Foundation for Growth: Housing and Employment in 2020

Technical Report

Prepared for the Massachusetts Housing Partnership Foundation for Growth Initiative

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Overview

Two Cases of Economic Growth for the Coming Decade

In 2009, the Massachusetts Housing Partnership launched the Foundation for Growth initiative to examine and promote housing policies that would sustain and encourage economic growth in Massachusetts. A major research goal of the initiative has been to identify housing production benchmarks that would provide optimal economic benefits for the state. To this end, the Foundation for Growth Scope A team were asked to project housing construction needs for the state under a variety of possible economic scenarios through the year 2020.

An adequate housing supply has far-reaching implications for economic growth. Optimal levels of housing production can support sustainable workforce growth by mitigating increases in housing prices.1 An adequate housing supply can help to ensure that employers continue to see Massachusetts as a good place to do business and create jobs. The opposite is also true: a constrained housing supply can lead to reductions in the rate of employment growth.2 In recent history, employment growth in Massachusetts has been consistently slower than in the U.S. overall, with a brief exception as the national and state economies plunged into the current recession. An analysis of current economic trends suggests that without intervention, continued slow housing growth in Massachusetts will lead to housing supply gaps through the year 2020, if healthy market vacancy rates are taken into account. The economic and fiscal implications of this housing supply gap, and the means for rectifying it, are the subject of later installments of the Foundation for Growth research series.

In this paper, we project housing supply and demand for two alternative and plausible employment growth scenarios over the next decade. The first is a baseline scenario that assumes that current economic trends will hold, and that employment growth in Massachusetts will lag the expected rate for the U.S. over the next 10 years. The second is a stronger growth scenario that assumes that through a set of unspecified pro-growth policies, Massachusetts achieves a rate of employment growth closer to, though still below, the expected national rate of growth during this same period.

This report presents data for these two growth scenarios at the statewide and regional levels of analysis using the seven regions tracked in MassBenchmarks, the quarterly economic journal published by the University of Massachusetts in cooperation with the Federal Reserve Bank of Boston. The regions were defined by the UMass Donahue Institute in 1998, based on an analysis of the geographies used by the Massachusetts Office of Business Development (MOBD) and the state’s Regional Planning Agencies, with modifications based on reviews by regional experts and entities. The seven regions are: Berkshire, Cape and Islands, Central, Greater Boston, Northeast, Pioneer Valley and Southeast.3

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3 The boundaries of the Berkshire, Pioneer Valley, and Cape and Islands regions are co-terminus with county boundaries. The other four regions approximate, but do not correspond precisely to the following counties: Northeast – Essex County; Greater Boston – Suffolk, Middlesex, and Norfolk Counties; Central – Worcester County; and Southeast – Bristol and Plymouth Counties.
This analysis results in the following key findings:

- New housing permits in Massachusetts have remained historically low for two decades, since the residential construction boom of the 1980s. During the current recession, housing permits plunged to the lowest levels on record, with only 391 permits issued statewide in March of 2009.

- In 2008, Massachusetts had a shortage of 20,116 housing units statewide, if vacancy rates needed for healthy markets are considered (1.5 percent for owner-occupied housing and 7.4 percent for renter-occupied housing). Vacancy rates for owner-occupied housing were lowest for single family units in Metro Boston (0.8 percent), the Northeast (0.8 percent), and Pioneer Valley regions (0.8 percent), and for multi-family units in the Berkshire region (zero percent). Rental vacancy rates were lowest for single family housing in the Metro Boston (3.4 percent) and Southeast (0.8 percent) regions, and for multi-family housing in the Metro Boston (4.5 percent), Pioneer Valley (5.5 percent) and Berkshire (1.7 percent) regions.

- If Massachusetts continues current trends for construction, employment and population growth:
  - Total employment can be expected to grow 2.7 percent from 2006-2008 to 2020, adding 87,000 jobs to the Massachusetts economy.
  - Housing construction from 2010 to 2020 is expected to result in 170,496 new homes.
  - The statewide shortage of housing units is expected to reach 29,926 units by 2020. Current trends will lead to mismatched housing supply and demand across regions, with a projected shortage of 46,124 units in Metro Boston, partially balanced by overbuilding in the Central and Southeast MassBenchmarks regions. Such mismatches could be met by ever-higher prices in high-demand regions like Metro Boston, and increasingly long commute times as much-needed housing is built farther and farther from employment centers.

- If economic growth rises above current levels to match the more robust levels of employment growth that were frequently seen before the year 2000:
  - Massachusetts could add three times as many jobs by 2020 as current trends would predict.
  - A healthy construction response, with no housing shortages, would require 340,196 new housing units between 2010 and 2020. This is 169,700 more housing units (including 52,737 additional single family and 113,863 additional multi-family units) than current construction trends predict by 2020.
  - Tax revenues would be markedly higher than if the Commonwealth continues under the status quo: income tax revenues could grow by twice as much from 2006 to 2020; property tax revenues could grow by 27 percent more from 2006 to 2020; and sales tax revenues could grow by 83 percent more from 2006 to 2020.

The two scenarios for growth depicted in this report offer a tool for thinking about what the future of the Commonwealth could and ought to look like. It is the task of the remaining Foundation for Growth report series to further consider that future and how the Commonwealth might get there.
Methodology

The supply and demand projections presented in this report rely on the following components:

Supply:
1) Existing housing units
2) Projected unit loss due to demolitions or conversions
3) Projected construction of new units

Demand:
1) Permanent, primary residences for the projected workforce and population
2) Seasonal, sold or rented but unoccupied, or otherwise unavailable units
3) Vacancies required for optimal market functioning.

This study’s methodology is partially adapted from that of the Harvard Joint Center study, “Projecting the Underlying Demand for New Housing Units: Inferences from the Past, Assumptions about the Future.”\(^4\) This report is also the source for the optimal market vacancy rates, or natural vacancy rates, used in this report.

Supply Methodology

Current housing stock for 2006 through 2008 was estimated using the American Community Survey (ACS) Public Use Microdata Sample (PUMS). The number of total housing units in the ACS is controlled to updated Decennial Census housing unit counts from the Census’ Intercensal Population Estimates. This estimate forms the basis for our methodology. New construction and units lost to demolition, conversion or other causes are then taken into account.

The New England Economic Partnership (NEEP) projects new residential building permits for single and multi-family buildings through 2013. NEEP’s projected building permits, the Census Manufactured Housing Survey, and Census of Construction data provide the basis to estimate the addition of new units above 2008 levels by region. Several assumptions are necessary to estimate the contribution of new housing units to the overall housing stock:

1. That 98 percent of residential building permits result in a completed housing unit, in keeping with the assumptions used by the U.S. Census for its housing unit estimates.
2. That the rate of addition of mobile homes in Massachusetts occurs at the same rate observed from 2000 to 2008, according to the Census Manufactured Housing Survey.
3. That each region will retain the same proportion of new statewide residential construction as during the period from 2000 through 2008, according to the Census of Construction.
4. That NEEP’s projected, moderate rate of new residential permitting for 2013 will continue from 2014 through 2020.

Unit loss due to demolition, conversion or other causes is projected using historical unit loss rates from 1990 to 2000. Different rates of loss for mobile homes and for all other units are estimated by annualizing a loss rate for pre-1990 units between 1990 and 2000. An assumption is then made that the loss of units built after 1990 is negligible. The strength of this methodology is that it avoids the use of unreliable data on precise unit age as a predictor of unit loss.

**Demand Methodology**

**Demand for Primary Residences**

Housing demand is a function of demand for primary residences, secondary or other residences, and a steady supply of vacant units available for rent and sale. To project demand for primary residences, forecasts of population by age and employment by industry and occupation are used to reweight the 2006-2008 American Community Survey (ACS) for Massachusetts. The ACS asks questions of a national sample of people and households, and assigns weights based on current population estimates to these people and households so that estimates for the entire population may be calculated from the survey sample. To calculate housing demand in the future for this study, existing ACS weights on person and household records have been systematically factored up or down until the reweighted survey reflects the relevant forecasts for population and age, and industry and occupation, rather than the current population estimates. For example, the recalculated weights for people over the age of 65 are likely to be higher on average than the original ACS weights, reflecting the growing numbers of people over the age of 65 in the population.

The methodology is consistent with reasonable assumptions about the location and composition of households in 2020. These assumptions include:

1. That economic activity is geographically fixed in the medium term. Financial activity, for example, will continue to be concentrated in downtown Boston, manufacturing facilities will continue to be located where they currently exist, etc.
2. That commuting patterns and related location decisions of households will be stable and reflect current behavior. Downtown office workers, for example, will want to live in the same communities that they do presently, families with school-age children and from a particular economic class will continue to exhibit preferences for towns that similar present-day families have chosen, elderly households will want to live in the same types of housing and locations that currently elderly households do, etc.

This methodology should yield the same patterns of demand for location and housing types that a careful econometric analysis would yield if it were conditioned on the industry and occupation of employment and the age composition of households. Its advantage is in its simplicity. An econometric analysis would not only be costly in terms of time to undertake, but it would also be difficult, if not impossible, to avoid specification errors; and there would still be the problem of constraining the model predictions to meet the population and employment projections. The reweighting methodology presented here, on the other hand, preserves the geographic distribution of population and distribution of housing types conditioned on the age and employment distribution – by industry and occupation, that existed in 2006-8.

For the baseline scenario, population targets are derived from official Census projections for Massachusetts, and employment targets are derived from projections of labor force participation for the United States from the Bureau of Labor Statistics (BLS). The distribution of employment by industry and occupation for the baseline scenario is from the BLS/Massachusetts Division of Unemployment Assistance (DUA) industry by occupation matrix for 2016.
For the stronger growth scenario, the aggregate employment target is derived from the 2018 estimate for the U.S., from the BLS, projected to 2020. The Massachusetts employment target for 2020 is set to achieve a rate of employment growth from 2006-8 to 2020 that is 75 percent of the U.S. rate of growth over the same period. The extra employment over and above the baseline employment target is met by additional in-migration into the state.

Demand for Seasonal and Vacant Residences

Seasonal, unoccupied but unavailable, and vacant units required for proper market functioning are a significant addition to the demand for permanent residences. To project the need for these units in the future, the following assumptions were employed:

1. That regional demand for second homes, sold or rented but not occupied units, and other unavailable units will be in the same proportion to permanent residences as exhibited in the 2006-2008 ACS.
2. That natural vacancy rates of 7.4 percent for rental units and 1.5 percent for owner units, based on the 2007 Joint Center for Housing study, are ideal for healthy market functioning.
3. That ownership rates by geography remain constant based on the 2006-8 ACS PUMS.\(^5\)

Tax Methodology

State Income Tax

The Massachusetts state income tax was estimated from a micro tax simulator applied to the 2006-8 ACS, using tax law for 2005. Future incomes and tax liabilities do not assume real income growth. Changes in aggregate income and tax liability in the baseline and stronger growth scenarios reflect growth in the population, and changes in the distribution of income related to changes in the distribution of age, employment, and industry and occupation of employment. For purposes of counting tax filers, filing units who have no tax liability because they are eligible for “no-tax status” (those who are not required to file) are not counted. Income and tax liability amounts are in 2008 dollars.

State Sales Tax

The Massachusetts sales tax paid by consumers was estimated from a micro tax simulator applied to the 2006-8 ACS, using tax law for 2006, but the new sales tax rate of 6.25 percent. A significant portion of sales taxes are paid by businesses. The estimates provided for 2006-8, the baseline, and the stronger growth scenarios only include the portion of sales taxes paid by households.

Each household’s expenditures on taxable items are estimated for 16 categories of expenditures, as expected values of expenditures given by econometrically estimated consumption functions for Northeast consumer units from the 2006 Consumer Expenditure Survey (U.S. Bureau of Labor Statistics, 2008). Expected

\(^5\) For this purpose, geographies are the Public Use Microdata Areas used for data reporting for the ACS PUMS.
expenditures are conditioned on household income (including food stamps) and demographics of the household.

Future incomes and expenditures and tax liabilities do not include income or price growth. The aggregate estimates do reflect growth in the population, and changes in the distribution of income related to changes in the distribution of age, employment, and industry and occupation of employment. Expenditures and taxes are in 2008 dollars.

**Local Property Taxes**

Local property tax payments were estimated for each household from information available on the ACS.

Homeowners on the ACS are asked about the amount of property taxes they paid in a 68-category item. Each homeowner is assigned the midpoint of the category range they selected.

The property tax question was not asked for renters, so property taxes are based on their monthly net rent. Property taxes are estimated to be 0.951 percent of the value of their unit, where the tax rate is the statewide average property tax on real estate in 2007 (Massachusetts Taxpayers Foundation, 2008). The value of each unit is estimated by applying the price to rent ratio of 221 for the Boston/Quincy Metro Division (HousingTracker.net, 2008). Monthly rents are available on the ACS. When utilities are included in rents, the estimated monthly value of these utilities are subtracted from the reported rent. These estimates were obtained from a regression of the utility payments on the number of rooms, where the regressions were estimated on renters for whom the utility payments were not included in rent, and therefore were reported separately.

Property tax payments are in 2006-8 dollars. Future property tax estimates do not include changes in housing values or property tax rates. Future aggregate property tax payments do reflect growth in the population, and changes in the distribution of housing related to changes in the distribution of age, employment, and industry and occupation of employment.

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6 The adjustment factors provided in the ACS for income and household dollar items were not applied for property taxes.
Findings

History of Housing Construction in Massachusetts

While housing permits and resulting construction have declined drastically in the current recession, the trend of decreasing construction goes back much further. Figure 1 shows that housing permits in Massachusetts have remained historically low for two decades. Massachusetts experienced major housing permit booms in the 1970s and late 1980s, with permits peaking at 6,783 units per month in March of 1973. Since the boom of the 1980s ended, monthly permits have been much lower, never exceeding the high of 2,484 monthly permits reached in January 2007 – just over a third of the 1973 high value.

During the current recession, housing permits plunged to the lowest levels on record, with only 391 permits issued statewide in March of 2009. Two decades of extremely slow construction have taken a toll on the state, with house prices skyrocketing and population stagnating as current and potential residents choose to live and work elsewhere. This pattern of low housing permits lays the groundwork for continuing housing shortages in the state.

Figure 1. Massachusetts Monthly Housing Permits, January 1969 through November 2009

Source: U.S. Census Bureau
Recent Housing Supply and Demand: Housing Shortages in 2008

For two decades, the Massachusetts housing supply has increased at a consistently slow rate, with none of the production spikes seen in previous decades. Despite simultaneous slow population growth, construction rates have not kept up with increases in housing demand in recent years.

The housing supply and demand projections in this section compare available housing supply to total housing demand, including demand for primary residences, seasonal or other residences, and a “healthy” vacancy rate. This healthy vacancy rate is defined as the rate at which prices neither rise nor fall, and has been estimated by the Harvard Joint Center for Housing Studies for the purposes of national housing projections to be 1.5 percent for owner-occupied housing and 7.4 percent for rental housing. Therefore, projected shortages rarely reflect absolute shortages, but rather reflect a market with a lower than optimal vacancy rate. This “shortage” can be expected to contribute to higher prices, greater out-migration and lower realized employment growth than might otherwise have been the case in the absence of the housing unit shortfall.

Table 1 shows the total available housing supply in Massachusetts in 2008 (the most recent year data were available from the American Community Survey), including permanent residences, second homes, and units for sale or rent. Thirty percent of single-family homes and over 50 percent of multi-family homes in the state were in the Boston Metro area in 2008.

Table 1. Massachusetts Housing Supply, 2008

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Boston Metro</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>38,786</td>
<td>155,387</td>
<td>182,841</td>
<td>437,305</td>
<td>206,789</td>
<td>170,810</td>
<td>256,085</td>
<td>1,447,004</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>25,398</td>
<td>26,387</td>
<td>133,648</td>
<td>648,092</td>
<td>165,278</td>
<td>110,773</td>
<td>157,649</td>
<td>1,267,225</td>
</tr>
<tr>
<td>Mobile</td>
<td>1,627</td>
<td>1,587</td>
<td>3,075</td>
<td>2,382</td>
<td>1,690</td>
<td>3,301</td>
<td>7,178</td>
<td>20,841</td>
</tr>
<tr>
<td>Total</td>
<td>65,811</td>
<td>183,363</td>
<td>319,563</td>
<td>1,087,779</td>
<td>372,757</td>
<td>284,885</td>
<td>420,912</td>
<td>2,735,070</td>
</tr>
</tbody>
</table>

Source: American Community Survey PUMS 2008

Housing demand is more complicated, and includes permanent homes based on current households, seasonal and other part-time homes, and a healthy vacancy rate as defined by the Harvard Joint Center. Table 2 shows regional demand for housing units in 2008, with the greatest demand in the Boston Metro region.

Table 2. Massachusetts Housing Demand, 2008

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Boston Metro</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>38,691</td>
<td>154,591</td>
<td>183,468</td>
<td>441,382</td>
<td>207,852</td>
<td>172,664</td>
<td>257,966</td>
<td>1,456,614</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>26,585</td>
<td>26,346</td>
<td>132,809</td>
<td>658,431</td>
<td>163,793</td>
<td>111,956</td>
<td>157,871</td>
<td>1,277,790</td>
</tr>
<tr>
<td>Mobile</td>
<td>1,654</td>
<td>1,603</td>
<td>3,076</td>
<td>2,309</td>
<td>1,753</td>
<td>3,370</td>
<td>7,016</td>
<td>20,782</td>
</tr>
<tr>
<td>Total</td>
<td>66,929</td>
<td>182,540</td>
<td>319,353</td>
<td>1,102,122</td>
<td>373,398</td>
<td>287,990</td>
<td>422,854</td>
<td>2,755,186</td>
</tr>
</tbody>
</table>

Source: American Community Survey PUMS 2008

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Comparing supply to demand yields relative housing shortages, which can be understood as places where the vacancy rate is so low that it contributes to increased competition for housing and higher prices. Table 3 shows relative housing shortages in different regions. In 2008, the Boston Metro region had a shortage of 14,343 units, reflecting shortages in both single and multi family housing units. The Pioneer Valley also had significant shortages of both single and multi family units. The Northeast and Southeast regions had shortages of single family units, while the Berkshires had a shortage of multi family units. The Central region and the Cape and Islands both had relatively balanced housing supply and demand. Table 3 shows housing shortages across the state in 2008.

Table 3. Massachusetts Housing Shortages, 2008

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Boston Metro</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>96</td>
<td>796</td>
<td>-628</td>
<td>-4,077</td>
<td>-2,062</td>
<td>-1,853</td>
<td>-1,881</td>
<td>-9,610</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>-1,187</td>
<td>43</td>
<td>838</td>
<td>-10,339</td>
<td>1,485</td>
<td>-1,183</td>
<td>-222</td>
<td>-10,565</td>
</tr>
<tr>
<td>Mobile</td>
<td>-27</td>
<td>-16</td>
<td>-0</td>
<td>73</td>
<td>-63</td>
<td>-69</td>
<td>162</td>
<td>59</td>
</tr>
<tr>
<td>Total</td>
<td>-1,118</td>
<td>823</td>
<td>210</td>
<td>-14,343</td>
<td>-641</td>
<td>-3,106</td>
<td>-1,942</td>
<td>-20,116</td>
</tr>
</tbody>
</table>

Source: American Community Survey PUMS 2008
Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

These shortages reflect low vacancy rates. The owner vacancy rate should be near 1.5 percent to avoid price inflation. Vacancy rates for single family housing were low in the Boston Metro, Northeast and Pioneer Valley regions, all with 0.8 percent vacancy rates for owner-occupied single family housing. The Cape and Islands region had a 2.5 percent vacancy rate, higher than needed. High vacancy rates for owner-occupied multi-family housing was the norm across the state, except in the Berkshire region, where the rate was effectively zero, and the Cape and Islands, where it was 1.2 percent. Elsewhere, the vacancy rate for owner-occupied multi-family units ranged from 2.7 percent in the Southeast region to 6.2 percent in the Central region.

The rental vacancy rate should be close to 7.4 percent to avoid unnecessary price inflation. Vacancy rates for single-family rental housing are low across the state, except in the Berkshire and Cape and Islands regions, ranging from 0.8 percent in the Southeast region to 3.4 percent in the Boston Metro region. The Berkshires is the only region with a significantly higher than desirable vacancy rate for single-family rental units, at 12.5 percent. The multi-family rental vacancy rate is low at the ends of the state: 4.5 in the Boston Metro region, 5.5 percent in the Pioneer Valley and only 1.7 percent in the Berkshire region. Table 4 shows the vacancy rates for various types of housing in each of the regions.
### Table 4. Massachusetts Vacancy Rates, 2008

<table>
<thead>
<tr>
<th>Owner Units</th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Boston Metro</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>1.4%</td>
<td>2.5%</td>
<td>1.5%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.2%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>0.0%</td>
<td>1.2%</td>
<td>6.2%</td>
<td>3.1%</td>
<td>3.0%</td>
<td>3.5%</td>
<td>2.7%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Total</td>
<td>1.2%</td>
<td>2.4%</td>
<td>2.3%</td>
<td>1.5%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.5%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

| Renter Units         |           |                  |         |              |           |                |           |
|----------------------|-----------|------------------|---------|--------------|-----------|----------------|-----------|-------|
| Single-Family        | 12.5%     | 7.3%             | 1.9%    | 3.4%         | 1.1%      | 1.7%           | 0.8%      | 2.9%  |
| Multi-Family         | 1.7%      | 7.9%             | 6.5%    | 4.5%         | 7.9%      | 5.5%           | 6.8%      | 5.5%  |
| Total                | 3.0%      | 7.6%             | 6.1%    | 4.4%         | 7.2%      | 5.0%           | 5.9%      | 5.3%  |

Source: American Community Survey PUMS 2008

### Baseline Forecast: Housing Shortages in 2020

The baseline scenario projects the likely relationship between housing supply and demand in 2020, if current trends in employment growth, population and housing construction continue, and in the absence of any policy intervention to increase employment or the production of housing.

The housing supply and demand projections in this section rely on employment projections by the Bureau of Labor Statistics for 2016, population projections from the U.S. Census through 2030, and housing permit projections through 2013 from NEEP. While state-level employment projections are available only for the BLS terminal projection year (2016), NEEP provides annual employment, population and housing permit forecasts for Massachusetts through 2013. Employment and population projections from the BLS and Census were adjusted to make them consistent with the NEEP forecast for 2013. These projections were extended through the final projection year, 2020. The NEEP forecasts an economic recovery expected to take place during the first three years of the housing projections.

### Population Changes in the Baseline Forecast

The baseline population forecast relies on population forecasts from NEEP and the U.S. Census. Between the baseline of 2006-2008 and the end year of 2020, these sources forecast 4.3 percent population growth, or an annual growth rate of about 0.3 percent. This is the same as the average annual growth rate the state experienced from 2000 to 2007, the midyear of the 2006-2008 projections base.

As shown in Table 5, the largest growth is expected among 65 to 74 year olds, at 56.9 percent, followed by 55 to 64 year olds at 26.3 percent, as the baby boomers age. There will also be considerable population growth among 75 to 94 year olds (10.7 percent) and 25 to 34 year olds (11.6 percent).

Significant declines in population are expected among 35 to 44 year olds (down 15.8 percent) and 45 to 54 year olds (down 10.7 percent). Expected population decline of 3.8 percent among 16 to 24 year olds is relatively moderate. Significantly, the population of under 16 year olds is expected to remain steady.
Table 5. Massachusetts Population Growth, Baseline Forecast

<table>
<thead>
<tr>
<th>Age</th>
<th>2006-2008</th>
<th>2020 Baseline</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 16</td>
<td>1,264,428</td>
<td>1,264,184</td>
<td>-0.0%</td>
</tr>
<tr>
<td>16-24</td>
<td>834,626</td>
<td>802,791</td>
<td>-3.8%</td>
</tr>
<tr>
<td>25-34</td>
<td>820,733</td>
<td>915,535</td>
<td>11.6%</td>
</tr>
<tr>
<td>35-44</td>
<td>973,100</td>
<td>819,385</td>
<td>-15.8%</td>
</tr>
<tr>
<td>45-54</td>
<td>988,931</td>
<td>883,609</td>
<td>-10.7%</td>
</tr>
<tr>
<td>55-64</td>
<td>725,944</td>
<td>916,934</td>
<td>26.3%</td>
</tr>
<tr>
<td>65-74</td>
<td>417,264</td>
<td>654,694</td>
<td>56.9%</td>
</tr>
<tr>
<td>75-94</td>
<td>444,744</td>
<td>492,470</td>
<td>10.7%</td>
</tr>
<tr>
<td>Total</td>
<td>6,469,770</td>
<td>6,749,601</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Sources: NEEP Forecast Fall 2009, U.S. Census Projections, American Community Survey 2006-2008

Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Employment Changes in the Baseline Forecast

Employment growth projections are based on NEEP and Bureau of Labor Statistics projections. According to NEEP’s fall 2009 forecast, Massachusetts employment will reach its nadir in 2010, at 3.1 million jobs. Job growth is expected to resume in 2011, with employment not expected to reach 2008 levels until 2013. In the baseline forecast, total employment can be expected to grow 2.7 percent from 2006-2008 to 2020, adding 87,000 jobs to the Massachusetts economy.

Employment growth by occupation type is shown in Table 6. The greatest growth can be expected among computer and mathematical occupations (16.0 percent), followed closely by health care support occupations (15.1 percent), personal care and service occupations (14.4 percent), and community and social service occupations (14.2 percent). These occupations account for an additional 53,000 jobs, or more than half of the net new jobs in the Massachusetts economy.

Double digit growth is also expected among healthcare practitioners and technical occupations (12.7 percent) and life, physical and social science occupations (11.6 percent), which together account for another 32,000 new jobs.

At the other end of the spectrum, production occupations are expected to continue a long-term decline, losing 22,000 additional jobs by 2020, a 13.4 percent decrease. No other occupational group comes close, with construction and extraction (down 4.3 percent) and transportation and material moving (down 3.8 percent) losing a combined 12,000 jobs. Office and administrative support occupations are projected to decline 2.4 percent, or almost 11,000 jobs.
Table 6. Massachusetts Employment Growth by Occupation, Baseline Forecast

<table>
<thead>
<tr>
<th>Occupation</th>
<th>2006-2008</th>
<th>2020 Baseline</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and Mathematical</td>
<td>114,151</td>
<td>132,358</td>
<td>16.0%</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>77,928</td>
<td>89,710</td>
<td>15.1%</td>
</tr>
<tr>
<td>Personal Care and Service</td>
<td>106,311</td>
<td>121,612</td>
<td>14.4%</td>
</tr>
<tr>
<td>Community and Social Services</td>
<td>58,219</td>
<td>66,489</td>
<td>14.2%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical</td>
<td>203,186</td>
<td>228,914</td>
<td>12.7%</td>
</tr>
<tr>
<td>Life, Physical and Social Science</td>
<td>57,594</td>
<td>64,273</td>
<td>11.6%</td>
</tr>
<tr>
<td>Education, Training and Library</td>
<td>225,483</td>
<td>242,998</td>
<td>7.8%</td>
</tr>
<tr>
<td>Business and Financial Operations</td>
<td>177,891</td>
<td>189,614</td>
<td>6.6%</td>
</tr>
<tr>
<td>Building and Grounds Cleaning and Maintenance</td>
<td>114,436</td>
<td>121,964</td>
<td>6.6%</td>
</tr>
<tr>
<td>Food Preparation and Serving Related</td>
<td>170,437</td>
<td>180,153</td>
<td>5.7%</td>
</tr>
<tr>
<td>Legal</td>
<td>48,938</td>
<td>51,634</td>
<td>5.5%</td>
</tr>
<tr>
<td>Arts, Design, Entertainment, Sports and Media</td>
<td>70,405</td>
<td>72,848</td>
<td>3.5%</td>
</tr>
<tr>
<td>Protective Service</td>
<td>68,561</td>
<td>70,423</td>
<td>2.7%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>77,190</td>
<td>78,463</td>
<td>1.6%</td>
</tr>
<tr>
<td>Farming, Fishing and Forestry</td>
<td>6,917</td>
<td>6,903</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Management</td>
<td>358,676</td>
<td>357,650</td>
<td>-0.3%</td>
</tr>
<tr>
<td>Sales and Related</td>
<td>361,232</td>
<td>357,109</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Office and Administrative Support</td>
<td>456,631</td>
<td>445,684</td>
<td>-2.4%</td>
</tr>
<tr>
<td>Installation, Maintenance and Repair</td>
<td>83,441</td>
<td>81,253</td>
<td>-2.6%</td>
</tr>
<tr>
<td>Transportation and Material Moving</td>
<td>139,328</td>
<td>134,019</td>
<td>-3.8%</td>
</tr>
<tr>
<td>Construction and Extraction</td>
<td>166,396</td>
<td>159,299</td>
<td>-4.3%</td>
</tr>
<tr>
<td>Production</td>
<td>165,202</td>
<td>143,105</td>
<td>-13.4%</td>
</tr>
<tr>
<td>Total</td>
<td>3,308,553</td>
<td>3,396,475</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Similar patterns are reflected in projections of employment by industry, shown in Table 7. The greatest growth is projected in professional and business services (13.6 percent) and education and health services (10.3 percent), which together account for nearly 144,000 new jobs. Moderate growth is projected in leisure and hospitality (4.7 percent) and other services (4.3 percent, including services such as equipment maintenance and repair, personal care services, and religious and civic organizations). Together, these account for an additional 18,000 new jobs.

Significant job losses are projected in manufacturing (down 15.4 percent), with a projected loss of over 51,000 jobs, as well as in construction (down 5.5 percent and 11,000 jobs) and trade, transportation and utilities (down 2.3 percent and 13,000 jobs). Natural resources and mining is projected to lose 17.7 percent, though with only 1,400 jobs to begin with, this represents a loss of only 248 jobs.
Table 7. Massachusetts Employment Growth by Industry, Baseline Forecast

<table>
<thead>
<tr>
<th>Industry</th>
<th>2006-2008</th>
<th>2020 Baseline</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional and business services</td>
<td>414,854</td>
<td>471,144</td>
<td>13.6%</td>
</tr>
<tr>
<td>Education and health services</td>
<td>852,529</td>
<td>940,181</td>
<td>10.3%</td>
</tr>
<tr>
<td>Leisure and hospitality</td>
<td>263,452</td>
<td>275,947</td>
<td>4.7%</td>
</tr>
<tr>
<td>Other Services</td>
<td>143,848</td>
<td>150,052</td>
<td>4.3%</td>
</tr>
<tr>
<td>Information</td>
<td>94,449</td>
<td>97,239</td>
<td>3.0%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>11,991</td>
<td>12,285</td>
<td>2.4%</td>
</tr>
<tr>
<td>Financial activities</td>
<td>273,600</td>
<td>275,100</td>
<td>0.5%</td>
</tr>
<tr>
<td>Government and military</td>
<td>129,435</td>
<td>126,971</td>
<td>-1.9%</td>
</tr>
<tr>
<td>Trade, Transportation and Utilities</td>
<td>577,383</td>
<td>563,936</td>
<td>-2.3%</td>
</tr>
<tr>
<td>Construction</td>
<td>212,289</td>
<td>200,528</td>
<td>-5.5%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>333,319</td>
<td>281,836</td>
<td>-15.4%</td>
</tr>
<tr>
<td>Natural resources and mining</td>
<td>1,404</td>
<td>1,156</td>
<td>-17.7%</td>
</tr>
<tr>
<td>Total</td>
<td>3,308,553</td>
<td>3,396,475</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Housing Demand in the Baseline Forecast

Population and employment estimates drive the housing demand projections. Table 8 shows total housing demand in 2020, including seasonal homes and the vacant units required to maintain healthy vacancy rates. Forty percent of housing demand is projected to be in the Greater Boston region, about the same as in 2006-2008. Another 15 percent of housing demand is projected to be in the Southeast, making those two regions accountable for more than half of the housing demand in the state. With the notable exception of the Greater Boston region, the greatest demand in most regions is for single family homes.

Table 8. Massachusetts Housing Unit Demand, 2020, Baseline Forecast

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>42,398</td>
<td>170,071</td>
<td>189,028</td>
<td>483,431</td>
<td>224,211</td>
<td>175,918</td>
<td>269,071</td>
<td>1,554,128</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>27,437</td>
<td>28,191</td>
<td>134,590</td>
<td>682,444</td>
<td>166,137</td>
<td>120,928</td>
<td>163,318</td>
<td>1,323,045</td>
</tr>
<tr>
<td>Mobile</td>
<td>1,483</td>
<td>1,589</td>
<td>3,945</td>
<td>2,484</td>
<td>2,151</td>
<td>4,729</td>
<td>8,636</td>
<td>25,017</td>
</tr>
<tr>
<td>Total</td>
<td>71,319</td>
<td>199,851</td>
<td>327,563</td>
<td>1,168,359</td>
<td>392,498</td>
<td>301,575</td>
<td>441,026</td>
<td>2,902,190</td>
</tr>
</tbody>
</table>

Note: Demand includes vacancy rates of 1.5 percent for owner units and 7.4 percent for rental units.

Housing Supply in the Baseline Forecast

As described above in the methodology section, current housing stock for 2006 through 2008 was estimated using the American Community Survey (ACS) Public Use Microdata Sample (PUMS), which controlled to the Census’ Intercensal Population Estimates. To project housing supply, new construction is added and housing unit losses are subtracted from the ACS 2006-2008 starting point.

According to NEEP, new housing permits through 2011 are projected to be considerably below pre-recession levels, when the growth rate of new residential unit production hovered near one half of one percent
per year. A housing recovery beginning in 2010 is expected to increase to 17,167 housing permits projected in 2013, the highest housing permit level since 2006. Figure 2 shows the statewide projected trajectory of residential building permits in Massachusetts through 2020.

**Figure 2. New Residential Construction for Single and Multi-Family Units in Massachusetts**

![Graph showing the number of new residential permits from 2002 to 2020. The graph includes data points for NEEP projection, History, and NEEP Trend.]

Sources: NEEP Forecast Fall 2009, Census of Construction 2000-2008

According to the extended projections, all told, over 170,000 new housing units are expected to be built statewide between 2010 and 2020, about the same number as were built from 2000 to 2009. The largest numbers of units will be added in the Greater Boston, Southeast, and Central regions. Table 9 shows the number of total new units projected to be built in each region of the state between 2010 and 2020. Table 10 shows the resulting housing supply in 2020, after demolitions and conversions are taken into account.
Table 9. Massachusetts Housing Construction, 2010 through 2020, Baseline Forecast

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>2,817</td>
<td>16,214</td>
<td>25,965</td>
<td>26,084</td>
<td>16,893</td>
<td>13,871</td>
<td>27,729</td>
<td>129,572</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>400</td>
<td>900</td>
<td>2,377</td>
<td>21,735</td>
<td>7,441</td>
<td>1,326</td>
<td>3,706</td>
<td>37,884</td>
</tr>
<tr>
<td>Mobile</td>
<td>237</td>
<td>231</td>
<td>449</td>
<td>347</td>
<td>247</td>
<td>482</td>
<td>1,047</td>
<td>3,040</td>
</tr>
<tr>
<td>Total</td>
<td>3,454</td>
<td>17,345</td>
<td>28,790</td>
<td>48,166</td>
<td>24,580</td>
<td>15,679</td>
<td>32,482</td>
<td>170,496</td>
</tr>
</tbody>
</table>


Table 10. Massachusetts Housing Unit Supply, 2020, Baseline Forecast

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>41,121</td>
<td>170,054</td>
<td>207,248</td>
<td>457,886</td>
<td>220,322</td>
<td>182,675</td>
<td>281,273</td>
<td>1,560,580</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>25,431</td>
<td>26,992</td>
<td>134,281</td>
<td>661,793</td>
<td>170,903</td>
<td>110,532</td>
<td>159,337</td>
<td>1,289,269</td>
</tr>
<tr>
<td>Mobile</td>
<td>1,737</td>
<td>1,731</td>
<td>3,308</td>
<td>2,556</td>
<td>1,840</td>
<td>3,524</td>
<td>7,718</td>
<td>22,415</td>
</tr>
<tr>
<td>Total</td>
<td>68,288</td>
<td>198,777</td>
<td>344,837</td>
<td>1,122,235</td>
<td>393,066</td>
<td>296,732</td>
<td>448,329</td>
<td>2,872,264</td>
</tr>
</tbody>
</table>

Sources: Census of Construction 2000 to 2008, NEEP Forecast Fall 2009, American Community Survey 2006-2008

Housing Surpluses and Shortages in the Baseline Forecast

As shown in Table 11, inadequate construction levels can be expected to contribute to housing shortages in four of the seven MassBenchmarks regions in 2020, with the worst shortages experienced in the Greater Boston region. Greater Boston is projected to experience shortages of tens of thousands of units among both single and multi-family homes. Despite the widespread greater demand for single family homes, shortages are projected to be both more common and more severe for multi-family homes, highlighting a key disconnect between current demand and building practices. Statewide, Massachusetts would need to build an additional 29,926 units over the projected building levels to meet demand and reduce unnecessary price inflation and resulting out-migration. Figure 3 shows a map of overall shortages and surpluses by region.

While the Central and Northeast MassBenchmarks regions have projected surpluses in 2020 in the baseline scenario, it is important to note that broad regional estimates of surpluses or shortages may mask local housing surpluses and shortages for smaller geographies within each region.

Table 11. Baseline Forecast for Massachusetts Housing Unit Supply Gap by Unit Type, 2020

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>-1,277</td>
<td>-17</td>
<td>18,220</td>
<td>-25,545</td>
<td>-3,889</td>
<td>6,757</td>
<td>12,202</td>
<td>6,452</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>-2,007</td>
<td>-1,198</td>
<td>-309</td>
<td>-20,651</td>
<td>4,767</td>
<td>-10,396</td>
<td>-3,981</td>
<td>-33,775</td>
</tr>
<tr>
<td>Mobile</td>
<td>253</td>
<td>141</td>
<td>-636</td>
<td>72</td>
<td>-311</td>
<td>-1,205</td>
<td>-918</td>
<td>-2,603</td>
</tr>
<tr>
<td>Total</td>
<td>-3,031</td>
<td>-1,074</td>
<td>17,275</td>
<td>-46,124</td>
<td>568</td>
<td>-4,843</td>
<td>7,303</td>
<td>-29,926</td>
</tr>
</tbody>
</table>

Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.
Figure 3. Massachusetts Housing Unit Supply Gap, Baseline Scenario, 2020

2020 Housing Deficits, Baseline Estimates, All Units, by Mass Benchmarks Region

Stronger Growth Forecast: A Balanced Housing Market

The stronger growth scenario projects housing supply and total demand in the event that the state were to achieve a higher rate of job growth than expected by the baseline scenario – specifically a rate that is 75 percent of the projected national employment growth rate. The Bureau of Labor Statistics projects national employment growth from 2008 to 2018 at approximately 12 percent, resulting in an assumed growth of nine percent for the Massachusetts stronger growth scenario. By comparison, the employment growth for the same period in the baseline scenario is only 2.7 percent.

The growth rate assumed for the stronger growth scenario, while significantly higher than the relatively flat growth of the baseline scenario, is comparable to growth seen in recent years in Massachusetts. The 2000s were a turbulent decade in Massachusetts, with overall employment losses in 2002 through 2004 and again in 2009, and employment growth in the positive years averaging a moderate 0.7 percent. The stronger growth
scenario assumes that with the right set of pro-growth policies, a similar annual average growth rate of approximately 0.7 percent from 2006-2008 to 2020 is achievable. This scenario does not explore what policies would be needed to achieve this growth rate, but it projects the total housing demand (allowing for a “healthy” vacancy rate) in the event this target employment growth rate was achieved.

The stronger growth scenario models a future where housing supply and demand are in balance by 2020. This requires housing construction to occur at a faster rate than expected by the baseline scenario. The 2020 forecast under this stronger growth scenario further reflects a housing market where vacancy rates across the state are a healthy 1.5 percent for owner units, and 7.4 percent for renter units. If this scenario is realized, more stable prices and lower out-migration than in the baseline scenario could be expected.

Population Changes in the Stronger Growth Forecast

In the stronger growth scenario, between the baseline of 2006-2008 and the end year of 2020, the forecast is for 10.4 percent population growth, or an annualized growth rate of about 0.8 percent, more than twice as fast as in the baseline scenario and faster than any recent population growth the state has experienced.

As shown in Table 12, population growth under the stronger growth scenario is still the greatest among 65 to 74 year olds (58.6 percent) and 55 to 64 year olds (28.8 percent, similar to the baseline scenario. However, population growth among 25 to 34 year olds increases dramatically, from 11.6 in the baseline scenario to 26.6 percent (in keeping with this group’s relative prevalence in the labor market), and population growth for 16 to 24 year olds increases from a 3.8 percent decline under the baseline scenario to a 5.7 percent increase. Finally, a stagnant under-16 population in the baseline scenario becomes a 5.6 percent increase in the stronger growth scenario.

Table 12. Massachusetts Population Changes, Stronger Growth Forecast

<table>
<thead>
<tr>
<th>Age</th>
<th>2006-2008</th>
<th>2020 Stronger Growth</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 16</td>
<td>1,264,428</td>
<td>1,334,727</td>
<td>5.6%</td>
</tr>
<tr>
<td>16-24</td>
<td>834,626</td>
<td>882,054</td>
<td>5.7%</td>
</tr>
<tr>
<td>25-34</td>
<td>820,733</td>
<td>1,038,999</td>
<td>26.6%</td>
</tr>
<tr>
<td>35-44</td>
<td>973,100</td>
<td>874,534</td>
<td>-10.1%</td>
</tr>
<tr>
<td>45-54</td>
<td>988,931</td>
<td>912,846</td>
<td>-7.7%</td>
</tr>
<tr>
<td>55-64</td>
<td>725,944</td>
<td>934,912</td>
<td>28.8%</td>
</tr>
<tr>
<td>65-74</td>
<td>417,264</td>
<td>661,963</td>
<td>58.6%</td>
</tr>
<tr>
<td>75-94</td>
<td>444,744</td>
<td>502,393</td>
<td>13.0%</td>
</tr>
<tr>
<td>Total</td>
<td>6,469,770</td>
<td>7,142,429</td>
<td>10.4%</td>
</tr>
</tbody>
</table>

Sources: NEEP Forecast Fall 2009, U.S. Census Projections, American Community Survey 2006-2008
Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Employment Changes in the Stronger Growth Forecast

In the stronger growth forecast, total employment can be expected to grow 9.0 percent from 2006-2008 to 2020, adding 296,000 jobs to the Massachusetts economy -- triple the growth of the baseline scenario.

Employment growth by occupation type for the stronger growth scenario is shown in Table 13. While in the baseline scenario, the greatest growth is among computer and mathematical occupations (16.0 percent), in
the stronger growth scenario, the greatest growth is among life, physical and social sciences occupations (32.1 percent and 18,000 jobs). Computer and mathematical occupations are projected to grow by 27.3 percent, or 31,000 jobs. Healthcare practitioners and technical occupations account for over 40,000 new jobs, while education, training and library occupations account for another nearly 35,000. In this scenario, the top 13 occupations are projected to experience double digit job growth, accounting for a net 258,000 new jobs.

Even in the stronger growth scenario, production jobs are projected to decline by 8.2 percent, losing 13,000 jobs, compared to 22,000 in the baseline scenario.

Table 13. Massachusetts Employment Growth by Occupation, Stronger Growth Forecast

<table>
<thead>
<tr>
<th>Occupation</th>
<th>2006-2008</th>
<th>2020 Stronger Growth</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life, Physical and Social Science</td>
<td>57,594</td>
<td>76,092</td>
<td>32.1%</td>
</tr>
<tr>
<td>Computer and Mathematical</td>
<td>114,151</td>
<td>145,281</td>
<td>27.3%</td>
</tr>
<tr>
<td>Community and Social Services</td>
<td>58,219</td>
<td>71,543</td>
<td>22.9%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical</td>
<td>203,186</td>
<td>244,079</td>
<td>20.1%</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>77,928</td>
<td>93,314</td>
<td>19.7%</td>
</tr>
<tr>
<td>Personal Care and Service</td>
<td>106,311</td>
<td>126,430</td>
<td>18.9%</td>
</tr>
<tr>
<td>Education, Training and Library</td>
<td>225,483</td>
<td>260,467</td>
<td>15.5%</td>
</tr>
<tr>
<td>Business and Financial Operations</td>
<td>177,891</td>
<td>203,661</td>
<td>14.5%</td>
</tr>
<tr>
<td>Arts, Design, Entertainment, Sports and Media</td>
<td>70,405</td>
<td>79,984</td>
<td>13.6%</td>
</tr>
<tr>
<td>Legal</td>
<td>48,938</td>
<td>55,129</td>
<td>12.7%</td>
</tr>
<tr>
<td>Building and Grounds Cleaning and Maintenance</td>
<td>114,436</td>
<td>128,472</td>
<td>12.3%</td>
</tr>
<tr>
<td>Food Preparation and Serving Related</td>
<td>170,437</td>
<td>191,339</td>
<td>12.3%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>77,190</td>
<td>84,944</td>
<td>10.0%</td>
</tr>
<tr>
<td>Management</td>
<td>358,676</td>
<td>378,590</td>
<td>5.6%</td>
</tr>
<tr>
<td>Protective Service</td>
<td>68,561</td>
<td>72,280</td>
<td>5.4%</td>
</tr>
<tr>
<td>Sales and Related</td>
<td>361,232</td>
<td>379,036</td>
<td>4.9%</td>
</tr>
<tr>
<td>Farming, Fishing and Forestry</td>
<td>6,917</td>
<td>7,218</td>
<td>4.3%</td>
</tr>
<tr>
<td>Office and Administrative Support</td>
<td>456,631</td>
<td>466,127</td>
<td>2.1%</td>
</tr>
<tr>
<td>Transportation and Material Moving</td>
<td>139,328</td>
<td>140,469</td>
<td>0.8%</td>
</tr>
<tr>
<td>Installation, Maintenance and Repair</td>
<td>83,441</td>
<td>83,891</td>
<td>0.5%</td>
</tr>
<tr>
<td>Construction and Extraction</td>
<td>166,396</td>
<td>165,153</td>
<td>-0.7%</td>
</tr>
<tr>
<td>Production</td>
<td>165,202</td>
<td>151,616</td>
<td>-8.2%</td>
</tr>
<tr>
<td>Total</td>
<td>3,308,553</td>
<td>3,605,113</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Similar patterns are reflected in projections of employment by industry, shown in Table 14. Professional and business services (up 22.7 percent) and education and health services (up 6.8 percent) show much stronger growth than in the baseline scenario, adding a combined 236,000 jobs.

Significant job losses remain in manufacturing (down 12.4 percent), with a projected loss of over 33,000 jobs, compared to 51,000 in the baseline scenario. Natural resources and mining is projected to lose 12.4 percent, or 174 jobs.
Construction losses are mitigated in the stronger growth scenario, with a decline of 1.5 percent, or 3,200 jobs, compared to over 11,000 jobs lost in the baseline scenario. Trade, transportation and utilities, down 2.3 percent and 13,000 jobs in the baseline scenario, gains 18,000 jobs in the stronger growth scenario.

Table 14. Massachusetts Employment Growth by Industry, Stronger Growth Forecast

<table>
<thead>
<tr>
<th>Industry</th>
<th>2006-2008</th>
<th>2020 Stronger Growth</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional and business services</td>
<td>414,854</td>
<td>508,831</td>
<td>22.7%</td>
</tr>
<tr>
<td>Education and health services</td>
<td>852,529</td>
<td>995,354</td>
<td>16.8%</td>
</tr>
<tr>
<td>Leisure and hospitality</td>
<td>263,452</td>
<td>294,951</td>
<td>12.0%</td>
</tr>
<tr>
<td>Other Services</td>
<td>143,848</td>
<td>158,673</td>
<td>10.3%</td>
</tr>
<tr>
<td>Information</td>
<td>94,449</td>
<td>103,378</td>
<td>9.5%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>11,991</td>
<td>12,971</td>
<td>8.2%</td>
</tr>
<tr>
<td>Financial activities</td>
<td>273,600</td>
<td>292,293</td>
<td>6.8%</td>
</tr>
<tr>
<td>Trade, Transportation and Utilities</td>
<td>577,383</td>
<td>595,802</td>
<td>3.2%</td>
</tr>
<tr>
<td>Government and military</td>
<td>129,435</td>
<td>132,481</td>
<td>2.4%</td>
</tr>
<tr>
<td>Construction</td>
<td>212,289</td>
<td>209,087</td>
<td>-1.5%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>333,319</td>
<td>300,061</td>
<td>-10.0%</td>
</tr>
<tr>
<td>Natural resources and mining</td>
<td>1,404</td>
<td>1,230</td>
<td>-12.4%</td>
</tr>
<tr>
<td>Total</td>
<td>3,308,553</td>
<td>3,605,113</td>
<td>9.0%</td>
</tr>
</tbody>
</table>


Note: Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Housing Demand in the Stronger Growth Forecast

Due to this higher assumed population and employment growth, the stronger growth scenario requires over 3 million housing units statewide, as shown in Table 15. The distribution of housing unit demand statewide remains about the same as in the baseline scenario, with 40 percent of demand in the Greater Boston region and 15 percent in the Southeast region.

Table 15. Massachusetts Housing Unit Demand in 2020, Stronger Growth Forecast

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>43,713</td>
<td>175,410</td>
<td>196,720</td>
<td>503,109</td>
<td>233,286</td>
<td>182,249</td>
<td>278,831</td>
<td>1,613,317</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>28,966</td>
<td>27,776</td>
<td>142,432</td>
<td>727,965</td>
<td>175,022</td>
<td>127,921</td>
<td>172,061</td>
<td>1,403,132</td>
</tr>
<tr>
<td>Mobile</td>
<td>1,671</td>
<td>1,612</td>
<td>4,042</td>
<td>2,473</td>
<td>2,255</td>
<td>4,800</td>
<td>8,760</td>
<td>25,514</td>
</tr>
<tr>
<td>Total</td>
<td>74,239</td>
<td>205,798</td>
<td>343,193</td>
<td>1,233,548</td>
<td>410,562</td>
<td>314,970</td>
<td>459,652</td>
<td>3,041,963</td>
</tr>
</tbody>
</table>


Note: Demand includes vacancy rates of 1.5 percent for owner units and 7.4 percent for rental units.
Housing Supply in the Stronger Growth Forecast

In most areas, construction in the stronger growth scenario surpasses that in the baseline scenario. Table 16 shows total construction needed between 2010 and 2020 under the stronger growth scenario. Since housing supply and demand are balanced by definition in this scenario, construction levels rise to account for increased population and job growth, but also to eliminate the presupposed shortages that exist currently and are projected to worsen in the baseline forecast.

Under the stronger growth scenario, the state would need to build 340,196 housing units between 2010 and 2020. This is 169,700 more housing units (including 52,737 additional single family and 113,863 additional multi-family units) than are projected to be built under the baseline scenario, a near doubling of construction. If decision makers pursue increased rates of job growth, a correspondingly higher rate of housing production would be necessary to avoid worsening housing shortages, higher prices, greater out-migration, and a resulting reduction in realized job growth.

To realize a balanced housing market in 2020, construction increases over the “status quo” baseline scenario would be seen in Greater Boston (a 231 percent increase over baseline), the Berkshire region (172 percent above baseline), the Pioneer Valley (116 percent above baseline), the Northeast region (71 percent above baseline), the Cape and Islands (40 percent above baseline), and the Southeast region (35 percent above baseline). Only the Central region would experience less construction to make up for a projected surplus in the baseline scenario that is not balanced by increased population growth in the stronger growth scenario. There, construction is somewhat counterintuitively projected to be six percent lower in the stronger growth scenario. It is worth noting again that this projection reflects the needs of an entire region. While the Central region is projected to need less construction than projected in the baseline scenario on balance, some individual townships or housing types may exhibit greater need for more housing, which is offset by projected overbuilding in others.

Statewide, the stronger growth scenario calls for over 52,000 additional single family units and 113,000 additional multi family units, compared to the baseline scenario. Figure 4 shows a map of housing construction for all units by MassBenchmarks region in the stronger growth scenario.

Table 16. Massachusetts Housing Construction, Stronger Growth Scenario

<table>
<thead>
<tr>
<th></th>
<th>Berkshire</th>
<th>Cape and Islands</th>
<th>Central</th>
<th>Greater Boston</th>
<th>Northeast</th>
<th>Pioneer Valley</th>
<th>Southeast</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Family</td>
<td>3,925</td>
<td>2,684</td>
<td>10,528</td>
<td>87,907</td>
<td>11,560</td>
<td>18,715</td>
<td>16,430</td>
<td>151,747</td>
</tr>
<tr>
<td>Mobile</td>
<td>72</td>
<td>113</td>
<td>1,182</td>
<td>265</td>
<td>661</td>
<td>1,757</td>
<td>2,089</td>
<td>6,139</td>
</tr>
<tr>
<td>Total</td>
<td>9,406</td>
<td>24,366</td>
<td>27,146</td>
<td>159,479</td>
<td>42,077</td>
<td>33,917</td>
<td>43,806</td>
<td>340,196</td>
</tr>
</tbody>
</table>

Figure 4. Massachusetts Housing Unit Construction, Stronger Growth Scenario, 2020


Tax Impacts: Benefits of Growth

For the baseline and stronger growth scenarios, projected Massachusetts property, sales and income taxes were estimated. This analysis provides insight into the likely scale of enhanced tax revenues if the state experienced greater employment and population growth.

Income Taxes

Income tax receipts were estimated using a tax simulator, and projected characteristics of future residents based on the 2006-8 ACS. As shown in Tables 17 and 18, Massachusetts income tax receipts in 2020 are projected to be 5.1 percent higher than in 2006 under the baseline scenario, and 10.2 percent higher than in 2006 under the stronger growth scenario. The difference between the two scenarios is due almost entirely to the larger number of Filers in the stronger growth scenario.

Table 17. Massachusetts Income Tax Revenue, Baseline Scenario

<table>
<thead>
<tr>
<th></th>
<th>Income tax (millions)</th>
<th>Income Tax Per Capita</th>
<th>Number of Tax Filers (thousands)</th>
<th>Income Tax per Tax Filer</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$9,877</td>
<td>$1,534</td>
<td>2,772</td>
<td>$3,563</td>
<td>6,437,760</td>
</tr>
<tr>
<td>2020</td>
<td>$10,378</td>
<td>$1,539</td>
<td>2,931</td>
<td>$3,541</td>
<td>6,744,570</td>
</tr>
<tr>
<td>Change</td>
<td>5.1%</td>
<td>0.3%</td>
<td>5.7%</td>
<td>-0.6%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

Sources: American Community Survey, 2006-2008
Notes: Dollar figures are in 2007 dollars and assume no real income growth conditional on age, industry, and occupation of employment. Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.

Table 18. Massachusetts Income Tax Revenue, Stronger Growth Scenario

<table>
<thead>
<tr>
<th></th>
<th>Income tax (millions)</th>
<th>Income Tax Per Capita</th>
<th>Number of Tax Filers (thousands)</th>
<th>Income Tax per Tax Filer</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$9,877</td>
<td>$1,534</td>
<td>2,772</td>
<td>$3,563</td>
<td>6,437,760</td>
</tr>
<tr>
<td>2020</td>
<td>$10,881</td>
<td>$1,550</td>
<td>3,072</td>
<td>$3,542</td>
<td>7,018,392</td>
</tr>
<tr>
<td>Change</td>
<td>10.2%</td>
<td>1.1%</td>
<td>10.8%</td>
<td>-0.6%</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

Sources: American Community Survey, 2006-2008
Notes: Dollar figures are in 2007 dollars and assume no real income growth conditional on age, industry, and occupation of employment. Shortages are denoted by negative numbers and red text; surpluses appear as positive numbers and black text.
Property Taxes

Property tax revenues were also estimated based on the number and types of projected residences in the baseline and stronger growth scenarios. Table 19 shows Massachusetts property tax receipts for 2006, the baseline scenario and the stronger growth scenario. The baseline scenario for 2020 projects a 7.9 percent increase in property tax revenues, while the stronger growth scenario projects an 11.7 percent increase.

Table 19. Massachusetts Property Tax Revenues, Baseline and Stronger Growth Scenarios (Millions of dollars)

<table>
<thead>
<tr>
<th>Property Tax</th>
<th>2006</th>
<th>Baseline</th>
<th>2020</th>
<th>Stronger Growth</th>
<th>Change from 2006 to 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Baseline</td>
<td></td>
<td>Stronger Growth</td>
<td>Baseline</td>
</tr>
<tr>
<td>Property Tax</td>
<td>$7,016</td>
<td>$7,568</td>
<td>$7,834</td>
<td>7.9%</td>
<td>11.7%</td>
</tr>
</tbody>
</table>

Sources: American Community Survey, 2006-2008
Note: Dollar figures are in millions of 2006 dollars and assume no change in property values or tax rates conditional on age, industry, and occupation of employment.

Sales Taxes

Sales taxes were projected based on projected income characteristics for the baseline and stronger growth scenarios. Table 20 shows sales tax estimates for 2006, and for 2020 under the baseline and stronger growth scenarios. Once again, sales taxes are projected to be higher under the baseline scenario than in 2006 by 5.2 percent, while under the stronger growth scenario, sales tax receipts increase by 9.5 percent. Under both the baseline and stronger growth scenarios, sales tax receipts increase due to increased incomes, even though a smaller share of incomes go to expenditures than in 2006.

Table 20. Massachusetts Sales Tax Revenues, Baseline and Stronger Growth Scenarios (Millions of dollars)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>Baseline</th>
<th>2020</th>
<th>Stronger Growth</th>
<th>Change from 2006 to 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Baseline</td>
<td></td>
<td>Stronger Growth</td>
<td>Baseline</td>
</tr>
<tr>
<td>Income</td>
<td>$198,338</td>
<td>$210,314</td>
<td>$219,954</td>
<td>0.0%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Expenditures</td>
<td>$137,304</td>
<td>$144,951</td>
<td>$150,949</td>
<td>0.0%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Sales Taxes</td>
<td>$2,876</td>
<td>$3,025</td>
<td>$3,150</td>
<td>0.0%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Sources: American Community Survey, 2006-2008
Notes: Dollar figures are in millions of 2007 dollars and assume no real income growth conditional on age, industry, and occupation of employment. Income includes food stamps. Sales Taxes includes regular sales and use, cigarette, alcohol, and gasoline excise taxes. Assumes sales tax rate of 6.25 percent.
Conclusion

Taken together with the forthcoming installments in the Foundation for Growth research series, the two scenarios presented in this report provide food for thought for Massachusetts policy makers to actively pursue types and levels of growth that are deemed most beneficial to the people – present and future – of Massachusetts. As has been shown in other studies, operating with the kinds of housing shortages seen in 2008, and projected to continue through 2020 under current conditions and policies, has real consequences, including inflated prices and difficulty retaining a competitive workforce. The two scenarios considered in this report take a first look at how housing construction and resulting tax revenues might look if Massachusetts follows the status quo, or adopts effective pro-growth policies.
Figure A-1: Massachusetts Housing Construction, MassBenchmarks Region:
All Units, Baseline Scenario, 2010 to 2020

Legend
Housing Construction, All Units, 2010 - 2020
- 3,454 Units
- 15,876 Units to 17,045 Units
- 24,580 Units to 32,482 Units
- 48,166 Units

Sources: American Community Survey Three-Year 2006 - 2008 PUMS, BLS 2018 projections,
US Census Population projections, Census of Construction, NEEP
Figure A-2: Massachusetts Housing Construction, MassBenchmarks Region: Single Family Units, Baseline Scenario, 2010 to 2020

Legend
Housing Construction, Single-Family Units, 2010 - 2020
- 2817 Units
- 13,871 Units to 16,883 Units
- 25,695 Units to 27,729 Units

Figure A-3: Massachusetts Housing Construction, MassBenchmarks Region: Multi Family Units, Baseline Scenario, 2010 to 2020

Legend
Housing Construction, Multi-Family Units, 2010 - 2010
- 400 Units to 1,320 Units
- 2,377 Units to 7,411 Units
- 21,735 Units

Figure A-4: Massachusetts Housing Construction, Public Use Microdata Area: All Units, Baseline Scenario, 2010 to 2020

2010 - 2020 Housing Construction, Baseline Estimates, All Units, by PUMA

Legend

Total
- 620 Units to 1,527 Units
- 1,527 Units to 2,196 Units
- 2,196 Units to 3,546 Units
- 3,546 Units to 5,493 Units
- 5,493 Units to 10,505 Units

Figure A-5: Massachusetts Housing Construction, Public Use Microdata Area: Single Family Units, Baseline Scenario, 2010 to 2020

2010 - 2020 Housing Construction, Baseline Estimates, Single-Family Units, by PUMA

Legend

Construction, Single-Family Units, 2010 - 2020
- 160 Units to 991 Units
- 991 Units to 1,993 Units
- 1,993 Units to 3,992 Units
- 3,992 Units to 5,758 Units
- 5,758 Units to 9,643 Units

Figure A-6: Massachusetts Housing Construction, Public Use Microdata Area: Multi Family Units, Baseline Scenario, 2010 to 2020

Legend

Construction, Multi-Family Units, 2010 - 2020

- 30 Units to 401 Units
- 401 Units to 847 Units
- 847 Units to 1,808 Units
- 1,808 Units to 2,888 Units
- 2,888 Units to 6,237 Units

Figure A-7: Massachusetts Housing Unit Shortage, MassBenchmarks Region: All Units, Baseline Scenario, 2020

2020 Housing Deficits, Baseline Estimates, All Units, by Mass Benchmarks Region

Legend
Supply - Demand, All Units, 2020
- 46,124 Units
- 4,843 Units - 1,074 Units
- 586 Units to 7,003 Units
- 17,275 Units

Figure A-8: Massachusetts Housing Unit Shortage, MassBenchmarks Region: Single Family Units, Baseline Scenario, 2020

Legend

Supply - Demand, Single-Family Units, 2020

- 25,545 Units
- 3,889 Units to 17 Units
- 8,757 Units
- 12,202 Units to 18,220 Units

Figure A-9: Massachusetts Housing Unit Shortage, MassBenchmarks Region: Multi Family Units, Baseline Scenario, 2020

2020 Housing Deficits, Baseline Estimates, Multi-Family Units, by Mass Benchmarks Region

Legend

Supply - Demand, Multi-Family Units, 2020
- 20,851 Units
- 10,398 Units
- 3,391 Units to 509 Units
- 476 Units

Figure A-10: Massachusetts Housing Unit Shortage, Public Use Microdata Area:
All Units, Baseline Scenario, 2020

Legend

Supply - Demand, All Units, 2020
-9,746 Units to -7,211 Units
-4,875 Units to -2,031 Units
-1,133 Units to -55 Units
127 Units to 2,912 Units
3,754 Units to 7,319 Units

Sources: American Community Survey Three-Year 2006 - 2008 PUMS, BLS 2018 Projections,
US Census Population projections, Census of Construction, NEEP
Figure A-11: Massachusetts Housing Unit Shortage, Public Use Microdata Area: Single Family Units, Baseline Scenario, 2020

2020 Housing Deficits, Baseline Estimates, Single-Family Units, by PUMA

Legend

Supply - Demand, Single-Family Units, 2020
-4,285 Units to -2,635 Units
-2,041 Units to -68 Units
148 Units to 1,054 Units
1,468 Units to 3,503 Units
4,535 Units to 7,043 Units

Figure A-12: Massachusetts Housing Unit Shortage, Public Use Microdata Area: Multi Family Units, Baseline Scenario, 2020

2020 Housing Deficits, Baseline Estimates, Multi-Family Units, by PUMA

Legend
Supply - Demand, Multi-Family Units, 2020
-7,966 Units to -3,318 Units
-2,037 Units to -1,188 Units
-851 Units to -14 Units
182 Units to 1,323 Units
1,529 Units to 3,584 Units

Appendix B: Stronger Growth Forecast Maps

Figure B-1: Massachusetts Housing Construction, MassBenchmarks Region: All Units, Stronger Growth Scenario, 2010 to 2020

Legend

Housing Construction, All Units, 2010 - 2020
- 9,468 Units
- 24,266 Units to 33,917 Units
- 42,977 Units to 60,000 Units
- 159,470 Units

Figure B-2: Massachusetts Housing Construction, MassBenchmarks Region: Single Family Units, Stronger Growth Scenario, 2010 to 2020

2010 - 2020 Housing Construction, Stronger Growth Estimates, Single-Family Units, by Mass Benchmarks Region

Legend
Housing Construction, Single-Family Units, 2010 - 2020
- 5,409 Units
- 13,446 Units to 15,838 Units
- 21,569 Units to 29,856 Units
- 71,307 Units

Figure B-3: Massachusetts Housing Construction, MassBenchmarks Region: Multi Family Units, Stronger Growth Scenario, 2010 to 2020

2010 - 2020 Housing Construction, Stronger Growth Estimates, Multi-Family Units, by Mass Benchmarks Region

Legend

Housing Construction, Multi-Family Units, 2010 - 2020

- 2,884 to 4,409 Units
- 10,538 to 18,715 Units
- 67,967 Units

Figure B-4: Massachusetts Housing Construction, Public Use Microdata Area: All Units, Stronger Growth Scenario, 2010 to 2020

Legend

<table>
<thead>
<tr>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,437 Units to 3,864 Units</td>
</tr>
<tr>
<td>3,864 Units to 7,115 Units</td>
</tr>
<tr>
<td>7,115 Units to 9,789 Units</td>
</tr>
<tr>
<td>9,789 Units to 15,438 Units</td>
</tr>
<tr>
<td>15,438 Units to 34,985 Units</td>
</tr>
</tbody>
</table>

Figure B-5: Massachusetts Housing Construction, Public Use Microdata Area: Single Family Units, Stronger Growth Scenario, 2010 to 2020

Legend
Construction, Single-Family Units, 2010 - 2020
-454 Units to 1,264 Units
1,264 Units to 2,853 Units
2,853 Units to 4,808 Units
4,808 Units to 7,237 Units
7,237 Units to 12,077 Units

Figure B-6: Massachusetts Housing Construction, Public Use Microdata Area: Multi Family Units, Stronger Growth Scenario, 2010 to 2020

Legend

Construction, Multi-Family Units, 2010 - 2020
-1,726 Units to 1,144 Units
1,144 Units to 3,066 Units
3,066 Units to 6,438 Units
6,438 Units to 9,019 Units
9,019 Units to 30,882 Units

## Appendix C: Projected Housing Demolition and Conversion

### Table C-1. Annual Housing Units Lost to Demolition or Conversion in Massachusetts

<table>
<thead>
<tr>
<th></th>
<th>Single-Family</th>
<th>Multi-Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.674</td>
<td>1.529</td>
</tr>
<tr>
<td>2011</td>
<td>1.672</td>
<td>1.527</td>
</tr>
<tr>
<td>2012</td>
<td>1.670</td>
<td>1.525</td>
</tr>
<tr>
<td>2013</td>
<td>1.668</td>
<td>1.523</td>
</tr>
<tr>
<td>2014</td>
<td>1.665</td>
<td>1.521</td>
</tr>
<tr>
<td>2015</td>
<td>1.663</td>
<td>1.519</td>
</tr>
<tr>
<td>2016</td>
<td>1.661</td>
<td>1.517</td>
</tr>
<tr>
<td>2017</td>
<td>1.658</td>
<td>1.515</td>
</tr>
<tr>
<td>2018</td>
<td>1.656</td>
<td>1.513</td>
</tr>
<tr>
<td>2019</td>
<td>1.654</td>
<td>1.511</td>
</tr>
<tr>
<td>2020</td>
<td>1.652</td>
<td>1.508</td>
</tr>
</tbody>
</table>

Sources: U.S. Census 1990 and 2000, American Community Survey 2008
Appendix D: Housing Demand Technical Methodology

Data Sources, Targets, and Methodology

Demand for housing is estimated from the 2006-8 multiyear American Community Survey (ACS). For population and housing units, weighted totals from the ACS are controlled to the corresponding estimates derived from the Census Bureau’s Population Estimates Program. Housing demand estimates should be interpreted as the average for the 2006-8 period. The ACS indicates, for each sample household, the type of housing (single-unit versus multi-unit, for example) and location by Public Use Microdata Area (PUMA).

For demand projections to 2020, the ACS is reweighted to meet certain population and employment targets, and the reweighted ACS is then used to estimate housing demand for 2020.

For the baseline scenario, population targets are derived from official Census projections for Massachusetts, and employment targets are derived from projections of labor force participation for the United States from the Bureau of Labor Statistics (BLS). The distribution of employment by industry and occupation for the baseline scenario is from the BLS/ Massachusetts Division of Unemployment Assistance (DUA) industry by occupation matrix for 2016. This matrix is referred to below as the IO matrix.

For the stronger growth scenario, the aggregate employment target is derived from the 2018 estimate for the U.S., from the BLS, projected to 2020. The Massachusetts employment target for 2020 is set to a level that yields a rate of employment growth from 2006-8 to 2020 that is 75 percent of the U.S. rate of growth over the same period. It is assumed that the extra employment over and above the baseline employment target is met by additional in-migration into the state.

Population targets are set for eight age categories (<16, 16-24, 25-34, 35-44, 45-54, 55-64, 65-74, and 75+) by two employment statuses (employed during the reference period versus not). The employed population is distributed to industry by occupation targets (12 industries by 22 occupations). Weights on the ACS are adjusted by an iterative process to meet these targets.

Baseline Projection Targets

The baseline population and employment forecasts were derived from two separate and independent official population and employment projections, and adjusted as necessary to make them consistent with one another and with the NEEP forecast from the spring of 2009. The Census Bureau’s population forecast for Massachusetts is through 2030, and the BLS’s employment by industry and occupation forecast is through 2016. The NEEP forecast is through 2013.
Population Targets, Baseline Scenario

Population growth rates for Massachusetts are calculated by age category, 2006-8 average to 2020, from the Census projections for Massachusetts. These growth rates are applied to the population by age category from the ACS to get the baseline population targets.

Employment Targets, Baseline Scenario

Using the estimated change in labor force participation rates for the U.S. by age category from the BLS for 2006-16 and 2008-18, changes are interpolated and extrapolated to the study period, 2007-2020. Labor force participation rates for 2007 are interpolated by averaging the 2006 and 2008 labor force participation rates. Labor force participation rates for 2018 to 2020 are extrapolated using the average annual change from 2007 to 2018. The change in Massachusetts employment to population rates from 2007 to 2020 are estimated using the change in U.S. labor force participation rates from 2007 to 2020. The 2020 estimated employment is applied to population rates and to the 2020 population targets to yield employment baseline targets by age group. This yields the baseline population by employment targets. The baseline employment target -- the sum of the employment targets by age group -- is distributed to industry and occupation using the industry occupation matrix.

In order to make the employment projection plausible and consistent with the population forecast and with the NEEP employment forecast, reasonable assumptions about employment to population rates were applied to the population forecast by age cohort. It was assumed that employment to population rates for those 54 years of age and younger would be the same in 2020 as in 2006-8, while employment to population rates for those 55 and older would increase by three percentage points. An increase in participation rates for older persons during this period of time is plausible considering the improved health and longevity that would allow persons to work more years, and the economic incentive for this generation to replace wealth lost in the current recession.

Stronger Growth Projection Targets

The stronger growth scenario projects housing supply and total demand in the event that the state were to achieve a higher rate of job growth than expected by the baseline scenario, specifically a rate that is 75 percent of the projected national employment growth. This rate was chosen because it is high compared to growth rates in recent decades in Massachusetts, but could be achieved with the right set of pro-growth policies.

Employment Target, Stronger Growth Scenario

The employment growth rate for the U.S., 2006-8 to 2020 is estimated. Employment for 2018 from the BLS 2008-2018 employment projections is projected to 2020 by applying an annual growth rate of 0.8 percent – the projected average annual growth of the U.S. labor force, 2008-18 – from 2018 to 2020. The growth from the three-year average employment during 2006-8 (from the BLS household employment series) to the 2020

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The stronger growth employment target for Massachusetts for 2020 is calculated by applying 75 percent of the U.S. growth rate from the prior step to the 2006-8 average Massachusetts employment from the ACS.

Stronger Growth Population and In-Migration

It is assumed that additional employment needs in the stronger growth scenario are met by in-migration. The stronger growth population by employment status targets are based on the baseline targets plus the additional population due to increased in-migration. The stronger growth employment by industry and occupation target is based on the baseline targets plus the additional employment due to increased in-migration.

The number of in-migrants by age category by employment status, and the number of working in-migrants by industry by occupation are estimated from the ACS. The results are normalized by dividing by the number of working in-migrants to get the age by employment status and industry by occupation per working in-migrant. The extra working in-migrants needed to fill the higher employment target (the stronger growth employment target minus the baseline employment target) are then calculated. The extra in-migration to age by employment status and industry by occupation for employed in-migrants is calculated using the normalized matrices.

Reweighting the ACS

The 2006-8 ACS was reweighted to meet the population by age and employment status targets for employment by industry and occupation targets. In all, there were 280 targets to achieve, 12 industry by 22 occupation targets, and eight age by two employment status targets (280 = 12x22 + 8x2). The method involved several iterations of nudging the weights for each household and household member up or down so that the targets were approximately met.

In the first iteration, each household in the ACS was processed in the following manner. The household weight and the weight for each person in the household was either increased by one percent, decreased by one percent, or left unchanged, depending on whether the new weights represented an improvement in meeting the targets. Improvement was defined by lowering a sum of squares objective function, composed by summing the squares of each of the 280 deviations of the newly weighted ACS from their respective targets. (Person weights were used in evaluating the objective function.) For two alternative weighting schemes for the ACS, the one with the lower value of the objective function is better. In the best case, where each target is met exactly, each deviation is zero, giving a value of the objective function of zero. In order to mitigate any effect on the outcome of the way the sample households were ordered in the Massachusetts ACS, the households were shuffled by means of a random assignment of order before the first iteration.

In evaluating each household, the household weight and each person’s weight were first increased by one percent. If these new weights lowered the value of the objective function, then they were accepted as the new weights for this household in the first iteration. If these new, larger weights did not lower the objective function, then the household weight and each person’s weight were decreased by one percent, and the objective function was re-evaluated. If these lower weights improved the value of the objective function, then they were accepted as the new weights for this household in the first iteration. If neither increasing nor lowering the weights improved the objective function, then the household and each person’s weights were left unchanged in the first iteration.
In each subsequent iteration, each household was evaluated again, starting with the weights from the prior iteration. The household weight and each person weight from the prior iteration was nudged up or down by one percent of the original weight, or left unchanged, depending on the effect on the objective function.

Iterations were continued until the targets were approximately met. The rule for terminating the iterations involved forming two matrices of deviations, one an eight-by-two matrix of deviations from targets by age category and employment status, another a 12 by 22 matrix of deviations from targets by industry and occupation employment. Smaller deviations, that is, deviations closer to zero, are better. One measure of how close a matrix is to zero is the L2 norm. The L2 norm of a matrix is determined by forming the column sums of the absolute values of each element of the matrix. The L2 norm is the largest such column sum. When the L2 norm of each deviation matrix was less than 1,000, the targets were deemed to be sufficiently met and the iterations were stopped. This stopping rule was applied at the end of each iteration.

The choice of 1,000 for an L2 norm, rather than say, 10,000 or 1, was determined by the rate of improvement in the measure as well as by its smallness. The number of iterations was also a factor because it seems reasonable that a better solution, everything else being the same, is one that involves smaller changes in household and person weights. Fortunately, it appears that the resulting reweighted ACS was not sensitive to the decision of when to stop.
Appendix E: Tax Revenue Technical Methodology

State Income Tax

The Massachusetts state income tax was estimated from a micro tax simulator applied to the 2006-8 ACS, using tax law for 2005.

Household members are organized into filing units according to their relationships and the following assumptions. Each subfamily, if any, is treated as a separate household for filing unit formation. Married couples who are both living in the household file a joint return. Married persons whose spouse is not present in the household file as married filing separately. All other persons who are not dependents on someone else’s form file individually as single filers, unless they are single parents with dependent children, who file as a head of household. Children who are under 18 or whose income does not exceed the “no tax status” amount of $8,000 are considered dependents on their parents' form; else they file as single filers. Parents of the household head whose income does not exceed $8,000 are considered to be dependents on their child’s form. Children of the household head who are heads of subfamilies and whose income does not exceed $8,000 are dependents on the household head’s form. Grandchildren whose parents are dependents on the household head’s form or who are in the care of the household head for more than half a year are also dependents on the household head’s form.

Each filer fills out the Form 1 tax form using their income and demographic information from the ACS. Mostly, this involves straightforward assignments and calculation directly from the ACS to the tax form. However, there are a few exceptions. Some pension income – essentially government pension income – is tax exempt. The determination for each filer is made by random assignment, with the probability of such income being exempt – 13 percent – set equal to the percent of jobs in government in 2005. Dividend, interest, and rental income comprise a single income component on the ACS, but need to be allocated to separate categories for calculating tax liability. The allocation is made using a multinomial model estimated from the Current Population Survey – for which all three of these income components are separately available – conditioned on age. Half of interest income is then allocated to Massachusetts banks, and half to non-Massachusetts banks. Capital gains income is not reported on the ACS. Receipt of long-term capital gains, and the amount of long term capital gains is determined from tables provided by the Massachusetts Department of Revenue from tax year 2005 filers. Receipt of long term capital gains, conditional on eight income classes, is randomly assigned based on the filer’s income. Filers receiving capital gains are then assigned the average capital gains reported for such filers in their income class. Short-term capital gains – the much smaller capital gains component – is not estimated in this simulator. Credits and voluntary contributions are also not estimated in this simulator.

The output of the simulator is a micro data set of tax filers with values for each of the lines on Form 1, including tax liability. The person weight of the tax filer is used to obtain aggregate tax liability for 2006-8, the baseline, and the stronger growth scenarios. Income and tax liability amounts are in 2008 dollars. Future incomes and tax liabilities do not include real income growth. Changes in aggregate income and tax liability in the baseline and stronger growth scenarios reflect growth in the population, and changes in the distribution of income related to changes in the distribution of age, employment, and industry and occupation of employment. For purposes of counting tax filers, filing units who have no tax liability because they are eligible for “no-tax status” – which means that they are not required to file – are not counted.
State Sales Tax

The Massachusetts sales tax paid by consumers was estimated from a micro tax simulator applied to the 2006-8 ACS, using tax law for 2006, but the new sales tax rate of 6.25 percent. A significant portion of sales taxes are paid by businesses. The estimates provided for 2006-8, the baseline, and the stronger growth scenarios only include the portion of sales taxes paid by households.

Each household's expenditures on taxable items are estimated for 16 categories of expenditures, as expected values of expenditures given by econometrically estimated consumption functions for Northeast consumer units from the 2006 Consumer Expenditure Survey (U.S. Bureau of Labor Statistics, 2008). Expected expenditures are conditioned on household income (including food stamps) and demographics of the household, including sex, age, marital status, race, ethnicity, and educational status of the household head, the size and age distribution of household members, the number of working persons in the household, the tenure status (home owned or rented), and vehicle ownership.

Each category of expenditure is classified as totally or partially taxable under the sales tax. Expenditures are not estimated for categories that were not taxable. In categories classified as partially taxable, it is assumed that 75 percent of expenditures were taxable. Taxable items include items taxable under the sales and use tax, motor vehicles, gasoline, cigarettes, and alcohol.

The output of the simulator is a micro data set of households with values for expenditures and taxes for each of the 16 categories of expenditure. The household weight is used to obtain aggregate sales taxes for 2006-8, the baseline, and the stronger growth scenarios. Expenditures and taxes are in 2008 dollars. Future incomes and expenditures and tax liabilities do not include income or price growth. The aggregate estimates do reflect growth in the population, and changes in the distribution of income related to changes in the distribution of age, employment, and industry and occupation of employment.

Local Property Taxes

Local property tax payments were estimated for each household from information available on the ACS.

Homeowners on the ACS are asked about the amount of property taxes they paid in a 68-category item. Each homeowner is assigned the midpoint of the category range they selected.

The property tax question was not asked for renters, so property taxes are based on their monthly net rent. Property taxes are estimated to be 0.951 percent of the value of their unit, where the tax rate is the statewide average property tax on real estate in 2007 (Massachusetts Taxpayers Foundation, 2008). The value of their unit is estimated by applying the price to rent ratio of 221 for the Boston/Quincy Metro Division (HousingTracker.net, 2008). So property taxes are estimated by multiplying monthly net rents by a factor of 2.10171 (= 221 x .00951). Monthly rents are available on the ACS. When utilities are included in rents, the estimated monthly value of these utilities are subtracted from the reported rent. These estimates were obtained from a regression of the utility payments on the number of rooms, where the regressions were estimated on renters for whom the utility payments were not included in rent, and therefore were reported separately.
These estimates are available in a micro data set of households. The household weight is used to obtain aggregate sales taxes for 2006-8, the baseline, and the stronger growth scenarios. Property tax payments are in 2006-8 dollars. (The adjustment factors provided in the ACS for income and household dollar items were not applied for property taxes.) Future property tax estimates do not include changes in housing values or property tax rates. Future aggregate property tax payments do reflect growth in the population, and changes in the distribution of housing related to changes in the distribution of age, employment, and industry and occupation of employment.
References


