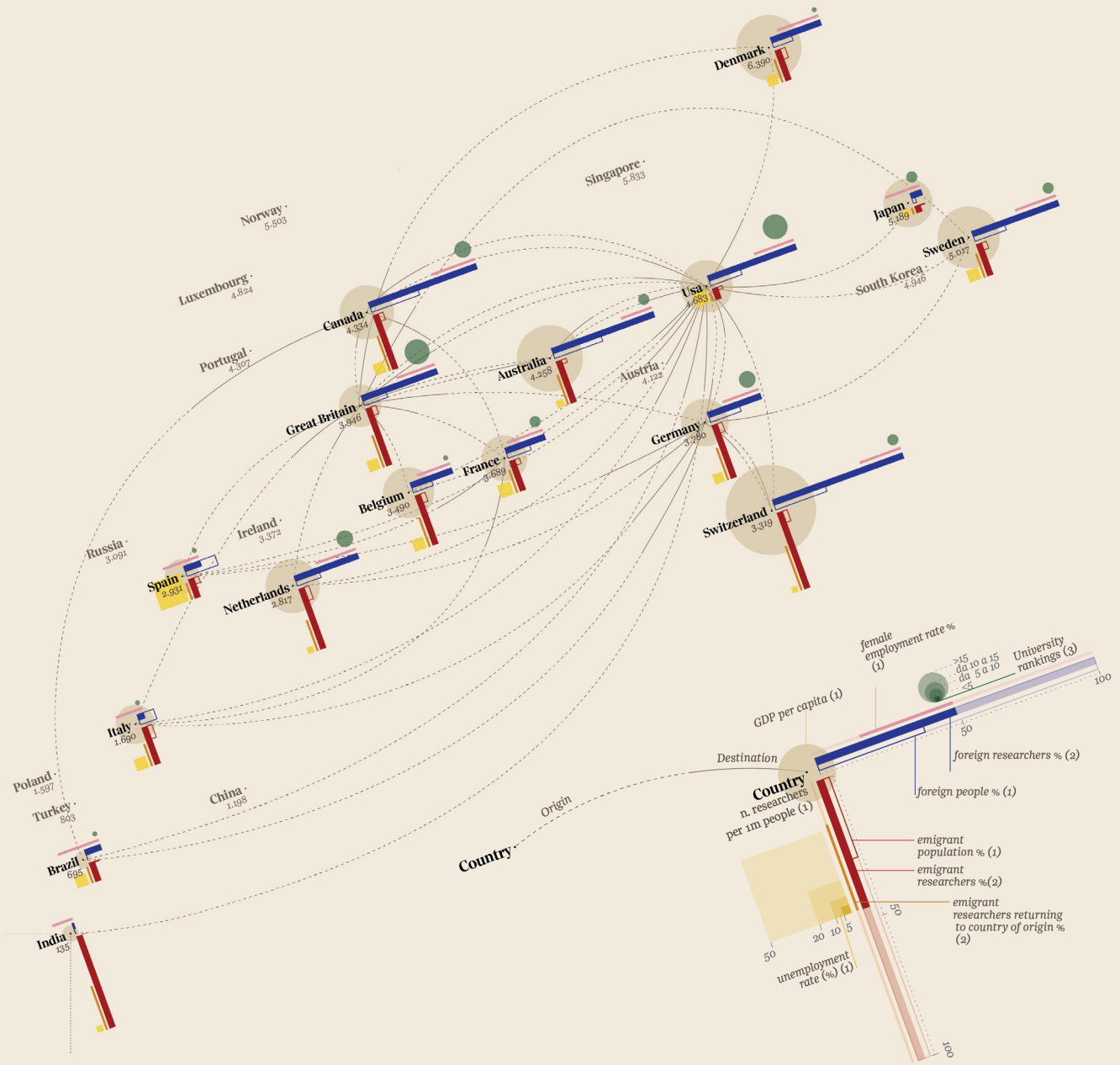


Retaining Recent College Graduates in Boston: Is There a Brain Drain?

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Introduction

Boston and its metropolitan area are recognized globally for their world-class cluster of higher education institutions. The city and region include the densest concentration of colleges and universities in the U.S.¹, and of the twenty largest metropolitan areas, Boston has the highest concentration of jobs in educational services.² Boston's colleges and universities attract students from all over the country, as well as the world. Much like the city's world-renowned teaching and research hospitals, the higher education sector provides a large in-flow of dollars to Boston's economy and a significant number of jobs.

The city itself is home to 35 colleges and universities enrolling about 152,000 students.³ While Boston comprises only 10% of the state's population, it has 34% of the state's total college enrollment. The concentration of college and university students, as well as knowledge-based industries in the region, allows Boston to stand out among major U.S. cities⁴ in terms of having a well-educated young adult population. Boston ranks first in percentage of the population between the ages of 20 and 34 and fourth in the percentage of young adults with a college degree. Over half the college degrees held by Boston residents are held by someone between the ages of 20 and 34.

Nevertheless, a concern is often expressed about a "brain drain" and "low retention" of graduates from Boston's higher educational institutions. A preoccupation with "brain drain" and "retention" is understandable given that a large population of younger, high-skilled, highly educated workers is a key factor in driving a city's economic growth, vitality, and per capita incomes.⁵ Boston's ability to attract and retain college graduates is an important public policy issue. Over the last decade, two notable research reports attempted to understand "brain drain" and "retention" in Greater Boston. A 2003 report by the Boston Consulting Group (BCG) for the Boston Foundation and the Greater Boston Chamber of Commerce, titled "Preventing a Brain Drain: Talent Retention in Greater Boston," estimated that half of Boston's graduates leave the region and that four out of five of these departures are "avoidable," i.e., represent "a voluntary decision to live elsewhere." Examples of "avoidable departures" include moving for better job opportunities, because the area is unaffordable, in search of a "better city experience" and to return home. Essentially, the research defined any voluntary reason is "avoidable," which renders the term "avoidable" somewhat meaningless. A more recent study (2013) by Northeastern University for the World Class Cities Partnership, titled "Talent Magnets – Cities and Universities Building the Workforce

Visualization by Accurat (www.accurat.it) Giorgia Lupi, Simone Quadri, Gabriele Rossi, Davide Ciuffi, Federica Fragapane, Francesco Majno.

¹ For example, Boston has the highest ratio of college enrollment to population of U.S. cities with 500,000 or more residents based on 2010 US Census Bureau data.

² As measured by location quotients using 2011 data from the U.S. Bureau of Economic Analysis for the 20 largest metro areas.

³ Boston by the Numbers – Colleges and Universities: <http://www.bostonredevelopmentauthority.org/PDF/ResearchPublications//BBNCollegesUniversities.pdf>

⁴ "Major U.S. cities" are defined by population size.

⁵ Enrico Moretti, *The New Geography of Jobs*, Houghton Mifflin Harcourt, 2012.

for the Knowledge Economy,” also found that the area’s retention of graduates is about 50% on average.

Although used together, “brain drain” and “retention” are terms describing two very different phenomena. The first is generally understood as large-scale emigration of highly skilled individuals, typically provoked by lack of opportunities or by political instability. The term was first used by the Royal Society of England to describe the emigration of scientists from Europe to the United States after the Second World War. The term has also been used to describe the outflow of highly skilled professionals from Asia and Africa to Europe and North America. In the United States, the term is often used for describing migration patterns in which young native college-educated individuals leave older rust belt cities due to lack of economic opportunities.

The second term, “retention,” is not clearly defined in any of the aforementioned studies. Both refer to “retention” as the proportion of students who stay in Boston after graduation. However, neither study specifies how long a person needs to stay in the region after graduation to be considered “retained.” Obviously this can be problematic, as it suggests that if a graduate leaves the area at any point subsequent to graduation, he or she has not been “retained.” This simply is not a realistic way of understanding how workers interact with the labor market or how people choose to settle over the course of their lifetime.

In this paper we argue that neither “brain drain” nor “retention” is a good indicator of how well Boston’s economy performs with regard to its need for younger, college-educated workers. In contrast, we argue that:

- **What is most important to the vitality of the Boston and its metro area, or any area for that matter, is the size and share of the population made up of college-educated workers. As explained in greater detail later in this paper, there are multiple reasons why Boston may have a lower “retention” rate⁶ of graduates than other areas, most notably the fact that the region imports a large number of students from outside the region. Nevertheless, recent Census data show that Boston has high concentrations of young adults and college-educated young adults among all major U.S. cities;**
- **Previous research suggests that the availability of jobs (not housing costs, not amenities) is the most important fact in retaining recent college graduates.⁷ Further, our analysis suggests that Boston and its metro area produce far more graduates than job openings (on an annual basis) and it would be virtually impossible to absorb all (or even most) of the graduates into the labor market.**

⁶ Defined as the share of students who come to study in Boston and stay in Boston after graduation.

⁷ Alicia Sasser Modestino, Retaining Recent College Graduates in New England: An Update on Current Trends, Police Brief 13-2, New England Public Policy Center at the Federal Reserve Bank of Boston, May 2013.

This is not to deny that creating and maintaining a strong environment to retain and attract talented, skilled, younger workers is an important goal. But based on the latest available data, the problem of college graduate retention in Boston has likely been overstated, since there is much evidence of Boston's strength in growing its talented, highly educated workforce.

The first part of this paper addresses issues regarding the hypotheses advanced in studies by the Boston Consulting Group and Northeastern University and elsewhere about "brain drain" and "retention" of young college-educated workers in Boston. Next, we describe some of the misunderstandings subsumed under those hypotheses regarding the relationship between Boston's higher education sector and Boston's larger economy. Finally, we investigate the plausibility of retaining a great majority of the "avoidable" departures by examining the implications for population, labor supply, and housing market growth.

The research for this paper was conducted by the Boston Redevelopment Authority's Research Division in collaboration with the UMass Donahue Institute.

The “Brain Drain” Hypothesis

As noted above, the 2003 report by the Boston Consulting Group sounded a warning of the “brain drain” occurring in Greater Boston and the risks to its competitiveness. We treat “brain drain” and college-graduate “retention” as two distinct issues. The first has to do with a large-scale emigration of highly skilled individuals provoked, according to the BCG report, by shortages of economic opportunities, affordable housing, and public amenities. Retention, on the other hand, is defined as the degree to which a region keeps recent college graduates as residents following graduation. It is important to state here that a region could experience low or modest retention without suffering from a “brain drain.” For example, a region could have a significant and growing college-educated population, without retaining a large proportion of recent graduates, particularly if the location imports a large number of students.

Using data from the 2000 and the 2010 U.S. Census, we assess the size of the population ages 20-34. The hypothesis here is that if there is a “brain drain” in the region we should expect either a flattened-out or increasingly low proportion of younger, college-educated people in the population.

Boston’s population increased from 589,141 in 2000 to 617,594 in 2010, and the very latest estimate of population for the city for July 1, 2012 is 636,479.⁸ These growth trends for the city are well ahead of population change for Massachusetts overall, with 3.1% growth in just the past two years compared to 1.5% growth statewide. The population of younger age cohorts is especially on the upswing, with 11% growth of the 20-34 age cohort between 2000 and 2010.

The growth of the young adult population in Boston is undoubtedly related to the increase in college enrollment over the past decade, as the total college enrollment in Boston increased from 86,000 to 101,000 students in 2010. In fact, Boston has by far the largest proportion of resident college students of all major U.S. cities, with almost 16.5% of Boston’s total population enrolled in 2010. The next closest cities are Seattle, Washington DC, San Diego, Austin, Columbus, and San Francisco (all between 10-12%).

This influx of college students helps distinguish Boston as a young city. Today, 35% of Boston is between the ages of 20 and 34, the highest share of all major cities in the U.S. Only Austin, Washington DC, Seattle, and Columbus have 30% or more in this age cohort with cities like

⁸ Data in this section is primarily derived from the U.S. Census unless otherwise noted.

San Francisco (28%), Philadelphia (26%), and New York City (25%) considerably lower.

Given the large impact that currently enrolled college students have on the population size of Boston's young population, we also consider the 25-34 age cohort. This age group reflects a more "permanent" (relative to individuals currently enrolled in school) set of young workers including recent graduates, graduate students, established workers, and native residents. This age cohort experienced population growth of 2.7% from 2000 to 2010 and now represents 20.7% of the population.⁹ This ranks Boston third out of all major U.S. cities, with only San Francisco (20.9%) and Seattle (20.8%) slightly ahead of Boston.¹⁰ To be clear, these data about young adults say nothing about where they went to school. It is possible, even likely, that some recent graduates of Boston area schools left the region after graduation and were replaced by graduates from schools outside of the region. We argue that the number and share of younger, skilled workers, regardless of where they attended school, is the most important measure of a vibrant economy and that Boston clearly performs very strongly on this metric. In the last decade, Boston's population has grown both younger and more college-educated. For example, 40% of Boston's population hold a college degree, compared to 28% for the U.S. overall. Additionally, more than 50% of the 20-34 year olds in the region hold a college degree and more than half of Boston residents with a college degree are between the ages of 20 and 34. These are hardly signs of a mass exodus of well-educated young adults pushed out from the region due to the lack of economic opportunities, affordable housing, and public amenities.

⁹ For context, this modest growth rate for the 25-34 cohort placed Boston well-behind mostly Southern cities like Fort Worth, Charlotte, Austin, Nashville, and San Antonio. Boston's rate of growth for this cohort was ahead of New York City, Chicago, Los Angeles, San Francisco, and Detroit (which saw a staggering decrease of 40.1%).

¹⁰ An assessment of enrolled students in the 25-34 age cohort reveals that Boston does have a higher share of population enrolled in college than most major cities. Ignoring the large number of people likely enrolled in part-time programs as they work, nearly 17% of Boston is in the 25-34 age cohort, ahead of Chicago, New York, and Philadelphia and just slightly behind San Francisco and Washington DC.

The “Low Retention” Hypothesis

The Boston Consulting Group study (2003) arrived at a 50% retention¹¹ rate by conducting a survey of recent graduates from eleven institutions in the Greater Boston area. The Boston-based institutions included Boston University, Bunker Hill Community College, Emmanuel College, Northeastern University, Suffolk University, and the University of Massachusetts Boston. The institutions located outside city limits included Boston College, Lesley College, Massachusetts Institute of Technology (MIT), Tufts University, and Wheaton College. The survey received 2,100 total responses. To calculate retention rates, BCG asked students to identify the location where they plan to live after graduation. Of those who responded that they would leave Boston (50% of the total sample), 38% said they would return to their hometown, 16% would move to a “familiar” destination, and 46% would move to a “new” destination. BCG determined that four out of five of graduates leaving the region were doing so for avoidable reasons.¹²

As with the BCG study, the World Class Cities Partnership study estimated that slightly fewer than 50% of college graduates in greater Boston are retained in the area, with wide variation from institution to institution. This retention rate was estimated based on data gathered from LinkedIn, the online professional social networking website, regarding where students of Boston-area colleges and universities settle and work after graduation. The report acknowledges “the self-selecting and self-reported nature of the sample and cannot conclude that these data are statistically significant.” Consequently, it is wise to treat these findings with some caution.

Supposing these rates are accurate, we argue that retention is itself not a good indicator of how well the Boston economy meets the needs of young, college-educated workers. The appropriate measure should take into consideration not only the “retention” of young highly skilled graduates from local colleges and universities, but also the “attraction” of young highly skilled graduates from elsewhere. That is, how well Boston’s companies recruit the population of young highly skilled graduates they need regardless of where they went to college. In reality, employers do not care if a person received their degree from Harvard or Yale, from Northeastern University or the University of Texas. Rather, employers are concerned with the supply of skilled labor for the jobs that they need to fill. While there is some anecdotal evidence of employers being unable to hire skilled workers, job vacancy data do not suggest a significant skilled-labor shortage in the region.¹³

¹¹ As mentioned before, the term “retention” is not clearly defined. For example, there is no specification of how long a person needs to stay in the region after graduation to be considered “retained.”

¹² BCG also conducted a survey of alumni from Boston University and Northeastern University, but did not use this information when calculating retention rates.

¹³ Massachusetts Department of Workforce Development, 2012 Job Vacancy Survey, http://lmi2.detma.org/Lmi/JVS_b.asp?indoc=occ&Area=000004

It is helpful in this context to consider the relationship between Boston's higher education sector and Boston's larger economy. As mentioned earlier, Boston and its metropolitan area are home to the densest cluster of colleges and universities in the United States. Of the twenty largest metropolitan areas in the country, Boston has the highest concentration of jobs in educational services as measured by location quotients.

Boston's colleges and universities constitute an "export" cluster. The region attracts students from all over the country and the world and, after several years, exports college graduates to the national and global labor market. This process provides a large in-flow of dollars and jobs, all related to the global market rather than to Boston's economy. That is, Boston's higher education sector is driven by worldwide student recruitment and not by Boston's labor market needs. The number of students recruited, the number who graduate, and the set of skills they graduate with do not necessarily conform to the needs of Boston's labor market.

On the other hand, Boston's economy recruits its skilled labor force not only from the colleges and universities located in and around the city, but also from those attending school outside of the metropolitan area. The size of this recruitment pool is a result of the structure of Boston's economy — with a high concentration of companies in the sectors of higher education, finance, professional services, and health care — as well as its important role in the global economy.

Therefore, if our concern is with how well Boston's economy performs regarding its capacity to fill its needs for young, college-educated workers, the appropriate measure is the balance between in- and out-migration of this population. In short, if the number of young post-college workers migrating to the region is larger than the number of recent graduates who leave it, the economy is absorbing the necessary number of skilled workers it needs independently of where they go to school. In this respect, Boston also performs well.

A recent policy brief of the Federal Reserve Bank of Boston by Alicia Sasser Modestino, titled "Retaining Recent College Graduates in New England: An Update on Current Trends,"¹⁴ calls attention to the fact that it is important to distinguish between "retention rates" and "migration rates" given the fact that "New England attracts a relatively high share of students from outside the (region), with more students arriving to attend college than leaving to attend college elsewhere." Sasser Modestino goes on to report that when considering the region's ability to attract college graduates educated elsewhere, "the division comes out ahead, actually adding each year to the number of recent college graduates beyond what it would have if it educated

¹⁴ This analysis updates earlier work that compares the retention of college graduates across different regions (divisions) of the U.S. from graduating class of 2008 based on data from the National Center for Education Statistics.

only its native population” (See Appendix A for a comparison of Boston’s migration rates to that of other major cities.)

The author also notes that New England’s relatively low retention rate (63.6%) compared to other regions of the country (67.6% to 88%) reflects a higher share of non-native students attending school in New England, exacerbated by the fact that retention rates for private colleges and universities tend to be much lower than for public institutions. Greater Boston has a much higher share of both non-native students and students in private colleges and universities than most regions in the country.

According to Modestino, “by far the biggest reason that college graduates leave a region is because of employment-related factors such as job offers and compensation. 58% cited employment factors for leaving New England with family-related factors next at 11.3%, and only 1.6% citing housing as the primary reason for leaving.”

How Many More Graduates Can Boston Retain?

While it is often stated that Boston should retain more college graduates, no one has tried to estimate how many more graduates Boston could possibly retain. Could Boston retain the 80% “avoidable” estimated departures identified in the BCG report? In order to answer this question, we need to compare the number of Greater Boston college graduates in a given year with the expected number of job openings in the Boston area labor market that require a college degree.

Using data from the Integrated Postsecondary Education Data System (IPEDS), we generated estimates of the number of graduates for both the city of Boston and the broader metropolitan area.¹⁵ As shown in Table 1, colleges and universities based in Boston produced over 68,000 graduates in 2011, a great majority of them with bachelor’s degrees or higher, including over 32,000 freshly minted bachelor’s degrees. For the full metro area, there were over 190,000 graduates with 153,000 of those at the bachelor’s degree level or higher. The region produces a very large number of master’s degrees (56,572) and PhDs (13,736) each year.

Table 1: Number of Graduates for Boston and the Metro Area (NECTA) by Type of Degree, 2011

Boston	NECTA	Degree Conferred
1,368	8,210	Certificate, less than 1 year
782	10,858	Certificate, at least 1 but less than 2 years
3,328	15,600	Associate’s degree
392	2,196	Postsecondary award, certificate, or diploma (less than 4 year)
32,670	79,358	Bachelor’s degree
702	2,080	Postbaccalaureate certificate
22,172	56,572	Master’s degree
410	1,602	Post-Master’s certificate
6,796	13,736	PhD
68,620	190,212	TOTAL DEGREES, 2011
62,750	153,348	TOTAL BACHELOR’S OR HIGHER, 2011

Source: UMDI Analysis of data from the Integrated Postsecondary Education Data System (IPEDS)

Estimating the number of annual job openings in the Boston area is a more complicated endeavor. As described in Appendix B, we used the Labor Market Assessment Tool (LMAT) for both the city of Boston and the metro area to estimate annual job openings as a point of comparison to the number of graduates. This analysis took into account:

¹⁵ We used the U.S. Census Bureau’s Boston-Cambridge-Quincy New England City and Town Area (NECTA) as the definition for Metropolitan Boston.

- Estimates of the growth in jobs by industry and occupation between 2011 and 2012;
- The annual number of job openings due to “replacement” that occur because of retirements or workers permanently leaving a position;
- Skill level requirements for different occupations by intentionally focusing on positions that would tend to require at least an associate’s degree. An associate’s degree was selected because in a competitive labor market such as Greater Boston, college-level workers will tend to compete for “non-college” middle-skill jobs, as well as college-level work. As a result, we wanted to consider other potential employment opportunities for recent college graduates.

Based on these parameters, we estimate that there are approximately 71,100 total job openings each year in the Boston metro area. Depending on how we define jobs that require college-graduate skills, the number of job openings relevant for new graduates ranges from approximately 20,200 to 27,150. After comparing this number to the total number of graduates produced per year for the Boston metro area (over 150,000), it is clear that there are many more graduates than job openings. And this doesn’t even take into account various skill mismatches or requirements for experience (e.g., the unlikelihood that a new graduate would be hired as CEO of a company).¹⁶ For the city of Boston only, there are approximately 25,000 total job openings per year; between 7,900 to 11,500 of them, depending on measurement methodology, are relevant to college graduates. Clearly, the Boston metro area does not produce sufficient job opportunities for all of its graduates. This should not be surprising, because absorption of labor, independent of educational or skills levels, is regulated by the labor market and not by the supply of local school graduates.

Could we retain the “avoidable” departures? As we saw above, the Boston metro area generates over 150,000 graduates each year at the bachelor’s degree level or higher. Fifty percent of these graduates equate to 75,000 people, and thus retaining 80% of these would imply an additional 60,000 people each year. If that level of retention continued for 10 years, for example, population in the region would increase by 600,000, a huge increase for a regional population of 4.6 million, far greater than any estimates of possible additional population or any reasonable level of housing production. For the city of Boston, which graduates 62,750 people each year, retaining 80% of the estimated 50% who leave results in an additional 25,100 people each year. As a point of reference, Boston’s population grew by under 29,000 between 2000 and 2010, a decade with the most significant housing production in over half a century. If we extend this rate of retention over multiple years, the result would be an unprecedented population boom, well beyond the

¹⁶ As a test, we “zeroed out” negative job growth trends for industries that have lost jobs in recent years to focus solely on the notion of job openings (ignoring that some people who lose a job will then compete for other jobs in the area). For the metro area, the “zeroed out” totals are 80,100 for total openings, with up to 31,000 relevant for college graduates.

city's capacity to absorb new people either in terms of jobs or housing.¹⁷

This highly simplified analysis is not meant to imply that Boston or its metro area cannot retain any additional graduates. Rather, it tries to provide some context around the limits of retention, arguing that any discussion of retention should stay within the confines of how much labor market can possibly absorb. Realistically, it is the labor market, not enrollment, which drives retention.

¹⁷ For further context, Boston added just over 20,000 housing units from 2000 to 2010 and projections estimate adding about 29,000 new housing units over the next decade.

Highlights and Conclusion

Based on the research and data analysis conducted in support of this paper, key findings include:

- Boston has a very large share of its population in the 20-34 year old age cohort, the highest in the country among all major cities. While this proportion is enhanced greatly because of the large number of non-native students imported into the Boston area, the city also maintains a growing population of 25-34 year olds with high levels of education;
- The retention of college graduates is lower in New England than other parts of the country. This is mostly due to the fact that the region imports students every year, with far more students coming into the region than leaving it. This retention rate also reflects the highly prestigious and selective schools in the Boston area which, as shown by research, produce more mobile graduates;¹⁸
- Findings from the latest policy brief from the Federal Reserve Bank of Boston demonstrate that when you combine the region's ability to attract college graduates educated elsewhere with the huge influx of students to the area, the region adds each year to the number of recent college graduates beyond what it would have if it educated only its native population;¹⁹
- The Federal Reserve Bank of Boston policy brief also emphasizes the point that by far the highest proportion of college graduates who leave a region leave for employment-related reasons such as job offers and compensation. Nearly three-fifths (58%) cited employment factors for leaving New England, with family-related factors next at 11.3%, and only 1.6% with housing as the primary reason for leaving (29% left for "other" reasons not easily categorized). As stated, "contrary to conventional wisdom, recent college graduates are leaving New England primarily for job-related reasons — not housing costs — and this trend has been exacerbated by the Great Recession;"
- New data comparing the number of graduates produced in the Boston area with the number of job openings indicate that there are far more graduates than can be reasonably accommodated by the area's labor market.

"Brain drain" and "low retention" hypotheses do not address Boston's capacity to meet its needs for young, college-educated workers because they do not take into consideration the place of Boston, and its institutions of higher education, in the global economy. In his speech after the Boston Marathon bombings, President Obama recalled how Boston welcomed him and his wife once as young law students. He noted that "every fall, you welcome students from all across America and all across the globe. And every spring, you graduate them back into the world, a Boston diaspora that excels in every field of human endeavor."

¹⁸ For example, according to the World Class Cities Partnership, approximately 95% of UMass Boston students are from Massachusetts and it is estimated that over 75% of UMass Boston graduates stay in the area. Suffolk University and Northeastern University also have high retention rates above 60%. On the other hand, fewer than 20% of Harvard University and MIT students are from Massachusetts and just fewer than 30% of graduates are retained in the area.

¹⁹ Alicia Sasser Modestino, Retaining Recent College Graduates in New England: An Update on Current Trends, Policy Brief 13-2, New England Public Policy Center at the Federal Reserve Bank of Boston, May 2013.

We have argued in this paper that Boston's economy, including its labor market and its higher education sector, is increasingly healthy and global. Discussions of "brain drain" and "retention" need to take into account: 1) the capacity of the labor market to absorb new graduates, not only the supply of graduates; and 2) the high share of Boston's population of 25-34 year olds, reflecting the ability of Boston to not only retain graduates but also to attract college graduates from elsewhere.

Appendix A:

Migration Analysis of Recent College Graduates for Boston and Metro Boston

A comparison of metropolitan area migration patterns for 22 to 25 year olds with four or more years of higher education reveals that the Boston metropolitan area is within the middle of the range for retention when compared to nine similar metropolitan areas — Table 1.²⁰ Analysis of the 2011 American Community Survey (ACS) migration data shows that 88% of 22-25 year olds in Greater Boston with four years of college or more remained in the region the following year.²¹ Of those who moved away, the majority (seven percent) left for another location that was not among the nine major metropolitan comparison areas. Only 2% left for the New York metropolitan area, 1% for the Los Angeles metropolitan area, 1% for the San Francisco metropolitan area, and 1% for the Washington, D.C. metropolitan area.

The Boston metropolitan area's retention of 88% of this demographic group is in the middle of the range compared to other metropolitan areas, and is especially similar to those areas of similar size to Boston. Boston's retention among this demographic was similar to or better than that of the metropolitan areas of Baltimore (87%), Minneapolis (90%) Philadelphia (88%), St. Louis (86%), and Washington, D.C. (87%). New York and San Francisco had the highest retention rates, at 96% and 94% respectively, while Chicago and Los Angeles had marginally higher retention rates than Boston, at 92 percent and 91 percent, respectively. The Boston metro area's comparability to most of these cities is notable given the region's relative preponderance of internationally and nationally known institutions of higher learning that draw a significant proportion of students from outside the region or the Commonwealth.

A comparison of selected central cities for these metro areas shows a similar pattern, with Boston in the middle range of retention for comparison cities — Table 2.²²

The city of Boston itself retained 77 percent of 22 to 25-year olds with four or more years of higher education. This was higher than Washington, D.C. (73 percent), though lower than Philadelphia (83 percent), San Francisco (82 percent), and New York City (93 percent).

²⁰ Comparison metropolitan areas were chosen based on their Location Quotient (LQ) for Educational Services, a measure that compares the dominance of a sector within a regional economy to the nation as a whole. The Boston-Cambridge-Quincy metropolitan area has the highest Educational Services LQ in the nation, at 2.15, with Philadelphia-Camden-Wilmington the next highest at 1.82. The next ten metro areas by Educational Services LQs were chosen for comparison purposes with Boston. American Community Survey (ACS) data were accessed through the Integrated Public Use Microdata Series (IPUMS), which defines metropolitan areas based on the geography of Public Use Microdata Areas (PUMAs) used for data reporting by the ACS. The Miami-Fort Lauderdale-Pompano Beach metropolitan area ranked ninth among comparison areas by Educational Services LQ but is not included in this analysis because, according to IPUMS, it is not adequately defined by the ACS PUMAs. In addition, the Baltimore, Chicago, Minneapolis and Washington, D.C. areas are imperfectly defined by ACS PUMAs, with between one and four percent of their populations considered "undefinable" by PUMA.

²¹ The American Community Survey is limited to current residents of the United States and territories, and therefore these figures do not include previous residents who have moved abroad.

Table 1. Retention of 22 to 25 Year Olds with Four or More Years of Higher Education for Metro Areas

All 22 to 25-Year-Olds, Four or More Years of Higher Education

Current Residence (2011)	Residence One Year Ago (2010)											Total
	Baltimore, MD	Boston, MA	Chicago-Gary-Lake, IL	Los Angeles-Long Beach, CA	Minneapolis-St. Paul, MN	New York-Northeastern NJ	Philadelphia, PA/NJ	St. Louis, MO/IL	San Francisco-Oakland-Vallejo, CA	Washington, DC/MD/VA	All Other Areas	
Baltimore, MD	87%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Boston, MA	1%	88%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%
Chicago-Gary-Lake, IL	0%	0%	92%	1%	1%	0%	0%	2%	0%	1%	1%	4%
Los Angeles-Long Beach, CA	0%	1%	0%	91%	0%	0%	0%	0%	1%	1%	1%	5%
Minneapolis-St. Paul, MN	0%	0%	0%	0%	90%	0%	0%	0%	0%	0%	0%	2%
New York-Northeastern NJ	1%	2%	1%	1%	0%	96%	2%	0%	1%	1%	2%	9%
Philadelphia, PA/NJ	1%	0%	0%	0%	0%	0%	88%	2%	0%	0%	0%	2%
St. Louis, MO/IL	0%	0%	0%	0%	0%	0%	0%	86%	0%	0%	0%	1%
San Francisco-Oakland-Vallejo, CA	1%	1%	0%	1%	0%	0%	0%	0%	94%	0%	1%	2%
Washington, DC/MD/VA	4%	1%	0%	0%	0%	0%	1%	0%	0%	87%	1%	3%
All Other Areas	5%	7%	6%	6%	9%	3%	7%	9%	4%	9%	92%	67%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Note: Numbers may not add due to rounding.

Source: UMDI Analysis; Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2010.

Table 2. Retention of 22 to 25 Year Olds with Four or More Years of Higher Education for Major Cities

All 22 to 25-Year-Olds, Four or More Years of Higher Education						
Residence in 2010						
City in 2011	Boston	New York	Philadelphia	San Francisco	Washington, DC	
Baltimore	n/a	n/a	1%	n/a	n/a	n/a
Boston	77%	0%	0%	n/a	n/a	n/a
Cambridge	1%	0%	0%	0%	n/a	1%
Chicago	1%	0%	n/a	0%	1%	1%
Los Angeles	1%	0%	n/a	0%	1%	1%
New York	3%	93%	3%	2%	4%	4%
Philadelphia	1%	0%	83%	n/a	n/a	n/a
San Francisco	0%	0%	n/a	82%	n/a	n/a
Washington, DC	1%	0%	1%	n/a	73%	73%
All Other	13%	6%	12%	15%	21%	21%
Total	100%	100%	100%	100%	100%	100%

Note: Numbers may not add due to rounding.

Source: UMDI Analysis; Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2010.

²² Not all cities were available for comparison due to insufficient geographical definition by ACS PUMA and/ or insufficient sample size.

Appendix B:

Labor Market Assessment Tool (LMAT) Methodology

To estimate the number of “college level” jobs that become available in a given year in Greater Boston, we used the Labor Market Assessment Tool (LMAT), a computer program developed by the Dukakis Center for Urban and Regional Policy at Northeastern University and the Research Division at the Boston Redevelopment Authority (BRA). We also used data from the Massachusetts Department of Workforce Development, the American Community Survey (ACS) and the Bureau of Labor Statistics (BLS).

LMAT is a program with a set of industry/occupation (I/O) matrices linked with occupational characteristic data. An I/O matrix can basically be understood as a distribution of occupations within an industry or set of industries. LMAT has different occupational distributions built into the program depending on the industry (or set of industries) and year queried. The I/O matrices come from the Massachusetts Department of Workforce Development and are for the Commonwealth of Massachusetts. A primary assumption of this research is that the industry-based occupational distributions in the state are similar to what you would see for the Boston metro area.

To complete the customized analysis for this paper, we first entered into LMAT the two-digit North American Industrial Classification (NAICS) employment data from the Massachusetts Department of Workforce Development’s ES-202 for Metro Boston (as defined as the NECTA) in 2011 and 2012. The difference between the estimated employment by occupation between these two years would indicate job growth or loss for the particular occupation. The aggregate of these changes would equal “net new” job creation for Greater Boston between 2011 and 2012. However, there are other jobs that become available in the economy as people retire, move elsewhere, switch jobs, etc. In order to estimate “replacement openings,” we used 10-year replacement rate estimates from BLS. Each occupation has an estimate of the percentage of jobs that become available due to a person permanently leaving a position (most typically through retirement). We estimated an annual number of replacements for each occupational title. Adding the annual number of replacement openings to net new job openings equals the total number of job openings in Greater Boston between 2011 and 2012.

Of course, for this exercise we are primarily interested in the retention of college students in the region. To do so, we need to filter the number of job openings in a given year for those that are “college level” positions. Overall, the Greater Boston region is very well educated, with over 40% of the population 25 years of age or older holding at least a bachelor’s degree. As a result, employers in the region are able to hire college-level workers for jobs that do not typically require a college education in other parts of the U.S. We initially limited the list of jobs to those occupations classified by the BLS as requiring at least an associate’s degree. From there, we looked at the 2007-2011 ACS and applied the percentage of workers within occupational titles in Greater Boston that held a bachelor degree or greater to the estimated number of openings for that occupation. This technique allowed us to account for the credential mark-up that may occur in Greater Boston by taking into account the actual educational attainment of workers in positions rather than rely on BLS data on “educational requirements.” At the same time, by limiting the list to those occupations that require at least an associate’s degree, we made sure to eliminate those occupations that are decidedly not “college level” work, even if some current workers in those occupations hold college degrees (e.g., a taxi driver with a bachelor’s degree).