Predicting Housing Price Changes in States and MSAs Using Area Specific Price Elasticities

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I. Introduction

The three most important aspects of understanding housing markets are: Location, location, and location. As housing markets across the U.S. decline, state and local differences in housing price responses are just as evident as during the boom. These differences have wide-ranging implications in terms of regional economic growth and responses to changes in policies.

Areas with relatively constrained land available for new development experience large fluctuations in housing prices in response to changing income and population pressures. Regions with more development potential can add or lose population and income with relatively modest housing price responses. This means that states with relatively high housing price responses tend to see economic growth mitigated as the cost of living increases, reducing the willingness of people to live in the state.

This paper presents new state and MSA-specific housing price elasticities in the REMI Policy Insight Version 9.5 model. In section II, we discuss state and MSA differences in housing price changes, and present basic data. Section III shows the housing price equations, and section IV shows the estimation results. Section V presents REMI Policy Insight simulation results.

II. Housing Price Dynamics

Recently, housing price dynamics have been perhaps the most widely followed economic concept, particularly at the state and local level. From January 2000 to the peak of June 2006, the S&P/Case-Schiller home price index more than doubled from 100 to 206.39. Since that time, however, the index has fallen back to 199.18 on a national level.

At the regional and metropolitan level, the changes have often been much more extreme over this same time period. The index went up to almost 250 or more for San Diego, Washington, Miami, with a peak of 273 for Los Angeles. On the low end of housing price appreciation are Detroit and Cleveland, peaking at less than 30% appreciation since January 2000.

We estimate responses using a separate data source, the Conventional Mortgage Price Index from the Freddie Mac Office of the Chief Economist. This data source shows the percent change in housing prices from 1997 to 2004. While prices rose for all areas over this time period, regional differences were large. California, Florida, and the Northeast showed the highest gains, while the central U.S. and Southeast had the least appreciating in housing prices.

Many economists have noted the great regional differences in housing price appreciation. Furthermore, these differences cannot be explained solely due to changes in housing demand. For example, Texas has experienced a large increase in housing demand due to population and income increases, yet housing prices have risen only gradually.

Instead, housing price dynamics may be better understood in the context of fundamental supply issues as well as changes in demand. Housing supply constraints may exist in various cities and states due to a variety of reasons. These may include physical constraints such as mountains or bodies of water, political constraints including zoning regulations, and economic constraints, most notably the scarcity of land within commuting distance of work in large cities.

Diagram 1 represents the housing supply response to a change in prices in two cases. The unconstrained case represents the housing supply curve as relatively flat in comparison with the constrained market, with a more steeply sloped housing supply curve. An equal change in quantity occurs with a relatively high price change in the constrained economy compared to the unconstrained economy.

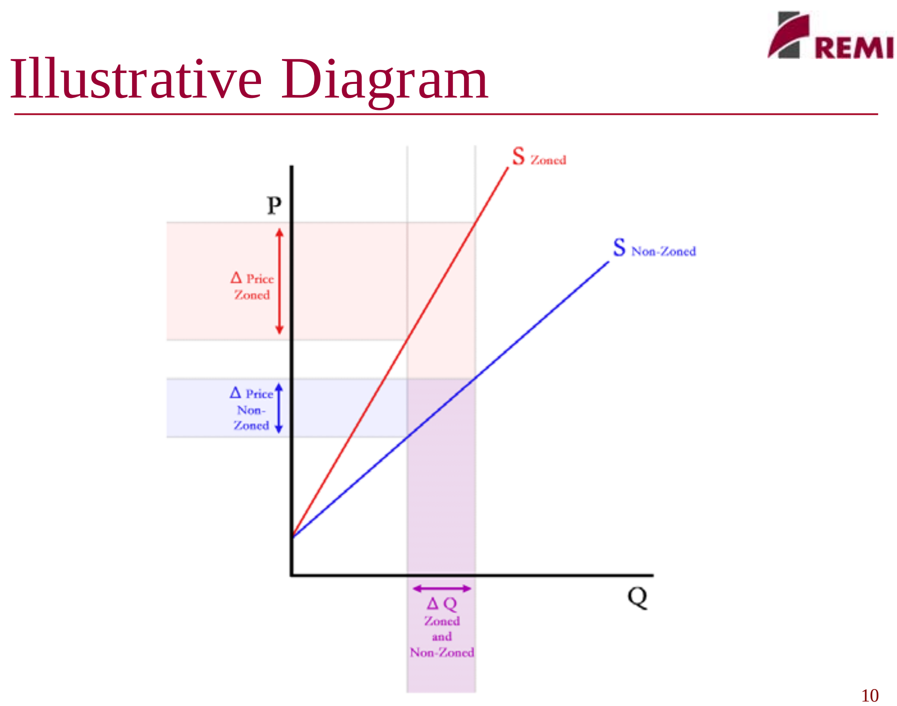
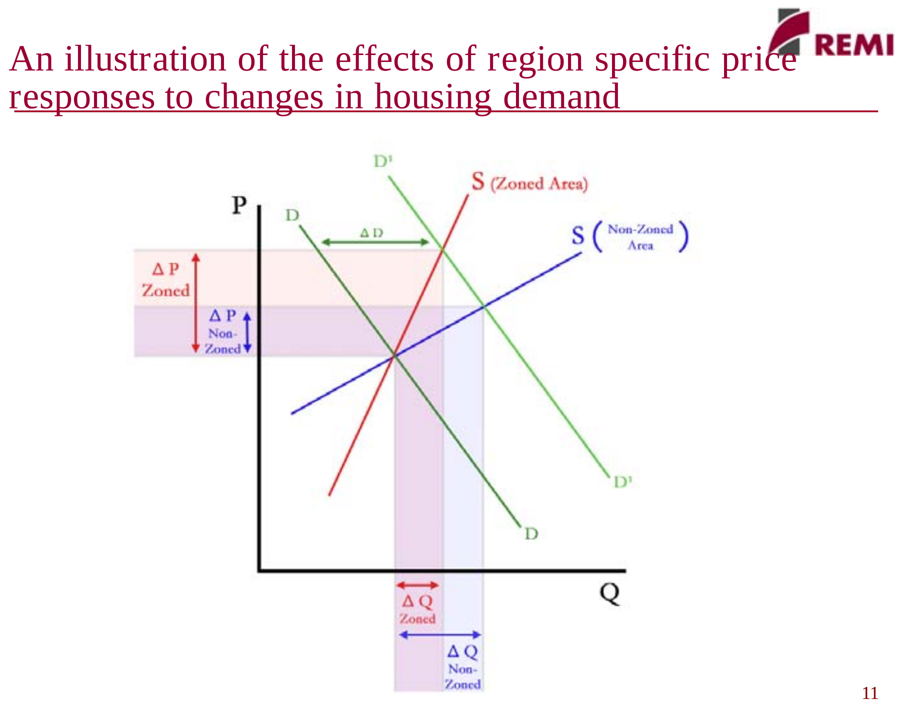


Diagram 2 extends the housing market dynamics to show the response in two economies to an equivalent change in housing demand. In the economy with constrained housing supply, a shift in housing demand raises prices more than in the unconstrained economy. Yet, this same shift in demand results in a lower increase in housing supply in comparison to the market with relatively unconstrained housing supply.



III. Housing Price Equations and Estimates

In version 9.5, the housing price equation is extended to scale housing price responses to reflect MSA and state-specific elasticities. We begin with the REMI housing price equation. This equation predicts the response in housing prices to changes in regional housing demand resulting from real disposable income and population changes, shown by

$$PH_t = \left\{ \left(\varepsilon_1 \left(\frac{RYD_t \div RYD_t^u}{RYD_{t-1} \div RYD_{t-1}^u} - 1 \right) + \varepsilon_2 * \left(\frac{N_t \div N_t^u}{N_{t-1} \div N_{t-1}^u} - 1 \right) \right) + 1 \right\} * PH_{t-1}$$

where (PH) is the relative housing price, (RYD) is real disposable income, (N) is population, (u) represents the value for the U.S. as a whole, (t) is the time period, and ε_1 and ε_2 are elasticities. In a given year (t), the change in housing prices from the previous year is determined by changes in real disposable income relative to the U.S. and changes in the population as a share of U.S. population.

We estimate the real disposable income and population coefficients in a pooled regression for 50 states and the District of Columbia over 27 years (1275 data points). From this, we estimate the elasticity of response to a change in real disposable income, ε_1 = 0.3218 (t-value of 4.84); and the elasticity of response to a change in population , ε_2 = 0.4295 (t-value of 3.09).

Policy Insight version 9.5 and higher incorporates new state and metropolitan-area estimates. We scale the real disposable income and population elasticities to the specific MSA or state using the respective price response of the area. Initially, we estimate the following equation:

$HP_t/HP_{t-1} = b * (BP_t / U_t)$

where HP is the Freddie Mac Home Price Index, BP is the number of building permits for single-family homes and U is the number of housing units. The price elasticity in response to demand, shown by the coefficient (b), uses the proxy of the number of housing permits as a percent of housing stock to represent demand change. We use the number of new houses built or started in a given year as a means to represent the shift in the demand curve. We estimate this equation using building permit and housing unit data from the Freddie Mac Conventional Mortgage Home Price Indices for state and MSA indices for 1998 to 2004.

Table 1 presents the state level home price elasticity estimates. Column 1, the b-values, shows the estimates, column 2 the standard error, and column 3, the t-statistic. The b-values represent the price elasticities in response to demand changes. We estimate these values using only the data for each state.

Column 4 of Table 1 shows the fdifference from the mean of all states (5.1) divided by the standard deviation (3.97) of the price elasticities for all states. Column 5 is the result of adding algebraically -.434 to 5.1 to obtain 4.658. The final column is calculated by dividing 4.658/5.1=.915. In the case of Alabama in REMI Policy Insight version 9.5 the values of the housing price equation above is made specific to Alabama by multiplying by .915*ε_1 and .915*ε_2 in the PH_t equation above.

Table 1: The estimate of housing price elasticities based on state specific data

Y = b* X

Y = change in housing price index (%)
X = (number of bldg. permits, single family) / (number of housing units, 1 detached) in %

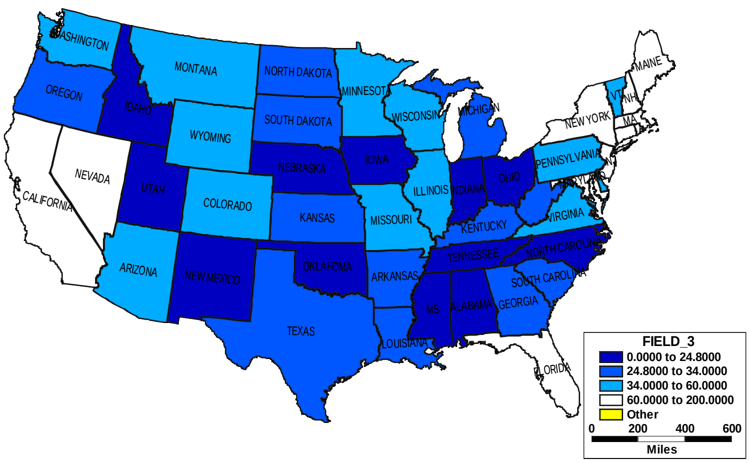
	b [1]	**std.error** [2]	**t** [3]	**Difference from U.S. mean (5.1) divided by standard deviation of b's** [4]	**(U.S. mean value of b (5.1) +col 4)** [5]	**Relative (col 5 / U.S. mean (5.1))** [6]
Alabama	3.4	0.469	7.2	-0.434	4.658	**0.915**
Alaska	4.6	1.077	4.2	-0.131	4.961	**0.974**
Arizona	1.6	0.158	10.3	-0.873	4.220	**0.829**
Arkansas	4.5	0.529	8.5	-0.146	4.947	**0.971**
California	8.2	0.826	9.9	0.776	5.868	**1.152**
Colorado	2.2	0.472	4.6	-0.732	4.360	**0.856**
Connecticut	9.7	0.600	16.2	1.163	6.255	**1.228**
Delaware	3.2	0.287	11.0	-0.487	4.605	**0.904**
District of Columbia	21.5	4.705	4.6	4.123	9.215	**1.810**
Florida	3.2	1.144	16.3	-0.468	4.625	**0.908**
Georgia	1.7	0.193	8.8	-0.855	4.237	**0.832**
Hawaii	5.3	1.492	3.6	0.064	5.156	**1.013**
Idaho	1.6	0.240	6.5	-0.891	4.201	**0.825**
Illinois	4.9	0.331	14.7	-0.061	5.031	**0.988**
Indiana	2.2	0.205	10.8	-0.725	4.367	**0.858**
Iowa	4.0	0.413	9.7	-0.270	4.822	**0.947**
Kansas	3.8	0.356	10.8	-0.318	4.774	**0.938**
Kentucky	3.4	0.258	13.1	-0.432	4.660	**0.915**
Louisiana	3.7	0.295	12.6	-0.347	4.745	**0.932**
Maine	7.1	0.371	19.2	0.509	5.601	**1.100**
Maryland	5.1	1.243	4.1	-0.003	5.089	**0.999**
Massachusetts	12.5	0.589	21.3	1.870	6.962	**1.367**
Michigan	3.6	0.479	7.5	-0.372	4.720	**0.927**
Minnesota	4.7	0.431	10.8	-0.109	4.983	**0.979**
Mississippi	3.5	0.477	7.2	-0.413	4.679	**0.919**
Missouri	5.0	0.326	15.2	-0.033	5.059	**0.993**
Montana	8.1	0.244	33.0	0.747	5.839	**1.147**
Nebraska	2.8	0.239	11.6	-0.583	4.509	**0.886**
Nevada	1.8	0.648	2.8	-0.831	4.261	**0.837**
New Hampshire	6.4	0.424	15.0	0.324	5.416	**1.064**
New Jersey	9.4	1.096	8.6	1.093	6.185	**1.215**
New Mexico	2.2	0.402	5.5	-0.725	4.367	**0.858**
New York	15.3	1.084	14.1	2.570	7.662	**1.505**
North Carolina	1.5	0.147	10.3	-0.901	4.191	**0.823**
North Dakota	5.2	0.538	9.7	0.026	5.118	**1.005**
Ohio	3.6	0.322	11.3	-0.366	4.726	**0.928**
Oklahoma	4.3	0.418	10.4	-0.192	4.900	**0.962**
Oregon	3.2	0.439	7.3	-0.474	4.619	**0.907**
Pennsylvania	6.1	0.829	7.4	0.263	5.355	**1.052**
Rhode Island	16.4	2.282	7.2	2.857	7.949	**1.561**
Sourth Carolina	1.8	0.246	7.4	-0.821	4.271	**0.839**
South Dakota	3.0	0.184	16.3	-0.528	4.565	**0.896**
Tennessee	2.4	0.237	10.1	-0.678	4.414	**0.867**
Texas	2.0	0.415	4.9	-0.768	4.324	**0.849**
Utah	0.8	0.211	4.0	-1.071	4.021	**0.790**
Vermont	7.0	0.851	8.3	0.489	5.581	**1.096**
Virginia	4.1	0.528	7.8	-0.250	4.842	**0.951**
Washington	3.2	0.403	8.1	-0.466	4.626	**0.909**
West Virginia	6.7	0.936	7.1	0.396	5.488	**1.078**
Wisconsin	3.5	0.364	9.7	-0.392	4.700	**0.923**
Wyoming	4.6	0.227	20.2	-0.123	4.969	**0.976**
	5.1					
				0.000	std dev-->	3.969821303

Source:
Housing Price Index is Conventional Home Price Mortgage from Freddie Mac website.
Housing permits and housing units come from the Census Bureau website.

For California the ε_1 and ε_2 are both multiplied by 1.152 (see column 6). Thus for a change in the value of % change in real disposable income (RYD) and % change in population (N) the % change in housing price will be 15% higher than the universal ε_1

and ε_2 values in California and in Alabama it will be 8.5% lower than what it would be if the U.S. average ε_1 and ε_2 values were not localized. In the model version 9.5 the relative values will be included in the coefficients but can be changed back to the average U.S. values by multiplying ε_1 and ε_2 by 1, or to other values determined by the user. Any forecast run with setting the modifier of ε_1 and ε_2 to one will use the U.S. elasticities.

Percentage Change in Housing Price 1999-2004



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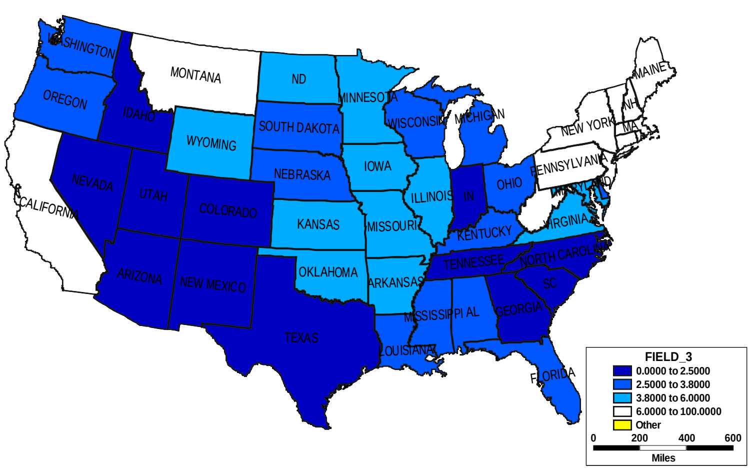
Regression Results: Percentage Change in Housing Price per percent of building permits relative to the housing stock



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In addition to calculating state differences relative to all other states, the same procedure was used for metro level areas. The results are shown for 116 MSAs on Table 2. For the MSAs the mean is 4.0 (U.S. 5.1 for the states) and the standard deviation was also 4.0 for the MSAs. To make the deviation comparable to the state average of 5.1 the variation for the MSAs was also calculated using the 5.1 average.

Since all of our models are based on aggregating county data, the MSA values are used for the counties in the MSA. The non MSA counties use the state values (elasticities) multiplied by an adjustment that will ensure that the weighted values of the counties will add up to the state values which are based on state wide data (the state data is shown on Table 1). The metro area estimates are listed on Table 2. In both cases the final column shows their relative elasticities using the overall standard error to calculate column 4 and 5.

Table 2: The estimate of housing price elasticities based on metro level data

[redacted]

51	KALAMAZOO-PORTAGE MI MSA	4.2	0.282	14.8	-0.232	4.868	0.955
52	KANSAS CITY MO-KS MSA	2.6	0.286	9.1	-0.624	4.476	0.878
53	KILLEEN-TEMPLE-FORT HOOD TX MSA	1.4	0.208	6.9	-0.918	4.182	0.820
54	KNOXVILLE TN MSA	2.4	0.242	10.1	-0.663	4.437	0.870
55	LAFAYETTE LA MSA	2.8	0.352	7.8	-0.585	4.515	0.885
56	LAKELAND FL MSA	1.3	0.186	7.0	-0.948	4.152	0.814
57	LANCASTER PA MSA	2.7	0.467	5.8	-0.596	4.504	0.883
58	LANSING-EAST LANSING MI MSA	3.7	0.283	13.2	-0.345	4.755	0.932
59	LEXINGTON-FAYETTE KY MSA	1.8	0.170	10.6	-0.827	4.273	0.838
60	LINCOLN NE MSA	1.3	0.102	12.6	-0.954	4.146	0.813
61	LITTLE ROCK-NORTH LITTLE ROCK AR	2.3	0.191	12.0	-0.702	4.398	0.862
62	LOS ANGELES-LONG BEACH-GLENDALE CA	28.5	4.747	6.0	5.854	10.954	2.148
63	LUBBOCK TX MSA	2.4	0.102	23.3	-0.684	4.416	0.866
64	MACON GA MSA	1.6	0.172	9.3	-0.876	4.224	0.828
65	MADISON WI MSA	2.1	0.221	9.4	-0.757	4.343	0.852
66	MCALLEN-EDINBURG-PHAR TX MSA	0.9	0.062	14.5	-1.050	4.050	0.794
67	Melbourne--Titusville--Palm Bay FL MSA	3.3	0.574	5.8	-0.438	4.662	0.914
68	MIAMI-MIAMI BEACH-KENDALL FL MSAD	3.9	0.494	7.9	-0.304	4.796	0.940
69	MOBILE AL MSA	3.8	0.513	7.4	-0.329	4.771	0.935
70	MODESTO CA MSA	4.9	0.537	9.2	-0.040	5.060	0.992
71	MONTGOMERY AL MSA	1.7	0.346	4.9	-0.854	4.246	0.833
72	NASHVILLE-DAVIDSON-MURFREESBORO TN	1.3	0.095	13.3	-0.960	4.140	0.812
73	NEW ORLEANS-METAIRIE-KENNER LA MSA	4.1	0.359	11.5	-0.242	4.858	0.953
74	OKLAHOMA CITY OK MSA	2.5	0.217	11.4	-0.657	4.443	0.871
75	ORLANDO FL MSA	1.9	0.170	11.5	-0.789	4.311	0.845
76	PENSACOLA-FERRY PASS-BRENT FL MSA	2.6	0.480	5.3	-0.637	4.463	0.875
77	PEORIA IL MSA	3.7	0.440	8.5	-0.343	4.757	0.933
78	PITTSBURGH PA MSA	7.0	0.703	10.0	0.482	5.582	1.095
79	PROVIDENCE-NEW BEDFORD-FALL RIVER RI	10.6	0.935	11.3	1.377	6.477	1.270
80	PROVO-OREM UT MSA	0.5	0.111	4.7	-1.144	3.956	0.776
81	RALEIGH-CARY NC MSA	1.0	0.088	11.3	-1.028	4.072	0.798
82	READING PA MSA	3.1	0.662	4.6	-0.510	4.590	0.900
83	RENO-SPARKS NV MSA	2.1	0.560	3.8	-0.743	4.357	0.854
84	RICHMOND VA MSA	2.7	0.321	8.4	-0.601	4.499	0.882
85	ROCHESTER NY MSA	4.6	0.546	8.3	-0.136	4.964	0.973
86	ROCKFORD IL MSA	2.5	0.279	8.9	-0.658	4.442	0.871
87	SAGINAW-SAGINAW TOWNSHIP NORTH MI	4.5	0.443	10.2	-0.151	4.949	0.970
88	ST LOUIS MO-IL MSA	4.3	0.288	15.0	-0.199	4.901	0.961
89	SALINAS CA MSA	11.6	1.935	6.0	1.634	6.734	1.320
90	SALT LAKE CITY UT MSA	1.5	0.304	5.0	-0.891	4.209	0.825
91	SAN ANTONIO TX MSA	1.9	0.095	19.6	-0.808	4.292	0.841
92	SAN DIEGO-CARLSBAD-SAN MARCOS CA	9.8	1.228	8.0	1.166	6.266	1.229
93	SAN FRANCISCO-SAN MATEO-REDWOOD CITY	20.5	4.756	4.3	3.845	8.945	1.754
94	SAN LUIS OBISPO-PASO ROBLES CA MSA	5.7	0.321	17.6	0.141	5.241	1.028
95	SANTA BARBARA-SANTA MARIA-GOLETA CA	14.9	1.507	9.9	2.446	7.546	1.480
96	SARASOTA-BRADENTON-VENICE FL MSA	2.5	0.219	11.5	-0.648	4.452	0.873
97	SAVANNAH GA MSA	2.5	0.184	13.4	-0.656	4.444	0.871
98	SCRANTON-WILKES-BARRE PA MSA	5.9	0.799	7.4	0.210	5.310	1.041
99	SHREVEPORT-BOSSIER CITY LA MSA	3.8	0.411	9.3	-0.321	4.779	0.937
100	SOUTH BEND-MISHAWAKA IN-MI MSA	3.9	0.323	11.9	-0.311	4.789	0.939
101	SPOKANE WA MSA	2.8	0.657	4.2	-0.586	4.514	0.885
102	SPRINGFIELD MO MSA	1.3	0.152	8.8	-0.939	4.161	0.816
103	SPRINGFIELD MA MSA	8.9	0.690	12.9	0.946	6.046	1.185
104	STOCKTON CA MSA	3.3	0.629	5.2	-0.458	4.642	0.910
105	SYRACUSE NY MSA	7.6	0.801	9.4	0.614	5.714	1.120
106	TALLAHASSEE FL MSA	2.3	0.398	5.9	-0.690	4.410	0.865
107	TAMPA-ST PETERSBURG-CLEARWATER FL	3.6	0.328	10.9	-0.383	4.717	0.925
108	TOLEDO OH MSA	3.4	0.420	8.0	-0.434	4.666	0.915
109	TUCSON AZ MSA	2.0	0.224	8.9	-0.776	4.324	0.848
110	TULSA OK MSA	2.5	0.363	6.9	-0.653	4.447	0.872
111	UTICA-ROME NY MSA	9.4	1.659	5.7	1.085	6.185	1.213
112	VISALIA-PORTERVILLE CA MSA	4.7	1.428	3.3	-0.109	4.991	0.979
113	West Palm Beach--Boca Raton FL MSA	3.1	0.224	13.9	-0.496	4.604	0.903
114	WICHITA KS MSA	2.1	0.245	8.5	-0.757	4.343	0.851
115	YORK-HANOVER PA MSA	2.0	0.357	5.6	-0.780	4.320	0.847
116	YOUNGSTOWN-WARREN-BOARDMAN OH-PA	5.2	0.871	6.0	0.024	5.124	1.005

Table 3 shows the adjustment to the state elasticities so that they can be used for the non-metro counties in such a way that the weighted values of all of the county values will produce the state elasticity when aggregated up to the state.

Table 3: Adjustment to the State Elasticity for all non-metro counties in the model

	Housing Price Relative Elasticity Modifier	**Non Metro Area Elasticity Modifier**	**x**
ALABAMA	0.9148	0.9789	1.0701
ALASKA	0.9743	0.9743	1.0000
ARIZONA	0.8286	0.8253	0.9959
ARKANSAS	0.9714	1.0583	1.0894
CALIFORNIA	1.1524	0.5204	0.4516
COLORADO	0.8563	0.8612	1.0058
CONNECTICUT	1.2284	1.2643	1.0292
DELAWARE	0.9044	0.9044	1.0000
DISTRICT OF COLUMBIA	1.8096	1.8096	1.0000
FLORIDA	0.9082	0.9581	1.0550
GEORGIA	0.8320	0.8752	1.0519
HAWAII	1.0126	0.8544	0.8438
IDAHO	0.8250	0.8499	1.0302
ILLINOIS	0.9881	0.9933	1.0053
INDIANA	0.8576	0.8743	1.0194
IOWA	0.9469	0.9752	1.0298
KANSAS	0.9375	1.0314	1.1001
KENTUCKY	0.9152	0.9261	1.0118
LOUISIANA	0.9319	0.9760	1.0473
MAINE	1.0999	1.0999	1.0000
MARYLAND	0.9994	0.9994	1.0000
MASSACHUSETTS	1.3673	1.2098	0.8848
MICHIGAN	0.9269	0.9059	0.9774
MINNESOTA	0.9786	0.9786	1.0000
MISSISSIPPI	0.9189	0.9570	1.0415
MISSOURI	0.9935	1.1617	1.1693
MONTANA	1.1466	1.1466	1.0000
NEBRASKA	0.8855	0.8996	1.0159
NEVADA	0.8369	0.8328	0.9951
NEW HAMPSHIRE	1.0636	1.0636	1.0000
NEW JERSEY	1.2146	1.2181	1.0029
NEW MEXICO	0.8576	0.8576	1.0000
NEW YORK	1.5048	1.5980	1.0619
NORTH CAROLINA	0.8230	0.8236	1.0007
NORTH DAKOTA	1.0052	1.0052	1.0000
OHIO	0.9281	0.8598	0.9265
OKLAHOMA	0.9623	1.1291	1.1733
OREGON	0.9070	0.9076	1.0006
PENNSYLVANIA	1.0517	1.0972	1.0433
RHODE ISLAND	1.5610	1.5610	1.0000
SOUTH CAROLINA	0.8387	0.8559	1.0205
SOUTH DAKOTA	0.8964	0.8964	1.0000
TENNESSEE	0.8668	0.8909	1.0279
TEXAS	0.8491	0.8632	1.0166
UTAH	0.7897	0.7470	0.9460
VERMONT	1.0959	1.0959	1.0000
VIRGINIA	0.9509	0.9631	1.0129
WASHINGTON	0.9085	0.9100	1.0016
WEST VIRGINIA	1.0777	1.0777	1.0000
WISCONSIN	0.9229	0.9320	1.0098
WYOMING	0.9758	0.9758	1.0000

including all states standard deviation (.1)

0.999

excluding states with no MSAs with std deviation of .11

1.0046

IV. Forecast and Simulation Results

The new housing price coefficients change both economic forecast and simulation results. For economies with relatively unconstrained housing supply, modeled economies grow faster in the baseline and as a result of a simulated economic stimulus. This section shows results over the same 2006-2050 time period with the earlier housing price coefficients compared to the new housing price coefficients.

Chart A shows the housing market dynamics in North Carolina using the new state specific housing price coefficient compared to the U.S. average housing price coefficient. In both economic forecasts, real disposable income and population increase over time, raising the price of housing. But, under the new set of responses, the housing price increase is more gradual in North Carolina due to a relatively low housing price elasticity compared to the U.S. average. Thus, the relative housing price change shown in Chart A is lower with the new supply response than under the previous response. This relatively slow growth in housing prices results in an increase in population and real disposable income growth for the state.

Chart A – Forecast of North Carolina Specific Housing Coefficients Compared to Forecast Using US Average Housing Coefficients

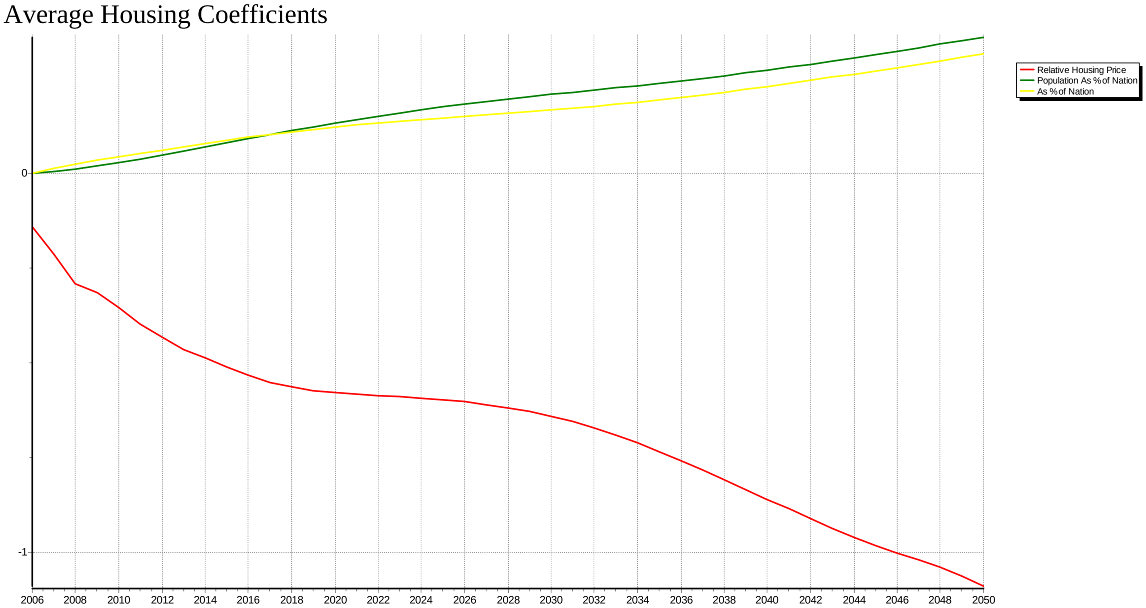

Table A shows the complete forecast comparison for selected years, 2006-2050. After the new housing price response starting in 2006, there is a gradual increase in economic activity due to the lower housing price response. The price index is lower due to housing prices; from this year disposable personal income increases, leading to additional in-migration and population increase. The larger population leads to increased employment, due to higher consumption and government spending, and a larger labor force.

Table A – Forecast of North Carolina Specific Housing Coefficients Compared to Forecast Using US Average Housing Coefficients

Variable	2006	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total Emp (Thous)	0.000%	0.034%	0.075%	0.108%	0.131%	0.149%	0.172%	0.201%	0.234%	0.268%
Total GRP (Bil Chained 2000$)	0.000%	0.038%	0.085%	0.125%	0.151%	0.172%	0.197%	0.228%	0.264%	0.300%
Total GRP (Bil Fixed 2000$)	0.000%	0.038%	0.085%	0.125%	0.151%	0.172%	0.197%	0.228%	0.264%	0.300%
Personal Income (Bil Nom $)	0.000%	0.024%	0.056%	0.083%	0.102%	0.118%	0.138%	0.164%	0.197%	0.233%
PCE-Price Index (Fixed 2000$)	0.000%	-0.019%	-0.031%	-0.039%	-0.044%	-0.048%	-0.055%	-0.064%	-0.073%	-0.080%
Real Disp Pers Inc (Bil Fixed 2000$)	0.000%	0.043%	0.086%	0.122%	0.145%	0.167%	0.193%	0.228%	0.270%	0.314%
Demand (Bil Fixed 2000$)	0.000%	0.039%	0.086%	0.124%	0.150%	0.171%	0.196%	0.229%	0.267%	0.306%
Output (Bil Fixed 2000$)	0.000%	0.038%	0.084%	0.121%	0.146%	0.165%	0.188%	0.218%	0.253%	0.287%
Labor Productivity (Thous Fixed 2000$)	0.000%	0.000%	0.005%	0.011%	0.015%	0.017%	0.019%	0.019%	0.020%	0.021%
Relative Delivered Price	0.000%	-0.014%	-0.023%	-0.030%	-0.034%	-0.038%	-0.043%	-0.051%	-0.058%	-0.064%
Relative Cost of Production	0.000%	-0.022%	-0.037%	-0.048%	-0.054%	-0.061%	-0.070%	-0.081%	-0.093%	-0.103%
Relative Labor Intensity	0.000%	-0.003%	-0.010%	-0.016%	-0.021%	-0.025%	-0.029%	-0.033%	-0.038%	-0.044%
Labor Access Index	0.000%	0.001%	0.004%	0.007%	0.009%	0.011%	0.012%	0.014%	0.017%	0.019%
Industrial Mix Index (calculated)	0.000%	0.000%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Reg Pur Coeff (SS over Dem)	0.000%	0.012%	0.026%	0.036%	0.042%	0.047%	0.053%	0.061%	0.070%	0.079%
Imports from Rest of Nation (Bil Fixed 2000$)	0.000%	0.026%	0.057%	0.083%	0.103%	0.120%	0.138%	0.161%	0.189%	0.219%
Imports from Rest of World (Bil Fixed 2000$)	0.000%	0.017%	0.043%	0.065%	0.081%	0.094%	0.107%	0.125%	0.146%	0.170%
Self Supply (Bil Fixed 2000$)	0.000%	0.052%	0.111%	0.160%	0.192%	0.218%	0.249%	0.290%	0.337%	0.385%
Exports to Rest of Nation (Bil Fixed 2000$)	0.000%	0.020%	0.049%	0.072%	0.087%	0.098%	0.110%	0.126%	0.144%	0.160%
Exports to Rest of World (Bil Fixed 2000$)	0.000%	0.013%	0.032%	0.049%	0.062%	0.072%	0.082%	0.095%	0.110%	0.124%
Ave Ann Comp Rate (Thous Nom $)	0.000%	-0.004%	-0.012%	-0.022%	-0.030%	-0.038%	-0.044%	-0.051%	-0.058%	-0.065%
Population (Thous)	0.000%	0.027%	0.079%	0.132%	0.174%	0.207%	0.237%	0.272%	0.313%	0.358%
Labor Force	0.000%	0.034%	0.089%	0.139%	0.176%	0.205%	0.235%	0.271%	0.312%	0.354%

As well as the economic forecast, the new housing price responses impact simulation results. We demonstrate this for Boston, using a multi-regional model of Massachusetts with MSA-specific and state-specific housing price coefficients. We compare the results of a simulation of fifty thousand new direct employees in the securities industry locating in Suffolk County, Massachusetts (Boston).

Chart B shows the simulation results for the model using the national housing price coefficients, and the region-specific responses. In both cases housing prices increase as a result of higher incomes and population that result from the increase in jobs. However, the new housing price response shows a significantly higher increase in prices, up over 7% by 2025 as a result of the stimulus, in contrast to a 5% increase using the U.S. average response.

Chart B – 50,000 Securities Employee Shock to Suffolk County MA, % Change from US Average Housing Price Coefficient Baseline

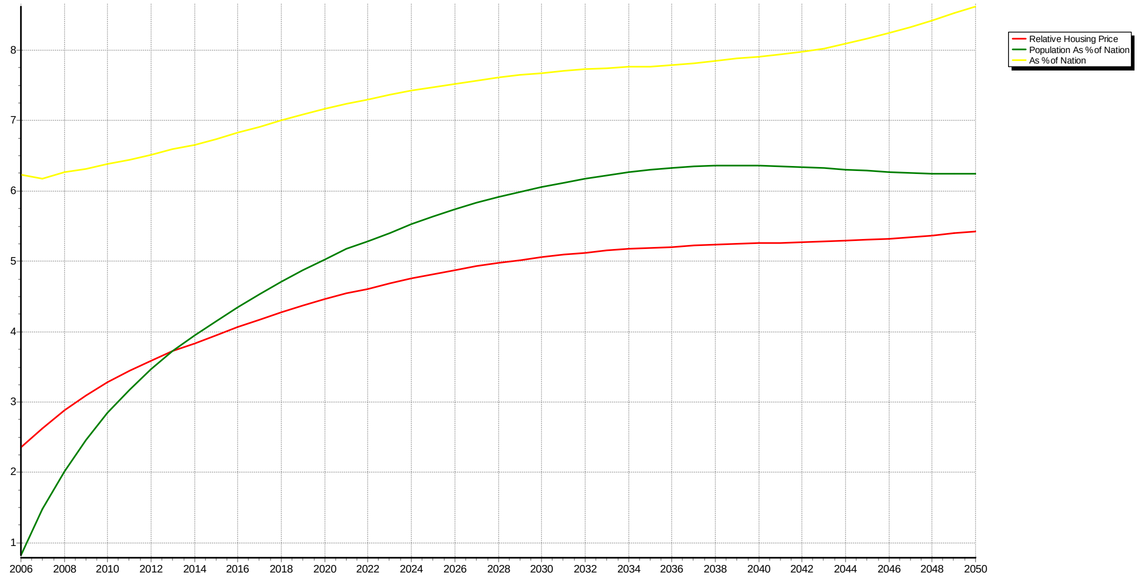

Table B shows the summary results of the employment increase with the U.S. average coefficients. Employment increases by almost 8% in the first year as a result of the shock. Real disposable income and population increase as a result of the employment stimulus. Higher incomes and population drive up housing prices, reflected in the overall increase in the price index, peaking at about a one-half a percent increase by 2009, but dropping to just over a quarter of a percent increase by 2025.

Table B – 50,000 Securities Employee Shock to Suffolk County MA, % Change from US Average Housing Price Coefficient Baseline

Variable	2006	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total Emp (Thous)	7.946%	7.605%	7.613%	8.002%	8.322%	8.543%	8.686%	8.850%	9.069%	9.254%
Total GRP (Bil Chained 2000$)	11.435%	11.598%	12.088%	13.233%	14.258%	15.151%	15.947%	16.823%	17.834%	18.783%
Total GRP (Bil Fixed 2000$)	11.435%	11.598%	12.088%	13.233%	14.258%	15.151%	15.947%	16.823%	17.834%	18.783%
Personal Income (Bil Nom $)	6.666%	7.129%	7.328%	7.671%	7.939%	8.109%	8.169%	8.271%	8.492%	8.929%
PCE-Price Index (Fixed 2000$)	0.156%	0.483%	0.374%	0.307%	0.278%	0.252%	0.224%	0.193%	0.168%	0.174%
Real Disp Pers Inc (Bil Fixed 2000$)	6.233%	6.377%	6.735%	7.165%	7.472%	7.674%	7.765%	7.904%	8.161%	8.619%
Demand (Bil Fixed 2000$)	9.706%	10.279%	11.070%	12.014%	12.872%	13.592%	14.182%	14.795%	15.527%	16.275%
Output (Bil Fixed 2000$)	12.387%	12.571%	13.163%	14.331%	15.381%	16.304%	17.140%	18.082%	19.187%	20.230%
Labor Productivity (Thous Fixed 2000$)	3.162%	3.960%	4.648%	5.402%	6.092%	6.749%	7.387%	8.073%	8.822%	9.545%
Relative Delivered Price	0.145%	0.426%	0.292%	0.213%	0.175%	0.143%	0.109%	0.070%	0.039%	0.041%
Relative Cost of Production	0.184%	0.546%	0.356%	0.246%	0.193%	0.149%	0.101%	0.044%	-0.006%	-0.009%
Relative Labor Intensity	-0.004%	-0.007%	0.009%	0.047%	0.087%	0.125%	0.159%	0.189%	0.217%	0.240%
Labor Access Index	0.080%	0.260%	0.333%	0.371%	0.401%	0.426%	0.448%	0.468%	0.489%	0.509%
Industrial Mix Index (calculated)	0.000%	0.033%	0.048%	0.048%	0.048%	0.048%	0.048%	0.048%	0.048%	0.048%
Reg Pur Coeff (SS over Dem)	1.814%	1.815%	1.918%	2.122%	2.318%	2.492%	2.641%	2.818%	3.037%	3.261%
Imports from Multiregions (Bil Fixed 2000$)	5.874%	6.218%	6.589%	7.132%	7.592%	7.963%	8.270%	8.561%	8.899%	9.240%
Imports from Rest of Nation (Bil Fixed 2000$)	5.309%	5.721%	6.072%	6.571%	6.982%	7.297%	7.550%	7.802%	8.118%	8.446%
Imports from Rest of World (Bil Fixed 2000$)	4.743%	5.589%	6.119%	6.538%	6.853%	7.082%	7.248%	7.400%	7.616%	7.892%
Self Supply (Bil Fixed 2000$)	11.696%	12.281%	13.200%	14.391%	15.488%	16.422%	17.198%	18.030%	19.035%	20.066%
Exports to Multiregions (Bil Fixed 2000$)	3.457%	2.971%	2.919%	3.173%	3.401%	3.572%	3.760%	4.011%	4.354%	4.671%
Exports to Rest of Nation (Bil Fixed 2000$)	21.943%	22.059%	22.813%	24.698%	26.376%	27.974%	29.520%	31.294%	33.282%	35.065%
Exports to Rest of World (Bil Fixed 2000$)	-0.053%	-0.384%	-0.179%	0.167%	0.433%	0.626%	0.783%	0.928%	1.064%	1.149%
Ave Ann Comp Rate (Thous Nom $)	6.132%	6.086%	5.490%	5.307%	5.224%	5.158%	5.087%	5.046%	5.054%	5.103%
Population (Thous)	0.823%	2.849%	4.150%	5.031%	5.634%	6.056%	6.300%	6.362%	6.287%	6.238%
Labor Force	1.643%	4.060%	5.001%	5.568%	5.930%	6.265%	6.548%	6.874%	7.138%	7.157%

Table C shows the results of this scenario using the new MSA and state-specific housing price elasticities. The first year employment effect is identical, but, over time the employment increase is mitigated by a higher increase in prices caused by the housing market. By 2025, the employment gain with the new housing price response is 7.68% compared by an 8.32% increase using the U.S. average response. Overall consumer prices, shown in the personal consumption expenditures (PCE) price index, peak at a 0.63% increase in 2009 and are still over half of one percent higher by year 2025. Thus, the new housing price response shows a greater, long-lasting increase in the cost of living due to an employment stimulus. Ultimately, this discourages people from locating in the region, so that the population increase by 2025 is 4.75% over the baseline with the higher housing price response, compared to a 5.63% increase in population using the U.S. average response. As a result, the labor force and employment are both lower as a result of a higher estimated increase in housing prices.

Chart C – 50,000 Securities Employee Shock to Suffolk County MA, % Change from Local Housing Price Coefficient Baseline

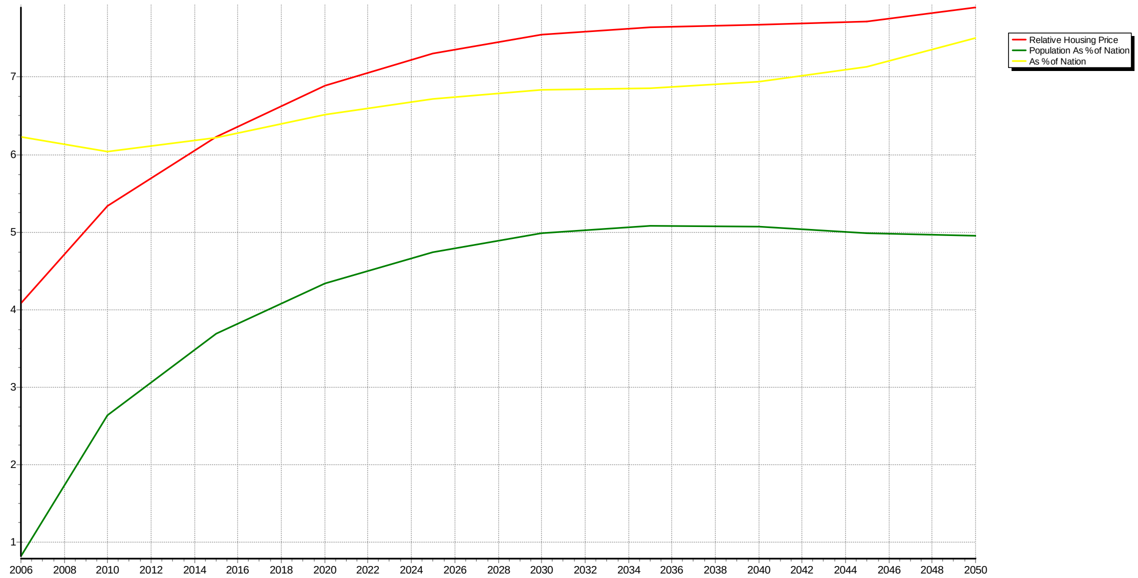

Table C – 50,000 Securities Employee Shock to Suffolk County MA, % Change from Local Housing Price Coefficient Baseline

Variable	2006	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total Emp (Thous)	7.95%	7.35%	7.20%	7.46%	7.68%	7.83%	7.91%	8.03%	8.21%	8.36%
Total GRP (Bil Chained 2000$)	11.44%	11.19%	11.39%	12.32%	13.16%	13.91%	14.60%	15.40%	16.34%	17.23%
Total GRP (Bil Fixed 2000$)	11.44%	11.19%	11.39%	12.32%	13.16%	13.91%	14.60%	15.40%	16.34%	17.23%
Personal Income (Bil Nom $)	6.67%	6.95%	7.01%	7.25%	7.43%	7.53%	7.53%	7.59%	7.76%	8.12%
PCE-Price Index (Fixed 2000$)	0.16%	0.64%	0.56%	0.52%	0.51%	0.50%	0.48%	0.45%	0.44%	0.45%
Real Disp Pers Inc (Bil Fixed 2000$)	6.23%	6.04%	6.22%	6.51%	6.72%	6.83%	6.86%	6.94%	7.14%	7.50%
Demand (Bil Fixed 2000$)	9.71%	9.91%	10.45%	11.21%	11.91%	12.50%	12.99%	13.53%	14.20%	14.88%
Output (Bil Fixed 2000$)	12.39%	12.15%	12.46%	13.41%	14.28%	15.06%	15.79%	16.65%	17.68%	18.65%
Labor Productivity (Thous Fixed 2000$)	3.16%	3.83%	4.41%	5.08%	5.70%	6.29%	6.89%	7.55%	8.28%	8.98%
Relative Delivered Price	0.15%	0.57%	0.48%	0.43%	0.40%	0.38%	0.36%	0.33%	0.30%	0.32%
Relative Cost of Production	0.18%	0.76%	0.62%	0.55%	0.52%	0.49%	0.45%	0.40%	0.37%	0.38%
Relative Labor Intensity	0.00%	0.01%	0.06%	0.12%	0.17%	0.22%	0.26%	0.29%	0.32%	0.34%
Labor Access Index	0.08%	0.26%	0.32%	0.35%	0.38%	0.40%	0.42%	0.43%	0.45%	0.47%
Industrial Mix Index (calculated)	0.00%	0.03%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%
Reg Pur Coeff (SS over Dem)	1.81%	1.77%	1.84%	2.02%	2.19%	2.35%	2.48%	2.65%	2.85%	3.07%
Imports from Multiregions (Bil Fixed 2000$)	5.87%	5.97%	6.18%	6.59%	6.94%	7.22%	7.45%	7.69%	7.99%	8.29%
Imports from Rest of Nation (Bil Fixed 2000$)	5.31%	5.44%	5.62%	5.98%	6.29%	6.52%	6.71%	6.92%	7.19%	7.48%
Imports from Rest of World (Bil Fixed 2000$)	4.74%	5.41%	5.83%	6.16%	6.40%	6.57%	6.69%	6.81%	7.00%	7.25%
Self Supply (Bil Fixed 2000$)	11.70%	11.85%	12.49%	13.45%	14.36%	15.14%	15.80%	16.54%	17.46%	18.40%
Exports to Multiregions (Bil Fixed 2000$)	3.46%	2.55%	2.25%	2.35%	2.47%	2.57%	2.72%	2.94%	3.25%	3.54%
Exports to Rest of Nation (Bil Fixed 2000$)	21.94%	21.66%	22.08%	23.69%	25.13%	26.53%	27.93%	29.58%	31.47%	33.16%
Exports to Rest of World (Bil Fixed 2000$)	-0.05%	-0.55%	-0.49%	-0.24%	-0.06%	0.08%	0.21%	0.32%	0.43%	0.49%
Ave Ann Comp Rate (Thous Nom $)	6.13%	6.08%	5.50%	5.33%	5.25%	5.19%	5.13%	5.10%	5.13%	5.19%
Population (Thous)	0.82%	2.64%	3.69%	4.34%	4.74%	4.99%	5.09%	5.07%	4.99%	4.95%
Labor Force	1.64%	3.82%	4.54%	4.95%	5.20%	5.44%	5.64%	5.86%	6.05%	6.04%

V: Conclusion

This paper presents the new MSA- and state-specific housing price coefficients incorporated in REMI Policy Insight version 9.5. The new responses more accurately represent differences in housing supply across the U.S. The new housing price responses to real disposable income and population change the forecast and simulation properties of the Policy Insight model. For areas that have relatively constrained housing supply, the economic forecast and simulation results are relatively lower with the new MSA- and state-specific results than with the U.S. average coefficients. The reverse is true of regions with relatively unconstrained housing supply. For areas with greater housing development capacity, the new estimates generate higher population, employment, and output forecasts in both economic forecasts and responses to positive economic shocks.

Reference

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