



# Boston: A City of Immigrants

1850–2015 Foreign-Born in Boston, MA & the United States

**LOCATION:** Boston, United States

**TIME PERIOD:** 1850–2105

**GRADES:** 7–12th

## OVERVIEW

Inspired by the Leventhal Map Center exhibition: [Who We Are: Boston Immigration Then and Now](#) and in coordination with the [Boston Planning and Development Agency Research Division](#), this investigation has students **think critically** about a 1850–2015 **time series graph** of the share of Boston, MA, & US population that is foreign-born. Using the critical thinking strategy *What Do You Notice?/What Do You Wonder?*, students develop their own questions that can be answered from the graph.

The mathematics focuses on the use of **percentage (or share)** and **number (or count)** and how to calculate and communicate them. Share and percentage can be used here interchangeably. Share is a non-statistical term. Percentage is a number 0–100 and is expressed with a “%”. Number and count can be used here interchangeably. Number is a general term with many meanings. Count is a statistical term.

The humanities focus is on **how immigration affects population composition**.

## TIME COMMITMENT

60 minutes class time plus optional assessment/homework

## MATH LEARNING GOALS

**Communicate effectively about percentages and counts and how counts, percentages, and rate of change can vary over time.**

Differentiate between **increasing (decreasing) percentages and increasing (decreasing) counts**.

Reflect on the share of Boston population that is foreign-born and how this compares **to the share for the larger communities of Massachusetts and the United States**.

Understand **how and why the percentage of foreign-born has changed during the period 1850–2015**.

## CURRICULUM STANDARDS



### Common Core State Standards

6.RP.A.3: Use ratio and rate reasoning to solve real-world and mathematical problems.

6.SP.B.5: Summarize numerical data sets in relation to their context.

6.SP.B.5.B: Describe nature of attribute under investigation, including how it was measured and its units.

HSS.IC.B.6: Evaluate reports based on data.

### Standards for Mathematical Practice

SMP 1. Make sense of problems and persevere in solving them.

SMP 3. Construct viable arguments and critique the reasoning of others.

SMP 6. Attend to precision.

### **MATERIALS**

*Accessible in a Map Set on the Leventhal Map Center Digital Collections website*

<https://collections.leventhalmap.org/map-sets/297>

*Included in this file following the Lesson Plan Procedure*

Survey Slips (*1 small slip per student; Instructional Plan A.2*)

Graph paper to chart survey estimates (*Instructional Plan A.3*)

Handouts (can be printed double-sided)

Blackline master with Graph of Foreign-born Share of Population 1850–2015 with What Do You Notice?/What Do You Wonder? (*Instructional Plan B.3*)

Table of Total and Foreign-born Population for Boston, Massachusetts, and the United States 1850–2015 (*Instructional Plan B.4-6*)

Examples: Graphs of Total Population, Native-born and Foreign-born for 1850–2015 for Boston, Massachusetts, and the United States (*C.1*)

*To be provided by the teacher*

Projector



## LESSON PLAN OUTLINE

### A. Hypothesize

- Students guess what share of Boston population is foreign-born

### B. Analyze (Noticing. Wondering. The Story.)

- Students analyze graph of share (percentage) of Boston, MA, and US population that is foreign-born for 1850–2015
- Students analyze table of Boston, MA, and US population and foreign-born (count) for 1850–2015

### C. Reflect

- Students graph Boston, MA, and US total and foreign-born populations and compare to the graph of share of population that is foreign-born
- Optional: Students write article or make video of their findings

## INSTRUCTIONAL PLAN

### A. Make a Conjecture (4 steps)

1. *“We are going to take a class survey on the percentage of foreign born in Boston. But, first, we need to define foreign-born.”*

Someone is foreign-born if they were not born in the United States. The opposite of foreign-born is native-born.

Many students will think falsely that they are foreign-born because their peers think of them as foreign-born or their parents were born abroad and are not US citizens.

People born in Puerto Rico are native-born.

2. *Hand out the confidential survey slips, “What percentage of Boston residents are foreign-born?”*

Cut slips. Answers should be in 10s (0%, 10%, 20%, etc.), which makes recording easier. Ask students not to share their responses since you don’t want students influencing each other. We want their responses to be *unbiased*.

Distribute slips to students. Students respond. Collect slips.

3. *Make a quick histogram graph of responses*

Project **Graph Paper to Chart Survey Estimates** on the board (or just draw a graph on board). Ask a student to fill in the graph with Xs.

4. *Analyze the histogram of their estimates*



This graph is a **histogram**. A histogram records **quantitative** data, like height. (**Bar graphs** record **categorical** data, like favorite pizza topping. They look similar to histograms, though bar graphs usually have spaces between the bars.)

Histograms (and bar graphs) display a **distribution**—all possible values (possible responses: 0%, 10%, etc.) on the x-axis with their frequency (counts or percentage of students giving this response) on the y-axis. Here, we use counts.

In describing a histogram, we want to observe these characteristics:

- **Center:** About what percentage is in the center?
- **Spread:** Most of the student survey data is between what two values? Any unusual estimates? (**Range** is the difference in the spread numbers.)
- **Shape:** What's the general shape?

There are names for shapes, but students need not give them. A description is sufficient.

Ask students what they notice about the histogram of their guesses.

- About what is the **center**?
- *Example:* "On average, we guessed 60% were foreign-born, with about half more and half less."
- What is the **spread**?

*Example:* "40% to 100%."

- What is the **shape**?

*Example:* "The shape is bell-shaped." (one peak and symmetric)

- What **story** does the graph tell?

*Example:* "We estimated that about a majority of Boston is foreign-born. Our class estimated that the percentage of foreign born is about 60% with most of us estimating 40% - 70%. There were a few estimates less than 40%. One person guessed 100%, but I don't think that can be true since I'm not foreign-born."

## **B. Thinking about the graph of 1850-2015 Share of Foreign-Born in Boston, MA, & the US (6 steps)**

### *1. Overall mathematical understanding of the graph*

There are TWO ways to approach in this graph.

Horizontal: Time series 1850 - 2015: How does the share of foreign born **change over time**?

*Example:* "The share of foreign born decreases for Boston, MA, and US from 1910–1970 and then increases."

Students tend to focus on this perspective. Have them discuss how the share of foreign born is different for the three populations.



Vertical: For any year(s), **comparative share** of foreign born for Boston, MA, and US

*Example:* “Boston's percentage of foreign-born is always the greatest.”

When comparing Boston, MA, and US, encourage students to discuss that the total population of each of the three are very different.

*Example:* Boston percentage is always the greatest, but its number of foreign-born is always less than for MA or US.

2. *Critical thinking strategy for analyzing the graph* (Noticing & Wondering)

Initially we ask students to tell the class what they notice and wonder about the graph using informal language. This precedes more formal academic language.

The questions ***What Do You Notice?*** and ***What Do You Wonder?*** are advanced by Annie Fetter to encourage students to become active and curious critical thinkers. (Here Annie explains how she uses the notice and wonder strategy in this video (<https://www.youtube.com/watch?v=a-Fth6sOaRA>)).

When students discuss in small groups and with the whole class what they notice and wonder, they meld their insights to discover deeper perspectives. The questions give this activity a “low floor” but a “high ceiling”, affording more students to become actively engaged. Since we don’t give directed questions, students do not just go for the answer, with some students staying on the sidelines. Instead students communicate and engage. Everyone is involved in seeing the bigger picture by discovering multiple strategies for tackling the graph.

The final question—***What Story Does This Graph Tell?*** invites students to think critically using what they noticed and wondered. Their answers reveal their own interpretations and discoveries.

3. *Critical thinking strategy for analyzing data table* (Noticing & Wondering)

*Project and distribute the handout **Graph of Foreign-born Share of the Population 1850–2015.***

Ask ***What Do You Notice?*** and ***What Do You Wonder?***

Individually, in pairs, and/or small groups, have students think about and write down their responses.

Remind students to think about ALL of the information on the page—titles, sources, colors, etc.

As a whole class, record concise answers on the board. (The questions can be done sequentially, which will probably bring out more ideas but take longer.) Give each student or group of students an opportunity to answer. Be supportive, but neutral



about their responses, writing down all without restating. If students are reluctant to answer, be more specific and ask what a Bostonian, a mathematician, or some other person with a different “lens” might notice. Maybe the graph looks different to different people.

- Some responses, which should be recorded, may not be mathematical, including responses that bring out historical contexts (Immigrant Quota Policy, wars, discrimination, etc.) or descriptive characteristics (3 lines, 1850–2015, etc.)
- *Noticings* are the graph’s “facts” and should be backed up by evidence in the graph. Ask students to explain these noticings. Dig deeper!
- *Wonderings* are the graph’s questions. Let students answer each other’s wonderings or say where they could find the answers.
- Ask if anyone wants a noticing or a wondering clarified and if any noticing answers a wondering.

Ask *What Story Does This Graph Tell?* Record responses.

This digs deeply into the graph’s implications. Claims need to be backed up with evidence from the graph.

Let students know that we all need to examine a graph many times to uncover its story and should combine other’s ideas.

You may want to assign writing up their story as a news article or recording a video. (See Follow Up)

4. *Project and distribute* **Table of Total and Foreign-Born Population for Boston, Massachusetts, and the United States 1850–2015.**

This data are used to make the graph Foreign-born Share of the Population 1850-2015.

Use this to explore how the percentage of foreign born is related to two factors: number of foreign born AND total population.

Below are key mathematical concepts about the differences between percentage (proportion) and counts (number) how to communicate them.

5. *Key mathematical concepts*

Comparing percentages

Students want to say, “Boston has more foreign born than MA or the US. After all, the Boston line is higher and the percentage is larger.” But, this is not true. Boston has the greatest percentage, but there are certainly more foreign born in both MA and the US.



- Ask students: "True or False: There are more foreign born in Boston than in US? In MA?" If students do not come around to why these statements are false, ask them to calculate the percentage of foreign born from the table's data. This will make it clearer.
- Then ask: "True or False: Boston is more diverse." They may say this is true, but they should realize that there is nothing in this graph that confirms this. Ask what questions they need to ask to answer this question and where they might find the answers.
- Require students to be specific. If they say that the percentage increases/decrease, ask "Percentage of what? Total population? Foreign born? Native born?" Only comment on counts after looking at the table of populations.

#### Comparing counts

- Population counts are rounded to nearest thousand. Confirm that students understand the rounding and how to say the counts.

*Example:* "In 2015, the Boston foreign-born population grew from about 90 thousand to about 480 thousand."

There are 3 time series here: Boston, MA, and US. The population sizes are significantly different.

- Boston: From 1850-2015, the population grew from 137,000 to 669,000. Foreign born grew from 47,000 to 190,000.
- Massachusetts: From 1850-2015, the population grew from 995,000 to 6,794,000. Foreign born grew from 164,000 to 1,096,000.
- US: From 1850-2015, the population grew from 23,192,000 to 321,419,000. Foreign born grew from 2,245,000 to 43,290,000.

The table has counts; the time series graph has percentages. From the graph, students can say "The foreign born percentage increases/decreases", but they should not say "The foreign born increases/decreases." This error is very tempting—for all of us.

*Example:* "For Boston 1940–1950, the foreign-born count increased from about 771,000 to about 801,000, but the percentage decreased from 24% to 19%."

Because of the different population sizes (the denominator of the percentage), the population change for a given percentage will be very different for Boston, MA, and US. For example, for 1850, a 1-point (1%) change in Boston foreign born is a mere 470. But, a 1% change in US foreign born is 22,000—47 times bigger.

Have students make sense of the magnitude of changes in population. Which changes are greater than or less than 2 times (100% increase)? (Example: Boston foreign born from 1870 to 1900.) Which are about the same? (Boston 1910 and 1920)



Which decreased? (Boston 1950–1970) This will give a feel of which populations are growing fastest or slowest.

### Comparing slopes

If the population remained constant over time, then an upward (downward) slope in the graph of the share of foreign born would indicate an increase (decrease) in the number of foreign born.

But, the populations increased overtime, except for Boston in 1930 – 1940 and 1950 - 1980. For the years of increasing population, the number of foreign born has to increase to just maintain the same percentage of foreign born.

Greater positive slopes signify increasing (upward) rates of change of the percentage of foreign born. Something big is going on.

### Scale of axis

Note that the vertical y-axes of the graph ranges from 0% to 40%. How different would the lines look if the same data were on a graph with vertical y-axes of 0%–100%? The lines would seem straighter and we may conclude falsely that the share of foreign born is not changing much.

## 6. *Some noteworthy mathematical responses*

### *What do you notice?*

#### Boston, MA, & the US

- Percentage foreign born is always greatest in Boston, then MA and the US.
- 1890–1910: Not much change in percentage of foreign-born share of population for Boston and the U.S.
- 1920–1970: Decrease in percentage of foreign-born share of population.
- 1980–2015: Increase in percentage of foreign-born share of population.

#### Boston

- Percentage foreign-born in Boston ranges from 13% in 1970 to 36% in 1910.
- Boston's percentage of foreign-born varies more than MA or US.
- For most of 1850–2015, Boston's share of population that is foreign-born is twice the US share.

#### Massachusetts

- Percentage of foreign-born in MA ranges from 9% in 1970 to 31% in 1910.
- MA's percentage of foreign-born increased more than either Boston or US for 1850–1910.



### United States

- Percentage of foreign-born in the US ranges from 5% in 1970 to 15% in 1890.

*What do you wonder?*

### Boston, MA, & the US

- For the entire time period, why does Boston have the greatest percentage of foreign-born and the US has the least?
- How do changes in the total population for Boston, MA, and US (denominator) affect the percentage of foreign born? Are the increasing percentages due to increases in the number of foreign born and/or decreases in population?

This wondering is answered with the table of Boston, MA, and US populations.

- What is happening 1920–1970 that results in the percentage of foreign born to decline?
- What is happening 1980–2015 that results in the percentage of foreign born increasing?
- What is the Immigrant Quota Policy?
- Why was 1970 the lowest percentage of foreign born for Boston, MA, and US?

### Boston

- Why does Boston have the most variability in share of the population that is foreign-born?
- What happened in 1880 that resulted in the percentage for foreign born dipping so much?

### Massachusetts

- Why does MA diverge so much from Boston during 1850–1880 and 1970–2015?
- What caused the increase in percentage of MA foreign born 1850–1910 and why did it stop?

### United States

- How much did total US population increase and how much did foreign-born population increase for each year? Which changes more?

## **C. Wrap Ups** (2 options)

### 1. *Count/Number: Population vs. Foreign born*

On three separate graphs, have students graph the total population, native born, and foreign born for 1850–2015 in Boston, MA, and US. (Examples below)



- Counts come from the **Table of Total and Foreign-Born Population for Boston, MA, and US 1850–2015** (thousands)
- Graphs should be on separate graphs because the y-axes ranges are so very different: 0–700,000 for Boston, 0–7,000,000 for MA, and 0–350,000,000 for US. Discuss with students what the y-axes should be for each graph.
- Label graphs with a title and note rounding ((thousands) or (1,000))

Based on these graphs, have students write up *What Do You Notice?* and *What Do You Wonder?*

- *What do you notice?* and *What Do You Wonder?* that you did not see in the time series graph that used percentages?

## 2. *News story or video*

The headline/title should include their major finding—The Story.

Show and explain the Foreign-born Share of the Population 1850–2015 graph.

Give supporting evidence for what they noticed.

Raise concerns (wonderings) that they have about evidence.

Care should be taken to clearly:

- Differentiate between foreign born and native born.
- Identify clearly which population (Boston, MA, or US), which year, and which statistic (total population, foreign born, or native born).
- Counts (number) and percentage

*Example:* “From 1910 to 1970, the number of foreign born in Boston went from 243,000 to 84,000. From 1910 to 1970, the percentage of foreign born in Boston went from 36% to 13%.

- Percentage and rate of change

*Example:* “From 1910 to 1970, the percentage of Boston foreign born went from 36% to 13%. The percentage point decreased 23% (36%–13%). But, the percentage decreased 63%  $((36\% - 13\%) / 36\%)$ .

## FOLLOW UP

You may want to follow up the lesson with this 4:11 minute video on misleading graphs.

### **How to Spot a Misleading Graph**

<https://ed.ted.com/lessons/how-to-spot-a-misleading-graph-lea-gaslowitz#review>

The video may make students skeptical of statistics. What you will want to make clear is that students need to think critically of graphs (and everything else), not jumping to being



skeptical. Some graphs "cherry pick" their data. Critical viewers need to think about the labels, numbers, scales, and context of the graph to determine what story it is telling. A critical eye will be needed to sort out reasonable graphs from those that deliberately manipulate the data to mislead the viewer.

Here's a fun video on graphing the motion of everyday objects. It connects back into your lessons on graphs.

### **Everyday Object Graphs**

[http://www.thisiscoolossal.com/2017/09/unendurable-line-short-film/?mc\\_cid=8222a707e8&mc\\_eid=07df947f72](http://www.thisiscoolossal.com/2017/09/unendurable-line-short-film/?mc_cid=8222a707e8&mc_eid=07df947f72)



### Survey Slips (A.2)

**What percentage of Boston residents are foreign-born?**

Answer in 10s: 0%, 10%, 20%, etc.

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**What percentage of Boston residents are foreign-born?**

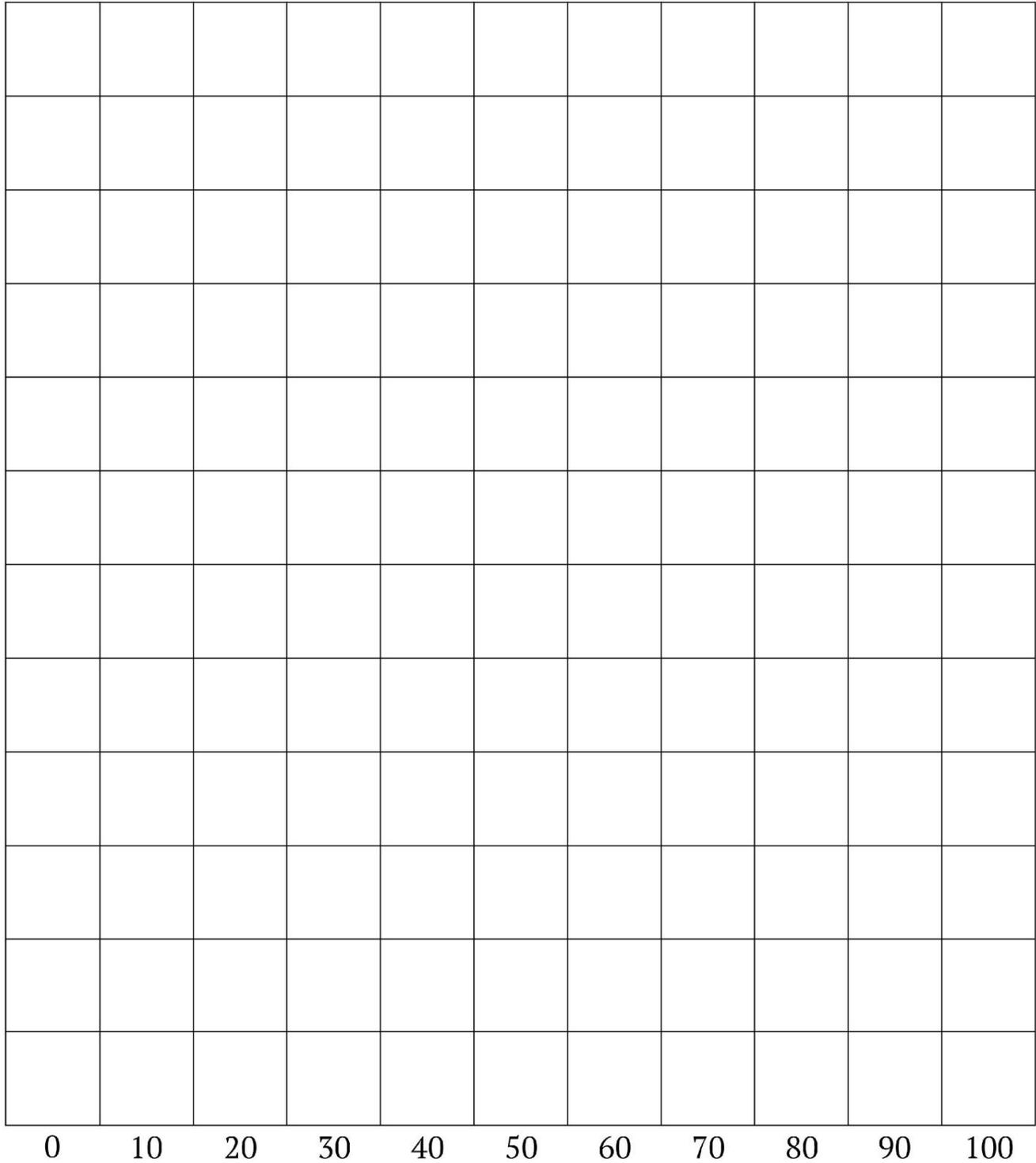
Answer in 10s: 0%, 10%, 20%, etc.

**What percentage of Boston residents are foreign-born?**

Answer in 10s: 0%, 10%, 20%, etc.

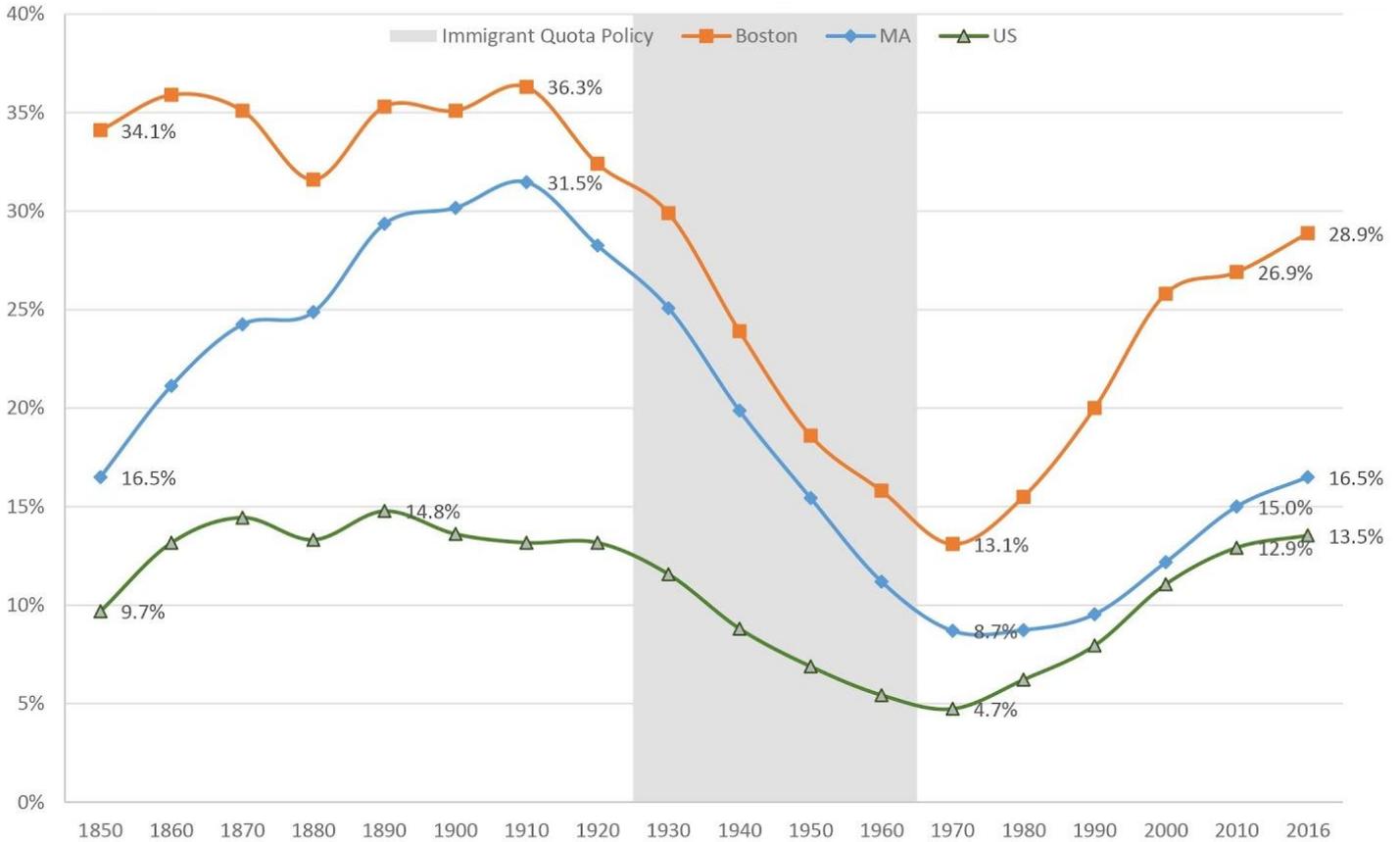


### Graph Paper to Chart Survey Estimates (A.3)





### Graph of Foreign-born Share of the Population 1850–2015 (B.3)



Graph courtesy of the Boston Planning & Development Agency Research Division  
Sources: U.S. Census Bureau, 1850–2000 Decennial Censuses, 2010 & 2015 1-year American Community Surveys, BPDA Research Division

#### What do you NOTICE?

- 1.
- 2.
- 3.

#### What do you WONDER?

- 1.
- 2.
- 3.

#### What STORY does this graph tell?



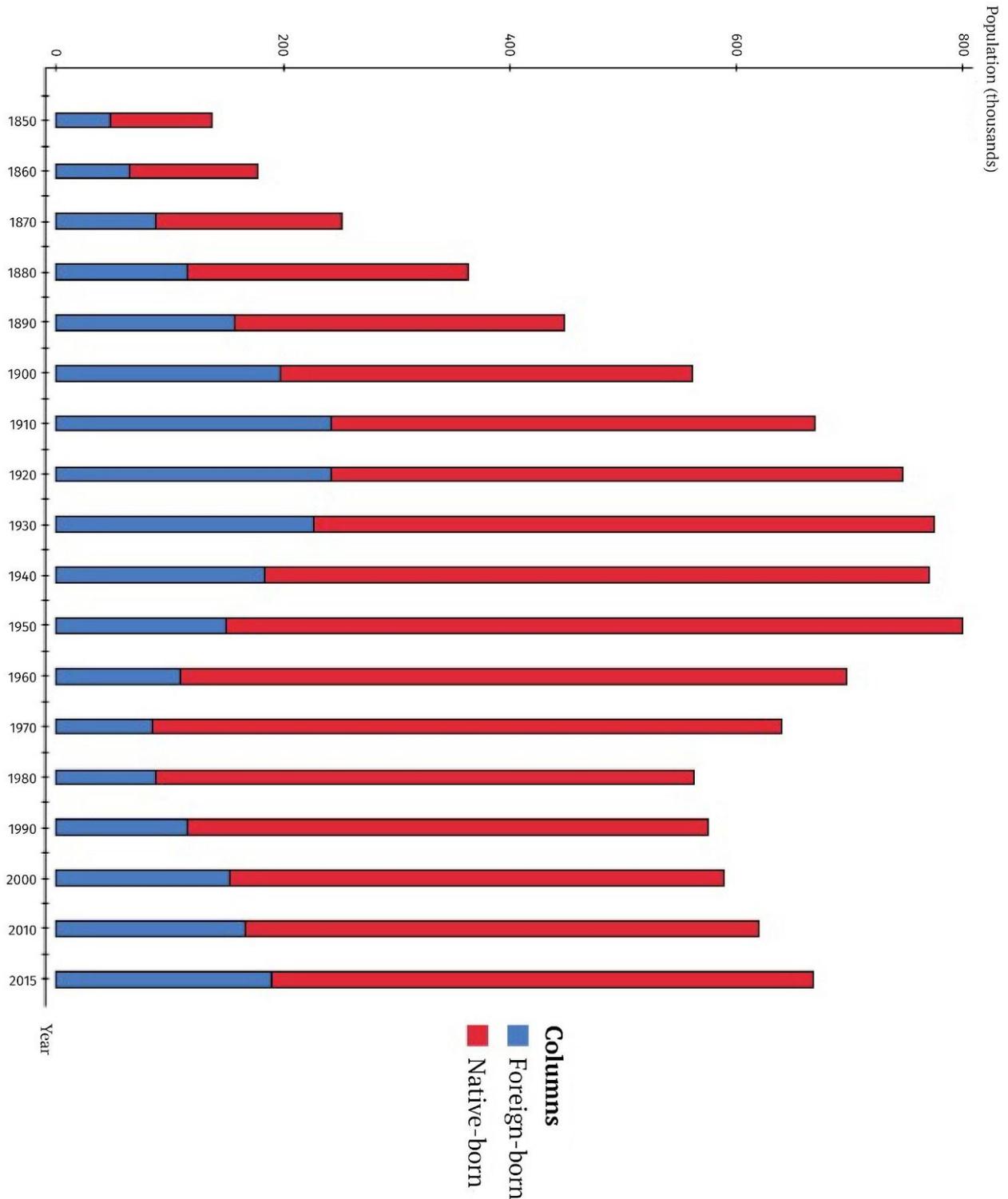
**Table of Total and Foreign-born Population for Boston, Massachusetts, and the United States 1850–2015 (B.4-6)**

TOTAL POPULATION & FOREIGN-BORN POPULATION: BOSTON, MA, & US (1850 - 2015)								
Boston			Massachusetts			United States		
Thousands (000)			Thousands (000)			Thousands (000)		
Year	Total population	Foreign-Born Population	Year	Total population	Foreign-Born Population	Year	Total population	Foreign-Born Population
1850	137	47	1850	995	164	1850	23,192	2,245
1860	178	64	1860	1,231	260	1860	31,443	4,139
1870	251	88	1870	1,457	353	1870	38,558	5,567
1880	363	115	1880	1,783	443	1880	50,156	6,680
1890	448	158	1890	2,239	657	1890	62,622	9,251
1900	561	197	1900	2,805	846	1900	75,995	10,341
1910	671	243	1910	3,366	1,059	1910	91,972	13,516
1920	748	243	1920	3,852	1,089	1920	105,711	13,921
1930	781	227	1930	4,250	1,066	1930	122,775	14,204
1940	771	184	1940	4,317	858	1940	131,669	11,595
1950	801	149	1950	4,672	721	1950	150,216	10,347
1960	698	110	1960	5,149	576	1960	179,326	9,738
1970	641	84	1970	5,689	495	1970	203,210	9,619
1980	563	87	1980	5,737	501	1980	226,546	14,080
1990	574	115	1990	6,016	574	1990	248,710	19,767
2000	589	152	2000	6,349	773	2000	281,422	31,108
2010	621	167	2010	6,557	984	2010	309,350	39,956
2015	669	190	2015	6,794	1,096	2015	321,419	43,290

Boston Source: U.S. Bureau of the Census, *Nativity of the Population for the 50 Largest Urban Places: 1870 to 1990 and Nativity of the Population for the 25 Largest Urban Places and for Selected Counties: 1850-2000*; ACS 2010, 2015 BPDAResearch Division Analysis  
Massachusetts Source: U.S. Census Bureau, *Historical Census Statistics on the Foreign-Born Population of the United States: 1850 to 2000*, ACS 2010, 2015, BPDAResearch Division Analysis

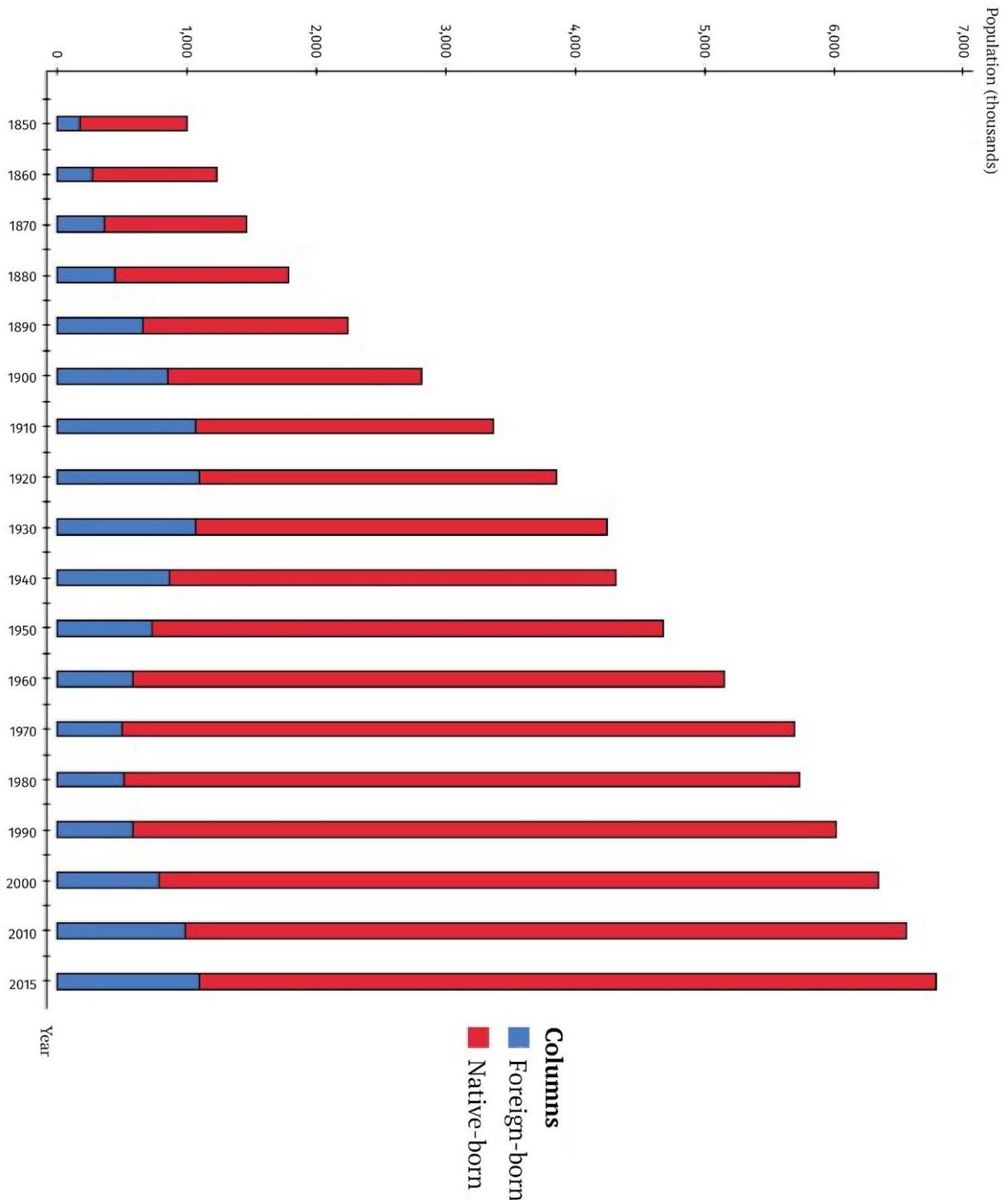


### Example: Graph of Native- and Foreign-born Population for BOSTON 1850–2015 (C.1)





### Example: Graph of Native- and Foreign-born Population For MASSACHUSETTS 1850–2015 (C.1)





### Example: Graph of Native- and Foreign-born Population For the UNITED STATES 1850–2015 (C.1)

