpaced those for firms across the entire economy during the last few decades.

Though they start small, young high-tech and ICT firms tend to grow especially rapidly in the early years—so rapidly, in fact, that job creation is robust enough to outshine the job destruction from early-stage business failures. The same cannot be said of new firms broadly, where net job destruction in the early and middle years is substantial.

After removing the job destruction from firm closures, the net job creation rate of surviving young high-tech and ICT firms is still more than twice that of businesses across the economy. This job creation is reflected in employment levels where the average employment at high-tech and ICT firms surpasses those across the private sector as a whole, starting with the early years.

Turning to the regional dimensions of entrepreneurship, high-tech and ICT business formations have been occurring across the United States in geographically and economically diverse regions. High-tech startups have been popping up in major tech hubs, in big cities, and in smaller ones. They have been growing in the Rocky Mountains, West Coast, Sunbelt, Midwest, Southeast, Mid-Atlantic, Northeast, and Great Plains. For the top regions, high-tech startup activity also has been concentrated in smaller cities with a known aerospace and defense presence, as well as in communities with major research universities.

Though the major metros and tech hubs were responsible for the substantial majority of high-tech and ICT startup levels, relatively speaking, the importance of smaller regions has grown. High-tech startup growth rates have been strongest, on average, in regions with lower densities. The opposite has been true for firms across the entire private sector, where new firm formations have been concentrated in regions with already higher levels of entrepreneurship.

The broad-based growth in high-tech startups is encouraging because entrepreneurship is good for the economy. The disruptive process of entrepreneurship and business churning, while potentially costly in the short-term, is an important source of productivity growth for the U.S. economy

26. Using OLS, we regress the five- or ten-year growth in startup levels in a region on the startup density in the base year as well as dummies for each base year (1990 to 2005, or 1990 to 2010) to account for changes over time.

overall.[27] The presence of entrepreneurship in a region has been consistently linked with measures of economic development, such as employment growth.[28]

It is reasonable to believe that this effect is especially strong for high-tech startups. For example, the presence of venture capital-backed firms in a region has been causally linked with greater employment growth and income generation in the same region, aside from the companies that receive venture funding.[29] Research shows that the creation of one high-tech job in a region is associated with the creation of more than four additional jobs in the local services economy of the same region in the long run.[30] High-tech firms also are responsible for about 60 percent of private sector R&D spending, which has important local spillovers.[31]

Looking ahead, the next few years of data releases will provide critical insights into the state of economic dynamism and entrepreneurship in the United States. There is no doubt that the decline in firm starts in recent years is largely due to a historic economic recession. But there also are signs that declining business dynamism may have played a role as well. While it is too soon to tell based on this evidence alone, this is an important development to watch for in the coming years. Let's hope that 2011 was the beginning of a sustained revival in technology entrepreneurship, and entrepreneurship overall.

27. Haltiwanger (2011), "Job Creation and Firm Dynamics in the U.S.," Innovation Policy and the Economy, Volume 12, NBER.

28. Glaeser, Kerr, and Kerr (2013), "Entrepreneurship and Urban Growth: An Empirical Assessment with Historical Mines," NBER Working Paper 18333; Glaeser, Kerr, and Ponzetto (2010), "Clusters of Entrepreneurship," *Journal of Urban Economics* 67:1 (2010), 150–168; Delgado, Porter, and Stern (2010), "Clusters and Entrepreneurship," *Journal of Economic Geography* 10:4 (2010a), 495–518.

29. Samila and Sorenson (2011), "Venture Capital, Entrepreneurship and Economic Growth," *Review of Economics and Statistics* 93:1, 338–349.

30. Hathaway (2012), "Technology Works: High-Tech Employment and Wages in the United States," Bay Area Council Economic Institute.

31. Bureau of Economic Analysis, 2010 Research and Development Satellite Account, Table 5.1, Private Businesses Investment in R&D by Industry, 1987–2007.

Appendices

Appendix 1: Defining High-Tech

According to a Bureau of Labor Statistics study published in 2005 that followed an interagency seminar aimed at classifying high-tech industries, a high-tech industry is defined by the presence of four factors: 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.[32]

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 3, but broadly speaking, these occupations coalesce around three groups—computer and math scientists; engineers, drafters and surveyors; and physical and life scientists.[33]

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 4 had the highest concentrations of technology-oriented workers. Each of these fourteen "Level-1" industries had concentrations of high-tech employment at least five times the average across industries.[34]

Table 3: Technology-Oriented Occupations

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

Source: Bureau of Labor Statistics

32. 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.

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

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

Table 4: High-Technology Industries

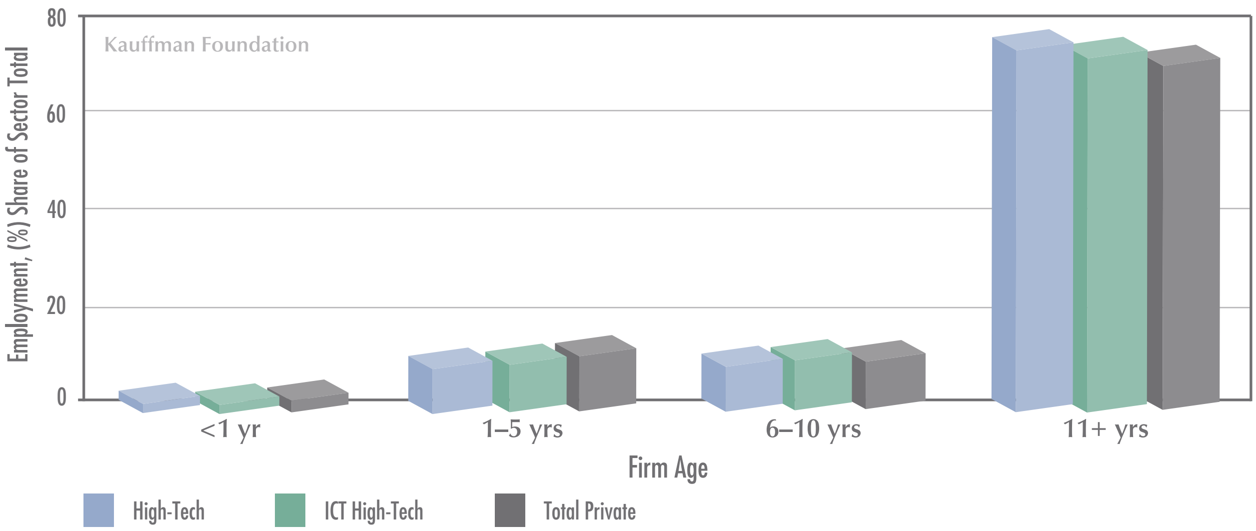
NAICS Code	Industry
Information and Communications Technology (ICT) High-Tech	
3341	Computer and peripheral equipment manufacturing
3342	Communications equipment manufacturing
3344	Semiconductor and other electronic component manufacturing
3345	Navigational, measuring, electromedical, and control instruments manufacturing
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
5415	Computer systems design and related services
Miscellaneous High-Tech	
3254	Pharmaceutical and medicine manufacturing
3364	Aerospace product and parts manufacturing
5413	Architectural, engineering, and related services
5417	Scientific research-and-development services

Source: Bureau of Labor Statistics

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.

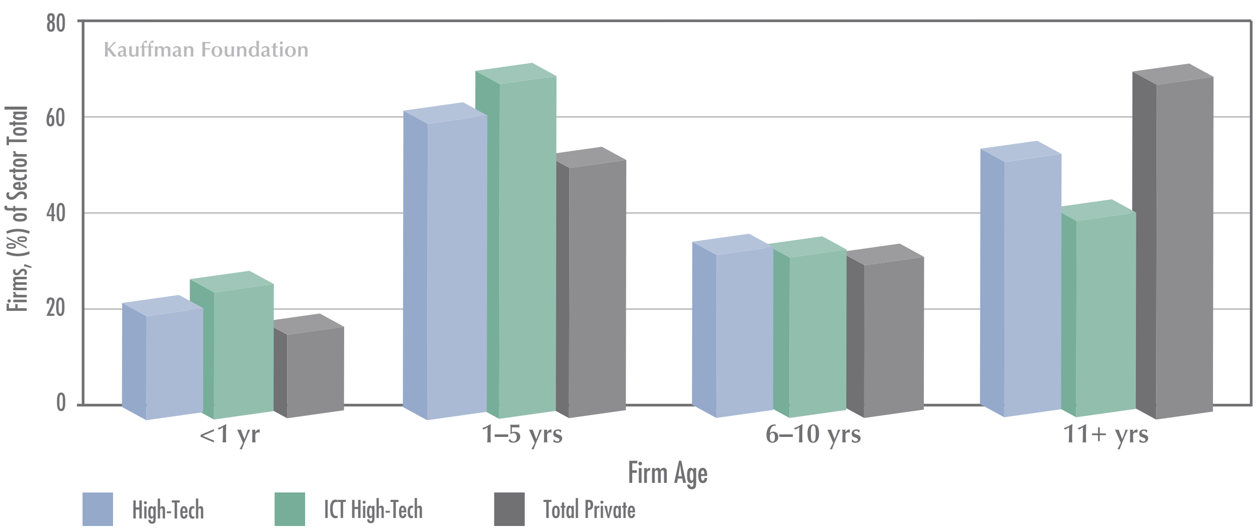
Appendix 2: Miscellaneous Charts

Figure A1: Distribution of Employment by Firm Age (1990–2011)



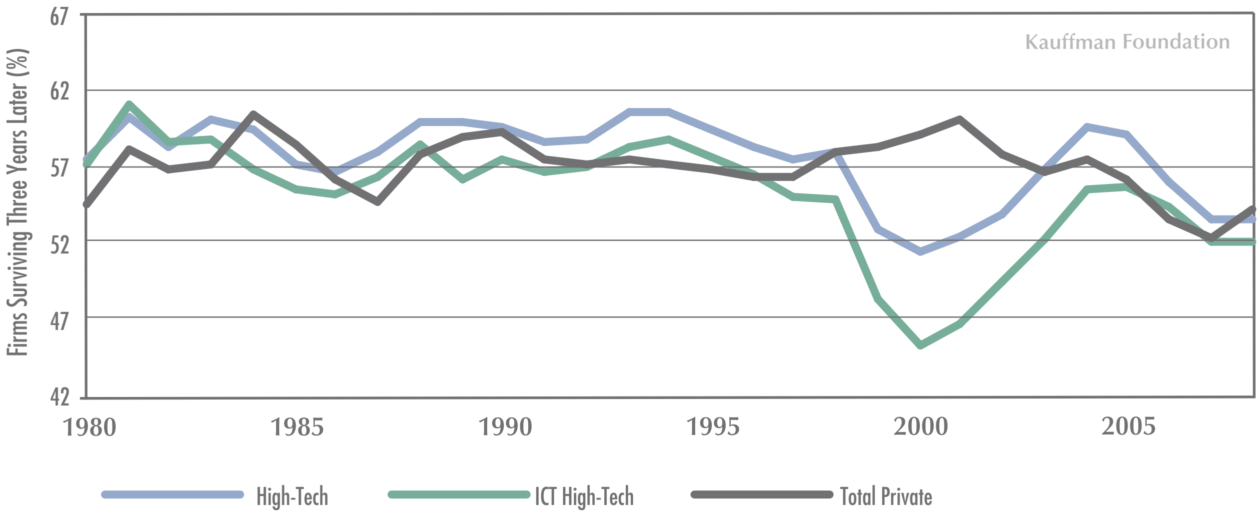
Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Figure A2: Distribution of Firms Age (1990–2011)



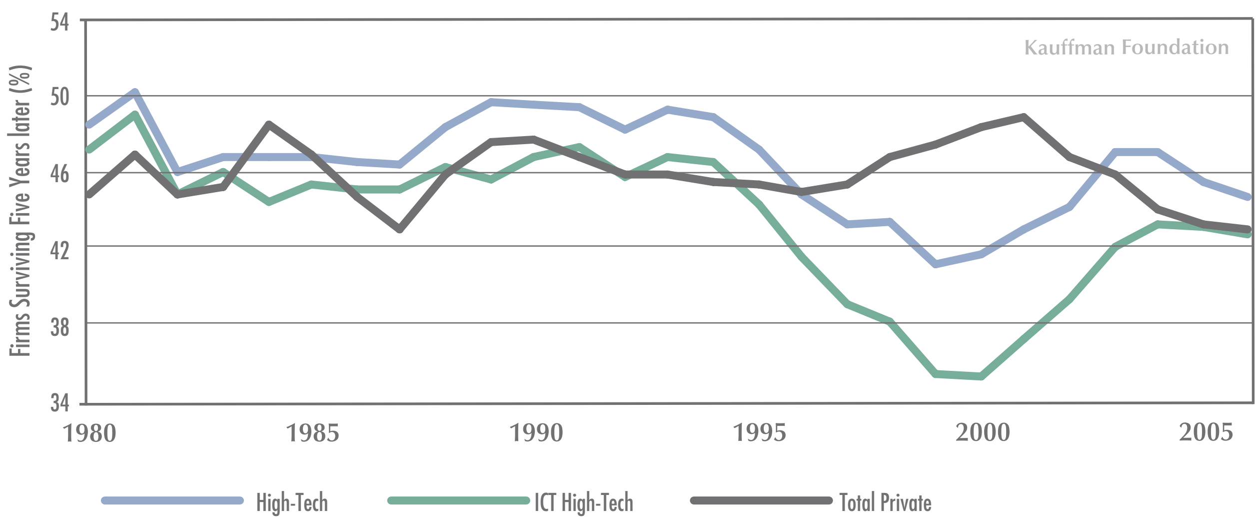
Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Figure A3: Three-Year Survival Rate by Birth Year (1980–2008 Births)



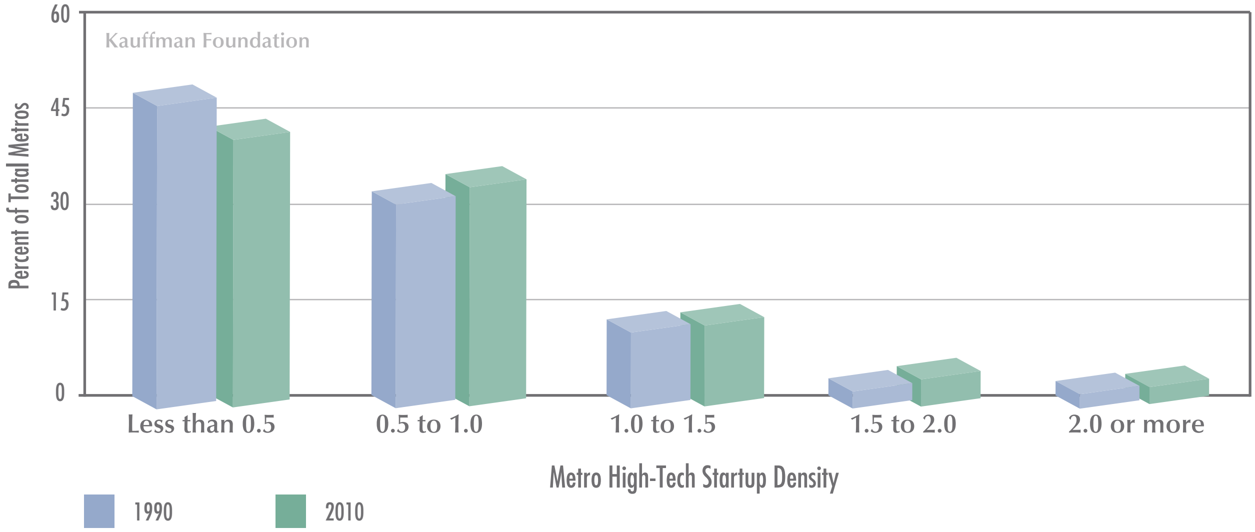
Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Figure A4: Five-Year Survival Rate by Birth Year (1980–2006 Births)



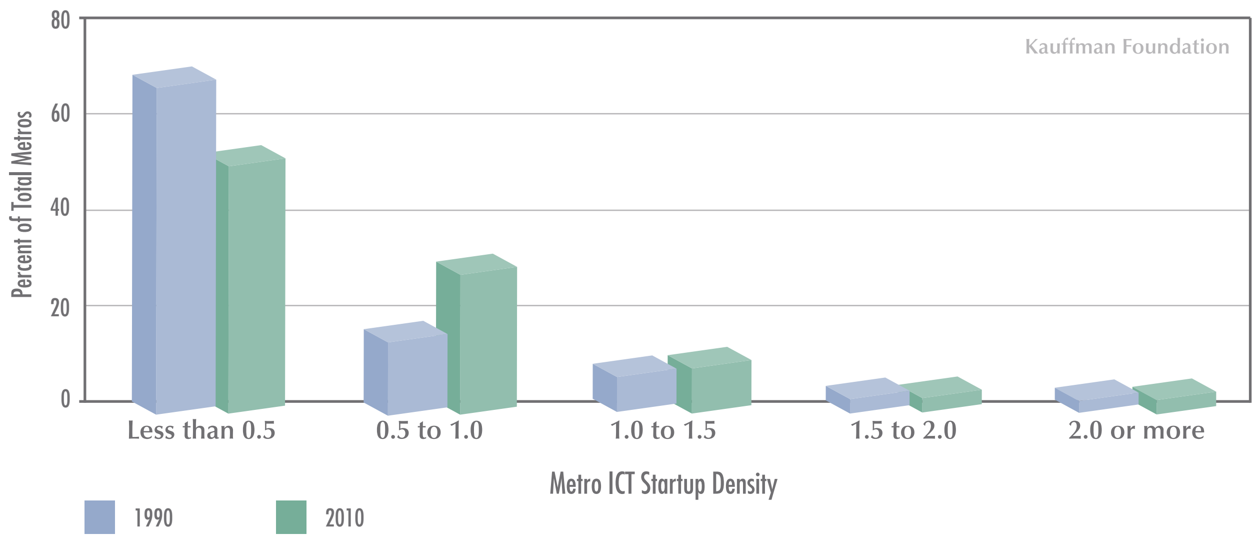
Source: U.S. Census Bureau, Business Dynamics Statistics and Special Tabulation; author's calculations

Figure A5: Distribution of Metro High-Tech Startups Densities (1990 and 2010)



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

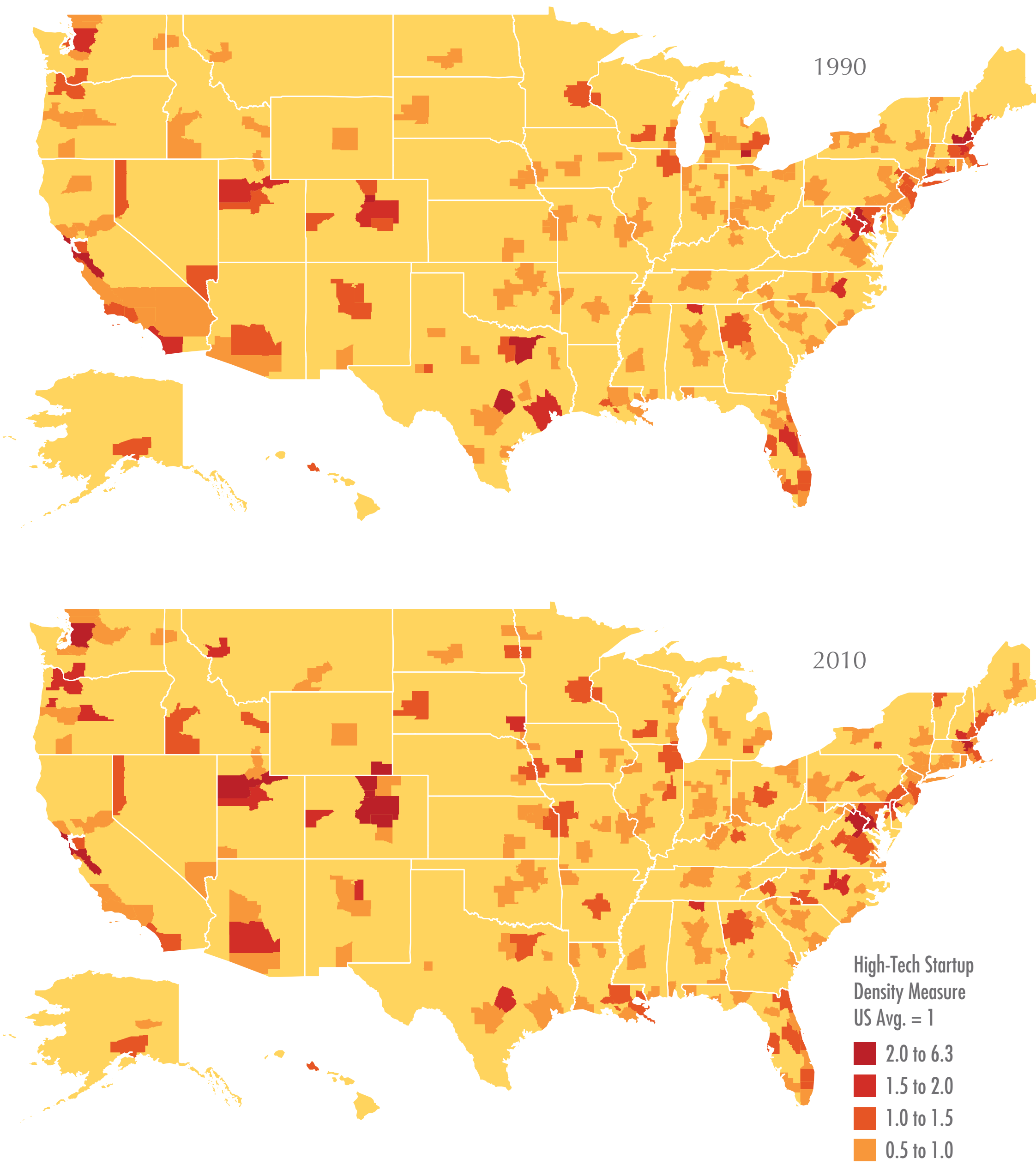
Figure A6: Distribution of Metro ICT Startups Densities (1990 and 2010)



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

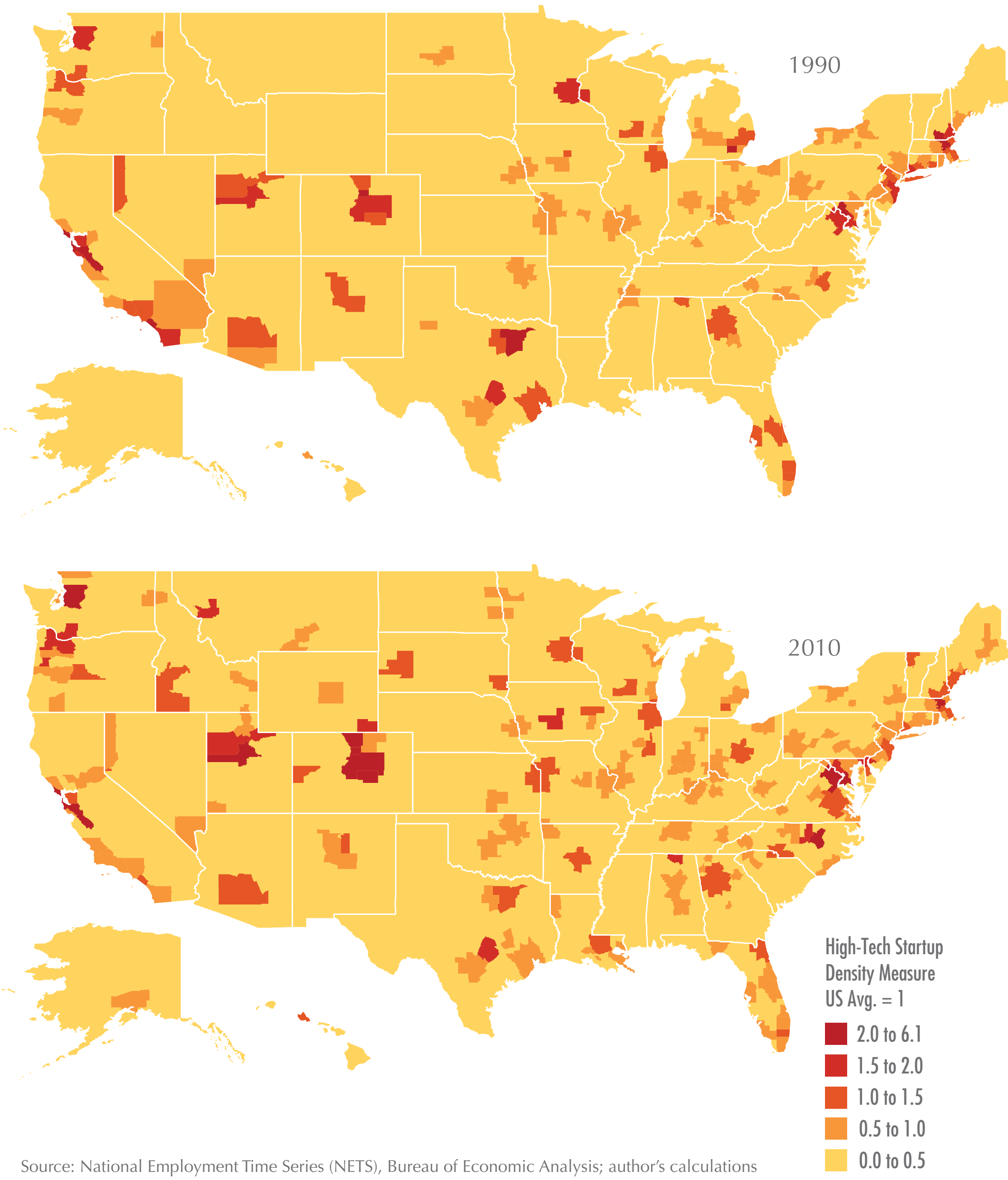
Appendix 3: High-Tech and ICT Startup Density by Metro Area

Appendix 3: High-Tech Startup Density by Metro Area



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

Appendix 3: ICT Startup Density by Metro Area



Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

Appendix 4: High-Tech and ICT Business Formations by Metro Area

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
United States	1.0	1.0	1.0	1.0
Abilene, TX	0.6	0.3	0.4	0.2
Akron, OH	0.8	0.7	0.9	0.7
Albany, GA	0.1	0.4	0.0	0.3
Albany-Schenectady-Troy, NY	0.7	0.7	0.4	0.8
Albuquerque, NM	1.3	0.9	1.1	0.8
Alexandria, LA	0.3	0.3	0.0	0.2
Allentown-Bethlehem-Easton, PA-NJ	0.7	0.5	0.5	0.5
Altoona, PA	0.3	0.3	0.2	0.3
Amarillo, TX	0.3	0.4	0.0	0.2
Ames, IA	0.7	1.6	1.1	1.5
Anchorage, AK	1.0	1.2	0.4	0.7
Anderson, IN	0.1	0.3	0.0	0.2
Anderson, SC	0.3	0.3	0.0	0.1
Ann Arbor, MI	2.6	1.4	2.9	1.1
Anniston-Oxford, AL	0.1	0.3	0.0	0.4
Appleton, WI	0.4	0.5	0.2	0.5
Asheville, NC	0.7	1.1	0.7	1.0
Athens-Clarke County, GA	0.4	0.6	0.3	0.7
Atlanta-Sandy Springs-Marietta, GA	1.4	1.3	1.4	1.4
Atlantic City-Hammonton, NJ	0.5	0.4	0.3	0.3
Auburn-Opelika, AL	0.5	0.5	0.0	0.2
Augusta-Richmond County, GA-SC	0.4	0.4	0.2	0.3
Austin-Round Rock, TX	2.3	1.7	1.9	1.8
Bakersfield, CA	0.6	0.3	0.2	0.2
Baltimore-Towson, MD	1.0	1.0	0.9	0.9
Bangor, ME	0.5	1.0	0.3	0.9
Barnstable Town, MA	1.3	0.7	0.5	0.8
Baton Rouge, LA	0.6	1.4	0.3	1.0
Battle Creek, MI	0.2	0.3	0.3	0.3
Bay City, MI	0.5	0.3	0.0	0.2
Beaumont-Port Arthur, TX	0.3	0.2	0.0	0.1
Bellingham, WA	0.6	0.9	0.2	0.7
Bend, OR	0.8	1.8	0.2	1.3
Bethesda-Frederick-Rockville, MD	2.4	1.7	2.4	1.5
Billings, MT	0.3	0.9	0.2	0.6
Binghamton, NY	0.3	0.5	0.2	0.3
Birmingham-Hoover, AL	0.7	0.8	0.5	0.7
Bismarck, ND	0.5	0.7	0.7	0.0
Blacksburg-Christiansburg-Radford, VA	0.4	0.7	0.2	0.5
Bloomington, IN	0.2	0.6	0.2	0.6
Bloomington-Normal, IL	0.4	0.7	0.1	0.9
Boise City-Nampa, ID	0.7	1.3	0.3	1.5
Boston-Quincy, MA	1.3	1.0	1.0	1.1
Boulder, CO	4.0	6.3	4.7	6.1
Bowling Green, KY	0.2	0.2	0.0	0.1
Bradenton-Sarasota-Venice, FL	0.8	1.0	0.4	0.8
Bremerton-Silverdale, WA	1.1	0.7	0.5	0.6
Bridgeport-Stamford-Norwalk, CT	1.4	0.9	1.6	1.1
Brownsville-Harlingen, TX	0.2	0.3	0.0	0.1
Brunswick, GA	0.3	0.5	0.0	0.5
Buffalo-Niagara Falls, NY	0.6	0.4	0.6	0.4
Burlington, NC	0.5	0.3	0.2	0.3
Burlington-South Burlington, VT	0.9	1.3	0.4	1.1
Cambridge-Newton-Framingham, MA	2.0	2.4	2.0	2.3
Camden, NJ	0.7	0.6	0.6	0.6
Canton-Massillon, OH	0.2	0.5	0.0	0.5
Cape Coral-Fort Myers, FL	0.8	0.7	0.4	0.5

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

Metro	High-Tech Startup Density		ICT Startup Density	
	1990	2010	1990	2010
Cape Girardeau-Jackson, MO-IL	0.1	0.3	0.0	0.2
Carson City, NV	0.5	1.2	0.5	1.4
Casper, WY	0.7	0.9	0.3	0.7
Cedar Rapids, IA	0.6	1.0	0.3	1.4
Champaign-Urbana, IL	0.4	1.2	0.2	1.5
Charleston, WV	0.3	0.7	0.1	0.5
Charleston-North Charleston-Summerville, SC	0.8	0.6	0.4	0.4
Charlotte-Gastonia-Concord, NC-SC	0.9	1.2	0.6	1.3
Charlottesville, VA	0.8	1.0	0.5	0.8
Chattanooga, TN-GA	0.4	0.5	0.2	0.3
Cheyenne, WY	0.5	2.0	0.2	1.6
Chicago-Naperville-Joliet, IL	1.1	1.1	1.3	1.2
Chico, CA	0.3	0.3	0.1	0.2
Cincinnati-Middletown, OH-KY-IN	0.6	0.8	0.5	0.9
Clarksville, TN-KY	0.0	0.3	0.0	0.2
Cleveland, TN	0.2	0.2	0.0	0.1
Cleveland-Elyria-Mentor, OH	0.9	0.9	0.8	0.9
Coeur d'Alene, ID	0.7	1.0	0.0	0.8
College Station-Bryan, TX	0.9	0.5	0.5	0.6
Colorado Springs, CO	1.2	2.3	1.4	2.2
Columbia, MO	0.6	0.5	0.6	0.4
Columbia, SC	0.6	0.5	0.3	0.4
Columbus, GA-AL	0.0	0.3	0.0	0.3
Columbus, IN	0.4	0.8	0.4	0.7
Columbus, OH	0.9	1.1	0.7	1.2
Corpus Christi, TX	0.6	0.3	0.2	0.1
Corvallis, OR	0.7	2.0	0.2	1.6
Cumberland, MD-WV	0.1	0.3	0.0	0.2
Dallas-Plano-Irving, TX	2.1	1.3	2.7	1.4
Dalton, GA	0.4	0.4	0.0	0.6
Danville, IL	0.0	0.2	0.0	0.1
Danville, VA	0.0	0.2	0.0	0.2
Davenport-Moline-Rock Island, IA-IL	0.3	0.6	0.2	0.5
Dayton, OH	0.8	0.7	0.7	0.8
Decatur, AL	0.3	0.4	0.0	0.4
Decatur, IL	0.5	0.3	0.3	0.0
Deltona-Daytona Beach-Ormond Beach, FL	0.7	0.7	0.3	0.6
Denver-Aurora-Broomfield, CO	1.8	2.4	1.7	2.5
Des Moines-West Des Moines, IA	0.9	1.4	0.9	1.9
Detroit-Livonia-Dearborn, MI	0.7	0.4	0.5	0.4
Dothan, AL	0.4	0.5	0.3	0.3
Dover, DE	0.2	1.0	0.0	1.1
Dubuque, IA	0.0	0.5	0.0	0.4
Duluth, MN-WI	0.3	0.3	0.1	0.2
Durham-Chapel Hill, NC	0.9	1.6	0.7	1.6
Eau Claire, WI	0.4	0.2	0.1	0.2
Edison-New Brunswick, NJ	1.2	1.3	1.5	1.4
El Centro, CA	0.2	0.2	0.0	0.2
Elizabethtown, KY	0.4	0.5	0.6	0.8
Elkhart-Goshen, IN	0.4	0.3	0.2	0.3
Elmira, NY	0.2	0.1	0.0	0.1
El Paso, TX	0.4	0.4	0.3	0.3
Erie, PA	0.4	0.3	0.2	0.3
Eugene-Springfield, OR	0.8	0.9	0.6	0.8
Evansville, IN-KY	0.3	0.2	0.1	0.3
Fairbanks, AK	0.2	0.6	0.0	0.4
Fargo, ND-MN	0.4	1.0	0.1	1.0
Farmington, NM	0.5	0.3	0.0	0.1
Fayetteville, NC	0.2	0.4	0.1	0.4
Fayetteville-Springdale-Rogers, AR-MO	0.4	1.0	0.1	0.6
Flagstaff, AZ	0.5	0.4	0.2	0.3
Flint, MI	0.4	0.3	0.3	0.4
Florence, SC	0.2	0.3	0.0	0.2
Florence-Muscle Shoals, AL	0.3	0.4	0.0	0.2

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
Fond du Lac, WI	0.4	0.1	0.0	0.2
Fort Collins-Loveland, CO	1.2	3.0	1.1	2.6
Fort Lauderdale-Pompano Beach-Deerfield Beach, FL	1.5	1.3	1.1	1.2
Fort Smith, AR-OK	0.6	0.3	0.3	0.2
Fort Walton Beach-Crestview-Destin, FL	0.2	0.9	0.0	1.0
Fort Wayne, IN	0.5	0.7	0.4	0.6
Fort Worth-Arlington, TX	1.2	0.7	1.2	0.6
Fresno, CA	0.4	0.3	0.2	0.2
Gadsden, AL	0.2	0.4	0.0	0.3
Gainesville, FL	0.8	0.9	0.2	0.5
Gainesville, GA	0.5	0.6	0.0	0.4
Gary, IN	0.6	0.3	0.4	0.2
Glens Falls, NY	0.5	0.3	0.0	0.3
Goldsboro, NC	0.2	0.0	0.0	0.1
Grand Forks, ND-MN	0.4	0.5	0.0	1.0
Grand Junction, CO	1.1	1.7	0.0	1.2
Grand Rapids-Wyoming, MI	0.9	0.5	0.7	0.5
Great Falls, MT	0.4	0.4	0.0	0.4
Greeley, CO	0.3	0.8	0.2	0.6
Green Bay, WI	0.1	0.6	0.0	0.6
Greensboro-High Point, NC	0.5	0.5	0.4	0.5
Greenville, NC	0.1	0.5	0.0	0.5
Greenville-Mauldin-Easley, SC	0.9	0.8	0.4	0.6
Gulfport-Biloxi, MS	0.5	0.7	0.2	0.4
Hagerstown-Martinsburg, MD-WV	0.5	0.6	0.0	0.6
Hanford-Corcoran, CA	0.2	0.3	0.0	0.2
Harrisburg-Carlisle, PA	0.3	0.7	0.2	0.7
Harrisonburg, VA	0.1	0.5	0.0	0.3
Hartford-West Hartford-East Hartford, CT	0.9	0.6	0.8	0.7
Hattiesburg, MS	0.0	0.4	0.0	0.1
Hickory-Lenoir-Morganton, NC	0.1	0.3	0.0	0.2
Hinesville-Fort Stewart, GA	0.0	0.4	0.0	0.1
Holland-Grand Haven, MI	1.3	0.4	0.9	0.3
Honolulu, HI	1.2	1.2	0.8	1.0
Hot Springs, AR	0.4	0.2	0.0	0.2
Houma-Bayou Cane-Thibodaux, LA	0.2	0.5	0.0	0.3
Houston-Sugar Land-Baytown, TX	1.9	0.9	1.5	0.7
Huntington-Ashland, WV-KY-OH	0.1	0.3	0.0	0.2
Huntsville, AL	1.7	1.9	1.0	1.7
Idaho Falls, ID	0.5	1.1	0.3	0.9
Indianapolis-Carmel, IN	0.7	0.9	0.6	0.9
Iowa City, IA	0.3	0.8	0.0	0.7
Ithaca, NY	0.7	1.2	0.5	0.6
Jackson, MI	0.4	0.3	0.0	0.2
Jackson, MS	0.5	0.7	0.2	0.4
Jackson, TN	0.1	0.2	0.0	0.2
Jacksonville, FL	0.6	1.2	0.3	1.0
Jacksonville, NC	0.1	0.8	0.0	0.7
Janesville, WI	0.1	0.3	0.0	0.3
Jefferson City, MO	0.1	0.5	0.0	0.6
Johnson City, TN	0.1	0.5	0.0	0.3
Johnstown, PA	0.3	0.6	0.5	0.7
Jonesboro, AR	0.2	0.1	0.0	0.1
Joplin, MO	0.2	0.4	0.1	0.2
Kalamazoo-Portage, MI	0.6	0.4	0.3	0.5
Kankakee-Bradley, IL	0.2	0.4	0.0	0.5
Kansas City, MO-KS	0.6	1.3	0.5	1.5
Kennewick-Pasco-Richland, WA	0.3	0.4	0.1	0.3
Killeen-Temple-Fort Hood, TX	0.2	0.4	0.1	0.3
Kingsport-Bristol-Bristol, TN-VA	0.3	0.3	0.0	0.1
Kingston, NY	0.4	0.6	0.6	0.5

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
Knoxville, TN	0.5	0.7	0.5	0.5
Kokomo, IN	0.4	0.6	0.0	0.8
La Crosse, WI-MN	0.4	0.2	0.2	0.1
Lafayette, IN	0.6	0.5	0.5	0.3
Lafayette, LA	1.1	1.4	0.2	0.7
Lake Charles, LA	0.4	0.6	0.0	0.4
Lake County-Kenosha County, IL-WI	1.0	1.2	0.7	1.5
Lake Havasu City-Kingman, AZ	0.2	0.3	0.0	0.2
Lakeland-Winter Haven, FL	0.4	0.5	0.2	0.3
Lancaster, PA	0.5	0.6	0.2	0.6
Lansing-East Lansing, MI	0.6	0.3	0.6	0.3
Laredo, TX	0.6	0.3	0.0	0.2
Las Cruces, NM	0.9	0.8	0.3	0.3
Las Vegas-Paradise, NV	1.0	0.9	0.5	0.9
Lawrence, KS	0.6	1.2	0.5	1.2
Lawton, OK	0.1	0.2	0.1	0.1
Lebanon, PA	0.2	0.3	0.0	0.3
Lewiston, ID-WA	0.0	0.0	0.0	0.0
Lewiston-Auburn, ME	0.3	1.0	0.0	0.5
Lexington-Fayette, KY	0.6	1.2	0.2	0.9
Lima, OH	0.1	0.3	0.0	0.3
Lincoln, NE	0.7	0.7	0.7	0.5
Little Rock-North Little Rock-Conway, AR	0.6	1.1	0.3	1.1
Logan, UT-ID	0.5	1.0	0.1	0.7
Longview, TX	0.6	0.2	0.3	0.2
Longview, WA	0.3	0.2	0.0	0.3
Los Angeles-Long Beach-Glendale, CA	0.9	0.7	1.1	0.6
Louisville/Jefferson County, KY-IN	0.4	0.9	0.4	0.9
Lubbock, TX	0.8	0.5	0.9	0.4
Lynchburg, VA	0.3	0.5	0.0	0.3
Macon, GA	0.5	0.3	0.5	0.3
Madera-Chowchilla, CA	0.5	0.1	0.0	0.1
Madison, WI	1.4	1.0	1.2	1.1
Manchester-Nashua, NH	3.2	1.6	4.0	1.5
Manhattan, KS	0.2	0.6	0.0	0.3
Mankato-North Mankato, MN	0.1	0.2	0.0	0.3
Mansfield, OH	0.1	0.4	0.0	0.3
McAllen-Edinburg-Mission, TX	0.2	0.2	0.0	0.1
Medford, OR	0.5	0.6	0.4	0.7
Memphis, TN-MS-AR	0.6	0.3	0.6	0.3
Merced, CA	0.2	0.1	0.0	0.1
Miami-Miami Beach-Kendall, FL	1.0	1.0	0.8	0.8
Michigan City-La Porte, IN	0.1	0.3	0.0	0.1
Midland, TX	1.4	0.7	0.0	0.3
Milwaukee-Waukesha-West Allis, WI	1.0	0.6	0.9	0.7
Minneapolis-St. Paul-Bloomington, MN-WI	1.4	1.1	1.5	1.3
Missoula, MT	0.7	1.7	0.3	1.9
Mobile, AL	0.4	0.6	0.2	0.5
Modesto, CA	0.5	0.2	0.2	0.2
Monroe, LA	0.3	0.7	0.0	0.2
Monroe, MI	0.4	0.2	0.0	0.1
Montgomery, AL	0.6	0.6	0.3	0.6
Morgantown, WV	0.2	0.8	0.0	0.4
Morristown, TN	0.0	0.2	0.0	0.1
Mount Vernon-Anacortes, WA	0.8	0.6	0.2	0.5
Muncie, IN	0.3	0.2	0.3	0.2
Muskegon-Norton Shores, MI	0.2	0.2	0.0	0.0
Myrtle Beach-North Myrtle Beach-Conway, SC	0.8	0.5	0.0	0.3
Napa, CA	1.0	0.5	0.0	0.5
Naples-Marco Island, FL	1.3	0.9	0.4	0.6
Nashville-Davidson--Murfreesboro--Franklin, TN	0.7	0.7	0.4	0.6
Nassau-Suffolk, NY	1.2	0.7	1.4	0.7

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
Newark-Union, NJ-PA	1.1	0.7	1.3	0.7
New Haven-Milford, CT	1.1	0.5	1.2	0.5
New Orleans-Metairie-Kenner, LA	0.6	1.3	0.4	0.9
New York-White Plains-Wayne, NY-NJ	0.7	0.8	0.9	0.8
Niles-Benton Harbor, MI	0.2	0.3	0.1	0.2
Norwich-New London, CT	1.1	0.8	1.1	0.9
Oakland-Fremont-Hayward, CA	1.5	1.1	1.8	1.1
Ocala, FL	0.6	0.4	0.0	0.2
Ocean City, NJ	0.4	0.3	0.0	0.4
Odessa, TX	0.8	0.3	0.3	0.2
Ogden-Clearfield, UT	0.5	1.0	0.5	0.8
Oklahoma City, OK	0.6	0.8	0.4	0.6
Olympia, WA	0.3	0.6	0.3	0.5
Omaha-Council Bluffs, NE-IA	0.8	1.1	0.6	0.9
Orlando-Kissimmee, FL	1.6	1.1	1.2	1.0
Oshkosh-Neenah, WI	0.4	0.4	0.2	0.4
Owensboro, KY	0.1	0.3	0.0	0.1
Oxnard-Thousand Oaks-Ventura, CA	1.4	0.9	1.5	0.8
Palm Bay-Melbourne-Titusville, FL	1.5	1.2	1.2	0.8
Palm Coast, FL	1.2	0.7	0.0	0.7
Panama City-Lynn Haven-Panama City Beach, FL	0.5	0.6	0.3	0.4
Parkersburg-Marietta-Vienna, WV-OH	0.1	0.3	0.0	0.2
Pascagoula, MS	0.2	0.3	0.0	0.1
Peabody, MA	1.0	1.0	1.1	0.9
Pensacola-Ferry Pass-Brent, FL	0.7	0.6	0.2	0.4
Peoria, IL	0.2	0.5	0.2	0.5
Philadelphia, PA	0.9	1.0	1.0	1.0
Phoenix-Mesa-Scottsdale, AZ	1.3	1.5	1.5	1.3
Pine Bluff, AR	0.0	0.2	0.0	0.1
Pittsburgh, PA	0.6	0.8	0.6	0.8
Pittsfield, MA	0.9	0.3	0.3	0.3
Pocatello, ID	0.3	0.5	0.0	0.1
Portland-South Portland-Biddeford, ME	1.0	1.1	0.7	1.5
Portland-Vancouver-Beaverton, OR-WA	1.3	1.6	1.2	1.7
Port St. Lucie, FL	0.7	0.7	0.0	0.7
Poughkeepsie-Newburgh-Middletown, NY	0.7	0.6	0.6	0.6
Prescott, AZ	0.4	0.6	0.0	0.2
Providence-New Bedford-Fall River, RI-MA	0.7	0.8	0.8	0.9
Provo-Orem, UT	1.4	1.9	1.7	2.1
Pueblo, CO	0.1	0.5	0.1	0.4
Punta Gorda, FL	0.6	0.4	0.0	0.3
Racine, WI	0.7	0.8	0.4	0.6
Raleigh-Cary, NC	1.8	1.9	1.4	2.1
Rapid City, SD	0.6	1.2	0.2	1.0
Reading, PA	0.5	0.4	0.3	0.4
Redding, CA	0.7	0.4	0.2	0.4
Reno-Sparks, NV	1.4	1.1	1.1	0.8
Richmond, VA	0.5	1.0	0.4	1.1
Riverside-San Bernardino-Ontario, CA	0.6	0.4	0.5	0.3
Roanoke, VA	0.2	0.6	0.1	0.5
Rochester, MN	0.3	0.4	0.4	0.5
Rochester, NY	0.7	0.7	0.8	0.7
Rockford, IL	0.4	0.4	0.2	0.4
Rockingham County-Strafford County, NH	2.1	1.4	1.7	1.4
Rocky Mount, NC	0.4	0.2	0.0	0.2
Rome, GA	0.2	0.4	0.0	0.6
Sacramento--Arden-Arcade--Roseville, CA	0.8	0.8	0.4	0.7
Saginaw-Saginaw Township North, MI	0.4	0.2	0.0	0.1
St. Cloud, MN	0.1	0.4	0.1	0.4

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
St. George, UT	0.3	0.7	0.0	0.7
St. Joseph, MO-KS	0.3	0.2	0.7	0.1
St. Louis, MO-IL	0.8	0.7	0.8	0.7
Salem, OR	0.5	0.4	0.2	0.5
Salinas, CA	0.6	0.4	0.7	0.4
Salisbury, MD	0.4	0.4	0.3	0.4
Salt Lake City, UT	1.6	2.0	1.4	1.9
San Angelo, TX	0.5	0.4	0.0	0.2
San Antonio, TX	0.9	0.7	0.7	0.6
San Diego-Carlsbad-San Marcos, CA	1.5	1.2	1.6	1.0
Sandusky, OH	0.0	0.2	0.0	0.3
San Francisco-San Mateo-Redwood City, CA	2.1	2.4	2.6	2.5
San Jose-Sunnyvale-Santa Clara, CA	3.0	2.6	4.4	2.9
San Luis Obispo-Paso Robles, CA	0.8	1.0	0.3	0.8
Santa Ana-Anaheim-Irvine, CA	1.9	1.3	2.1	1.1
Santa Barbara-Santa Maria-Goleta, CA	1.4	0.9	1.0	0.6
Santa Cruz-Watsonville, CA	1.5	0.9	1.7	0.8
Santa Fe, NM	1.2	1.6	0.2	1.2
Santa Rosa-Petaluma, CA	1.0	0.7	0.8	0.6
Savannah, GA	0.3	0.6	0.3	0.3
Scranton--Wilkes-Barre, PA	0.6	0.4	0.4	0.3
Seattle-Bellevue-Everett, WA	1.7	2.4	1.9	2.7
Sebastian-Vero Beach, FL	1.3	0.8	0.0	0.4
Sheboygan, WI	0.8	0.2	0.7	0.1
Sherman-Denison, TX	0.2	0.3	0.0	0.1
Shreveport-Bossier City, LA	0.4	0.7	0.3	0.5
Sioux City, IA-NE-SD	0.2	0.5	0.0	0.4
Sioux Falls, SD	0.4	1.7	0.3	1.0

	High-Tech Startup Density		ICT Startup Density	
Metro	1990	2010	1990	2010
South Bend-Mishawaka, IN-MI	0.6	0.4	0.2	0.3
Spartanburg, SC	0.1	0.4	0.0	0.3
Spokane, WA	0.7	0.9	0.5	0.8
Springfield, IL	0.7	0.8	0.4	0.7
Springfield, MA	0.4	0.3	0.3	0.3
Springfield, MO	0.3	0.6	0.1	0.5
Springfield, OH	0.7	0.3	0.0	0.3
State College, PA	0.2	1.1	0.0	0.8
Stockton, CA	0.5	0.2	0.7	0.1
Sumter, SC	0.4	0.0	0.0	0.0
Syracuse, NY	0.7	0.4	0.6	0.4
Tacoma, WA	0.6	0.6	0.3	0.5
Tallahassee, FL	0.5	0.9	0.3	0.8
Tampa-St. Petersburg-Clearwater, FL	1.1	1.1	1.0	1.0
Terre Haute, IN	0.2	0.4	0.2	0.2
Texarkana, TX-Texarkana, AR	0.1	0.4	0.0	0.2
Toledo, OH	0.6	0.2	0.6	0.2
Topeka, KS	0.5	0.6	0.5	0.5
Trenton-Ewing, NJ	1.1	1.5	0.9	1.2
Tucson, AZ	1.0	0.7	0.7	0.5
Tulsa, OK	1.0	1.0	0.8	0.8
Tuscaloosa, AL	0.5	0.5	0.0	0.4
Tyler, TX	0.4	0.6	0.2	0.3
Utica-Rome, NY	0.1	0.4	0.2	0.2
Valdosta, GA	0.0	0.3	0.0	0.4
Vallejo-Fairfield, CA	0.3	0.4	0.2	0.3
Victoria, TX	0.2	0.1	0.0	0.0
Vineland-Millville-Bridgeton, NJ	0.1	0.3	0.0	0.2
Virginia Beach-Norfolk-Newport News, VA-NC	0.3	0.8	0.2	0.8
Visalia-Porterville, CA	0.2	0.1	0.0	0.1
Waco, TX	0.2	0.4	0.0	0.2
Warner Robins, GA	0.5	1.0	0.5	0.6
Warren-Troy-Farmington Hills, MI	1.5	0.8	1.3	0.7

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

	High-Tech Startup Density		ICT Startup Density	
Metro	**1990**	**2010**	**1990**	**2010**
Washington-Arlington-Alexandria, DC-VA-MD-WV	1.8	2.3	1.9	2.6
Waterloo-Cedar Falls, IA	0.1	0.2	0.1	0.2
Wausau, WI	0.4	0.1	0.0	0.1
Weirton-Steubenville, WV-OH	0.0	0.1	0.0	0.1
Wenatchee-East Wenatchee, WA	0.2	0.5	0.0	0.4
West Palm Beach-Boca Raton-Boynton Beach, FL	1.4	1.2	1.0	1.0
Wheeling, WV-OH	0.4	0.1	0.0	0.1
Wichita, KS	0.5	0.7	0.4	0.6
Wichita Falls, TX	0.4	0.3	0.0	0.2
Williamsport, PA	0.2	0.3	0.0	0.1
Wilmington, DE-MD-NJ	0.9	1.6	0.3	1.8
Wilmington, NC	0.9	1.0	0.3	0.7
Winchester, VA-WV	0.2	0.7	0.0	0.4
Winston-Salem, NC	0.4	0.7	0.2	0.7
Worcester, MA	1.1	0.9	0.8	0.9
Yakima, WA	0.2	0.3	0.1	0.1
York-Hanover, PA	0.6	0.5	0.6	0.4
Youngstown-Warren-Boardman, OH-PA	0.5	0.4	0.2	0.5
Yuba City, CA	0.2	0.5	0.0	0.2
Yuma, AZ	0.6	0.3	0.0	0.2

Source: National Employment Time Series (NETS), Bureau of Economic Analysis; author's calculations

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