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**Urbanization, Natural Amenities, and Subjective Well-Being: Evidence from
U.S. Counties**

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Urbanization, Natural Amenities, and Subjective Well-Being: Evidence from U.S. Counties

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Abstract

This paper examines the effects of county-level urbanization and natural amenities on subjective well-being (SWB) in the U.S. SWB is measured using individual-level data from the Behavioral Risk Factor Surveillance System (BRFSS) which asks respondents to rate their overall life satisfaction. Using individual-level SWB data allows us to control for several important individual characteristics. The results suggest that urbanization lowers SWB, with relatively large negative effects for residents in dense counties and large metropolitan areas. Natural amenities also affect SWB, with warmer winters having a significant positive effect on self-reported life-satisfaction. Implications for researchers and policymakers are discussed.

Keywords: subjective well-being; urbanization; population density; amenities; quality of life

JEL classifications: I00, Q00, R00

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Introduction

Happiness, life-satisfaction, and well-being are important topics for individuals, policymakers, and researchers, but there is still much that is unknown about these outcomes. Researchers interested in these topics often analyze data from surveys that ask individuals to report their subjective assessment of their own life-satisfaction, which is commonly referred to as subjective well-being (SWB). A number of factors have been shown to systematically affect SWB. Reviews of the SWB literature are provided by Diener and Biswas-Diener (2002), Dolan et al. (2008) and MacKerron (2012).

Many researchers have hypothesized that individual well-being may be considerably affected by the physical, social, and economic environment in which the individuals are situated. There is some support for this contention using data from countries around the world, but empirical research on geographic differences in subjective well-being across the U.S. has been relatively scarce largely because of limited data. However, the Behavioral Risk Factor Surveillance System (BRFSS) began asking individuals to report their subjective well-being in 2005 and provides large samples sizes and geographic identifiers needed to reliably assess spatial differences in SWB across the U.S. Oswald and Wu (2010, 2011) and Glaeser et al. (2014) have examined these data and documented that there are indeed differences in subjective well-being across states and metropolitan areas in the U.S., but there are still numerous issues in need of further exploration to increase our understanding of the causes and consequences of these differences.

This paper uses the 2005-2010 BRFSS to examine the effects of county urbanization and natural amenities on individual subjective well-being. Specifically, we measure county urbanization in two separate ways, first based on a single continuous variable for population

density and then based on a set of categories for metropolitan status and size. Natural amenities examined relate to weather, topography, and proximity to water. We use individual-level data and therefore can also control for individual characteristics that could confound analyses using aggregate data. Our approach to measuring urbanization combined with using individual level data is novel in the SWB literature. Additionally, we are the first researchers to our knowledge to examine the effects of county-level natural amenities on SWB across the U.S.

Previewing the results, we find evidence that urbanization lowers individual subjective well-being, especially for residents of dense counties and large metropolitan areas. We also find consistent evidence that areas with warmer Januaries have happier residents. These results have important implications for researchers and policymakers interested in improving well-being. Specifically, policies that increase (decrease) urbanization may decrease (increase) individual well-being. Furthermore, Lucas (2014) suggests that local subjective well-being levels predict future population growth. Planners and forecasters need to be aware of these differences in well-being across areas.

Conceptual framework and literature review

General considerations

Research on subjective well-being has considered a number of possible individual determinants including age, sex, race, ethnicity, marital status, presence of children, employment status, education, and income. There is also debate as to how SWB relates to other measures of well-being including economists' notion of utility (Kahneman and Krueger 2006; MacKerron 2012).¹ Though not the focus of the current study, there is an especially large literature

¹ The current study uses the terms “subjective well-being” and “life satisfaction” interchangeably but allows them to potentially differ from the concepts of “utility” and “well-being” more generally.

examining the effects of income on subjective well-being. Much of this literature following Easterlin (1974) has shown that increases in average income levels do not necessarily increase average happiness levels. Researchers have suggested that this paradoxical result may occur because economic growth over time raises individual aspirations, so that individuals need a higher income to achieve a given level of life-satisfaction (Easterlin 1995; Easterlin 2001; Proto and Rustichini 2015). Similarly, it may be that individuals judge their life-satisfaction based on how well they are doing relative to others. However, Gardner and Oswald (2007) show that exogenous windfall income gains do increase happiness for medium-sized lottery winners. Furthermore, Winkelmann and Winkelmann (1998) show that unemployment reduces happiness and the magnitude is even larger than the effect attributable to the income loss. Therefore, SWB measures do appear to be correlated in the expected direction with variables that are expected to affect individual well-being and a host of researchers have used them to measure individual well-being (MacKerron 2012).

Various locational characteristics have also been posited to affect various notions of individual well-being. For example, an individual's well-being in a given location could be affected by local labor market conditions, prices of local goods and services, and the presence and quality of location-specific amenities and disamenities. In particular, individual well-being is thought to be increasing in the local wage level and amenities and decreasing in the level of housing prices and disamenities. However, there is a pervasive belief that individuals' ability to migrate from one place to another should greatly reduce the extent of well-being differences across places (Roback 1982; Winters 2009; Oswald and Wu 2011; Glaeser et al. 2014).

Much research in regional and urban studies posits that areas should achieve a spatial equilibrium, at least in the long run.² The spatial equilibrium hypothesis suggests that freely mobile individuals with identical skills and preferences should receive equal utility across all areas. If not, some individuals will have an incentive to move. More specifically, individuals will move from areas offering low levels of utility to areas offering higher utility. As they relocate, they alter local markets for both labor and housing by increasing (decreasing) the supply of labor and the demand for housing in their new (old) locations. In unconstrained competitive markets, prices will adjust to achieve equilibrium. As workers move from low utility to high utility areas, wages and housing prices will adjust to push markets toward spatial equilibrium. Specifically, population growth will bid up housing prices and apply downward pressure on wages, so that the initial utility gap between the areas diminishes.

However, researchers have documented that there are indeed spatial differences in self-reported life-satisfaction, even controlling for individual differences such as age, race, ethnicity, and education (Oswald and Wu 2010, 2011; Glaeser et al. 2014). A natural next question then becomes what is causing these spatial differentials in SWB? Do they represent short-term differences from transitory shocks that require movement from one equilibrium to another? Do they simply capture unobserved differences in skills and preferences across workers in different areas? Glaser et al. (2014) suggest that spatial differentials in SWB may result because individual utility depends on more than just what one considers when providing a subjective response to typical life-satisfaction questions. Specifically, individuals may be willing to trade off SWB for other things like consumption, leisure, social status, and accomplishments; these

² A large strain of this literature follows Rosen (1979) and Roback (1982) to estimate implicit values of location-specific amenities using hedonic regressions of wages and housing prices; the estimated implicit amenity values are often used to rank areas based on amenity-based quality of life. Recent examples for the U.S. include Winters (2011) and Winters (2013). A recent review is provided by Rickman (2014).

likely affect SWB but may also affect individual utility independently of SWB. Furthermore, individuals may prefer to take actions that help achieve various long-term desires and goals yet make them less happy at the time of the survey.

Another possible explanation for spatial SWB differentials is that there may be barriers to migration that prevent the spatial arbitrage process from fully equating happiness across areas. The U.S. has historically experienced relatively high internal migration rates compared to other developed countries, but internal migration has fallen in the U.S. in recent years perhaps because of decreased responsiveness to spatially asymmetric demand shocks (Partridge et al. 2012). Furthermore, Krupka (2009) suggests that individuals may make location-specific human capital investments that increase the benefit they receive from living near familiar amenities and deter them from moving to highly dissimilar areas.³ Krupka and Donaldson (2013) suggest that heterogeneous moving costs combined with housing supply constraints may bias traditional hedonic estimates of amenity values. Location-specific preferences, heterogeneous moving costs, and other frictions constraining mobility imply that infra-marginal residents in one city may achieve different utility levels than infra-marginal residents in another city. Thus, spatial arbitrage in housing and labor markets may equate utility across areas for marginal migrants without doing so for infra-marginal migrants.⁴

While life-satisfaction responses may not equal utility, an individual's life-satisfaction at a point in time certainly has an important effect on utility and is an important outcome for researchers to study. The current paper examines the effects of local urbanization and natural

³ For example, persons who grow up near snow-covered mountains are more likely to make investments learning to ski, while persons growing up near warm coasts are more likely to make investments learning to surf. Once such location-specific investments are made, they increase the utility from residing in an area offering complementary amenities.

⁴ This possibility also lends support for the potential efficacy of place-based policies (Partridge and Rickman 2007, 2008; Partridge et al. 2015).

amenities on individuals' self-reported life satisfaction. That these factors might affect well-being is not new, but the approach taken in this paper is novel in many ways and aims to provide additional insights to the existing literature.

Urbanization might affect individual well-being in numerous ways, both positively and negatively (Easterlin et al. 2011). Positive effects of urbanization on well-being might result from agglomeration economies and increased variety and quality of consumption opportunities. Agglomeration economies due to thick labor markets, intermediate input sharing, and knowledge spillovers are thought to increase worker productivity and wages in larger and denser areas (Puga 2010), which could increase life-satisfaction, *ceteris paribus*. Big cities may also offer better and more diverse consumption opportunities for numerous goods such as museums, theaters, music, professional sports, public transit, health care, and specialized restaurants (Glaeser et al. 2001; Borck 2007; Albouy 2008; Berry and Waldfogel 2010). However, urbanization also likely increases living costs, congestion, pollution, traffic, and crime and reduces public greenspace, all of which can make life more unpleasant and decrease life-satisfaction (Smyth et al. 2008; Stutzer and Frey 2008; Berry and Okulicz-Kozaryn 2011; Sander 2011; Ambrey and Fleming 2014; Navarro-Azorín, and Artal-Tur 2015; Steiner et al. 2015). Furthermore, urbanization could affect social capital and alienation (McKenzie 2008), which can affect well-being (Helliwell 2006; Helliwell et al. 2014). The net effect of urbanization on well-being is ambiguous and depends on individual preferences for the good and bad attributes that cities possess. The current paper does not try to empirically sort out the magnitudes of the various mechanisms by which urbanization might affect life-satisfaction. Instead, we focus on the overall effect of urbanization on SWB, which is fundamentally important on its own.

A natural amenity can be broadly thought of as any naturally-occurring locational attribute that makes a location more desirable. Areas with better natural amenities might be expected to increase individual well-being. More generally, researchers have suggested that amenities related to nicer weather have played a central role in regional population redistribution in the U.S., especially from the nation's "Rustbelt", i.e., the older industrial Great Lakes region, to the nation's "Sunbelt", i.e., warmer areas in the South and West regions (Rappaport 2007; Partridge 2010; Rickman and Rickman 2011; Rickman and Wang 2015).⁵

Literature on spatial SWB differentials

Oswald and Wu (2010, 2011) use the BRFSS to show that there are significant differences in SWB across states in the U.S. even after controlling for a large number of individual characteristics. Oswald and Wu (2010) also show that these SWB differences are correlated with state quality-of-life rankings based on hedonic pricing of locational amenities. Specifically, Oswald and Wu (2010) find that states with better quality of life have higher subjective well-being, but they do not examine the relationships with specific amenities. The Oswald and Wu (2010, 2011) state SWB differences appear to be at least somewhat related to climatic differences between the Sunbelt and Rustbelt regions, but they do not provide formal evidence on this.

Natural amenities have also been considered to affect life-satisfaction and well-being by other researchers for other areas. Climate variables, in particular, have received considerable attention in the subjective well-being literature (Rehdanz and Maddison 2005; Brereton et al.

⁵ Faggian et al. (2012) suggest that natural amenities may play a less important role for well-being in Europe than in the USA, but Rodríguez-Pose and Ketterer (2012) find that natural amenities are still quite important determinants of well-being in Europe.

2008; Moro et al. 2008; Fischer et al. 2011; Maddison and Rehdanz 2011; Cuñado and Pérez de Gracia 2013). The literature suggests that both very hot summers and very cold winters reduce life-satisfaction.⁶

Glaeser et al. (2014) show that there are meaningful differences in subjective well-being across metropolitan areas of the U.S. They show that persons in declining urban areas experience lower SWB, and this appears particularly true for those in the nation's Rustbelt. Glaeser et al. (2014) also report regression-adjusted mean SWB levels for selected metropolitan areas showing that the nation's largest metropolitan area, the New York City MSA, had the lowest life-satisfaction level in the country. Other large MSAs like Los Angeles, Chicago, Boston, San Francisco, and San Jose tended to perform poorly as well, though there were some exceptions including Washington D.C. Glaeser et al. (2014) do not systematically examine the effects of population density on SWB. They do briefly examine the effect of log MSA population, but do not find a consistent relationship; they do not examine metro status and size categories such as used in this study. Their analysis also employs MSA-level measures instead of county-level ones.

The literature on spatial differences in subjective well-being across the U.S. is relatively small, and we make several contributions relative to the previous literature. Our approach to measuring urbanization at the county-level combined with controlling for individual characteristics is novel in the literature. A few studies have examined the effects of population density on subjective well-being (Cramer et al. 2004; Moro et al. 2008; Berry and Okulicz-Kozaryn 2011; Florida et al. 2013), but the only other study to do so using U.S. county-level data (Lawless and Lucas 2010) uses county averages to examine correlations and does not control for

⁶ For a given place and season, transitory weather conditions may also affect reported life-satisfaction (Connolly 2013).

individual characteristics. Measuring density at the county-level rather than the MSA-level is important because MSAs typically include both densely populated central areas and low-density suburban areas. Using a single density measure for an entire MSA hides these large differences and may inaccurately describe the relationship between density and SWB. Controlling for individual characteristics like age and education is important to isolate effects due to locational factors. For example, more educated persons may sort into high amenity and high density areas and confound relationships based on area averages. We are also the first researchers to our knowledge to explicitly examine the effects of metropolitan status and size and county-level natural amenities on subjective well-being in the U.S.

Empirical approach

This paper combines individual-level data from the 2005-2010 BRFSS with county-level data on urbanization and natural amenities. The dependent variable is a measure of subjective well-being from the BRFSS. During this time period, the BRFSS asked individuals “In general, how satisfied are you with your life?” Respondents were to choose answers from the following categories: Very satisfied, Satisfied, Dissatisfied, or Very dissatisfied. Our analysis codes the life satisfaction categories from one to four with one being Very dissatisfied and four being Very satisfied, so that our variable is increasing with life satisfaction. A few survey participants either refused or were unsure about how to respond to the life satisfaction question; persons with invalid responses are excluded from the analysis. The analytical sample is also restricted to persons ages 18-85 living in a county that is identifiable in the BRFSS excluding Alaska and Hawaii. The BRFSS identifies a total of 2361 counties across this period but does not identify small counties with very few observations because of confidentiality concerns. The natural

amenity data discussed below are unavailable for Alaska and Hawaii, necessitating their exclusion.

We use ordinary least squares (OLS) regression⁷ to estimate variants of the following equation:

$$LifeSat_{ij} = X_{ij}\beta + Z_j\theta + \varepsilon_{ij}.$$

The dependent variable, $LifeSat_{ij}$, is life satisfaction for person i in county j , X_{ij} includes several individual characteristic variables and Z_j includes county-level variables such as natural amenity and urbanization measures. Individual characteristics are included to control for observable differences in individuals across areas. These include dummy variables for sex, race/ethnicity, five-year age group, marital status, employment status, highest education completed, number of adults in the household, and a continuous variable for the ratio of minor children to adults in the household.⁸ The regressions also include dummies for survey year and month. A full list and summary statistics for individual and county-level variables included in the analysis are reported in Table 1.

The interest in this study is on the effects of urbanization and natural amenities on subjective well-being. We measure urbanization in two separate ways. We first measure urbanization using a continuous variable based on the population density (in thousands of people per square mile) in the county in year 2000. The population density is measured based on the average density experienced by county residents and not the density experienced by the land (Glaeser and Kahn 2004; Rappaport 2008). Specifically, the density measure is computed by

⁷ Results are qualitatively robust to using ordered probit, but OLS permits easier interpretation and is used by Oswald and Wu (2010, 2011) as well.

⁸ We do not include controls for income in our main results, because incomes partially depend on the extent of urbanization. Furthermore, spatial equilibrium theory suggests that local income and wages are jointly determined with the local cost of living and amenities. Since we cannot reliably include a full set of amenities, we choose to focus on the overall effects of urbanization and natural amenities on life-satisfaction.

dividing the resident population for every census-defined block group by its land area and then computing a population-weighted average of block-group population density for each county. In results not shown, we also used the simpler raw density measure that is computed as county population divided by land area, which yielded qualitatively similar results with slightly different magnitudes; these results are available from the authors by request.

Our second approach for measuring the extent of urbanization is based on metropolitan area status and size. Specifically, we use year 2000 county population data and 2003 metropolitan and micropolitan area component classifications (both from the U.S. Census Bureau) to assign each county to one of six categories. We classify metropolitan statistical areas (MSAs) as either small, medium, large, or very large based on MSA population groupings of 0-249,999, 250,000-999,999, 1,000,000-3,999,999 and 4,000,000 or more, respectively.⁹ We also divide non-metropolitan areas into micropolitan areas and non-urban areas. Non-urban areas are defined as areas that are part of neither a metropolitan nor micropolitan area. In the regression results below, non-urban counties are the excluded base group; coefficients for the metro status and size dummy variables are measured relative to this base group.

We examine the effects of six county-level natural amenity measures obtained from the United States Department of Agriculture (USDA) Economic Research Service (ERS) natural amenity database. These are described in McGranahan (1999) and include mean January temperature, mean January sunlight hours, mean July temperature, mean July relative humidity, topography (measured on a scale of 1-21 with higher values indicating a more mountainous land surface), and the percentage of total county area covered by water. Having a warmer and sunnier

⁹ The small and medium MSA size classifications were defined to be consistent with definitions used by the United States Department of Agriculture Economic Research Service. The 4,000,000 population boundary between large and very large MSAs was chosen in part so that there are a reasonable number of MSAs and individual observations in both groups. The results below are qualitatively robust to moderately different boundary definitions.

January is expected to increase life-satisfaction, while having a hotter and more humid July is expected to reduce life-satisfaction. The effect of topography is somewhat ambiguous; more mountainous topography may provide greater consumption amenities but make production more difficult and reduce employment outcomes. Water coverage is expected to provide greater recreational opportunities and increase life-satisfaction.

The later years of our data correspond to the Great Recession of 2007-2009 and the ensuing slow recovery. Year dummies will capture aggregate differences over time, but the economic downturn was more severe in some areas than others. Therefore, we also examine the robustness of our results to including the county annual unemployment rate computed by the U.S. Bureau of Labor Statistics (BLS) in its Local Area Unemployment System (LAUS). Living in a stronger local labor market with lower unemployment rates is expected to increase well-being. Empirical evidence routinely finds that being unemployed reduces individual subjective well-being (e.g. Clark and Oswald 1994; Winkelmann and Winkelmann 1998; Oswald and Wu 2011), but there is also evidence that the local unemployment rate in an area reduces the well-being of its residents, even among those who are currently employed (Helliwell and Huang 2014). This latter effect could be because of increased risk of becoming unemployed or increased perception of unemployment risk.

Empirical results

We estimate the SWB equation for several regression specifications that include different sets of control variables in order to examine the sensitivity of the results. All regressions include month and year dummies and cluster standard errors by county.

Results for urbanization measures

Table 2 presents the results for the effects of urbanization on subjective well-being. We report results for the two measurement approaches in panels A and B. Results for the population density variable are reported in panel A, and results for the metropolitan area status and size dummies are reported in panel B. Each panel includes regression results for four specifications with differing variables included. Columns 1-3 include only one of the two approaches to measuring urbanization, and column 4 includes both the population density and the metro status and size dummies jointly. Column 1 includes the urbanization measure(s) but excludes all other variables except for month and year dummies. Column 2 adds the individual controls. Column 3 adds the county unemployment rate and the natural amenity variables as controls (results for natural amenities are reported separately in Table 3). Column 4 includes both sets of urbanization measures along with all other variables in previous columns.

The results in Panel A suggest that urbanization as measured by county population density has a negative effect on an individual's subjective well-being. The coefficient is negative and statistically significant in all four columns. Interestingly, the coefficient does fall when individual controls are included, e.g. the coefficient falls from -0.0020 in column 1 to -0.0014 in column 2. This suggests that studies using aggregate data that do not control for individual characteristics may produce inaccurate results because of differences in individuals across areas. The specification in column 3 that also includes amenities and the unemployment rate yields a coefficient for population density of -0.0013. Adding the metro status and size dummies lowers the population density coefficient to -0.0011, but these are both measures of urbanization, so column 4 partials out some of the urbanization effect. Still, it is quite notable that the negative effect of density on SWB largely remains when controlling for city size.

Panel B examines the effects of the metro status and size dummies; the omitted base group is non-urban counties. With no controls in column 1, it appears that the relationship between urban utility and urban size has an inverted U-shape. Specifically, the highest well-being occurs in micropolitan areas (0.0158), small metro areas (0.0236), and medium metro areas (0.0159); large and very large metros are not statistically different from non-urban areas. However, controlling for individual characteristics in column 2 generates coefficients that are largely decreasing in urban size. Micropolitan areas and small metropolitan areas have small negative coefficients that make them statistically indistinguishable from non-urban areas. The coefficients are significantly negative for medium metros (-0.0080), large metros (-0.0146), and very large metros (-0.0210). Controlling for the county unemployment rate and natural amenities increases the magnitude of the metro status and size coefficients, and the micropolitan dummy is now significant with a coefficient of -0.0047; the coefficients for medium, large, and very large metros are -0.0141, -0.0212, and -0.0262, respectively. Adding the county population density in column 4 reduces the metro status and size coefficients, and the micropolitan dummy is no longer statistically significant. The coefficients for medium, large, and very large metro areas are still statistically significant but are reduced in magnitude to -0.0114, -0.0171, and -0.0145, respectively. The decrease is largest for very large metro areas suggesting that much of the negative effect of very large cities on SWB in column 3 is due to the adverse effects of density. Of course, the results in column 4 should be interpreted carefully since we are including two competing measures of urbanization.

Collectively, the results in Table 2 suggest that both population density and metropolitan area size significantly reduce individual life-satisfaction. There is considerable disagreement in the previous literature as to how cities affect the well-being of those living in them (Albouy

2008; Sander 2011; Glaeser et al. 2014). Cities certainly possess a number of both positive and negative attributes, but the empirical results in Table 2 suggest that living in dense and heavily-populated areas has an overall negative effect on an individual's subjective assessment of their own well-being.¹⁰ We do not explore the specific attributes of cities that are driving this overall negative effect, but this is an issue worthy of future exploration.

The negative effects of urbanization on SWB also raises the question of why so many people live in cities. The answer likely depends in part on the uncertain relationship between SWB and utility. One possibility is that SWB is a component of utility that is partially substitutable with other factors as suggested by Glaeser et al. (2014). If so, people may live in large and dense cities because doing so allows for greater wealth accumulation, human capital accumulation, social status, and accomplishments that both affects SWB and is substitutable with it. This is in contrast to arguments that people live in large and dense cities because of greater consumption opportunities and quality of life. Alternatively,

Results for natural amenities

The effects of natural amenities on life-satisfaction are reported in Table 3. Column 1 includes the six natural amenity variables but excludes all other variables except for month and year dummies. Column 2 adds the individual controls. Column 3 adds the county unemployment rate and all of the urbanization measures as controls.

The coefficient estimates for the natural amenity variables do vary somewhat across specifications, but there are some commonalities as well. The coefficients for January temperature and January sunlight conform to expectations for all specifications, that is, they are

¹⁰ Recall that these results do not control for income because higher incomes are one of the main benefits of urbanization. We consider the effects of controlling for income in sensitivity analysis below.

positive and statistically significant, suggesting that warmer and sunnier Januaries increase life-satisfaction. This is consistent with previous literature showing that people have been moving to areas with nicer weather (Rappaport 2007; Partridge 2010; Rickman and Rickman 2011; Rickman and Wang 2015). Interestingly, the coefficient estimates for January temperature in column 3 (0.0011) is twice as large as in column 1 (0.0005) with no controls. However, the coefficient for January sun decreases moving from column 1 (0.0002) to columns 2 and 3 (0.0001 for both).

The coefficient for July temperature is statistically significantly negative in columns 1 as expected, but it is not statistically significant in columns 2 or 3. The lack of robustness prevents one from drawing strong conclusions about the effects of July heat on life-satisfaction. Similarly, July relative humidity is significantly negative in column 1 (-0.0005), but the effect decreases in magnitude and becomes statistically insignificant in columns 2 and 3.¹¹ Topography has a negative coefficient in all specifications but is never statistically significant, preventing us from making strong conclusions. The percent of water area is also statistically insignificant in all specifications.

Further sensitivity analysis

We next further consider how sensitive the results are to alternative specifications and samples. Table 4 presents some additional results for both urbanization measures and natural amenities. Column 1 reproduces results for the “base specification” with all of the variables

¹¹ The amenity variables are moderately correlated, and multi-collinearity issues could hinder their explanatory power, e.g., for July temperature and humidity. However, the pairwise correlation coefficients are all less than 0.6 and we have a reasonably large number of counties (2361), so multi-collinearity is likely not a major issue as indicated by the relatively small standard errors.

included thus far, including both sets of urbanization measures simultaneously; this corresponds to column 4 of Table 2 and column 3 of Table 3.

Column 2 of Table 4 examines the effects of controlling for individual income using interval-coded survey responses in the BRFSS. It is certainly possible that higher ability (and hence higher income) individuals may differentially sort into areas based on the extent of urbanization and natural amenities. However, we also recognize that higher incomes are one of the main benefits of urbanization, and controlling for income hinders our ability to interpret the coefficients on our urbanization measures as reporting overall effects. Examining the results in column 2, we see that the population density coefficient is still significant and unchanged in magnitude (-0.0011). However, the metropolitan status and size dummy coefficients are significantly affected. The coefficients become more negative, and are strongly increasing in magnitude with metropolitan area population. For example, very large metro areas have a very large coefficient of -0.0563.

The January temperature coefficient is slightly reduced (from 0.0011 to 0.0010) by controlling for income but it is still statistically significant. However, the coefficient for January sunlight is reduced and becomes statistically insignificant. The lack of robustness for January sunlight hinders our ability to make strong inferences about its effect on subjective well-being. The other natural amenities remain statistically insignificant.

The results are somewhat sensitive to controlling for income, but controlling for one of the main benefits of urbanization may be inappropriate if we are not also controlling for the costs of urbanization like higher cost of living, increased congestion, etc. Controlling for cost of living at the county level is complicated by lack of data on non-housing prices and differences in user costs between home-owners and renters (Winters 2009, 2013), so we make no attempt to do so

but this could be an area for future research. There are many possible urban amenities and disamenities and including all possible relevant characteristics is not feasible. Thus, our preferred approach in this paper is to focus on the overall effects of urbanization and natural amenities on subjective well-being. As such, our preferred results do not control for income since doing so would partial out a major benefit of large dense cities. However, it is worth emphasizing that controlling for income does not change the directional effect of urbanization on subjective well-being; it only intensifies the magnitudes of the negative effects for city size that we observe.

Column 3 of Table 4 examines of the effects of limiting the sample to years 2005-2006. The primary motivation for doing so is to recognize that the housing crash, economic recession, and generally sluggish economy experienced during years 2007-2010 affected some areas more than others. Restricting to years 2005-2006 reduces the magnitude of the density coefficient to -0.0009, but it is still significant. The metro status and size coefficients are largely unchanged except that the coefficient for very large metropolitan areas increases in magnitude from -0.0145 to -0.0179. The January temperature coefficient of 0.0010 is again significant and the coefficient for January sun is unchanged from the base specification. The other natural amenities are again statistically insignificant.

Conclusion

Most individuals care about both their own well-being and the well-being of others. Researchers and policymakers are interested in how various factors affect individual well-being, in part because they are interested in improving the well-being of others. However, there is still limited knowledge about what factors actually improve individual well-being. Locational factors

have been hypothesized to affect well-being, but the previous literature offering empirical evidence is quite limited, especially for the U.S. This paper examines the effects of county-level measures of urbanization and natural amenities on subjective well-being using individual-level data from the BRFSS.

We find evidence consistent with expectations that more extreme climate conditions reduce subjective well-being. Specifically, warmer winter months consistently increase life satisfaction, and there is some evidence that January sunlight increases life satisfaction and hotter summer months reduce life satisfaction. Mobile individuals are expected to seek out areas offering them the highest well-being, so these spatial differences in SWB by climate suggest that the long-term U.S. population redistribution to areas with nicer weather, especially those with warmer winters, is likely to continue for the foreseeable future.

The primary contribution of this paper, however, relates to the effects of urbanization. Living in an urban area conveys a number of both costs and benefits. The results in this study suggest that large and densely populated urban areas have negative net effects on individual life-satisfaction; that is, living in cities on average makes people in the U.S. less satisfied. Negative effects on SWB are found from both county population density and metropolitan area size. The implications of this paper depend in part on how individuals' responses to the SWB question relate to their overall well-being and utility. To the extent that utility and SWB are distinct, individuals may tolerate lower SWB in large and dense urban areas because of the additional sources of utility that doing so confers such as greater human capital accumulation and accomplishments that affect both present and future life-satisfaction.

The results in this study should also be of interest to policymakers. Public policies that constrain the population and density of urban areas may be able to improve individual life-

satisfaction, for example, by reducing congestion, pollution, and time spent commuting.

However, there is still much that is unknown about the exact causes of the negative urban effects and these should be explored in future research to improve our understanding and help shape policy. Effective policy may be better directed towards treating the underlying causes of dissatisfaction rather than imposing crude constraints on urban size, density, and growth. More generally, policy should continually aim to improve well-being by both better leveraging the benefits of cities such as higher productivity and human capital accumulation and minimizing the costs that urbanization creates.

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Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Life satisfaction	3.387	0.631	1	4
Population density (in thousands per square mile)	3.840	7.461	0.0004	126.76
Microropolitan (In a microropolitan area)	0.176	0.381	0	1
Small metro (In metro area w/ population less than 250,000)	0.151	0.358	0	1
Medium metro (In metro area w/ population 250,000-999,999)	0.221	0.415	0	1
Large metro (In metro area w/ population 1,000,000-3,999,999)	0.202	0.401	0	1
Very large metro (In metro area w/ population 4,000,000 or more)	0.147	0.354	0	1
January mean temperature	33.600	11.547	1.4	67.2
January mean sunlight	149.226	41.212	48	266
July mean temperature	74.781	5.569	55.6	93.7
July mean relative humidity	56.783	15.995	14	80
Topography	9.543	7.002	1	21
Percent water area	8.198	13.687	0	75
County unemployment rate	6.493	2.833	1.7	29
Black	0.083	0.276	0	1
Asian	0.012	0.108	0	1
Hispanic	0.062	0.241	0	1
Native American	0.013	0.113	0	1
Other non-white	0.015	0.120	0	1
Female	0.621	0.485	0	1
Ages 23-27	0.035	0.185	0	1
Ages 28-32	0.054	0.226	0	1
Ages 33-37	0.069	0.253	0	1
Ages 38-42	0.081	0.272	0	1
Ages 43-47	0.093	0.290	0	1
Ages 48-52	0.107	0.309	0	1
Ages 53-57	0.111	0.314	0	1
Ages 58-62	0.110	0.313	0	1
Ages 63-67	0.096	0.294	0	1
Ages 68-72	0.079	0.270	0	1
Ages 73-77	0.066	0.249	0	1
Ages 78-82	0.053	0.224	0	1
Ages 83-85	0.022	0.146	0	1
Highest education: some high school	0.061	0.240	0	1
Highest education: high school diploma	0.293	0.455	0	1
Highest education: some college	0.266	0.442	0	1
Highest education: bachelor's or higher	0.349	0.477	0	1
Married	0.567	0.495	0	1
Divorced	0.143	0.350	0	1
Widowed	0.120	0.325	0	1
Separated	0.022	0.146	0	1
Partner	0.024	0.152	0	1
Self-employed	0.085	0.278	0	1
Unemployed	0.048	0.213	0	1
Homemaker	0.077	0.266	0	1
Student	0.018	0.133	0	1
Retired	0.253	0.435	0	1
Can't work	0.067	0.250	0	1
Two adults in household	0.544	0.498	0	1
Three or more adults in household	0.092	0.290	0	1
Ratio of kids to adults in household	0.328	0.633	0	16

N=1,942,490

Table 2: Effects of Urbanization Variables on Life-Satisfaction

	(1)	(2)	(3)	(4)
<u>A. Density Measure</u>				
Population density	-0.0020*** (0.0006)	-0.0014*** (0.0004)	-0.0013*** (0.0004)	-0.0011*** (0.0003)
Individual Controls	No	Yes	Yes	Yes
County Unemployment Rate	No	No	Yes	Yes
Natural Amenities	No	No	Yes	Yes
Rural-Urban Dummies	No	No	No	Yes
<u>B. Metro Status and Size Measures</u>				
Micropolitan area county	0.0158*** (0.0046)	-0.0009 (0.0029)	-0.0047* (0.0027)	-0.0038 (0.0027)
Small metropolitan area county	0.0236*** (0.0047)	-0.0007 (0.0031)	-0.0045 (0.0031)	-0.0027 (0.0031)
Medium metropolitan area county	0.0159*** (0.0056)	-0.0080** (0.0033)	-0.0141*** (0.0030)	-0.0114*** (0.0030)
Large metropolitan area county	0.0075 (0.0075)	-0.0146*** (0.0035)	-0.0212*** (0.0032)	-0.0171*** (0.0033)
Very large metropolitan area county	0.0006 (0.0088)	-0.0210*** (0.0047)	-0.0262*** (0.0047)	-0.0145*** (0.0049)
Individual Controls	No	Yes	Yes	Yes
County Unemployment Rate	No	No	Yes	Yes
Natural Amenities	No	No	Yes	Yes
Population Density	No	No	No	Yes

Notes: The sample is restricted to persons ages 18-85 living in a county that is identifiable in the BRFSS. All regressions include month and year dummies. The omitted metro category in Panel B is “non-urban” counties that are part of neither a metropolitan nor micropolitan area. Standard errors are clustered by county.

*Statistically significant at 10% level; **Significant at 5% level; ***Significant at 1% level.

Table 3: Effects of Natural Amenities on Life-Satisfaction

	(1)	(2)	(3)
January mean temperature	0.0005** (0.0002)	0.0009*** (0.0001)	0.0011*** (0.0001)
January mean sunlight	0.0002*** (0.0001)	0.0001*** (0.00003)	0.0001*** (0.00003)
July mean temperature	-0.0015*** (0.0006)	-0.0001 (0.0003)	-0.0002 (0.0003)
July mean relative humidity	-0.0005*** (0.0001)	-2.3E-05 (0.0001)	-1.4E-05 (0.0001)
Topography	-0.0002 (0.0004)	-0.0001 (0.0002)	-0.0002 (0.0002)
Percent water area	0.00003 (0.0002)	-0.0001 (0.0001)	0.0001 (0.0001)
Individual Controls	No	Yes	Yes
Urbanization and Unemployment Rate	No	No	Yes

Notes: The sample is restricted to persons ages 18-85 living in a county that is identifiable in the BRFSS. All regressions include month and year dummies. Standard errors are clustered by county.

Significant at 5% level; *Significant at 1% level.

Table 4: Results for Alternative Specifications

	(1) Base Specification	(2) Controlling for Income	(3) Only Years 2005-2006
County population density	-0.0011*** (0.0003)	-0.0011*** (0.0003)	-0.0009** (0.0004)
Micropolitan area county	-0.0038 (0.0027)	-0.0108*** (0.0026)	0.0005 (0.0044)
Small metropolitan area county	-0.0027 (0.0031)	-0.0172*** (0.0030)	-0.0019 (0.0048)
Medium metropolitan area county	-0.0114*** (0.0030)	-0.0323*** (0.0032)	-0.0123** (0.0050)
Large metropolitan area county	-0.0171*** (0.0033)	-0.0457*** (0.0032)	-0.0172*** (0.0054)
Very large metropolitan area county	-0.0145*** (0.0049)	-0.0563*** (0.0045)	-0.0179** (0.0071)
January mean temperature	0.0011*** (0.0001)	0.0010*** (0.0001)	0.0010*** (0.0002)
January mean sunlight	0.0001*** (0.00003)	0.00003 (0.00003)	0.0001*** (0.00004)
July mean temperature	-0.0002 (0.0003)	0.00020 (0.0003)	-0.0002 (0.0004)
July mean relative humidity	-0.00001 (0.0001)	-0.00002 (0.0001)	0.00004 (0.0001)
Topography	-0.0002 (0.0002)	-0.0001 (0.0002)	-0.0003 (0.0003)
Percent water area	0.0001 (0.0001)	0.00002 (0.0001)	0.0001 (0.0001)
Individual Controls and Unemployment Rate	Yes	Yes	Yes

Notes: The sample is restricted to persons ages 18-85 living in a county that is identifiable in the BRFSS. All regressions include month and year dummies. Standard errors are clustered by county.
 Significant at 5% level; *Significant at 1% level.