Applying Current Core Based Statistical Area Standards to Historical Census Data, 1940-2020

by

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Abstract

In the middle of the twentieth century, the Bureau of the Budget, in conjunction with the Census Bureau and other federal statistical agencies, introduced a widely used unit of statistical geography, the county-based Standard Metropolitan Area. Metropolitan definitions since then have been generally regarded as comparable, but methodological changes have resulted in comparability issues, particularly among the largest and most complex metro areas. With the 2000 census came an effort to simplify the rules for defining metro areas. This study attempts to gather all available historical geographic and commuting data to apply the current rules for defining metro areas to create comparable statistical geography covering the period from 1940 to 2020. The changes that accompanied the 2000 census also brought a new category, "Micropolitan Statistical Areas," which established a metro hierarchy. This research expands on this approach, using a more elaborate hierarchy based on the size of urban cores. The areas as delineated in this paper provide a consistent set of statistical geography that can be used in a wide variety of applications.

Keyword: metropolitan, micropolitan, statistical geography, methodology

[*] Disclaimer: Any opinions and conclusions expressed herein are those of the authors and do not represent the views of the U.S. Census Bureau. The Census Bureau has ensured appropriate access and has reviewed these results. No confidential data was used in this paper.

Introduction

As cities have grown beyond their political boundaries, the federal government has tried various means to measure the extent of urbanization and assess the reach of urban centers. In the 1940s the Census Bureau along with several other federal agencies formed the Federal Committee on Standard Metropolitan Areas, sponsored by the Bureau of the Budget. The primary goal was to establish a standardized metropolitan definition that would allow a wide variety of statistical data to be presented in an easily comparable format. Standard Metropolitan Areas were introduced with the 1950 census, and despite methodological changes in subsequent decades, metro areas have generally been regarded as comparable for long-term time-series analyses. For some metro areas, however, the methodological changes have resulted in a radical redrawing of boundaries that has undermined comparability. Because of geographic changes and a lack of suitably comparable data, not to mention the increasingly complicated methodology,[1] any attempt to apply the rules for defining metro areas from one decade to another was a practical impossibility.[2] With the 2000 decennial census came an effort to simplify the rules for defining metro areas.[3] Greater computing power has also allowed researchers to create comparable data across time. This study attempts to gather all available historical geographic and commuting data to apply the current rules for defining metro areas to create comparable statistical geographic units covering the period from 1940 to 2020. This effort promises to make directly comparable statistical geographies available for a wide variety of purposes.

Another significant development associated with methodological changes that came with Census 2000 was the introduction of "Micropolitan Statistical Areas". Micropolitan areas were constructed using the same rules as metro areas, but where metro areas were made up of counties with strong ties to urban cores with populations of at least 50,000 people, micropolitan areas were constructed around smaller urban cores (with populations of at least 10,000 but less than the metropolitan threshold of 50,000). Metropolitan and micropolitan areas both fall under the category of Core Based Statistical Areas (CBSA). This innovation has an even greater significance in that it established a hierarchy. When viewed over an extended period of time, it becomes clear that areas of different size have experienced significantly different changes in population. This research expands on this hierarchical approach, using a more elaborate hierarchy based on the size of urban cores.

From 1940 to 2020 the population of the United States grew from 132,165,129 to 331,449,281.[4] The great majority of this growth occurred in metro areas, particularly in the largest metro areas. Table 1 shows the distribution of population by size category from 1940 to 2020, which reveals that in the early years of this period rural areas and small towns accounted for a substantial portion of the population. Micropolitan areas would have been a useful geographic unit in 1940. Because commuting was more

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[1] "Alternative Approaches to Defining Metropolitan and Nonmetropolitan Areas," *Federal Register* 63:244 (December 21, 1998), pp. 70526-70561.

[2] Todd Gardner, "Changes in Metropolitan Area Definition, 1910-2010," Center for Economic Studies (CES) Working Paper Series, CES-21-04 (February 2021) https://www.census.gov/library/working-papers/2021/adrm/CES-WP-21-04.html

[3] "Final Report and Recommendations from the Metropolitan Area Standards Review Committee to the Office of Management and Budget Concerning Changes to the Standards from Defining Metropolitan Areas, *Federal Register* 65:163 (August 22, 2000), pp. 51600-51077.

[4] Historical Population Change Data (1910-2020) on the U.S. Census Bureau website at https://www.census.gov/data/tables/time-series/dec/popchange-data-text.html.

limited, micropolitan areas in the early years of this period were more isolated and self-contained, and they accounted for roughly double the share of population they did by the end of the century.

[Table 1. Population of the United States by CBSA Type, 1940-2020]

Consistent application of rules to historical data requires identification of urban cores in each decennial decade. We also need commuting data to assess the ties between urban cores and adjacent counties. This presents a number of challenges, particularly for the earliest years under examination here. We also need spatial information, particularly a complete list of adjacent geographic units, so that we can automate the process of building out from urban cores. Fortunately, enough data is available to carry out these operations and meaningfully apply the CBSA rules to all decennial census years between 1940 and 2020.

Metropolitan Hierarchy

Realizing that cities by themselves were not adequate units of analysis for many kinds of social and economic research, in 1905 the Census Bureau created Industrial Districts, economic regions centered on large cities. The 13 Industrial Districts were not based on population, but instead focused on the economic links between large urban centers and their hinterlands. Arguing that manufacturing in these areas was controlled largely by capital owned by residents of the cities and linked to the urban centers by rail, the Census Bureau mapped the extent of these economically integrated regions. The Census Bureau also established a classification of the urban hierarchy in the United States based on these Industrial Districts. New York, with a population of 5,294,682, was in a category by itself. In the second class were the Industrial Districts of Chicago, Philadelphia, and Boston. Each of these districts had a population of between 1,000,000 and 2,000,000 and each had an area of roughly 500 square miles. In the third class were the districts of St. Louis, Pittsburgh-Allegheny, Baltimore, Cincinnati, San Francisco, Cleveland, Buffalo, and Minneapolis-St. Paul. Each of these districts had a population in the neighborhood of 500,000 (give or take 150,000). Providence stood by itself in the fourth class. In the original conception of this classification system, Providence was to have been grouped with the Industrial Districts of Detroit, Milwaukee, New Orleans, Washington, Kansas City, and Louisville, but the Census Bureau offered only the explanation that "statistics for these have not been compiled."[5] The Census Bureau also contemplated adding a fifth class of Industrial Districts consisting of Indianapolis, Rochester, Denver, Toledo, and Columbus, but did not carry efforts that far.

In 1910 the Census Bureau began designating Metropolitan Districts, a metropolitan classification based primarily on population density rather than economic factors. These areas were composed of large urban centers and densely populated adjacent Minor Civil Divisions.[6] As W.M. Steuart, the director of

[5] U.S. Bureau of the Census, *Industrial Districts: 1905* (Washington, DC: Government Printing Office, 1909).

[6] The term "Minor Civil Division" is a general term that the Census Bureau uses to describe the primary political boundaries of politically independent incorporated and unincorporated places. Some states refer to unincorporated areas as townships, while others refer to them as towns, districts, wards, precincts, hundreds, or beats. Depending on the state, incorporated areas are referred to as villages, towns, boroughs, or cities. In many states, incorporated places lie wholly within unincorporated territory or may straddle the boundaries of more than one township. In some states incorporated places are made independent of townships. The differences in the way states define Minor Civil Divisions make applying a standard definition of metropolitan difficult, particularly when a metropolitan region crosses state lines.

the Census Bureau explained, "the Metropolitan District is a population area purely, and may or may not correspond to what might be regarded as the industrial or trade district of the particular city."[7] The Census Bureau employed the concept of the Metropolitan District from 1910 until 1940, but its utility was limited. As the Baltimore Chamber of Commerce complained, "for while ... the [metropolitan] district defined is purely a population area, we feel it is of little practical value from a business point of view."[8] Despite criticisms such as these, the Metropolitan District proved to be an instructive concept and was used in urban planning efforts. The concept was less useful than it might have been, however, because the Census Bureau failed to maintain a consistent definition for metropolitan districts in successive censuses. In the four censuses employing Metropolitan Districts, the Census Bureau used three different definitions.

When Metropolitan Districts were first introduced they were divided into two categories: those with central city populations of at least 200,000 and a lower tier of "emerging metropolises" with central city populations of between 100,000 and 200,000 inhabitants. The Census Bureau continued making this distinction in 1920, but in 1930 the Census Bureau abandoned any attempt at establishing a metropolitan hierarchy. All Metropolitan Districts regardless of total population or the population of the urban core were regarded as equivalent. The minimum central city population in 1930 was 100,000 but was changed to 50,000 for the 1940 census. In addition, in 1930 a population density threshold of 150 persons per square mile was enforced on all Metropolitan District components, but all adjacent Minor Civil Divisions were included in the Metropolitan District whether they met the population density threshold or not.

The changes in Metropolitan District definition between 1910 and 1940 made comparing metropolitan data over time difficult. Changes in subcounty geography, such as municipal boundary changes, annexations, and redistricting on the basis of population after each census, presented significant challenges to establishing a geographic unit that would be comparable over time. Recognizing the need for a stable and more flexible standard metropolitan definition, With the 1950 enumeration Metropolitan Districts were abandoned in favor of Standard Metropolitan Areas, which were composed of counties, more stable geographic units than minor civil divisions. Counties have proven to be an effective compromise between the precision of Metropolitan District boundaries and the availability of data and comparability over time.

Since 1950, figures have been tabulated for metro areas of varying sizes but the only formal classification was given in *The Metropolitan Statistical Area Classification: 1980 Official Standards and Related Documents*. Emphasizing the need for greater flexibility for those tabulating figures for metro areas, the Federal Committee on Standard Metropolitan Statistical Areas stated, "Flexibility is further enhanced by the classification of the areas into four levels based on total population size—Level A with

[7] Correspondence from W.M. Steuart (Director, Bureau of the Census) to William L. Fairbanks (Baltimore Chamber of Commerce), September 5, 1931, U.S. National Archives, Record Group 29, Entry 160, Box 73 (Folder: Baltimore)

[8] Correspondence from George J. Clautice (Executive Secretary, Baltimore Chamber of Commerce) to W.M. Steuart (Director, Bureau of the Census), August 10, 1931, U.S. National Archives, Record Group 29, Entry 160, Box 73 (Folder: Baltimore)

1,000,000 or more; Level B with 250,000 to 1,000,000; Level C with 100,000 to 250,000; and Level D with less than 100,000."[9] Metropolitan levels were never widely employed, though.

In 1998 the Metropolitan Area Standards Review Committee (MASRC) presented a discussion of alternative approaches to metropolitan definition. The MASRC sought to divide metro areas more formally into categories based on the population of the core of each area:

> Four kinds of areas are identified in this approach: metropolitan regions, defined around cores of at least 100,000 persons; mesopolitan regions, defined around cores of at least 50,000 persons and less than 100,000 persons; and micropolitan regions, defined around cores of at least 10,000 persons and less than 50,000 persons. Counties not included in a metropolitan, mesopolitan, or micropolitan region will constitute rural community areas.[10]

A few months later the MASRC presented recommendations to the Office of Management and Budget (OMB). They still sought to categorize metro areas based on the size of the population core, but they put forth an alternative classification that emphasized the largest metro areas, which they referred to as "megapolitan areas," with population cores of 1,000,000 or more. This proposal also included micropolitan areas.[11] In another document, MASRC had also suggested that the smallest metropolitan areas, those with cores of between 50,000 and 250,000 inhabitants, be put into a separate category called "mesopolitan areas." After considering these recommendations OMB decided that for the sake of continuity and simplicity, metropolitan areas would include all areas with cores of at least 50,000 people. They did approve one of the new categories, though, and Micropolitan Statistical Areas, with cores of between 10,000 and 50,000 people, were included with Metropolitan Statistical Areas under the umbrella term Core Based Statistical Areas.

For this study I have taken the approach suggested by the MASRC, with some minor alterations. I established a CBSA hierarchy based on the population of the core. The largest cores, with populations of at least 1,000,000 will be classified as "megapolitan". The smallest metropolitan areas, with cores of less than 100,000, will be classified as "mesopolitan", while those with cores with populations of at least 100,000 but less than 1,000,000 will retain the classification "metropolitan". This study also maintains the category of "micropolitan" using the same population range currently in use (urban cores with populations of at least 10,000 but less than 50,000). It's also useful to divide counties outside CBSAs by whether or not they contain any urban population. To take the metric prefixes a step further, a county with an urban core of at least 1000 but less than 10,000 population could be considered "nanopolitan", although a more appropriate term would be "small towns". I will not try to identify these areas. Any county without any urban population will be considered a rural county. Table 2 summarizes the CBSA classifications used in this project.

[Table 2. Modified CBSA classifications used in this study based on urban core population]

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[9] The Metropolitan Statistical Area Classification: Final Standards for Establishing Metropolitan Statistical Areas Following the 1980 Census, Prepared by Federal Committee on Standard Metropolitan Statistical Areas, Reprinted from *Statistical Reporter*, December, 1979, p. 33.

[10] Alternative Approaches to Defining Metropolitan and Nonmetropolitan Areas, 63 *Federal Register* 70542 (December 21, 1998).

[11] Recommendations from the Metropolitan Area Standards Review Committee to the Office of Management and Budget Concerning Changes to the Standards for Defining Metropolitan Areas, 64 *Federal Register* 56633 (October 20, 1999).

These categories offer a couple of benefits. First, the population thresholds are easily identifiable orders of magnitude (core populations of 1000, 10,000, 100,000 and 1,000,000). Second, these categories can easily be compared to the current CBSA classifications. Combining the mesopolitan, metropolitan and megapolitan areas yields Metropolitan Statistical Areas as defined by OMB, micropolitan areas in this study are equivalent to Micropolitan Statistical Areas as defined by OMB, and small town and rural counties are equivalent to Outside CBSA areas.

Input Data

While "urbanized areas" (areas of contiguous urbanization with a population of at least 50,000) have been defined since 1950, "urban clusters" (areas of contiguous urbanization with a population of at least 10,000 but less than 50,000) were first introduced with the 2000 census. These terms are no longer used and term "urban area" is now applied to all areas of contiguous urbanization. These areas are defined using census blocks, but we don't have block data as far back as 1940. We do, however, have census tract data for all of these years. An essential resource for this project is the Historical Housing Unit and Urbanization Database (HHUUD10).[12] HHUUD10 takes census tracts as defined in 2010 and provides an estimate of the number of housing units in each census tract for the decennial census years from 1940 to 2010, as well as 2019. I was also able to add 2020 to this time series by using the Census Bureau's 2010-2020 block relationship files to convert 2020 blocks to 2010 tracts.[13] The availability of data using consistent census tract boundaries across all years allows us to construct comparable urban cores over time.

One of the key decisions in this project was what geography to use for delineating urban areas and CBSAs. Census tracts are a good geographic unit for building urban areas because a wealth of digital information is available about them, from shape files to Census Bureau maps to NHGIS aggregate data files. Census tracts have the added benefit of nesting within counties. Using census tracts for time series analysis normally presents substantial difficulties because tract boundaries are redrawn with each decennial census, but that is not an issue for this study because the HHUUD10 database uses census tracts as defined in 2010 for all years.

For delineating CBSAs, a clear choice of geographic units is counties as defined in 2010. The HHUUD10 database is based on 2010 geography and county boundaries were stable for the most part between 1940 and 2010. By sticking with 2010 county geography we avoid the recent changes to how county data is tabulated for Connecticut.[14] A state that presents substantial challenges in this regard is Alaska, which does not have counties and has changed the boundaries of its county-equivalent geography several times. The HHUUD10 database, which starts with 1940, does not include Alaska and Hawaii, as each achieved statehood in 1959. That being the case, this project only covers only the continental United States. Even without Alaska, some county boundary changes have occurred:

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[12] Scott Markley, Steven R Holloway, Taylor Hafley, Mathew Hauer, "HHUUD10: Historical Housing Unit and Urbanization Database 2010", Center for Open Science (OSF), https://osf.io/fzv5e/.

[13] 2010 Census Tabulation Block to 2020 Census Tabulation Block Relationship Files, U.S. Census Bureau, Relationship Files.

[14] Connecticut abolished counties in 1960 but only after the 2020 census did Connecticut request that county data be tabulated for that state's planning regions https://tinyurl.com/4na9mmee.

- La Paz County, AZ (created in 1983 from part of Yuma County, AZ)
- Broomfield County, CO (created in 2001 from parts of Adams, Boulder, Jefferson and Weld Counties)
- Cibola County, NM (created in 1981 from part of Valencia County, NM)
- Los Alamos County, NM (created in 1949 from parts of Sandoval and Santa Fe Counties, NM)
- Menominee County, WI (created in 1959 from part of Shawano County, WI)

The most challenging of these county boundary changes by far was Broomfield County, CO, which was created from parts of four counties that were spread across three metro areas. As difficult as that change was, an even larger problem was what to do about independent cities in Virginia. When delineating CBSAs, OMB uses Virginia city/county combinations rather than treating independent cities as counties. There are 41 independent cities in Virginia, and 36 of those are included in a city/county combination. The remaining five independent cities are treated as counties: Colonial Heights, Hampton, Newport News, Suffolk and Virginia Beach. Table 3 shows the Virginia city/county combinations that have been used for decades now and applied to all data used in this study.

[Table 3. City/county combinations in Virginia]

We also need spatial information about counties and tracts. Once we identify which census tracts are the most densely developed, we need to know which census tracts are adjacent to one another so that we can determine the extent of densely populated areas. Similarly, in order to delineate CBSAs, we need to know which counties are adjacent to one another. A 2010 census tract adjacency file is available from the Long-Term Database project at Brown university,[15] and a county adjacency file is available from the Census Bureau's public website.[16]

Gathering the commuting data for this project presented a number of challenges, as commuting data was not collected on the census until 1960. Publicly available county-to-county commuting data is available in decennial census sample data from 1960, 1970, 1980, 1990 and 2000, but we have no commuting data for 1940 and 1950. This paper approximates commuting in 1940 and 1950 by fitting curves to commuting patterns from later years and extrapolating to these earlier decades. The 2000 census was the last census to include a "long form" sample. For the most recent years in this study—2010 and 2020—we have an ample amount of commuting data from the five-year American Community Survey releases, but we still need to adjust the figures somewhat to make them line up with the 2010 and 2020 decennial censuses.

Harmonization of Geographic Coding

This project also required harmonizing various levels of geography. Harmonizing county coding was straightforward, but it was much more difficult to harmonize coding for places, urban areas and CBSAs. Harmonization also played an important role in using available geographic resources to display the data, such as shape files and mapping software.

Harmonizing place coding was particularly challenging because the Census Bureau has employed several different place coding schemes since 1960 (and did not numerically code places prior to that). Much of

[15] The LTDB Tract Adjacency is located at Diversity and Disparities (brown.edu)

[16] The 2010 county adjacency file is at County Adjacency File (census.gov)

the work toward harmonizing place codes had been done by the NHGIS project but I worked with them to refine the harmonized historical place codes. The harmonized place codes used in this study are based on the 2010 FIPS place codes.

I created a series of files, one for each decennial year, where I entered all names and populations for states, counties, county subdivisions and places. Alongside the coding used at the time of each census I entered harmonized codes for all geographic levels (although I only applied harmonized coding to New England county subdivisions). These files were organized by "summary levels," which are as follows:

- 040 State
- 050 County
- 060 County subdivision
- 070 Place in county subdivision
- 155 Place in county
- 160 Place

I also developed harmonized coding for urban cores and CBSAs based on the largest city in each of these area types. While urban areas and metro areas each have their own set of harmonized values, the method used to create the coding for each area type was similar, based on an alphabetized list of place names. This differs somewhat from the practice the Census Bureau has long employed, where lists of the full titles of each area are alphabetized and assigned a number in sequence. In cases with common city names, such as Springfield, Lexington or Columbus, alphabetizing on the full title often required a code change when a second city was added to the title. Alphabetizing on the name of the largest city alone reduces the need for coding changes.

Methods

Step 1: Geography

The geographic work requires several tasks. The program geo_step1_adjacency.pl converts county and tract adjacency files to the commuting geography that will be used throughout this study. The program geo_step2_2010.pl tabulates the population for each census tract and associates places with census tracts by using the geographic information in the NHGIS 2010 block file to determine which place accounted for the greatest share of population in every census tract in 2010. The program geo_step3_2020.pl reads in the NHGIS 2020 block file and the 2010-2020 block relationship file to tabulate the population and associated places with 2010 tracts. The programs geo_step4_2000.pl and geo_step5_1990.pl convert the block-level data from each of these years to 2010 census tract geography and associate places with the census tracts, as well. There is an additional set of programs for each of the years from 1940 to 1980 that locate historical places within 2010 census tract geography. The output from all of these programs is used as input to the program step1_geo.pl.

For census years before 2000 the process was less accurate but we do have enough information to meaningfully associate places with 2010-vintage census tracts. Although we do not have a block relationship file that associates blocks defined in 1990 with 2010 census tracts, we do have the location of the centroid for all 1990 census blocks and we can use the SAS PROC GINSIDE procedure to place these centroids in 2010 census tracts. Once we have the association between 1990 blocks and 2010

census tracts, the program uses the NHGIS 1990 block file to determine which place accounts for the greatest share of the population in each 2010 census tract. For census years from 1940 to 1980 I obtained place point files from NHGIS and used the SAS PROC GINSIDE procedure to locate each place in 2010 census tract geography. In most cases the program worked backwards from 1990 to 1980 to 1970 and so on back to 1940. If a census tract was urban in the earlier year, I maintained the same tract-place association as in the later year, unless that was contradicted by the place point information.

The program step1_geo.pl reads in the summary level files from 1940 to 2020 and produces output files that harmonize the coding for counties and places from 1940 to 2020. This program then reads in the HHUUD10 data and the output from the other geo programs to create the 2010 tract data file that will be used in later steps. One of the most useful features of the HHUUD10 database is that it provides two variables indicating when a census tract first became urban. Since the land area of each tract is known, we can calculate the housing unit density of each tract in each decade. The first variable, UY1, relies only on housing unit density to determine if a census tract is urban. Using a threshold housing unit density of 200 housing units per square mile, UY1 indicates the decade when the census tract crossed this threshold. The variable UY2 uses the same housing unit density threshold as UY1 but also factors in what percentage of a tract's land area has been developed for a nonresidential purpose in determining a census tract's urban/rural status.

Another key function of the program step1_geo.pl is to estimate the population for each census tract in all census years from 1940 to 2020. The HHUUD10 database provides only an estimate of the number of housing units in each tract and does not provide population estimates. Fortunately, the Longitudinal Tract Database (LTDB), which also uses 2010 census tract geography, provides population estimates for all tracts in 1990 and 2000, as well as most tracts in 1970 and 1980. The remainder of the 1970 and 1980 census tracts are mostly rural. For these census tracts, as well as census tracts from 1940, 1950 and 1960, we only have estimates of the total number of housing units. Unfortunately, we do not have any information about the number of vacant housing units, which can vary substantially in different areas.

Since census tracts nest within counties, and we know the county population in each decennial census year, we can estimate the population of each tract given the number of housing units and the average number of persons per housing unit in each county. In the current version of this study, I used a crude method of estimating the number of persons in each housing unit based on the distribution of urban and rural census tracts in a county. I compared the average household size in counties that were entirely rural with the average household size for counties that were entirely urban. Table 4 compares the average household size in rural and urban counties from 1940 through 1980. Average household size was larger in rural areas than in urban areas, though this gap was narrowing over time. The exception is 1950, a manifestation, perhaps, of the housing shortage following World War II. The census tract variables used as input to subsequent programs are as follows:

- Population
- Housing Units*
- Area*
- Housing Unit Density*
- Urban/Rural Status*
- Place

*included in HHUUD10 database

[Table 4. Household size in entirely rural and entirely urban counties, 1940-1980]

Step 2: Employment and Commuting Data

Employment data is used in a couple ways when delineating CBSAs. Commuting data is the means used to establish links between the urban core and outlying counties. Also, the location of jobs is used to establish whether a place in a CBSA is a principal city. Because commuting data does not exist for 1940 and 1950, I had to estimate both the number of jobs and employed residents for places and the county-to-county commuter flows. To do this I constructed a time series of commuter flow data from 1960 to 2020. For almost all years, we can obtain the number of employed residents as well as the number of people employed in agriculture for all counties from NHGIS—all except 1960, that is. To estimate the number of employed residents and agricultural workers in each county in 1960, I interpolated the percentage of county residents who were employed for all other years of available data. I used a similar method to estimate the percentage of commuters who worked within the same county and who commuted to other counties for 1940 and 1950.

Taking the data points for as many years of data as are available, the program step2_employment.pl uses ordinary least squares regression to estimate the percentage of flows between counties for 1940 and 1950. The county-to-county commuter flow data available publicly is as follows:

- Journey to Work Frequency Table (includes data for 1960, 1970, 1980 and 1990)
- 1990 Census County-to-County Commuting Flows
- 2000 Census County-to-County Commuting Flows
- 2006-2010 5-Year ACS Commuting Flows and Employment
- 2009-2013 5-Year ACS Commuting Flows
- 2011-2015 5-Year ACS Commuting Flows
- 2016-2020 5-Year ACS Commuting Flows

This method of using time-series county-to-county journey to work data is crude but for most counties, the great majority of employed residents worked in their county of residence. In 1960, less than 25 percent of employed residents commuted outside of their county of residence in 83.6 percent of counties. In other words, the great majority of counties in 1960 (and 1940 and 1950, presumably) had too little out commuting to be considered an outlying county of a CBSA.

I used a similar approach to estimate the 2010 and 2020 county-to-county commuter flows. The ACS five-year files average to the midpoint of each five-year period. That is, the 2006 to 2010 5-year ACS file averages to July 1, 2008, the 2009-2013 data averages to July 1, 2011, the 2011-2015 data averages to July 1, 2013, and the 2016-2020 data averages to July 1, 2018. I used the 1990 and 2000 decennial county-to-county flow data as well as the ACS 5-year files to estimate the commuting flows on April 1, 2010 and April 1, 2020. I calculated the percentages of employed residents commuting to each county and then did a simple regression to determine the trend line for each county-to-county commuter flow. Once all commuter flows were established, step2_employment.pl calculates the number of jobs located in each county. The county-level data from step2_employment.pl used as input to subsequent steps is as follows:

- Population
- Employed residents
- Workers employed in agriculture
- Percentage employed in agriculture

- Jobs
- County-to-county commuting flows

Steps 3 and 4: Urban Cores

Two programs are used to determine the extent of each urban core using the output from step1_geo.pl. The program step3_clusters.pl builds clusters of urban census tracts using the HHUUD10 UY2 variable.; The program carries out this process in chronological order starting with 1940, working through each decennial year through 2020. This program identifies all clusters with populations of at least 1000. Once all clusters have been identified, the program step4_cores.pl identifies the largest place in each cluster that has at least 10,000 inhabitants, the minimum population to qualify as a core. A core code is assigned to each cluster based on the largest place in the most recent census year that cluster was delineated.

The program step3_clusters.pl sorts the census tracts in order of housing unit density, building urban areas by including all contiguous urban census tracts starting with the census tract with the highest housing unit density. The program then uses an iterative process, examining each of the tracts adjacent to the starting census tract. Each iteration involves examining a list of all census tracts adjacent to the cluster, adding any census tracts classified as urban to the cluster. The program repeats this process until only rural tracts are adjacent to the cluster. The program then proceeds to the tract with the next highest housing unit density that was not included in any cluster and repeated the process of building a new cluster.

Once the list of clusters was complete for 1940, I moved on to 1950 and repeated the process. One underlying implicit assumption here is that once a census tract is classified as urban it remains urban throughout the period of this study. That is, if the UY2 value for a census tract is 1950, then that tract is regarded as urban for all subsequent decades. Even if a census tract experiences population and housing unit losses and the housing unit density falls below the threshold of 200 housing units per square mile, that census tract is still regarded as urban in all subsequent decades.

Moving from decade to decade from 1940 through 2020, most clusters of urban census tracts expand outward as peripheral areas urbanize. In many cases urban cores expand and become contiguous with adjacent urban cores. Once neighboring urban cores become contiguous, this study considers them to have merged into a single urban core, as the smaller area absorbed into its larger neighbor. Table 5 shows the number of urban cores of any size that are absorbed into neighboring urban areas. This number peaks in the 1970s with regard to cores of any size, and peaks in the 1980s when considering only large urban cores.

[Table 5. Urban cores absorbed into larger contiguous urban cores]

One of the pitfalls of using census tracts as the basic unit of geography in constructing urban cores, as opposed to the much finer grain of census blocks, is that it is more difficult to maintain separate areas when a contiguous group of urban census tracts connects large urban centers that have historically been separate. In some parts of the country, such as the Northeast corridor, urban cores grow together at a rapid rate, particularly after 1980. This is particularly an issue in the area around New York City. By 1980 a contiguous set of urban census tracts extends out from the New York urban core to Hartford and then to Springfield, Massachusetts by 1990, and in that same year a contiguous set of tracts stretches past Philadelphia and into Maryland. By 2020 the combined population of this set of 6,506 contiguous urban

tracts extending from Massachusetts to Maryland is 28,685,290. Similarly, Baltimore and Washington become contiguous in 1980, and by 1990 Boston becomes contiguous with Worcester, Providence, Fall River and New Bedford. This is not confined to the Northeast, however, as several states have urban cores growing together by 2020.

I believe that long-established large urban centers should maintain a distinct identity to acknowledge their historical significance, so to avoid the situation where an urban agglomeration becomes a single undifferentiated area, I implemented a rule in step3_cores.pl that prevents large urban areas from being absorbed into neighboring urban areas. If a city has a population of 100,000 or more and is the largest place in an urban core, that core cannot be absorbed into another core for all subsequent years. That is, once an urban area is identified where the population of the largest place is over 100,000, that area maintains its status as an independent urban area, even if it becomes contiguous with a larger area. A good example of this is Washington, DC, which had a city population of over 600,000 and a core population of over 2.5 million by 1980 when an unbroken group of contiguous urban census tracts connected the Baltimore and Washington core areas. The population of Baltimore city (786,775) was larger than that of Washington, DC with a core population of 1.8 million. In this case both areas remain independent cores in that and all subsequent decades. Both cores continued to grow and absorb nearby smaller cores, though, and this creates some complications when urbanizing census tracts are adjacent to both areas. In cases where a newly urban tract was only adjacent to one or the other area, it was assigned to that area. In cases where an urban tract was adjacent to both areas, it was assigned to the core with the larger population. For example, in 1980, Baltimore added 35 newly urban tracts, as well as absorbing the urban cores of Bel Air South-Bel Air North-Bel Air, MD, and Reisterstown-Owings Mills, MD. Washington, DC, added 130 newly urban tracts, as well as absorbing Bowie, MD, Dale City-Woodbridge-Marumsco, VA, and Sterling Park-Herndon, VA.

Step 5: Delineating CBSAs: Counties with Ties to Urban Cores

Once the urban cores had been identified for all decades from 1940 to 2020, the program creates an output file with the urban core population by county. This file is used as input to the next step. The program step5_coreareas.pl applies the standards for delineating CBSAs as described in the December 27, 2000, edition of the *Federal Register*.[17] This process requires three steps: first, identifying central counties; second, identifying outlying counties; and third, checking to see if any adjacent areas have strong enough commuting ties to merge. I refer to the areas resulting from the first two steps (central and outlying counties) as "core areas," as the areas are not finalized CBSAs until all merges have been completed.

Before identifying the central counties, counties must first be associated with urban cores. If a county contains only a single urban core, the county is assigned to that core. If a county contains all or part of multiple cores, the county is associated with the urban core that accounts for the largest share of the county's population. After associating counties and core areas, step4_coreareas.pl then determines which counties are the central counties of each core area. In almost all cases counties associated with cores are classified as central counties. The only instances where a county would not be considered a central county is if that county contains only a small portion of an urban core, less than 5000 people. In

[17] Standards for Defining Metropolitan and Micropolitan Statistical Areas, 65 Fed. Reg. 82235-82238 (December 27, 2000).

most cases, however, if a county contains all or part of an urban core it is classified as a central county. Outlying counties are adjacent counties with strong commuting ties to the central counties. This condition is met if at least 25 percent of employed residents of a county commute to the central counties of a core area, or if at least 25 percent of the jobs in a county are held by residents of the core counties. In some cases, a county may be adjacent to more than one group of central counties. If this is the case, the county is only tested with the core area that accounts for the largest commuter flow.

The last step in this process is to see if adjacent core areas merge. A merge occurs with rules similar to those for determining outlying counties described above. The program checks to see if 25 percent of the employed residents in the smaller area commute to the larger area, or if 25 percent of the jobs in the smaller area are held by residents of the larger area. If these conditions are satisfied, the smaller area merges with the larger area, and the counties of the smaller area are classified as outlying counties of the larger area. Once the merges have been completed for a given census year, we can now refer to these areas as CBSAs.

Step 6: CBSA Principal Cities and Titles

Once the CBSAs have been delineated, the program step6_cbsa.pl determines which places qualify as principal cities and constructs the title of each CBSA. The program step5_cbsa.pl first makes a list of all places included in a CBSA. If a place crosses county boundaries and is only partially in a CBSA, it is added to the list only if at least 50 percent of the population resides within the boundaries of the CBSA. The program ranks all places in the CBSA by population contained within the area and then determines which places are principal cities. Places are classified as principal cities if any of the following conditions are met:

(a) The place with the largest population in the CBSA
(b) Places with populations of at least 250,000 residents or where the number of jobs located in that place is at least 100,000.
(c) Places with populations of at least 50,000 but less than 250,000 residents and where the number of jobs exceeds the number of employed residents
(d) Places with populations of at least 10,000 but less than 50,000 residents and the population is at least one-third that of the largest place, and where the number of jobs exceeds the number of employed residents.

In order to determine which places qualify to be types (b), (c) or (d) principal cities, we need an estimate of the number of jobs located in those places. The program step5_cbsa.pl does this by tabulating the number of jobs in each county from the commuter flows established in step2_employment.pl. The program step5_cbsa then subtracts the number of people employed in agricultural jobs and then distributes the nonagricultural jobs proportionately by urban population to each place within the county. This is a crude method and future versions of this work will implement more refined methods for determining the number of jobs in each place. Really, though, we do not need an exact number of jobs located in each place. For the purposes of identifying principal cities, we need to know only if a place has more than 100,000 jobs (to qualify as a type (b) principal city), or if it has more jobs than employed residents (to qualify as either a type (c) or (d) principal city).

The program step5_cbsa.pl ranks all of the places in each CBSA and assigns a harmonized code based on the largest place in the CBSA, which is the type (a) principal city. Once the program has identified all of the principal cities, it constructs the title of the CBSA. Up to three place names can be included in the CBSA title, ordered by population. This program produces two output files: CBSACounties.txt, which

contains the finalized list of county components in each CBSA, indicating which are central counties and which are outlying counties; and CBSAPlaces.txt, which lists all of the places contained in each CBSA and indicates which are principal cities.

Results

Table 6 shows the changes taking place in the United States by decade from 1940 to 2020. Using census tracts as defined in 2010 as our basic geographic unit and considering each census tract either all urban or all rural, we see that a majority of the U.S. population was urban by 1940 but a minority of census tracts were classified as urban. Of the 72,537 census tracts as defined in 2010 in the continental United States, of 22,263 were urban by 1940, but they accounted for 57.1 percent of the population. The country continued urbanizing over the next eight decades so that by 2020 almost three quarters of the population lived in urban census tracts. A large majority of census tracts, 53,111, were urban by 2020.

[Table 6. Population of urban and rural census tracts (as defined in 2010), 1940-2020]

Table 7 shows urban cores by size category from 1940 to 2020. In 1940 only ten urban areas in the United States had populations of over 1,000,000 people, and these areas accounted for less than a quarter of the population. By 2020, however, the largest urban centers in the country had grown to where they accounted for nearly half of the population. By this time 48 urban areas were home to over 1,000,000 people. Smaller urban cores also grew in number and in population, but the proportion of the population residing in smaller urban cores has been slowly declining for several decades. After peaking at 21.1 percent of the population, the percentage of people living in urban cores of between 100,000 and 1,000,000 has slowly declined to where they accounted for 17.2 percent of the population by 2020.

The growth of large urban cores has come at the expense of rural and small town America, as shown in Table 8. Taken together, small urban centers with populations of less than 50,000 people and rural areas accounted for a majority of the population in 1940. By 2020, however, these areas accounted for just over 30 percent of the population. These areas have not only declined in percentage terms but in absolute numbers, as well. The population of urban cores of between 10,000 and 50,000 peaked in 1970 and has declined slightly since then. Very small urban cores of less than 10,000 people peaked in 1990 and have been on the decline since then. The population of rural census tracts has been increasing through this period but had leveled off by 2020.

[Table 7. Urban cores by size category, 1940-2020]

The output of step2_employment.pl and step3_core.pl was then used as input to the program step4_coreareas.pl. Table x shows the results of the tests for central counties, outlying counties and merges from 1940 to 2020. As the number of urban cores increased during this period, the number of counties qualifying as central counties increased, as well. Almost all counties containing all or part of an urban core with a population of at least 10,000 people qualified as a central county. Qualifying as an outlying county was a different matter. Though the number of counties adjacent to central counties was stable throughout this period, the percentage of tracts qualifying as outlying counties was only around five or six percent in the early years of this period. Counties qualifying as outlying increased steadily from 1970 onward, though, with 29.3 percent qualifying on the first pass and an additional 2.1 percent qualifying on the second pass.

[Table 8. Central counties, outlying counties and merges, 1940-2020]

Because at least 25 percent of employed residents need to be employed in the core counties in order for a county to qualify as an outlying county, it should come as no surprise that so few counties met this threshold in the middle of the twentieth century. In the great majority of counties relatively few people commuted outside of their county of residence in these early years.

The same principle applies to the merge tests, which has similar commuting thresholds as the test for outlying counties. In addition, the low number of core areas meant that a relatively small number of core areas were adjacent to one another. Still, step4_coreareas.pl carried out 698 merge tests in 1940 and that number steadily increased to 1,305 by 2020. While only about one to two percent of merge tests resulted in a qualifying merge in the middle of the twentieth century, over eight percent of adjacent areas merged from 2000 to 2020, as shown in Table 8.

One of the most substantial changes that came with the introduction of CBSAs with the 2000 census in designating employment centers in metro areas. The terminology changed from central cities to principal cities. The term “central cities” indicated the underlying assumption that employment in metropolitan areas was centralized, with the greatest share of jobs located in the central business district of cities. By 2000, however, suburban employment centers had emerged and employment had generally become much more distributed throughout metro areas. Table 9 shows that the number of places designated as principal cities increased dramatically from 1940 to 2020.

The increase in the number of principal cities is in part explained by the increase in the number of CBSAs throughout this period. In 1940 there were 629 CBSAs in the United States and 706 in 2020. This increase occurred mainly in the early decades of this period, however, as the number of CBSAs actually peaked in 1960. Because of the growth of urban areas and changes in commuting patterns, the pace of CBSA consolidation increased in later decades, and the number of CBSAs declined from a peak of 773 in 1960. Smaller CBSAs had always been more numerous than larger areas, so while the number of large CBSAs increased steadily throughout this period, the number of smaller areas declined after 1960.

Most of the increase in the number of principal cities is because of the dispersal of employment within CBSAs, but the emergence of large concentrations of employment outside of central business districts was occurring mainly in the largest CBSAs. The great majority of the largest CBSAs had multiple principal cities even as early as 1940, but among small CBSAs areas with multiple principal cities were always in the minority. The titles of CBSAs were limited to three places, so most of the principal cities of the largest CBSAs have never been represented in the titles. In 1940 the Boston area had 11 principal cities, and was among eight CBSAs with more than three principal cities. By 1960, the Los Angeles CBSA emerged as the area with the most principal cities and in later decades this area by far had the most principal cities. In 1960 the Los Angeles CBSA had 17 principal cities, and that number had increased to 65 by 2020.

Conclusion

Although metropolitan areas as they have been defined since 1950 offer a roughly comparable unit of statistical geography, the methodological changes that have occurred over time make comparisons difficult, particularly for larger metro areas. The approach taken in this paper offers comparability and

consistency over a broad span of time. The availability of the HHUUD10 database and several decades worth of commuting data make it possible to consistently apply the rules for delineating CBSAs that have been in use since the 2000 census to data covering the period from 1940 to 2020. In some cases values had to be estimated, but whatever accuracy may be lost in this process Is more than made up for by being able to apply a consistent, comparable methodology over such a broad span of time. The areas as delineated in this paper provide a consistent set of statistical geography that can be used in a wide variety of applications.

Table 1a. CBSAs in the United States, 1940-2020

	In CBSAs				Outside CBSAs	
Year	Megapolitan	Metropolitan	Mesopolitan	Micropolitan	Counties with urban population	Rural Counties
1940	10	82	69	472	586	1664
1950	12	100	89	520	573	1567
1960	16	127	94	539	562	1520
1970	24	136	91	495	543	1406
1980	26	146	113	475	547	1263
1990	31	147	106	456	530	1184
2000	39	150	105	430	496	1070
2010	42	160	105	419	482	1035
2020	46	174	102	388	469	980

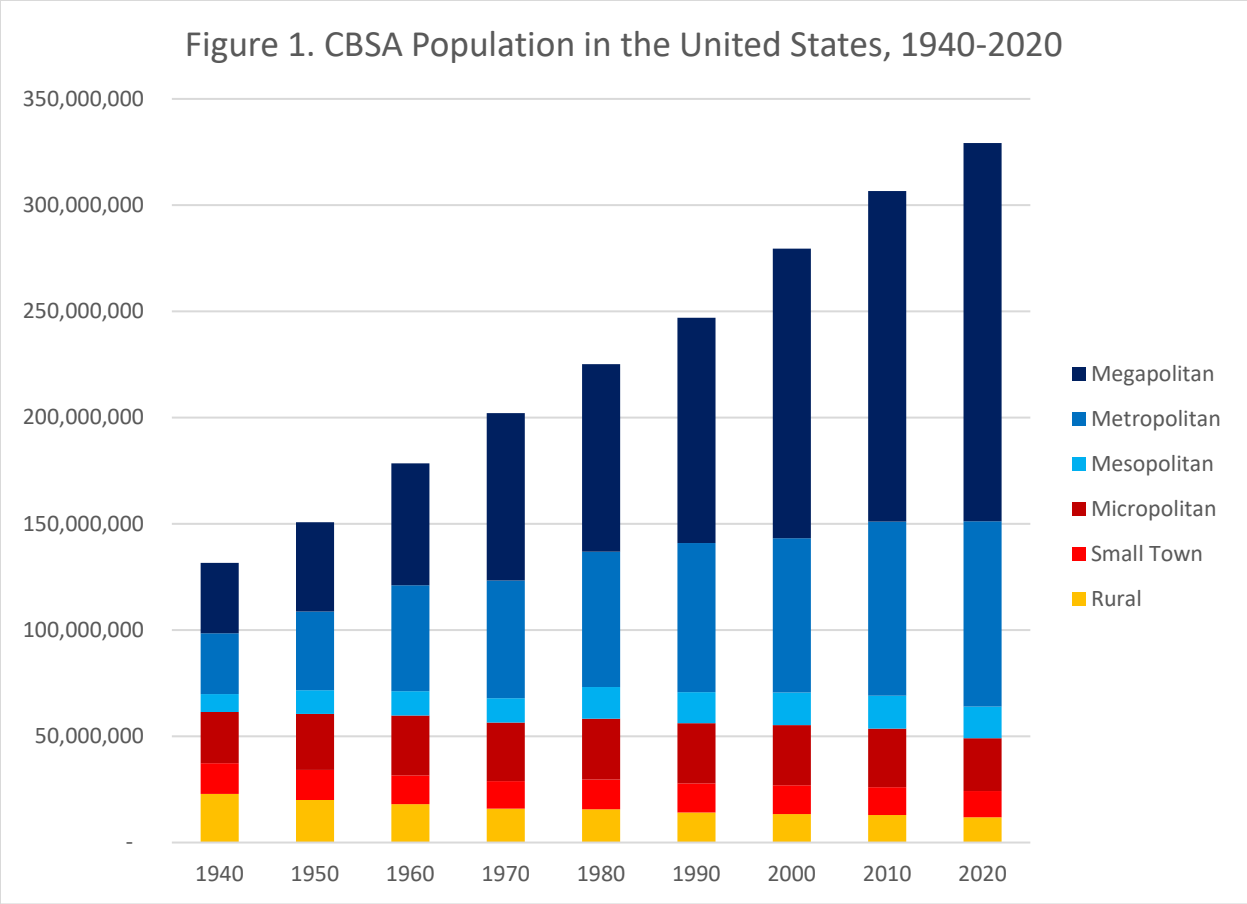
Figure 1. CBSA Population in the United States, 1940-2020
350,000,000
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
-
1940
1950
1960
1970
1980
1990
2000
2010
2020
Megapolitan
Metropolitan
Mesopolitan
Micropolitan
Small Town
Rural

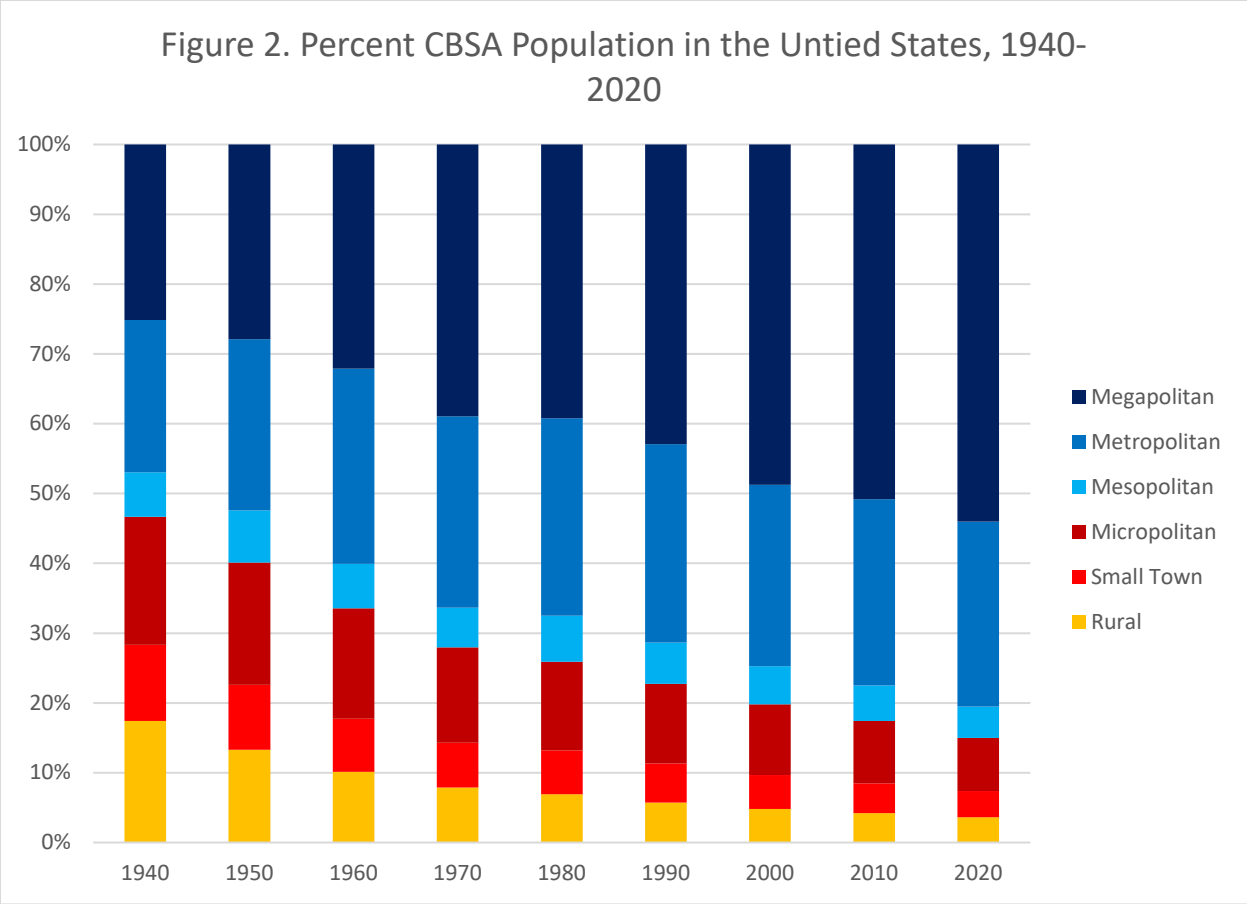

Table 2. Modified CBSA classifications used in this study based on urban core population

Category	Urban Core Population	Equivalent to
Megapolitan	over 1,000,000	Metropolitan
Metropolitan	100,000-999,999	
Mesopolitan	50,000-99,999	
Micropolitan	10,000-49,999	Micropolitan
Small Town	1,000-9,999	Outside CBSA
Rural	Counties with no urban population	

Table 3. City/county combinations in Virginia

Combinations		Components			
FIPS Code	Name of Combination	FIPS Code	County	FIPS Code	city
51901	Albemarle/city	51003	Albemarle County	51540	Charlottesville city
51903	Alleghany/cities	51005	Alleghany County	51560	Clifton Forge city
				51580	Covington city
51905	Arlington/city	51013	Arlington County	51510	Alexandria city
51907	Augusta/cities	51015	Augusta County	51790	Staunton city
				51820	Waynesboro city
51909	Bedford/city	51019	Bedford County	51515	Bedford city
51911	Campbell/city	51031	Campbell County	51680	Lynchburg city
51917	Dinwiddie/city	51053	Dinwiddie County	51730	Petersburg city
				51570	Colonial Heights city
51919	Fairfax/cities	51059	Fairfax County	51600	Fairfax city
				51610	Falls Church city
51921	Frederick/city	51069	Frederick County	51840	Winchester city
51922	Grayson/city	51077	Grayson County	51640	Galax city
51923	Greensville/city	51081	Greensville County	51595	Emporia city
51925	Halifax/city	51083	Halifax County	51780	South Boston city
51927	Henrico/city	51087	Henrico County	51760	Richmond city
51929	Henry/city	51089	Henry County	51690	Martinsville city
51931	James City/city	51095	James City County	51830	Williamsburg city
51933	Montgomery/city	51121	Montgomery County	51750	Radford city
51937	Norfolk/cities			51710	Norfolk city
				51550	Chesapeake city
				51740	Portsmouth city
				51785	South Norfolk city
51939	Pittsylvania/city	51143	Pittsylvania County	51590	Danville city
51941	Prince George/city	51149	Prince George County	51670	Hopewell city
51942	Prince William/cities	51153	Prince William County	51683	Manassas city
				51685	Manassas Park city
51943	Roanoke/cities	51161	Roanoke County	51770	Roanoke city
				51775	Salem city
51945	Rockbridge/cities	51163	Rockbridge County	51530	Buena Vista city
				51678	Lexington city
51947	Rockingham/city	51165	Rockingham County	51660	Harrisonburg city
51949	Southampton/city	51175	Southampton County	51620	Franklin city
51951	Spotsylvania/city	51177	Spotsylvania County	51630	Fredericksburg city
51953	Washington/city	51191	Washington County	51520	Bristol city
51955	Wise/city	51195	Wise County	51720	Norton city
51958	York/city	51199	York County	51735	Poquoson city

Table 4. Average Household Size in Entirely Rural and Entirely Urban Counties, 1940-1980

Year	Average household size in entirely rural counties	Average household size in entirely urban counties	Differential household size
1940	3.7	3.4	0.91
1950	3.3	3.3	1.01
1960	3.0	2.9	0.96
1970	2.8	2.7	0.98
1980	2.4	2.4	1.00

Table 5. Urban cores absorbed into larger contiguous urban cores

Year	Total Cores Absorbed	Large (Population > 100,000) Cores Absorbed
1950	29	1
1960	47	1
1970	45	0
1980	76	2
1990	57	8
2000	55	4
2010	61	6
2020	40	3

Table 6. Population of urban and rural census tracts (as defined in 2010), 1940-2020

Year	USA Population*	Urban Census Tracts	Rural Census Tracts	Urban Census Tract Population	Rural Census Tract Population	Percent Urban Census Tract Population	Percent Rural Census Tract Population
1940	131,668,650	22,263	50,274	75,162,374	56,506,158	57.1	42.9
1950	150,696,701	26,766	45,771	92,935,761	57,760,968	61.7	38.3
1960	178,461,184	33,360	39,177	119,624,243	58,837,021	67.0	33.0
1970	202,134,207	38,509	34,028	140,826,059	61,308,079	69.7	30.3
1980	225,170,667	44,006	28,531	155,972,696	69,197,859	69.3	30.7
1990	247,051,307	47,752	24,785	173,793,000	73,467,921	70.3	29.7
2000	279,581,657	50,434	22,103	199,115,867	80,392,291	71.2	28.8
2010	306,675,006	52,414	20,123	223,049,880	83,625,126	72.7	27.3
2020	329,260,619	53,111	19,426	245,953,816	83,229,787	74.7	25.3

* Excluding Hawaii and Alaska

Table 7a. Urban and Rural Population in the United States, 1940-2020

Year	USA Population*	in Urban Cores Population	Pct	Rural Population	Pct
1940	131,668,650	75,052,057	57.0	56,616,593	43.0
1950	150,696,701	92,844,618	61.6	57,852,083	38.4
1960	178,461,184	119,557,196	67.0	58,903,988	33.0
1970	202,134,207	140,776,330	69.6	61,357,877	30.4
1980	225,170,667	155,947,495	69.3	69,223,172	30.7
1990	247,051,307	173,773,723	71.1	73,277,584	28.9
2000	279,581,657	199,108,028	71.9	80,473,629	28.1
2010	306,675,006	223,047,115	72.7	83,627,891	27.3
2020	329,260,619	245,950,188	74.7	83,310,431	25.3

* Excluding Hawaii and Alaska

Table 7b. Population in the United States by Urban Core Size, 1940-2020

	Popuation Range of Urban Core									
	1,000,000+		100,000-999,999		50,000-99,999		10,000-49,999		1,000-9,999	
Year	Population	Pct	Population	Pct	Population	Pct	Population	Pct	Population	Pct
1940	29,634,320	22.5	21,408,890	16.3	5,249,625	4.0	12,821,859	9.7	5,937,231	4.5
1950	38,212,891	25.4	27,601,422	18.3	6,666,660	4.4	14,256,554	9.5	6,107,091	4.1
1960	52,825,092	29.6	37,601,019	21.1	7,063,526	4.0	15,327,401	8.6	6,740,158	3.8
1970	70,849,100	35.1	39,410,159	19.5	7,304,340	3.6	16,263,453	8.0	6,943,908	3.4
1980	79,289,842	35.2	44,480,968	19.8	8,875,365	3.9	15,929,436	7.1	7,366,584	3.3
1990	95,695,599	38.7	47,825,285	19.4	9,443,117	3.8	15,757,319	6.4	6,946,420	2.8
2000	117,968,535	42.2	50,604,427	18.1	9,426,543	3.4	16,081,413	5.8	6,961,759	2.5
2010	137,594,857	44.9	53,688,946	17.5	9,457,864	3.1	15,830,367	5.2	6,458,073	2.1
2020	148,551,235	48.3	56,309,437	17.2	8,512,397	2.7	15,496,508	4.6	6,142,550	1.9

Table 8a. Core area central county tests, 1940-2020

Year	Central Counties Tests	Added	Pct
1940	749	729	97.3%
1950	854	834	97.7%
1960	939	920	98.0%
1970	976	957	98.1%
1980	1036	1018	98.3%
1990	1076	1051	97.7%
2000	1111	1092	98.3%
2010	1149	1134	98.7%
2020	1173	1157	98.6%

Table 8b. Core area merge tests, 1940-2020

Year	Merges Tests	Qualified	Pct
1940	698	16	2.3%
1950	849	18	2.1%
1960	975	14	1.4%
1970	1061	52	4.9%
1980	1139	57	5.0%
1990	1189	77	6.5%
2000	1290	106	8.2%
2010	1295	105	8.1%
2020	1305	108	8.3%

Table 9. Principal cities in CBSA, 1940-2020

Year	Principal Cities				CBSAs with multiple principal cities	Percent of CBSAs with multiple principal cities
	a	b	c	d		
1940	629	4	37	72	77	12.2%
1950	716	5	44	107	103	14.4%
1960	773	5	88	113	126	16.3%
1970	743	5	137	142	152	20.5%
1980	757	7	165	177	179	23.6%
1990	731	18	307	172	184	25.2%
2000	716	22	292	179	186	26.0%
2010	719	32	343	163	187	26.0%
2020	698	49	395	158	196	28.1%