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When warm and cold don't mix: The implications of climate for the determinants of homelessness

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ABSTRACT

It is widely understood that climate affects the spatial distribution of homelessness—warm places have on average higher rates of unsheltered homelessness than cold places. A less recognized fact is that variation in rates of unsheltered homelessness is higher in warm places as well. We document this fact using quantile regression techniques and show that it has important implications for estimating the determinants of homelessness across communities. In particular, housing prices, poverty rates and religiosity are much more strongly associated with rates of unsheltered homelessness in warm places than in cold places. As an alternative to splitting the sample, we find that logarithmic transformations of rates of unsheltered homelessness can be reliably used in a pooled sample. Associations between total homelessness and important covariates also vary across warm and cold places, in this case in terms of both rates and logarithms. Ultimately, future research should carefully account for climate when estimating the determinants of homelessness.

1. Introduction

A mild climate is an important amenity. It helps explain why housing is much more expensive in San Diego than Minneapolis. For the homeless population, climate is especially important, as lack of shelter in cold places can have serious consequences for health or potentially mortality (Hwang, 2011). But climate is not directly capitalized into the cost of living for homeless people, who do not pay rent or mortgages. Thus, we would expect their populations to be much larger in places with warm climates. Indeed, 48% of the unsheltered homeless population is found in California and Florida alone, while just 15% of the United States population lives in these two states. Conventional wisdom among local officials and experts in cities with warm climates is that warm temperatures are major draws for homeless individuals.[1]

Similarly, research has generally affirmed that homelessness, and particularly the unsheltered type, is more common in warmer areas. For example, Appelbaum et al. (1991) find that warmer temperatures are associated with higher rates of total homelessness using some of the earliest cross-sectional estimates of homelessness across select U.S. cities in 1984, as do Quigley et al. (2001) using 1990 U.S. Census counts of homeless populations and Raphael (2010) using more recent homeless counts. Others consider sheltered and unsheltered populations separately and find that warmer temperatures are particularly relevant for unsheltered homelessness (e.g., Grimes and Chressanthis, 1997; Early and Olsen, 2002). In an extensive review, Byrne et al. (2013) summarize the persistent pattern: "Among these studies, most have found climate to have a significant relationship with rates of homelessness, and in the expected direction, with higher temperatures and less precipitation associated with higher rates of homelessness, and higher proportions of persons experiencing homelessness in unsheltered locations" (page 613).

Although it is widely understood that the average rate of unsheltered homelessness is higher in warm places, it is less well recognized that the variation in rates of unsheltered homelessness is much higher in warm places as well. We document this fact using cross-sectional homeless counts from communities across the United States, employing quantile regression techniques that allow us to predict the distribution of homelessness rates over temperature when controlling for other factors. In a community where the average daily low temperature in January is 10°, the predicted unsheltered rate is 0.1 per 10,000 for the 10th percentile community and 3.8 per 10,000 for the 90th percentile. But in communities where the temperature is 40°, the predicted unsheltered rates in the 10th and 90th percentile communities are 1.8 and 39.3 per 10,000 people. In other words, while

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[1] For example, Vancouver's mayor stated in 2015 that "B.C. faces a bigger challenge because it's warmer than the rest of Canada" (Hopper, 2015). A homelessness consultant states, "Where there are palm trees and golf courses, there will always be homeless individuals because of the moderate climate" (Marbut, 2011).

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unsheltered homelessness rates are uniformly low in cold climates, there is wide variation in unsheltered homelessness rates in warm communities.[2]

This finding has important implications for studies using cross-sectional data to estimate the determinants of homelessness. Because cold places exhibit little variation in rates of unsheltered homelessness, pooling them with warm places serves to attenuate estimates of the effects of other community characteristics or policy variables in warm places. We suggest two ways in which this model misspecification problem—in which all communities are pooled in regressions explaining variation in rates of unsheltered homelessness—can be addressed. First, determinants of rates of unsheltered homelessness can be estimated separately for cold and warm places. Using cross-sectional data, we find that housing prices, poverty rates and religiosity have stronger associations with rates of unsheltered homelessness in the subset of communities with above-median January temperatures than when a single estimate is generated for the pooled sample. Second, a pooled sample can be used when taking the logarithmic transformation of the rate of unsheltered homelessness. Based on a quantile regression, we show that the distribution of the natural logarithm of unsheltered rates is relatively constant over January temperature.

There are important implications for studying cross-sectional variation in total homelessness as well. Housing prices, poverty rates and religiosity are more strongly associated with rates of total homelessness in warm places than cold places. And in this case, heterogeneity in associations across warm and cold places carries over for logarithmic transformations of rates of total homelessness. Thus, using logarithmic transformations of rates of total homelessness in a pooled sample may continue to mask heterogeneity in the determinants of total homelessness across warm and cold places. Splitting the sample by climate will help researchers investigating the determinants of total homelessness identify any such effects.

In addition to their methodological value, the results that account for the role of climate provide new insights into the determinants of homelessness. Based on the full sample logarithmic specification, a one percent increase in median rent is associated with a 3.7% increase in the rate of unsheltered homelessness, and a one percentage point increase in the poverty rate is associated with a 20% increase. When including a set of variables capturing the religiosity of the community's population, we find that a one percentage point increase in the population that is an adherent to Catholic churches is associated with a statistically significant 2.8% decrease in the rate of unsheltered homelessness. The magnitude for Protestants is similar but not statistically significant, while that for Mormons and Evangelicals are smaller. Given that adherence to Catholic churches is associated with fewer homeless assistance beds, it is unclear whether this result is driven by more effective services despite fewer beds, or by broader cultural factors in the population.

This paper contributes to an extensive literature on the determinants of homeless population sizes across the United States. The quality of measures of homelessness has varied significantly across this literature, with earlier studies relying on counts with methodological flaws, counts that omit unsheltered homeless populations altogether, or personal estimates by local experts of their homeless populations (Appelbaum et al., 1991; Grimes and Chressanthis, 1997; Honig and Filer, 1993; Quigley et al., 2001; Early and Olsen, 2002; Lee et al., 2003). More recent studies have relied on homeless counts conducted by Continuums of Care that span the United States and are considered significantly more reliable, though still highly imperfect (e.g., Raphael, 2010; Byrne et al., 2014; Lucas, 2017). Cross-sectional studies typically conclude that housing prices and climate are among the most important predictors of homeless populations. Time-series and panel data have occasionally been employed as well, and have found that macroeconomic conditions, as well as housing prices, are associated with larger homeless populations (Cragg and O'Flaherty, 1999; Culhane et al., 2003; O'Flaherty and Wu, 2006; 2008; Hanratty, 2017). Some have sought to identify the effects of policy on homeless populations—findings of the effect of federal funding for homeless assistance have been mixed (Moulton, 2013; Lucas, 2017); permanent housing targeted to homeless families reduces homeless populations (Cragg and O'Flaherty, 1999; O'Flaherty and Wu, 2006); permanent supportive housing has small to modest effects on homeless populations (Byrne et al., 2014; Corinth, 2017); and higher shelter quality increases the number of people sleeping in shelters (Cragg and O'Flaherty, 1999). We contribute to this literature by documenting the much wider variation in rates of unsheltered homelessness in warm places and its implications for estimating the determinants of homelessness in cross-sectional data. We also provide new evidence on the importance of religiosity.

The paper proceeds as follows. We discuss our data and methodology in Section 2. We present our results in Section 3. We discuss our findings with implications for policy and future research in Section 4. Section 5 concludes.

2. Data and methodology

To explore the relationship between climate and homelessness, we use cross-sectional data for the year 2013 from communities that span the United States. Our measures of homelessness come from the Department of Housing and Urban Development's (HUD's) annual Point in Time (PIT) counts. Unsheltered counts are carried out by volunteers and social workers who identify local homeless populations during a single night in January. Emergency shelters and transitional housing programs provide sheltered counts for the same night. The PIT counts are reported at the Continuum of Care (CoC) level. CoCs are geographies created by HUD to facilitate the coordination of homeless services. Each CoC may comprise one county, multiple counties, or a portion of a county. CoC geographies as of 2013 are shown in Fig. 1.

Climate variables are obtained from the United States Historical Climate Network (USHCN). Following the literature, we capture two key measures of climate: long-term temperature and precipitation. For temperature, we use the mean daily low temperature for the month of January averaged over the 25 years ending in 2013. For precipitation, we use the average monthly precipitation in January over the same 25-year period. Temperature and precipitation for each CoC are based on readings from the weather station nearest to its centroid. Poverty rates and racial demographics are drawn from the American Community Survey.[3] Median rent comes from HUD's annual 50th percentile rent estimates by county. For these variables, CoCs composed of multiple counties are attributed a population-weighted average. We also use the U.S. Department of Agriculture's "rural-urban continuum" score, which assigns each county a score ranging from one (most urban) to nine (most rural). We create a set of indicator variables based on the county population-weighted average score in the CoC.

In regressions that estimate the determinants of homelessness, accounting for the climate patterns observed, we sometimes include additional explanatory variables. Rates of adherents of churches are obtained from the Association of Religion Data Archives 2010 U.S. Religion Census: Religious Congregations & Membership Study (RCMS). These data are available at the county level and are merged into our CoCs. It should be noted that these data are based on the number of adherents documented by churches themselves, not the number of people identifying under a particular denomination or religion. We include measures of Catholic, Evangelical, Protestant and Church of

[2] In an appendix, we use panel data on homeless counts within communities over time to provide evidence that non-persistent multiplicative measurement error cannot explain this fact. However, we cannot rule out persistent measurement error within particular communities as an explanation.

[3] We use the 2013 five-year pooled estimates.