A Correlation Analysis of the ACS Supplemental Poverty Measure Geographic Adjustment

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Correlation analysis of the ACS Supplemental Poverty Measure Geographic Adjustment

- History of the Supplemental Poverty Measure.
- Definition of the Geographic Adjustment:
  - Median Rent Index
- Geographic Adjustment:
  - ACS compared to CPS
- Correlation Analysis of the ACS Geographic Adjustment:
  - Findings:
    - The average level of the adjustment over the years 2012 to 2019 is positively correlated with the change in the level of the adjustment over the years 2012 to 2019;
    - Substituting 2012 geographic adjustment values for average values also resulted in statistically significant correlation with the 2012 to 2019 changes.
- Poverty and Domestic Migration Prediction Using the Geographic Adjustment

What is the Supplemental Poverty Measure?

- The Supplemental Poverty Measure (SPM) was developed to incorporate family resources and expenses not included in the Office Poverty Measure (OPM);
- The SPM adjusts poverty thresholds to include the geographic variation in housing costs;
- The SPM is a research measure and does not replace the OPM and is not used for program eligibility or funding distribution;
- The SPM has been published as part of the annual Current Population Survey's Annual Social and Economic Supplement since 2009;
- The SPM is representative for poverty estimates at the national level – however, the Census Bureau recommends that state-level poverty estimates use a three-year average;

ACS Implementation of the SPM

- Because the ACS has a much greater sample size than the CPS ASEC, it can be used to produce single-year estimates at the state and sub-state levels;
- The purpose of the ACS release of the SPM is to provide users and researchers a way to explore the SPM at different geographic levels and for different demographic groups;
- Like the CPS ASEC incorporation of the SPM, the ACS release allows joining of the SPM variables to the ACS microdata sets;
- The Census Bureau released the ACS SPM for 1-year ACS PUMS microdata for the years 2009 to 2019;

ACS Implementation of the SPM - continued

- SPM poverty thresholds are based on the out-of-pocket costs of a basic set of goods and services that includes food, clothing, shelter, utilities, and telephone (and internet, in more recent years), as well as a small additional amount to allow for other needs (e.g., household supplies, personal care, nonwork-related transportation) for a two-adult, two-child household;
- SPM poverty thresholds are identical between the ACS and CPS SPM implementation;
- Thresholds are produced by the Bureau of Labor Statistics using 5 years of quarterly Consumer Expenditure Survey (CE) interview data for all consumer units with children, lagged 1 year.
- The base thresholds are adjusted for three housing groups (owners with mortgage, owners without mortgage, and renters) to account for differences in housing costs;

What is the geographic adjustment?

- The geographic adjustment is used to adjust base poverty thresholds in the SPM for price differences across geographic areas;
- The first step is to determine the median rent index (MRI);
- The MRI is then adjusted by the share of the housing and utilities costs for three household types – owner with a mortgage, owner without a mortgage, and renter;
- Data source for the MRI calculation is the 5-year ACS;

Median Rent Index

- The MRI is defined as ratio of the median gross rent (including utility costs) for two-bedroom, two-bath units with working kitchens and bathrooms for a specified geography to the median gross rent for the same types of units for the United States as a whole:

$$MRI_{ij} = \frac{Median\ gross\ rent\ for\ 2\ bed, 2\ bath\ unit_{ij}}{Median\ gross\ rent\ for\ 2\ bed, 2\ bath\ unit_{n}}$$

where

- $i =$ state
- $j =$ specific metro area, other metro or nonmetro area
- $n =$ national
- MRI = Median Rent Index

Geographic Adjustment

- The geographic adjustment is calculated by adjusting the MRI using the housing and utilities threshold components share for each of three household types: owner with mortgage, owner no mortgage, and renter:

$$Geographic\ Adjustment_{ijt} = HousingShare_t \times (MRI_{ij} - 1) + 1$$

where

- i = state
- j = specific metro area, other metro or nonmetro area
- t = tenure: owner with mortgage, owner without a mortgage, renter
- $HousingShare$ = percent of threshold represented by housing and utilities (which range from 40 to 50 percent of total expenditures, depending on tenure status)

Geographic Adjustment – continued

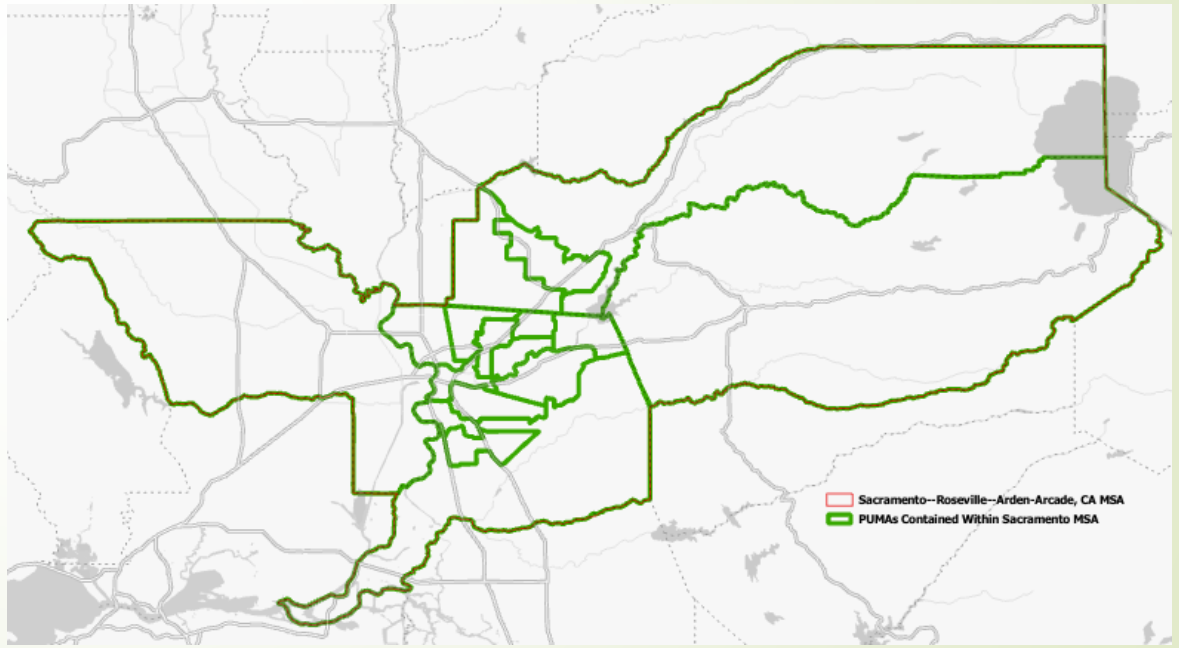
- Differences between the ACS and CPS SPM geographic adjustments –
  - For the CPS ASEC, median gross rents were calculated for metropolitan areas large enough to be identified on the public-use CPS ASEC file, for non-metropolitan areas, and for a combination of all smaller metropolitan areas within a state;
  - However, the ACS microdata file does not identify metropolitan statistical areas, so a PUMA-MSA crosswalk is used to create MSAs and non-metropolitan areas for each state;
  - The resulting ACS geographic adjustments are delimited by PUMA, but are identical for PUMAs that lie within a county or MSA;

Geographic Adjustment – continued

Table 1

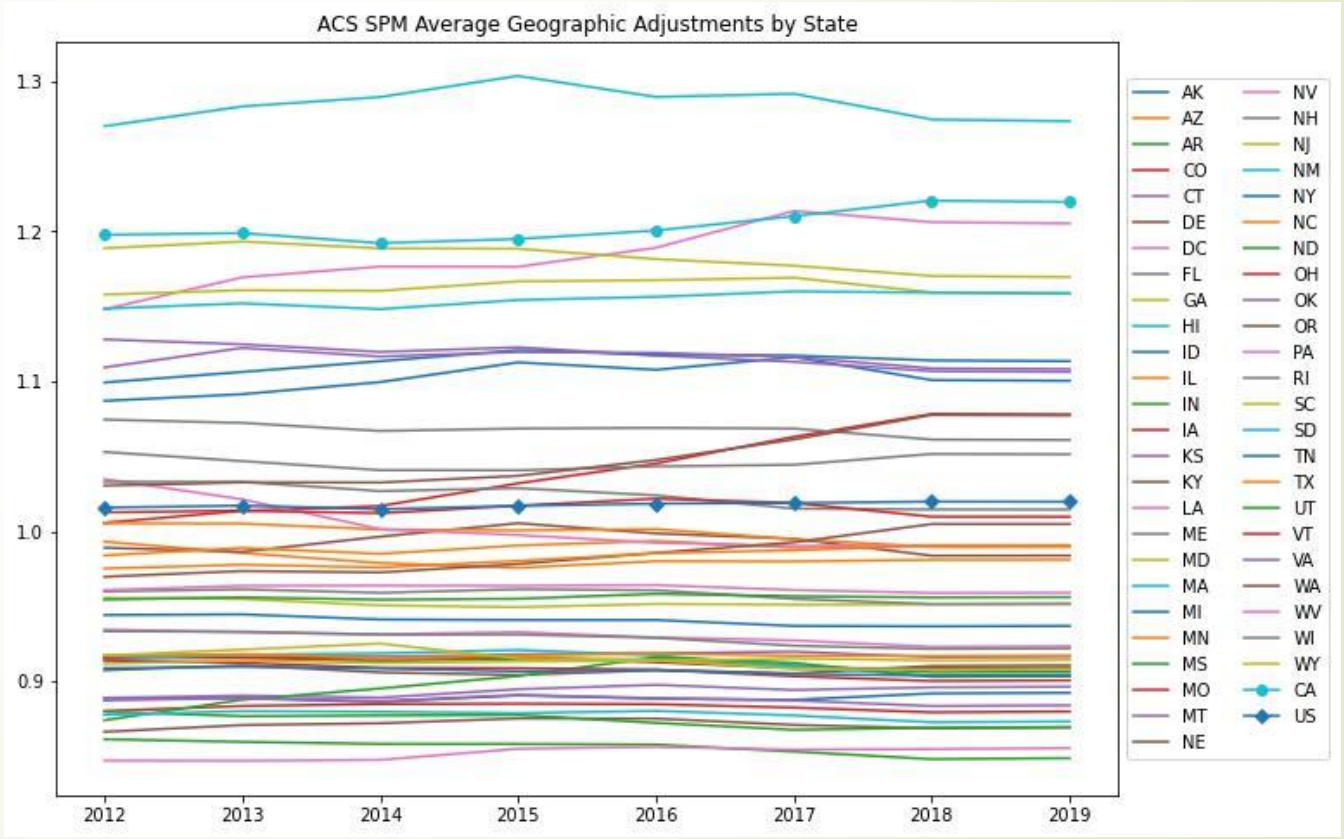
2010 PUMA	2010 PUMA NAME	Index based on Median Rents	Homeowners with Mortgage	Homeowners without a Mortgage	Renters
0601700	El Dorado County--El Dorado Hills	1.152	1.0758	1.0628	1.0749
0606101	Placer County (Southwest)--Roseville City	1.152	1.0758	1.0628	1.0749
0606102	Placer County (Central)--Rocklin, Lincoln Cities & Loomis Town	1.152	1.0758	1.0628	1.0749
0606103	Placer County (East/High Country Region)--Auburn & Colfax Cities	1.152	1.0758	1.0628	1.0749
0606701	Sacramento County (North Central)--Citrus Heights City	1.152	1.0758	1.0628	1.0749
0606702	Sacramento County (Central)--Rancho Cordova City	1.152	1.0758	1.0628	1.0749
0606703	Sacramento County (North Central)--Arden-Arcade, Carmichael & Fair Oaks (West)	1.152	1.0758	1.0628	1.0749
0606704	Sacramento County (North Central)--North Highlands, Foothill Farms & McClellan Park	1.152	1.0758	1.0628	1.0749
0606705	Sacramento County (Northwest)--Sacramento City (Northwest/Natomas)	1.152	1.0758	1.0628	1.0749
0606706	Sacramento County (North)--Sacramento City (North), Antelope & Rio Linda	1.152	1.0758	1.0628	1.0749
0606707	Sacramento County (West)--Sacramento City (Central/Downtown & Midtown)	1.152	1.0758	1.0628	1.0749
0606708	Sacramento County--Sacramento City (Southeast/Fruitridge, Avondale & Depot Park)	1.152	1.0758	1.0628	1.0749
0606709	Sacramento County--Sacramento City (Southwest/Pocket, Meadowview & North Laguna)	1.152	1.0758	1.0628	1.0749
0606710	Sacramento County (Central)--Elk Grove City	1.152	1.0758	1.0628	1.0749
0606711	Sacramento County (South)--Galt, Isleton Cities & Delta Region	1.152	1.0758	1.0628	1.0749
0606712	Sacramento County (Northeast)--Folsom City, Orangevale & Fair Oaks (East)	1.152	1.0758	1.0628	1.0749
0611300	Yolo County--Davis, Woodland & West Sacramento Cities	1.152	1.0758	1.0628	1.0749

- PUMAs within the Sacramento--Roseville--Arden-Arcade, CA MSA;
- Table 1 - geographic adjustments from 2019 ACS SPM;



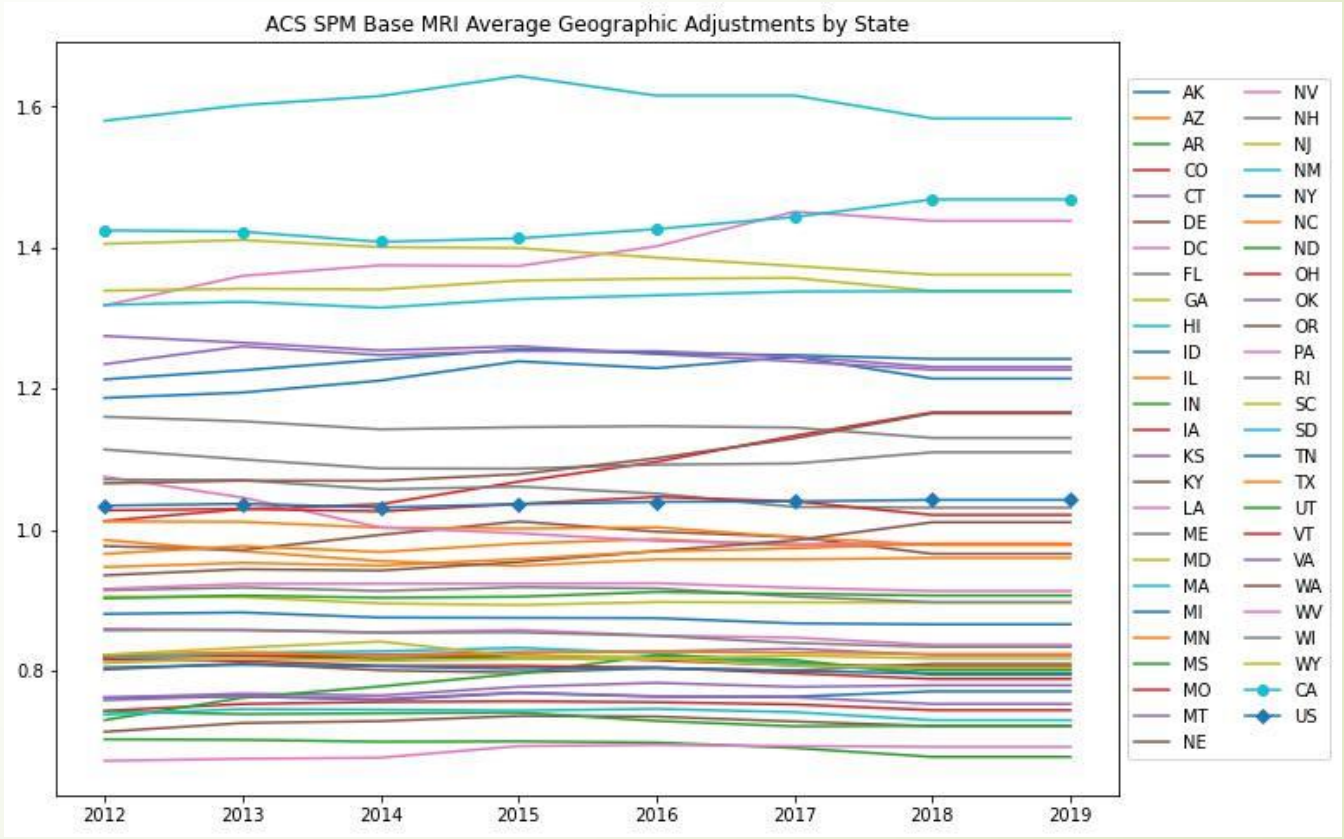
Geographic Adjustment – continued

- Geographic Adjustments by State.
- States with the largest Geographic Adjustment (2019):
  - Hawaii
  - California
  - Washington DC
  - New Jersey
  - Maryland
- States with the smallest Geographic Adjustment (2019):
  - West Virginia
  - Arkansas
  - Kentucky
  - North Dakota
  - South Dakota



Geographic Adjustment – continued

- Geographic adjustments by state.
- States with the largest Base MRI (2019):
  - Hawaii
  - California
  - Washington DC
  - New Jersey
  - Maryland
- States with the smallest Base MRI (2019):
  - Arkansas
  - West Virginia
  - Kentucky
  - Mississippi
  - South Dakota



Correlation Analysis

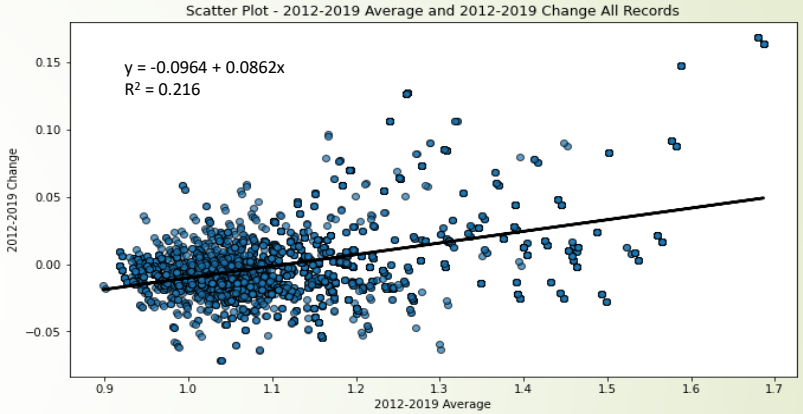
- An analysis of the ACS geographic adjustments showed that the average level of the adjustment over the period 2012 to 2019 is significantly correlated with the change in the adjustment over the same period;
- The same analysis substituting 2012 geographic adjustment values for average values also resulted in statistically significant correlation with the changes over the 2012 to 2019 period;
- This result implies that PUMAs with relatively higher average geographic adjustment values saw increases in their geographic adjustment values, while areas with relatively lower average geographic adjustment values experienced smaller increases or decreases in their geographic adjustment values over the 2012 to 2019 period;

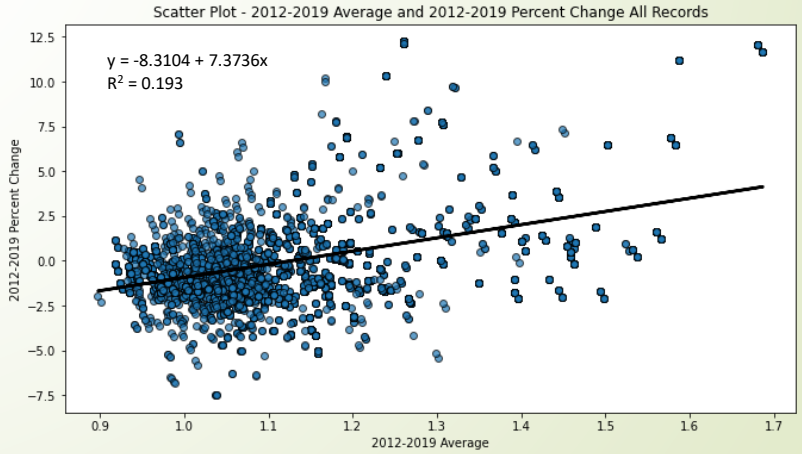
Correlation Analysis – continued

- Geographic Adjustment - all PUMAs in states and DC:

2012-2019 Geographic Adjustment Change	R (N=7,002)	Confidence Interval (level=95%)	
		Low	High
Average Geographic Adjustment	0.465	0.446	0.483
2012 Geo Adjustment	0.377	0.357	0.397

2012-2019 Geographic Adjustment Percent Change	R (N=7,002)	Confidence Interval (level=95%)	
		Low	High
Average Geographic Adjustment	0.440	0.421	0.458
2012 Geo Adjustment	0.351	0.330	0.371





Correlation Analysis – continued

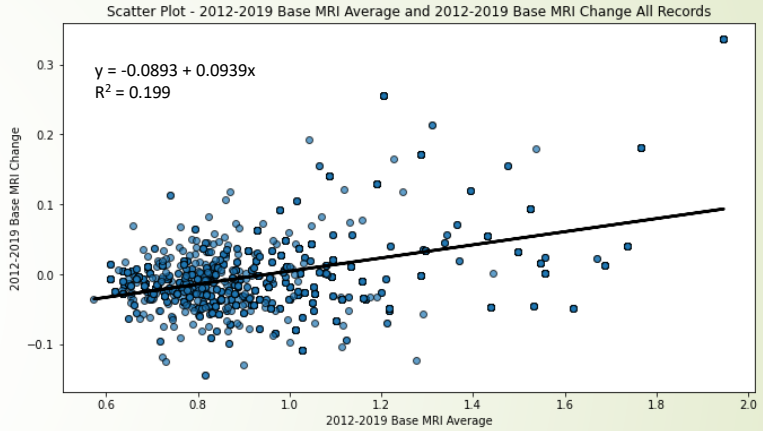
- Top 5 PUMAs by Geographic Adjustment (Top 2012-2019 change) –
  - Santa Clara County (Northwest)--Mountain View, Palo Alto & Los Altos Cities-California
  - Santa Clara County (Northwest)--Sunnyvale & San Jose (North) Cities-California
  - Santa Clara County (Northwest)--San Jose (Northwest) & Santa Clara Cities-California
  - Santa Clara County (North Central)--Milpitas & San Jose (Northeast) Cities-California
  - Santa Clara County (North Central)--San Jose City (East Central) & Alum Rock-California
- Bottom 5 PUMAs by Geographic Adjustment (Bottom 2012-2019 change) –
  - Southern Georgia Regional Commission (South Central)--Lowndes County--Valdosta City-Georgia
  - St. Mary's & Calvert Counties-Maryland
  - Sumter (North) & Lake (North) Counties-Florida
  - South Region--Harrison County--Gulfport & Biloxi Cities-Mississippi
  - South Region--Jackson County-Mississippi

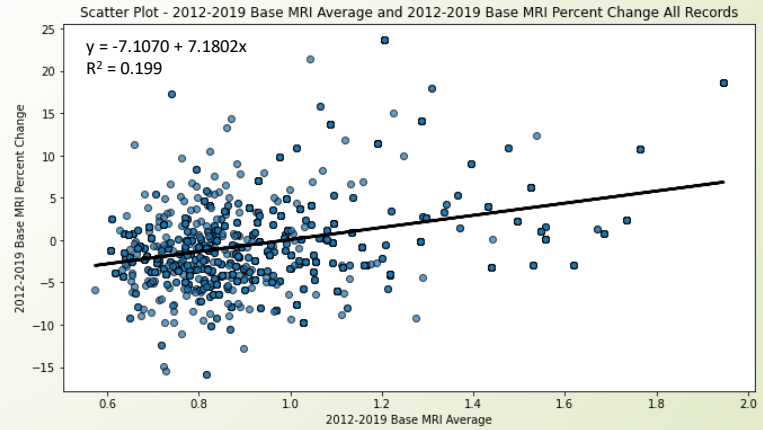
Correlation Analysis – continued

- Base MRI - all PUMAs in states and DC:

2012-2019 Base MRI Change	R (N=2,224)	Confidence Interval (level=95%)	
		Low	High
Average Base MRI	0.446	0.413	0.478
2012 Base MRI	0.358	0.322	0.393

2012-2019 Base MRI Percent Change	R (N=2,224)	Confidence Interval (level=95%)	
		Low	High
Average Base MRI	0.398	0.364	0.432
2012 Base MRI	0.310	0.273	0.346





Correlation Analysis – continued

- Top Five PUMAs by Median Rent Index (Top 2012-2019 change) –
  - Santa Clara County (Northwest)--Mountain View, Palo Alto & Los Altos Cities-California
  - Santa Clara County (Northwest)--Sunnyvale & San Jose (North) Cities-California
  - Santa Clara County (Northwest)--San Jose (Northwest) & Santa Clara Cities-California
  - Santa Clara County (North Central)--Milpitas & San Jose (Northeast) Cities-California
  - Santa Clara County (North Central)--San Jose City (East Central) & Alum Rock-California
- Bottom Five PUMAs by Median Rent Index (Bottom 2012-2019 change) –
  - St. Mary's & Calvert Counties-Maryland
  - Southern Georgia Regional Commission (South Central)--Lowndes County--Valdosta City-Georgia
  - Sumter (North) & Lake (North) Counties-Florida
  - South Region--Harrison County--Gulfport & Biloxi Cities-Mississippi
  - South Region--Jackson County-Mississippi

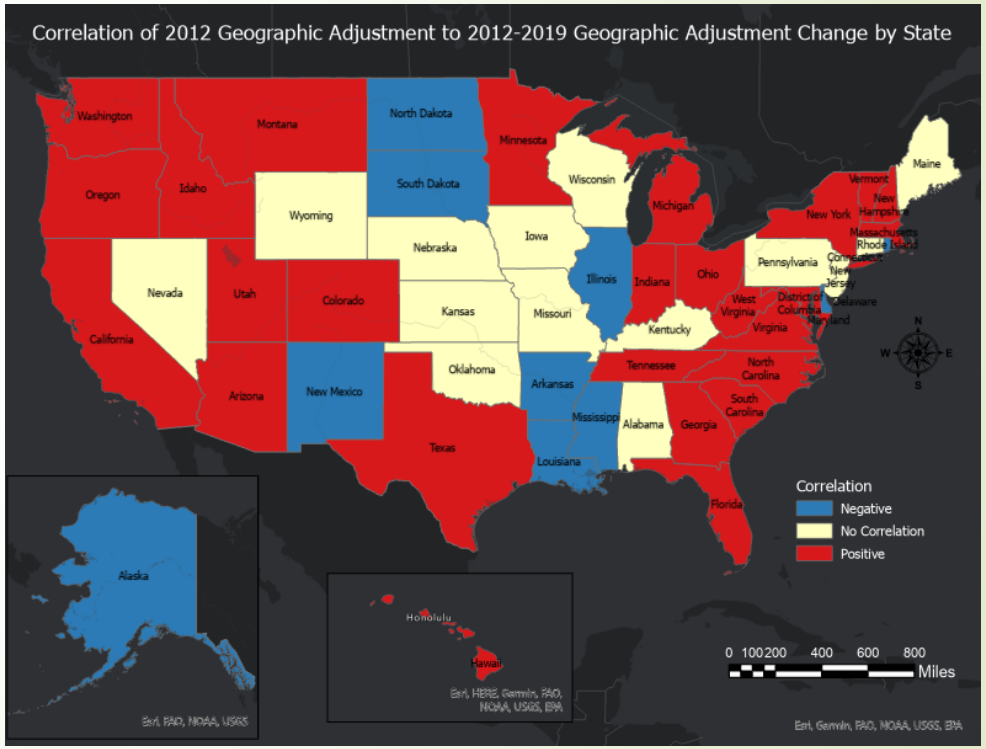
Correlation Analysis – continued

- Geographic Adjustment Correlations:

Correlation of 2012 Geographic Adj to 2012-2019 Change by Type:	Number of States
Positive	27
No Correlation	14
Negative	10

- Top five states by correlation type and change:

Positive	**No Correlation**	**Negative**
Vermont	Nebraska	Illinois
Oregon	Connecticut	Arkansas
District of Columbia	Oklahoma	New Mexico
Colorado	Kansas	Mississippi
Arizona	Missouri	Louisiana



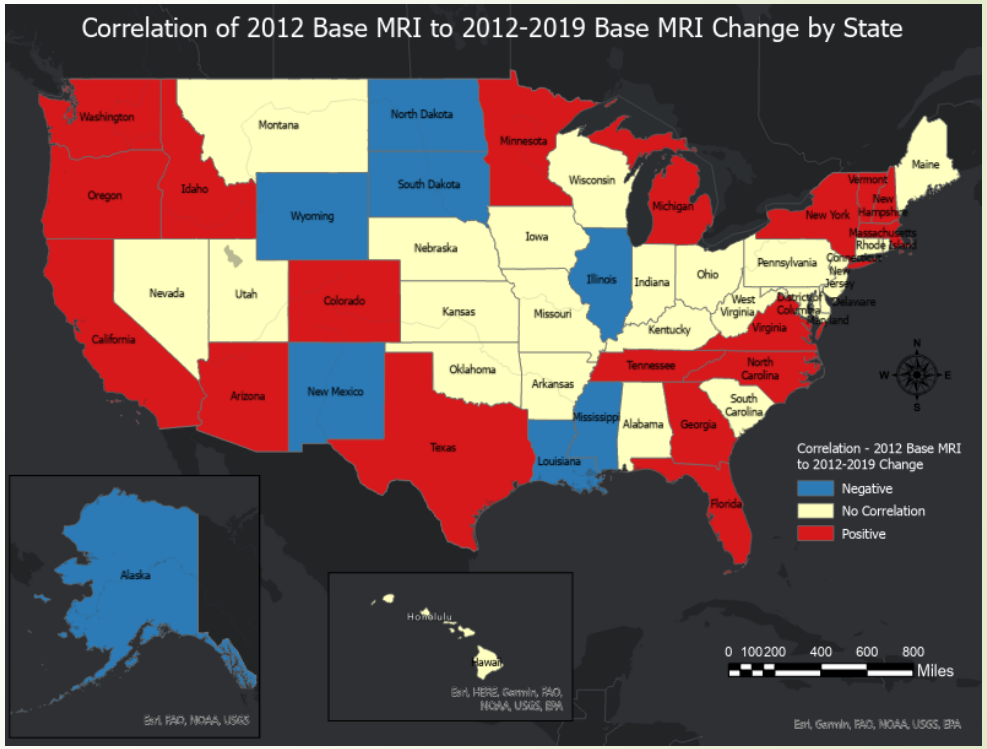
Correlation Analysis – continued

- Base MRI Correlations:

Correlation of 2012 Base MRI to 2012-2019 Change by Type:	Number of States
Positive	18
No Correlation	25
Negative	8

- Top five states by correlation type and change:

Positive	**No Correlation**	**Negative**
Vermont	Rhode Island	Louisiana
Idaho	Hawaii	South Dakota
Arizona	Montana	North Dakota
New Hampshire	West Virginia	Alaska
Oregon	Nebraska	Wyoming



Poverty and Domestic Migration Prediction Results

- The analysis looked at the predictive value of the geographic adjustment across two variables – poverty and domestic migration;
- It employs logit regression – this technique estimates the probability of an event occurring based on a set of independent variables;
- The dependent variable will be 1 or 0 – which is transformed by use of a "logit transformation" which transforms the dependent variable into the ratio of the probability of success to the probability of failure;
- The regression equation takes the form of $ln\left(\frac{pi}{1-pi}\right) = \beta_0 + \beta_1 x_1 \ldots + \beta_n x_n$

Prediction Results – Poverty

- Tables for regression results - Dependent Variable: SPM Poverty (1=SPM Poor):

	Odds Ratio	Lower CI	Upper CI
Intercept	0.141	0.140	0.141
2012-2019 Change	1.292	1.154	1.447
Observations:	3.1 million		

	Odds Ratio	Lower CI	Upper CI
Intercept	0.141	0.140	0.141
2012-2019 Percent Change	1.062	0.936	1.206
Observations:	3.1 million		

	Odd Ratio	Lower CI	Upper CI
Intercept	0.029	0.029	0.029
Mortgage Status	2.216	2.207	2.226
2012-2019 Change	0.625	0.556	0.703
Observations:	3.1 million		

Mortgage = 1 LLR p-value: 0.09942

	Coefficient	Std Err	z	P>|z|	Odds Ratio
Intercept	-2.693	0.003	-785.837	0.000	0.677
2012-2018 Change	-0.182	0.110	-1.645	0.100	0.834

Mortgage = 2 LLR p-value: 2.375e-06

	Coefficient	Std Err	z	P>|z|	Odds Ratio
Intercept	-2.0386	0.003	-598.164	0.000	0.130
2012-2018 Change	-0.6791	0.145	-4.695	0.000	0.507

Mortgage = 3 LLR p-value: 4.730e-23

	Coefficient	Std Err	z	P>|z|	Odds Ratio
Intercept	-1.1184	0.003	-417.206	0.000	0.327
2012-2018 Change	-0.8032	0.082	-9.841	0.000	0.448

Prediction Results – Domestic Migration

- The types of analysis available for domestic migration are limited because of the variables included in the ACS;
  - Demographic variables describe current place of residence – migration variables are limited to previous state of residence and migration PUMA;
  - The independent variable for these regressions is a modified 2012-2018 geographic adjustment change – if the record is coded as having moved in the past year (2018) then the change is the difference in the geographic adjustments for the MIGPUMA (the PUMA previously resided in); otherwise, the change is the difference for the 2018 residence PUMA;
- Does the change in the 2012-2018 Geographic Adjustment predict 2018 migration?
  - For the entire dataset (~3 million observations), a unit increase in the 2012-2018 numeric change of the geographic adjustment predicts a 273% increase in the odds of moving within the United States;
  - For the entire dataset (~3 million observations), a unit increase in the 2012-2018 numeric change of the MIGPUMA geographic adjustment predicts a 440% increase in the odds of moving within the United States;

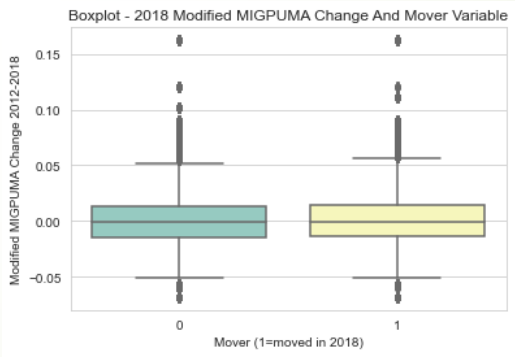
Dependent Variable: Mover (0 or 1)	**Odds Ratio**	**Lower CI**	**Upper CI**
Intercept	0.121	0.120	0.121
2012-2018 Change	3.735	3.327	4.192
Observations:	3.1 million		

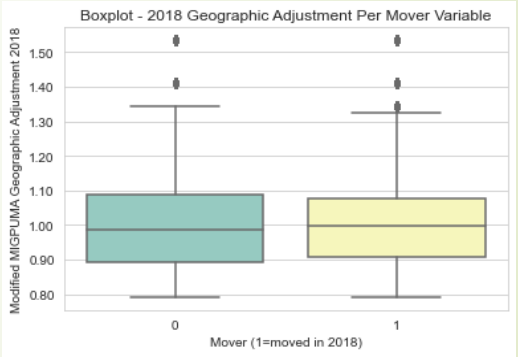
Dependent Variable: Mover (0 or 1)	**Odds Ratio**	**Lower CI**	**Upper CI**
Intercept	0.120	0.120	0.121
Modified MIGPUMA 2012-2018 Change	5.398	4.804	6.065
Observations:	3.1 million		

Prediction Results – Domestic Migration continued

- Further analysis revealed that individuals living in PUMAs with relatively higher geographic adjustment levels in 2018 were less likely to move then persons in relatively lower geographic adjustment levels (holding modified MIGPUMA change values constant);
- Mean values for both modified MIGPUMA 2012-2018 changes and 2018 values were statistically greater for movers then for non-movers;

Dependent Variable: Mover (0 or 1)	Odds Ratio	Lower CI	Upper CI
Intercept	0.136	0.132	0.140
Modified MIGPUMA Geographic Adjustment Value 2018	0.887	0.861	0.913
Modified MIGPUMA 2012-2018 Change	7.585	6.573	8.752





Mean Values and t-test	Modified MIGPUMA 2018 Geo Adj Value	Modified MIGPUMA 2012-2018 Change
Mover=0	1.0141	0.0033
Mover=1	1.0167	0.0049
t-test	9.553	27.363

Thank You!

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