3. CASE STUDIES USING ACS DATA

Case Study #1: San Diego Region: City Data Profile

Skill Level: Introductory/Intermediate
Subject: County- and city-level demographic and socioeconomic data
Type of Analysis: Analysis and visualization of American Community Survey (ACS) data trends across the nation, state, county, and subcounty areas
Tools Used: American FactFinder, Excel spreadsheet, data visualization tools
Authors: Marcela Alvarez, Research Coordinator, San Diego Regional EDC; and Kirby Brady, Research Director, San Diego Regional EDC

San Diego Regional Economic Development Corporation (EDC) uses a multitude of publicly available datasets coupled with visualization software to create powerful economic development tools that provide clarity and insight into the region's demographic and economic landscape. As part of a greater initiative to uncover and highlight subregional trends within the county, EDC produced a demographic and socioeconomic profile for the City of San Marcos, California. This profile and accompanying online interactive dashboard were created to better inform business leaders, other decision makers, and the public about the city's social, economic, and demographic characteristics. City-level data can be compared with data for the county, state, and nation to provide additional context.

We used data from the U.S. Census Bureau's ACS and Longitudinal Employer-Household Dynamics (LEHD) program to inform parts of the profile (see Table 3.1). The Census Bureau releases single-year ACS data for geographic areas with 65,000 people or more. Since the City of San Marcos—the smallest geographic area under consideration—meets this threshold, we were able to use 1-year estimates throughout the analysis. EDC recognizes that all estimates have an associated level of uncertainty. However, after careful consideration, margins of error were not included in the profile.

Table 3.1. **List of Key Variables and Data Sources**

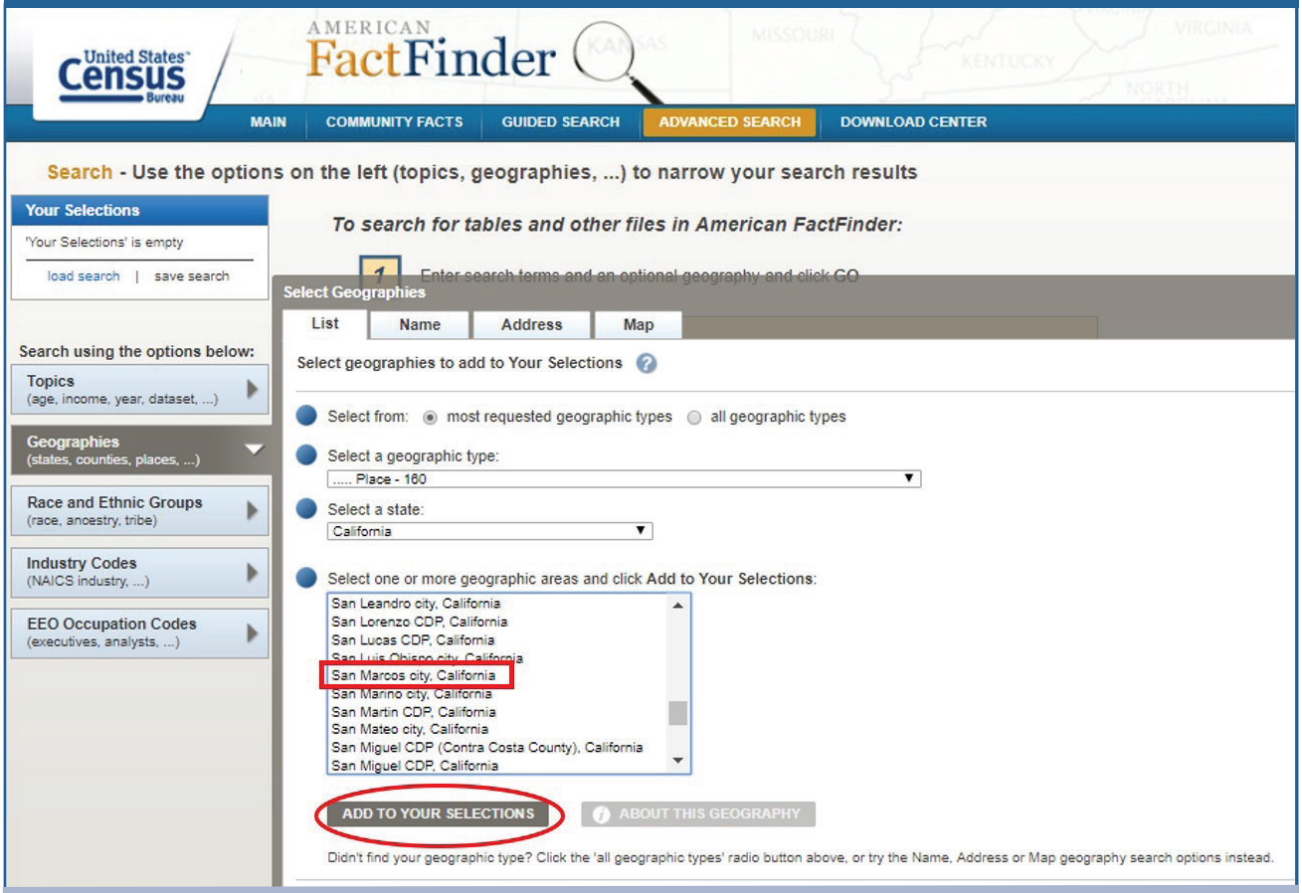
Variable	Dataset
Median household income	ACS 1-Year Estimates
Population below poverty level	ACS 1-Year Estimates
Educational attainment	ACS 1-Year Estimates
Field of bachelor's degree	ACS 1-Year Estimates
Median income by industry	ACS 1-Year Estimates
Work destination	LEHD OnTheMap
Distance to work	LEHD OnTheMap

Other data sources used in the profile include the San Diego Association of Governments, Emsi (a labor market analytics firm), the State of California Employment Development Department, and ReferenceUSA.

To obtain the desired data, we used the American FactFinder (AFF) "Advanced Search" tool, as follows:

- Go to the AFF Web site at <https://factfinder.census.gov>.
- Click "Advanced Search" on the ribbon.
- Select "Geographies" on the left sidebar, select "Place" under "Geographic Type," select "California" from the state drop-down option, and use the scroll functionality to select "San Marcos city, California." After highlighting the desired geography, click "Add to Your Selections" (see Figure 3.1).

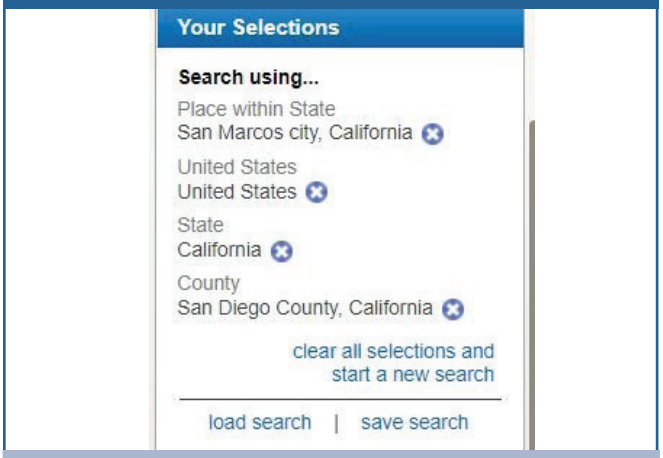
Figure 3.1. **Selecting Geographic Areas**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- Continue adding geographies until San Diego County, California, and the United States have been selected, each time selecting the appropriate geography under "Geographic Type." At the end of this step, we have a total of four geographic areas specified under "Your Selections" (see Figure 3.2).
- Return to the left sidebar. Under "Topics," expand the "Dataset" option, and select "2016 ACS 1-year estimates."
- Since we are interested in the city's socioeconomic characteristics, we begin by learning about the city's educational attainment. Revisit the "Topics" window, expand the "People" category, expand "Education," and select "Educational Attainment" (see Figure 3.3).

Figure 3.2. **Geographic Selections**



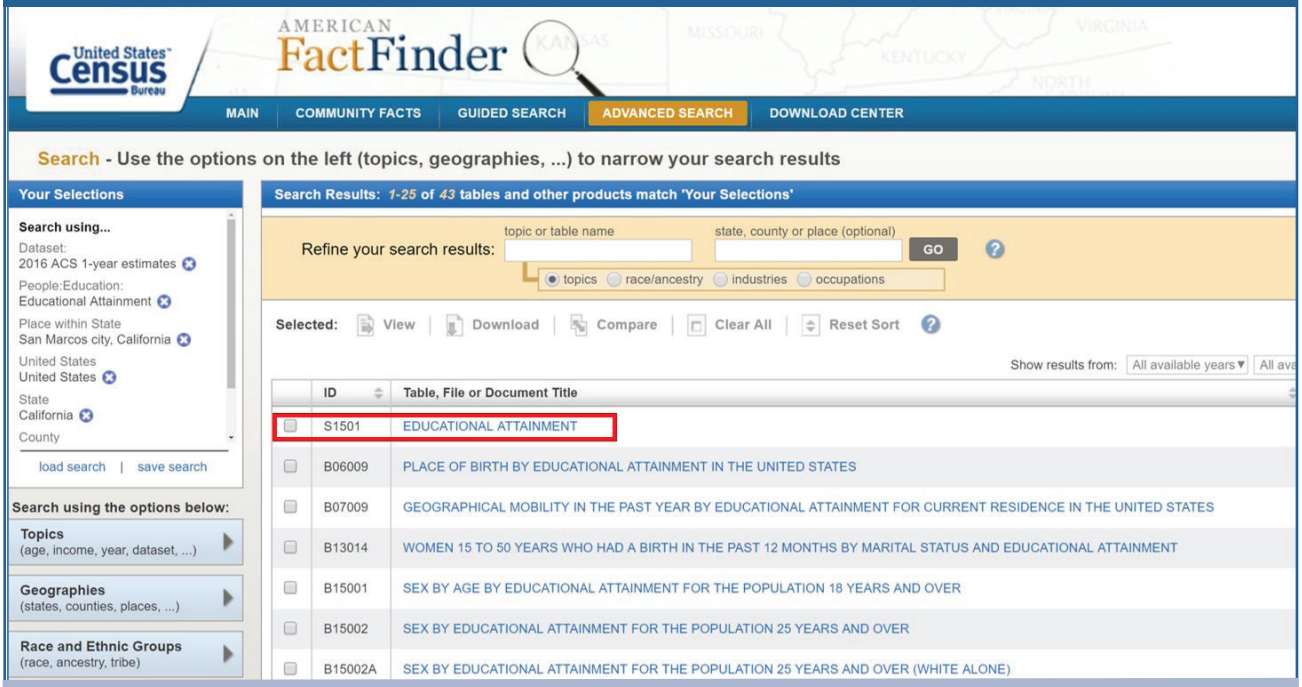
Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

Figure 3.3. **Selecting the Educational Attainment Topic**

Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- Use the descriptive table titles to make your selection. We know we are searching for a summary table, so we select the first result, "S1501: Educational Attainment" (see Figure 3.4).[21]

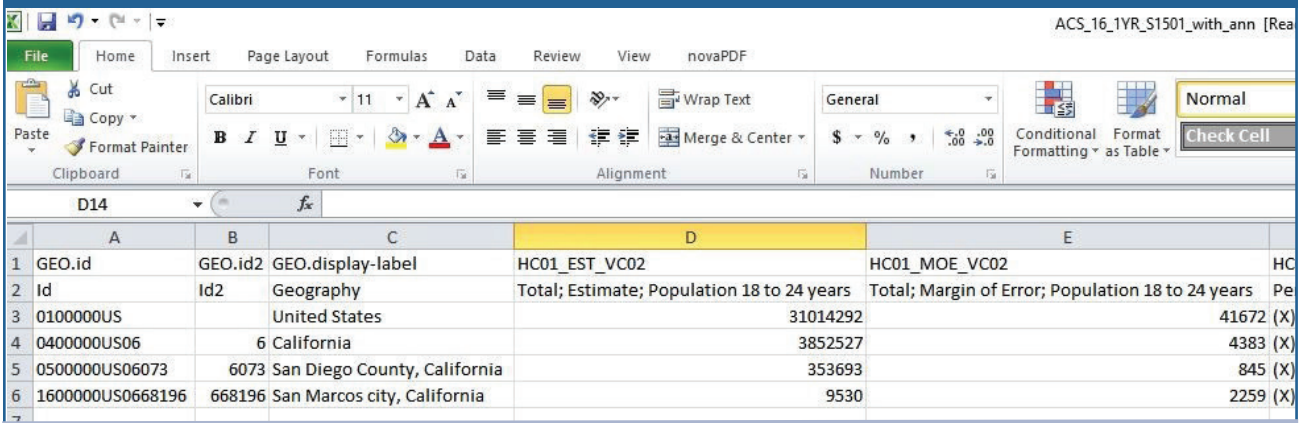
Figure 3.4. **Selecting an Educational Attainment Table**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- From the results window, the table "Educational Attainment" (S1501) is exported and saved as a spreadsheet (see Figure 3.5).

Figure 3.5. **American FactFinder Data Table S1501 Exported and Opened in Excel**



	A	B	C	D	E	
1	GEO.id	GEO.id2	GEO.display-label	HC01_EST_VC02	HC01_MOE_VC02	HC
2	Id	Id2	Geography	Total; Estimate; Population 18 to 24 years	Total; Margin of Error; Population 18 to 24 years	Pe
3	0100000US		United States	31014292	41672	(X)
4	0400000US06	6	California	3852527	4383	(X)
5	0500000US06073	6073	San Diego County, California	353693	845	(X)
6	1600000US0668196	668196	San Marcos city, California	9530	2259	(X)

Source: U.S. Census Bureau, American FactFinder, Table S1501: Educational Attainment.

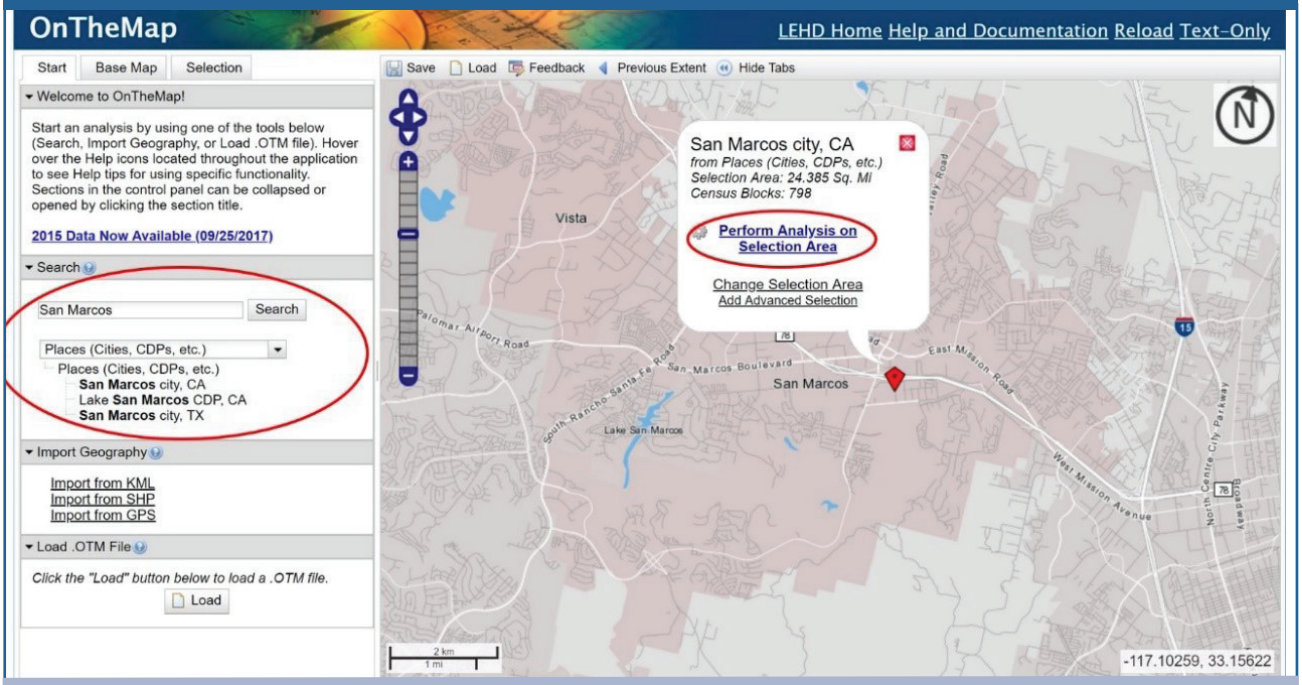
- We repeat this process for all AFF topics in the profile.

[21] Tables beginning with "S" are Subject Tables that focus on particular ACS subjects and include both estimates and percentages. More information about Table IDs is available on the Census Bureau's Web site, <www.census.gov/programs-surveys/acs/guidance/which-data-tool/table-ids-explained.html>.

For data on commuting patterns, we accessed LEHD data, as follows:

- Go to the LEHD Web site at <https://lehd.ces.census.gov/research/>.
- Click "OnTheMap" on the left sidebar. This action will open a new window.
- Under the "Search" box, type "San Marcos" in the search bar, using the dropdown menu to select "Places" as the geography type. Be sure to select San Marcos, California, rather than San Marcos, Texas. Our selection refreshes the map view and zooms in to San Marcos (see Figure 3.6).

Figure 3.6. **Searching for a Geographic Area in OnTheMap**

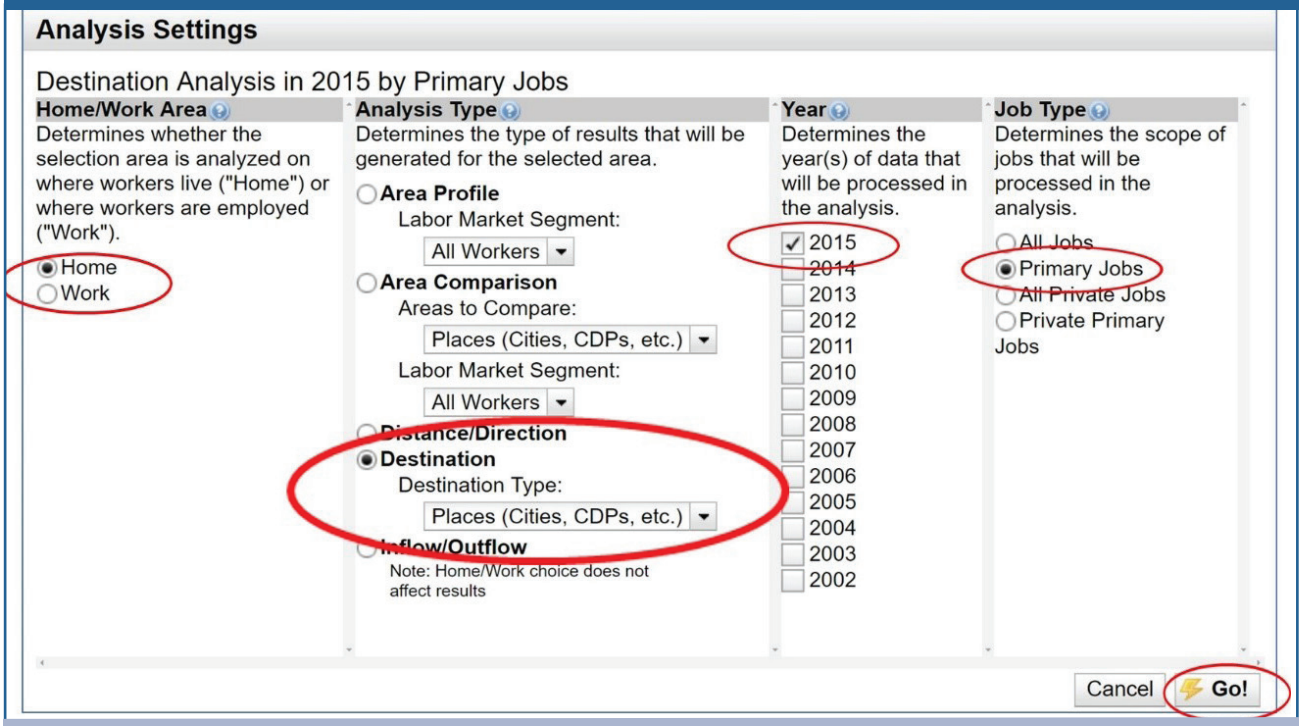


Source: U.S. Census Bureau, OnTheMap, <https://onthemap.ces.census.gov/>.

- Use the information bubble next to the location pin to select "Perform Analysis on Selection Area."
- The "Analysis Settings" window opens, allowing us to refine our search.
    - Home/Work Area: Since we are interested in understanding commuting patterns, we select "Home." This will produce an analysis based on San Marcos' residents, rather than workers.
    - Analysis Type: We are interested in understanding where residents work. We select "Destination" and "Places" as our destination type.
    - Year: We select the most recently available data.
    - Job Type: Select "Primary Jobs."

- Once all selections have been made, we click on "Go!" (see Figure 3.7).

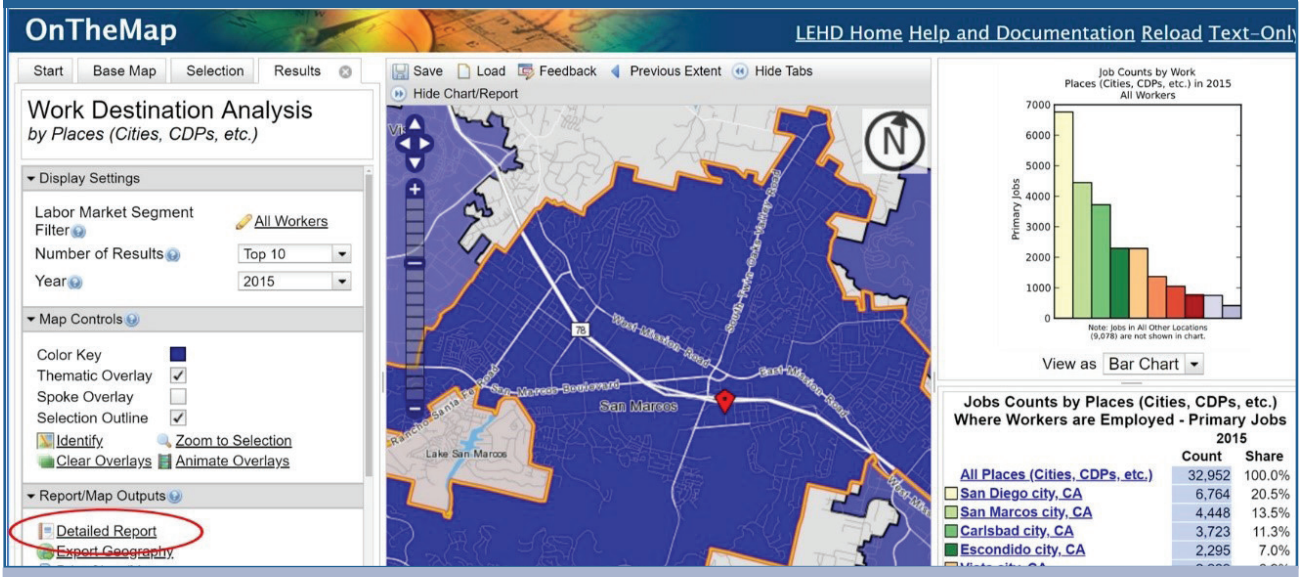
Figure 3.7. **Selecting Variables for Analysis in OnTheMap**



Source: U.S. Census Bureau, OnTheMap, <https://onthemap.ces.census.gov/>.

- The page refreshes and populates our search results. We export the results by selecting "Detailed Report" under the left sidebar's "Report/Map Output" bin, and export the data in spreadsheet format (see Figure 3.8).

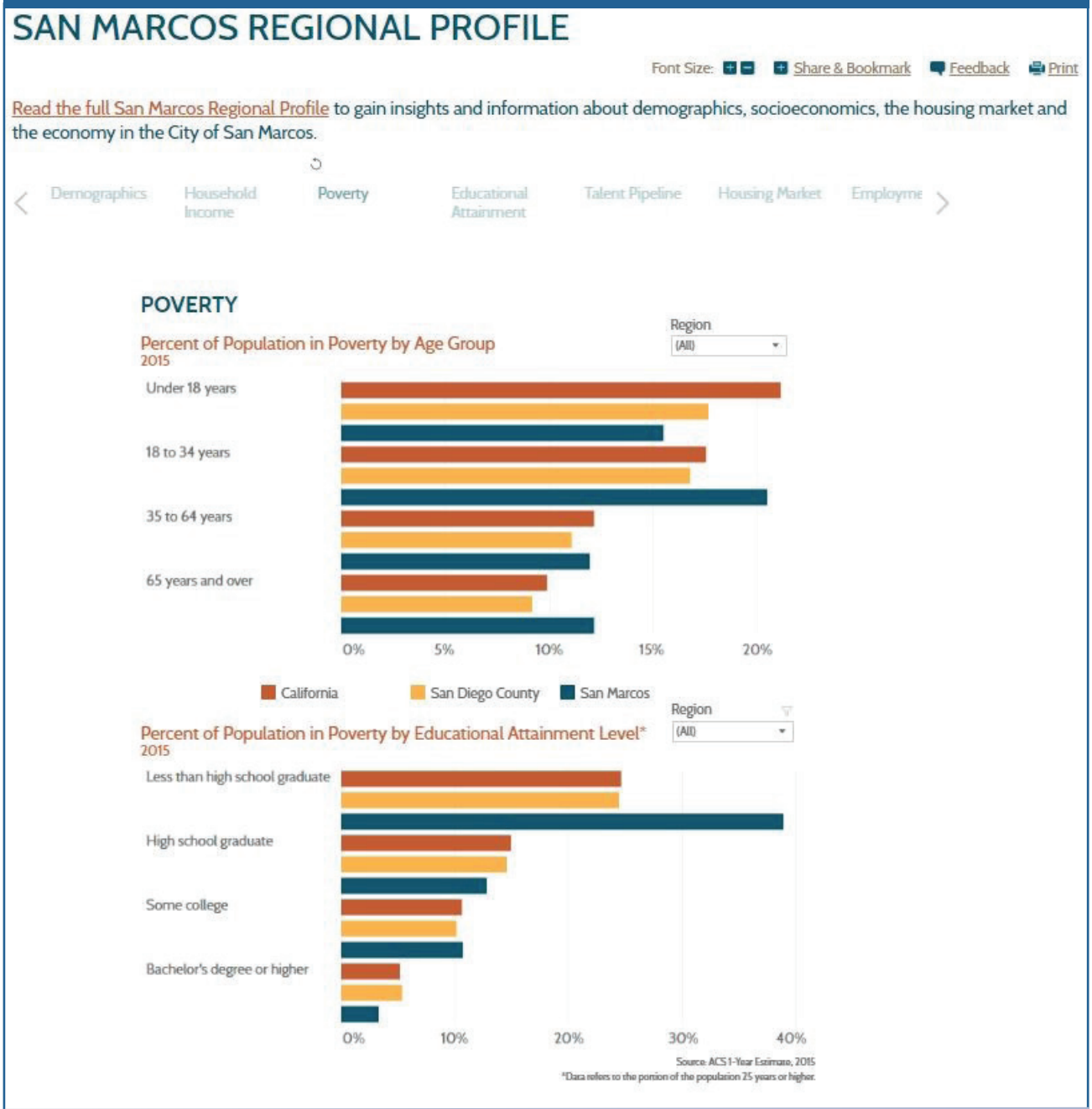
Figure 3.8. **Creating a Detailed Report in OnTheMap**



Source: U.S. Census Bureau, OnTheMap, <https://onthemap.ces.census.gov/>.

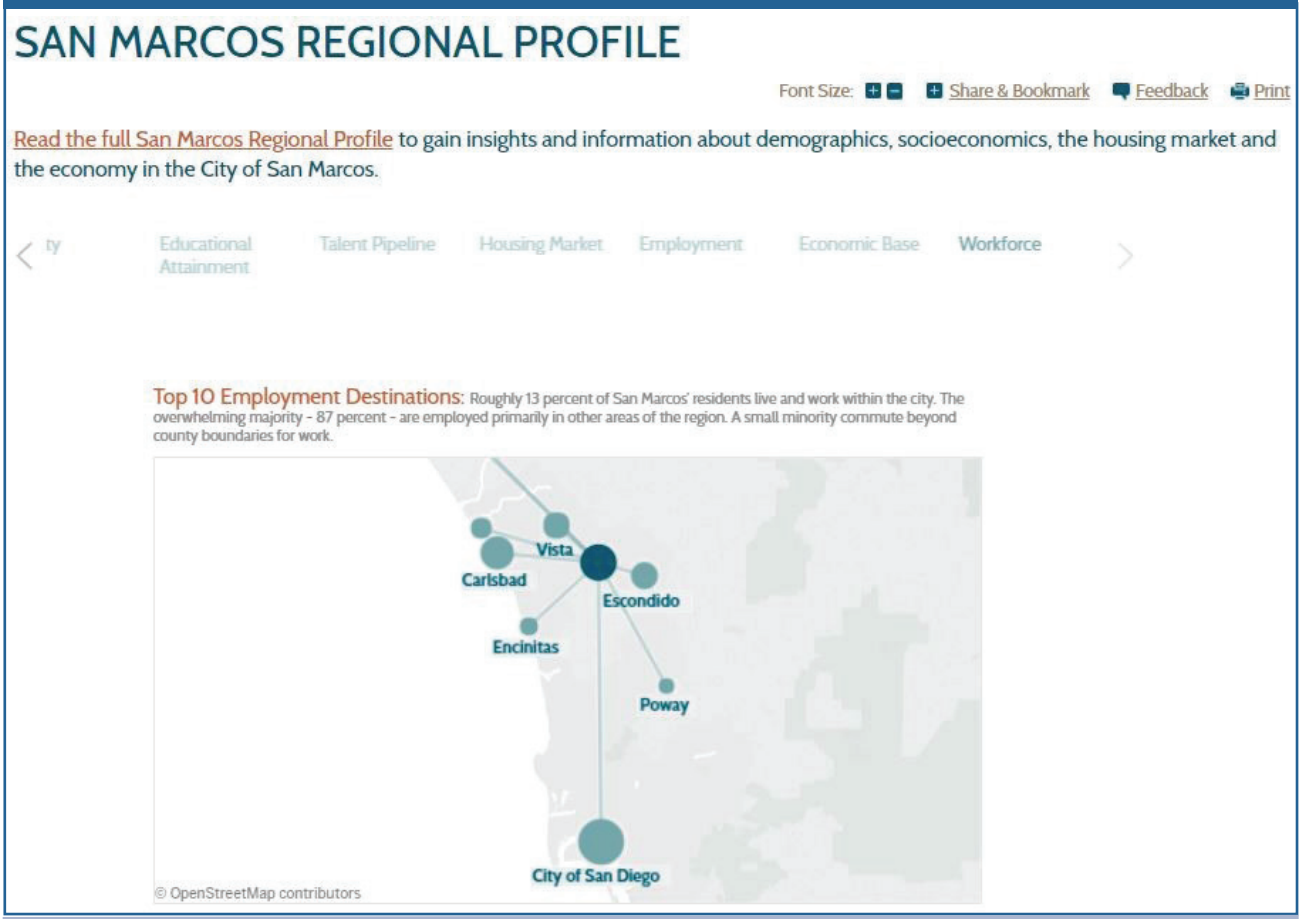
Initial analysis was conducted in a spreadsheet, by sorting results from highest to lowest and comparing the city of San Marcos to the county, state, and nation. The resulting charts were created using a mixture of spreadsheets and visualization software. Figure 3.9 illustrates how poverty data was visualized in the dashboard. Figure 3.10 shows an interactive flow map that was created to visualize the city's commuting patterns.

Figure 3.9. **City of San Marcos Regional Profile: Poverty**



Source: San Marcos City Hall, San Marcos Regional Profile, <www.san-marcos.net/live/about-us/demographics>.

Figure 3.10. **City of San Marcos Regional Profile: Commuting Patterns**



Source: San Marcos City Hall, San Marcos Regional Profile, <www.san-marcos.net/live/about-us/demographics>.

The City of San Marcos Regional Profile and interactive dashboard were launched in the fall of 2017. Since then, the dashboard has been viewed more than 1,000 times and is actively used by the city and its partners to better inform the region's business community. In partnership with the city of San Marcos, the EDC plans on updating the profile and dashboard on an annual basis as data becomes available. Both products can be found on the city of San Marcos Web site.[22]

[22] San Marcos City Hall, San Marcos Regional Profile, <www.san-marcos.net/live/about-us/demographics>.

Case Study #2: Housing Affordability Gap

Skill Level: Intermediate
Subject: Median household income, housing affordability
Type of Analysis: Analysis of national housing trends, combining American Community Survey (ACS) data with other sources
Tools Used: ACS Public Use Microdata Sample, spreadsheet
Authors: Svenja Gudell, Chief Economist, Zillow; and Aaron Terrazas, Senior Economist, Zillow

In the decade since the 2007–2009 Financial Crisis, there has been a boom in housing market data available to the public. Each month, Zillow—an online resource for home buyers and renters—produces and publishes over 100 housing market data series—including median home values and median rents—aggregated at the national, state, metro, county, ZIP code, and neighborhood levels.[23]

Zillow data provide a comprehensive view into the state of the U.S. housing stock, but Zillow's economic research and data science teams also rely on critical data inputs from the Census Bureau to analyze the full implications of changing home values and rents for American households. One prominent example is how Zillow combines proprietary data on home values with household income data from the Census Bureau's ACS to explore the share of income that the typical household spends on a monthly mortgage payment. (Zillow also produces a similar statistic for the share of income spent on rent.)

By the middle of 2016—the most recent data available at the time of this writing—the typical American household earning the country's national median income and buying the median-valued U.S. home could expect to pay 15.5 percent of their income on a mortgage. In the nation's priciest markets—such as San Jose, Los Angeles, and San Francisco—these shares exceed 40 percent.

But calculating housing affordability estimates based on median income and median home values by themselves does not provide a complete picture of affordability. Home values and incomes have consistently grown more at the top of the housing market and at the top of the labor market than at the bottom. Increasingly, affordability varies dramatically depending on a given buyer's income level and the type of home they are trying to buy.

To illustrate these diverging trends between more affluent and less affluent Americans, Zillow also computes mortgage affordability—the share of income spent on a mortgage—for the bottom, middle, and top third of households by income. This more granular (and, some would argue, more powerful) tier analysis is conducted by combining Zillow's property-level data with ACS microdata.

Calculating Mortgage Affordability

To calculate mortgage affordability, Zillow first estimates the mortgage payment for the median-valued home in a metropolitan area (based on the Zillow Home Value Index for a given quarter) and the 30-year, fixed mortgage interest rate during that quarter (from the Freddie Mac Primary Mortgage Market Survey), assuming a 20 percent down payment. Zillow uses their internal property-level data to estimate mortgage payments, but data users can also access housing data—including home value and mortgage payment estimates—from the ACS.

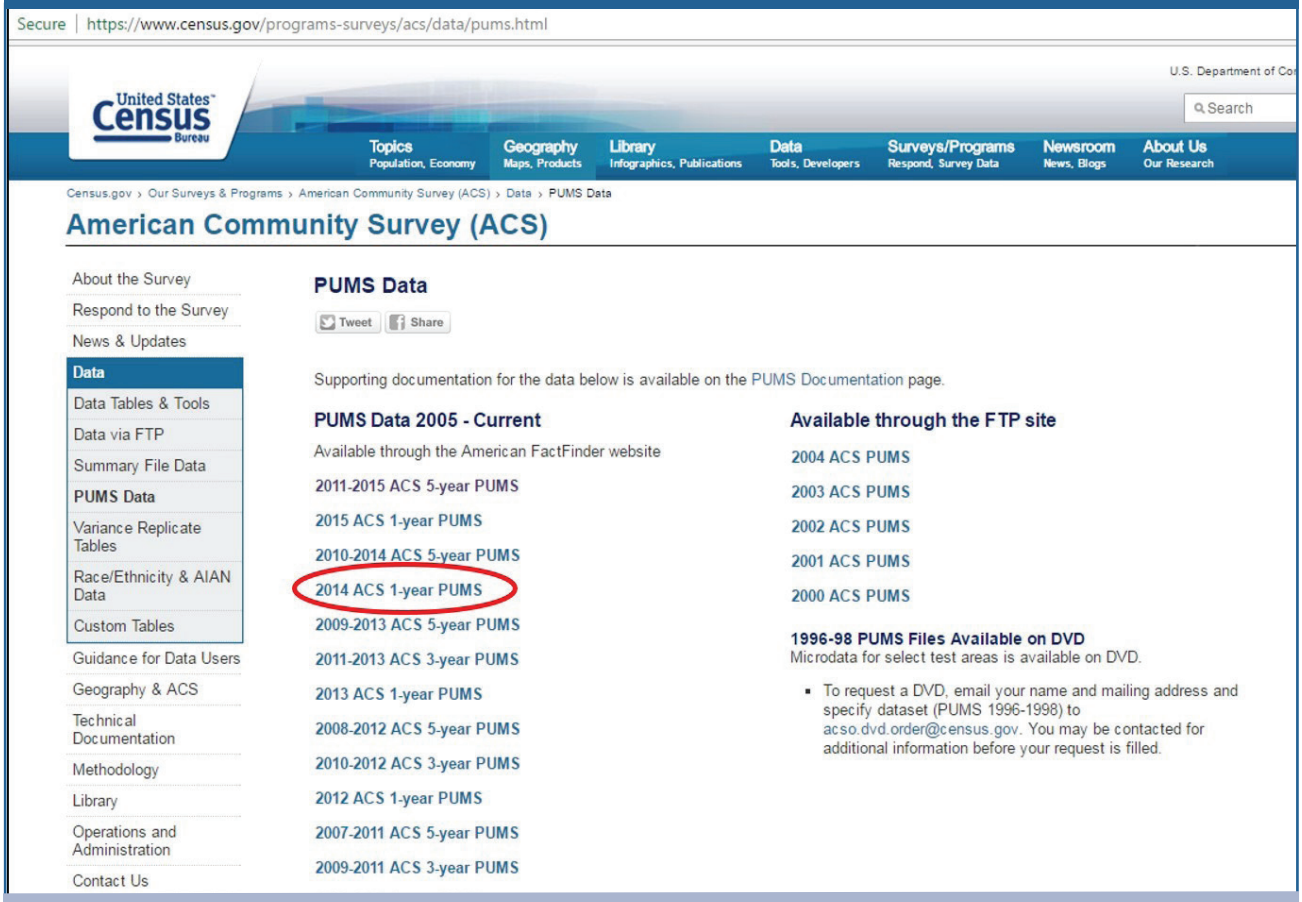
Data on median household income are from the Census Bureau's ACS Public Use Microdata Sample (PUMS). The PUMS files allow data users to conduct a custom analysis of the ACS data using a sample of actual responses to the survey. They are much more flexible than the aggregate data available on American FactFinder, though the PUMS files also require familiarity with statistical analysis software.

With access to appropriate software—the most common are SAS, SPSS, STATA, R, and Python—using the ACS PUMS data is straightforward. Analysts without statistical software can extract detailed cross tabulations using DataFerrett <dataferrett.census.gov>, the Census Bureau's online query tool.

[23] Data are published at <www.zillow.com/data>.

To download PUMS data, go to the Census Bureau's ACS PUMS Data Web site (see Figure 3.11) and elect the desired timeframe for the PUMS data. Data are available from the year 2005 to the present. You can select single-year or multiyear data. The example below uses data from the 2014 ACS 1-year file.

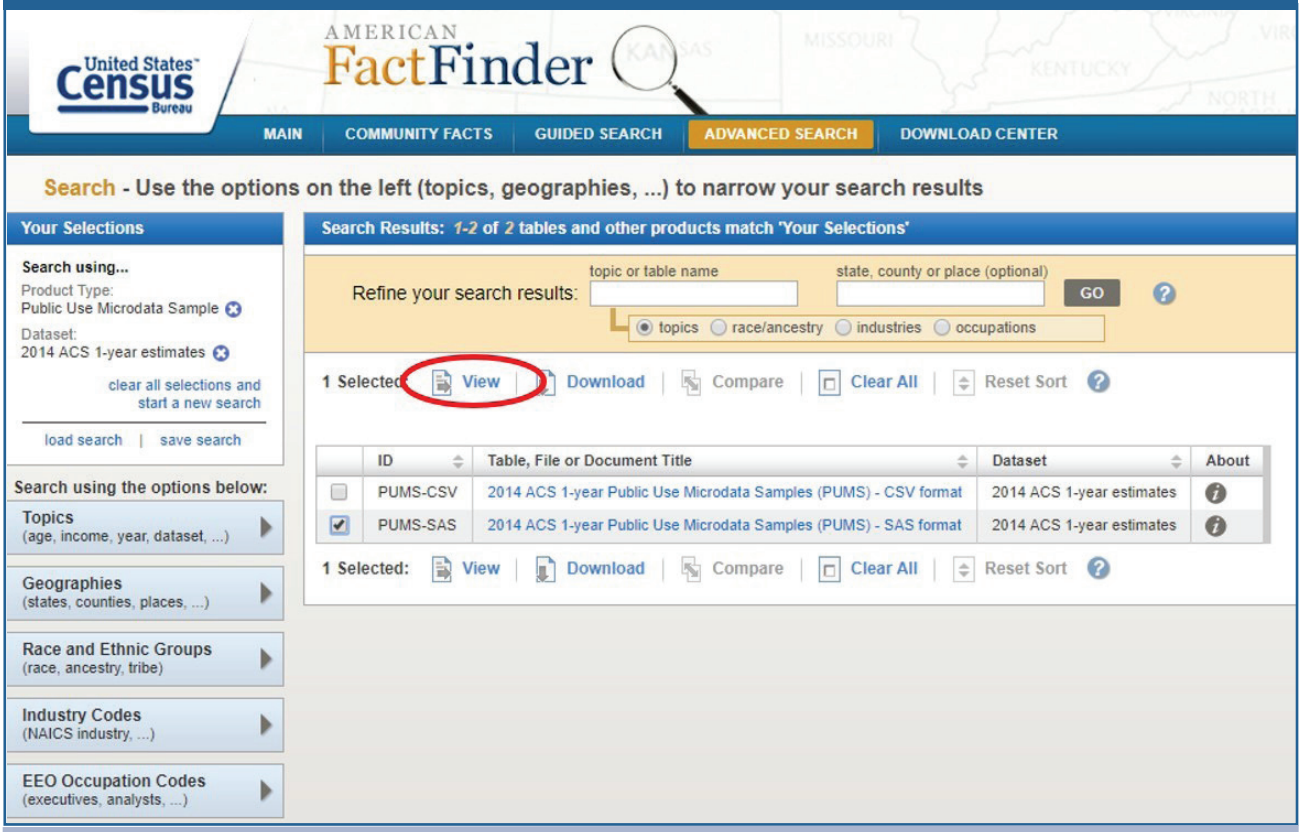
Figure 3.11. **ACS PUMS Data Repository**



Source: U.S. Census Bureau, American Community Survey (ACS), PUMS Data, <www.census.gov/programs-surveys/acs/data/pums.html>.

Once you have selected a data file, you will be directed to a page in American FactFinder, where you can choose between downloading the data in CSV format (comma-delimited data) or SAS format (see Figure 3.12).

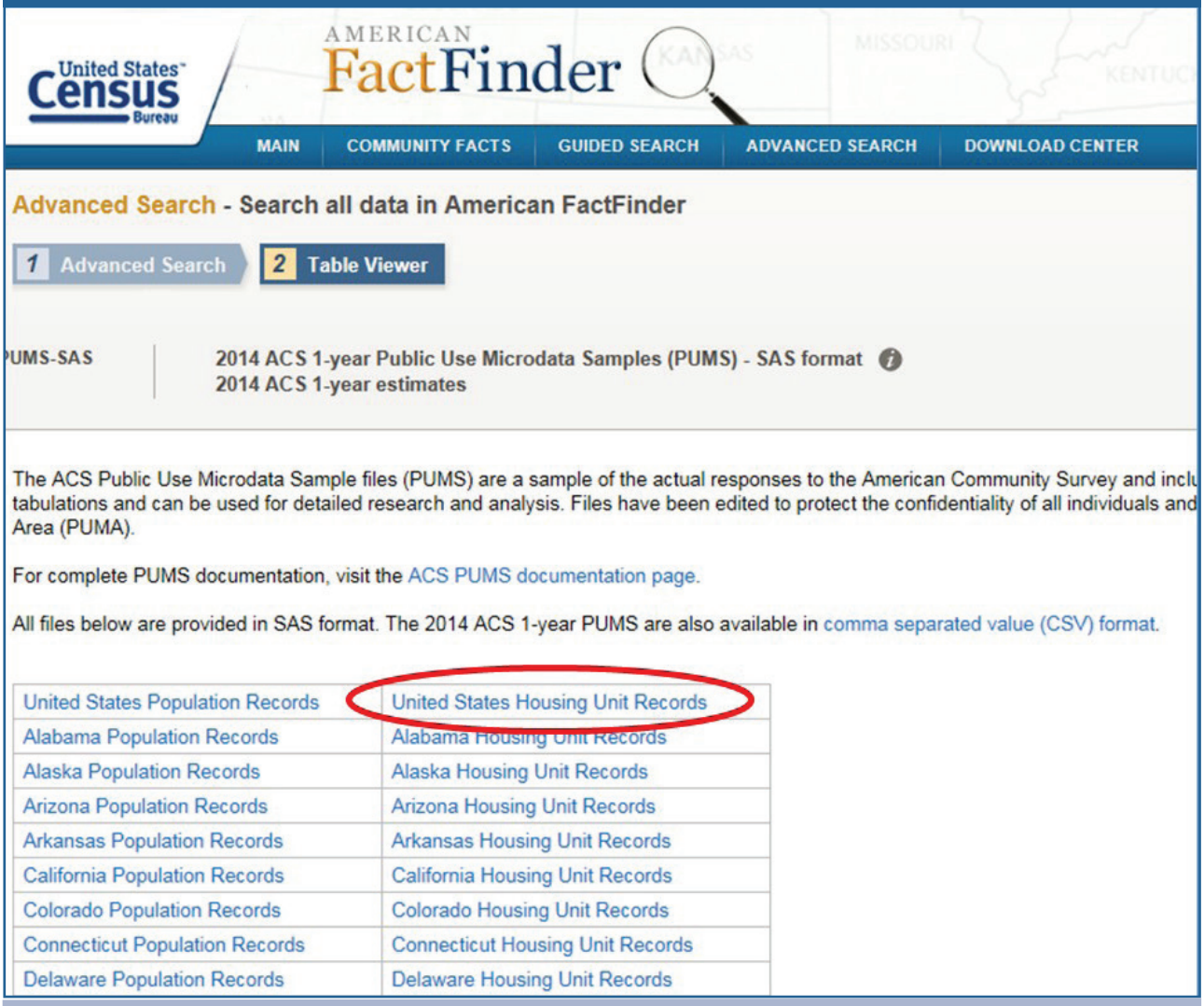
Figure 3.12. **ACS PUMS Data Download**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

After making a selection, clicking "View" brings you to another page where you can choose between population records (total U.S. population or a specific state) or housing records (entire United States or a specific state) (see Figure 3.13). Zillow uses the "United States Housing Unit Records" file.

Figure 3.13. **ACS PUMS Downloads by Geography (Nation and States) and File (Population and Housing)**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

After downloading the file, Zillow loads the ACS data into R (software for statistical computing) to produce estimates of monthly owner costs as a percentage of household income for households at different income levels. The PUMS Data Dictionary can help you find the variable needed for this analysis: HINCP (Household income in the past 12 months).[24]

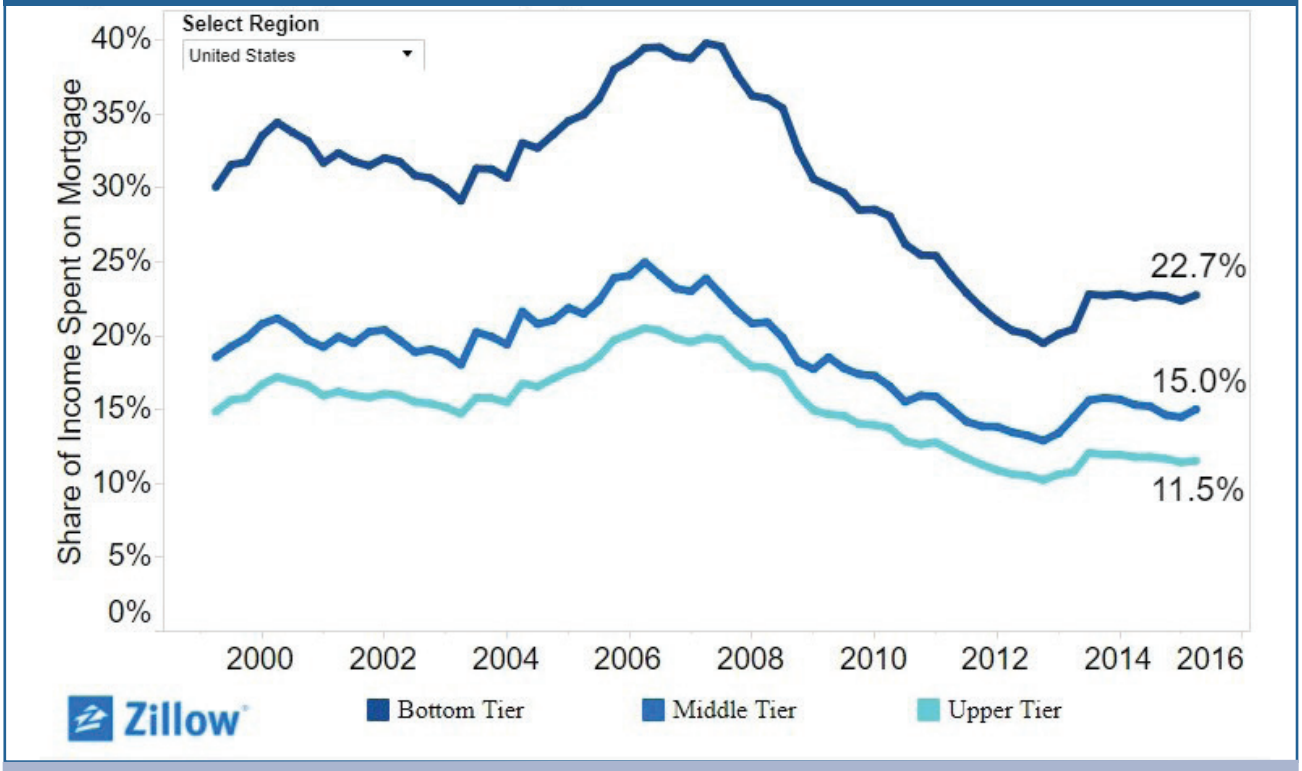
Using the HINCP variable to estimate median household income for households in the bottom third of the income distribution, Zillow then assumes that these households purchase a median bottom-tier home (i.e., 16.7th percentile of homes in a metro area) and then calculates the percentage of monthly income that household would have to spend to pay the mortgage.[25]

[24] U.S. Census Bureau, PUMS Data Dictionary, <www.census.gov/programs-surveys/acs/technical-documentation/pums/documentation.html>.

[25] For median income used in the overall affordability analysis, Zillow chains the ACS income data forward using the Employment Cost Index (ECI), which is updated quarterly with a one-quarter lag. Income tier data are not directly published in the ECI, so to calculate tiers, Zillow relies on the Consumer Expenditure Survey (CES), which is published with a one-year lag. For this reason, tier data are only available through Q2 2016, but overall affordability data are available through Q2 2017.

The key results from Zillow's analysis are shown in Figure 3.14. Depending on a given buyer's household income level and the kind of home they're trying to buy, affordability can vary dramatically. Nationwide, a buyer at the median household income in the bottom one-third of all incomes and looking to buy a home valued in the bottom one-third of all homes would need to spend 23 percent of their household income on a mortgage as of Q2 2016, the latest quarter for which data were available at the time of this writing. A buyer in the top third of household incomes and looking to buy a more expensive home in the top third of homes by value would only spend 11.5 percent of their income on a mortgage.

Figure 3.14. **Mortgage Affordability by Income Tier**



Source: Svenja Gudell, Housing Highs & Lows: How the Home Affordability Gap Between the Rich and Poor is Widening, <www.zillow.com/research/affordability-2016q1-12763/>.

A decade after the 2007–2009 Financial Crisis and associated housing market bust, there has been a proliferation of housing market data available to consumers and researchers. Census Bureau data, particularly from the ACS, are a critical complement to Zillow's housing market data.

In an era when the gap in net worth between higher- and lower-wealth households is increasing, medians or averages cannot tell the full story of the American housing market.[26] Exploring within the distribution of home values and household incomes—analysis that is possible with Zillow's property-level home values and the Census Bureau's ACS PUMS data—allows for a much richer and more complete perspective on what is, for most Americans, their largest single asset.[27]

[26] U.S. Census Bureau, Gap Between Higher- and Lower-Wealth Households Widens, Census Bureau Reports, <www.census.gov/newsroom/press-releases/2014/cb14-156.html>.

[27] Zillow updates this analysis periodically. For the most recent data and analysis, see <www.zillow.com/research>.

Case Study #3: USAA Potential Market Size Estimation

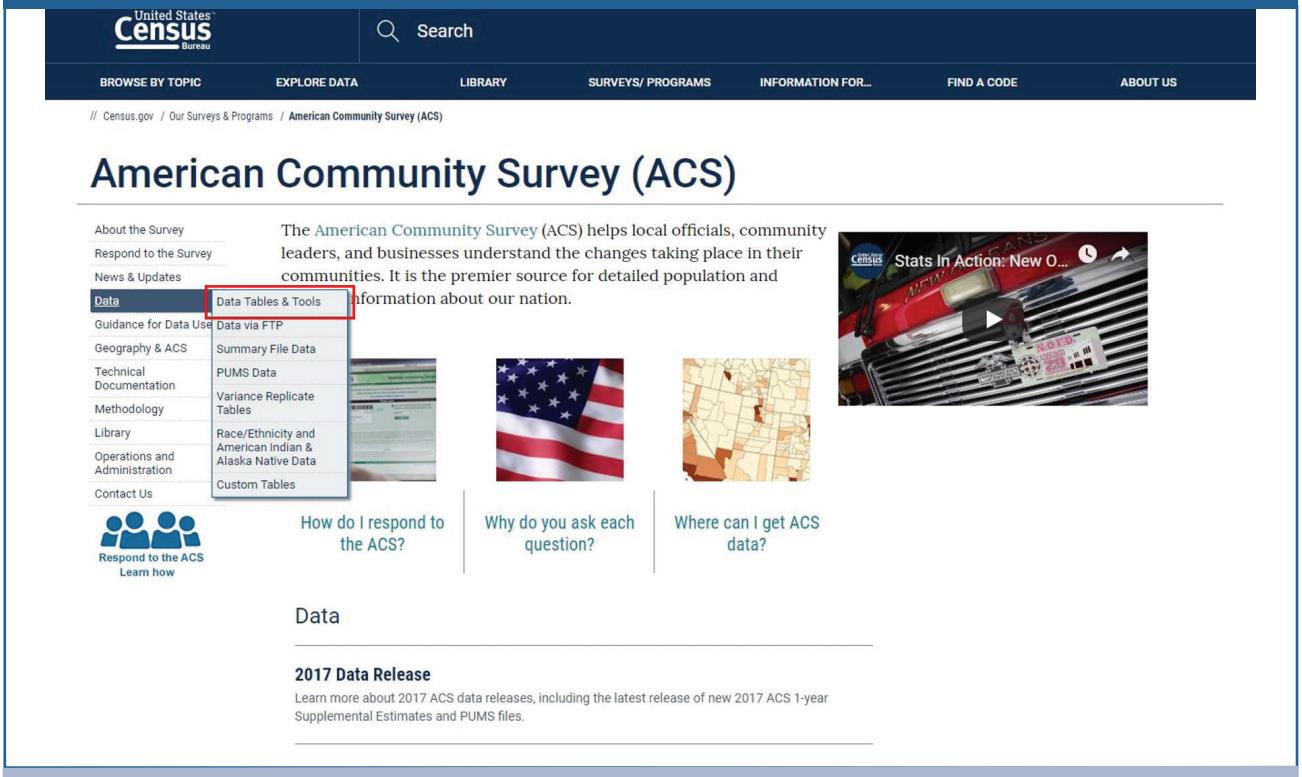
Skill Level: Introductory/Intermediate
Subject: Housing
Type of Analysis: Comparisons of American Community Survey (ACS) data over time, across demographic groups, and across states; identifying business market(s)
Tools Used: American FactFinder, spreadsheet
Author: Rob Galbraith, Director of Underwriting Research, Property & Casualty Insurance Group, USAA

Rob Galbraith is a Director of Underwriting Research with the Property & Casualty Insurance Company at USAA, a large financial services member-owned association that focuses on serving active duty military, veterans, and their families. The underwriting area is challenged with providing insurance to as many eligible members as possible while not taking on excessive exposure to natural hazards that could put the company at risk of bankruptcy. ACS data are used at USAA in conjunction with advanced analytics and predictive modeling to identify segments to target for marketing three of its major lines of business: homeowners insurance, sold to those with owner-occupied homes; renters insurance, sold to those who are renting a dwelling from a landlord who owns the property; and rental property insurance, sold to those who are landlords renting their property to one or more tenants. ACS data are also used to track trends in owner- and renter-occupied housing to target marketing expenditures to achieve profitable growth.

Rob scans the documentation available for the ACS and learns that while single-year data are available for states and many large geographic areas, data for smaller areas with fewer than 65,000 people are only available in 5-year tabulations (e.g., 2012–2016). He also learns that there is uncertainty—margin of error—associated with ACS estimates, particularly for smaller geographic areas and small population groups. For this example, Rob is interested in accessing ACS housing data at the state level.

Rob begins at the ACS home page and scrolls down, clicking on "Data Tables and Tools" (see Figure 3.15).

Figure 3.15. **Selecting Data Tables and Tools From the ACS Home Page**



Source: U.S. Census Bureau, American Community Survey (ACS), <www.census.gov/programs-surveys/acs/>.

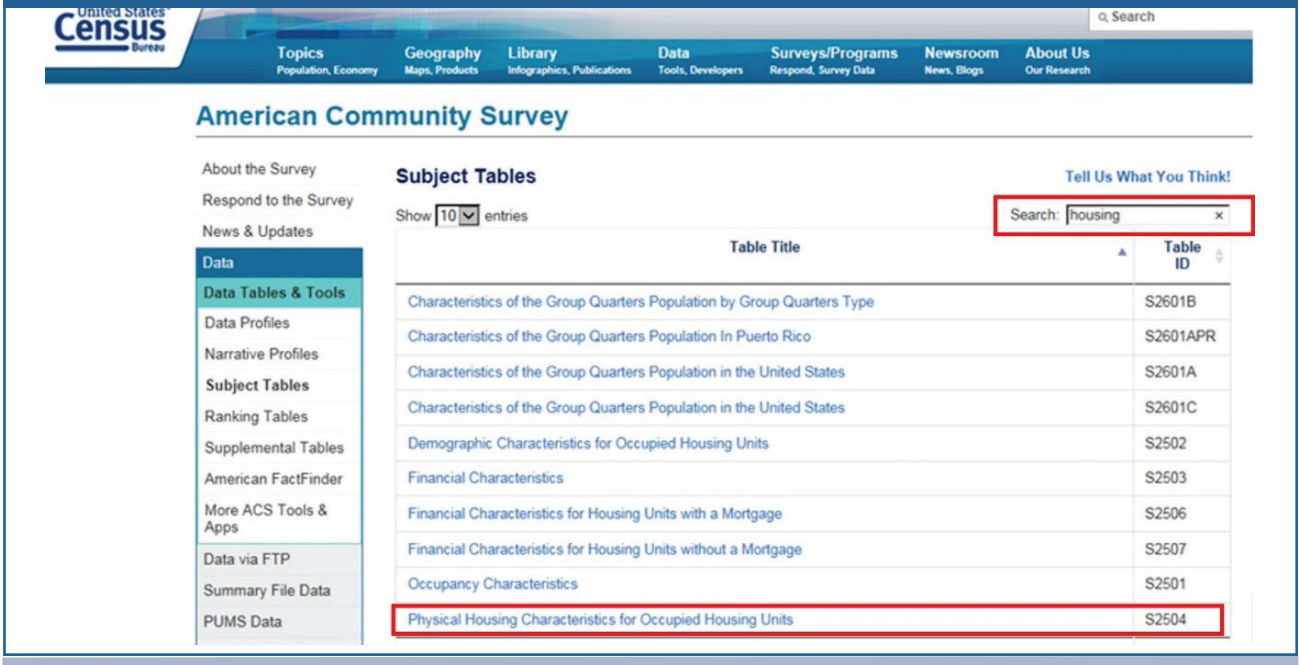
- Under the subheading of "Subject Tables," he clicks on the link, "Choose your subject table here!" (see Figure 3.16).

Figure 3.16. **Selecting ACS Subject Tables**

Source: U.S. Census Bureau, American Community Survey (ACS), <www.census.gov/programs-surveys/acs/>.

In the search box near the top right corner of the page, he types in "housing" and then selects Table S2504: Physical Housing Characteristics for Occupied Housing Units (see Figure 3.17). When he clicks on this link, he is connected to American FactFinder, the Census Bureau's primary tool for accessing data from the ACS and many other Census Bureau data sets.

Figure 3.17. **Searching for ACS Housing Tables**



Source: U.S. Census Bureau, American Community Survey (ACS), <www.census.gov/programs-surveys/acs/>.

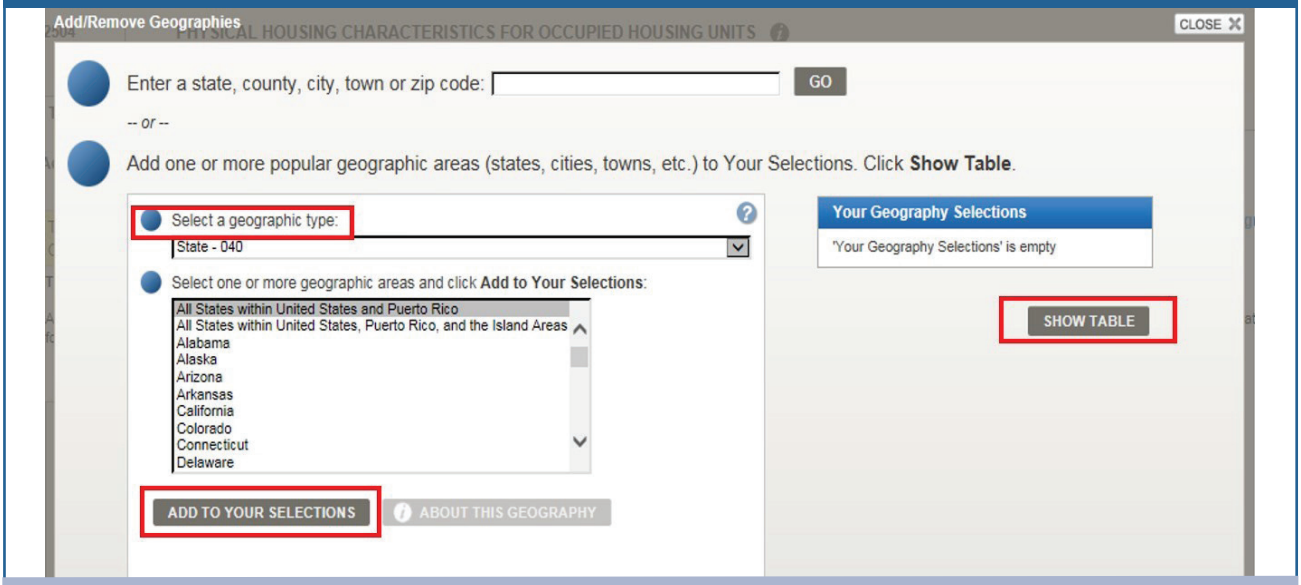
- Next, he clicks on "Add/Remove Geographies" near the top of the page (see Figure 3.18).

Figure 3.18. **Adding and Removing Geographies**

Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- He clicks on the drop-down box under “Select a geographic type,” scrolls down to “State,” and clicks to select.
- A new box appears, and he selects the first one in the list called “All States within United States and Puerto Rico,” clicking the button labeled “Add to Your Selections” (see Figure 3.19).

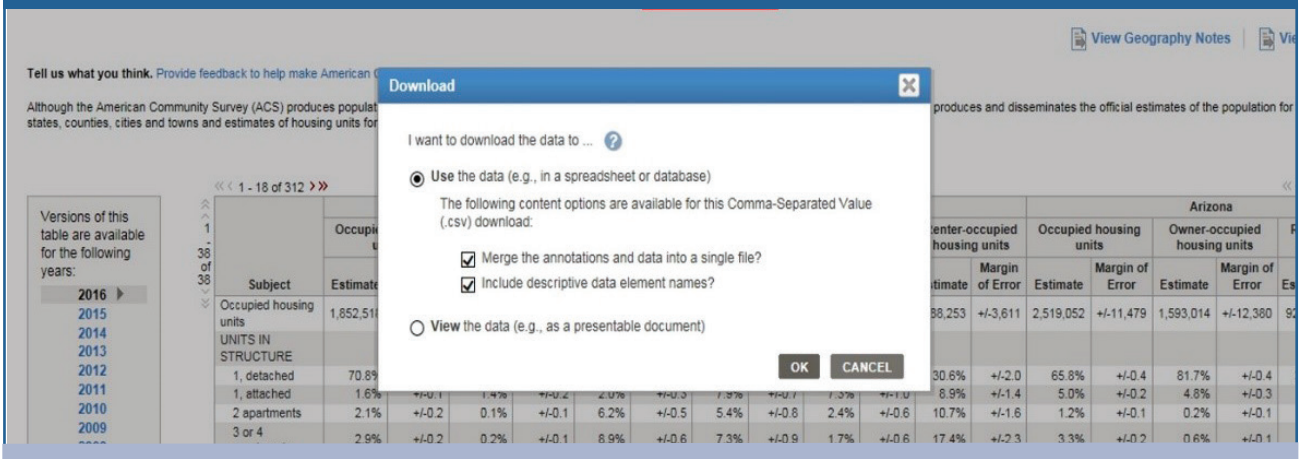
Figure 3.19. **Selecting a Geographic Type**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- He then clicks the “Show Table” button on the right-hand side of the screen.
- The results are displayed in HTML format on the page. He selects “Download” at the top of the page.
- A pop-up window appears. He clicks on the radio button for “Use the data” and then clicks OK (see Figure 3.20).

Figure 3.20. **Downloading ACS Data**

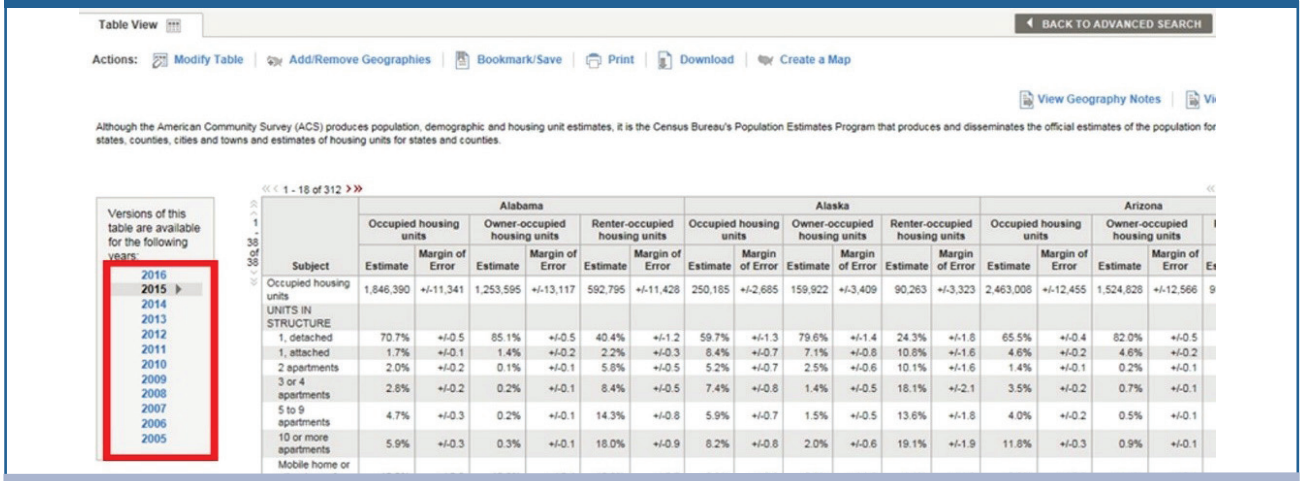


Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

- The data table is saved in a Temporary Internet File called “ACS_16_1YR_S2504_with_ann.csv” and can be opened using a spreadsheet.

This process is repeated for multiple years to allow Rob to see trends in the data to assist with the selection of target markets to recommend (see Figure 3.21).

Figure 3.21. **Selecting ACS Data for Previous Years**



Source: U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov>.

Rob opens the .csv file and copy and pastes the owner-occupied and renter-occupied data for each state into a new table showing the data for the last 5 to 10 years (see Table 3.2). He can then use this table and compare it with internal USAA data showing the number of policies in force for each of the three lines of business and compare the two tables to determine potential market size by state. Since the purpose of this analysis is to identify target market opportunities, the margin of error is not considered as a critical factor, as the goal is merely to gain reasonable estimates of potential market size.

Table 3.2. **Owner-Occupied Housing Units by State and Year**

State	2012	2013	2014	2015
Alabama	1,268,565	1,240,017	1,246,080	1,253,595
Alaska	159,427	156,107	156,006	159,922
Arizona	1,496,650	1,490,031	1,484,857	1,524,828
Arkansas	757,722	739,987	744,318	746,000
California	6,781,817	6,804,639	6,855,688	6,910,823
Colorado	1,278,158	1,291,945	1,302,533	1,322,618
Connecticut	908,452	888,478	900,039	889,035
Delaware	241,050	243,047	245,808	249,681
District of Columbia	110,681	110,513	112,492	112,555
Florida	4,724,428	4,672,482	4,693,821	4,760,071

Source: U.S. Census Bureau, American FactFinder, Table S2504: Physical Housing Characteristics for Occupied Housing Units.

If desired, this process can be replicated at a county level for further refinement of market segmentation.