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Quality of Life in Urban Neighborhoods in Costa Rica

by

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Abstract[*]

This paper considers valuation of amenities in urban neighborhoods and satisfaction with both those neighborhoods and life in general. First, rents are used to estimate neighborhood amenities price in San Jose, which explain 39 percent of the standardized variation of rents. Some districts rank very high in housing characteristics but poorly in neighborhood amenities, while others rank poorly in housing characteristics but high in neighborhood amenities, suggesting that indirect policy measures might reduce inequality in urban areas through improving neighborhood amenities. Second, the paper explores differences in the valuation of amenities by calculating prices in different urban areas. In more sparsely populated urban areas, distance to national parks becomes less important, but distance to primary roads becomes more important. Finally, housing and safety satisfaction represent the key components of life satisfaction.

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1. Introduction

In Costa Rica, more than 60 percent of the population lives in cities (INEC, 2000), and these people face specific challenges particular to highly concentrated population areas. To identify the most important challenges, we use census data and a life satisfaction survey. We also examine how people value amenities in urban neighborhoods and how satisfied they feel about them, their neighborhoods and their life in general.

We show how neighborhood amenities and public goods influence the pricing of neighborhoods, following Blomquist, Berger and Hoehn (1988) and Gyourko, Kahn and Tracy (1999). We employ detailed census data on the characteristics of each house in the country. Moreover, we introduce neighborhood amenities using Geographic Information Systems (GIS). These data allow us to obtain detailed and precise calculations of neighborhood amenities and better controls for unobservable effects. For instance, instead of determining whether or not there is a fire department within the neighborhood border, we determine how far the nearest fire department is located from the respondent's home. Data of this type are also available for the evaluation of health variables, such as distance to clinics and hospitals, and education characteristics such as distance to other neighboring schools.

We analyze rents and wages in different urban areas in Costa Rica, finding that rents are highly spatially correlated. This might not be due to neighborhood amenities but due to housing characteristics. We also find that housing characteristics are highly spatially correlated. Wages are spatially correlated when considering all urban areas. However, when considering only San Jose's metropolitan areas or only urban areas outside the metropolitan area, the spatial correlation disappears. This is evidence that there is a significant difference between wages in the metropolitan area and other urban areas but not within these areas.

Wages and rent differentials across neighborhoods might be used to estimate price amenities. Within San Jose's metropolitan area we only focused on rent differentials (as in Linneman, 1980). When estimating price amenities outside San Jose we also consider wage differentials (as in Blomquist, Berger and Hoehn, 1988). We do this because within San Jose wages do not reflect differences in price amenities, given that people can live in one neighborhood and work in another. However, people who live in urban areas outside San Jose tend to work in the same urban area where they live and are restricted by a smaller labor market if they want to stay.

For San Jose's metropolitan area, we find that the price of safety is positive (i.e., the safer a neighborhood is the more valuable it is). Average neighborhood slope of the terrain affects the value of the neighborhood negatively. Neighborhoods with steeper average terrain have lower values. Precipitation also has a negative effect on the value of the house, and people assign significantly lesser value to areas with a high risk of being affected by volcanic eruptions. Additionally, people value living close to national parks and close to urban and neighborhood roads. On the other, proximity to rivers and primary roads negatively affects the level of rents, which might reflect people's reaction to odors and noise in the city.

We calculate the relative importance of housing and neighborhood amenities in the determination of rents following Linneman (1980) and find that neighborhood amenities explain 39 percent of the standardized variation of rents. We also look at the distribution of the contribution of housing and neighborhood characteristics to the level of rents. For housing characteristics, the mean and the median are very similar (less than one percent difference). This is not the case for neighborhood characteristics. First, the mean is 10 percent higher than the median. This implies that more than 50 percent of the neighborhoods are worse off than the mean neighborhood characteristics. We can also see that there is a wider gap between the median neighborhood and the neighborhood in the top 25 percentile than between the median neighborhood and the neighborhood in the lowest 25 percentile. This is evidence that there exist neighborhoods that are significantly better off than most of the other neighborhoods in the metropolitan area. Our interpretation of these results is that neighborhood characteristics create a regressive effect on welfare distribution.

Using these price estimates we computed the index and found similar results to previous studies when we aggregated our findings to their level (MIDEPLAN, 2007). In particular, very rich urban neighborhoods such as Sanchez, San Rafael and Mata Redonda appear in the top ranks, while extremely poor urban neighborhoods such as Salitrillos, Patarra and Concepcion appear lower. We additionally find that some districts (e.g., Mata Redonda) rank very high in housing characteristics but poorly in neighborhood amenities, while other districts (e.g., Escazu) rank poorly in housing characteristics but highly in neighborhood amenities. This shows the potential of indirect policy measures to reduce inequality in urban areas through the improvement of neighborhood amenities.

We also consider differences in the way people value amenities when considering only the metropolitan area within the province of San Jose, or the larger definition of metropolitan area that encompasses urban areas in other provinces attached to San Jose. For some variables such as safety, slope, and precipitation we find no significant difference. For others, such as Distance to National Parks or abundance of primary roads, coefficients change. Distance to National Parks becomes less valuable when we consider areas in the fringe of the city, probably due to the relative abundance of wooded land in those areas. The positive role of the primary roads for transportation becomes more important in areas outside the metropolitan area of San Jose.

When we look at the effects of wages, we find that they are a very important component of the price of the amenities. In fact, 12 percent and 17 percent of the standard deviation of the wage can be explained by environmental amenities of the cities where workers are located. However, here we should not only consider the location decisions of household workers, but also the location decisions of firms. In fact we find that for some disamenities, such as the risk of being affected by floods, firms avoiding these areas play such important role that prices of the amenities switch their sign. One would actually end up paying to live in an area with risk of being affected by a flood because attainable wages are significantly lower in those areas. This implies that firms' location decisions might reduce the effect of disasters as probabilities of these disasters change and firms change location (provided full information is available).

In order to complement our results obtained from the available datasets and to provide more detailed discussions of neighborhood amenities, we administered a survey on the quality of life in the metropolitan area of San Jose, gathering data on other factors driving the quality of life of these communities and on individuals' subjective valuation of their life satisfaction. The subjective valuation is an issue that has garnered attention in the literature (see van Praag and Ferrer-i-Carbonell, 2004; Kahneman and Krueger, 2006; and Di Tella and MacCulloch, 2005).

We used the resulting data to run a series of regressions explaining different aspects pertaining to quality of life such as housing satisfaction, health satisfaction, neighborhood satisfaction, and safety satisfaction, as well as an overall valuation of quality of life. We find the expected results when regressing each satisfaction domain. We also obtained intuitive results when running as independent variables each of the domains, and as a dependent variable the subjective valuation of quality of life. However, results changed when we used predicted values of those domains instead of the real values. Health satisfaction, for instance, becomes insignificant. We conclude that that housing and safety satisfaction are the key components in determining life satisfaction.

Finally, we directly consider all the objective variables to explain quality of life. Income appears to be insignificant. Our interpretation of this result is that we are controlling for the factors that affect quality of life fairly well, most of which have to be purchased. Income might not generate quality of life by itself, but the goods bought by that income do.

This study will allow policy makers at both the national and local level to identify what urban areas are at a disadvantage and determine what actions will be most effective in improving the quality of life of those areas. The information generated might additionally help individuals and firms make more informed decisions concerning location decisions and what to demand from the local and central governments as a community.

The paper is organized as follows. In Section 2, we describe our data and test for spatial correlation in our dependent variables as well as in our explanatory variables. In Section 3, we develop the hedonic pricing model following Blomquist, Berger and Hoehn (1988). We also present our estimates of amenity prices and study the behavior of the errors. We use these prices to calculate the quality of index and the rankings. In Section 4, we present our estimated amenity prices for different neighborhoods in Costa Rica. We use both definitions of the metropolitan area (San Jose and the Greater Metropolitan Area) as well as urban areas outside the Greater Metropolitan Area. In Section 5, we develop a descriptive analysis of our survey. Additionally, we present all the life satisfaction regressions. In Section 6, we conclude with a summary of our main findings and recommendations.

2. Data and Descriptive Statistics

To perform our analyses, we employ data from several sources: the 2000 Housing and Population Census, the 2003 Multipurpose Household Survey and GIS neighborhood amenity variables. In this section, we describe these datasets in detail.

2.1 2000 Census Data

The unit of analysis is a household. In the 2000 census, 1,034,893 households were counted across Costa Rica. Of those households, 605,821 households (58.53 percent) were located in urban areas and peripheral urban areas (for formal definitions of urban and peripheral urban areas see INEC, 2000). Census tracts are divided into urban, peripheral urban, rural, and sparse rural areas according to the classification that appears in the census.

The census tract represents the smallest geographical division available, and districts are composed of census tracks. Counties are composed of districts, and provinces are in turn composed of counties. Our analysis focuses on the urban and peripheral urban census tracts of two areas: the metropolitan area using two definitions: i) the Greater Metropolitan Area (GAM) and the Metropolitan Area of San Jose (AMSJO) and ii) other urban areas of the country (see Figure 1).

In Table 1, we show population and population density of these urban areas. Most of the people in urban areas live in the Great Metropolitan Area. AMSJO is the most densely populated urban area, and the average population per census tract in each of these areas does not vary significantly. This is because census tracts are designed to implement the census interviews, and the goal is to maintain a similar number of people per tract. The average population of census tracts in urban areas is around 250 people.

2.1.1 Rents

Each renting household across Costa Rica, as per the 2000 census, was asked about rents. Out of the 605,821 households in urban areas, only 20.00 percent of the households rent their home, though people in San Jose people tend to rent their houses more than in other urban areas (see also Table 1).

In Figure 2, we show the distribution of monthly rents in the urban areas under analysis. The GAM has a higher mean (higher rents on average) and the variance is also larger. Areas outside the GAM have a lower mean and variance than those inside the GAM.

We map the distribution of rents by census tracks for the GAM and AMSJO in Figure 3. Higher rents are found in areas inside AMSJO than in the rest of the GAM. When we focus on AMSJO, we can see that there are high-rent poles in the east and west of the city. Tracts with lower rents (red tracts) are concentrated in the south of the city, while in the north we find tracts with medium rent levels (orange, green and light blue census tracks). This map suggests spatial segregation in the distribution of rents, though statistical tests are needed to confirm this hypothesis.

In order to test spatial concentration, we use a non-parametric estimate of correlation across census tracks as a function of distance (developed by Conley and Topa, 2002) for monthly rents (see Figure 4). We find statistically significant spatial dependence of rents in AMSJO. Within four kilometers, monthly rents tend to be highly and positively correlated. After four kilometers, we find that the correlation tends to be negative. Four-kilometer pockets of high and low rent levels are next to each other in AMSJO. After nine kilometers, we find no significant correlation.

2.1.2 Household and Housing Characteristics

The 2000 census also contains a series of housing and household characteristics. Table 1 shows average household size for each of the areas under analysis. We find that the size of households across Costa Rica does not vary significantly within urban areas, nor does the average number of rooms and bedrooms. The share of houses in poor conditions is higher outside the GAM than inside the GAM. Electricity access and water access is widespread in all urban areas, although inside the GAM these services have better coverage.

As a proxy for house size, we map average number of rooms across AMSJO and neighboring areas. Again, we find a concentration of houses with higher number of rooms in the east and west ends of the AMSJO. To the south, we find smaller houses. To the north, we find medium size houses. Water access in AMSJO is uniformly distributed.

We also test whether these variables are spatially correlated using the non-parametric spatial correlation function (see Figure 5). We find that the number of rooms (house size) is spatially correlated following a pattern similar to that of rent levels. We find high positive spatial correlation within four kilometers. After four kilometers, the sign of the correlation becomes negative and significant. In general, as distance increases the sign of the correlations switches back and forth, as in cycles. Average household sizes (approximated by number of rooms) are highly spatially correlated when looking at census tracts. Another housing characteristic we analyze is water access. We find that it is spatially correlated within two kilometers but there is no significant relationship between census tracts after this distance.

2.2 The 2003 Multipurpose Household Survey

Individuals might also be willing to accept a smaller (larger) wage for living in a neighborhood that generates amenities (dis-amenities). Therefore wage behavior across and within neighborhoods and urban areas is important for determining the implicit price of neighborhood amenities. We use the 2003 Multipurpose Household Survey to obtain labor market information.

We consider head of households under the assumption that they make the location decision based on the goal of maximizing their welfare. We consider only those heads of households who are employed because we want to focus on people who have to work in a specific place and whose remuneration only comes from selling their labor. For these individuals, we show unemployment rates and wage levels in Table 1. Unemployment is lower inside the GAM and even lower inside AMSJO. Wages are higher in the GAM and even higher in AMSJO.

When we look at all urban areas (Figure 6), we see that there is spatial correlation within 20 kilometers. But we attribute this mainly to the difference in wages between urban areas in the metropolitan area and urban areas outside the metropolitan area. Within the metropolitan areas, there is no spatial correlation, and outside metropolitan areas there are no spatial correlations in wages either.

2.2.1 Labor Force Characteristics

We now look at the characteristics of the labor force, which are also shown in Table 1. People in AMSJO are more educated than people in the rest of the urban areas, and they are less likely to belong to a union or cooperative. These findings show the importance of controlling for other explanatory variables of wage differentials.

2.2.2 Neighborhood Data

Information at the census-tract level was obtained for our analysis. We divide neighborhood variables into three groups: social neighborhood characteristics, environmental (dis-)amenities, and public goods.

Social Neighborhood Characteristics. An important set of neighborhood characteristics are related to the composition of the members of the neighborhood (neighbors). The following characteristics clearly affect housing location decisions and therefore rents:

- *Socioeconomic status*: Census tracks' socioeconomic status is defined based on a series of socioeconomic characteristics of individuals. In Table 1, we show the share of census tracts in each of the socioeconomic strata. Areas outside the metropolitan area contained relatively lower socioeconomic status tracts. However, high and medium socioeconomic statuses do not show any clear patterns.

- *Political participation*: At the district level, we have information of the percentage of individuals who voted in the election for 2002. This variable might reflect how politically active neighbors are.

Environmental (Dis-)amenities. Within this group of environmental factors, we include variables related to contamination and environmental risk. Rivers are associated with high levels of contamination and odors within urban areas in Costa Rica. We calculated the distance from the centroid of each census tract to the closest river.

Physical and natural characteristics of neighborhoods were also computed for this study. We used average precipitation in the census tract and average slope of the terrain. We also had geographic information about the risk of floods and the risk of being affected by volcanic eruptions. We determine the presence of these risks for each census tract. Finally, we calculated the distance from each census tract to the epicenter of every earthquake greater than 3.0 on the Richter scale from 2000 to 2004. This variable can serve as a proxy for expectation of earthquakes given that earthquakes are highly spatially correlated.

Public Goods. Public goods also affect the quality of life of neighbors. We considered public goods such as roads, education, health, fire protection, recreation areas and security.

- *Roads:* We obtained GIS maps that show where the main roads are located within the city. Beside their obvious role as infrastructure, roads can also be employed as a proxy of contamination. For each census tract we found the length of three different types of roads (primary, secondary and neighborhood roads). We calculate the density of each type of road for each census tract.

- *Educational facilities:* We obtained the location of primary and secondary schools across Costa Rica and calculated the distance from each tract to the closest primary school and secondary school.

In Table 2, we show that in the metropolitan area of San Josa (AMSJO) there is a higher concentration of educational centers. We also found that census tracts with higher socioeconomic status tend to be closer to primary schools and secondary schools.

- *Fire Departments* We used the distance from each census track to the closest fire department as a measure of how protected each neighborhood is from the event of a fire.

- *Health Facilities* Health facilities locations were also available. We computed the closest distance from the centroid of the census track to these facilities.

- *Recreation Areas* The location of all the protected areas that include national parks, biological reserves and national monuments were also available. We computed the distances to these places from each of the census tracks.

- *Safety* Given the large variety of types of crimes, we used an index at the county level of safety developed by the UNDP for Costa Rica in 2004.

This highly detailed information will allow us to calculate accurately prices of neighborhood amenities.

3. Pricing Amenities Using Hedonic Analysis

Here we present the estimation of the housing and neighborhood characteristic index for the urban areas in Costa Rica. Wages and rents are simultaneously determined, and both are affected by neighborhood amenities. Following Blomquist, Berger and Hoehn (1988), the implicit price of the amenity is composed of two factors: i) the sum of the land expenditure differential and ii) the negative of the wage differential. Why should we consider changes in rents and wages? The intuition is that when we have an increase in the amount of an amenity in neighborhood *k*, people will move in to the neighborhood, which will lead to an increase in housing demand and therefore an increase in rents. However, the supply of labor will increase and wages will also decrease. People will move in until what they pay extra (increase in housing expenditures plus the decrease in the wages) equals their benefit of the additional amount of the amenity. The change of housing expenditures in equilibrium is represented by $h_k(dp_k / da_k)$, where h_k represents the amount of housing consumed by the household and (dp_k / da_k) represents the change in the equilibrium prices of housing due to the change in the amenity. The change in equilibrium wages due to the change in the amenity is represented by (dw_k / da_k). Therefore, we can write the implicit price of amenity *k* as,

$$f_k = h_k(dp_k / da_k) - dw_k / da_k \qquad (1)$$

In order to estimate these two components, we estimate how housing expenditures and wages change with the amount of amenities.

To estimate the hedonic equations for rents and wages, we use the Box-Cox search procedure to determine the functional form. Formally, we estimate both coefficients λ (within the range from -0.2 to 1.4)[1] and δ (that could only take the value of either 0 or 1) in the following equation,

$$\frac{Y^{\lambda} - 1}{\lambda} = b_0 + \sum_{i=1}^{n} b_i \frac{X^{\delta} - 1}{\delta} + \varepsilon \qquad (2)$$

where the dependent variable *Y* is first estimated for rents and second for wage and where *X* represents the set of explanatory variables.

Our data set provides rent information only for people who actually rent the house or for people who are currently working. We treat this as an endogenous selection mechanism that can potentially bias our estimations. Since we are estimating the implicit prices for the index, this can affect our results and produce inadequate amenity prices. Following Heckman (1979), we correct for sample selection. Following standard practice in labor economics, we also correct for self-selection bias in the wage equation in relation to labor participation decisions.

[1] Note that choosing this functional form is more general than just taking the logs. We are allowing the data to show us if taking the logs (λ=0) is better than other specifications (λ≠0)

We assume that neighborhoods have different land and labor markets. When we estimate the prices of city amenities, these assumptions are plausible. However, when we are looking at neighborhood amenities, these assumptions might be violated. Workers can live perfectly in one neighborhood with the amenities they prefer and still work in a different neighborhood. If this is true, however, the amenity price will be captured solely by the housing market. For our empirical analysis, we look at within city effects using only the housing market, and across city effects using both housing and labor markets.

3.1 Results and Amenity Prices for AMSJO

In the first column of Table 3, we present the estimates of *b* from equation (1). In the second column, we present the estimated implicit price. We obtained the price by transforming the coefficient using

$$b' = b((\overline{y})^{(1-\lambda)})$$

following Blomquist, Berger and Hoehn (1988), where $\overline{y}$ is the sample mean monthly rent (and wages for the following sections too). This is how much an average household benefits from using an additional unit of the amenity for a month. In the third column we present the mean contribution of each specific amenity to the AMSJO neighborhoods. The fourth, fifth and sixth columns show the contribution of each of the amenities by quartiles (the first, second and third, respectively.

When maximizing the log likelihood we found that δ equals 1 and that λ equals 0.1006. These results are similar to what Blomquist, Berger and Hoehn (1988) found (δ =1 and λ=0.2).

Most of the coefficients in column 1 are statistically significant. Regarding the sign of the coefficient, all of the statistically significant coefficients produce the expected signs. A higher number of rooms leads to higher rents. This implies that the price of each additional room is positive. This price represents how much an additional room is valued by the average household. If the conditions of the floors, walls, roofs and ceilings are good, the price of the house also increases. The type of water sources and sewer type also affect the price significantly. The value of the house decreases when water is not supplied by the National Water Company and when the source of the water is rain or a river. When the sewer is not connected to the network, house expenditures also decrease, whether it is connected to a septic tank or if the house only has a latrine. The source of electricity also affects the rent levels as expected. Houses covered by the National Electric Company (the dummy left out) are more valued.

The safety indicator price has a positive sign, suggesting that the safer a neighborhood, the higher the rents of the house units. Average slopes negatively affect the value of the neighborhood. The steeper on average a neighborhood is, the lower the value. Precipitation has a negative effect on the value of house. People also assign a significantly lesser value to areas with a high risk of being affected by a volcanic eruption.

People value living close to national parks. Proximity to rivers negatively affects the level of rents, which reflects people's reaction to the highly contaminated rivers inside the city. The presence of primary roads is negatively valued in San Jose, as they are associated with contamination and noise. However, the presence of secondary, urban and neighboring roads is positively valued. The effects of distances to primary, secondary schools and clinics come up with an unexpected sign. However, all these coefficients are insignificant. Fire departments turn out to be negatively valued; the farther the house is located from a fire station the higher its value. This might be due to the endogenous location of fire stations. Finally, rents decrease significantly if the census tract is classified as being of a low socioeconomic stratum.

Following Linneman (1980), we calculate the relative importance of housing and neighborhood amenities in the determination of rents, calculating the ratio of the sum of the absolute beta coefficients for neighborhood amenities to the same sum for all the amenities included in the regression. The beta coefficients are a measure of the standardized impact of a variable and are defined as $b_i(\sigma_i/\sigma_y)$. We find that neighborhood amenities explain 39.15 percent of the standardized variation of housing rents, which shows the importance of neighborhood amenities within San Jose.

We additionally look at the distribution of the value of housing and neighborhood characteristics. For housing characteristics, the mean and the median are very similar (less than one percent difference). Also, the distance from the median to the first quartile and third quartile are similar. This is evidence of a symmetric distribution. This is not the case for neighborhood characteristics. First, the mean is 10 percent higher than the median, which implies that more than 50 percent of the neighborhoods are worse off than the mean neighborhood characteristics. Second, there is a wider gap between the median neighborhood and the neighborhood in the top 25 percentile than between the median neighborhood and the neighborhood in the lowest 25 percentile. This is evidence that there are neighborhoods that are significantly better off than most of the neighborhoods in the metropolitan area. Our interpretation of these results is that neighborhood characteristics create a regressive effect on welfare distribution.

3.2 Spatial Distribution of Errors

In this section, we study the distribution of the error term of our regression. In Figure 7a, we show the distribution of errors. Most of the errors do not reach 25 thousand colones, and they seem to behave normally.

However, if the errors are spatially correlated, more analysis is required. In order to determine if the errors are spatially correlated we plot the errors in the map (Figure 7b). In the north, south and middle of San Jose we find evenly distributed errors. However, in the east and west ends there are concentrations of positive errors (dark blue). This means that the variables do not fully explain why these neighborhoods have such a high value. One plausible explanation could be the spatial dependence of the dependent variable itself. An increase in a house's rent might be caused by an increase in the rents of neighboring houses. This phenomenon might be the result of signals in the market (rent increases without real changes in the house or neighborhood) or just fashionable behavior.

Another explanation is that there could be unobservable factors that are not considered in our analysis. These factors could affect the estimation of the standard errors and therefore could lead to incorrect conclusions about the significance of the results (Gyourko, Kahn and Tracy, 1999; Anselin, 1988; Conley and Topa, 2002). If the errors are also spatially correlated with some of our variables we could even obtain biased estimates. However, the high number of observations and the number of amenities considered in this analysis reduce these possible effects.

3.3 Neighborhood Rankings for AMSJO

We now compute the index using the endowment of amenities obtained in each location at the equilibrium prices previously obtained. Taking the vector of amenities, we can calculate the value of the endowment of amenities offered by each district. We take this value as the index of the quality of life to rank the districts. We estimate three rankings. The first considers housing as well as neighborhood characteristics. The second ranking considers only neighborhood characteristics and the third ranking considers only housing characteristics. Formally, the index is defined as,

$$QLI_k = \sum_{i=1}^{I} f_i a_{ki}$$

where f refers to the price of the amenity (uniform across urban cities, equilibrium value) and a refers to the quantity of amenity i in urban neighborhood k and I is the number of housing characteristics, neighborhood amenities or both. We obtain the index for each census tract. However, we aggregated the index at the district level by averaging the quality of life for each of the census tracts in each district for illustration purposes (so that they can easily be recognized by a name rather than a number).

There are 51 districts in San Jose's Metropolitan Area (AMSJO). The value of the index based on housing and neighborhood characteristics ranges from 143 dollars to 370 dollars, and the value of the index based on neighborhood characteristics ranges from -67 dollars to 27 dollars. Finally, the index based on housing characteristics ranges from 183 dollars to 343 dollars.

In Table 4, we present the ranks of urban districts in the Metropolitan Area of San Jose and the index decomposed into neighborhood and housing characteristics. The order is as expected. In particular, very rich urban neighborhoods such as Sanchez, San Rafael and Mata Redonda appear at the top, while extremely poor urban neighborhoods such as Salitrillos, Patarra and Concepcion appear lower in the ranks.

However, there is unexpected information that could lead to interesting results. For example, Mata Redonda ranks very high in housing characteristics (3^{rd}) but poorly in neighborhood amenities (10^{th}), while Escazu ranks poorly in housing characteristics (26^{th}) but very high in neighborhood amenities (4^{th}). This is important because there is still space for improvement. Public policy might be able to contribute to the increase of welfare of those living in districts with low-valued neighborhood characteristics.

4. Pricing Amenities in Different Urban Areas

Again using hedonic pricing methods, we test whether people in different urban areas value differently amenities. We focus on the great metropolitan area first. We use both definitions of metropolitan area, AMSJO and GAM, and compare the results. As we noted previously (Figure

1), the GAM contains the whole metropolitan area (urban areas in all four provinces connected to capital), while AMSJO contains only the metropolitan area in the province of San Jose. In terms of population, the GAM is 70 percent larger than AMSJO. This 70 percent, as can be seen in Figure 1, is located in the periphery of the metropolitan area.

Our results are presented in Table 5. We find that safety, slope and precipitation coefficients are very similar in both areas. However, prices change significantly due to the linearization procedure. The reason is that, as shown in Table 1, average rents are significantly different in those two areas; therefore, the average household is significantly different, and thus, despite having similar coefficients, the average household values these amenities differently. The opposite is true for the risk of being affected by a volcanic eruption. In the GAM, the coefficient is significantly larger than in AMSJO; however, after linearization prices are similar.

The effect of National Parks changes significantly in terms of both coefficient and prices. In AMSJO, people place a significantly higher value on living close to a National Park than they do in the GAM. People outside AMSJO might be more restricted in their access to green areas and therefore tend to value more highly proximity to a National Park.

Distance to primary and secondary schools is insignificant in both areas. People in the GAM tend to negatively value proximity to clinics, while in AMSJO these distances do not seem to matter. The sign of the coefficient for the distance to the Sabana Park is the same in both areas. However, the effect of proximity to the park is significantly lower in the GAM.

The negative effects of primary roads are reduced significantly when we consider GAM. Although access to primary roads is associated with the noise and contamination, for areas farther from downtown (that are now considered when using GAM) they could facilitate transport. Secondary roads lose value, though small urban neighborhood roads have very similar coefficients.

We also focus on all urban areas in Costa Rica (Table 6). In order to measure the price of amenities, we consider effects on labor markets. As discussed in Section 3, this is because part of the neighborhood amenities might be reflected through wages in the labor market. Amenities will affect the amount of workers in an urban area, which in turn will affect wages.

For example, when we consider all urban areas, the safety index seems not to correlate with rents. However, safety is significantly correlated with lower wages. The result is that people willing to live in a safe neighborhood would have to accept lower wages. This effect is significantly higher in urban areas.

However, amenities could also affect the location of firms, which will in turn affect wages. Even though slopes seem irrelevant for rents when we consider all urban areas, they affect significantly the equilibrium wage. Since firms might tend to locate on plains, people may actually end up paying, through a reduction in their wages, if they want to live in places with steep slopes.

In Costa Rican urban areas, we also find that the risk of being affected by a volcanic eruption decreases rents in a similar fashion to what we found previously. Wages, however, are not significantly affected. The risks of being affected by floods significantly reduce rents, but they also significantly decrease wages. Due to where a firm decides to locate, if people want to live in a place with a risk of floods they would actually have to pay to do so. Note that markets by themselves are reacting to risks and reducing the negative impact of this type of natural disaster.

Distance to earthquakes has a negative coefficient. This means that the further from an earthquake the lower the rents. This result is not intuitive. However, when we consider areas outside the GAM, the coefficient switches the sign and it is significant. If, for example, house structures are resistant to earthquakes in the GAM, the effect of earthquakes might be 0 and the coefficient may be capturing some unobservable effect. However, when we look at urban areas outside the GAM, the negative effect of earthquakes is shown to be significant.

The effects of roads are also interesting to discuss. We find that primary roads have a positive effect on rents in all urban areas. When we look only at urban areas outside the GAM, we find that this positive effect is even greater. The positive effect of primary roads, e.g., reducing transport costs, is greater than the negative effect, providing a source of contamination or noise as in AMSJO. The increase in price goes from 1,912 colones to 5,280 colones. The implicit price of abundance of secondary roads also increases when we consider only areas outside the GAM (from -1,194 to 118), despite the change in the effect of wages that goes in the other direction (increase in the positive effect on wages from 1.89 to 2.73, which reduces the price of the amenity). Small urban neighborhood roads become less important in urban areas outside the GAM.

Finally, as expected, being in a poor neighborhood decreases rents (even more so outside the GAM), but it also decreases wages. This negative effect on wages is larger outside the GAM, switching the sign of the price (from -1,334 to 1,458). An average household will end up paying for living in a poor neighborhood due to the lower wage they will be able to access.

It would also be interesting to include other amenities such as garbage collection, provision of social events, proximity to coasts and performance measures of health and education to improve the precision of the index. In the next section, we tackle some of these points by elaborating on the survey administered in AMSJO. First, we introduce more detailed data on amenities as provided directly by the interviewees and, second, we also introduce the subjective valuation of life satisfaction, an issue that has been brought to light recently by some authors in the literature of quality of life valuation (see, for example, van Praag and Ferrer-i-Carbonell, 2004; Kahneman and Krueger, 2006; and Di Tella and MacCulloch, 2005).

5. Quality of Life Survey and Life Satisfaction Aproach

Here, we consider a different approach to find quality of life determinants. We implemented a survey focused on life satisfaction issues and quality of life. The survey is representative of the Metropolitan Area of San Jose for socioeconomic strata (low, medium and high) and for counties. Seven hundred and forty eight individuals were interviewed. In the Appendix, we describe the survey design and sampling strategy.

5.1 Subjective Valuation

Our survey included a question on the person's subjective valuation of her quality of life: "In general, on a scale of 1 to 10, with one being the lowest and 10 the highest figure, how high or low is your quality of life?" In this section, we study the results of the survey in qualitative terms to fully assess the survey data on this matter. In Figure 8, we show the distribution of the quality of life subjective question. We find that the mean is around 8.15 and the standard deviation is 1.37. In Table 7, we present means and standard deviation per county for quality of life. There is considerable dispersion in the valuation of quality of life across counties, though this dispersion is not extreme. The quality of life subjective valuation ranges from 7.67 to 8.61, almost one unit for the averages. Notice that since the ranges move from 5 to 10, one unit of dispersion is almost a 17 percent variation on average. Expressing the standard deviation in mean terms, the relative variation ranges from 0.11 to 0.20 mean units.

In Table 8, columns represent counties and rows move from 10, the highest level of quality of life, to the lowest level of 1. We only report from 5 to 10 because only 5 individuals out of 745 interviewed ranked their quality of life below 5. The cell shows the percentage of individuals answering the specific level of quality of life per county. The second part of the table shows the same values accumulated from highest to lowest values.

For the country as a whole, 20 percent, 19 percent and 35 percent rate their quality of life at 10, 9 and 8, respectively. When we compare these values across cities, we can see that there is variation across cities. In this sense, the distribution of valuation per county is not uniform across counties. For Curridabat, for example, 31 percent report the highest level, while in Desamparados it is only 15 percent. Across counties, we observe more variation in the valuation that what is observed only by comparing means.

We observe the same phenomena if we take the cumulative frequencies. Cumulative frequencies reveal in this case the aggregate valuation obtained. On average, 74 percent of respondents rated their life satisfaction at 8 or higher. However, in some counties such as Tibas 90 percent of respondents were in that range, while only 69 percent in that range in counties such as San Jose, Escazu or Desamparados.

In the next item, we ask respondents to value the different components of the amenities found in their cities on a scale where 0 means that the amenity is not important in their quality of life while 100 is very important. We report our findings by county in Table 9. On average people give a high valuation to almost all components. Religion and entertainment present the lowest importance on average while health, education and food are very important factors driving their quality of life.

Location decisions, e.g. the decision where to live, are extremely important for the underlying theoretical model of the quality of life. The action takes place in the housing market and people will move in and out of town as a response to amenities provided by the city in addition to other factors. The value of land or its proxy, the housing unit, becomes the mechanism of adjustment. In this respect, we also try to capture this source of decisions in our survey. We include two types of questions relating to this decision. We ask individuals about their motivation when they decide to move into the town. Next, we also ask them the degree of satisfaction concerning the different amenities provided and existing in the city.

Regarding the first question—"What factors did you consider when deciding to move into this neighborhood?"— we found that a substantial degree of variability in the criteria and variability across counties. Distance to work, distance to health facilities, quality of schools and safety were considered by 30 percent of interviewees (see Table 10, in which the number represents the percentage of people who answered yes to the question). Social and cultural activities garnered less consideration, and neighbors' education, distance to sport facility and air quality earned a medium amount of attention. These values are for the averages across the whole sample.

When we break out these data across counties, we find greater dispersion. For instance, in Coronado, 50 percent of respondents took into consideration the distance to work, while only 8 percent did so in Moravia (which is also consistent with our finding that most people drive to work in Moravia). On the other hand, in Coronado 7 percent of respondents considered the quality of schools, while 25 percent did so in Moravia. We can see that a multidimensional analysis of the quality of life is key in capturing this source of variation in preferences and endowments characterizing different counties.

Besides considering the decision to move in, we also evaluated the degree of satisfaction generated by the amenities once the person is in the county by asking "How satisfied are you with the following criteria in your neighborhood?" Descriptive statistics are presented in Table 11. Social groups provided the lowest levels of satisfaction, and there seems to be little social contact with non-related individuals. In contrast, people feel strongly satisfied with the distance to health facilities, an item to which they gave an approval rating of 92 percent. The quality of schools and the distance to relatives rank top in the satisfaction approval rates, and other factors rank in the middle of the satisfaction rates.

Again we see a strong variation across cities. For example, 58 percent overall report satisfaction with distance to work. However, when we look across cities this satisfaction rate ranges from 68 to 97 percent. Access and school quality receive 70 percent approval in Tibas and 90 percent in San Jose County. While safety seems to be an important source of dissatisfaction, with a 49 percent approval rate, there is some dispersion in the satisfaction with safety across counties. It is interesting to observe that even though only 16 percent of the sample report that they consider their neighbors' education when deciding to live in a neighborhood, 69 percent report feeling satisfied with their neighbors' education.

Lastly, we ask about willingness of individuals to move out to another neighborhood or within the neighborhood (see Table 12). Almost one quarter of the sample considered moving to another neighborhood. However, results vary across counties. Only 12 percent considered moving out of Escazu, while 53 percent considered moving out of Coronado.

We can conclude that there is variation in the subjective valuation of the quality of life within and across counties. People do value standard commodities such as housing, food, health, education and work when choosing communities but are less uniform when considering other factors such as entertainment, safety and transportation. When deciding to move, people place particular importance on distance to relatives, health, quality of schools, safety and distance to work. Less important considerations turned out to be air quality or social contacts out of the relative group.

5.1.1 Neighborhood Variables

In this section we will present results from the survey related to neighborhood amenities. We analyze water use, quality and availability in the AMSJO (see Table 13). Boiling water before consumption could reflect the fact that water quality is poor, especially in Coronado, Desamparados and Tibas. This tendency is also reflected in the proportion of people who bought bottled water for drinking purposes. Interestingly, Coronado, Desamparados and Tibas are also among the counties with relatively higher consumption of bottled water for daily needs. Finally, a relatively small percentage of households reported that somebody in their homes became sick because of drinking water from the tap in the last six months.

Some other important variables from the survey are related to perceived neighborhood environmental problems. On average, the most noticeable problems are the existence of garbage at public venues and air pollution. However, the data presented in Table 13 reveal a relatively higher disparity among counties. Other problems, such as the presence of graffiti drawing as well as sound pollution, are less important on average.

We also present data related to transportation. We asked people if they tend to walk, drive or use public transportation to commute to work. We found that a plurality of respondents (46 percent) in the metropolitan area take public transportation. However, we find significant differences among counties. For example, in the county of Moravia most people drive to work, while in the county of Goicochea most people take public transportation.

5.2 Quality of Life Determinants and Life Satisfaction Approach

As previously discussed, we asked individuals how they felt about their overall quality of life on a scale from 1 to 10. We also asked questions about housing, security, health and neighborhood satisfaction. In this section, we study these subjective responses using formal methods proposed by van Praag and Ferrer-i-Carbonell (2005).

First, we present individual regressions for each component of life, housing, security, health and neighborhood satisfaction, using explanatory variables for each of these components. Tables 14 to 17 present these results. We then explain overall quality of life using these four components and properly correcting for potential endogeneity elements (see van Praag and Ferrer-i-Carbonell, 2005, for details). Tables 18 and 19 summarize these results. Finally, we explain the overall quality of life using all the explanatory variables from each of the four individual satisfaction domains.

We present our results for housing satisfaction in Table 14. We include a series of characteristics of housing units, income and number of members in the unit. Our results are as we expected. We find that the more rooms in a unit and the better the quality of floors, with owners residing in the unit and less people living in the house, the higher the rating interviewees give for housing satisfaction. An interesting point concerning Table 14 is that women interviewed are more satisfied with their houses than men.

In Table 15, we show how safe individuals feel using a series of characteristics included in our interview. People robbed in the last six months, and persons reporting vandalism or auto theft, presence of dangerous driving and gangs in their neighborhoods tend to feel significantly less safe. As expected, a higher quality of policing makes people feel significantly safer.

Results on health service satisfaction (Table 16) are statistically less conclusive. Factors such as time spent in the clinic and distance to it are not significant. Moreover, people who have required medical attention report a higher valuation of health services, which suggests that accessing the health system might change perception. It is also interesting to note that level of income is not significant.

In Table 17 we show neighborhood satisfaction results. Again, some of the explanatory variables are not statistically significant. People in neighborhoods closer to secondary schools tend to be happier with their neighborhood, and people in neighborhoods far away from fire departments also tend to be happier with their neighborhood. The latter is a counter-intuitive result. Fire departments could be endogenously located in areas that tend to be more likely to be on fire, and people in those neighborhoods probably would not feel satisfied. Another plausible explanation is the fact that fire departments can be very noisy and disruptive. Further analysis is required.

We next use housing, health service, safety and neighborhood satisfaction as explanatory variables for overall quality of life. We also include a variable *Z* that is obtained from a first components analysis of these four elements and allows us to disentangle potential endogenous effects (see van Praag and Ferrer-i-Carbonell, 2005, for details). Our results are interesting. All elements lead to a better overall quality of life valuation, and all variables are statistically meaningful except neighborhood satisfaction (see Table 18). In Table 19, we use predicted values of these four components obtained from the previous four regressions, finding that that health satisfaction in particular becomes insignificant when we employed predicted values.

Finally, we use all variables previously used to explain each of the satisfaction domains in order to explain the overall quality of life. We show these results in Table 20. The coefficients are statistically weak, though several show the expected sign. In particular, we find that presence of gangs decreases quality of life, and we also find that police quality increases life satisfaction. House characteristics have an important impact on overall life satisfaction.

6. Conclusions

Wages and rent differentials across neighborhoods were used to estimate price amenities. For San Jose's Metropolitan Area, we found that the price of safety is positive. The safer a neighborhood is the more valuable it is. Average slopes negatively affect the value of the neighborhood, so that the steeper on average a neighborhood is the lower its value. Precipitation has a negative effect on the value of a house, and people value significantly less areas with a high risk of being affected by volcanic eruptions.

Additionally, people value living close to national parks. Proximity to rivers negatively affects the level of rents, which might reflect people's reaction to the highly contaminated rivers inside the city. The presence of primary roads is negatively valued; however, the presence of urban and neighborhood roads is positively valued within San Jose.

We found that neighborhood amenities explain 39 percent of the standardized variation of rents. We also looked at the distribution of the contribution of housing and neighborhood characteristics to the level of rents. For housing characteristics, the mean and the median are very similar (less than one percent difference). This is not the case for neighborhood characteristics. First, the mean is 10 percent higher than the median, which implies that more than 50 percent of neighborhoods are worse off than the mean neighborhood characteristics. Second, there is a wider gap between the median neighborhood and the neighborhood in the top 25 percentile than between the median neighborhood and the neighborhood in the lowest 25 percentile. This is evidence that there are some neighborhoods that are significantly better off than most of the neighborhoods in the metropolitan area. Our interpretation of these results is that neighborhood characteristics create a regressive effect on welfare distribution.

We found that districts like Mata Redonda rank very high in housing characteristics but poorly in neighborhood amenities, and districts like Escazu rank poorly in housing characteristics but high in neighborhood amenities. This shows the potential of indirect policy measures to reduce inequality in urban areas through the improvement of neighborhood amenities.

When we looked at the effects of wages, we find that they are a very important component of implicit price amenities. In fact, 12 percent and 17 percent of the standard deviation of the wage can be explained by environmental amenities. We found that for some dis-amenities, such as the risk of being affected by floods, firms' avoidance of certain areas plays such an important role that prices of the amenities switch sign when wage effects are considered. Individuals would actually end up paying to live in an area with a risk of being affected by a flood because wages are significantly lower in those areas. This implies that the decisions firms make regarding where to locate might reduce the effect of disasters as probabilities of these disasters change and firms change location (provided full information is available).

We also ran a series of regressions explaining different aspects of quality of life such as housing satisfaction, health satisfaction, neighborhood satisfaction and safety satisfaction as well as an overall valuation of quality of life. We find the expected results when regressing each satisfaction domain. We also obtained expected results when running as independent variables each of the domains and as a dependent variable the subjective valuation of quality of life. However, results change when we used predicted values of those domains instead of the real values; health satisfaction, for instance, becomes insignificant. We conclude that housing and safety satisfaction are the key components in determining life satisfaction.

Finally, we directly considered all the objective variables to explain quality of life. Income appears to be insignificant. Our interpretation of this result is that we are controlling for the factors that affect quality of life fairly well, which of course have to be purchased. Income might not generate quality of life by itself, but the goods bought by that income do.

This study will allow policymakers at both the national and local levels to identify which urban areas are disadvantaged and determine what actions will be most effective for improving the quality of life. The information generated might help individuals and firms, who could take more informed decisions concerning where to live and what to demand as a community from local and central governments.

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Table 1. Urban Characteristics

	AMSJO	GAM	Urban Areas Outside GAM	All Urban Areas
Population 2000 Census				
Population	975 175	1 653 854	595 442	2 249 296
Population per Km^2	6 129	4 796	1 963	3 470
Average Pop. per CT	251	253	238	249
Households Characteristics				
Number of Households	264 530	439 976	165 845	605 821
Households Renting	63 191	91 938	29 227	121 165
Households Renting (%)	23.88%	20.89%	17.62%	20.00%
Housing Characteristics				
Ave. HH Size	3.92	3.99	3.90	3.97
Ave. Number of Bedrooms	2.59	2.16	2.45	2.56
Ave. Number of Rooms	5.09	5.14	4.73	5.03
House Condition: Good (%)	65.46	67.8	59.26	65.45
House Condition: Regular (%)	20.94	19.6	23.8	20.78
House Condition: Poor (%)	7.36	6.56	8.87	7.19
Access to Electricity (%)	99.86	99.80	99.32	99.69
Access to Water (%)	91.29	91.3	87.46	90.22
Labor Market 2003				
Head of HH Unemployment Rate	2.52	2.57	3.93	3.04
Head of HH Monthly Wages	188 725	178 616	133 661	166 177
Education				
Primary School Finished	90.61	88.87	77.24	84.05
Secondary School Finished	40.25	39.19	27.37	34.29
Diploma	5.82	5.97	4.17	5.22
Bachelor	6.73	5.78	3.66	4.9
Post-Graduate	2.82	2.82	0.83	2
Labor Affiliations*				
Unions (%)	4.73	4.78	8.03	6.13
Cooperatives (%)	9.47	9.48	14.65	11.62
Solidarity Associations (%)	13.38	14.08	8.48	11.76
Unorganized workers (%)				
Socioeconomic Status of CT				
High	42.62	38.33	43.77	39.83
Medium	41.21	50.22	36.67	46.46
Low	16.15	11.44	19.55	13.69

CT: Census Track, *The total might add up more than 100 percent since some of the workers could belong to more than one organization.

Table 2. Mean Distances from Census Tracks' Centroid to Education Facilities by City and Socioeconomic Status (Km)

		AMSJO	GAM	Outside GAM	All Urban Areas
Dist. to Primary Schools	Low	0.61	0.64	0.98	0.72
	Medium	0.55	0.61	0.71	0.60
	High	0.45	0.53	0.71	0.53
	Total	0.52	0.58	0.76	0.59
Dist. to Secondary Schools	Low	1.24	1.50	2.07	1.49
	Medium	0.76	1.02	1.50	1.01
	High	0.60	0.86	1.06	0.77
	Total	0.78	1.02	1.41	0.98

Table 3. Rent Regression with Selection Correction for AMSJO and Price Amenities Measured at the Mean Prices in 2000 Colones (308=1$)

Amenities	*B*	Monthly Price+	Component of the Index			
			Mean	25%	50%	75%
Housing Characteristics						
Number of Bedrooms	0.55***	9500	24886	22439	24887	27382
Number of Rooms (No Bedrooms)	0.33***	5791	14707	12535	14146	16297
Floor (Good)	0.24***	4198	3043	2448	3205	3798
Walls (Good)	0.44***	7644	5414	4320	5662	6857
Walls of Blocks	0.82***	14083	9691	7041	10026	13351
Roof (Good)	0.32***	5614	3957	3186	4101	4940
Ceiling (Good)	0.43***	7534	6152	5560	6918	7401
Water Source: Community Org.	-0.36***	-6235	-199	0	0	0
Water source: Rain	-0.82**	-14189	-11	0	0	0
Water source: Well	0.13	2291	3	0	0	0
Water source: River	-0.89***	-15287	-16	0	0	0
Sewer (Septic Tank)	-0.10***	-1856	-603	-1349	-179	-30
Sewer (Latrine)	-0.21*	-3609	-44	0	0	0
Sewer (Other)	-0.33***	-5728	-48	0	0	0
No Sewer	0.09	1555	7	0	0	0
Exclusive Bathroom for the HH	0.48***	8339	8116	8339	8339	8081
Electricity Supplied Not by ICE	-0.24***	-4206	-0.43	0	0	0
No Electricity Supplied	-0.70**	-12059	-16	0	0	0
Total Housing Char. Contribution			**75072**	**70211**	**75779**	**81716**
Housing Relative Importance	60.84%					

Table 3., continued

Amenities	*B*	Monthly Price+	Component of the Index			
			Mean	**25%**	**50%**	**75%**
Neighborhood Characteristics						
Safety Index	0.46***	7953	4077	2226	3976	5328
Slope Degrees	-0.01***	-177	-1309	-1644	-837	-380
Precipitation (mm^3)	-0.12**	-2154	-4478	-4308	-4308	-4308
Risk of Being Affected by an Eruption	-0.13**	-2316	-2024	-2316	-2316	-2316
Log Distance to National Parks (Km)	-1.25***	-21589	-57751	-53840	-59005	-61543
Log Distance to Clinics (Km)	0.01	175	42	-42	46	140
Log Distance to Secondary Schools (Km)	0.02	364	-161	-296	-128	13
Log Distance to Primary Schools (Km)	0.00	59	-49	-71	-42	-20
Log Distance to Rivers (Km)	0.06***	1054	-1035	-1665	-887	-250
Log Distance to Fire Departments (Km)	0.05**	968	638	244	730	1174
Log Distance to Sabana Park	-0.54***	-9419	-17997	-15497	-19493	-22064
Log Distance to Peace Park	1.35***	23273	65655	62467	65594	68625
Length of Primary Roads (Km)	-0.46***	-7974	-146	0	0	0
Length of Secondary Roads (Km)	0.23***	4098	180	0	0	0
Length of Urban-Neig. Roads (Km)	0.57***	9785	4691	1689	3028	4826
Track Qualified as Poor	-0.35***	-6133	-1092	0	0	0
Total Neighborhood Char. Contribution			**-10444**	**-12271**	**-11117**	**-8170**
Neigh. Amenities Relative Importance	39.15%					
Other Parameters						
Constant	16.0807***					
Selection Parameter	-0.2238					
Lambda	0.1006					

*, **, *** represent significance at 10, 5, and 1 percent respectively. +To obtain these values, estimated prices were multiplied by quantities of the amenity c./ symbol of colones + The price was calculated following Bosquit et al 1988. Price = b*(Ybar)^(1-λ) where b is the estimated coefficient from the best functional form and Ybar is the average of the dependent variable. The dummy left out for sewer is being connected to a sewer network. The dummy left out for water source is being supplied by the national water company.

Table 4. Ranking of Districts by Housing and Neighborhood Characteristics, Neighborhood Characteristics, and Housing Characteristics and Estimates of Equilibrium Prices per Month in Year 2000 US$

	Housing and Neighborhood Characteristics		Neighborhood Characteristics		Housing Characteristics	
District	Ranking	Value	Ranking	Value	Ranking	Value
SANCHEZ	1	370	1	27	1	343
SAN RAFAEL	2	285	2	9	8	275
MATA REDONDA	3	275	10	-23	2	299
CARMEN	4	264	11	-24	3	287
SAN VICENTE	5	258	8	-20	6	277
ANSELMO LLORENTE	6	254	13	-28	4	281
SAN ISIDRO	7	245	3	-5	23	250
SAN PEDRO	8	238	20	-32	10	271
SAN JUAN	9	237	16	-30	11	267
SABANILLA	10	237	35	-39	7	276
COLIMA	11	236	12	-27	14	263
ESCAZU	12	235	4	-11	26	246
GRAVILIAS	13	235	25	-36	9	271
SAN FCO. DE DOS RIOS	14	231	44	-47	5	278
SAN ANTONIO	15	228	30	-37	12	265
PATALILLO	16	228	5	-15	28	242
CURRIDABAT	17	226	33	-38	13	264
MERCEDES	18	225	29	-37	15	262
SAN RAFAEL	19	224	14	-28	20	252
CALLE BLANCOS	20	222	19	-32	17	254
GRANADILLA	21	222	18	-31	19	252
PAVAS	22	220	9	-20	29	240
MATA DE PLATANO	23	220	22	-34	18	254
ZAPOTE	24	216	41	-45	16	260
IPIS	25	215	17	-30	27	246
DAMAS	26	212	26	-36	25	248
GUADALUPE	27	211	37	-40	22	251
SAN ANTONIO	28	211	7	-19	35	230
DESAMPARADOS	29	207	39	-42	24	249
HATILLO	30	205	42	-46	21	251
CATEDRAL	31	196	38	-41	31	238
SAN RAFAEL ARRIBA	32	194	31	-38	33	232
LEON XIII	33	193	24	-35	37	228
MERCED	34	192	27	-37	36	228

Table 4., continued

	Housing and Neighborhood Characteristics		Neighborhood Characteristics		Housing Characteristics	
SAN RAFAEL ABAJO	35	189	43	-46	32	235
SAN SEBASTIAN	36	188	45	-51	30	239
URUCA	37	181	21	-33	41	214
SAN FRANCISCO	38	181	34	-39	39	220
PURRAL	39	180	23	-35	40	215
SALITRILLOS	40	176	6	-17	50	192
SAN MIGUEL	41	172	32	-38	44	210
ALAJUELITA	42	172	48	-59	34	230
HOSPITAL	43	169	40	-42	42	211
SAN JOCESITO	44	166	46	-54	38	220
SAN FELIPE	45	165	36	-40	46	205
CINCO ESQUINAS	46	164	28	-37	48	200
PATARRA	47	154	15	-29	51	183
SAN JUAN DE DIOS	48	148	50	-62	45	210
TIRRASES	49	144	51	-67	43	211
CONCEPCION	50	143	49	-61	47	204
ASERRI	51	143	47	-57	49	199

Table 5.
Regression Results and Price Amenities with Selection Decision
Housing Characteristics Controlled, Prices in 2000 Colones (308=1$)

Amenities	AMSJO		GAM	
	B	**Price**	***B***	**Price**
Safety Index	0.46***	7953	0.52***	6801
Slope degrees	-0.01***	-177	-0.01***	-165
Precipitation (mm^3)	-0.12**	-2154	-0.10***	-1283
Risk of Being Affected by an Eruption	-0.13**	-2316	-0.23***	-2980
Log Distance to National Parks (Km)	-1.25***	-21589	-0.66***	-8582
Log Distance to Clinics (Km)	0.01	175	0.05***	678
Log Distance to Secondary Schools (Km)	0.02	364	-0.00	-58
Log Distance to Primary Schools (Km)	0.00	59	-0.01	-68
Log Distance to Rivers (Km)	0.06***	1054	0.09***	1201
Log Distance to Fire Departments (Km)	0.05**	968	0.07***	881
Log Distance to Sabana Park	-0.54***	-9419	-0.54***	-7025
Log Distance to Peace Park	1.35***	23273	0.43***	5663
Length of Primary Roads (Km)	-0.46***	-7974	-0.18***	-2384
Length of Secondary Roads (Km)	0.23***	4098	0.08	1092
Length of Urban-Neg. Roads (Km)	0.57***	9785	0.39***	5105
Track Qualified as Poor	-0.35***	-6133	-0.39***	-5140
Relative Importance of Neg. Amenities	39.15%		29.70%	
Lambda	0.1006		0.1217	

*, ** and *** represent statistical significance at 10, 5 and 1 percent.

Table 6. Regression Results and Price Amenities with Selection Decision Rent and Wage Regression for All Urban Areas and Urban Areas Outside GAM Housing Characteristics Are Controlled, Prices in 2000 Colones (308=1$)

Amenities	All Urban Areas			Urban Areas outside GAM		
	Monthly Rents	Monthly Wage	Price	Rents	Wage	Price
Safety Index	-0.03	-25.24***	23393	-0.03	-39.32***	30079
Slope Degrees	0.00	-0.40***	329	-0.01***	-0.46***	268
Precipitation (mm^3)	-0.09***	-0.96	-668	0.01	-1.33	1112
Risk of Being Affected by an Eruption	-0.22***	1.12	-5380	0.15***	-3.52	3993
Risk of Being Affected by Flows	-0.06**	-7.67*	5540	-0.09**	-13.17***	9435
Log Dist. to Earthquakes	-0.06***	0.57	-856	0.16***	0.87**	657
Log Dist. to National Parks (Km)	-0.28***	-1.39*	-2691	-0.17***	-1.76***	-37
Log Dist. to Clinics (Km)	0.03***	-2.91**	3085	-0.01	-5.71	4334
Log Dist. to Secondary Schools (Km)	0.03***	-1.55	1826	-0.05***	0.22	-592
Log Dist. to Primary Schools (Km)	0.02***	-3.07*	3192	0.10***	-2.35	2616
Log Dist. to Rivers (Km)	0.07***	0.33	754	0.07***	-1.55	1796
Log Dist. to Fire Departments (Km)	0.02***	-4.05***	3853	-0.06***	-3.66***	2332
Length of Primary Roads (Km)	0.07*	-1.13	1912	0.56***	-0.85	5280
Length of Secondary Roads (Km)	0.06	1.89	-1194	0.27***	2.73*	118
Length of Small Urban-Neg. Roads (Km)	0.24***	-1.16***	4659	0.12***	-1.02***	1811
Track Qualified as Poor	-0.28	-4.25***	-1334	-0.37***	-5.87**	1458
Relative Importance of Neg. Amenities	22.71%	12.01%		27.73%	17.28%	
Lambda	0.09	0.41		0.11	0.41	

We used a GAM dummy for all Urban Areas We did not consider GAM dummy when calculating relative importance of neighborhood amenities for all urban areas for comparison reasons. The wage effect was deflated to 2000 colones.

Table 7. Descriptive Statistics of the Subjective Valuation of Quality of Life

	San José	Escazú	Desamparados	Aserrí	Goicochea	Alajuelita	Coronado	Tibás	Moravia	Montes de Oca	Curridabat	**Total**
# Observations	180	40	155	62	89	67	15	51	13	37	36	**745**
Mean	8.06	8.00	8.01	8.11	8.27	8.06	7.67	8.61	8.38	8.68	8.42	**8.15**
St. Dev.	1.61	1.40	1.42	1.24	1.28	1.40	1.63	1.02	0.96	1.00	1.30	**1.39**
Sd/Mean	0.20	0.17	0.18	0.15	0.15	0.17	0.21	0.12	0.11	0.12	0.15	**0.17**

Table 8. Quality of Life Subjective Valuation per County (Relative Frequencies)

	San José	Escazú	Desamparados	Aserrí	Goicochea	Alajuelita	Coronado	Tibás	Moravia	Montes de Oca	Curridabat	**Total**
						Relative Frequency						
10 (Highest)	0.21	0.20	0.15	0.19	0.20	0.18	0.20	0.25	0.15	0.24	0.31	**0.20**
9	0.21	0.13	0.18	0.13	0.20	0.21	0.07	0.22	0.23	0.32	0.11	**0.19**
8	0.27	0.35	0.41	0.37	0.37	0.30	0.27	0.43	0.46	0.30	0.36	**0.35**
7	0.17	0.15	0.16	0.23	0.16	0.18	0.27	0.08	0.15	0.14	0.14	**0.16**
6	0.07	0.15	0.05	0.06	0.03	0.07	0.07	0.02	0.00	0.00	0.08	**0.06**
5	0.06	0.03	0.05	0.02	0.02	0.06	0.13	0.00	0.00	0.00	0.00	**0.04**
						Accumulated Relative Frequency						
10 (Highest)	0.21	0.20	0.15	0.19	0.20	0.18	0.20	0.25	0.15	0.24	0.31	**0.20**
9	0.42	0.33	0.33	0.32	0.40	0.39	0.27	0.47	0.38	0.57	0.42	**0.39**
8	0.69	0.68	0.74	0.69	0.78	0.69	0.53	0.90	0.85	0.86	0.78	**0.74**
7	0.86	0.83	0.90	0.92	0.93	0.87	0.80	0.98	1.00	1.00	0.92	**0.90**
6	0.93	0.98	0.94	0.98	0.97	0.94	0.87	1.00	1.00	1.00	1.00	**0.96**
5	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	**0.99**

Table 9. Importance of Selected Aspects on Quality of Life by County

Criteria	Total	San José	Escazú	Desamparados	Aserrí	Goicochea	Alajuelita	Coronado	Tibás	Moravia	Montes de Oca	Curridabat
House	96	96	96	96	96	95	95	97	99	93	92	95
Health	98	98	97	97	98	97	99	98	99	97	98	98
Education	98	98	99	96	96	95	97	97	97	95	96	95
Entertainment	87	87	86	83	87	89	90	85	89	83	87	86
Safety	94	92	96	94	92	94	96	99	97	95	95	91
Transportation	91	92	92	90	89	89	95	98	92	86	84	88
Religion	85	86	82	84	85	87	92	96	79	80	81	76
Meals	98	97	98	98	97	98	98	98	99	95	96	99
Work	96	97	97	97	93	96	97	99	95	97	96	96

Table 10. Did You Consider This Factor When Deciding to Move into This Neighborhood? (Percentage of participants answering yes)

County	San José	Escazú	Desamparados	Aserrí	Goicochea	Alajuelita	Coronado	Tibás	Moravia	Montes de Oca	Curridabat	Total
Distance to Work?	27%	35	18	49	31	28	50	45	8	43	37	29
Quality of Schools?	30	33	27	54	18	29	38	45	8	25	20	28
Distance to Health Facility?	32	48	30	51	25	32	36	53	17	24	16	32
Safety?	24	39	26	71	31	30	29	43	42	33	23	30
Distance to Relatives?	30	25	31	68	28	24	29	49	25	27	20	31
Distance to Sport Facility?	19	20	7	35	15	6	7	27	9	24	10	15
Quality of Air?	14	38	17	83	15	21	7	29	36	24	10	21
Participation Social Groups	5	5	7	15	6	2	0	4	17	5	6	5
Distance to Cultural or Sport Events?	7	10	3	23	7	3	7	12	8	22	6	8
Education of Neighbors?	15	20	17	42	13	15	7	18	25	22	3	16
Other	42	0	4	47	26	27	36	8	18	35	52	24

Table 11. Are You Satisfied with the Following Criteria in Your Neighborhood? (Percentage of participants answering yes)

Question/County	San José	Escazú	Desamparados	Aserrí	Goicochea	Alajuelita	Coronado	Tibás	Moravia	Montes de Oca	Curridabat	Total
Distance to Work?	73%	97	69	79	70	68	93	84	82	73	84	75
Access and Quality of Schools?	90	89	86	89	77	88	77	70	91	83	73	85
Distance to Health Facility?	92	100	92	94	91	91	100	92	100	100	75	92
Safety?	44	58	42	60	54	55	47	49	85	54	43	49
Distance to Relatives?	65	68	73	77	69	73	73	75	92	81	58	71
Distance to Sport Fac.?	67	70	39	58	63	36	60	54	92	70	46	56
Quality of Air?	53	67	53	80	64	56	80	47	92	76	50	59
Participation Social Groups	23	21	19	25	33	20	30	14	67	31	38	24
Distance to Cultural or Sport Events?	43	55	31	50	47	29	73	37	67	54	29	41
Education of Neighbors?	64	75	69	68	69	66	77	70	92	86	59	69

Table 12. Considered Moving to Another Place?

County	No	Yes	
		Different Neighborhood	Same Neighborhood
San José	77%	21%	3%
Escazú	88%	8%	5%
Desamparados	69%	24%	6%
Aserrí	82%	13%	5%
Goicochea	76%	19%	4%
Alajuelita	79%	16%	4%
Coronado	47%	33%	20%
Tibás	78%	18%	4%
Moravia	85%	15%	0%
Montes de Oca	81%	19%	0%
Curridabat	86%	6%	8%
Total	77%	19%	4%

Table 13. Descriptive Statistics from Survey

	Drinking water			**Perceived environment problems**				**Mode of transportation**		
Canton	**Boil**	**Bottled**	**Sick**	**Garbage**	**Graffiti**	**Air Pollution**	**Sonic contami-nation**	**Walk**	**Public**	**Drives**
San José	0.13	0.09	0.02	0.58	0.44	0.47	0.18	0.34	0.44	0.22
Escazú	0.15	0.22	0.05	0.40	0.22	0.25	0.15	034	0.42	0.23
Desamparados	0.17	0.30	0.03	0.57	0.38	0.44	0.35	0.20	0.55	0.25
Aserrí	0.14	0.27	0.04	0.58	0.29	0.43	0.35	0.28	0.42	0.28
Goicochea	0.14	0.24	0.03	0.41	0.21	0.30	0.17	0.16	0.58	0.25
Alajuelita	0.08	0.19	0.01	0.64	0.29	0.32	0.20	0.38	0.35	0.26
Coronado	0.20	0.06	0.20	0.46	0.40	0.66	0.20	0.40	0.50	0.10
Tibás	0.15	0.23	0.01	0.62	0.46	0.52	0.28	0.30	0.34	0.34
Moravia	0.07	0.38	0.07	0.38	0.07	0.38	0.07	0.00	0.11	0.88
Montes de Oca	0.08	0.21	0.02	0.43	0.18	0.29	0.13	0.24	0.32	0.44
Curridabat	0.13	0.25	0.02	0.47	0.30	0.36	0.20	0.14	0.51	0.33
Total AMSJO	**0.14**	**0.21**	**0.03**	**0.54**	**0.34**	**0.41**	**0.23**	**0.26**	**0.46**	**0.27**

Table 14. Housing Characteristic Satisfaction (Question 20), Model COLS

Variables	Coefficients
Sex (Male=1)	-0.19
Ln age	-7.28*
Ln age^2	1.07*
Ln (children in the household + 1)	-0.23
Log of Income	0.02
Log of Number of People in the Household	-0.11
Number of Rooms	0.22**
Floor made of cement	-0.86***
Floor made of wood	-0.45*
Dirt floor	-2.96
Rented house	-0.87***
Constant	20.62**
Number of Observations	741
Log Likelihood	-1499

Dummy left out for floors is ceramic floor.
As before, *, **, *** represent significance at 10, 5, and 1 percent.

Table 15. Safety Satisfaction Regression (Question 32) Model COLS

Variables	Coefficients
Sex (Male=1)	0.1
Ln age	-8.05*
Ln age^2	1.18*
Ln (children in the household + 1)	-0.03
Log of Income	-0.01
Log of Number of People in the Household	0.19
Have been robbed in the last six months	-0.15*
Presence of Vandalism	-0.53**
Presence of Auto Theft	-0.44**
Presence of Dangerous Driving	-0.47**
Presence of Dangerous Looking individuals	-0.18
Presence of Gangs	-0.65***
Police Quality	1.27***
Constant	20.88**
Number of Observations	683
Log Likelihood	-1417

*, **, *** represent significance at 10, 5, and 1 percent.

Table 16. Health Services Satisfaction Regression (Question 37) Model COLS

Variables	Coefficients
Sex (Male=1)	-0.13
Ln age	-10.85**
Ln age^2	1.62**
Ln (Children in the Household + 1)	-0.15
Log of Income	-0.04
Log of Number of People in the Household	0.23
Time to Clinic	0.01
Distance to Clinics	0
Have Needed Medical Attention	0.59**
Reported Not Receiving Adequate Attention	-3.17***
Constant	25.29**
Number of Observations	685
Log Likelihood	-1458

*, **, *** represent significance at 10, 5, and 1 percent.

Table 17. Neighborhood Satisfaction Regression (Question 53) Model Probit

Variables	Coefficients
Sex (Male=1)	0.007
Ln age	-3.045
Ln age^2	0.516
Ln (Children in the Household + 1)	-0.254*
Safety Index	0.087
Log of Number of People in the Household	0.408**
Time to Clinic	-0.006
Time to Reach a Park	-0.001
Distance to Fire Departments	0.000**
Distance to Schools	0
Distance to Secondary Schools	0
Distance to Clinics	0
Length of Primary Roads	0.005
Length of Secondary Roads	0.002*
Length of Neighborhood and Urban Roads	0
Distance to National Parks	0
Average Slope	-0.005
Constant	5.069
Number of Observations	730
Log Likelihood	-303.79

*, **, *** represent significance at 10, 5, and 1 percent.

Table 18. Life Satisfaction Regression Explained by Other Subjective Valuations (Question 58) Model COLS

Variables	Coefficients
Housing Satisfaction	0.19***
Safety Satisfaction	0.09**
Health Facilities Satisfaction	0.08**
Neighborhood Satisfaction	0.07
Zn	-0.14
Constant	5.35***
Number of Observations	635
Log Likelihood	-1083

*, **, *** represent significance at 10, 5, and 1 percent.

Table 19. Life Satisfaction Regression Explained by Predicted Subjective Valuations (Question 58) Model COLS

Variables	Coefficients
Housing Satisfaction	0.31***
Safety Satisfaction	0.11*
Health Facilities Satisfaction	-0.04
Neighborhood Satisfaction	0.6
Zn	0.24***
Constant	4.55***
Number of Observations	633
Log Likelihood	-1064

*, **, *** represent significance at 10, 5, and 1 percent.

Table 20. Life Satisfaction Regression Explained by Objective Variables (Question 58) Model COLS

Variables	Coefficients
Sex (Male=1)	-0.04
Ln age	4.13
Ln age^2	-0.6
Ln (Children in the Household + 1)	0.01
Log of Income	0.03
Log of Number of People in the Household	-0.21
Number of Rooms	0.04
Have Been Robbed in the Last Six Months	0.02
Presence of Vandalism	-0.05
Presence of Auto Theft	0.05
Presence of Dangerous Driving	-0.07
Presence of Dangerous Looking Individuals	0.13
Presence of Gangs	-0.35**
Police Quality	0.17
Safety Index	-0.08
Time to Clinic	-0.01
Have Needed Medical Attention	-0.12
Reported Not Receiving Adequate Attention	-0.19
Time to Reach a Park	0
Distance to Fire Departments	0
Distance to Schools	0
Distance to Secondary Schools	0
Distance to Clinics	0
Length of Primary Roads	0
Length of Secondary Roads	0
Length of Neighborhood and Urban Roads	0
Distance to National Parks	0
Average Slope	0
Zn	0.22***
Floor made of cement	-0.26*
Floor made of wood	-0.35*
Rented house	-0.36**
Constant	1.32
Number of Observations	633
Log Likelihood	-1048

Dummy left out for type of floors is ceramic floor. As before, *, **, *** represent significance at 10, 5, and 1 percent.

Figures

Figure 1. Urban Areas in Costa Rica

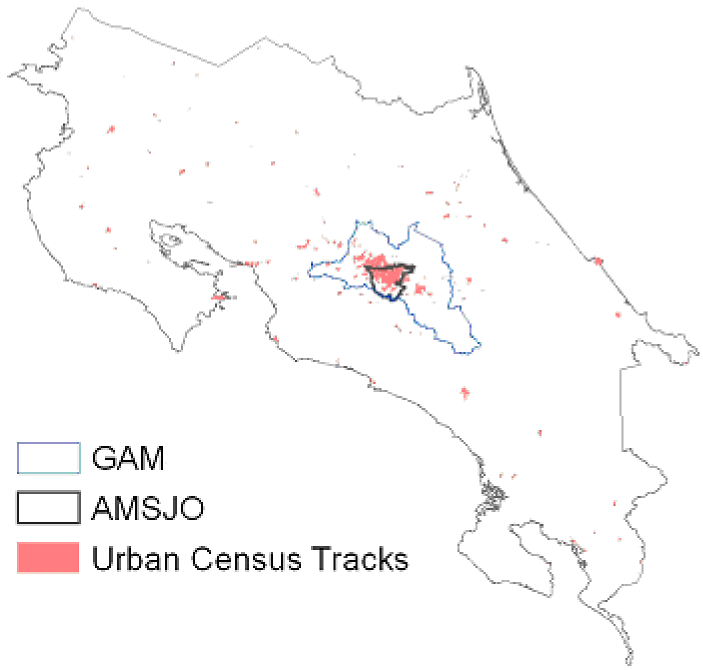


Figure 2. Distribution of Rents in Urban Areas

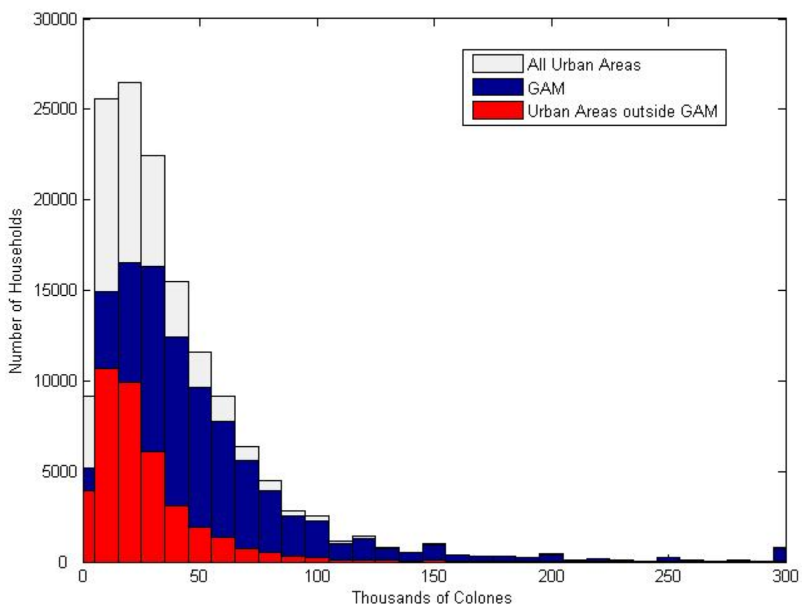
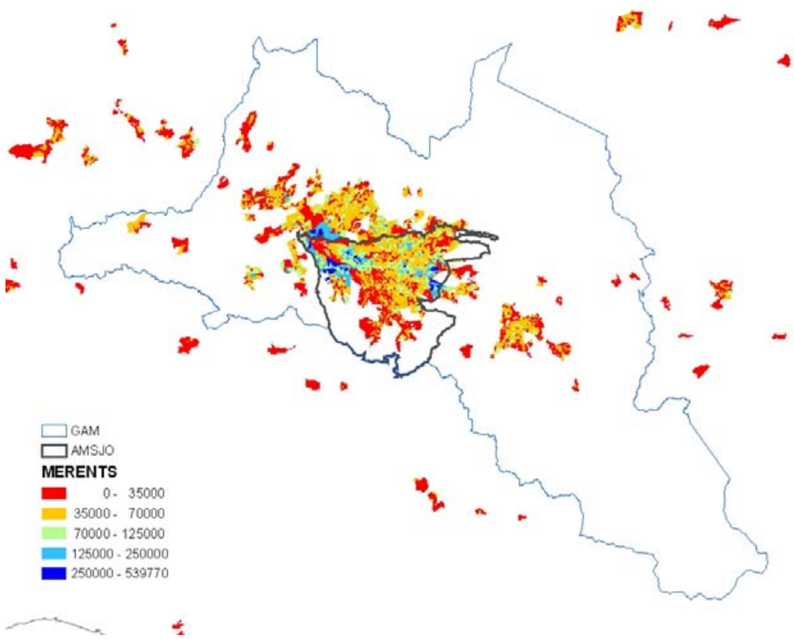


Figure 3. Average Rents by Census Track in GAM and AMSJO

a) Average Rents by Census Tracks in GAM



b) Average Rents by Census Tracks in AMSJO

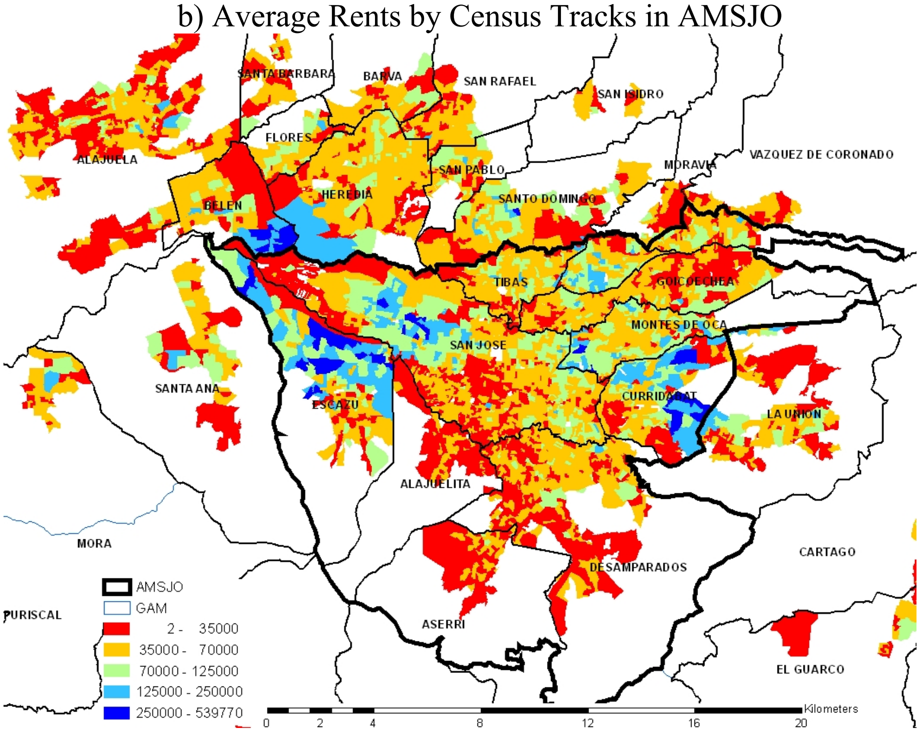


Figure 4. Spatial Correlation of Rents across Census Tracks at Different Distances

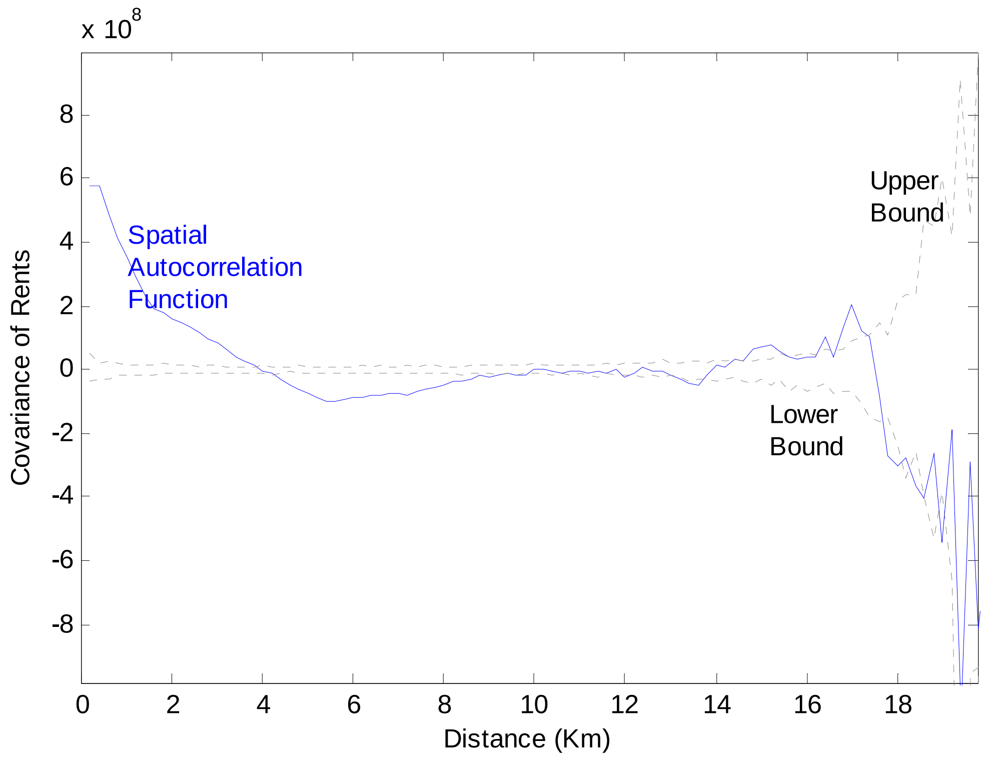
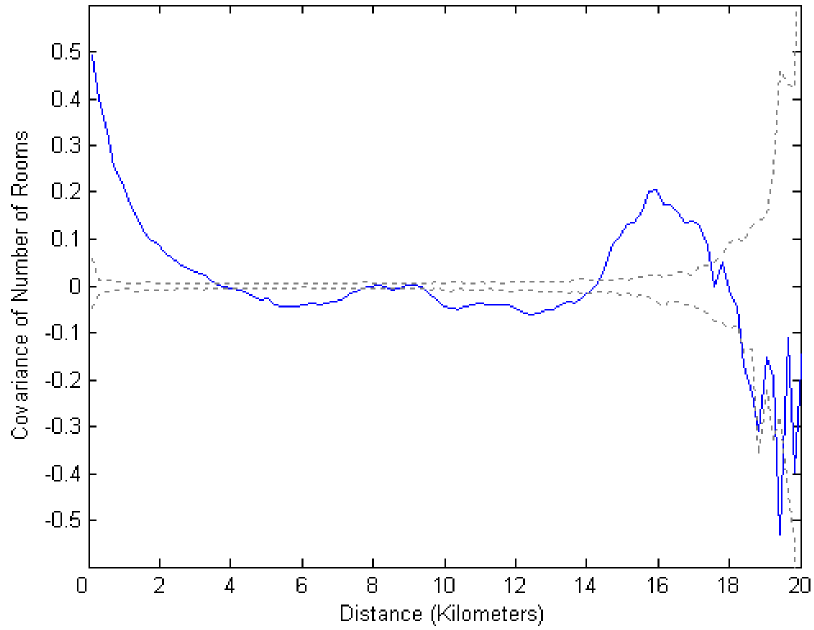


Figure 5. Autocorrelation Function of Housing Characteristics

a) Number of Rooms



b) Water Access

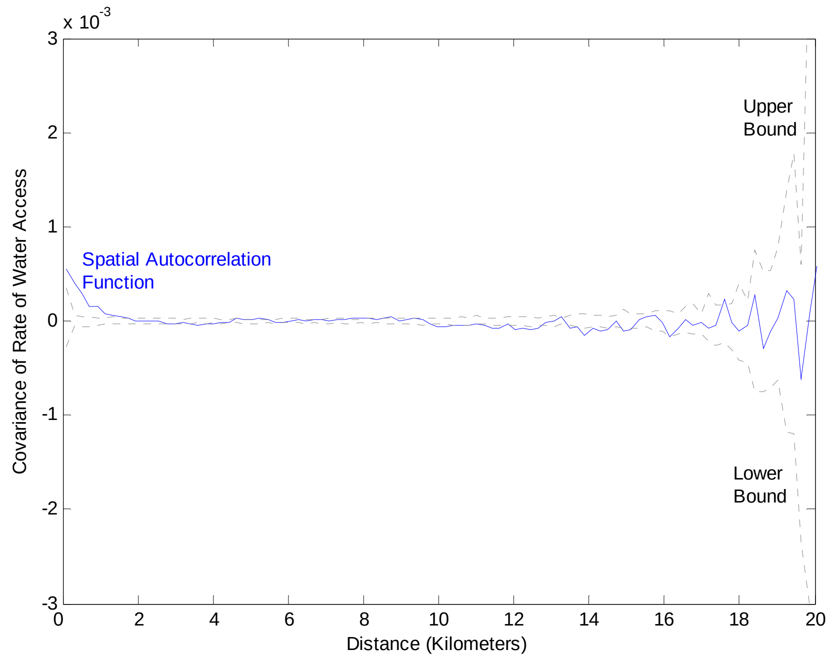
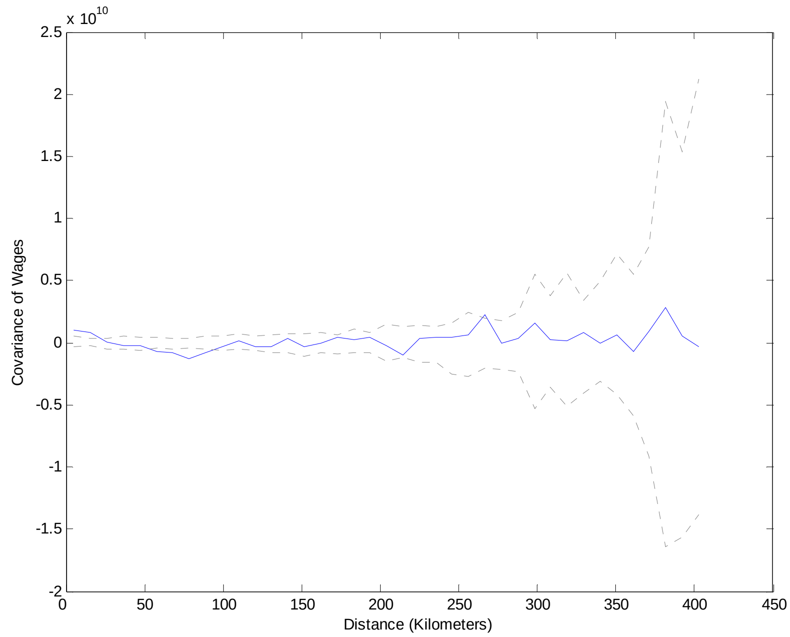
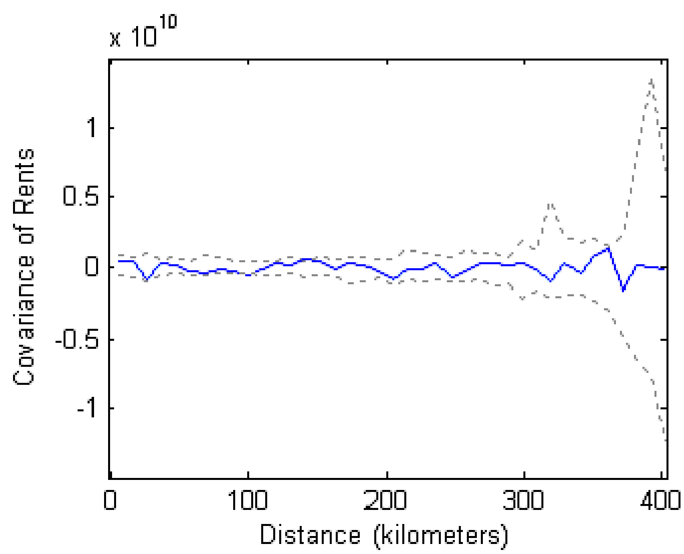


Figure 6. Spatial Autocorrelation of Wages by Area

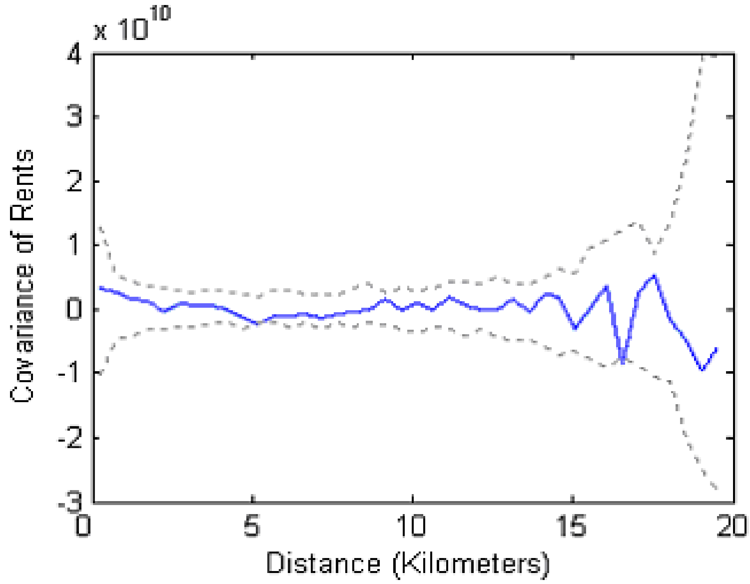
a) All Urban Areas



b) Urban Areas outside GAM



c) AMSJO


x 10^10
4
3
2
1
0
-1
-2
-3
0
5
10
15
20
Covariance of Rents
Distance (Kilometers)

d) GAM

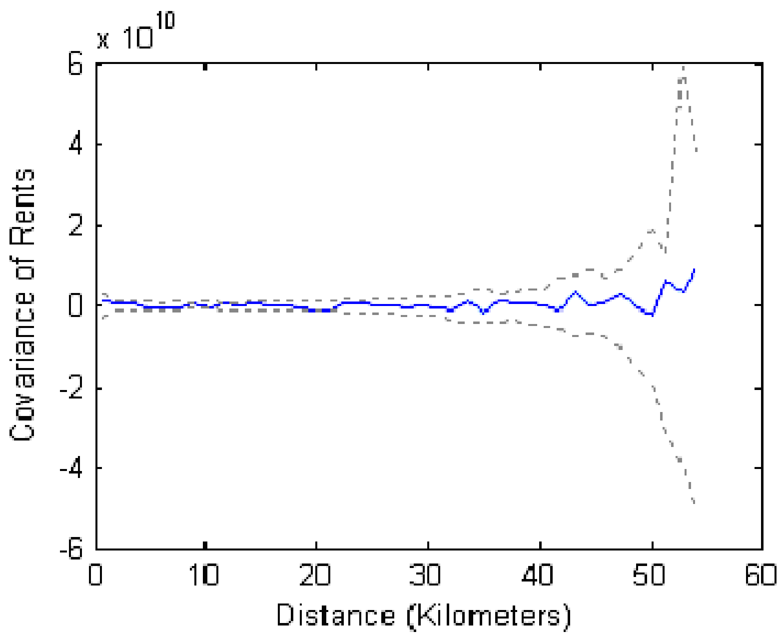
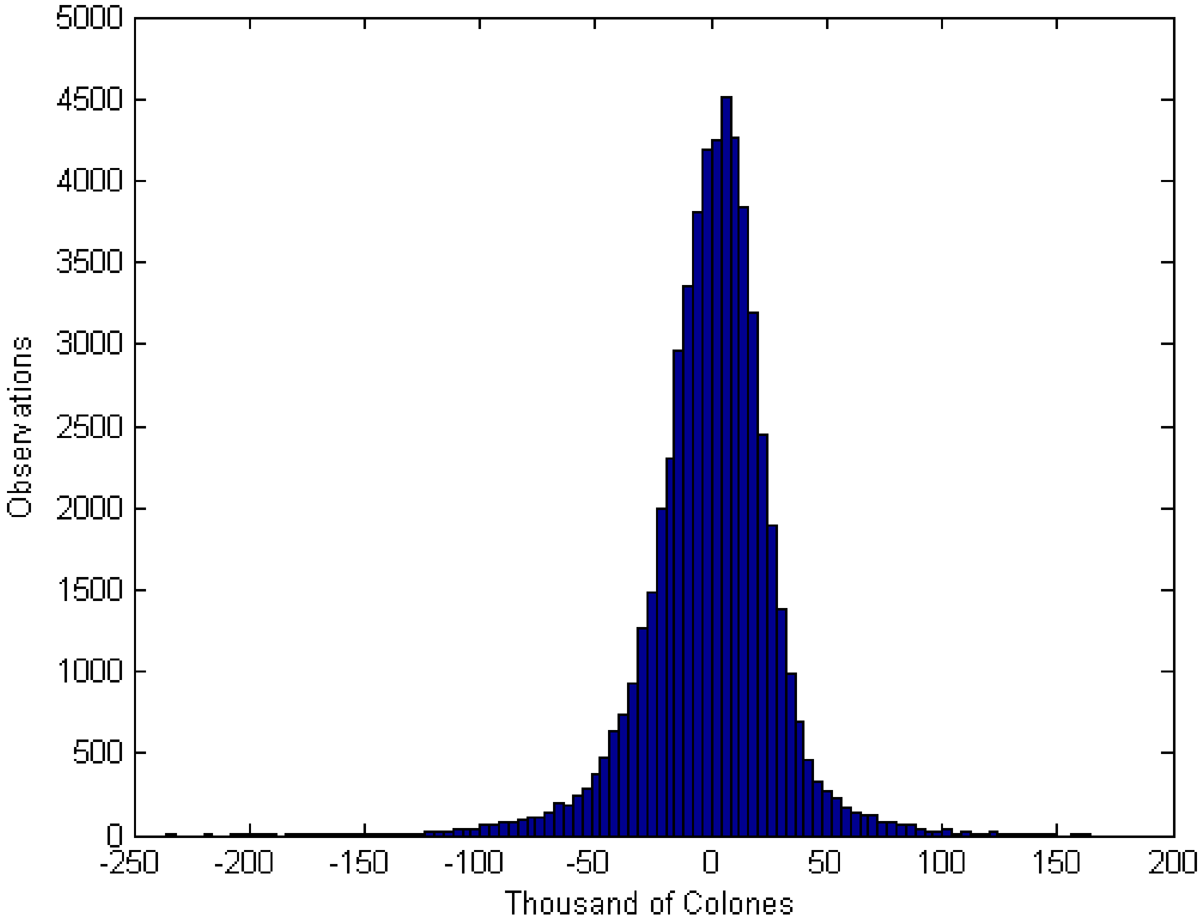

x 10^10
6
4
2
0
-2
-4
-6
0
10
20
30
40
50
60
Covariance of Rents
Distance (Kilometers)

Figure 7. Error Term Distribution

a) Monetary Distribution of the Error term



b) Spatial Distribution of the error term

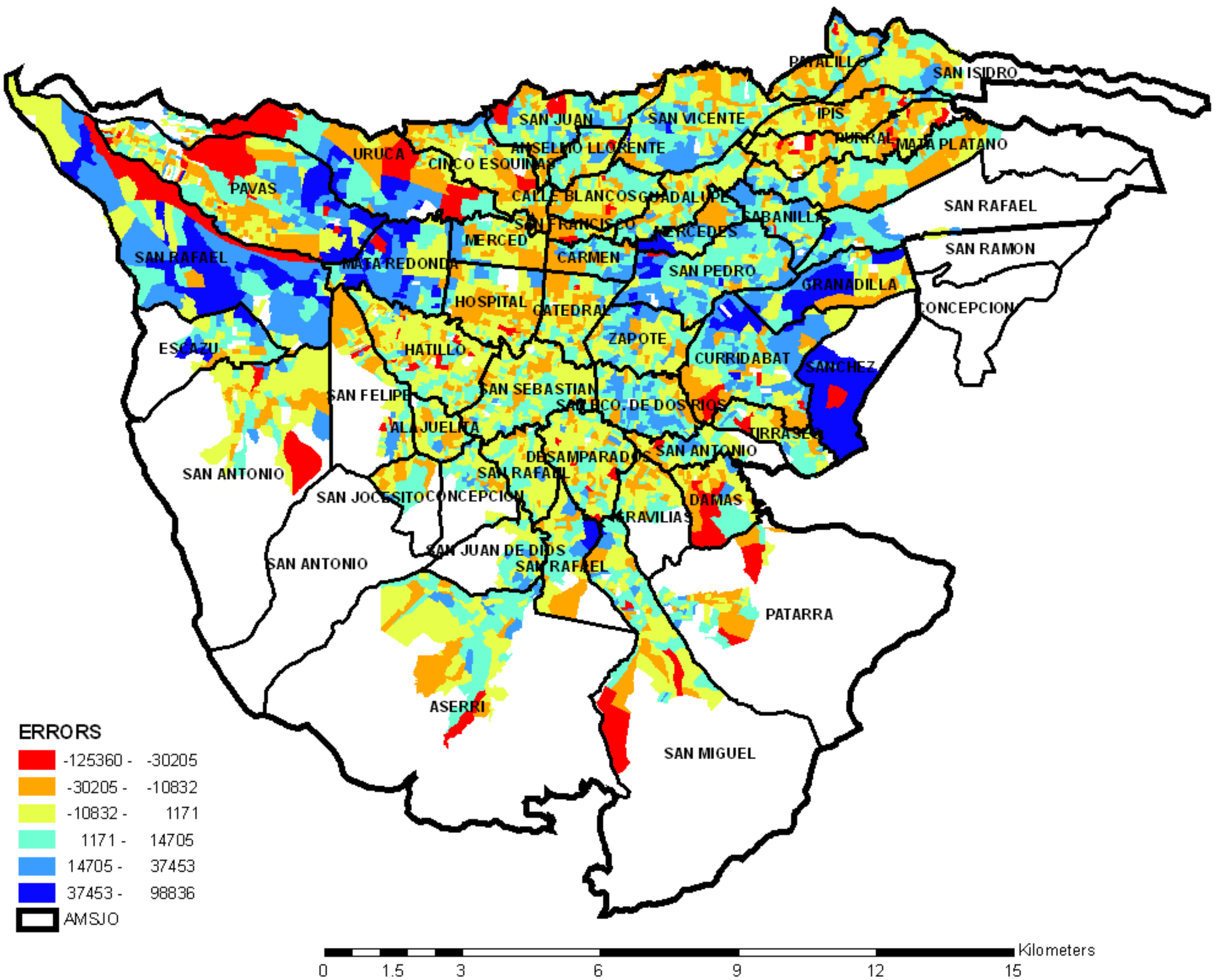
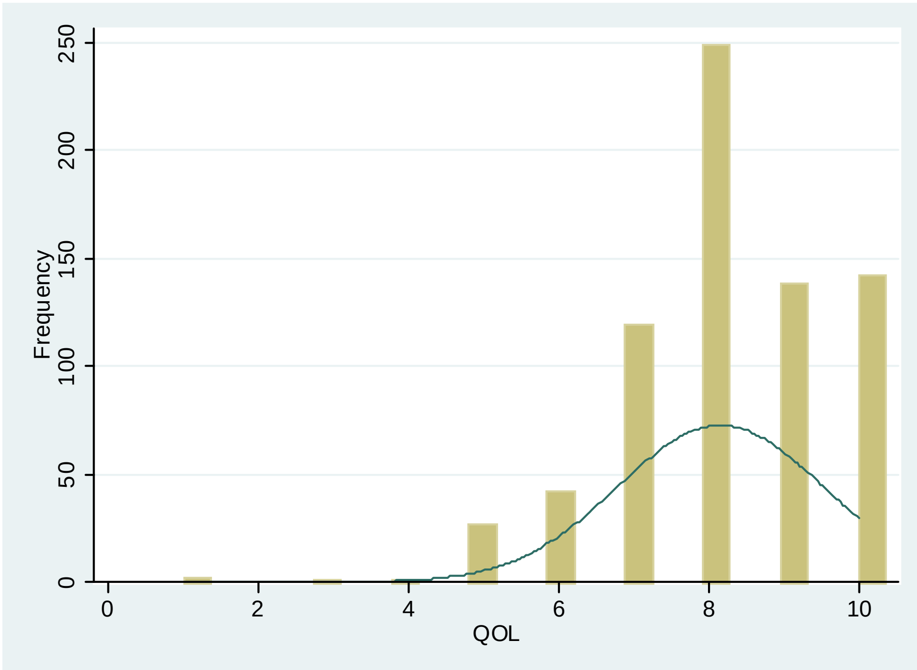


Figure 8. Quality of Life (QOL) Subjective Valuation Distribution



Appendix: Survey Design and Application

The survey was implemented by the Central American Center for Population (CCP) at the University of Costa Rica. The survey is representative of the Metropolitan Area of San Jose for socioeconomic strata (low, medium and high) and for counties.

- Geographic Area Covered: The Metropolitan Area (11 Counties)
- Number of Surveys Implemented: 748
- Sampling, by Stages:

    i. Within each county, districts are chosen according to socioeconomic strata.
    ii. Within each chosen district, census tracts are randomly chosen.
    iii. Chosen census tract is partitioned in subsections.
    iv. Within each chosen census track, these subsections are randomly chosen.
    v. Within each subsection, interviews took place to replicate socio-demographic characteristics (age, gender and education).

- Group: The survey was administered in each household to a member between 18 and 65 years of age whose birthday is closest to the date of the interview. If the person was not present, the interviewer tried again later. If after the third time the individual is not available, the house was dropped and substituted, the interviewer will continue until the set of characteristics of the sample are satisfied.
- Interview: The interviewers were trained for the survey. They entered the data using an electronic organizer. In case the electronic organizer did not work the survey was administered in paper form (the paper survey is attached in the appendix). The date and time of the interview was recorded as was the name of the interviewer.

The survey included in the appendix of this paper is composed of eight parts:

i. Housing and household characteristics: These detail the infrastructure and size of the housing unit including ownership status and rent, if applicable. Also, household member characteristics on age, education and income were obtained.

ii. Quality of water and water services: Questions related to the quality of the water supply and the service were included.

iii. Crime, personal security and health: Crime and personal safety issues were also addressed in the questionnaire. Questions related to perceived and actual crime, health status and accessibility to health facilities.

iv. Environment and transport: We covered a series of questions related to environment and transport that can affect the quality of life. These questions were related to garbage disposal and recycling, pollution, green areas, and transport.

v. Public participation, social interactions and diversity: We posed questions about how engaged individuals are in the community. We also asked about participation in neighborhood associations and in the associations for the children's schools.

vi. Entertainment services: Questions related to sports and art were also addressed. We asked the interviewees to rate the availability of sports facilities as well as the availability of cultural events for the city and for the neighborhood.

vii. Subjective valuation of quality of life: We asked subjective valuation of quality of life in two questions, one with 5 categories and in the other a subjective valuation on a 1 to 10 scale. We asked questions that afforded some context to the answers of the previous questions. (For example, we asked: How long have you lived here? Where did you live before? What elements did you considered when you decided to move? Currently, how do you feel about your decision? Have you thought about moving out?). We also asked about the degree of importance ascribed by the interviewee to the quality of life factors.

viii. City amenities: Using a 1 to 10 scale, we asked interviewees how they value a list of city amenities available. For consistency, we inquired about how often they have used these amenities. Additionally, we asked about the use of city amenities located outside the city (e.g., visits to National Parks).