BOSTON TECH HUB FACULTY WORKING GROUP
REPORT SERIES

Funding Part 2:

Tech Hub Competition and Private Funding of the Innovation Life Cycle

HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs
TECHNOLOGY AND PUBLIC PURPOSE PROJECT

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The Boston Tech Hub Faculty Working Group Report Series was designed to provide a brief overview of various tech policy topics. These papers are not meant to be exhaustive.

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Boston Tech Hub Faculty Working Group Report Series

This report is part of a 3-part series of research primers produced by the Technology and Public Purpose (TAPP) Project focused on the strengths, weaknesses, opportunities, and challenges faced by the Boston tech hub.

Report Topics

1. Funding Part 1: Tech Hub Competition and Federal R&D Funding
2. Funding Part 2: Tech Hub Competition and Private Funding of the Innovation Life Cycle
3. International Students and Scholars in STEM in the United States

The report authors would like to thank the Boston Tech Hub Faculty Working Group speakers and attendees for their perspectives on the topics covered in each report.

About the Boston Tech Hub Faculty Working Group

The Boston Tech Hub Faculty Working Group (FWG), founded by former Secretary of Defense and Belfer Center Director Ash Carter and Harvard John A. Paulson School of Engineering and Applied Sciences Dean Frank Doyle, holds monthly discussion-based meetings with senior faculty and Boston-based practitioners/decision makers across the public and private sectors that explore and answer the question: How do we resolve the dilemmas posed to public good and public purpose, created by technology's unstoppable advances?

For the Spring 2022 FWG series, the working group focused on Boston's competitive edge in science, technology, and innovation.

Session Topics

- Tradition of S&T Excellence: Boston's History of R&D during WWII, the Cold War, and beyond.
  Speakers: David Kaiser, Sheila Jasanoff, Robin Wolfe Scheffler, G. Pascal Zachary, and Kate Zernike
- How can Boston acquire increased federal R&D funding?
  Speakers: France Córdova, Eric Evans, Susan Hockfield, and John Holdren
- How can Boston compete with other tech hubs for private funding from companies and investors?
  Speakers: David Cox, Vilas Dhar, David Fialkow, Katie Rae, and Vicki Sato
- How will Boston universities address the challenges of recruiting, training, and retaining international STEM students and scholars?
  Speakers: Nicole Elkin, Rebecca Keiser, David Kris, and Richard Lester

Executive Summary

Private funding of Research & Development (R&D) is crucial for sustaining Boston's tech hub. Investments from businesses, Venture Capital firms, or philanthropic organizations may increase research and innovation, lead to more conversion of basic research to commercial applications, improve supply chains, and support talent development. While Federal funding for R&D is mainly focused on basic research, private funding is often aimed at more advanced stages of research, when a new product or service has already proven its commercial potential. In the U.S, the business or the private sector performs and funds most R&D activities.

Existing and emerging tech hubs are competing to attract private funding. While Boston's tech hub is still an attractive hub for private investors, there are indications that Boston-based entrepreneurs and companies are lagging behind other tech hubs when it comes to attracting private funding. In 2018, Business R&D investments in Boston reached close to $30 Billion – a 25% increase in three years. However, this growth rate lags behind several other tech hubs, such as Seattle, the Bay Area, Detroit, and New York City. Compared to New York City, Boston-based entrepreneurs had access to fewer private investors, including a smaller number of locally-based investors. The scarcity of investors is felt across fields, including biotech - Boston's strength, and affects every stage of the development pipeline. Furthermore, the pandemic has accelerated the growth of alternative tech hubs, including Michigan, North Carolina, and Colorado. While still small, these emerging hubs gradually attract higher volumes of Venture Capital Investments out of traditional tech hubs, such as Boston.

Local government and other stakeholders may adopt a range of policy tools to better position Boston's tech hub in the national competition for private funding. Traditional tools, such as wider tax credits for R&D, grants or loans to startups, may be helpful but limited in their reach and efficiency. Other tools should try to make Boston more affordable and attractive for talent, and support scientists and potential entrepreneurs in their effort to commercialize their ideas and scientific breakthroughs.

Framing and Organization of Factsheet

Background and motivation: A myriad of interdependent factors have won the Boston metro area the status of a leading tech hub: strong academic institutions, skilled workers, burgeoning tech firms, leading medical institutions, and substantial private investments and federal research funding are some of these essential factors. However, growing competition (internationally and domestically), the national decline in federal funding as a share of total R&D expenditure, higher cost of living, and workforce changes may pose challenges to the Boston tech hub.

In a prior fact sheet, **Funding Part 1: Tech Hub Competition and Federal R&D Funding**, we discussed the unique role of federal funding for research and development (R&D.) Namely, its impact on basic research stages – developing ideas and scientific innovation. However, federal R&D alone is not sufficient to sustain a tech hub. Private investments from companies, investors, and civil society play an important role in advancing the research and commercializing it, which in turn, contributes to the overall economy. Boston, home to many innovative companies in various stages of development, is experiencing increasing competition for capital, companies, and talent. COVID-19 has also impacted this competition; remote work has presented opportunities to expand the reach for talent. However, remote work may also geographically distribute future tech workforce and company locations. For these reasons, to ensure that Boston continues to serve as a thriving tech hub, Massachusetts, Boston and local stakeholders must map out Boston's competition and opportunities to attract private investments.

To that purpose, this fact sheet focuses on the role of private funding in promoting and sustaining the Boston tech hub. It includes an analysis of Boston's place in the national landscape of private investment and how current and future trends may influence Boston's attractiveness. Lastly, it explores policy tools to encourage private investment across the technology innovation life cycle.

The challenge: Emphasize Boston's economic and institutional advantages to strengthen Boston's tech hub and continue to compete with traditional and emerging tech hubs.

The opportunity: Boston checks all the required boxes for a thriving tech hub: abundant talent, scientific knowledge, leading research universities, supportive policymakers, and both history and culture of innovation. Boston could foster partnerships and policies that will leverage its advantages and resources to solidify its existing ecosystem and scale the knowledge that these stakeholders are producing to attract private funding.

Introduction: Explaining the Focus on Private Investment

Many factors contribute to the success of a tech hub. These include skilled workers and talents, scientific and traditional infrastructure, and collaboration potential between universities, research centers, and private firms.[1] Additionally, regulation, taxation, quality of life, and other factors that influence the attractiveness of the city are critical to a tech hub's success. None of these factors, including private funding, is by itself sufficient to ensure the success of a tech hub.[2]

Nevertheless, private funding plays a critical role in contributing to a tech hub's success. In particular, this factsheet discusses 3 forms of private funding: business investment, venture capital (VC) investment, and philanthropic investment.

- **Business investments can help improve supply chains, increase innovation, and improve competition.** If cost dynamics are favorable, existing firms have strong incentives to localize the supply of their inputs or raw materials - i.e. to increase their control over the supply chain. These incentives prompt existing businesses to encourage suppliers (new or distant) to invest in the creation of local operations.[3] This investment can set off a chain reaction leading to the growth of a cluster or tech hub. Additionally, factors that encourage investment and fierce competition between businesses can contribute towards a competitive innovation environment. This can further snowball, helping to develop a vibrant tech hub.[4]
- **Increased intensity of VC investments is linked with a greater conversion of research from universities and firms into commercial applications.**[5] VC investors fund, guide, and convene together large groups of innovators and entrepreneurs who then learn from one another. A disproportionate share of high-growth companies in the U.S. are VC-backed. That said, VC investments also come with limitations,[6] including; a narrow band of technological innovations that fit the requirements of institutional venture capital investors; and, in parts of the East Coast, a relatively small number of venture capital investors who hold and shape the direction of a substantial fraction of capital and financing.
- **Philanthropic investment contributes to tech and innovation hubs in a number of ways:**[7,8] supporting talent development, advancing basic research, encouraging innovation, facilitating translation of research into products, providing first loss capital to de-risk the equity stack, and lobbying for policy changes. To note, philanthropic investment also comes with questions of accountability, motivations of tax benefits and other private interests, etc.[9]

In addition to funding, accelerators and incubators play a vital role in boosting innovation and entrepreneurship. Innovation-driven entrepreneurship requires a "culture of openness and collaboration," including access and interactions between the different vital actors of the ecosystem. Accelerators and incubators help facilitate those much-needed interactions to support new and mature start-ups.[10] **Accelerators** focus on early-stage companies and offer them education, mentorship, working space, and financing for a fixed period. Accelerators help young companies define and build their product, identify a customer base, and interact with other entrepreneurs through accelerator cohorts.[11] Different actors, including VC, local government, non-profits, universities, etc are involved with accelerators. **Incubators** offer some resources for founders, such as working facilities, but generally support founders over longer periods of time compared to accelerators. They also support later-stage companies. There is not a strong emphasis on mentorship but rather access to facilities. This vital infrastructure is crucial for the early stages of startups, when they lack the resources to acquire or develop

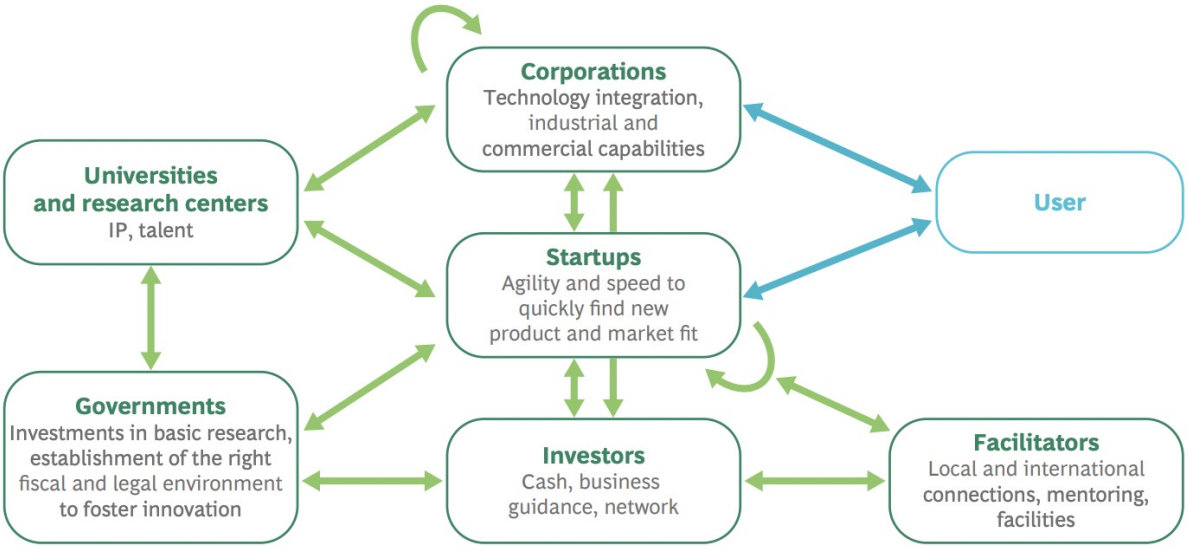
this infrastructure in-house.[12] Philanthropies often provide access to non dilutive funding through incubators, structured as prizes or challenges.

Landscape of Private Funding Participants in the Tech Ecosystem

The tech ecosystem is highly dynamic and consists of various interwoven relationships featuring numerous participants. This section begins with a high-level overview of the participants in the tech ecosystems (Figure 1) and proceeds with examples of the typical funders and recipients in the tech ecosystems (Table 1).

Participants of the Tech Ecosystem. The tech ecosystem is a complex network of relationships between technology developers (Startups, Corporations, Governments, and Universities), Funders (Corporations, Governments, Investors, and Universities), other Facilitators and Users. For a tech hub to succeed each component of the ecosystem must be present and engaged. Factors which affect one component will spillover into other parts of the ecosystem.

Figure 1: Participants in the Tech Ecosystem.



NOTE: Reprinted from Boston Consulting Group and Hello Tomorrow

Participant Landscape of the Private Funding Tech Ecosystem. The following table outlines common relationships between private sources of capital and recipients in private and public markets. See **Annex 1** for definitions of the funders and recipients outlined below.

Table 1: Participants in the Private Funding Tech Ecosystem

Private Funding for Private Markets		
Funder/Source of Capital	**Recipient**	**Example(s) of Funder/Recipient Investment Type in Massachusetts (MA)** *Noted below as "Funder → Recipient"*
Angel Investors	Startups	Beacon Angels[13] → Cognoptix
Accelerators and Incubators	Startups	Techstars Boston Accelerator[14] → Health Haven Rx
Venture Capital Firms	Startups	General Catalyst[15] → OM1
Private Equity Firms	Mature Companies	Bain Capital[16] → Aveanna Healthcare
Mutual Funds	Late-Stage / High-Value Startups	Fidelity[17] → Airbnb
Private or Public Companies	Themselves	Thermo Fisher Scientific → Thermo Fisher Scientific R&D
	Universities	MIT-IBM Watson AI Lab
Public Company[18] Venture Capital (VC), usually referred to as Corporate Venture Capital (CVC)	Startups	Eni Next[19] → Commonwealth Fusion Systems
Philanthropy	Startups	Bill & Melinda Gates Foundation[20] → Affinivax
	Universities	Chan Zuckerberg Initiative[21] → Harvard Kempner Institute; Patrick J. McGovern Foundation → MIT McGovern Institute for Brain Research[22]

Private Funding for Public Markets		
Funder/Source of Capital	**Recipient**	**Example(s) of Funder/Recipient Investment Type in Massachusetts (MA)**
Shareholders	Public Companies	Cambridge-based Amylyx Pharmaceuticals raised $190 million in its IPO by selling 10 million shares at $19 per share in Jan. 2022.[23]

Current Stats on Private Investments and Key Performance Indicators

This section analyzes the top-performing metropolitan areas or states for each metric. While many areas are present in multiple metric analyses, others are only present in one or two. Areas present in most or all analyses – e.g., Boston, the Bay Area, and New York – can be accurately viewed as high-performing in almost every metric of private funding activity. This analysis is broken into two sections: Investments and Key Performance Indicators.

Investments metrics analyzed include (1) Business Enterprise R&D spending[24] at the Core-Based Statistical Area (CBSA) level, (2) Venture Capital funding at the CBSA level, (3) VC Fundraising Activity by Tech Hub, (4) Investors and Investments by Tech Hub, and (5) Nonprofit funding at the national level.

Main Takeaways:

- The Bay Area dominated U.S. venture capital fundraising activity, followed by New York, Boston, and Los Angeles. VC fundraising activity remained consolidated in the top-10 tech hubs.
- Boston-based entrepreneurs have access to fewer locally-based investors across the commercialization pipeline and across key industries. Boston-based entrepreneurs also have less support from their local ecosystems.

Key Performance Indicators (KPIs) metrics include (1) Number and Value of IPOs by Tech Hub, (2) Number of Acquired and Acquiring Companies by State, and (3) Corporate Utility and Independent Investor Patents by State.

Main Takeaways:

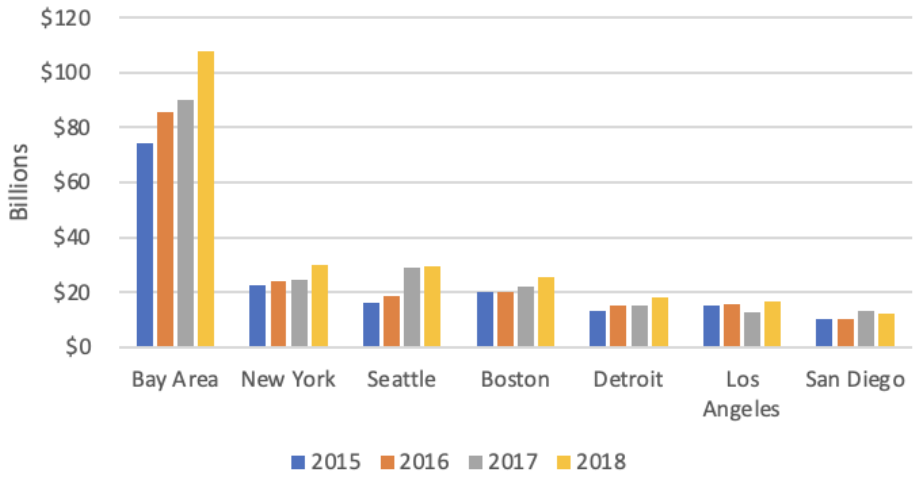
- The Bay Area and New York City led IPO activity in the 2014-2021 period, with Massachusetts appearing to fall behind during the pandemic years of 2020-2021.
- California dominated acquisition activity in the 2014-2021 period. Massachusetts lagged behind California and New York but surpassed Washington.
- Massachusetts trailed California, Texas, and New York in corporate utility patents and was in close competition with Washington. In independent investor utility patents, California's lead remained stable and dominant, with Massachusetts and Washington trailing far behind.

NOTE: Each tech hub identified in this section is a unique Core-Based Statistical Area except for the Bay Area, which is an aggregate of both the San Jose-Sunnyvale-Santa Clara CBSA and the San Francisco-Oakland-Berkeley CBSA.

Investments

Business R&D Funding Comparison by Tech Hub

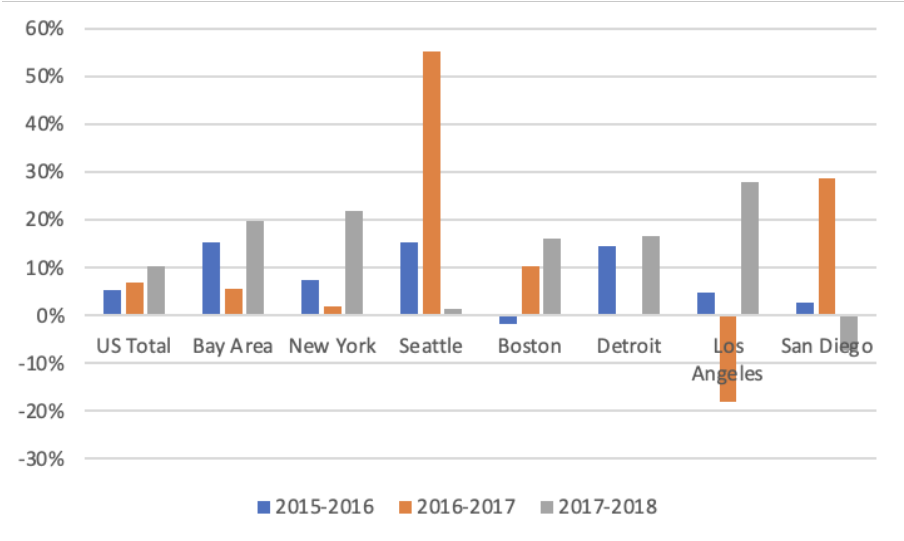
Figure 2: Total Business Enterprise R&D Spending by CBSA from **2015-2018**.



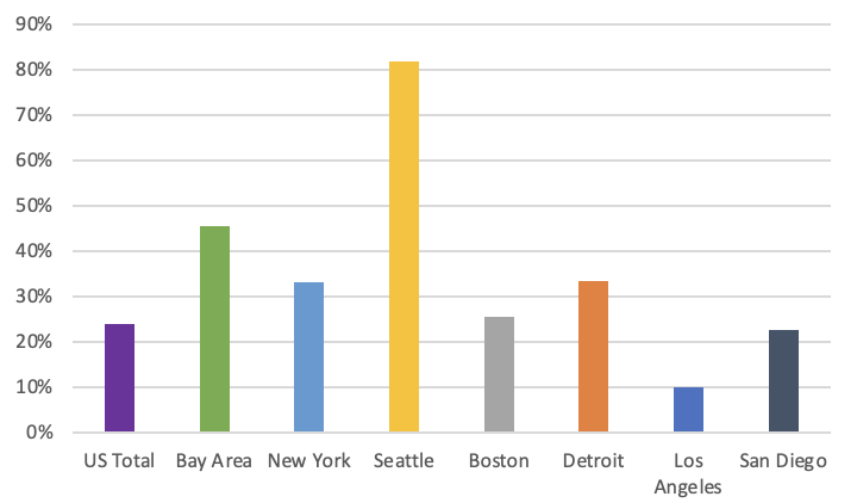
The Bay Area experienced significantly higher (over 300% greater than nearest competitor) Business R&D spending than the other tech hubs. Boston fell into the next tier of tech hubs by Business R&D spending, along with New York and Seattle. This tier represented roughly $20-$30B in annual Business R&D Spending per hub. Detroit, Los Angeles, and San Diego fell into the third tier of Business R&D spending. This tier represented roughly $10-20B in annual Business R&D spending per hub.

Figure 3: Growth Rates in Business R&D by CBSA from **2015-2018**.

A. Percent Annual Change in Growth Rates in Business R&D by CBSA



B. Total Growth Rates in Business R&D by CBSA from 2015-2018



From 2015 to 2018 Boston's business R&D spending grew faster than the U.S. economy as a whole at 25.52% (1.57 percentage points above U.S. average) but slower than several other major tech hubs. U.S. business investment in R&D grew by 23.95% from 2015 to 2018. While the U.S.' business R&D investment grew steadily, there was substantial variation in growth rates per year in each tech hub. The largest yearly fluctuations came from Seattle, Los Angeles, and San Diego.

Four tech hubs outpaced Boston's R&D Spending growth:

- Seattle (57.77 percentage points above U.S. average)
- Bay Area (21.56 percentage points above U.S. average)
- Detroit (9.47 percentage points above U.S. average)
- New York (9.07 percentage points above U.S. average)

Boston's growth outpaced two tech hubs:

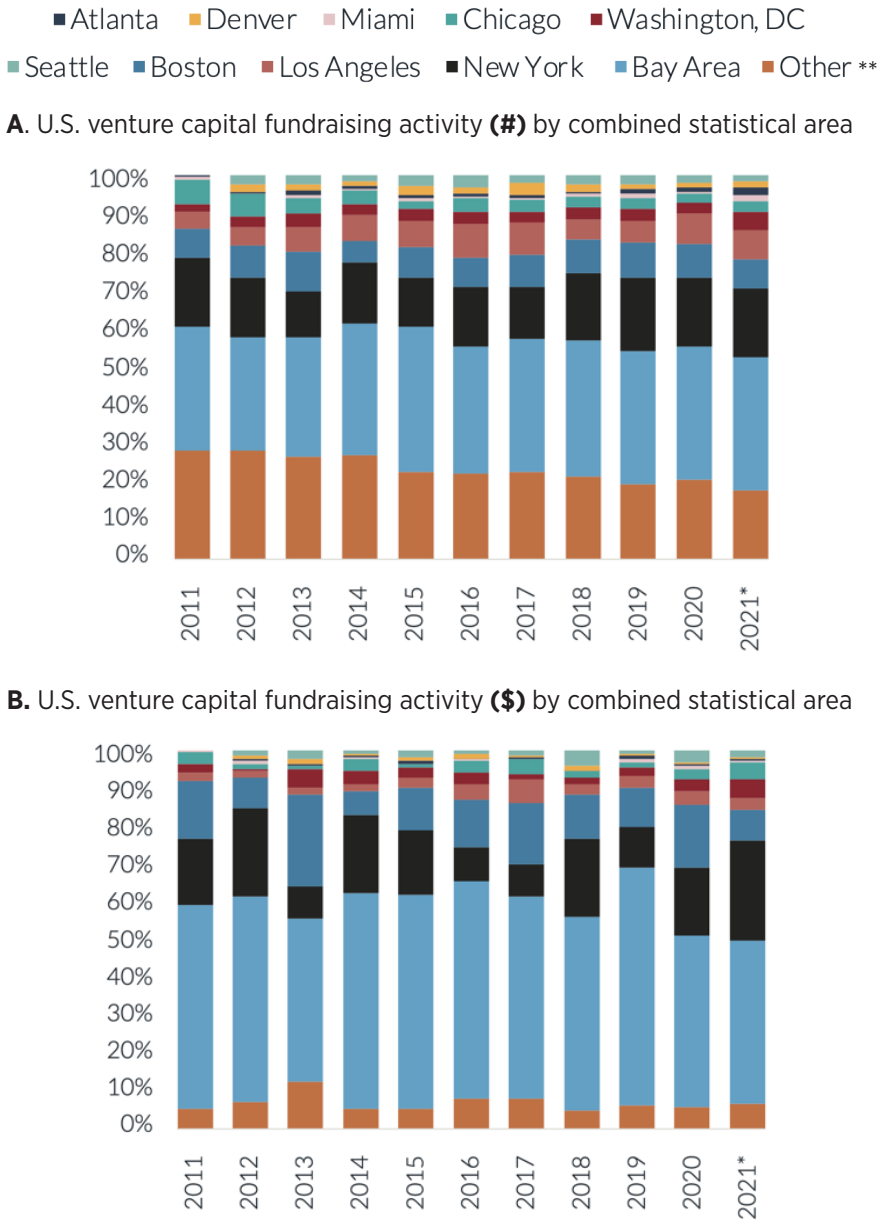
- San Diego (1.46 percentage points below U.S. average)
- Los Angeles (14.01 percentage points below U.S. average

VC Fundraising Comparison by Tech Hub

The Bay Area dominated U.S. venture capital fundraising activity, followed by New York, Boston, and Los Angeles (Figure 4). As of 2021, the shares of these tech hubs in the total number of U.S. fundraising activities were more than 30% for the Bay Area, 15-20% for New York, and less than 10% each for Boston and Los Angeles (Figure 4.A). By value of fundraising activity, the shares were almost 50% for the Bay Area, ~30% for New York, ~10% for Boston, and ~5% for Los Angeles (Figure 4.B).

Venture capital fundraising activity remained consolidated among the top-10 tech hubs. The share of "Other" tech hubs either decreased by number (from almost 30% in 2011 to ~20% in 2021) or remained stable by value (~5%).

Figure 4: Venture Capital (VC) Fundraising Activity**.**



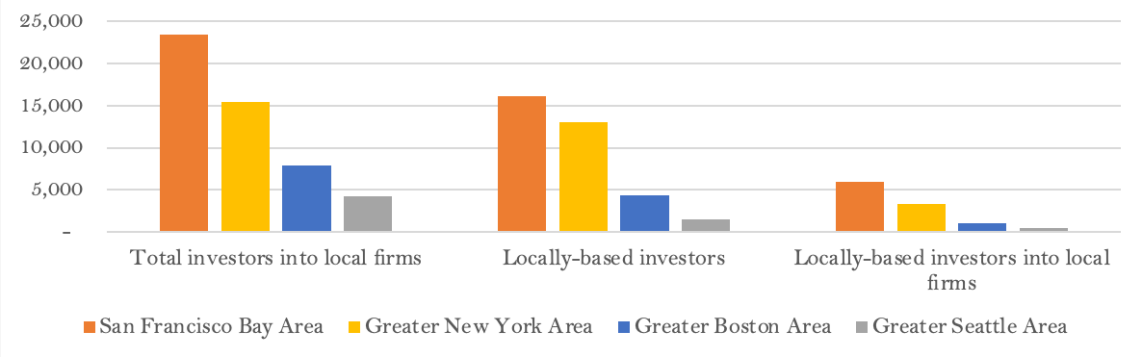
** As of September 30, 2021 ** Austin (Texas) is included in "Other."Austin is not in the top-10 combined statistical areas in terms of the number or value of U.S. venture capital fundraising activity.*

NOTE: Reprinted from Cameron Stanfill et al., "Venture Monitor: Q3 2021," accessed April 15, 2022, https://nvca.org/wp-content/uploads/2021/10/Q3_2021_PitchBook-NVCA_Venture_Monitor.pdf.

Comparison of Local Investors and Investments by Tech Hub

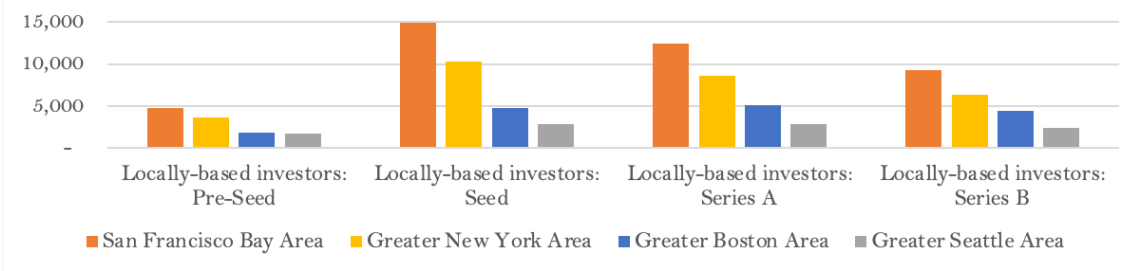
Boston-based entrepreneurs have access to fewer total and locally-based investors than competitors based in the Bay Area and New York (Figure 5). For instance, as of April 2022, Boston had 4,340 locally-based investors, only about 1/4th the number based in the Bay Area and 1/3rd that of New York. Of these locally-based investors, about 1,001 invested into local firms, less than 1/5th that of the Bay Area and about 1/3rd that of New York.

Figure 5: Tech hub comparison in terms of number of investors and investment targets (as of April 2022).



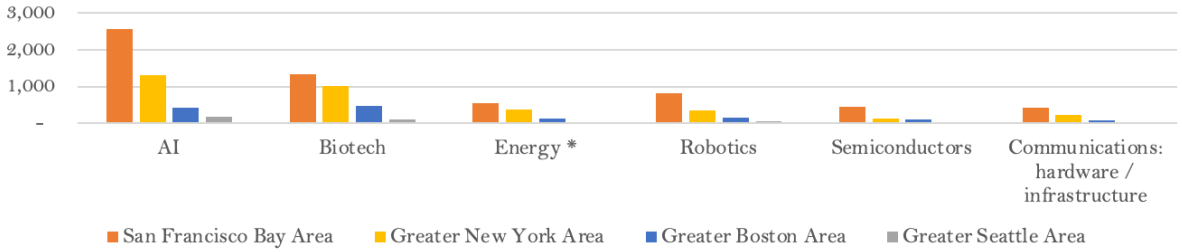
Boston-based entrepreneurs receive fewer investments than Bay Area and New York competitors at every stage of development from lab-based innovation to established business: Pre-seed, Seed, Series A, through Series B (Figure 6). This difference is most pronounced in the middle of this pipeline. For instance, as of April 2022, the numbers of Seed and Series A investments into Boston-based startups were 4,755 and 5,124, respectively, which correspond to about 30% to 40% of investments into startups in the Bay Area and about 50% to 60% that of New York.

Figure 6: Tech hub comparison in terms of number of investments into local startups at each stage of investment / fundraising by companies (as of April 2022).



Boston-based entrepreneurs have access to fewer locally-based investors than Bay Area competitors across every high-tech industry (Figure 7). For instance, as of April 2022, Boston had 436 AI investors, less than 1/5th the number in the Bay Area and about 1/3rd that of New York. Even in biotech, which is Boston's strongest tech industry, Boston had only 484 locally-based investors, well below half of the numbers in the Bay Area and New York.

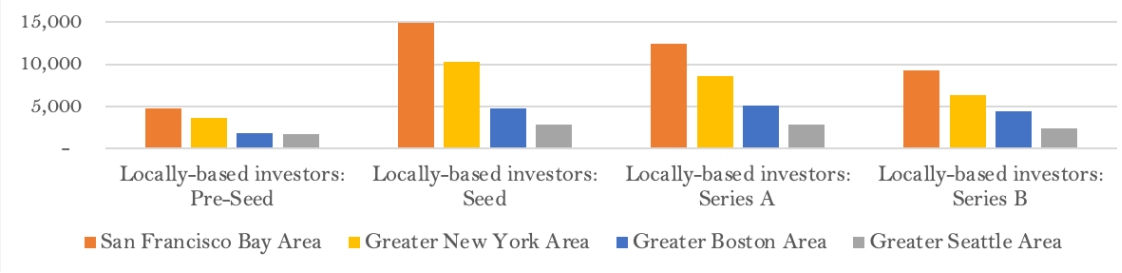
Figure 7: Tech hub comparison in terms of number of **locally-based** investors in key **high-tech** industries (as of April 2022).



** Energy: green energy-related areas: battery, clean energy, energy storage, fuel cell, renewable energy, solar, wind energy*

Boston-based entrepreneurs have less support from the local ecosystem, except in terms of university programs for entrepreneurship (Figure 8). As of April 2022, Boston lagged well behind the Bay Area and New York in terms of accelerators, incubators, and even entrepreneurship programs. Boston was competitive only in terms of university programs. To note: more accelerators and incubators are not always value-adding, and could experience diminishing returns. However, this analysis shows that Boston has significant room for improvement compared to the Bay Area and New York in providing these elements of the ecosystem to local entrepreneurs.

Figure 8: Tech hub comparison in terms of entrepreneurial ecosystem: number of accelerators, incubators, university programs, entrepreneurship programs, and startup competitions (as of April 2022).

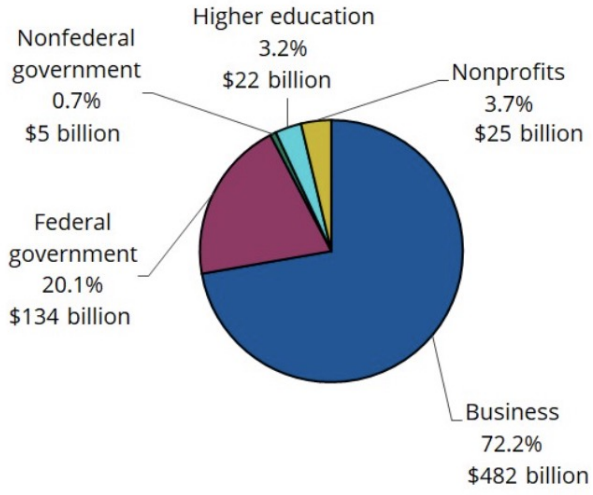


National and State-Level Nonprofit Funding Trends

Nonprofit and philanthropic organizations are playing an increasingly important role in R&D and scientific funding. In this section we will provide a short overview of this trend at the national and state level based on available data. **Recommendation for Further Research:** Given more time, we would encourage future researchers to pursue a temporal, city level comparison of nonprofit and philanthropic funders and their respective recipients.

Figure 9: U.S. R&D Expenditures by Source of Funds: 2019

US Total of R&D Expenditures in 2019: $667 Billion



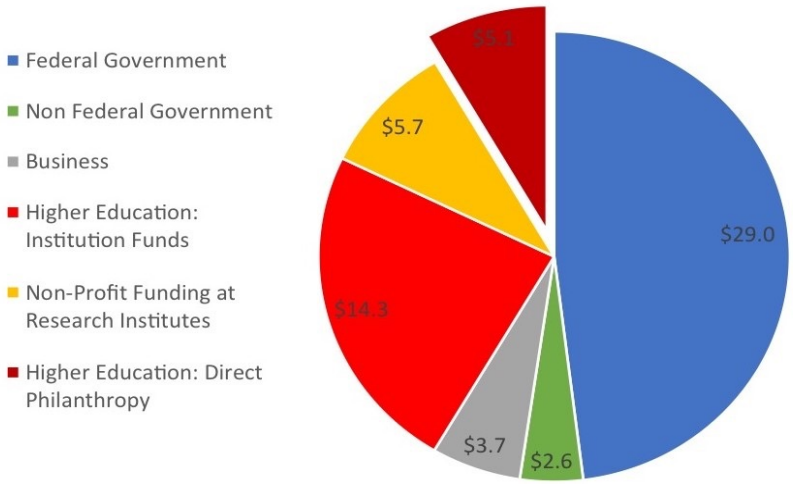
NOTE: Reprinted from Boroush M; National Center for Science and Engineering Statistics (NCSES). 2021. New Data on U.S. R&D: Summary Statistics from the 2019–20 Edition of National Patterns of R&D Resources. NSF 22-314. Alexandria, VA: National Science Foundation. Available at https://ncses.nsf.gov/pubs/nsf22314.

The Growing Role of Nonprofit Funding in Research. As seen in Figure 9, funding from nonprofits remains a relatively small portion of total U.S. R&D expenditures. However, as evidenced by Figure 10 below, nonprofits play a significant role in funding basic research for higher education.

State Comparison. California receives the most funding from nonprofits for higher education, followed by New York, Texas, then Massachusetts. Of note, Massachusetts ranks No. 1 on a list of most shuttered college campuses of any state since 2016.[25]

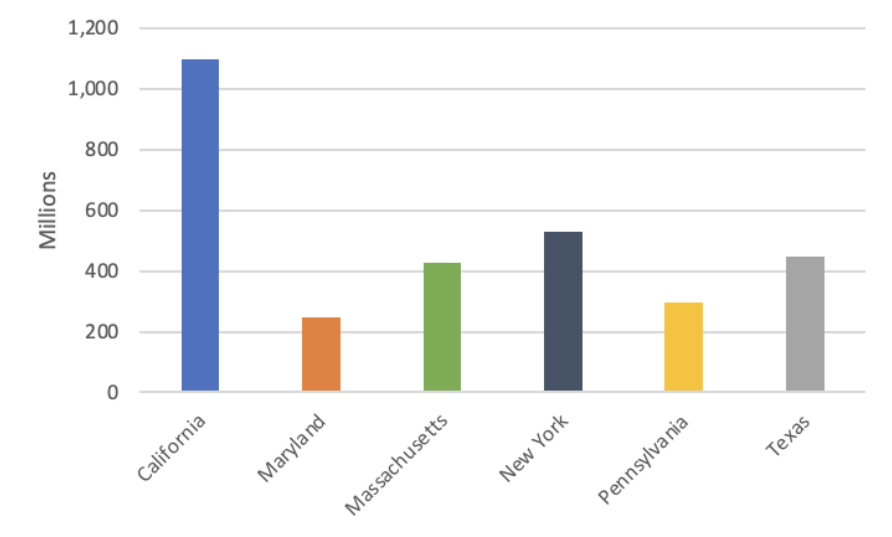
Figure 10: Nonprofit Funds to Higher Education

A. Source of Funds for Basic R&D Expenditures at Universities and Research Institutes (2020 estimate; current billions of dollars)



NOTE: Reprinted from Analysis of NSF data by France Cordova for Boston Tech Hub Faculty Working Group.[26]

B. Top 6 Recipients by State of Funding from Nonprofit Organizations for Higher Education: 2019

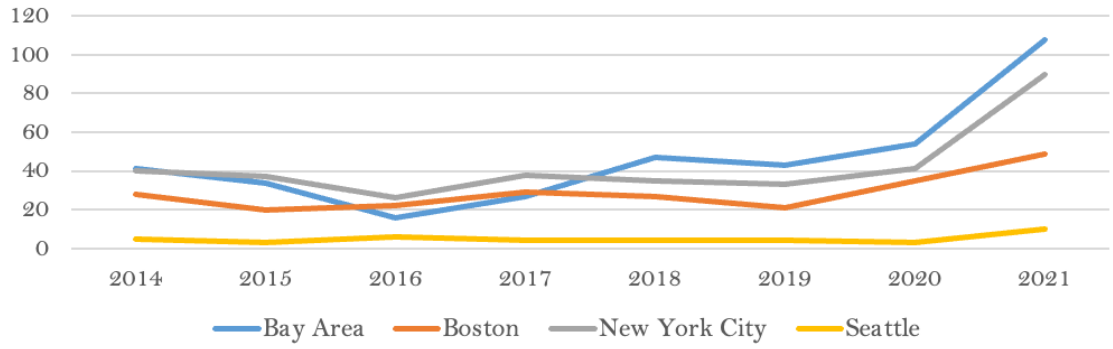


Key Performance Indicators

Initial Public Offerings (IPOs)

The Bay Area and New York City led IPO activity in the 2014-2021 period, with Boston appearing to fall behind during the pandemic years of 2020-2021 (Figure 11). The Bay Area gained a lead over the second-placed New York City in 2018 (47 and 35 IPOs, respectively). The Bay Area has maintained this lead since then. Boston has fallen behind the Bay Area and New York since 2018. In 2021, the Bay Area, New York, and Boston had 108, 90, and 49 IPOs, respectively.

Figure 11: Tech hub comparison in terms of number of IPOs.*

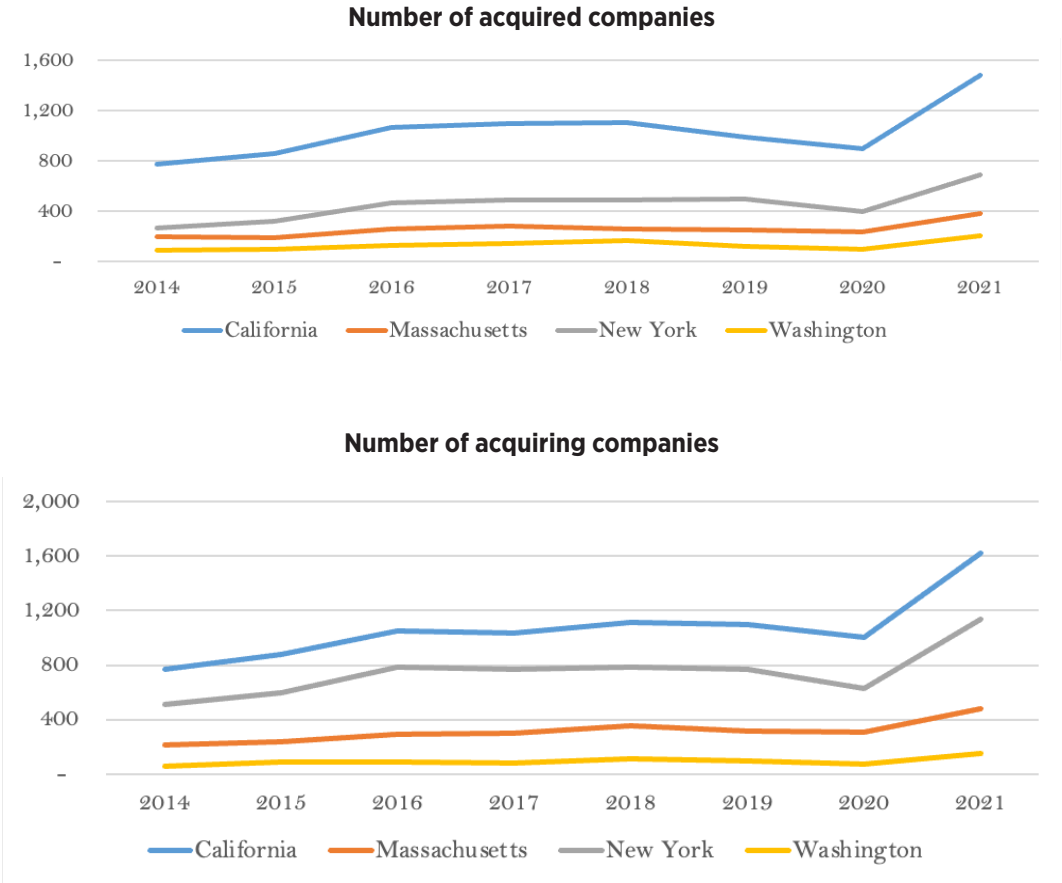


Company Acquisitions

California dominated acquisition activity in the 2014-2021 period. Massachusetts lagged behind California and New York but surpassed Washington (Figure 12).

- In terms of the number of acquired companies (2014-2021), California led the next nearest competitor by at least 500 companies in all years. In 2021, Massachusetts (384) trailed behind California (1,480) and New York (692).
- In terms of the number of acquiring companies (2014-2021), California led its nearest competitor by at least 200 acquired companies in all years.As of 2021, Massachusetts (483) lagged California (1,625 companies) and New York (1,140 companies).

Figure 12: Number of Acquired and Acquiring Companies.



NOTE: Some of these acquisitions may be talent acquisitions, with the acquired companies shut down following the acquisition.

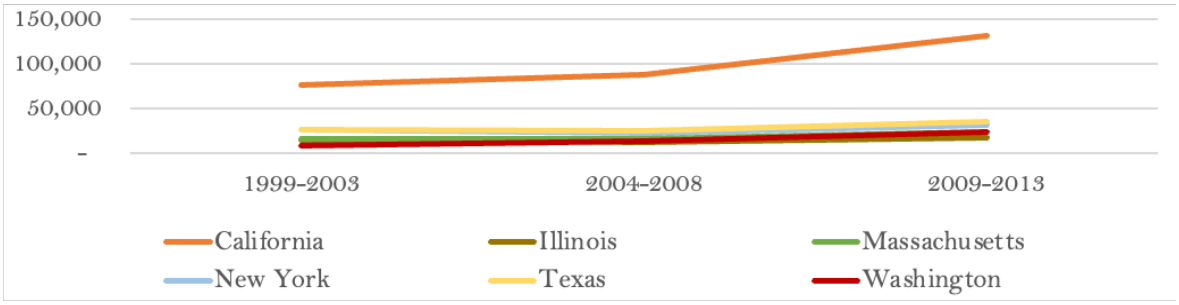
Patents Comparison by State[27]

Massachusetts trailed California, Texas, and New York in corporate utility patents and was in close competition with Washington (Figure 13.A). Based on corporate utility patents, California's dominance increased substantially, going from around 80,000 patents in 1999-2003 to around 130,000 patents in 2009-2013. In this time, Massachusetts' numbers increased gradually to slightly over 20,000 patents. Massachusetts trailed behind even New York and Texas. Washington caught up with Massachusetts.

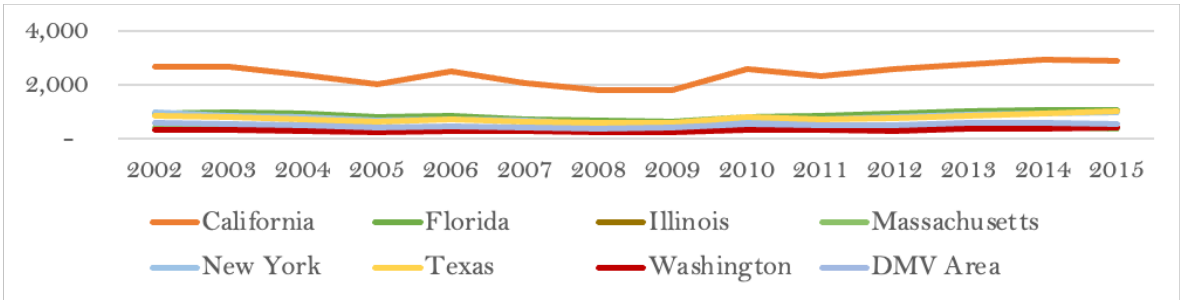
Based on independent investor utility patents, California's lead remained stable, with over 2,000 patents per year on average (Figure 13.B). Massachusetts was in close competition with Washington, with less than 500 patents per year. Both these states trailed behind Florida, New York, and Texas (shown in the figure) as well as the DMV Area, Illinois, Michigan, New Jersey, Ohio, and Pennsylvania (not shown in the figure in the interest of brevity and clarity).

Figure 13: Corporate Utility Patents and Independent Investor Patents by State.[28]

A. Corporate utility patents for leading states



B. Independent investor utility patents for select states*.



** The following states are omitted in the interest of brevity and clarity of the graphic despite having higher numbers of patents than Massachusetts as of 2015: Michigan (453 patents), New Jersey (444 patents), Ohio (367 patents), Pennsylvania (362 patents).*

The Shifting Geography of Tech Hubs

Large VC investors are starting to focus on geographic areas other than traditional tech hubs. VC investment growth in states like Michigan (885.1%), North Carolina (409.6%), and Colorado (304.1%) has outpaced traditionally dominant states like New York (41.2%), California (119.7%), and Massachusetts (157.3%) from 2016-2020.[29] The steep growth rates in these states have not made them direct competitors to the traditionally funded hubs; for example, North Carolina received $4.1B in VC investment in 2020, less than one third of the VC investment in MA ($15.9B). While California, New York, and Massachusetts still secure a disproportionate level of VC investment, slowing growth rates indicate a greater decentralization of this crucial funding. Greater investment in secondary markets will create new competition outside of the traditionally dominant tech hubs.

The increased geographic spread of R&D investment has been discussed much in recent years, including before the pandemic. **In the years preceding the pandemic,** traditional tech hubs saw steady, if slowing, growth in tech sector jobs, and a few emerging tech hubs like Atlanta, Dallas, and Denver saw comparable growth. However, since the beginning of the pandemic, the traditional tech hubs have experienced substantially lower growth rates in tech jobs, and Boston has lost tech jobs. At the same time, other medium and large metro areas saw their 2020-2021 tech job growth rate outpace their 2015-2019 growth rate. This spread of tech jobs across the country demonstrates the effect that the pandemic and distributed work are having on the innovation and tech ecosystems.[30]

What is Driving These Changes?

A contributing factor for the exodus of workers and companies from traditional tech hubs is the rise of remote and distributed work as a result of the COVID-19 pandemic. While the decline of traditional tech hubs like the Bay Area is a topic of discussion that predates the COVID-19 pandemic,[31] the substantial growth in remote work has been reflected in strengthening these pre-pandemic trends. Traditional tech hubs saw greater outflows of human capital during the first year of the pandemic than other major cities. Other cities saw declining outflow rates and a few saw growth during the pandemic.[32]

Most of these people moved to relatively close (<100 miles away) locations. But the disparate rates of exodus between established tech hubs and other cities suggest that remote work is contributing to decentralized tech work. At the same time, research that studied neighborhood choice after COVID found that graduate students, including in Boston, favored neighborhoods where they have social and professional networks (together with a preference for lower rent and farther from the city center).[33] This tendency could help sustain Boston's talent pool, given the city's large population of students.

Current trends suggest that investors, companies, and tech workers are becoming increasingly willing to explore non-traditional tech hubs and to explore areas or groups that had not previously been prioritized. These emerging hubs do not appear to share much in common in terms of geographic location and size. However, they each represent a more affordable location than the traditional hubs.[34] The rise of remote work has made it more feasible for startups in small cities to attract investors without having to relocate to traditional hubs.

The established tech hubs remain dominant in absolute terms but are being outpaced in growth rates of tech jobs, IPOs, and investment. This suggests that the next several years may feature toward a more decentralized innovation ecosystem in America. While the established tech hubs will remain important centers of innovation, new metro areas will be added to their ranks.

For Boston, these trends imply the following:

- While Boston continues to receive a large amount of private investment in innovation, VCs and other investors are finding increasingly competitive investment targets outside of Boston, and are following innovations and entrepreneurs to other tech hubs. A number of VCs have moved from Boston to the West Coast and other tech hubs (e.g., New York).
- In response, stakeholders invested in sustaining the Boston tech hub should focus on increasing the number of attractive startups in Boston. Private investors will follow these attractive investment targets.

Policy Tools and Recommendations to Better Attract Private Funding

As described in the introduction, in addition to direct investments in R&D, a myriad of interdependent policy tools support innovation. Federal,State, and Local governments, universities, non-profits, and other companies can all promote and support tools that would foster innovation and entrepreneurship. These tools include, but are not limited to, tax incentives, investment and access to infrastructures, loans, regulation, IP protection, grants, and mentorship.

This section covers some prominent policy tools aimed at supporting and sustaining innovation, with a focus on policies that seek to attract businesses investments for R&D or support local entrepreneurs to develop and scale their innovations. Each policy tool might address different desired outcomes or tackle a specific obstacle or gap encountered by the private sector. We acknowledge that the efficiency of these

tools is debated and that some are long-term tools that will require time and other conditions to materialize.

The factsheet ends with a snapshot of the Life Sciences Initiative adopted by the Massachusetts Legislature. This initiative incorporated several policy tools into a long-term integrated approach to support and strengthen the local ecosystem.

Tax incentives: These are among the most common tools used by the Federal and local governments to support business investment in innovation and entrepreneurship:[35]

Governments worldwide adopt various tax policies to promote **R&D investments by businesses**.[36] The adoption of similar instruments is quite common at the US federal, state, and local level.[37] While this incentive could come in different forms (such as credit, deduction, exemption, allowance, reduced rates, etc.[38]), its shared purpose is to reduce the cost of investing in R&D and thus create an incentive for businesses to invest more.

There are several justifications for governments to "subsidize" R&D investment. Some research shows a correlation between R&D tax incentives and entrepreneurship and innovation,[39] which in turn could promote economic growth and job creation. Businesses may need incentives to increase investments in R&D as such investments sometimes represent high risk or come with concerns of knowledge spillovers. In addition, the growing competition between tech-hubs (both internationally and nationally) pushes states to take measures to reduce the costs of doing business in their region by using tax incentives.[40]

Tax incentives could be used to promote specific policy goals: the credit could focus on jobs by offsetting the costs of the wages of R&D related employees. It could support marginalized communities by offsetting the costs of small businesses or of facilities located in specific zones. Such an incentive could be industry-oriented to promote other policy goals, as was the case with the Massachusetts Life Sciences Initiative. Local governments can also encourage investments in R&D through credit for investing in certain R&D activities (Investment Tax Credit - ITC).

Table 4: State Comparison of Tax Credit Policies

State Comparison of Tax Credit Policies *✓ and X indicate that a state has or does not have the relevant tax credit policy respectively*				
State	**MA**	**CA**	**WA**	**NY**
R&D Tax Credit	✓	✓	X	✓
ITC	✓	X	X	✓

Tax incentives that focus on investors. Young companies or startups often encounter significant constraints raising capital investments due to the risky nature of the innovative activity, their lack of collateral, and the information asymmetry regarding their activity. This is often the case for knowledge-based startups that require capital investment for R&D.[41] Sophisticated investors such as Venture Capital or angel investors can bridge the financing gap by investing in these startups while expecting high returns in the future. Tax incentives are used to encourage such necessary and "risky" investments. For example, many states have introduced tax credits for capital gains incurred from an investment in early-stage companies ("seed investment").[42]

Table 5: State Comparison of Angel Investor Tax Credits

State Comparison of Tax Credit Policies ✓ and X indicate that a state has or does not have the relevant tax credit policy respectively				
State	**MA**	**CA**	**WA**	**NY**
Angel Investor Tax Credit	Partial	X	X	✓

Other tax incentives can include preferential treatment for equipment used for R&D purposes (for example, through deductions) and reduced sales tax or property tax related to R&D. Some countries also apply a special tax regime to revenues from patents to encourage investment in R&D.

- **Policies for Further Research - expand tax credit for R&D at both the federal and state level.** The Federal Government extended the tax credit for R&D without limitation in 2015[43] after a period of temporary extensions. However, the U.S indirect investment in R&D is still below the OECD average (6.4%) and has lagged since 2003.[44] **An increase in this credit may incentivize further private investment in R&D.** Massachusetts also granted a tax credit for private investment in R&D and used this tool to support the Life Sciences Initiative. **Massachusetts should explore whether additional credits for industries in which Boston is lagging could increase Boston's competitiveness in these industries.**

Funding, loans, grants: Tax incentives for companies are a form of subsidy as the government forgoes "its part" in the company's income. Hence, these incentives are usually targeted at companies with taxable income. Therefore, these incentives are not necessarily as efficient for young startups.

Another policy tool to encourage companies to invest in R&D or other activities to foster innovation is direct funding, such as seed money that can help entrepreneurs or young startups explore their product or prototype (it can also be in the form of investment), secured loans, or in-kind grants. This could also include an increase in government funding for basic research, which has declined as a share of national GDP over the last several decades.[45]

- **Recommendation: provide loans, grants, or in-kind support for startups.** Local governments can give loans or secure loans for startups and young companies.This could also include grant-making for a specific purpose or industry that the state wishes to foster (for example, to an industry in which Boston is lagging). Local government and universities could also designate available space or equipment for the use of entrepreneurs in the area.

Enabling environment: The aforementioned tools offer companies or investors a set of incentives to further explore their innovative ideas and invest in R&D. However, the ability to perform such activities is dependent on a set of additional wide-ranging factors: talent, affordable and sufficient office spaces, and in the case of Boston, labs and other scientific infrastructure,[46] stable regulation, IP regimes, labor laws, etc.

Encourage Skilled Worker Immigration: Skilled employees are essential to sustain a tech hub. However, there is growing competition for these employees. The federal government, state government, and universities could play a role in Boston's competitiveness for talent, though short-term policy options are limited. H1-B visas are the largest skilled worker visa and are the main tool used to draw skilled immigrants to the country. However, there is a cap on the number of visas issued every year (65,000, with an additional 20,000 eligible for the US advanced Degree Exemption).[47] H1-B visas are also employer-based. Individual companies apply for the visa on behalf of an identified prospective employee. The firm bears the cost of the visa application.[48] A person with an H1-B visa can switch employers, but the process can take several weeks and cost the new firm several thousand dollars.[49] The long wait and high fees incurred by switching employers may hamper H1-B visa holders' ability to join innovative companies.

Recommendations:

- Encouraging high-skill worker immigration is a relatively efficient way to increase the country's human capital. Immigration has been shown to contribute both to innovation and wage growth at the local level in the long term.[50] **Therefore, the federal government should consider raising the H1-B visa cap and making them more easily portable between firms with reduced additional fees.**[51]

- An interim solution, especially for young ventures, **could be to encourage programs such as the "Global Entrepreneur in Residence (GEIR) program".** This program enables entrepreneurs to work part-time at the University of Massachusetts and use the rest of their time to develop their products or company. These entrepreneurs hold H1-B visas and since universities are exempted from the annual H-1B quota, there is more flexibility in applying for this type of visa.[52]

Quality of living and flexibility: The ability to sustain a tech hub also depends on the cost of living and quality of life in the area, including commutes, the education system, etc. These latter factors, though

beyond the scope of this factsheet, are vital for maintaining talent in the region, especially with growing competition from emerging tech hubs. Of note, factors like cost of living are a particularly difficult challenge to tackle in the short term, as is the case in the Boston area.[53] In this case a city or state has greater incentives to use the more immediate tools (like tax incentives, funding, loans, and grants) to encourage tech companies, entrepreneurs, and talent to remain in the area.[54]

Recommendations:

- **Survey graduate students, founders and local entrepreneurs to better understand the factors that drove them to stay or leave the Boston area.** It is crucial to learn what influences the choices of these employees and design adequate policies that correspond to these needs. For example, are employees interested in more work flexibility but are currently being limited by non-compete clauses?[55] Do employees look for proximity to their work or an efficient commute? Are they interested in a hybrid model of work? To better compete for talent, both the public and the private sector in Boston should understand the factors that drive talent to choose one hub over the other (through surveys, interviews, etc).

Foster scientific innovation, and also commercialization: Boston has some of the best universities in the world, which yield many scientific discoveries as well as technological ventures. Moreover, a recent survey shows that Harvard and MIT are at the top of the list of schools producing funded founders.[56] However, these ventures will not necessarily remain in Boston. Many of those that remain will encounter difficulties in scaling. The government, universities, and the private sector could improve the translation of scientific, lab-based innovation to commercialization:

Recommendations:

- **Improve training and mentorship for scientists and founders:** There are existing federal programs (e.g., I-Corps) that increase the impact of scientific discoveries. Similar programs could be facilitated at the local level too. It is important to provide mentorship and training to entrepreneurs. This could be achieved through collaboration with universities (e.g., the work of The Engine) and accelerators and incubators.
- **Create hubs for sharing and learning:** Founders, innovators, and scientists could benefit from interactions among themselves to accelerate the learning and growth process of businesses. Local governments and universities could use their convening power to facilitate important interactions and amplified innovation, in addition to providing space and infrastructure to gather and collaborate.[57]

Case Study: Massachusetts' Life Sciences Initiative

Introduction: Compared to the federal government and the private sector, state and local governments play relatively minor roles in funding R&D. However, the adoption of some of the aforementioned policies by state/local governments could supplement the efforts of both the federal government and the private sector. This would help to efficiently support the growth of a local innovation cluster or sustain a comparative advantage of the area. This, in turn, could catalyze a self-sustaining and perpetuating ecosystem creating an attractive hub for private investors, talent, and other supporting services.

An example of such an approach is Massachusetts' Life Sciences Initiative. Through this initiative, local legislators adopted a long-term integrated approach to innovation.

We focus on this initiative as it presents a meaningful case study about the private and public sector's roles in sustaining and promoting a local ecosystem. In this case, the local government recognized the life sciences as a strength in Boston's ecosystem and combined policy tools to supplement the efforts by the private sector. This case study could, therefore, inform policymakers and the private sector as they are working to diversify Boston's tech industries and create new stable clusters. Lastly, it could also be useful to examine how these policies could benefit industries in which Boston is lagging.

About the initiative: From 2008 - 2018 the initiative dedicated $1 billion of investment over 10 years to support and cement Massachusetts's life sciences cluster. This program is implemented by the Massachusetts Life Science Center (MLSC), a quasi-governmental institution established by legislation. The initiative enlists some of the aforementioned policy tools to achieve its goals, e.g., tax incentives, capital funding, loans, etc. The program grants broad discretion to MLSC in executing these policy tools. Over the years, MLSC has promoted various programs to strengthen the life science industry in Massachusetts, including:

- Tax-Incentive Program – in addition to MA's R&D credit, the center has a tax incentive program for companies that meet certain criteria (e.g., job creation) and also for angel investors.
- Research Infrastructure Program – provides grants for capital projects that support the life sciences ecosystem in Massachusetts by enabling and supporting life sciences R&D.
- Internships and Apprenticeships Program – provides funding for research institutions and companies to hire paid interns.
- Grants, loans, and seed money, with a focus on small businesses.
- Incubators, accelerators, research facilities, and co-working spaces.
- Support for entrepreneurs, and early-stage and scaling companies.

Potential Discussion Question/Topics

Local Government Strategy. What is the role of state and local governments in attracting business to Boston? Should Massachusetts and/or Boston invest in a new "Life Sciences Initiative" style long-term investment for a field outside of the life sciences? If so, in which industry should Massachusetts and/or Boston invest?

- **Attracting private funding.** Massachusetts seems to be falling behind New York and Texas in terms of acquisition activity and numbers of corporate and individual patents. In addition to federal funding, what type of private funding (business vs. VC vs. philanthropic) is best placed to address this shortfall? And how should Boston attract this kind of funding?
- **Attracting both startups and established firms.** Boston has a vibrant, innovative community of startups, scientists, and other small firms. In the past, this vibrant community attracted big firms to Boston that wanted to be close to scientific breakthroughs and innovations. How can Boston continue to attract large established firms while also investing in small (but maybe risky) companies that, in turn, will attract companies that can invest in more scientific research?

Future of Work. How can policymakers use the increasing geographic spread of innovative jobs and investments to increase diversity and inclusion within various technology fields?

- **Mitigate negative effects.** What are the second and third-order effects of the geographic spread of innovation jobs in metro areas?
    - How can policymakers attract these new opportunities while addressing the needs of underserved communities and the risks for displacement caused by gentrification?

Annex 1: Definitions of the Funders and Recipients in the Tech Ecosystem

NOTE: Unless otherwise noted, the definitions below are from the Pitchbook report, "What are private markets?"[58] Some definitions have been slightly modified to meet the scope of this factsheet.

Funders.

- **Venture capital firms.** Using capital raised from limited partners (see limited partners below), venture capital (VC) firms fund and mentor startups or other young, often tech-focused companies in exchange for equity. If a company the VC firm has invested in is successfully acquired or eventually goes public, the firm makes a profit. The firm could also make a profit by selling some of its shares to another investor in what is called the secondary market. Investors working at a venture capital firm are called venture capitalists.
- **Corporate venture capital.** Corporate venture capital (CVC) is a subset of venture capital in which large companies strategically invest in startups—often those operating within or adjacent to their core industry—to gain a competitive advantage or increase revenue. Unlike VC investments, CVC investments are made using corporate dollars, not through contributions from limited partners.
- **Private equity firms.** Like VC firms, private equity (PE) firms invest in businesses to increase value over time before eventually selling at a profit. In contrast to VC firms, PE firms often take a majority stake— meaning 50 percent ownership or more—in mature companies in traditional industries. This practice, however, is changing as PE firms increasingly buy out VC-backed tech companies.
    - Limited partners. Limited partners (LP) have a passive role with "limited" say in a fund's operational activities. Examples of LPs include institutional investors (e.g., pension funds, foundations, endowments, banks and insurance companies) and family offices and high-net-worth individuals (HNWIs). The bulk of capital for venture funds comes from pension funds.[59] Limited partners that are large institutions (like pension plan providers) must steadily increase their cash reserves to financially provide for the large groups of people they serve. They do this (in part) by committing capital to funds raised by VC or PE firms, who then invest in promising companies and provide financial returns.
- **Angel / Seed Stage Investors.** An angel and seed stage investors provide a high net-worth individual who provides capital to an early-stage startups in exchange for equity.
- **Incubators and Accelerators.** Incubators and accelerators are competitive programs that

offer entrepreneurs financial support, connections, mentorship, working space, and technical resources, usually, in exchange for a minority stake in their business.

- **Mutual Fund.** Mutual funds are investment strategies that allow an investor to pool their money together with other investors to purchase a collection of stocks, bonds, or other securities.[60]

Funder or Recipient, situation-dependent

- **Private companies.** A private company is a company that is not listed on a stock exchange or otherwise publicly traded. Its shares are owned by the founders, the employees, or some outside investors (like VC firms), and are not available for the public to purchase.
- **Public companies.** A public company is a company whose ownership – usually in the form of shares – is publicly traded in some way. Although public and private companies operate within different sectors, crossover is common. A public company can become private in what is known as a public-to-private buyout, something that occurs when investors, founders, or management buy back publicly issued shares, thereby removing the company from the stock exchange. Public companies also often purchase private companies to grow or compete, and many private companies aim to eventually go public.

Recipients

- **Startups.** A startup is a fast-growing private company in an early stage of development. Often led by entrepreneurial founders who have built a new product or service in response to a market need, startups rely on funding from investors (like VCs or PEs), grants from donors, or early revenue generation to scale and grow.
- **Unicorns.** A unicorn is a startup valued at $1 billion or more. Once relatively rare, unicorns have become more common as startups stay private longer, securing higher and higher valuations with each new round of funding.

Annex 2: Methodology

Figure 1: Participants in the Tech Ecosystem

1. Drawn directly from "Deep Tech Ecosystems" by BCG and Hello Tomorrow
2. Available at: https://www.bcg.com/capabilities/digital-technology-data/emerging-technologies/deep-tech.

Figure 2: Total Business Enterprise R&D Spending by CBSA from 2015-2018 AND

Figure 3: Growth Rates in Business R&D by CBSA from 2015-2018.

1. This data is compiled from the Business Enterprise Research and Development (BERD) survey conducted by the U.S. Census Bureau.
2. 2018 data are the latest available, with new data expected to be released in Fall 2022.
3. CBSA data are not available in 2014, so our analysis focused on 2015-2018.
4. There is **no more granular spending data available at this level**, focusing on either industry spending or spending along the R&D pipeline. We contacted the survey author who confirmed this.[61]
5. We attempted to find a detailed breakdown of Business R&D by industry, but could not find detailed reports for each tech hub. We did discover details on MA's innovation economy in the biotech sector.[62]

Figure 4: Venture Capital (VC) Fundraising Activity.

1. Drawn directly from Pitchbook-NVCA Venture Monitor, Q3 2021.
2. Available at: https://nvca.org/wp-content/uploads/2021/10/Q3_2021_PitchBook-NVCA_Venture_Monitor.pdf

Figure 5. Tech hub comparison in terms of number of investors and investment targets (as of April 2022)

1. In the Crunchbase database, go to "Search Companies".
2. Select the "Investors" tab.
3. In the "Overview" filter, enter the name of focus metro area.
4. In the "Investments" filter, enter the name of focus metro area.
5. Export data to csv.
6. In Excel, calculate the number of investors for different metrics.

Figure 6. Tech hub comparison in terms of number of investments into local startups at each stage of investment / fundraising by companies (as of April 2022).

1. Complete steps 1-3 as noted for Figure 7.
2. In the "Investments" filter, select the focus funding stage.
3. Complete steps 5-6 as noted for Figure 7.

Figure 7. Tech hub comparison in terms of number of locally-based investors in key high-tech industries (as of April 2022).

1. Complete steps 1-3 as noted for Figure 7.
2. In the "Investments" filter, select the focus industry.
3. Complete steps 5-6 as noted for Figure 7.

Figure 8. Tech hub comparison in terms of entrepreneurial ecosystem: number of accelerators, incubators, university programs, entrepreneurship programs, and startup competitions (as of April 2022).

1. Complete steps 1-3 as noted for Figure 7.
2. In the "Overview" filter, select the type of organization (accelerator vs. incubator vs. etc.).
3. Export data to csv.
4. In Excel, calculate the number of organizations for different metrics.

Figure 9: U.S. R&D Expenditures by Source of Funds: 2019

1. Drawn directly from: Boroush M; National Center for Science and Engineering Statistics (NCSES). 2021. New Data on U.S. R&D: Summary Statistics from the 2019–20 Edition of National Patterns of R&D Resources. NSF 22-314. Alexandria, VA: National Science Foundation.
2. Available at https://ncses.nsf.gov/pubs/nsf22314.

Figure 10: Nonprofit Funds to higher Education

1. Presented by France A. Córdova at Boston Tech Hub Faculty Working Group meeting held on 3/1/2022
2. Source of Data NSF National Pattern of R&D Resources: 2019-2020 Data Update (February 2022) https://ncses.nsf.gov/pubs/nsf22314

Figure 11: Tech hub comparison in terms of number of IPOs.

1. From the Crunchbase database, download data on all the organizations undergoing IPOs during the focus years, in each focus Headquarters (Headquarters = Focus MSA).
2. Export data to csv.
3. In Excel, calculate the number of IPOs in each year in each focus MSA.

Figure 12. Number of Acquired and Acquiring Companies.

1. In the Crunchbase database, go to "Search Companies".
2. Select the "Acquisitions" tab.
3. In "acquired company" or "acquired company" filters, enter the name of focus state.
4. Export data to csv.
5. In Excel, calculate the number of acquired or acquiring companies per year for each state.

Figure 13. Corporate Utility Patents and Independent Investor Patents by State.

1. Download utility patents data for Corporates and Independent Investors for focus States from the USPTO portal
2. Plot chart in Excel.

Endnotes

1 See for example the discussion about the interaction between these factors in the interview with the authors of "Jump-Starting America", Jonathan Gruber and Simon Johnson, where they also discuss Kendall square: https://mitsloan.mit.edu/ideas-made-to-matter/to-jump-start-america-invest-a-lot-science

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31 "Why Startups Are Leaving Silicon Valley," The Economist, August 30, 2018, https://www.economist.com/leaders/2018/08/30/why-startups-are-leaving-silicon-valley.

32 "COVID-19 Impact on Migration Patterns," CBRE, April 1, 2021, https://www.cbre.com/insights/reports/covid-19-impact-on-migration-patterns.

33 Ferreira, Fernando V., and Maisy Wong. Neighborhood Choice After COVID: The Role of Rents, Amenities, and Work-From-Home. No. w29960. National Bureau of Economic Research, 2022. (hereinafter - Neighborhood Choice After COVID)

34 Rivero, Nicolás. "Silicon Valley's Iron Grip on Venture Capital Is Slipping." Quartz. Accessed May 23, 2022. https://qz.com/1967972/silicon-valleys-iron-grip-on-venture-capital-is-slipping/.

35 States and countries can differ in the tax instruments they use (for example, credit vs. deduction), the rate of the tax benefit, and the terms to enjoy it. Therefore, the comparison between states was kept to the mere question of the existence of the tool. See for example the following review.

36 In 2021, 34 out of 38 OECD countries offered R&D tax incentives at central or subnational government level - OECD R&D tax incentives database, 2021 edition.

37 26 U.S. Code § 41 Credit for increasing research activities. See Federal Funding factsheet for an elaboration on the Federal Tax Credit for R&D.

38 Tax allowances, exemptions, and deductions subtract from the tax base before the tax liability is determined, reducing the taxable amount before the tax liability is calculated. A tax credit is an amount subtracted directly from the tax liability after the liability has been calculated.

39 See, for example, Fazio, C., Guzman, J., & Stern, S. (2019). *The impact of state-level R&D tax credits on the quantity and quality of entrepreneurship* (No. w26099). National Bureau of Economic Research

40 Some research indicates that R&D tax incentives do not necessarily increase total investment in R&D but rather lead to a relocation of activity. See: Bloom, N., Van Reenen, J., & Williams, H. (2019). A toolkit of policies to promote innovation. *Journal of economic perspectives*, 33(3), 163-84.

41 Ibid.

42 Kovalevich, A. A., and A. A. Kuznetsova. "The Use of Innovative Financial Instruments for Financing Small and Medium Businesses" OECD (2018).

43 Through The Protecting Americans from Tax Hikes Act (the PATH Act).

44 "Measuring Tax Support for R&D and Innovation: Indicators - OECD," accessed May 3, 2022, https://www.oecd.org/sti/rd-tax-incentive-indicators.htm.

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46 For example, see a comparison of the tax rates on R&D facilities: https://taxfoundation.org/location-matters-effective-tax-rates-rd-facilities-state/

47 "USCIS Reaches Fiscal Year 2022 H-1B Cap | USCIS," February 28, 2022, https://www.uscis.gov/newsroom/alerts/uscis-reaches-fiscal-year-2022-h-1b-cap.

48 "H-1B Visa Fees 2022-23: Extension, Amendment & Transfer Cost [Updated 3/28/22]," VisaNation, March 28, 2022, https://www.immi-usa.com/h1b-visa-processing-fees-2016/.

49 "How to Change Jobs on an H-1B Visa | Prodigy Finance," accessed May 3, 2022, https://prodigyfinance.com/resources/blog/job-change-h1b-visa/#:~:text=So%2C%20the%20good%20news%20is,find%20yourself%20out%20of%20status. Startups and small businesses especially may find the costs and wait times for H1-B visas to be burdensome.

50 Konrad Burchardi et al., "IMMIGRATION, INNOVATION, AND GROWTH," *National Bureau of Economic Research*, no. Working Paper 27075 (November 2021), https://www.nber.org/system/files/working_papers/w27075/w27075.pdf.

51 There has been debate around the use and justification of H1-B visas, which were intended to bring in the best and brightest workers from abroad. Some argue that the wage calculations are used to bring in cheap labor to undercut American wages by outsourcing firms. While this issue is nuanced, reducing the barriers to visa holders changing employers will likely help not hurt America's innovation economy. See: Nicole Torres, "The H-1B Visa Debate, Explained," Harvard Business Review, May 4, 2017, https://hbr.org/2017/05/the-h-1b-visa-debate-explained.

52 Brah, W "How Does the Massachusetts Global Entrepreneur in Residence Program Work?" see: https://vdc.umb.edu/2019/04/20/how-does-the-massachusetts-global-entrepreneur-in-residence-program-work/#:~:text=The%20program%20gives%20an%20entrepreneur,of%20the%20University%20of%20Massachusetts.

53 Boston is ranked 3 in the Zamper national rent report, after New York and San Francisco

54 See a parallel discussion about the increasing cost of living in California: Melaas, Aaron Charlotte Kesteven and Matt Hortom. "Sustaining California's Innovation Economy Through Investment in R&D." (2021).

55 For example, California banned the use of non-compete agreements in the 1990s, which freed workers to move between companies.

56 Joanna Glasner, "Stanford, Harvard, MIT still Top The List Of Schools Producing Funded Founders" Crunchbase News, May 17, 2021,

57 City and state officials in Boston have at times focused on creating an ecosystem of innovators, entrepreneurs, and investors: this was the initial intention in creating the "innovation district" in South Boston Seaport and the development of Kendall Square in Cambridge. See: Drucker, Joshua M., Carla Maria Kayanan, and Henry C. Renski. "Innovation Districts as a Strategy for Urban Economic Development: A Comparison of Four Cases." Available at SSRN 3498319 (2019). The analysis also suggest that the rise in real estate prices in the seaport failed the idea of attracting startups to the area

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