Evaluating the Effects of Projected Job Growth on Housing Demand

The Association of Bay Area Governments (ABAG) Jobs Housing Connection Draft Land Use Scenario *(Draft Scenario)* projects that 1.1 million new jobs will be added to the Bay Area by 2040. This memo explores how the wages these jobs pay might impact household incomes. It then asks what type of housing at what affordability levels might be needed to house this future workforce.

The first section describes the translation from the *Draft Scenario's* job projections into future demand for affordable housing. The second section analyzes how housing costs might change in the future.

A. Using forecasted jobs as the basis for future household income

Methodology

The industry sectors expected to lead job growth in the future are comprised of various occupations that pay a range of wages. To estimate future affordable housing needs, we analyze the impacts of macroeconomic transformations that affect the types of work that occur in the Bay Area. These changes in turn shape the amount of income available to households to pay for housing.[1]

The model uses a multi-step process that translates industry sector-level employment forecasts by county into estimated growth in households in four income groups: very low (less than 50% of median county household incomes), low income (50-80%), moderate income (80% to 120%), and above moderate income (greater than 120%). The model begins by linking ABAG's sector-level employment forecasts with occupational characteristics: sectors are translated into industries (at the 3-digit NAICS level), which are then linked to occupations (at the 3-digit SOC level) and then median wages. Wages are then translated into household incomes by assuming an average number of workers per household. The following outlines the specific steps.

1. Linking industries to occupations

The 2010 analysis begins with the staffing patterns matrix for the state of California that estimates the occupations within each industry in the state.[2] We then calculate each occupations share of employment within each industry.

[1] We are assuming that salary from employment determines the amount of housing that a household will purchase. This ignores non-salary income and assets (e.g., personal wealth that can be used for home equity). We look at the job growth from 2010 to 2040 in isolation, assuming that this will not affect the income distribution and housing demand in the existing population. In other words, we do not account for the possibility that, for instance, the arrival of in-migrants to the region to work in the new jobs will crowd out existing jobseekers and workers and thus lower their wages, creating more demand for affordable housing. Thus, the results may be conservative: we may underestimate future housing demand.

[2] NAICS 3-digit level

Next, we link each industry (and its associated occupations) to one of the 11 summary employment sectors used by ABAG in the *Draft Scenario*. We thus derive the distribution of occupations by the employment categories used in the *Draft Scenario*.

To derive the occupations in 2040, we use the growth factors for each industry between 2010 and 2040 from the MTC TREDIS regional employment model. This creates a new distribution of occupations, using the occupational shares from the 2010 analysis. We then take the forecast 2040 employment totals by the 11 ABAG categories, and apply this new distribution to estimate occupational employment by sector in 2040.[3]

2. Translating wages to household income

Next, we link each occupation in the 2010 staffing patterns matrix with the 2010 annual statewide median wage for that occupation from the State of California's Employment Development Department (EDD) Occupational Employment Survey.[4] We then multiply the 2010 wage estimate by the average number of workers per household (estimated by ABAG at 1.3) to derive household income. This assumes that all workers in each household, on average, earn the same salary, an assumption that is not unreasonable as members of a given household tend to have a similar educational background.

Using the 2010 income categories for each county, we assign each occupation to one of the four income categories. We then sum the total number of workers (and households) that fall into each of the four income categories for each of the 11 sectors, based on each county's income limits.

To estimate the total number of households by income group for 2040, we use a similar methodology. To project wages in 2040, we analyzed wage trends from 2000-2010, a time period in which there was increasing wage inequality. We assumed that these trends would continue in future decades but at a lower rate, since wage levels tend to equilibrate over time. For example, if janitors experienced a 20% decline in wages from 2000-2010, we assumed that wages would decline 10% further from 2010-2020, an additional 5% from 2020-2030, and another 2.5% from 2030-2040. Using this method, the median wage change (in 2010 dollars) from 2010-2040 was an increase of just over three percent, with a range from -32% to +74%. Table 1 shows where wages are projected to change the most.

[3] Due mostly to technological change, occupational distributions often change, particularly over a 30-year period. For instance, over time the share of clerical occupations has decreased, while the share of information technology occupations has increased. It is possible to analyze this using historical staffing patterns matrices. However, the oldest matrix available is from 2003, and we determined that changes from 2003-2010 were not significant enough to warrant factoring into this analysis.

[4] For occupations that were suppressed at the state level we substituted national median wages adjusted for the Bay Area's cost of living.

Table 1. Occupations where wages are projected to change the most by 2040.

2000 SOC Code	2000 Occupation Title	2000 Annual Median Wage	2010 Annual Median Wage	Ten-Year Change	10-Year Change in Real Dollars	30-Year Change	2040 Projected Annual Wage
	Top ten occupations with wage decreases						
53-4012	Locomotive Firers	47870	43510	-9.1%	-36.1%	-31.6%	29,763
41-9091	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	24050	22190	-7.7%	-34.7%	-30.4%	15,446
53-4013	Rail Yard Engineers, Dinkey Operators, and Hostlers	36800	35480	-3.6%	-30.6%	-26.8%	25,984
29-1011	Chiropractors	67030	67200	0.3%	-26.7%	-23.4%	51,473
49-9063	Musical Instrument Repairers and Tuners	31410	31760	1.1%	-25.9%	-22.6%	24,566
27-2022	Coaches and Scouts	28020	28340	1.1%	-25.9%	-22.6%	21,928
53-4011	Locomotive Engineers	44210	46630	5.5%	-21.5%	-18.8%	37,847
51-9197	Tire Builders	36510	39250	7.5%	-19.5%	-17.1%	32,555
33-2022	Forest Fire Inspectors and Prevention Specialists	32140	34910	8.6%	-18.4%	-16.1%	29,295
29-1020	Dentists	129030	141040	9.3%	-17.7%	-15.5%	119,206
	Top ten occupations with wage increases						
43-5053	Postal Service Mail Sorters, Processors, and Processing Machine Operators	32080	53080	65.5%	38.5%	33.7%	70,943
27-2012	Producers and Directors	41030	68440	66.8%	39.8%	34.8%	92,277
11-3040	Human Resources Managers	59000	99180	68.1%	41.1%	36.0%	134,849
11-2031	Public Relations Managers	54540	91810	68.3%	41.3%	36.2%	125,016
47-5011	Derrick Operators, Oil and Gas	25810	43470	68.4%	41.4%	36.2%	59,226
47-5012	Rotary Drill Operators, Oil and Gas	30860	51980	68.4%	41.4%	36.3%	70,827
29-1061	Anesthesiologists	129680	220100	69.7%	42.7%	37.4%	302,384
41-9012	Models	19080	32920	72.5%	45.5%	39.8%	46,037
11-3061	Purchasing Managers	53030	95070	79.3%	52.3%	45.7%	138,556
45-1012	Farm Labor Contractors	14190	29990	111.3%	84.3%	73.8%	52,123

Source: US Bureau of Labor Statistics; projections by the author.

Projected household income - results

Table 2 shows the results of this analysis: the 2010-40 change in households by income group and sector. Some sectors pay workers relatively low wages that may translate at the household level to a greater affordable housing need; for instance, 87% of the new jobs in Arts, Recreation, Other (a category dominated by restaurants, hotels, and tourist employment) could put households associated with this category in the very-low income group. Two sectors (Agriculture/Natural Resources and Manufacturing/ Wholesale) experience negative change in several categories because of low or negative overall employment growth as well as projected transformation in industries.

Table 2. Change in households by sector and income group, 2010-40.

ABAG Summary Employment Categories	Very Low Income	Low Income	Moderate Income	Above Moderate Income	Total
Agriculture, Natural Resources	106%	-32%	32%	-5%	**-1,300**
Arts, Recreation, Other	87%	5%	3%	4%	**185,686**
Construction	4%	55%	27%	14%	**80,694**
Finance and Leasing	0%	37%	4%	60%	**48,596**
Government	6%	11%	25%	59%	**72,595**
Health, Education	16%	27%	22%	35%	**244,482**
Information	-4%	5%	57%	42%	**36,497**
Manufacturing, Wholesale	113%	-112%	-40%	139%	**5,700**
Professional and Business	24%	34%	14%	29%	**365,673**
Retail	78%	6%	11%	6%	**52,396**
Transportation, Utilities	48%	40%	4%	7%	**28,898**
Total	**32%**	**25%**	**16%**	**28%**	**1,119,918**

Based on this analysis, up to 72% of new households may fall into the very-low, low, and moderate income categories all of which qualify for affordable housing today. Together, very-low and low income households could represent up to 57% of new household growth. Moderate income households also qualify for affordable housing and could represent 16% of projected household growth. Overall, these trends are due to the large number of new jobs in sectors such as Arts/Recreation/Other, with relatively low wage occupations such as hotel workers.

By comparison, only 58% of households today fall into the very-low, low and moderate income groups (Figure 1, second column). Although this may suggest that there is a heightened need for affordable housing in the future, several caveats must be kept in mind. First, the income of existing households appears relatively higher because ACS data includes all sources of income, not just wage and salary income. Second, the universe of existing households includes a wide range of households, not just worker households, including those suffering from unemployment or underemployment, empty-nester or retiree households, and so forth.

Existing Housing Units and Affordability

Figure 1. 2010-40 housing need versus existing distribution of households and housing units (ACS).

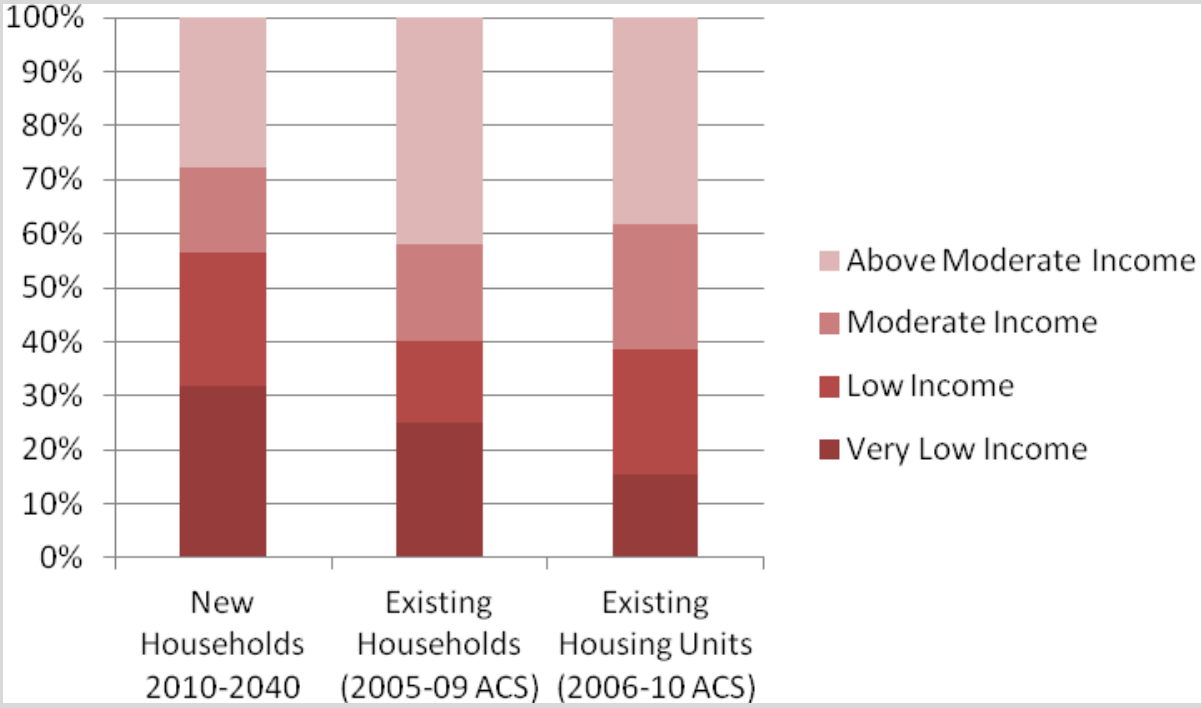


Figure 1 compares 2010-2040 household growth to both the Bay Area's existing households and its existing housing stock. It shows that based on the mortgage or rent that households paid, 62% of the Bay Area's ***units*** *could be classified as affordable to very-low, low and moderate income households. Instead of today's market rents, this reflects the fact that many mortgage- or lease-holders have remained in the same housing unit for a long period of time, with relatively stable mortgages or rents. The universe of vacant for rent or vacant for sale units is likely to be much less affordable.*

At the county level, household growth by income category was estimated from the employment forecast contained in the *Draft Scenario*. Table 3 shows the income distribution of these new households by 2040..

Table 3. Household Growth 2010-2040, by Income Category and County.

	Household Growth 2010-2040 ABAG Draft Scenario	Households by Income Group, Growth 2010-2040, Based on County Job Growth			
County		VLI	Low Inc.	Mod Inc.	Above Mod.
Alameda	152,347	28%	26%	16%	30%
Contra Costa	87,989	34%	28%	14%	24%
Marin	9,176	42%	25%	7%	25%
Napa	5,014	27%	33%	8%	32%
San Francisco	100,543	17%	38%	12%	32%
San Mateo	65,462	43%	16%	18%	24%
Santa Clara	223,405	41%	14%	21%	24%
Solano	26,101	24%	33%	11%	33%
Sonoma	30,050	34%	23%	13%	31%
SF Bay Area	700,087	32%	25%	16%	28%

Distribution to cities

To distribute these households to cities, we assumed that the income distribution of new households in each city should match the income distribution of households in its county. While historically the Regional Housing Needs Allocation (RHNA) asks suburban municipalities to bear their fair share of the regional housing burden, this method distributes the new households qualifying for affordable housing evenly across the county.

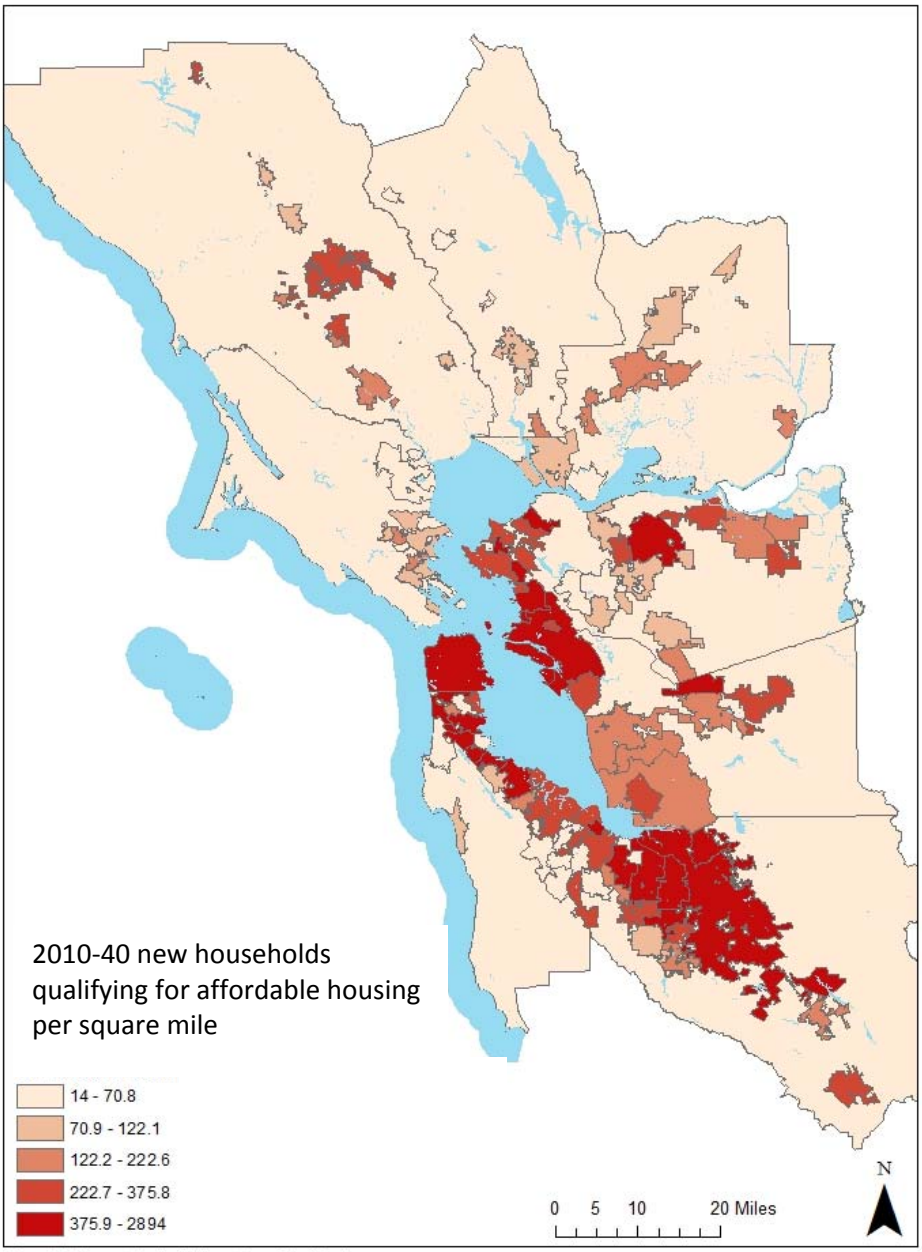
There are two primary sustainability assumptions embedded in this approach.

1. We assume that municipalities and unincorporated areas within a county should provide housing appropriate for the type of jobs created in the county. In other words, we are using the county as a proxy for its cities' commutesheds, and linking county job creation to households and housing production at the local level in order to give new workers an opportunity to live nearby their jobs.

2. Second, we are suggesting that if the county (i.e., commuteshed) fosters low paying jobs and therefore lower income households, then its cities and unincorporated areas should provide these households with affordable housing.

Figure 2 maps this distribution of household growth by income category for very-low, low, and moderate income groups at the city level.

Figure 2. Growth in Very Low, Low, and Moderate Income Households, 2010-2040.



Map: E. Pincus-Roth, University of California

2. Estimating future housing costs

Previous studies of housing prices have suggested several factors at work: employment accessibility, school quality, crime rates, and natural, public, and commercial amenities.[5] Research on housing prices in the Bay Area specifically has shown that there is unusual price volatility due to the boom-bust economy, with price appreciation particularly high in areas with high employment growth and accessibility.[6]

For this analysis we looked at the housing price changes (in terms of residential sales) that have occurred historically. We then developed a regression model that explains those changes specifically in terms of jobs, transit and housing. Taking the factors identified as important by that model, we then looked at the effects of the forecasted new jobs, new income distribution, and transit improvements on housing prices.

It is important to keep in mind what this model does and does not do. We only have good housing price data back to 1989 (a twenty-year period), so we only forecast for a twenty-year period, from 2009-2029. The model is useful for identifying potential trends in the Bay Area – but there will be places and neighborhoods that do not fit the model. For example, access to amenities varies even across adjacent neighborhoods, while quality of amenities (e.g., frequency of transit service) may change over time. Likewise, affordability characteristics change: though two neighborhoods may appear at a certain point to offer the same level of affordability, the units may be permanently affordable in one area but change to market-rate in another. Given these constraints, this analysis is best used to illustrate general trends and principles behind changes in housing cost, rather than to predict future housing costs on a micro-level.

Historic housing price change

We begin by looking at historic price changes. Figure 3 shows the change in prices per square foot by city from 1989 to 2009, dividing the cities into thirds: low (including a few cities with negative changes), medium, or high. There are few surprises here: price appreciation is disproportionately high in San Francisco, Silicon Valley, some North Bay communities, and a few East Bay cities, while it is lower in some of the core areas that suffer from entrenched poverty, as well as many of the outlying areas.

To explore what factors affect these price changes, we tested a series of models that included demographic characteristics, amenities, employment changes by sector, and presence of affordable housing. There are some conceptual problems with including affordable housing in a model predicting housing prices, as there is likely some endogeneity. Another issue is that we do not have data on the production of new affordable housing but only the overall affordability in each city.

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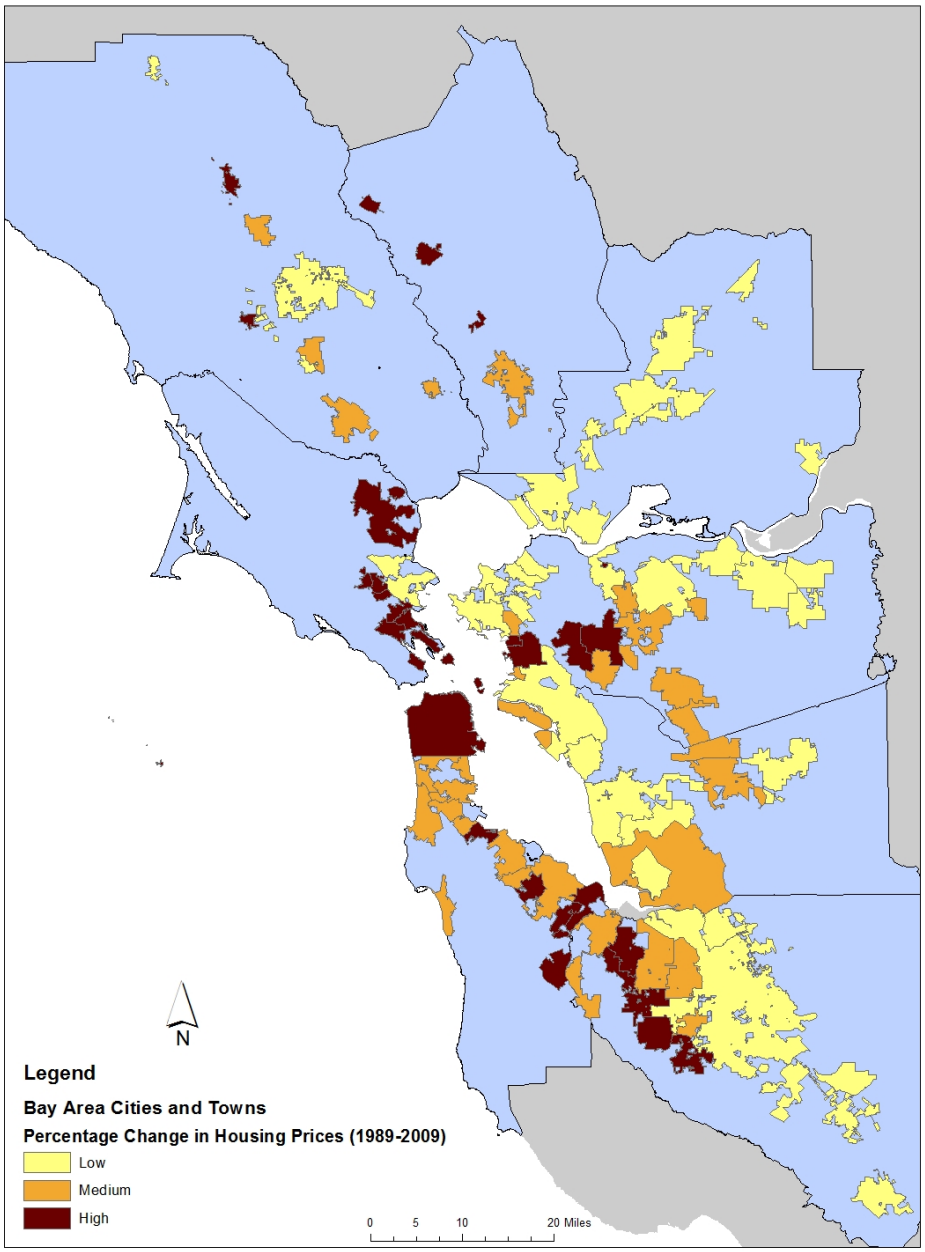
[5] William A. Fischel, *The Economics of Zoning Law: A Property Rights Approach to American Land Use Controls* (Baltimore, Johns Hopkins University Press, 1985).

[6] Karen Chapple, John V. Thomas, Dena Belzer, and Gerald Autler, "Fueling the Fire: Information Technology and Housing Price Appreciation in the San Francisco Bay Area and the Twin Cities," *Housing Policy Debate* 15,2: 347-383.

Figure 3. Housing price changes (median price per square foot) in the SF Bay Area, 1989-2009.



Map: E. Pincus-Roth, University of California

However, we wanted to construct a model using affordable housing as a variable in order to be able to compare "business as usual" price changes – the continuation of local trends – versus price changes for the household income distribution estimated in the previous section (which assumed that a city should provide housing to match the income levels for the jobs that its county generates). Thus this analysis included models both with and without an affordable housing variable.

The best base model we found, with an adjusted R^2 of .60 (in other words, accurately predicting price changes in 60% of the cities), uses just four variables to predict percent change over the twenty year historical period: percent change in Arts/Entertainment/Other employment (which has positive effects), percent change in Retail employment (negative effects), transit accessibility (share of the city that is within ½ mile of fixed rail transit) (positive effects), and percent of the housing stock that was affordable in 2000 (negative effects). The most important factors were change in Arts/Entertainment/Other employment and share of affordable housing (again, as measured by household income in relation to housing price paid, not necessarily designated or subsidized affordable housing).

Projected housing price change – "business as usual"

The next step was to incorporate the projected changes into the model in order to predict future change. We used the county employment projections for the Arts/Entertainment/Other and Retail categories, planned fixed rail transit improvements, and the proposed distribution of households qualifying for affordable housing (described above) to predict housing price change between 2009-2029. Figure 4 shows the results. The projected changes are not radically different from what occurred in the past (Figure 3), except that prices in suburban municipalities tend to increase more because of the assumed growth in affordable housing in core areas.

Projected housing price change – proposed distribution at the county level

To control for the likely endogeneity in the model that incorporating affordable housing as a variable introduced, we also looked at what factors would yield the best model to predict housing price change absent the affordable housing variable. In addition to the three remaining variables in the model, we added three new variables: percent of the population with college degrees or higher (positive effects), percent of the area's square footage that is underutilized (with an improvement to land ratio of less than 1) (negative effects), and per square foot prices in 1989 (negative effects). As it turns out, the college degree factor plays a role almost exactly opposite to affordable housing (and in fact, the two variables are highly negatively correlated, at -.80).

Using these factors, the model reached an R^2 of .73 and the results are presented in Figure 5. The differences are minor, with the principal change being that outlying areas of the region are projected to experience less housing price appreciation in this model. This suggests that the general trends observed in Figure 4 – and historically – are likely to continue in the future, if the same factors continue to drive price appreciation.

Findings summary

How might one interpret this, particularly in light of the need to understand future housing plus transportation costs in the region? To summarize, we make three principal findings:

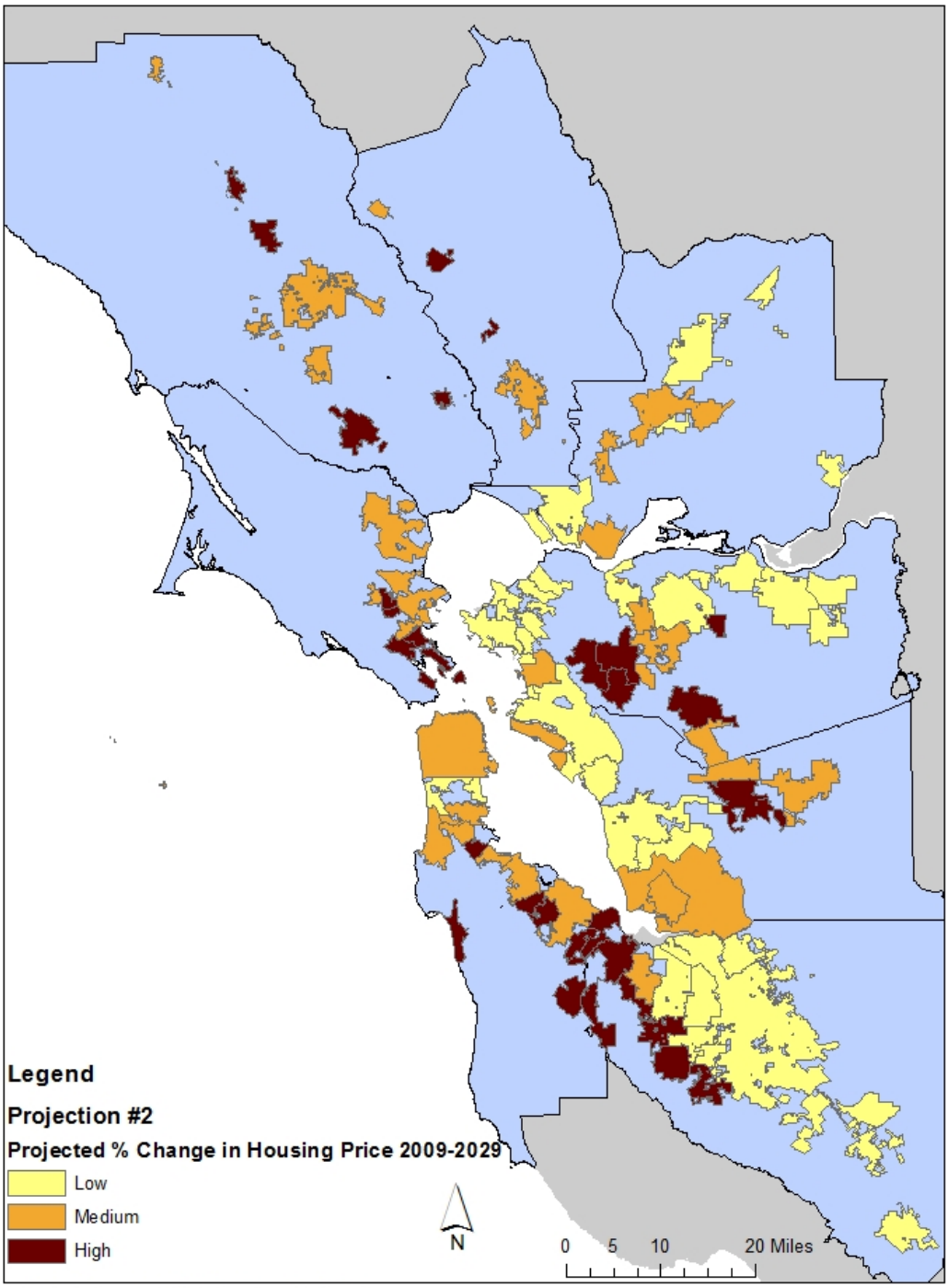
1. First, the types of jobs added in each county will affect price appreciation, with lower-wage jobs (e.g., in the retail sector) dampening local housing price appreciation.

2. If a city has a high share of affordable housing stock at present (whether because of filtering, affordable housing production, a stable residential population, or some other cause), price appreciation will be slowed.

3. Fixed rail transit improvements will have a positive, but quite slight, effect on housing price changes.

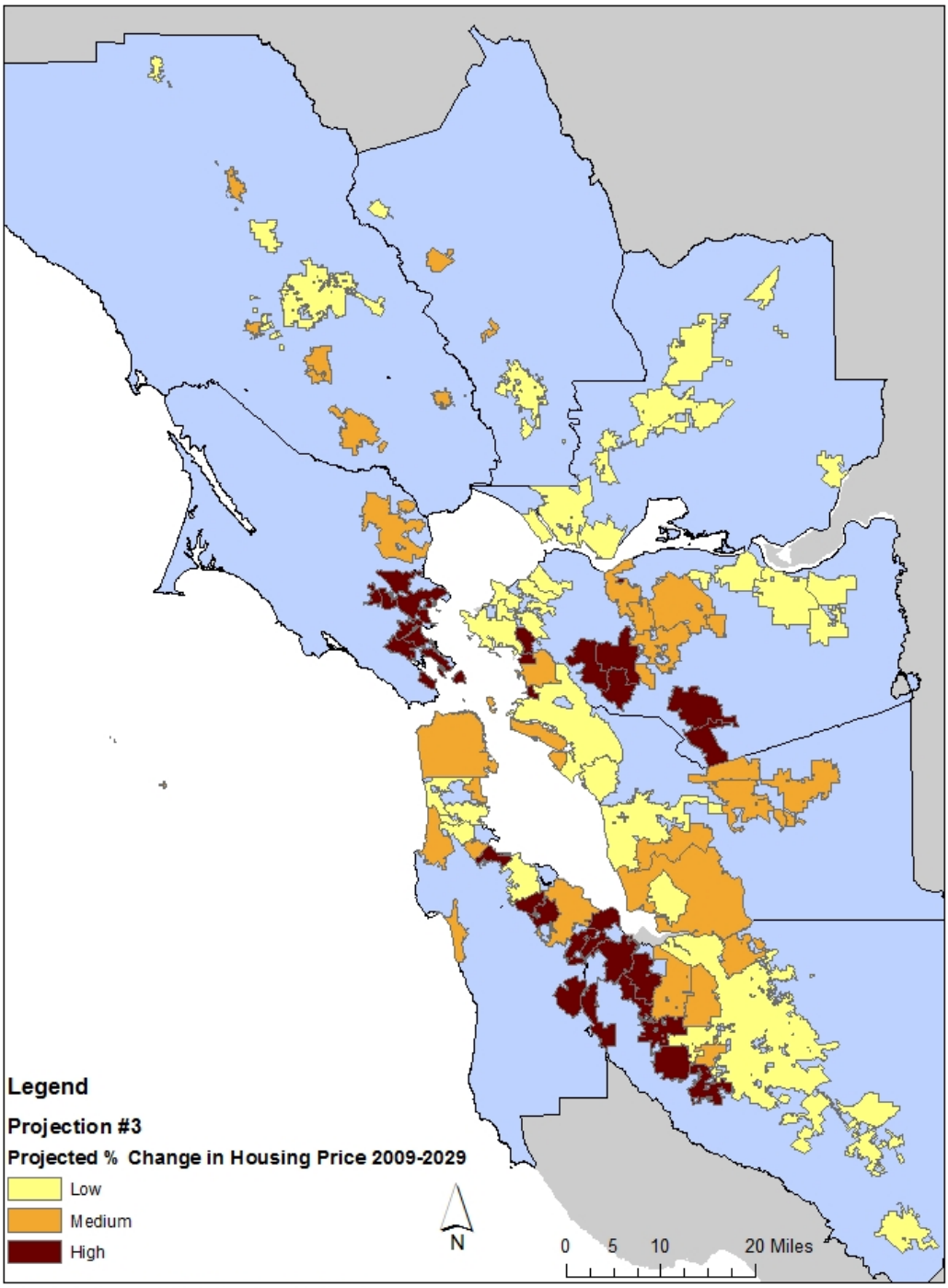
In terms of housing and transportation costs, this also suggests that housing costs will rise less rapidly in areas that experience the addition of a substantial amount of new affordable housing. And in areas where transit is improved – along with associated reduction of transportation cost – housing prices are likely to increase.

Figure 4. Projected changes in housing price, 2009-2029.



Map: E. Pincus-Roth, University of California

Figure 5. Projected changes in housing price, 2009-2029, alternative model



Map: E. Pincus-Roth, University of California