Who Moves into Rhode Island Housing?

2015 Residential Demographic Multipliers

November 2017

plan with confidence

COMMUNITY DATAANALYTICS

ECONSULT SOLUTIONS
economics | policy | strategy

1435 Walnut St., 4th Floor | Philadelphia, PA 19102 | econsultsolutions.com

2015 ESI Residential Demographic Multipliers

Report created in November 2017
Derived from 2011-2015 ACS-PUMS

Overview

This report presents two sets of 2015 residential demographic multipliers produced by Econsult Solutions, Inc. (ESI):

a) School-age children (SAC) per household, and
b) Total persons per household, also known as average household size (AVHH).

The multipliers are developed by ESI's Community Data Analytics (CDA) team, using the most current American Community Survey (ACS) Public Use Microdata Sample (PUMS) records. The estimates are based on a mover sample that contains households whose householders moved into a unit between 2008 and 2015.

What is a Demographic Multiplier?

A residential demographic multiplier is an average ratio of demographic measures per occupied housing unit or per household. Common examples are SAC (persons age 5 to 17), AVHH, public school-age children or attendees.

Multipliers are reported by housing configuration defined by multiple characteristics, such as structure type, size, housing tenure, and housing value or rent. This specificity is needed to match the housing component of development projects.

Demographic Multipliers are Critical to Development Impact Analysis

Demographic multipliers serve a critical role in development impact studies which planners, developers, school districts, local governments, and policymakers rely on to make land use and zoning decisions.

Government officials have a duty to maintain a sustainable living environment and prevent their residents from suffering school overcrowding, gridlock, gaps in public services, and fiscal distress. As such, they need impact analysis to assess development proposals. Should a development potentially generate negative impacts, decision makers need to mitigate these effects by scaling down the project, changing the housing mix, charging impact fees, imposing alternate conditions such as free public facilities, open space, and infrastructure improvement.

Demographic multipliers provide vital inputs to estimating added populations in development impact studies. They are critical to assessing impact fees and consequent costs to public services.

However, the popular Fannie Mae demographic multiplier series still widely used was released 11 years ago based on the 2000 census 5-percent PUMS. The use of outmoded data can produce inaccurate estimates of development impacts, overestimating or underestimating how new developments will affect school enrollment, traffic patterns, and municipal finances. An urgent need exists to devise current demographic multipliers that reflect recent demographic changes.

Improved Multipliers

ESI multipliers are developed to provide up-to-date information and to minimize biases in estimating development impacts.

ESI multipliers have the following enhancements:

- They are derived from the most recent 2011-2015 ACS PUMS.
- A large and more stable mover sample is used.
- Due to a larger sample, the estimates are associated with a smaller margin of error and a narrower range between the lower and upper limits.
- ESI multipliers can be updated each year after the annual ACS PUMS is distributed.
- The large sample enables the generation of multipliers for small areas.

Except for the District of Columbia, multipliers reported in this report are at the state level, and should not be considered as representative to local demographic conditions.

Mover Sample Multipliers: Rhode Island

RI

Housing Configurations	School-Age Children			Total Persons		
	Per Household Estimates	90 Percent Confidence Interval		Per Household Estimates	90 Percent Confidence Interval	
		Lower	Upper		Lower	Upper
All Housing Types						
Own or Rent						
All Sizes	0.408	0.390	0.426	2.356	2.325	2.386
1 Bedroom or Studio	0.043	0.028	0.058	1.340	1.312	1.368
2 Bedroom	0.293	0.266	0.319	2.132	2.094	2.171
3 Bedroom	0.682	0.641	0.722	3.050	2.996	3.104
4 Bedroom	0.908	0.837	0.979	3.502	3.409	3.595
Own Only						
1 Bedroom or Studio	0.184	0.006	0.362	1.730	1.424	2.037
2 Bedroom	0.177	0.134	0.220	1.984	1.909	2.059
3 Bedroom	0.437	0.381	0.493	2.693	2.619	2.767
Rent Only						
1 Bedroom or Studio	0.036	0.023	0.048	1.320	1.292	1.348
2 Bedroom	0.325	0.293	0.357	2.174	2.127	2.221
3 Bedroom	0.883	0.820	0.946	3.344	3.273	3.414
Single-Family Units						
All Single-Family, Own or Rent						
All Sizes	0.534	0.505	0.564	2.761	2.714	2.809
3 Bedroom	0.542	0.500	0.584	2.834	2.772	2.895
4 Bedroom	0.893	0.820	0.967	3.462	3.375	3.549
Detached, Own or Rent						
All Sizes	0.535	0.503	0.567	2.776	2.723	2.830
Attached, Own or Rent						
All Sizes	0.533	0.444	0.622	2.650	2.523	2.777
Multi-Family Units						
All Multi-Family, Own or Rent						
All Sizes	0.333	0.311	0.355	2.115	2.077	2.153
2 Bedroom	0.307	0.275	0.339	2.146	2.101	2.191
2-4 Unit Structure, Own or Rent						
All Sizes	0.463	0.430	0.495	2.471	2.416	2.526
5+ Unit Structure, Own or Rent						
All Sizes	0.166	0.144	0.188	1.655	1.613	1.697

Multiplier estimates pertain to a mover sample, i.e. units that householders moved into the unit between 2008 and 2015.
If the value of the lower limit is negative, zero is reported.

Refined Housing Configurations

The table reports on multipliers for selected housing configurations. ESI has prepared multipliers for over 80 configurations such as 2-bedroom townhomes, 3-bedroom single-family rental units, and studio units in a rental apartment.

Users are welcomed to contact ESI for more details on these additional multipliers. Multipliers for custom geographies or samples other than the mover sample can be generated upon request.

Glossary

2-4 Unit. A housing unit in multifamily structures containing 2, 3, or 4 units.

5+ Unit. A housing unit in multifamily structures containing 5 or more units.

American Community Survey (ACS). An ongoing survey taken each year by the Census Bureau. It provides 1-year, 3-year, and 5-year estimates of demographic, housing, social, and economic information.

Average Household Size. Average household size is a measure obtained by dividing the number of people in households by the number of households. It is equivalent to the total persons per household multiplier. People in group quarters are excluded.

Bedroom. The room in a housing unit designed to be used as bedroom; a one-room unit such as studio, efficiency, or in-law apartment is considered as having no bedroom.

Confidence Interval. It is a probability-dependent interval of a sample estimate factoring into the margin of errors. Following the Census Bureau tradition, a probability of 90 percent is used. In other words, there is a 90-percent chance that the "true" multiplier falls within lower and upper limits.

Household. A household consists of all people who occupy a housing unit. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated people who share living arrangements. People living in group quarters like dormitories, nursing homes, military barracks, and correctional facilities are not classified as household population.

Householder. A person in a household, usually the one whose name the home is owned, being bought, or rented. But an adult household member 15 years old and over could be designated as a householder. In the past, the term -- head of a household -- was used.

Housing Configuration. A category in a housing typology defined by housing characteristics, such as dwelling types, number of units in the structure, size (bedrooms), housing tenure, and housing value or rent. ESI only reports multipliers for selected configurations to ensure a sufficient sample size to make reliable estimate.

Housing Unit. May be a house, an apartment unit, a single room, or other separate living quarters, excluding group quarters. In calculating multipliers, ESI excludes vacant units, mobile homes, boats, RVs, vans, houseboats, and railroad cars.

Insufficient Sample Size. Multipliers are sample estimates and the likelihood they represent the true value depends on the sample size. ESI considers a multiplier unreliable if the number of unweighted observations falls below 35.

Mover Sample. A sample of households in which the householder moved into the unit within four years of the starting year of the ACS PUMS. For 2011-2015 ACS PUMS, the earliest move-in year is 2008.

Multifamily Unit. Housing units in a structure of 2 or more units, not classified as a single-family house.

Owner-Occupied Unit. A housing unit occupied by an owner regardless it is mortgaged or fully paid off.

Public School-Age Children. Persons who are between 5 to 17 years of age and attend public schools. Persons attend private schools, colleges, receive home schooling, or drop out of school are excluded.

Public Use Microdata Area (PUMA). A geographic unit demarcating by the US Census consisting at least 100,000 people. It is built on contiguous census tracts within a state. Some PUMAs have more than 200,000 persons. For example, the most populous PUMA (0500 in Florida) has a 2010 population of 268,718.

Public Use Microdata Sample (PUMS). A sample that contains information of individual people, household and housing units. PUMS files contain the actual responses to questionnaires sent to a sample population. Currently, the survey is conducted annually under ACS to 1 percent of the population. ACS PUMS is reported in 1-year, 3-year and 5-year increments. ESI multipliers are based on 5-year ACS PUMS.

Recently Built Unit Sample. A sample contains occupied housing units that were first built within 10 years of a PUMS survey. This is the sample used in the Fannie Mae multiplier series. For 2000 Census PUMS, this sample contains units built in and after 1990. Using 2011-2015 ACS PUMS, ESI has generated a similar sample containing units first built between 2005 and 2015 for internal use. Because of its smaller sample size, multipliers from this sample are less reliable for uncommon and highly differentiated housing configurations.

Renter-Occupied Unit. A housing unit occupied by renters who may rent the unit for cash or for other kinds of payment.

School-Age Children (SAC). Persons who are between 5 and 17 years of age. SAC includes those attending public, private or other types of schools, who are home schooled, who may be working, have dropped out of school, or who are attending college before age 18 but living at home. If the SAC is differentiated by grade group, the groups are approximated by age, not by actual grade attendance.

Single-Family Attached. A one-family house that has one or more walls extending from ground to roof separating it from adjoining structures. In row houses (sometimes called townhouses), double houses, or houses attached to nonresidential structures, each house is a separate, attached structure if the dividing or common wall goes from ground to roof.

Single-Family Detached. A one-family house detached from any other houses with open space on all four sides, not including adjoining sheds or garages.

Studio. A unit without a designated bedroom or living and sleeping space combined; also known as an efficiency unit or in-law apartment.

Traditional Multipliers

In *The Fiscal Impact Handbook*, Dr. Robert Burchell and Dr. David Listokin (1978) developed the estimation method for demographic multipliers. They used a sample of units built within the past 10 years of the decennial PUMS.

Their last multiplier series was released in 2006 under the sponsorship of the Fannie Mae Foundation. The multipliers covered the District of Columbia and 50 states and were based on housing units built between 1990 and 2000. The series reported AVHH, SAC and public SAC in 19 broad housing configurations that were further divided into 4 groups by housing value or rent.

ESI Methodology

ESI's CDA Team. In 2016 ESI formed the Community Data Analytics (CDA) team with an aim of generating multipliers that reflect up-to-date demographic trends. The CDA team has conducted research to enhance estimation procedures and to reduce estimation biases.

ESI uses the most recent 2011-2015 American Community Survey PUMS records on persons and housing. These records are actual responses questionnaires sent to 1-percent of the population each year in that period.

The ESI multipliers are generated from a **mover sample** that fluctuate less to housing activity. The large size of this sample improves statistical validity and makes geographically specific multipliers possible. For current PUMS, the earliest move-in year is 2008. The mover-based multipliers are highly correlated with those based on traditional recently built unit samples. They also capture long-term characterizes of the future population.

Estimation Procedures. The ESI estimation involves the following steps: 1) select the most recent ACS-PUMS records based on the year the householders moved into a unit, 2) create housing configuration categories by PUMS variables on structure, size, housing tenure, etc., 3) populate household and person characteristics to each configuration and classify each population groups like SAC and total persons, 4) calculate configuration-specific multipliers by dividing populations groups by the weighted number of households.

Sample Size and Estimate Validity. Like all sample estimates, the precision of a multiplier is affected by sample size. ESI provides the lower and upper limit to earmark an interval that has 90 percent of chance of capturing the true value of the multiplier. Small samples make the estimate unreliable because it increases the margin of error and generate a wide confidence interval. ESI does not report a multiplier when the sample is less than 35 unweighted observations.

Guide for Using Demographic Multipliers

- Development impact varies greatly by housing mix, so users should use a multiplier specific to each housing configuration.
- All PUMS-derived multipliers are sample estimates. Users should examine the confidence interval bounded by the lower and upper limit.
- Users should pay attention to sampling fluctuation in the following circumstances caused by small samples: a) uncommon or highly refined housing configurations; b) multipliers differentiated by age cohort, grade group, housing tenure, housing value or rent; and c) specialized housing.
- Statewide multipliers may not reflect local conditions. Users should use geographically specific multipliers whenever possible. ESI can generate multipliers for customized geography upon request.
- Users should avoid applying the statewide public school-age children, also known as public school children, to local projects. The assumption in this multiplier is a uniform public school participation rate (share of SAC attending public schools) across the state. Users should use it only if they are geographically specific; otherwise, they should adjust the state or regional SAC with the local public school participation rate.
- SAC multipliers generated by local surveys of recent developments can be misleading. These surveys reflect conditions of a very small sample of developments. Because of aging, the snapshot data becomes obsolete once the student cohorts shift upward.

How to Use Multipliers to Estimate the Impacts of Development

Step 1: Classify the units of a project by ESI housing configuration. For example, "townhome" is classified as a single-family attached, and "high-rise condominium" and "rental apartment" are treated as multifamily units. If the project contains other housing configurations, or includes specialized housing, contact ESI for the availability of such multipliers.

Step 2: Use the multipliers for the county or PUMA aggregate where the project is located. Users then select multipliers specific to the impact. For school impact, use school-age children; for added population, use average household size.

Step 3: Match the multipliers to the corresponding housing configuration of the project. For more accurate projection results, users should differentiate the housing mix with as much detail as possible.

Step 4: Multiply the corresponding multipliers with the number of units in the proposal to obtain the initial projected impact. The result provides a set of mid-point estimates. Users are encouraged to use the lower-limit and upper-limit figures to construct a projection range around the midpoint estimates.

Step 5: Users should adjust the result for vacancy. A vacancy rate between 5 to 7 percent is recommended, but users can alter the percentage according to housing market condition.

Step 6: It is recommended to round the results to integers. If the results are used to estimate public expenditures, users should find out if the capacity of a service is reaching the limit to avoid cost underestimation.

Simple Illustration – School Impact

This illustrates how school-age children multipliers are used to estimate the impact to the public school system. The development proposal contains 190 units with the following housing mix. [Impacts on population, traffic, and other impacts can be similarly projected.]

Single-Family Home, Detached	Units
3 Bedroom	40
4 Bedroom	20
3-Bedroom Townhome	50
5-Story Condominium & Apartment	
2 Bedroom	80

After Step 3, a table of matching geographically-specific SAC is created.

	Units	SAC, mid-point estimate
Single-Family Home, Detached		
3 Bedroom	40	0.485
4 Bedroom	20	0.816
3-Bedroom Townhome (treated as single-family attached)	50	0.425
5-Story Condominium & Apartment (treated as 5+ unit multifamily)		
2 Bedroom	80	0.284

The number of SAC is estimated before vacancy adjustment is conducted (figures are rounded to the nearest integer).

	Units	SAC, mid-point estimate	Number of SAC	Total SAC
Single-Family Homes, Detached				
3 Bedroom	40	0.485	19	
4 Bedroom	20	0.816	16	
3-Bedroom Townhome	50	0.425	21	
5-Story Condominium & Apartment				
2 Bedroom	80	0.284	23	
				79

Assume an occupancy rate of 94 percent; and local public school participation rate of 73 percent, i.e. 27 of the 100 SAC are home-schooling, attending private and other non-public schools, etc.

The mid-point estimate of SAC who will attend public schools from this development:

$$79 \times 94\% \times 73\% = 54$$

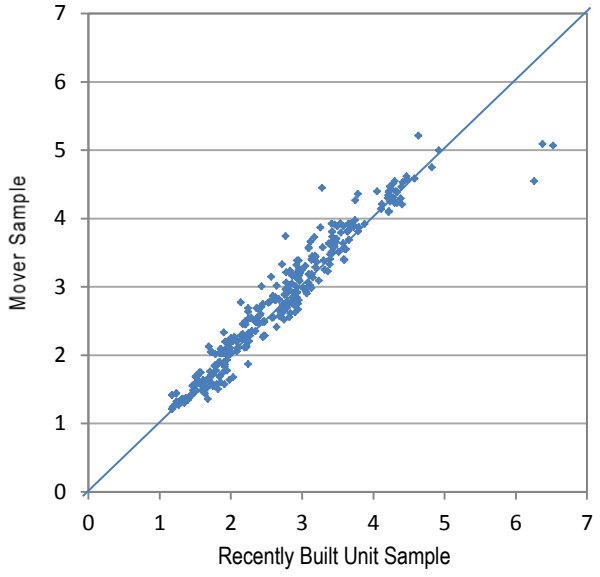
Technical Notes

Comparing the Mover Sample with the Recently Built Sample. The housing downturn between 2007 and 2012 significantly reduced the sample size of the recently-built unit sample used to generate traditional multipliers. As a result, statistically valid multipliers are not available for less popular housing configurations and some age- or grade group-differentiated multipliers.

To solve this problem, ESI created a mover sample based on the assumption that movers to new and older units have similar attributes as those who live in recently built units. The size of the mover sample is on average about 4.4 times larger the recently built unit sample. The mover samples is less affected by housing activity and has better potential to estimate local multipliers for an aggregate of several PUMAs.

At the state level, the AVHH from the two samples highly correlate, with a Pearson *r* of 0.966. Below is a scatterplot of 362 AVHH pairs in Arkansas, California, Georgia, New Jersey, and Ohio.

Average Household Size Multipliers between Two Samples



Historical Comparison. Mover-based demographic multipliers using historical data are being examined by ESI and will be reported to the public. Comparing the 2000 and 2015 multipliers from 10-year recently built unit samples is being performed by the CDA team but sample size issue of the 2015 multipliers makes historical comparison of some configurations difficult. One possible solution is to extend the earliest year of structure built to 2000.

Other ESI Demographic Multipliers. ESI also generates multipliers like local public school attendees, vehicles available, workers who drive or use public transit to work, average household income, persons who are foreign born, and so on. While the mover sample is the staple, ESI can provide multipliers based on samples like recently built units, condominium units, specialized housing, or samples for small geography.

Resources and References

Users can find resources on demographic multipliers at http://www.econsultsolutions.com/cda-library. This includes materials the CDA team uses to guide research on estimation methodology and how to improve impact analysis. Below are selected works on demographic multipliers:

Burchell, Robert W. & David Listokin. 1978. *The Fiscal Impact Handbook: Estimating Local Costs and Revenues of Land Development*. New Brunswick, NJ: Center for Urban Policy Research.

Burchell, Robert W., David Listokin, & William Dolphin. 2006. *Fannie Mae Foundation Residential Demographic Multipliers: Projections of the Occupants of New Housing*. [Report series for the US, 50 states and the District of Columbia].

Listokin, David, Ioan Voicu, William Dolphin, & Matthew Camp. 2006. *Who Lives in New Jersey Housing? New Jersey Demographic Multipliers*. New Brunswick, NJ: Center for Urban Policy Research.

Wong, Sidney. 2016. "A New Technique for More Accurate Impact Assessment," http://www.econsultsolutions.com/a-new-technique-for-more-accurate-impact-assessment/

Wong, Sidney. 2016. "Demographic Multipliers: Data Mining & Measuring Development Impacts," *Planning and Technology Today*, 113 (Summer/Fall):6-7.

Wong, Sidney, Daniel Miles, Gabrielle Connor, Brooke Queenan, & Alison Shott. 2017. "Residential Demographic Multipliers: Using Public Use Microdata Sample Records to Estimate Housing Development Impacts," *Cityscape: A Journal of Policy Development and Research*, 19(3): 312-24.

Contact

Econsult Solutions, Inc. is a Philadelphia-based consultant providing economic studies, impact analysis, and GIS and PUMS analytics services. For more information please contact:

Dr. Sidney Wong, CDA Project Lead
wong@econsultsolutions.com