Measurement of Rural Populations in Political Science *

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Abstract

Recent popular accounts of American politics focus heavily on the urban-rural gap in political behavior. Scholarly research on rural politics is growing but has been stymied by difficulties defining, identifying, and measuring which Americans qualify as "rural." In this article, we discuss theoretical and empirical challenges to studying rurality. Much existing research has been inattentive to conceptualization and measurement of rural geography, with likely impacts on the validity of its empirical results. We focus our efforts on improving empirical estimation of different conceptualizations of rurality (geography, economic structure, and consciousness). We apply different conceptualization and operationalizations to two studies of rural politics. First, we use survey data from Mummolo and Nall (2016) to show that the measurement of "rural consciousness" is not substitutable with objective, place-based classifications. Second, we replicate findings from Flavin and Franko (2019) to demonstrate sensitivity of empirical results to the operationalization of rural residents. This sensitivity is found in the main independent variables, in addition to the rural control variables. We conclude by providing strategies for conceptualizing and operationalizing rural Americans with readily available tools.

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1 Introduction

The news media focuses intently on the urban-rural divide as a source of American political polarization. For example, *The New York Times* has featured 16 articles about America's urban-rural political divide in the last three months. UPDATE IN SEPTEMBER In one week in June 2019, *The Washington Post* wrote articles on "How rural America can grab a bigger megaphone," "Idealizing rural America," "When we think of America, we shouldn't think rural." Clearly journalists and opinion writers believe the urban-rural gap is a critical political cleavage in American politics. Yet political science has done surprisingly little work to systematically and scientifically scrutinize the urban-rural divide in American political behavior, nor have many focused specifically on "rural" politics. For example, in the last five years, the search term "rural" appears 0 times in the abstracts for research articles in the *American Political Science Review* in reference to American politics, 0 times in the *American Journal of Political Science*, and 2 times in the *Journal of Politics*. Despite clear journalistic attention and certain scholarly interest, an obstacle to studying rural voters is the myriad ways of operationalizing rurality, and the likelihood that these methodological choices are consequential for the validity of our scientific conclusions.

Although we rarely hear members of the discipline refer to themselves as 'political geographers,' many questions central to American politics necessitate a basic understanding of geography and associated demography. We intend for this article to equip readers with a methodological toolbox for studying rural politics in the United States. To this end, we outline the resources available to political scientists to select geographic units and, where possible, to enable them to account for different concepts of rurality within their indicators. We start off by dissecting two measurement decisions crucial to the study of rural politics. First, choosing a unit of aggregation that reduces measurement error without unduly limiting potential data sources. Second, choosing a measurement classification scheme that accurately accounts for the theoretical notion of rurality intended by the researcher. We conclude by illustrating the consequences of geographic measurement decisions in studying rural American politics. First, we demonstrate the importance of differentiating rural identity and rural location by showing remarkably low correlations between

rural self-identification and actual rural residence. Second, we show that recent scientific knowledge on rural politics is sensitive to measurement decisions by replicating "Economic Segregation and Unequal Policy Responsiveness" by (Flavin and Franko 2019). We conclude with a summary of the tools available to researchers to match their rural concept to existing datasets.

Despite its challenges, dismissing rural research due to difficulties with conceptualization and measurement would miss out on very important questions in American politics. Most evidently, understanding rural political preferences and voting behavior may be crucial to understand the rise of populism in the United States (and abroad). Rural communities are critical to politically-relevant topics of economic opportunity, economic mobility, and public health, and have outsized weight in our political institutions. Rural communities also feature prominently in discussions of political districting and gerrymandering. In this article, we aim to provide a toolkit for empirically-oriented scholars to examine the rural elements of these questions.

1.1 San Diego: Urban, Rural, or Both?

The example of San Diego, California sets forth the problem of measuring the concept of rurality for the purpose of conducting political science research. By most accounts, the city of San Diego is unequivocally urban, given it is the 8th largest city in the United States and home to 1.3 million people packed in at a density of 4,326 people per square mile. Most data on San Diego is measured at the level of its eponymous San Diego County, which has almost two million additional residents living outside San Diego city limits. It is the fifth most populous county in the United States, with more residents than 20 states. The county's economy is largely service based, focused on health care, computer and bio-technology, higher education, and military services.

Despite its reputation as metropolitan, San Diego is also geographically large and population density varies widely within the county. It takes slightly over two hours to drive across the county of 4,525 square miles, from the border with Mexicali, Mexico to Fallbrook, CA on the Orange County border. Many of San Diego County's residents live in suburbs, exurbs, small towns, and remote rural areas. One such example is the unequivocally rural mountain town of Julian, CA that

has a population of 1,500, a population density of 190 people per square mile, and an agriculture-based economy.

Studies commonly treat San Diego County as an urban agglomeration, implicitly assuming uniform distribution of people and preferences across the county. If we are trying to understand the causal links of rurality to political behavior, therefore, we obscure enormous variation on both factors by measuring San Diego County as urban. The political factors associated with urbanity, captured in San Diego's average value, may explain why the county voted for Democrat Hillary Clinton over Republican Donald Trump by a margin of 18 points, but its suburban, exurban, and rural residents on the eastern edge of the county returned federally-indicted Republican Congressman Duncan Hunter to office in 2018 by a margin of 4 points.[1]

Analyses that code San Diego County as metropolitan erase the geographic, economic, and cultural heterogeneity within the county and fail to account for its (likely related) political heterogeneity. Perhaps the averaging out of San Diego's population density, economic structure, or rural preferences reduces theoretical nuance, but may seem harmless from a measurement standpoint. After all, our theories may be primarily concerned with the "average resident" or the "median voter" in the county. Yet this logic is fundamentally challenged by concerns with the Modifiable Areal Unit Problem (MAUP), whereby measuring the same concept at different unit scales or zones results in different values (Lee and Rogers 2019; Wong 2009). We would get very different accounting of the "rurality" of San Diego if we measured it as San Diego City, San Diego County, North-East-South-West San Diego County (a common subdivision), zip codes within, or the county's incorporated towns.

This problem is not unique to San Diego. Each time we measure rurality, we encounter choices

[1] In fact, Hunter's district is over 10% rural in a state that is just 6% rural. It is eighth most rural congressional district of California's fifty-three districts and the most rural congressional district in southern California. In comparison, the populations of the other congressional districts located primarily in San Diego county are just 1.4% (CA-49), 0.5% (CA-52), and 0.3% (CA-53) rural. (Urban and Rural, 2010 Census Congressional District Summary File (115th Congress).)

of: 1) the appropriate geographic unit of aggregation; 2) the appropriate conceptualization of rurality to our theory. In the next section, we describe the options of geographic units in American politics, and the tradeoffs involved in choosing them. In the following section, we discuss different conceptualizations of rurality and how scholars can account for that conceptualization across different geographic units.

2 Units of Aggregation

For most questions of political behavior, the optimal unit of analysis is the individual. With aggregation of data we introduce choices about the appropriate unit of aggregation and appropriate statistic to capture the aggregate value. In the case of geographic data, we also introduce challenges of the MAUP. Yet we cannot get away from units of aggregation when we are trying to capture place-based notions of such as rural, neighborhood, community, or area.

When studying geographic aggregations, researchers should be centrally concerned with choosing the unit that is theoretically relevant to the question at hand. For example, if we are trying to evaluate preferences of state legislators from rural districts in comparison to those from more urban districts, the clear unit of analysis is the legislative district. Similarly, we might examine voting in the US Senate by comparing votes cast by Senators from prominently rural states to those in majority urban states.

For most questions of political behavior, however, the unit of analysis will not be so clear. If we are trying to link individuals in surveys to the rurality of their location, for example, it is not obvious what the unit of aggregation should be. Is that individual's location best captured by her zip code? Her county? Her census tract? None of those measures accurately capture most people's notion of a "community" or "neighborhood," which is what most people intend when coding for the rurality of their location. Yet these are the most common indicators of an individual's location.

As discussed briefly above, the unit of aggregation decision is highly consequential because of its implications for the MAUP. The MAUP involves two central features−problems of zoning

and problems of scale. The zoning problem refers to the choice of where to draw our lines of geography. In most cases, we are using administrative "zones" to draw our lines. Research on the MAUP reveals that if we used some other zoning schema, whether we simply shifted the administrative boundaries in one direction or another while retaining their size, our new units would have different means and standard deviations than the previous units. Thus, our results using existing administrative units provide a specific characterization of our geography. If this characterization of our geography is theoretically appropriate, there is not concern with the MAUP. However, if we have simply chosen the unit of geography that is available (such as the county) but is not theoretically relevant for the question at hand, we are faced with the possibility of the MAUP and our results being contingent upon our selection of a theoretically arbitrary geographic unit. With a plausible reformulation of that geography, the results may differ (Lee and Rogers 2019).

The MAUP scale problem refers to the size of the units employed. If we employ big units, such as the US state, or counties such as San Diego, we will have an average value that obscures considerable heterogeneity on most variables. If we use a smaller unit, such as the Zip Code Tabulation Areas (ZCTA) or Census blocks, we include many "extreme" values that mischaracterize the experience of those living within them. Intuitively, the scale of the aggregation will be consequential for the characterizations we will discern from those units. These concerns need to be considered carefully when choosing the unit of analysis. Some of the classification schema discussed below may help to "scale" the measure to reduce concerns with the scaling problem of the MAUP.

2.1 Counties

The most commonly chosen unit in the study of American politics is the county. Counties are administrative units immediately below the state government.[2]

The geographic size and political relevance of counties varies tremendously across states. In

[2]Instead of counties, Alaska has "boroughs", Louisiana has "parishes", and Virginia has "independent cities." These political subdivisions are very commonly considered county-equivalent for the purpose of political science research.

some states the counties have immense political jurisdiction and taxation and redistribution power, while in other states the counties exist solely as units of aggregation. Rhode Island, Connecticut, and half of Massachusetts' counties have no political function. In general, as one moves from the Northeast to the Southwest counties gain political function, which is also highly correlated with the recency of county establishment. In addition to any political functions, counties are almost always employed as the sub-state unit used for data produced by the national and state governments. Because of their consistency over time and the preponderance of data availability, they are the most common unit of geography in American Politics research. However, counties have immense variation in their physical and population size.[3]

Counties are extremely heterogenous, with enormous counties in the West and much smaller ones in the East. Counties in the eastern United States were determined using a system of metes and bounds, essentially a detailed description of the county's border using natural and cultural landmarks, such as rivers and churches. Counties in the western United States were drawn largely after the invention of land-surveying technology, which allowed for straight county borders that could stretch far beyond settlements and into stretches of uninhabited land. For this reason, counties in the West are larger physically and can contain immense amount of empty space. For example, San Bernardino County, California is geographically larger than 9 states, and is close to the size of West Virginia.

Within-county heterogeneity is especially present in the western United States, where much of the rural population of interest lives, because of the large physical size of counties. This raises concerns that the western counties are hiding much more variation in population density, political opinion, and economic structure when represented in research by county-level averages than it is

[3]There are 3,242 counties, or county-equivalent units, in the United States. The average number of counties per state is 62, with a range from the three counties of Delaware to the 254 counties of Texas. On average, there are roughly 100,000 residents in each county- but the variation in residents per county is too great to be used as a meaningful nationwide statistic.

in the East. This raises concerns that counties are not comparable units in a theoretical or empirical sense for many studies.

Many scholars do not use a county-level classification of urban-rural as their main independent or dependent variable, but instead employ a county level measure of rurality in their control variables. It may seem that such a choice would not impact the main results, because the measurement error is within the controls, not the variables of focus. However, even a control for rural with a county indicator, when the county is not the theoretical unit, can significantly alter the results of the main variables (Soifer and Alvarez 2017; Lee et al. 2019). We demonstrate how rural control variables may impact the main empirical results in Section 5.

Given that the county is the most common geographic unit of data collection of the American government, we may not be able to study smaller units.[4] The preponderance of data available at the county-level which may outweigh the costs of masking urban-rural divisions. To be sure, some questions, such as those about county sheriffs (e.g., Nemerever (2019) or county legislatures (de Benedictis-Kessner and Warshaw 2018) necessitate counties as the unit of analysis.

2.2 Zip Code Tabulation Areas

Another commonly collected geographic unit is the zip code tabulation area (ZCTA). The United States Postal Service uses zip codes to assign an address to a post office or mail distribution center in a way that maximizes mail route efficiency. ZCTAs are created by taking the modal zip code in a census block, and then merging all adjacent census blocks with the same modal zip code.[5] There are 42,000 zip codes and 32,000 ZCTAs in the United States. The Census does collect select

[4]For example, unemployment statistics are only regularly collected at the county level.

[5]Some addresses will be assigned to a ZCTA that do not match their zip code and not all zip codes have a corresponding ZCTA. Very rarely do ZCTAs span two states, but it occasionally occurs in border metropolises, such as Kansas City (KS and MO) or Cincinnati (OH and KY). 153 ZIP Codes in more than one state. There are 9,000 ZIP Codes in more than one county.

demographic information for ZCTAs and it is a preferred geographic unit of analysis for survey data because ZCTAs are much smaller than county. It is more common for a survey to ask for a respondent's zip code than their full address (which they may be reluctant to share) or their Census block (which they are highly unlikely to know). Yet, ZCTAs are not likely to be theoretical units of political interest.

2.3 Census Tracts, Census Blocks, and Precincts

Less frequently used units of aggregation include Census tracts, Census blocks, and voting precincts. Census tracts are statistical subdivisions of a county ranging between 1,200 and 8,000 residents and used primarily for purposes of the Census.[6] Census blocks are subdivisions of Census tracts, and thus counties and states. Unlike Census tracts, Census blocks are not bounded by population requirements and tend to remain more stable over time than tracts.[7] Political outcomes (e.g., distribution of programs or government funding), election returns, and measures of public opinion are rarely made available at the Census tract or block level, in part because they are politically arbitrary aggregations. Conversely, demographic information is not often collected by voting precinct. One option is for researchers to use Geographic Information Systems (GIS) and aerial interpolation to overlap Census tract or block boundaries with voting precincts to ascribe demographic data to precincts (see Karp and Banducci (2000) for an applied example).[8]

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[6]For more information, see https://www2.census.gov/geo/pdfs/education/CensusTracts.pdf.

[7]For more information, see https://www.census.gov/newsroom/blogs/random-samplings/2011/07/what-are-census-blocks.html.

[8]Using GIS of aggregated data, however, would raise concerns with the MAUP (Lee et al. 2019).

3 Urban-Rural Classification Schema

A substantial amount of research alludes to rural places or rural voters, without serious efforts at conceptualization. The perfunctory account of "rural" is often characterized as those in the cross-section of whiter, older, less educated, and more socially conservative. Rural areas are often assumed to be tied to the agricultural or extractive economy. Yet these notions are at odds with fuller accounts of rural populations, which include substantial minority populations, affluent areas holding second homes of the rich, and significant non-agricultural industry. An important step in advancing research on rural politics in America will be more close consideration of what is theoretically important about rural America for researchers, and how those theoretical ideas of rural might be operationalized. In this section we lay out possibilities for coding common geographic units according to different classifications.

Once we have chosen the theoretically relevant unit of analysis, we must select the classification of rural that best fits the theoretical construct of the research. The choice of rural classification is a theoretical one. Scholars may be interested in rurality as it relates to population size or density, adjacency or proximity to a metropolitan area, commuting population, agricultural economy, distance to public services, or rural consciousness. These measurement strategies use objective classifications to assign individuals or geographic groups to urban-rural categories, regardless of how urban or rural they believe themselves to be.[9] In contrast, recent rural ethonographies such as Cramer (2016) and Hochschild (2016) focus on rural self-identification–people's beliefs that they are rural. Rural individual or group identity, or rural consciousness, should be measured by self-identification, which we discuss in Section 6.

[9]Examples of studies concerned with assigned rurality include Acharya et al. (2016) and Nemerever (2019).

3.1 Metropolitan, Micropolitan, or Nonmetropolitan

The Office of Management and Budget (OMB) classifies counties as Metropolitan, Micropolitan, or Neither. By definition, Metropolitan Statistical Areas must contain core urban area of 50,000 or more population, while a Micropolitan Statistical Area contains an urban core of at least 10,000 population. All counties that are not part of a Metropolitan Statistical County are considered non-metropolitan, or rural (Office of Management and Budget 2010). Importantly, this is not equivalent to a measure of urban-rural. Frustrated analysts lament, "Metro/micro definitions always follow county boundaries. Urban/rural territory doesn't respect those political borders" (Center Center). Counties included in metropolitan and micropolitan statistical areas contain both urban and rural territory and populations, such as the vast nothingness of the Grand Canyon which spans two "metropolitan counties" in northern-eastern Arizona.

Studies of voting behavior (Morrill et al. 2007; Scala and Johnson 2017; Scala et al. 2015) that use this measure are not directly capturing urban-rural dynamics, but rather the voting behavior of a county that contains a metropolitan area of 50,000 or more people. This measurement strategy is dubious–scholars would nearly always be better off employing measures that capture economic, cultural, or political differences across rural and urban areas.

3.2 Holistic Scales: Rural Urban Commuting Area Codes, Rural Urban Continuum Codes, Urban Influence Codes

A more detailed schema for coding the urban-rural spectrum is Rural Urban Commuting Area Codes. RUCA codes are released by the Department of Agriculture Economic Research Service and use population density, urbanization, and daily commuting to classify census tracts into the 10 categories listed in Table 1. Within each integer category are subcategories for different commuting patterns. For example, category 6.2 has more commuting to a large Urban Cluster than category 6.3. This allows researchers to distinguish between people who live in rural areas but have access to urban job opportunities and resources (such as hospitals) from those who live in rural areas and

do not have regular contact with urban areas. Commuting distances can also proxy for access to political participation. Gimpel and Schuknecht (2003) find that the distance and congestion of the commute to polling locations is associated with voter turnout rates. The RUCA code is a more specific operationalization than using a single factor such as population size or population density, maximizing researchers' ability to detect differences between the lived experiences of rural and non-rural populations.

Although the Census Bureau publishes RUCA codes only for census tracts, the University of Washington Rural Health Research Centers publishes RUCA approximations for ZCTAs.[10] ZCTA-level codings are especially useful to political scientists because zip code is often the lowest level provided in major surveys, such as the Cooperative Congressional Election Study (CCES).

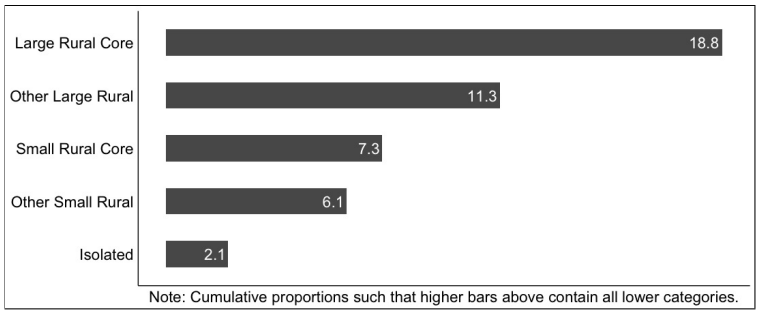
Table 1: USDA Rural-Urban Commuting Area Codes

1	Metropolitan area core: primary flow within an urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30% or more to a UA
3	Metropolitan area low commuting: primary flow 10% to 30% to a UA
4	Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)
5	Micropolitan high commuting: primary flow 30% or more to a large UC
6	Micropolitan low commuting: primary flow 10% to 30% to a large UC
7	Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30% or more to a small UC
9	Small town low commuting: primary flow 10% to 30% to a small UC
10	Rural areas: primary flow to a tract outside a UA or UC

Even after selecting to use the RUCA codes, researchers must decide whether to use the codes as a categorical variable or to aggregate the classes into urban and rural bins. Choosing which categories belong in the urban and rural bins changes not only the qualities of the populations, but the size of the sample and sampling frame. Nearly 20% of the United States is rural according to the most generous definition of rural, only 2% of the United States is rural using a more stringent definition. To see this visually, Figure 1 shows how the size of the rural population shrinks as the classification standards become more stringent.

[10]For information on their coding procedure, see: https://depts.washington.edu/uwruca/ruca-approx.php.

Figure 1: Rural proportion of US population, defined using ZCTA-level RUCA codes



Given more extensive data availability at the county level, many researchers will decide to use one of two county-level schema that classify counties according to the similar criteria as the ZCTA-level RUCA codes. The Rural Urban Continuum Codes (RUCC) and Urban Influence Codes (UIC) are released by the USDA Economic Research Service. RUCC distinguish counties by the population size of their metro area, degree of urbanization, and adjacency to a metro area (if non-metro). UIC distinguish metropolitan counties by population size of their metro area, and nonmetropolitan counties by size of the largest city or town and proximity to metro and micropolitan areas. The RUCC and UIC codings are very similar, and when applied to CCES respondents, for example, are correlated at 0.92. Table A1 enumerates these schemas alongside the OMB county-level codes. The metropolitan/non-metropolitan classification is suggested, but like with the RUCA codes, researchers can choose how to collapse the categories into bins, or maintain the original coding and use it as a categorial variable.[11]

3.3 Measuring Education, Economic Structure, Healthcare, etc.

Scholars may also be interested in geographic units tied to specific policy delivery, such as school districts or proximity to healthcare. For scholars interested in differences in urban and rural

[11] Urban-Rural Classification Scheme for Counties is published by the National Center for Health Statistics. It is a six-level county-classification scheme. Political scientists are unlikely to come across it within the political science literature because it is mostly used for public health research. For most purposes, this measure is inferior to RUCC and UIC because it has fewer categories.

schools, all U.S. public schools and schools districts are coded on an 12 point scale incorporating both population size and distance to metropolitan areas.[12] Alternatively, ArcGIS enables researchers to overlap election returns with other data.

Measures of population size or density should not be used as a proxy for other concepts that might be more directly accounted for with existing data. For example, if scholars want to know which counties have low-education and persistent poverty, two characteristics common in, but not unique to rural areas, scholars can use the USDA ERS County Typology Codes.[13] For example, USDA typology codes have been used to show how vote choice varies between rural recreation-based economic and rural farming-based economies (Scala et al. 2015).[14]

4 Empirical Consequences of Measurement Decisions

In this section we use descriptive data to show how choices of unit and rural concept may be consequential for measurement precision and group-level estimates.

Many studies in American politics rely on the CCES, thus we demonstrate our next point using the geographic locations of CCES respondents 2006-2018. This group is a commonly studied sample of respondents, so it is particularly useful to know more information about their geographic distribution. Figure 2 depicts the urban-rural heterogeneity within counties, even when they are

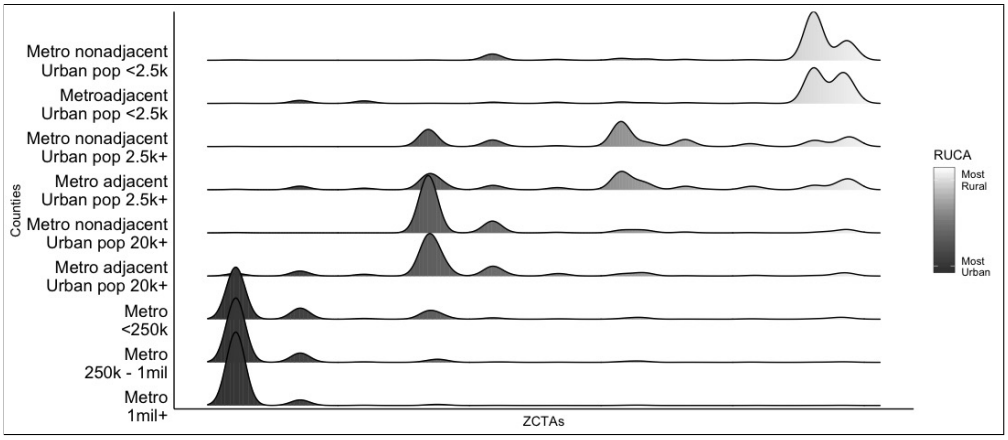
[12]For Public Schools: National Center for Education Statistics. Private school urbanicity is available by only population size (city, suburban, town, rural) and not distance to a metro area (central, fringe, remote) NCES Private School Universe Survey.

[13]County typology codes classify counties by most prominent economic sector (farming, mining, recreation, nonspecialized, or government) and by individual indicators for the presence of any of the above categories. The typology also includes non-mutually exclusive binary indicators of low education, low employment, population loss, retirement destination, persistent poverty, and persistent child poverty.

[14]The Rural Health Information Hub provides a very useful summary of how rural is defined for purposes of government services, and whether a given address is rural, here: Am I Rural?.

sorted into RUCC codes. Each row is a different RUCC category. The density curve shows the distribution of within each categoy of county. The geographic heterogeneity is not too surprising, given that most counties contain urban, suburban, and rural populations. In fact, less than 2% of the population lives in a completely rural county and less than 4% lives in a completely urban county. However, zip codes are much less heterogenous due to their small size. Slightly over 20% of zip codes in the United States are rural and slightly less than 40% of zip codes are core metropolitan areas. The other 40% of zip codes are in some classification between mostly urban and mostly rural. ZCTAs offer significant improvement on measurement precision, and should be used in place of county whenever possible.

Figure 2: Heterogeneity of Urban-Rural CCES Respondents within Counties



Note: Counties are coded by RUCC. ZCTAs are coded by RUCA.

Secondly, classification decisions can affect descriptive variables or group means. For example, studies concerning socioeconomic status should be especially mindful of differences in demographic variables based on measurement decisions. Using county as the unit of analysis and RUCC as the coding schema, the median rural household income is $4,168 less than the median non-rural household. Measured using RUCA at the ZCTA-level, the median rural houshold income

is $6,938 less than the median non-rural household. [15] The rural gap in median houshold income increases by over two-thirds when the measurement strategy is refined.

Thus far we have addressed how to choose units of analysis and location-based classification schemes. In the next section we examine discuss identity-based notions of rurality, and how they differ from location-based schemes.

5 Replication of Flavin and Franko (2019)

In their 2019 article "Economic Segregation and Unequal Policy Responsiveness" in *Political Behavior*, Flavin and Franko examine the links between economic context and policy responsiveness in the United States House of Representatives. They find that regardless of an individual's level of income, those who live in affluent areas are better represented by their Member of Congress. They measure representation by matching CCES survey items asking individual citizens their preference on legislation to the roll call votes by their representatives on those exact pieces of legislation.

One of the covariates in their analysis in the rural/urban status of each zip code. In their article they define rural ZCTAs as those that are not located within an urban area or urban cluster.[16]. The Census defines urban areas and clusters as "Urbanized Areas (UAs) of 50,000 or more people; Urban Clusters (UCs) of at least 2,500 and less than 50,000 people." Problematically, this definition conflates rural with non-urban.[17]

Wilson Mill's, NC provides an example of the potential problems of this coding scheme. Wilson Mill's has a population of 2,400 and would be classified as rural under this coding schema.

[15] Source: Income In The Past 12 Months (In 2017 Inflation-Adjusted Dollars) 2013-2017 American Community Survey 5-Year Estimates

[16] Census Bureau. (2010). "Explanation of the 2010 Urban Area to ZIP Code Tabulation Area (ZCTA) Relationship File," retrieved from: Census Bureau

[17] This is not the only study to define rural as simply, "non-urban." See also Gamm and Kousser (2013); Parker (2009); Dimick et al. (2014).

However, Wilson Mill's is only 30 miles from Raleigh and the greater Research Triangle region. The majority of that 30 mile drive is not through sparse farmland, but sprawling suburbs. The RUCA code for Wilson Mill's is 4.2, a micropolitan area core with primary flow within a large urban cluster of 10,000 to 49,999 (large UC). Numbers aside, we likely should not consider Wilson Mill's rural considering it is a short drive from Raleigh, which is the state's second largest city of nearly half a million residents, job opportunities, healthcare providers, and educational opportunities.

We re-run their analyses replacing their measurement schema with ZCTA-level RUCA codes from the University of Washington. We classify all ZCTAs with a RUCA value of 7 or greater as rural.[18] In their original analysis, they find that living in rural parts of the country leads to significantly better representation.[19] Table 2 shows our results (Columns 2a and 2b)) alongside the original results published in Flavin and Franko (2019) (column 2). In Column 2a, we use a binary indicator of rural-not rural, in Column 2b we use a categorical indicator, as in Lay (2006).

The contrast in the results in column 2 versus columns 2a and 2b in 2 highlights the consequences of how we measure rurality. First, how we measure rural affects whether rurality is a significant predictor of the variable of interest. In the Flavin and Franko coding, their indicator of rural (classified as non-urban) is significant and positively related to opinion-vote congruence. When we recode the variable to only capture rural locations as defined by RUCA, the rural variable is not significant, whether it is measured dichotomously or categorically. This difference is consequential–in the original analysis rurality appears to be a benefit to voters, in the recoding the effect is unclear. More importantly, perhaps, the recoding of the rural variable also impacts the main results. Flavin and Franko argue that rich, segregated areas are "better" represented by

[18]The results for Table 5 hold if you classify rural using a cutoff of equal to or greater than 5, 6, 8, 9, or 10. The sensitivity analyses are in the replication code.

[19]Their other two dependent variable are "contact by a campaign" and "made political donations". They do not find statistically significant effects of rural residence on either of these variables. Our replication for these variables are in Appendix C.

Table 2: Original and Replication Results of Flavin and Franko (2019)

	DV = *Opinion-vote congruence*		
	(2)	(2a)	(2b)
Individual Level			
Income	0.067	0.064	0.067
	(0.073)	(0.073)	(0.073)
Same PID as Representative	24.302**	24.304**	24.297**
	(0.159)	(0.159)	(0.159)
Age	0.032**	0.032**	0.031**
	(0.005)	(0.005)	(0.005)
Black	-2.151**	-2.150**	-2.185**
	(0.291)	(0.291)	(0.292)
Hispanic	-0.689*	-0.690*	-0.693*
	(0.325)	(0.325)	(0.327)
Zip Code Level			
Rich Insulation Index	**0.212***	**0.158**	**0.177**
	(0.102)	**(0.103)**	**(0.106)**
% Black	4.653**	4.289**	4.368**
	(0.778)	(0.771)	(0.783)
% Hispanic	0.614	0.144	0.139
	(0.851)	(0.841)	(0.853)
Rural (Original)	**0.850****		
	(0.265)		
RUCA Binary		**0.279**	
		(0.318)	
RUCA Categorical			**0.051**
			0.043
Gini Coefficient	4.628*	3.695*	4.056*
	(1.830)	(1.805)	(1.818)
Constant	42.411**	42.995**	42.808**
	(1.463)	(1.450)	(1.461)
Observations	121,121	121,121	119,912
Log Likelihood	-568,369.400	-568,374.200	-562,691.100

members. Once we include other measures of rurality, however, the statistical association between rich areas and representation quality becomes weaker and insignificant in common metrics.

Yet there is no definitive way to account for geographic location in our studies, and therefore our alternative results in columns 2a and 2b are not more objectively "correct" than Flavin and Franko's. Without changing the measurement strategy - and consequently, the significance of the primary results - their results might be more accurately presented by changing the framing of the analysis. If the concept and/or measurement is truly about urbanism, then the variable should be labeled non-urban rather than rural. This erases important political differences between suburbs, exurbs, and rural areas. Perhaps suburbs are better represented than other non-urban areas, and these districts are driving the results (citation?). As an example, Corder and Wolbrecht (2006) appropriately center their claims of political geography on urban instead of rural, "with a data set that can distinguish truly urban areas, we find little gender difference in the effect of urbanism in 1920 or 1924." Because rurality is not central to their analysis, aside from it being an appropriate control variable, changing "rural" to "non-urban" (or "urban" with a sign change) would not change the article's motivation, empirical strategy, or conclusions.

This section has shown the potential consequences of scholars' choice of rural variables in their empirical analysis. Again we emphasize that even a rural control variable can impact the main empirical results. Many scholars in American Politics use such variables regularly, and should be aware of the potential consequences to their results.

6 Rural Location versus Rural Identity

Some researchers may be interested in rural identity, distinct from rural location. For this classification, we suggest scholars collect these data within the survey instrument, as in Mummolo and Nall (2017). As we stated earlier, concepts such as "rural consciousness" (Cramer 2016) do not necessarily require rural residence. If a researcher is using survey data to study the effects of rural identity on another variable, such as racial attitudes or trust in government, there are a couple

ways they could measure a respondent's rurality. One option is to ask for identifying geographic information such as zip code or county, and code rural residence using a scale like RUCA. Alternatively, a survey item could ask respondents to classify themselves in a question such as the 2009 CCES question "What type of community do you live in?"[20] Using data from Mummolo and Nall (2017), we show that results on rural consciousness may be sensitive to the choice of geographic identification versus self-identification.

Participants in the Mummolo and Nall (2017) study were asked, "Which best describes the neighborhood where you now live?" and could choose from the following options:

- City- downtown with a mix of apartments, offices, and shops
- City- in a more residential neighborhood
- Suburb - in a neighborhood with a mix of apartments, offices, and shops
- Suburb - in a neighborhood with houses only
- Small town
- Rural area - on a farm
- Rural area - not on a farm

For our analysis, we collapsed the pairs of City, Suburb, and Rural categories. To compare the self-identification with actual geographic location, we coded each respondent as City, Suburban, Small Town, or Rural using the provided zip codes. We assigned the RUCA codes to the Mummolo and Nall (2017) categories using the schema in Table 3.[21] These data come from the ZCTA version of the RUCA codes provided by the University of Washington Rural Health Research Center.

Figure **??** shows the breakdown of geographic location for all respondents who consider themselves to be rural. Strikingly, a minority of respondents who described their neighborhood as rural

[20]This is the only wave of the CCES this question, or a similar one, was asked. The answer options were: In a large city, Immediate suburb of a large city, Outer suburb of a large city, In a medium sized city, Suburb of a medium sized city, In a small city, Suburb of a small city, Town, Rural area.

[21]For this exercise, we dropped the 1,344 respondents who did not provide a zip code on the survey. We also dropped 71 respondents from the remaining 5,355 respondents because their zip code did not directly match onto a ZCTA.

Table 3: Recoding of Mummolo and Nall (2016) using ZCTA-level RUCA

	RUCA Codes	Mummolo & Nall
1	Metro area core: primary flow w/in an urbanized area (UA)	
2	Metro area high commuting: primary flow 30% or more to a UA	City
3	Metro area low commuting: primary flow 10% to 30% to a UA	
4	Micro area core: primary flow w/in urban cluster of 10,000 to 49,999	
5	Micro high commuting: primary flow 30% or more to a large UC	Suburban
6	Micro low commuting: primary flow 10% to 30% to a large UC	
7	Small town core: primary flow w/in urban cluster of 2,500 to 9,999	
8	Small town high commuting: primary flow 30% or more to small UC	Small Town
9	Small town low commuting: primary flow 10% to 30% to a small UC	
10	Rural areas: primary flow to tract outside UA or UC	Rural

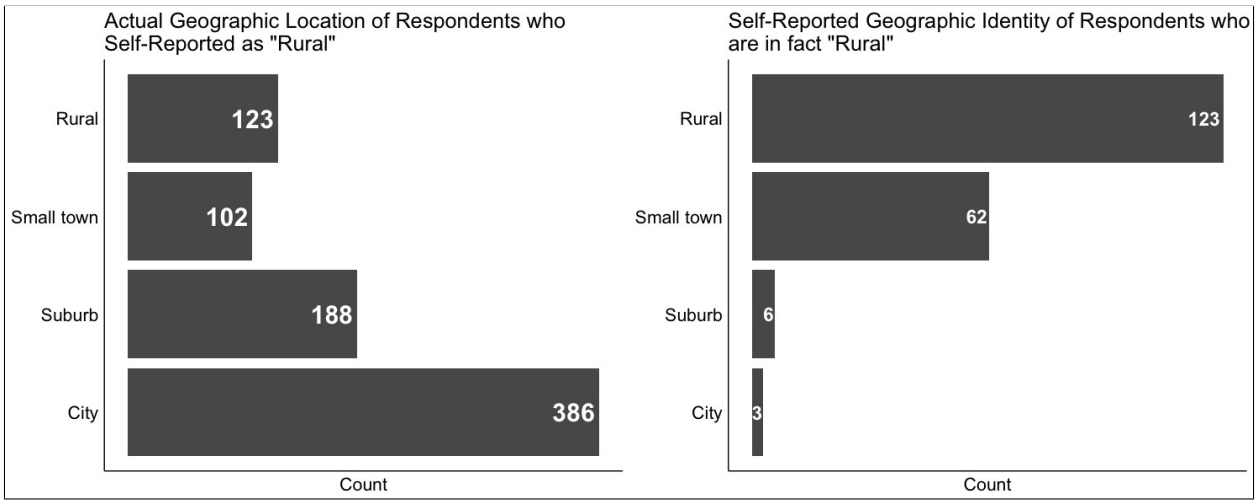
actually live in an area considered rural by RUCA, either 15% or 28% depending on whether small towns are considered rural. The most lenient interpretation of the data combining the rural, small town, and suburb categories increases the proportion of self-identified rural respondents who live in a non-city area to 52% - barely better than a coin flip. Figure 4 shows how respondents from rural areas self-identify. The majority of rural respondents say that they are indeed, rural. The second most popular answer is small town, with hardly any rural respondents saying they live in a suburb or city. Considered together, these figures inform us that rural people accurately self-identify as rural most of them time, but respondents from small towns, suburbs, and even cities commonly describe themselves as rural.[22]

To be sure, we may not expect there to be perfect alignment between self-identification and RUCA identification. First, RUCA, and similar measures, are objective, uniformly apply standards to all data points, transparent, and replicable. Self-identification respondents likely apply different standards, compare themselves to different points of comparison, and may be influenced by group identities or rural stereotypes propagated by media. Second, although ZCTAs are far more precise than counties, there could still be zoning issues that account for the geographic mismatch (e.g., a

[22]We draw a similar conclusion when looking at the self-identification and geographic location of small-town respondents. Those figures are included in Appendix Figure A1.

rural respondent lives on the edge of a small town ZCTA). Given that the conclusions hold when rural and small town are combined, this is less of a concern than the first point.

Figure 3: Geographic Analysis of Respondents from Mummolo and Nall 2016



Scholars that does not focus on rural issues may wonder if our discussion so far in this paper has direct bearing on their research. Most research evaluates rurality as a control variable, not the variable of interest. In the next section, we replicate a recent study to show how that how rural is measured has direct bearing not only in the results for the rural variable, but also for main explanatory variables if rural is a control. These result highlight that how we measure rural is consequential to our empirical results and interpretation of scientific findings.

7 Advice for Choosing Measurement Schema

Having laid out the menu of options and demonstrated their use through a replications, in this section we offer suggestions of how scholars might think about choosing a rural classification scheme- both the concept and the unit- for their research. The first principle of classification is theoretical, scholars should have a notion of what is important about rural location or rural identity from the perspective of their research to guide their selection of concept. If their theoretical concept is about population density or distance from a city, measures of these concepts, such as county

or RUCC classifiers make sense. Table 4 provides a summary of the classification schemes for common concepts of rural in political science. If the notion relates to agricultural production, USDA typology codes are sensical, if the idea is rural identity, scholars will likely need to ask that in surveys themselves (e.g., Mummolo and Nall (2017)). We emphasize the need to take the concept of rural seriously because it is rural variables have often been included uncritically.

Table 4: Components of Classification Systems

	Population Size	**Population Distribution**	**Adjacency to metro area**	**Commuting Population**
RUCC	✓		✓	✓
IUC	✓		✓	✓
RUCA	✓	✓		✓
OMB	✓			

Once scholars have the concept of classification in mind, they must choose an appropriate unit. Again, this should be a theoretical choice. For scholars examining county level phenomena, the county is the appropriate unit, and the county level classifiers should be employed. For many facets of political behavior, however, we do not know the theoretical unit. To capture those living in a rural "community" or "neighborhood," there is no theoretical unit that can be captured in aggregated data (Kwan 2012). The definition of a community or neighborhood is individual even if the concept is aggregated.[23]

When scholars do not know the theoretical unit, a few choices are available to alleviate concerns with operationalization and minimize the MAUP. If scholars have individual level location data, it may be possible to use ArcGIS to map different "zones" and scales to capture the rural location concept to include in their analysis. By showing the (lack of) sensitivity of their analysis to the choice of rural concept, readers can be more assured of the validity of the results. For certain research questions, the collection of individual data on the rural concept to aggregate to different levels may be the most appropriate path.

[23]This is known as the "uncertain geographic context problem" (Kwan 2012).

Many scholars will not have individual point data either because of the limitations of the survey or government data.[24] In many cases, scholars may want to select a relatively small unit, such as a ZCTA, to pair with individual level data. As described above, the ZCTA is a much more precise accounting of rural geography. The concept of rural is much more homogeneous within ZCTAs, so there should be a better mapping of concept to measure at the individual level.[25] "Going smaller," however, will not eliminate concerns with the MAUP. The best option to reduce concerns with MAUP will be to show robust results at different "zones" and scales.

Even if a scholar knows the theoretical unit, there may not be data at that unit. For example, if scholars wondered how participation in the Affordable Care Act (ACA) affects voting in rural towns or in elections in the House of Representatives, they would find that data on ACA pick up is only produced at the county level. The use of county level data to address questions at the town or House district level would in most cases be nonsensical. For these questions, the data cannot approximate the unit, so scholars would need to revise the research question or collect original data on ACA pick up to achieve a valid research approach. Using data at inappropriate units, even as a control variable, has the potential to alter empirical results in unpredictable ways (Soifer and Alvarez 2017; Lee and Rogers 2019; Lee et al. 2019).

8 Conclusion

In this article we have detailed the challenges to measuring rural America and offered potential solutions. We point to two important choices−the geographic unit and the classification−that should guide the researcher's choice of measurement of rurality. We distilled technical information for a political science audience to provide descriptions of the unit and classification options, and linked them to available tools and data. We further demonstrated the consequentiality of measurement

[24]Table A2 lists the aggregation levels found in surveys common to the study of American politics.

[25]Classifying survey respondents at lower levels of classification my substantially reduce sample sizes, however.

choices in a replication study. We hope that our efforts will prove useful to a range of scholars in American Politics and public policy, and with adaptation, to scholars in Comparative Politics.

In Table 5, we provide a summary guide for scholars to link unit and classification to existing data. In the first column we provide the concept (classification), in the second column we show the operationalization of that concept, and in the final two columns we show commonly employed, available datasets that provide these measures at two units (county and zip code). These sources should provide options for a large percentage of researchers using observational data to capture rurality in the United States.

Table 5: Examples of Rural Measurement

Theoretical Concept	Operationalization	County-Level	ZCTA-Level
Low population density	Population per land area	US Census	US Census
Non-urban	Small town, low commuting	UIC or RUCC	RUCA
Rural consciousness	Self-identification		Mummolo and Nall 2016
Agricultural Economy	Primary economic sector	ERS Typology	US Census Business Patterns
Distance to Public Services	Proximity to urban center	UIC or RUCC	RUCA

The study of political geography, including rurality, requires scholars to use observational, aggregated data. These data may not be provided in the format preferred by the researcher, forcing researchers to consider suboptimal data and operationalizations. We have emphasized that these decisions can be impactful. Given the potential impact of these choices, we implore scholars to think more carefully about what they mean by rural, to state their notion explicitly, and to try to match their concept to measurement. Failure to specify appropriate geographic conceptualization, or to substitute geographic concepts for identity concepts, may result in a disconnect between readers and writers, and between concept and measurement. Much like the ubiquitous "South" variable, rural in many cases has been relegated by political scientists as a dummy variable control or a catch-all term for white, less-educated, older, and more socially conservative voters. We hope to push scholars to place more effort in their research on the conceptualization and measurement of rurality.

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Table A1: Comparison of County-Level Schemas

Office of Management and Budget	**Rural Urban Continuum Codes**	**Urban Influence Codes**
	Metropolitan	
Central counties with 1+ urban areas, defined as densely settled areas of $\geq$ 50,000	1. Counties in metro areas, $\geq$ 1 million	1. Large metro area, $\geq$ 1 million
Outlying counties economically tied to central counties via a minimum of 25% labor-force commuting	2. Counties in metro areas of 250,000 - 1 million	2. Small metro area $\leq$ 1 million
	3. Counties in metro areas $\leq$ 250,000	
	Micropolitan	
Nonmetro labor-market areas centered on urban clusters, 10,000-49,999	4. Urban $\geq$ 20,000, adjacent to metro area	3. Micropolitan area adjacent to large metro area
	5. Urban $\geq$ 20,000, not adjacent to metro area	4. Noncore adjacent to large metro area
	6. Urban 2,500-19,999, adjacent to metro area	5. Micropolitan area adjacent to small metro area
	7. Urban 2,500-19,999, not adjacent to metro area	6. Noncore adjacent to small metro area, contains a town $\geq$ 2,500
		7. Noncore adjacent to small metro area, no town $\geq$ 2,500
		8. Micropolitan area not adjacent to metro area
	Non-core	
All remaining areas	8. Completely rural or $\leq$ 2,500 urban, adjacent to metro area	9. Noncore adjacent to micro area, contains town $\leq$ 2,500
	9. Completely rural or $\leq$ 2,500 urban, not adjacent to metro area	10. Noncore adjacent to micro area, no town $\geq$ 2,500
		11. Noncore not adjacent to metro or micro area, contains town $\geq$ 2,500
		12. Noncore not adjacent to metro or micro area, no town $\geq$ 2,500

Table A2: Units of Aggregation in Common Survey Data

Survey	**Units of Aggregation**
National Annenberg Election Survey	State, County[A]
Cooperation Congressional Election Study	State, County, Zip Code
American National Election Studies	State[B]
General Social Survey	N/A[C]

[A] Zip code available by application.
[B] Zip code and county by restricted access agreement.
[C] Under contract, the GSS will provide data on State, Primary sampling unit, County, & Census track.

Table A3: Replication of Mobilization and Donation DVs from Flavin and Franko (2019)

	DV = Contacted by a campaign			DV = Made political donation		
	(2)	(2a)	(2b)	(3)	(3a)	(3b)
Individual Level						
Income	0.360**	0.361**	0.360**	0.502**	0.502**	0.503**
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Age	0.047**	0.047**	0.047**	0.036**	0.036**	0.036**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Black	-0.096**	-0.096**	-0.097**	-0.090**	-0.090**	-0.092**
	(0.032)	(0.032)	(0.032)	(0.031)	(0.031)	(0.031)
Hispanic	-0.422**	-0.422**	-0.427**	-0.275**	-0.275**	-0.272**
	(0.035)	(0.035)	(0.036)	(0.035)	(0.035)	(0.035)
Zip Code Level						
Rich Insulation Index	0.047**	0.051**	0.041**	0.096**	0.096**	0.092**
	(0.010)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)
% Black	-0.078	-0.057	-0.093	0.026	0.035	0.009
	(0.075)	(0.075)	(0.076)	(0.065)	(0.065)	(0.066)
% Hispanic	-0.172*	-0.145	-0.184*	0.221**	0.233**	0.210**
	(0.078)	(0.077)	(0.079)	(0.065)	(0.064)	(0.065)
Rural (Original)	-0.041			-0.046		
	(0.029)			(0.024)		
RUCA Binary		0.001			-0.042	
		(0.035)			(0.029)	
RUCA Categorical			-0.008			-0.011**
			(0.005)			(0.004)
Gini coefficient	1.285**	1.331**	-2.829**	2.904**	2.942**	2.907**
	(0.195)	(0.193)	(0.111)	(0.161)	(0.160)	(0.161)
Constant	-2.827**	-2.857**	-2.829**	-5.178**	-5.199**	-5.160**
	(0.111)	(0.110)	(0.111)	(0.171)	(0.171)	(0.172)
Observations	79,617	79,617	78,803	104,870	104,870	103,838
Log Likelihood	-41,729.30	-41,730.29	-41,334.99	-59,055.79	-59,056.66	-58,466.87

Figure A1: Geographic Analysis of Respondents from Mummolo and Nall 2016