The Objective vs. Subjective Debate

One of the central debates in the quality of life literature revolves around whether the indicators used to measure quality of life are "subjective" or "objective" in nature and understanding the division among the literature is a useful starting point for any attempt to create a quality of life measure particularly one designed to be used as a metric of success.

In the literature objective measures are defined as being based on aggregate population data have been advocated by such measures as the UNDP (2008) in their Human Development Index, and the World Bank (2009) in their World Development Indicators. Measures such as life expectancy, adult literacy rates, student enrollment ratios, and gross domestic product per capita are used to create the Human Development Index. The reasoning behind using these measures is based in the belief that the use of quantifiable aggregate measures of economic, social, health or other indicators are sufficient to gauge the quality of life for a given population. Their usage and efficacy also rest on the assumption that the indicators that are being measured are objective in the sense that they are universally seen as desirable attributes.

On the other hand, subjective measures, such as those advocated by Brooks and Gill, place the measurement of quality of life in the psychological realm of satisfaction and overall happiness, which is only definable by the individual and thus can only be measured by the use of surveys to individuals. Instead of measuring what they believe to be the most important indicators of quality of life like the UNDP and World Bank do, they instead pose more open questions to the individual, which allows the respondents to express their perceived level of life quality without any bias or value weighting. For example, Gill proposes using surveys that ask the respondent to mark their level of overall quality of life on a scale of 0-100 (p681). This allows for the respondents to create their own value weightings for all the inputs into their lives; it is subjective to the respondent. These results may be statistically combined to draw conclusions about the aggregate population.

The literature however suggests the division might be less clearly delinated than a first blush might suggest. Costanza et al asset that these differences between the two types of measuring are not as deep as they appear. They claim that these "so-called "objective" measures (of quality of life) are actually proxies for experience identified through "subjective" associations of decision makers;" and thus "the distinction between objective and subjective indicators is somewhat illusory" (Costanza et al, 2008 p.18).

Another aspect of the debate surrounding the objective and subjective issue focuses on the differences in what is actually being measured. The objective measures represent environmental indicators that imply the possibility of having a good quality of life, while not asserting that their mere presence guarantees it. They represent what most people see as necessary conditions for a high quality of life, but they in themselves do not represent a sufficient condition for having a high quality of life. The subjective, micro measures on the other hand only measure a person's psychological perception of satisfaction and life quality, which may be independent of environmental conditions considered in the objective measures.

The Economist Intelligence Unit's quality-of-life Index (2005), which attempted to merge the traditional objective measures of economic and health data with subjective survey data taken as a sample of an area. They were able to successfully use both

aggregate population data and survey data to draw their conclusions. Both aggregate population measures and individual level preference based data are necessary in order to be able to draw connections of life quality in the population as a whole.

This controversy has lead to what Lieske explains as the major research issues in life quality studies tendency "…to revolve around its measurement, the magnitude of differences from one city to the next, and patterns of regional variation. As a consequence, most quality of life studies have been largely descriptive and either unable or unwilling to provide much theoretical or empirical insight into the determinants of life quality differences" (Lieske, 1990 p.43).

The purpose in building a quality of life index should be to explore the substantive effects of quality of life as suggested by Lieske. This reality suggests the necessity of including only those indicators that theoretic basis for affecting the outcomes, and life quality experienced by individual citizens. In what follows I review the relevant literature for each of the sub-indicators, and explore how variation in those indicators should affect life quality.

The Literature on Quality of Life

Scholars of economics, sociology, political science and social psychology have all attempted to define and effectively quantify their definitions of quality of life in order to make meaningful observations of society and to formulate policy prescriptions.

The literature on quality of life touches many areas of interest; unfortunately most of it has failed to connect the overlapping indicators and methods from the various fields with each other to achieve a consensus on a definition of quality of life and how to measure it. I have examined many of the past indexes that had been created by other researchers. Each researcher found distinct aspects to include in the index, often based on what the research was intended to study

Lambiri et al, compiled most of the significant studies and analyzed their similarities. According to Lambiri et al (Labiri et al, 2006), the indicators can be formed into six different classifications:

> natural environment (climate, state of natural environment, etc.), built environment (type and state of building, etc.), socio-political environment (community life, political participation, etc.), local economic environment (local income, unemployment, etc.), cultural and leisure environment (museums, restaurants, etc.), public policy environment (safety, health care, education provision, etc.). (pg. 9)

I found these distinction useful in examining what the different studies used to measure the quality of life. Using this classification system as a model, I chose to examine other indexes and formed five classifications: public safety, health, infrastructure, education, economic environment, and other (anything included in the index that did not fit within the other four categories).

Public Safety

In many of the quality of life indicators I observed that most public safety measures included some element regarding crime. Most found some way of representing the amount of violent crime in the area: Graves (Graves, 1976) used the number of violent crimes per 100,000; Rosen (Rosen, 1979) simply uses the total crime rate; Blomquist et al (Blomquist et al, 1988), Ceshire and Hay (Ceshire and Hay, 1989), Stover

and Leven (Stover and Leven, 1991), Ready, Burger and Blomquist (Ready Burger, and Blomquist, 1997), Nzaku and Bukenya (Nzuku and Bukenya 2005) (even though they place this measure in an "amenities" category), and Shapiro (Sharpiro, 2006) all use a measure of violent crime in the area to measure public safety. *The Economist* (2005) uses a measure of political stability and security to measure the public safety between countries in their index.

Most indexes, simply include some measure of the frequency of crime, generally specified to be violent crime, as the standard of measurement for public safety of an area.

Health

The measure for health in quality of life indexes was less uniform than the public safety measurement. Although a common theme was to use mortality rates or life expectancy, this is certainly not the only way that researchers chose to examine this element of quality of life.

 Calvert and Henderson chose to use a composite that includes the infant mortality rate, the life expectancy rate, and self-reported health. (Henderson Lickerman and Flynn, 2000) The Economist (2005) uses the life expectancy at birth in years for the health indicator. While Suffian simply uses the infant mortality rate (Suffian, 1993). Agostini and Richardson combine infant mortality, child mortality, and maternal mortality to measure public health (Agonstini and Richardson, 1997).

Infrastructure

There was not a large consensus through the literature of what a viable form of representation can be attributed to infrastructure. In general, the indexes attempt to quantify this by examining three things: population characteristics, available utilities, and housing characteristics.

Both Rosen and Roback examine the population size, and the population density, but uniquely include central city population and population growth rate, respectively (Rosen, 1979, Roback 1982). While Nzaku and Bukenya use a composite that includes population density with age of the population, non-white population, owner-occupied housing, per capita tax rate, distance to metro area, and road density (Nzaku and Bukenya, 2005). Still other indexes include a measure of the available facilities for the treatment of water, sewage, or landfills. (Blomquist et al, 1988, Stover and Leven, 1991, Ready, Burger and Blomquist, 1997, Henderson Lickerman and Flynn, 2000)

Education

Roughly half of the indexes that I examined included some measure of educational quality. The most common way to represent this was including a measure of the ratio of students to teachers. (Blomquist et al, 1988, Gyuurko and Tracy, 1991, Stover and Leven, 1991 Stover and Leven 1992, Ready Burger and Blomquist, 1997) Other studies include input-based measurements like cost-adjusted per pupil, and library circulation in number of books (Schmidt and Courant, 2006). Others look at outputs of education: percent of children in secondary school (Suffian, 1993), or mean year of schooling, number of 16-year-olds enrolled in school, and college and post-college graduates (Agostini and Richardson, 1997). Calvert and Henderson created a composite variable made of educational attainment levels, educational expenditures, literacy rates, access to education, distribution, segregation, discrimination, lifelong learning, and alternative education. (Henderson Lickerman and Flynn, 2000)

Economic Environment

This variable quantifies the state of the economic environment within the area. Most indexes use different indicators to attempt to capture this. The Economist (2005) used GDP per person and percent unemployment; Roback uses the unemployment rate, as does Rosen although Rosen includes population growth as part of the index (Roback, 1982, Rosen, 1979). In contrast, Agostini and Richardson capture the economic environment using the real per capita income. (Agostini and Richardson, 1997).

Other Indicators

Although many of the indexes examined had variables that fit well within these categories, there were usually a few that did not. Some used a variety of different indicators, but there were a few similar indicators that repeatedly showed throughout the literature. One of the most prevalent indicators was weather and environment in general. Many indexes examined the amount of pollution, the type of weather, the location, or other positive aspects of the natural environment.

Many indexes also included other factors beside weather and natural environment. Many tried to capture a social environment, like Shapiro who measured the number of restaurants in an area, or the number of professional sports teams in the city area by Ginneas (Shapiro, 2006, Ginneas, 1998). Florida attempts to measure the many unconventional aspects of an area, including the homosexual population, the number of bars and nightclubs, the amount nonprofit art museums and galleries, the number public golf courses among a host of other factors (Florida, 2002).

These factors which seek to extend the explanation of quality life beyond my five included indexes, and the natural environment (see Appendix One) are not particularly useful and in my opinion should not be included in quality of life metric as they are not consistently included across studies of quality of life, and represent indiosyncratic conceptions of what life quality is.

Where the Rubber Meets the Road: Deciding what to include;

Despite the relative consistency, which emerged from the meta-analysis conducted by Lambiri and from my own review of the mechanics of the various quality of life indexes deciding what to actually include is substantially more complex.

This problem is somewhat compounded by problems of data availability as well as a the fundamental problem faced by scholars of Life Quality, namely that quality of life has both a retrospective and prospective component. Individuals consider their life condition boht in terms of what they have experienced and by what they expect to experience in the future. While this approach is clearly a more accurate description of how individuals view their life quality it presents unique methodological problems that cannot be ignored in any attempt to measure life quality in a meaningful way .

In the appendix to this document I provide a short justification for a Life Quality Index premised on each of five core area's that I believe is a useful approach to measuring life quality in the United States.

These categories which emerged from the literature are; Education, Health, Public Safety, Infrastructure, Economic Development. In each case I suggest a two-fold approach to measuring life quality that focuses on service availability (potential in the private and/or public market) and outcome measures.

<u>Constructing the Index:</u>

I believe that indexes should enable comparability and so should be designed to maximize variation and comparisons between observations as well as individual observations across time.

I suggest a three-step procedure to scale data into this index, for each variable I converted the actual value to a scale from 0 to 1. To accomplish this scaling I used the well-tested and verified metric of the United Nations Human Development Index. This method uses the maximum observed value, the minimum observed value, and the actual observed value for each observation to scale the data. The basic formula is $\frac{(Observed\ Value - Minimum\ Value)}{(Maximum\ Value - Minimum\ Value)}$. Using this scaled value which represents where each observations value for a particular variable falls within the full universe observations, allows for direct comparability within the data set, without any further calculations. From this calculation we know that a value of 1 is the maximum value, and a value of 0 is the minimum value, and between those values lies most of these observations. Because I convert each variable to this scale I am no longer measuring the actual results of a particular variable but rather the counties score in relation the maximum and minimum observed for that value. This becomes important to the next step, where I aggregate the data into sub-indicators.

Because the scaled variables now represent a ranking they can be aggregated using simple averages, and for each sub indicator aggregate those values by taking an average of the counties core on each of the variables included. The formula I suggest employ uses S as the scaled value of the individual variable, and X as the total number of variables included in the sub-indicator. After taking the average the data is scaled using the above formula to obtain the value of the sub-indicator.

Using the value of the sub indicators the value of the overall indicator and quality of life score can be calculated using the same mechanism.

This methodology is has the benefit of being remarkably simple and allowing disparate data to be combined into a commons scale, but does it meet the requirements for a good scale. The first concern is one of reliability however, by applying the formulas consistently the results are identical in every case that identical date are used. A second criterion for a good scale is comparability, using this set of rules for scaling the results can be directly compared between each observation and across time. I third criterion is that they must be severable, and because of how each individual piece of data is scaled before aggregating the values one can compare counties using any subpart of the scale. A fourth criteria is repeatability, by using commonly available census data that is gathered often, and providing a clear delineation of how that data are scaled together this approach is easily repeatable. I would also add two additional criteria that I feel are essential to a good scale, openness and parsimony. All of the data should commonly available through non-proprietary sources, and a relatively small number of variables should be used to create the scale.

Validating the Index:

The goal of creating a quality of life index (or really any index) must be validity. Quality of life is such a broad area of research and therefore, its research results can prove lacking and uninformative.

A critical part of any index are the data collected. First off, the data must be relevant to the various indicators. Next, the data must be applied and correlated to understand the meanings. Without application, data is just a long sheet of numbers.

Finally, the data must be uniform, thus ensuring the quality of the information gathered and the ability to analyze and understand its meaning.

Once the data are collected, a valid index must be able to analyze that data and draw conclusions from it. The data found in quality of life study indices can be used for a wide variety of purposes. Politicians can use them make better public policy choices, businesses can use them for marketing purposes, and academics can use them for research. If the data does not explain anything, it is of little use. Thus, the data must be presented in a way that it is informative. The methods used to construct the quality of life index must also be easy to understand and replicate. In order to facilitate the use of the information, the index needs to be organized and well structured for further analysis and use.

Any index, including my own, must be viewed skeptically. At the heart of the scientific method and index building is the need for validation. Indexes can be plagued with measurement problems that center on whether they are actually measuring what they purport to be measuring. The prelude to testing whether an index is measuring what it claims to measure is to validate its methodologies.

The methodology for calculating quality of life scores yields a reliable and repeatable index. This index can be calculated using commonly available data, where as all parts of the index are separable. As discussed above, meeting these requirements is of paramount importance, if the data is to be used to explain phenomenon in the real world.

While methodological rigor is important, even the most rigorously constructed index can fail if it does not measure what it purports to. Indexes that fail in this regard are doubly problematic. Because their construction methodology is sound, often times they are accepted at face value and assumption is made that the results can in fact be used in the way the authors claim.

The preference then, as it is for most scholars, is to validate that the index is indeed measuring what it claims to. I suggest a three-prong approach to validating an index. First, any index that claims to measure a social phenomenon must begin with a strong theoretical explanation to back up why the data included in the index is in fact a component of or a proxy for what is being measured. Second, the data included in the index should scale together using some commonly accepted approach to analysis, such as confirmatory factor analysis. (Confirmatory analysis is preferable to exploratory because it can rely on theory and is rooted in hypothesis test that is falsifiable). Finally, independent tests of the theoretical links such as secondary data analysis or experimental tests should validate the construction of the index.

Appendix A: Indicators

Education

The quality of an education system in a county is a telling indicator of the quality

of life in that area. And since quality of life is so connected to education, its quality is an

indicator of what the future will hold for an area. Areas with better education systems

have been shown to have higher levels of educational attainment, and as a consequence, higher income (Baum & Ma, 2007). Better health outcomes are also attributed to higher levels of educational attainment and income than those who are less educated and poorer (Pincus et al, 1998).

In my measure of education as an indicator of overall quality of life, I capture a measure of the availability of educational services. I look at the services that are offered in public schools in order to determine if the schools are fulfilling the educational needs of the largest number of students possible. One of the programs that I measure is the availability of college preparation courses like Advanced Placement, International Baccalaureate, or concurrent enrollment for college credit while still in high school. This allows us to capture a measure of the needs fulfillment for advanced students that could be held back from reaching their potential if these courses are not offered and they are kept with the bulk of the students in classes that don't challenge them.

I also capture a measure of the needs fulfillment of the students in a school system that may need extra assistance to succeed. The availability of a Limited English Proficient (LEP) program is measured to account for the ever-growing number of students who need extra help with English due to the diversity of home-spoken languages. In addition, I measure the availability of special education services to help those students with special needs.

Also in my measure of service availability for education, I measure the access that people in a particular county have to higher education. There is a myriad of literature on the benefits of higher education to individuals and society (Baum and Ma, 2007) and the citation here of the full literature would be superfluous. I assume and the literature

concurs that the proximity and availability of higher education make taking advantage of

its benefits easier for the local population and it is a positive attribute to have access to

higher education. As education system becomes increasingly competitive in attempts to

capture previously untapped markets, new technologies and efforts are being made to

make higher education available to increasingly isolated places (Hanna, 1998). I expect to

see access to higher education to continue to expand to the benefit of the local citizens in

most counties.

The final measures of availability that I used are of the presence of charter schools

in a county, as well as other education services offered such as private schools. The

presence of charter schools is measured by the annual survey done by the National Center

for Education Statistics and the measure of other education services is obtained from the

U.S. Census data. The presence of either or both of these indicators represent efforts by

the local government and population to offer services that can be invaluable to those that

take advantage of them. While charter and private schools are not designed to be to the

benefit of everyone, those who wish to take advantage of their service often feel it is very

important and can strongly influence their academic performance. It is also claimed by

some that the presence of choices within the education system is healthy as it usually

fosters competition (Forster, 2009) and increased efficiency with funding (Herzberg &

Fawson, 2004).

If an area has a good education system, many studies assert they should have

positive outcomes from that system to show for it (Baum & Ma, 2007). In the attempt to

determine if an area has these positive outcomes, I use a number of different indicators to

measure the education system's impact. I first looked at the dropout rate in the local

secondary schools. A student is defined as a dropout if they are between the ages of 16 and 19, have not graduated from high school and are not enrolled. Those who fit this category have either failed the system or been failed by the system, neither of which tells of a promising quality of life in an area. I expect to see a lower dropout rate in areas with better education systems.

Another outcome of a good education system is the number of persons enrolled in higher education. I use U.S. Census data to get this indicator that measures all the previous year's high school seniors who are enrolled in higher education and also the number of any others who are enrolled in higher education in the county. This allows us to see both the level of high schools students going on to attend college and also the total number of people enrolled in higher education in a given area.

The final outcome that I captured by this method is the education level of the population in the given county. Using U.S. Census data I was able to capture the percent of the population that has graduated from high school, the percent that has graduated college, and the percent that has obtained an advanced degree. This allows us to determine the level of education of the whole community which is important to understanding how much an area values education and its impacts. I suspect that a higher level of education in the community at large will correlate with the other indicators of quality of life.

Our measure of educational availability, funding, and outcomes gives an effective and telling measure of the education system in a given area. This measure allows us to adequately account for the education system of an area since, as Lyson notes, education

"serves as an important marker of social and economic viability and vitality" (Lyson, 2002, pg.137).

Public Safety

Community-wide safety and peace are important parts of the quality of life for residents. Crime, lack of fire protection, and deficiencies in other services designed to protect the security, well being, and property of individual citizens impact them negatively and reduce their quality of life. In developing a metric for quality of life, it is clear that public safety and security is an essential part of that metric. Public safety involves the prevention of and protection from potential occurrences that could jeopardize the well being or security of the general public.

To understand public safety, it is important to know the benefits of public safety service availability. I focus on two sub-indicators: the availability of police and fire protection in each area. The available data, dichotomous availability, had no explanatory power when compiling the index. Thus, I still believe the availability of these resources important but will only include the funding effort data, which captures availability, in the final data analysis.

Fire services throughout the country are significant in identifying, developing, and promoting ways and means of protecting life and property from fire-related perils, such as house, school, car, and job-related fires, etc. In 2007, "fire killed more Americans than all natural disasters combined" from "an estimated 1.6 million fires" (US Fire Administration, 2008).

Shoup and Madema in their book *Public Finance* discuss the necessity of fire service availability for protection to life and property. The authors also specify fire

service's positive role in contributing to economic development: "Risk, in the sense of relative dispersion of possible outcomes of a venture, is reduced for almost any venture by an increment to fire protection service. All in all, fire protection is clearly one of the most important stimuli to economic growth" (Shoup and Madema, 2005). Clearly the availability of local fire services in each county is necessary in maintaining higher public safety, greater economic growth, and better quality of life for county residents.

The availability of police services in rural counties is an important contributor to the prevention of various types of property and violent crimes towards its residents. Police persons are in charge of maintaining order, enforcing the law, and preventing and detecting crime for the well being and safety of the citizens in their area. Mladenka and Hill discuss the importance of distributing police services evenly among states in order to maintain public safety (Mladenka and Hill, 1978).

In Gyimah's analysis of police production, he uses the crime rate to measure community safety. Although somewhat obvious, his reasoning and empirical data simply show that when "the crime rate is lower in community A than it is in community B, then it is reasonable to postulate that community A is safer than community B" (Gyimah, 1989). I can therefore determine that people will have a higher quality of life with a greater amount of police service protection.

The use of this crime data in the analysis is necessary to arrive at a more accurate measure of quality of life. It is obvious that the less frequent violent crimes occur in each county, the greater the public safety will be. Cebula and Vedder did a quality of life study on how crime affects peoples' decisions when migrating to new areas. They state that "Higher crime rates should lower net benefits obtainable from migration in a number

of ways: loss through theft of property, higher insurance rates, an increase in fear and tension, etc." (Cebula & Vedder, 1973). Thus one can determine that quality of life is usually lower in counties with higher crime rates.

While it is clear that the presence or absence of police and fire protection is important to public safety in a particular area, it tells only part of the story. The whole story can be understood only by examining the availability of funds to provide those services. I consider the availability of funds for these services by using a measurement of per capita expenditures for fire and police services. I use this measure for two reasons. First, while spending of this sort may be subject to the law of diminishing returns, I believe that as more is spent per person on fire and police services, the higher public safety will likely be. Second, it is clear that even in areas with higher crime rates, residents perceive additional police spending as contributing positively to public safety.

According to Charney, "public [safety] expenditures reflect both the quality and cost of providing public services," even if "public [safety] expenditures are not a perfect measure of the quality of public services." For example, a county with high public safety expenditures could signify an area that demands more safety spending, "rather than measuring a high feeling of safety" (Charney, 1993). Even though this is a difficult measure of public safety quality, county residents will still have a greater amount of fire and police protection if more money is spent per capita for these public services.

The amount of countywide per capita expenditures on fire and police services can act as proxies for other county spending on public safety, such as ambulance services and correctional facilities. If the data shows that a county puts a high priority on public safety

by spending more per capita on fire and police services than average, it is presumably true that the county will also spend more per capita on these other public safety services.

For example, spending on ambulance services in rural counties is important for the health and life expectancy of its residents. The service's role is to help maintain the life of the injured/dying until transported to the nearest hospital for emergency care. According to Stults et al, communities served by a basic ambulance service, versus those served by conventional advanced ambulance care, have a lower survival rate (Stults, et al, 1984). From this, one can also verify that counties' public safety will be much lower if access to ambulance services is scarce.

Public safety is a crucial indicator in determining quality of life. Public safety, as defined earlier, involves the prevention of and protection from potential occurrences that could jeopardize the well being or security of the general public. With the optimal amount of public safety service funding per county—in areas such as fire and police services—the greater the safety is of that particular county. I believe that the measurement of these types of services designed to protect the security, wellbeing, and property of county residents is necessary in order to have a valuable quality of life index. I conclude that county residents with greater public safety will also have a greater quality of life.

Infrastructure

Infrastructure that functions efficiently and effectively is another positive attributor to quality of life. Infrastructure is the physical and organizational structures needed for operation of a societal structure or the services and facilities necessary for an

economy to function. Basic infrastructure facilitates economic transactions, allows access to services such as health and education, and provides individuals with the ability to realize their preferences for goods and services across time and space.   Failing to include infrastructure as part of any metric of quality of life quickly renders that metric useless.

Our metric captures the various types of infrastructure that are necessary for individuals to maximize the other indicators of the index and their quality of life. To measure infrastructure I use both service availability and funding effort that is the existence of the infrastructure and the resources devoted to its expansion, maintenance, and replacement.

Measured infrastructure could include a wide variety of public services. I have chosen to use three indicators that I believe capture what is essential to improving quality of life. My metric represents an expansion of earlier work that has primarily focused on the provision of public or quasi-public goods such as highways as infrastructure. I assert that a more expansive definition of infrastructure is necessary. My metric both recognizes the importance of the public or quasi-public goods to infrastructure and adds private or toll goods to the measure of infrastructure.

These indicators—culinary water, grid fuel, and telephone—are measured as the percentage of households with these services directly available in their homes. This penetration metric, which uses end consumer access as a proxy for general service availability, provides a clear picture of the development of infrastructure and allows for differentiation between areas where most residents have access and other areas where most do not.

The systemic availability of culinary water—also known as domestic water, drinking water, or potable water—is a large contributor to the well being of those with the service. Culinary water is the water suitable for human consumption or use in the preparation of food. The study measures the percentage of households per county with culinary water access directly in their homes from a communal source. I conclude that households with culinary water communally available will have a higher quality of life and that counties with higher percentages of culinary water penetration will attract more residents and more development. Howard and Bartram support this assertion, and they indicate that significant benefits are available as culinary water services are more accessible, namely advances in greater public health and sanitation (Howard and Bartram, 2003).

The percentage of grid culinary water availability per county is also a proxy for government involvement and spending in that specific county. Because grid culinary water is primarily a government service, I assert that a greater percentage availability of grid culinary water in a particular county also translates to a greater amount of other government provided infrastructure in that county. For example, municipal solid waste (MSW) services and sewer services, are not recorded in the data but are highly correlated with grid culinary water provision, and because culinary water is highly correlated to the provision of MSW and sewer services, counties with grid culinary water are also likely to provide MSW and sewer services as well.

Sewer systems collect sewage waste from local buildings and are later used to either dispose of or treat the sewage for sanitary purposes. Having available sewer systems provides greater sanitation and health to the community. Likewise MSW

services are also contributors to greater sanitation and health. Furthermore a major source of water used to create culinary water is ground water, and according to Miranda, et al, MSW services are important in reducing groundwater contamination as well as reducing other solid and hazardous waste material (Miranda, et al, 1994).

The second measure of infrastructure availability is the access to grid fuel. Having access to grid fuel is a significant measure of a county's development, and unlike the earlier measure of grid water is likely to be provided through private sources over public ones. Grid fuel is primarily natural gas, although there are other types of grid fuel used less commonly. Having household access to these fuels is a positive measure of residents' quality of life. The benefits of household access include the direct influx of fuel for heating or cooking purposes without having to actively seek the fuel; all the residents must do is adjust a switch and pay a monthly bill.

Rothfarb, et al, in "Optimal Design of Offshore Natural-Gas Pipeline Systems" argues for the importance of a well-organized system in providing natural gas to US households and business, due to their great "depend[ence] on gas for heating and other essential services." The authors discuss the greater availability and reduced cost benefits consumers receive with better developed and systematized grid fuel systems (Rothfarb, 1970). An example of grid fuel benefits was written in an article from *The Cordova Times* of Alaska. The author expands on the potential benefits of expanded grid natural gas —such as convenience, versatility, safety, improved air and health quality, value, and others—for the Cordova residents when a grid fuel system for their rural Alaskan city was implemented (Avezak, 2009).

Our final measure of infrastructure service availability is the household penetration of telecommunication. Although this is not as strong of an indicator as the other two used, I believe it to be a useful measurement nonetheless. Hudson explains very well the quality of life advantages of telecommunication availability:

Telecommunications is a tool for the conveyance of information, and thus can be critical to the development process. By providing information links between urban and rural areas and among rural residents, telecommunications can overcome distance barriers, which hamper rural development. Access to information is key to many development activities, including agriculture, industry, shipping, education, health and social services (Hudson, 1995).

Without telecommunications access, it is more difficult for residents to receive and convey necessary information for their day-to-day transactions. In addition household telecommunications availability also presents access to minimum low-speed internet. Having at least dial-up internet available in the home can provide important communication and information access. Strover states the significance of "adequate connections to advances telecommunications infrastructure and services [for] rural communities…to be able to fully participate in the emerging information economy," in which she includes access to internet (Strover, 2001). With a greater percentage of available telecommunications services, including phone and internet, residents have greater access to communication and information that are essential to increasing quality of life.

While it is clear that the presence or absence of my selected proxies and their penetration rates provides an important picture of the level of development of

infrastructure in a particular county, it tells only part of the story. The rest of the story can be understood only by examining the availability of funds to provide infrastructure. While my first set of measures speaks to the level of development of a county's infrastructure, my second set of measures speaks to the financial resources available for infrastructure and how those resources are being used.

To capture both the presence and absence of infrastructure I also analyzed the funding that is available to each county that could be used to develop infrastructure. I measure this availability both as a function of the total land area in a county and as a per capita measure. This distinction is important as both differences in size and population create differing infrastructure needs. I use utility bonding numbers and transportation expenditures as proxies for the larger suite of infrastructure goods. Using these proxies allows for both a measurement spending on immediate needs—transportation—and longer-term needs—utility bonding. This combination provides evidence for the level investment in infrastructure. Both measures are population controlled to ensure the opportunity of inter-county comparisons.

I measure the public transportation spending per capita for all US counties. Public transportation can include subways, buses, streetcars, light-rail transit, or the most common form of highway funding. Higher spending on all types of public transportation provides a higher quality of life to its residents than do counties with lower per capita spending on transportation. Transportation spending has a myriad of benefits in facilitating business, recreation, social and family, emergency health, and education travel, etc. I believe this measurement to be a valuable quality of life component in that residents will have greater options of transportation for life's every-day activities.

A key element of transportation infrastructure spending in dealing with economic development is the amount of highway spending allocated by each county. In an economic growth study by Dye, he states that "highway spending emerges as the strongest correlate of economic growth" because of its ability to facilitate commerce and transportation (Dye, 1980). A few of the major benefits of having a well-developed highway system are explained in an article by Weisbrod and Beckwith. These include the "expansion of existing business, attraction of new business, and tourism growth" as well as "increasing business productivity over time associated with reducing shipping costs." In their argument, they also include the benefits of reduced travel time that better highways provide for residents' everyday transportation (Weisbord and Beckwith, 1992). Residents' opportunity for greater productivity and a higher quality of life are significantly increased by counties that allot more spending on highways.

Not measured in the data, yet highly correlated with transportation spending, is the availability of transit and airport services. If more funding is allocated for transportation by a county, it is very likely that transit services will be offered as well. The availability of local public transit services is a positive contributor to quality of life. For various reasons, numerous county residents might not have access to private transportation or the ability to travel on their own. Public transportation, whether by bus or rail, is significant to their well being when traveling to and from home to work, to shop, or to study, etc. Baum-Snow et al explain a number of benefits to having public transit accessible in their 2000 article: "…better transit may disproportionately improve the quality of life and the quality of job opportunities…. Public transit potentially increases the access of the poor to better labor market opportunities. This comes in

addition to reduced commuting times for people served by better transit." They also add

public transit's contribution to reducing air pollution (Baum-Snow, et al, 2000).

The benefits of airport services are associated with transportation spending in that

counties with transportation spending as a priority will likely have similar reasoning to

provide airport services as well. Counties with airport availability provide advantages to

the quality of life of its residents more than those counties who do not offer the service.

The benefits of having a local airport, mentioned by Newkirk and Casavant, "include

economic development, health care and emergency medical services, support of business

and commerce, recreation, community activities, enriched community life…. [These]

themes support the strong conclusion that rural airports clearly improve the quality of life

in rural communities" (Newkirk and Casavant, 2002).

The more developed infrastructure accessible to county residents, the more it can

achieve the desired economic development that brings the greatest opportunity to the

people within the county. These advantages include greater access to transportation,

communication, household energy, water, activities, etc. A well-constructed index that

purports to measure quality of life must include a coherent measure of the infrastructure.

Health

The majority of the quality of life literature that was reviewed for this study

includes a measure of health as an indicator, and inclusion in my own index was

important. It is difficult, or untenable at best, for someone to have a good quality of life

if they are living in unhealthy conditions or do not have access to quality health care.

Maslow underscored the significance of good health when he placed physiological needs

at the base of his hierarchy of needs in his explanation of human motivation (Maslow, 1943). I recognize health's importance to a good quality of life and developed an indicator that would capture the effect of health on quality of life.

Review in the health measurement literature uncovered some interesting intellectual debates surrounding the demand for health care. Newhouse, Hitiris and Posnett make the assertion that since per capita health expenditures follow GDP fairly closely, health expenditure consumption is elastic, indeed elastic enough that it is a luxury good since its income elasticity of demand coefficient is greater than 1.0 (Newhouse, 1977, Hitiris & Posnett, 1992). If their assertion that health care is a luxury good is correct, then there is a lot of spending in health care that only marginally improves quality of life and an increase in funding won't necessarily result in an increase in care.

The counter to this claim is that since health care represents a basic human need it must be a necessity and an inelastic good. Parkin asserts that the claim of its being a luxury good can only be measured as a luxury by incorrectly applying microeconomic data to a macroeconomic problem (Parkin, 1987). Parkin also claims that more spending is needed to increase health outcomes and none should be cut. He and other authors base this conclusion on their belief that basic health necessitates for many individuals are not being met in the current system and thus each unit of health care purchased is not diminishing in utility and won't be until all the societies' needs are met.

I agree with portions of both arguments and eventually came to the same conclusion as Getzen who views health care expenditures as both a necessity and a luxury which can vary with the level of analysis (Getzen, 2000). On the micro level, I believe

that health care is a necessity at first because a certain level of care is essential, and thus inelastic. However, due to diminishing marginal returns there is a point reached where health expenditures become a luxury, even on the micro level.

On the macro level I am not surprised to see that Getzen comes to the conclusion that health services are a luxury since there is a massive amount of spending going into the total expenditures that has marginally less utility than the first dollars spent. While I am not sure where this point of diminishing returns is, I believe that for all of the people in the study there is at least a level of health expenditure that is a necessity that must be funded in order to have a good quality of life. The indicators are designed to capture the aggregate health care system in the test areas in order to determine if it affords individuals at least the necessary level of care needed, if not also desired luxury health goods.

To capture an aggregate measure of the health system in the test counties, I would first use a measure of the availability of professional health workers. My measure includes physicians per 1000 and health care workers per 1000 to asses this availability. Originally I had hoped to use measures of hospitals per 1000 and hospital beds per 1000 in addition to the number of professionals, but the data was not available on the county level like I needed. However, since health care requires very specific and well practiced skills, I assume that the more of these health care workers there are in a population, the more likely it is that they will have facilities to work in. This measure is sufficient to furnish a snapshot of the availability of health care facilities that I believe to be most vital to a good quality of life.

I do, however, acknowledge that there may be other factors that may also be indicators of the health of a population other than physical facility access. Socioeconomic status, educational attainment, and cultural factors have all been shown in some cases to be the single greatest determinant of health status (Pincus et al, 1998, Grossman, 1973). Grossman's conclusion that the single greatest determinant of health is the level of education a person attains may be pertinent to this study. Similarly, Pincus's conclusion that socioeconomic status is a more important indicator of health than access to care should also be covered to the furthest extent possible under the economic development indicator and should not be a confounding factor in the final measure.

While having health facilities readily available is important, the existence of the facilities is of marginal value if people do not have the resources, primarily health insurance, required to be treated in the facilities. I use a measure of health insurance enrollment to help determine accessibility. The number of people with health insurance in a community reflects a measure of access to care and is valuable to the study. The measure that I use to show the insurance rate is taken from the U.S. Census data and includes all forms of insurance including government programs such as Medicaid and Medicare.

While it may be true that there are flaws associated with the insurance system in the country- such as overconsumption as outlined by Feldstein (Feldstein, 1972) - I feel that the level of insurance in a county helps us to determine what portion of the population is at least having their basic health needs met. Davis et al assert that the single greatest indicator of whether or not an individual has access to the care they need is their economic status (Davis et al, 1981). While I know that this measure of insurance levels

will not capture perfectly an area's access to care, my accounting for the economic status of a county in the economic development indicator, along with the measure of insurance here, should combine to give us a clear picture of people's access to care despite financial restraints.

After considering access to health care through availability and insurance, I examine what health-related outcomes are being produced from access to that care. There is a debate in the literature concerning what the most telling measure of health should consist of. Some scholars argue that today's unique circumstances warrant a different measure of health outcomes for today's society. They feel that it is important to break with traditional measures of health that have mainly dealt with morbidity and mortality and also take into account "diseases of civilization" like obesity and depression that have recently appeared as society has become more developed (Hunt & McEwen, 1980). It is their belief that even though there might be longer life spans and less infant deaths in developed societies, that doesn't mean that the health of the people is any better off since they see these new diseases as a drain on quality of life.

However, it is my view that while these may be real threats to the well-being of individuals, their inclusion in this measure would be very difficult to achieve since that data is not consistently available. The concerns raised by Hunt and McEwen are valid, but they differentially affect individual populations and it is hard to make the case for using them in an over-arching measure. While my measure may not capture a complete picture overall health in a specific area, it does capture a sufficient portion of the whole system as infant mortality is a particularly telling indicator of care. It is also easily

accessible for every area I looked at and universal in its application; whereas the inclusion of other subjective indicators would have to be more area specific.

I decided to use a measure of health outcomes that was the most objective possible. Nearly every study I looked at used infant mortality measures in one form or another, including the UNDP's Human Development Index and the WHO which both used measures of infant mortality as a strong indicator of quality of life and in their own indices (WHO, UNDP). Consequentially I also decided to use infant mortality as the basis of my health outcomes measures.

This indicator is also one of the most obvious and observable results of a good, accessible health care infrastructure that was measured earlier. My initial measurements of the availability of physicians and hospital beds are directly connected to infant mortality and with life expectancy that I measured in this area. Hospitals and their services are vital to helping mother's give birth to children and combating chronic sickness that often appear in the later years of life.

While some scholars would argue that a better measure of health outcomes would be broader than mine, I feel that very few would argue that infant mortality is not one of the most telling individual indicators of health. This measure captures the availability of non-luxury health care.

Health services that are readily available could still be inadequate to properly serve the needs of the patients. Health services need adequate funding to be able to function well. I measure the health services funding effort in order to determine if the services are being adequately funded and given every chance to succeed. This measure

includes the overall per capita health expenditures by government agencies and the total amount spent on payroll in health care professions.

Funding for health related services is not cheap. Some estimates place the total yearly spending in the U.S. around $3 trillion or nearly 20% of the GDP. By capturing this funding information I was able get a better understanding of the health services in the targeted areas. This then allows basic health care, which would impact the health outcome indicators of life expectancy and infant mortality, to be measured. Basic health care is defined in various ways, but for simplicity purposes I define it as access to the services and procedures that sustain life and impact of the health outcome indicators. If a person has access to basic health care, I assume they would have a greater probability of surviving birth and living to an older age.

As summarized earlier, I realize that the amount of funding does not guarantee quality since there is a real potential to waste the funds after they reach the point of diminishing returns. Evans and Marmor are correct to point out that there is massive rent seeking and waste in the health care industry (Evans et al, 1994). Reinhardt is also correct to point out that health care providers are being allocated a luxurious lifestyle at the expense of the patients (Reinhardt, 1987). This, however, does not diminish the fact that a certain level of funding is needed to maintain a basic level of service. By my reasoning, a higher level of funding indicates a higher likelihood that those basic needs will be filled even if there is waste going on after those needs are filled.

There is also good literature that indicates that higher expenditures on health care are linked to better health results (Or, 2000). Poland et al also seems to agree that higher expenditures should produce better health outcomes (Poland et al, 1998), but I feel that

his call for increased government control of the funding would be just as wasteful, if not more than, the current system. I feel that the measurement of the funding effort for health services provides the reader with an overview of the system without making any judgments on how the system should be.

In sum, I chose to use the measures I did because they are the best way for us to capture the availability of and access to health services in a given area. My measure is objective and is comparable across the diverse areas in this study. It encompasses the causes as well as the consequences of a good health system and allows us to see its impact on the overall quality of life in a defined area.

Economic Development

Economic development is a necessary indicator when determining quality of life. Economic development can be defined as efforts that seek to improve the economic well being and quality of life for a community by creating and/or retaining jobs and increasing incomes. It is the institutional changes made to promote economic betterment and the social organizational changes made to promote growth in an economy.

I have chosen to use and gather data for three categories that I believe to best determine the county residents' quality of life level, namely the availability of services, economic outcomes—such as per capita income and the unemployment rate—and availability of private capital for the rural counties.   The following paragraphs will support my argument that the more economically developed a county is the higher quality of life its residents have.

How accessible services are in each county affects the quality of life of its residents. To measure service availability I focus on the total number of employers and the number of new businesses per year in each county.

Employment is one of the most fundamental measurements of economic development. When unemployment is high, it creates a downward spiral in a community's economy: the unemployed residents cannot receive an income, which reduces consumer spending, which in turn reduces industry earnings, creating fewer jobs, and so on. Thus a healthy economy arrives as close to full employment as possible, generating more consumer spending and industry growth in the community. I chose to measure the total number of employers in each county as an economic quality of life indicator because when more opportunities are available for resident employment, residents have the ability to receive their desired income with greater facility. Hence, they will be able to better satisfy their needs and wants.

By measuring the total number of employers, the number of individual businesses within the community can be determined. Wennekers and Thurik assert that the positive economic effects from the number of small firms within a community include: "routes of innovation, industry dynamics and job generation" as well as "a lower propensity to export employment, a qualitative change in the demand for capital, and more variety in the supply of products and services" (Wennekers & Thurik, 1999).

The greater the number of new businesses established each year is also linked to a higher quality of life for residents in the counties I researched. Buchanan and Ellis list entrepreneurship, the creation and development of new businesses, in their book as one of the basic factors that pushes economic development (Buchanan & Ellis, 1955). When

more businesses are created, more opportunity for employment is available for the residents. Business expansion can also be evidence of more capital availability and greater response to higher consumer demand. I measured and recorded data on how many new establishments were created in each county per year to capture the entrepreneurship that is occurring in each of the counties. To calculate this activity I take the number of businesses that existed the previous year and subtract the current year's business count.

The number of new establishments contributes to a dynamic economy. According to Postrel, "'dynamism' [is] an open-ended society where creativity and enterprise, operating under predictable rule, generate progress in unpredictable ways" (Postrel, 1998). This preservation of constant growth and improvement is necessary for the residents in these communities to have an increase in their quality of life.

Reduced employment opportunities, due to low business creation and poorly diversified business within a county, create the necessity to travel for employment. I have measured data on the number of county residents who travel for employment by determining the commute time and destination. These measures indicate the investment of time people are making for a desired employment. To measure destination, I measured the percent of residents employed outside of a county. From this measurement, I can conclude that a greater percentile of residents employed outside the county of residence is indicative of a lower level of economic development in that county.

Khan, et al, explains the effects of commuting on individual economic growth: "if economic growth elsewhere raises an individual's earning prospects, the individual will move, but if the individual can exploit economic growth elsewhere by commuting,

he will not need to move to gain from the expansion" (Khan, et al, 2001). They chose eight states in the Midwest and researched them on a county level to determine that the local county population "responds positively to own-county economic growth, economic growth in the adjacent county, and economic growth two counties away" (Khan, et al, 2001). This provides an excellent demonstration of how multidimensional this quality of life scale is.

In other literature, Shields and Swenson conducted research on 65 Pennsylvania counties to determine how commuters balance employment and wage opportunities with relation to housing prices and travel costs. The results suggest that the "proportion of jobs filled by in-commuters varies by industry" (Shields & Swenson, 1999). This is an important factor because it illustrates why counties should focus on industry diversity when attracting businesses in order to best capture all types of employment.

Consequently, when services are more readily accessible in each county, its residents' quality of life is improved. With a greater number of employers and an increase in the number of businesses every year, residents are able to have more diverse opportunities for employment and the community benefits from a more diverse set of goods and services. In contrast, the further the distance a resident must travel for employment indicates limited opportunity for resident employment.

In determining the level of economic development of counties, I have chosen three indicators: economic diversity, per capita income, and unemployment rate. Quantifying these variables will help us better measure resident standard of living as well as economic growth by county.

The more diversified business is in a county, the higher the opportunity is for the residents to have a higher quality of life. For example, consider a county with mining as its sole industry and source of employment. If its resources were exhausted or a natural accident occurred that made it impossible to mine, the county and its residents' quality of life would decrease substantially. A book by Phillips supports this example in stating that economic diversity is vital to sustaining development in rural areas because of the negative effects of the boom and bust cycles (Phillips, 1990). In this data, I used Hachman's method to determine the economic diversity score. I therefore conclude that a county that has employment and business across diverse industries is more economically developed and can provide a higher quality of life for its residents (Hachman, 1995).

Per-capita income is one of the most obvious and routinely used indicators of quality of life. Those who have a higher per-capita income have more funds to purchase the necessities as well as more disposable income to purchase luxuries. Lucas, in his study "On the Mechanics of Economic Development," argues that per-capita income is the best indicator of economic development (Lucas, 1988). However, Alpert reminds us that that per-capita income is not an all-encompassing indicator when determining the degree of economic development. He uses other indicators also in this research such as dynamism in business, continuous process of capital accumulation, and other social indicators (Alpert, 1963). My conclusion is the same, and my index reflects that conclusion, per-capita income is important, but not the single factor in determining quality of life.

The unemployment rate is another indicator of how economically developed a county is. This measurement has been used in many quality of life studies: a lower unemployment rate provides more opportunities for residents to find jobs which leads to higher quality of life. Phillips argues the unemployment rate is an important indicator in determining economic development. He states both the need for both "basic and nonbasic employment: basic jobs are those that bring new money into the economy" whereas "nonbasic jobs are those that recycle money through the local economy" (Phillips, 1990). With a high countywide unemployment rate, the need for its residents to commute for employment is much higher. The unemployment rate and commute time for employment do not measure the same thing however: a resident may not be employed in his/her own county but is employed in the adjacent county.

The final indicator seeks to measure the availability of capital in counties. Capital availability is a vital part of any county's economic development as it represents the potential funds that can be used to hire workers, develop infrastructure, and power the engine of economic growth. I used total deposits in commercial banks, manufacturing capital expenditures, and total annual payroll of all industries as the indicators.

The greater the total deposits in local commercial banks, the greater the funds readily available for use in entrepreneurial activities, for larger scale business investment, and for private investment on homes/home improvement and automobiles, and so on. Low, et al, explains the positive correlation between bank deposits and entrepreneurial growth, emphasizing the effects of bank deposits on "creat[ing] loanable funds that could help regional entrepreneurs invest and grow further" (Low et al, 2005). These funds are

of great importance to local communities because without them, new businesses cannot be instigated, making employment opportunities more scarce, etc.

Although funding availability through deposits in commercial banks is useful in community economic development, simple capital availability does not necessarily indicate productive potential use of the capital. Capital has a multiplicative effect when it is invested and put to use that cannot occur when it is simply held in reserve. The measurement of manufacturing capital expenditures is a valuable measurement of capital use and availability in economic development because it illustrates how businesses apply their capital. Fisher explains the economic growth benefits—including higher employment and income, among other market stimuli—to which private capital spending contributes when allocated productively (Fisher, 1997). Measuring manufacturing capital expenditures is valuable in providing evidence of business growth and productivity within distinct communities due to local capital investment.

My final sub-indicator measures the total annual payroll of all industries for each county. This measure, which indicates the amount of money businesses allocate to paying employees each year, is evidence of industry growth or decline. Greater payroll indicates an expansion in the local community because industries have additional funds to pay employees after covering their costs and other financial obligations.

Payroll can also indicate the quality of human capital available in the county: employees with higher degrees and work experience receive higher wages. With greater payroll provided to employees, greater opportunity for private capital investment is available as well. The reverse is also true, as noted by Eberts and Fogarty: "as private investment increases, demand for labor and thus payrolls also increase, expanding the

income of the local economy" (Eberts and Fogarty, 1987). Thus, with more private capital availability, opportunity for growth and development increases, creating a greater quality of life for residents.

As described above, economic development can be defined as efforts that seek to improve the economic well being and quality of life for a community by creating and/or retaining jobs and increasing incomes. From the three areas discussed above—service availability, economic outcomes, and private capital availability—Iwere able to establish the advantages to having an economically developed county. I can therefore see that residents living in a county with a more advanced level of economic development will have a better quality of life than of those whose county is less economically developed.