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VALUATING OBJECTIVE AND SUBJECTIVE URBAN ENVIRONMENTAL CHARACTERISTICS: A MEANS TOWARDS A BETTER URBAN ENVIRONMENTAL QUALITY, USING HEDONIC PRICE AND LIFE SATISFACTION METHODS
(SHIRAZ CASE STUDY)

Abstract: Since early Athenian times, when Aristotle was philosophising about the correct way to live the good life, a proliferation of academic theories and religious texts have considered the question of human quality of life and wellbeing. Which housing characteristics, neighbourhood amenities, and urban public services are important in determining individuals' level of wellbeing or quality of life? How policy makers decide where to focus their limited resources? These are basic but critically important questions for citywide planning authorities and neighbourhood organizations that frequently must make decisions about the provision of urban services as they try to enhance the living standards in cities. Making such decisions is very challengeable since many such services and amenities are not traded in the direct markets, and there is little reason for individuals to disclose their true demands or valuation. This paper presents a summary of the outcomes derived from applying Hedonic Price and Life Satisfaction methodologies to provide such valuation for Shiraz city case study.
Key words: Quality of life, hedonic pricing, life satisfaction, urban services.

Introduction

With the rapid growth in urban population, large cities are facing typical problems such as neighbourhood degradation, increased road traffic, socio-economic deprivation and inequities in health, well-being and health care accessibility, *etc.* This is reflected in the essential role of local environmental quality in recent strategic governmental policy papers with respect to housing, spatial planning and local environmental policy. At an international level, this focus is apparent in numerous scientific publications, and other documents concerning **quality of life** (**QoL**) and urban planning.

So far, science has not advanced a comprehensive framework to address these issues in an integrated manner and to enable an evaluation of physical, spatial and social indicators. Review of relevant literature revealed that neither generally accepted conceptual framework in relation to well-being and QoL has been no developed, nor any coherent system to measure and properly evaluate aspects of, and trends in, environmental quality. The concepts of urban environmental quality and related terms such as liveability, QoL and sustainability enjoy great public popularity and form a central issue in research-programmes, policy making, and urban development or at least they do so in terms of the appearance of these terms in the respective literatures. However, the manifestation and context in which environmental quality and QoL is used in research and policymaking is seldom uniform. Therefore, research on QoL is a very complex issue in terms of choosing the right methodology and theoretical framework; however, it is very essential for achieving more clarification on this subject.

This paper does not pretend to solve all the problems that must be addressed to establish a system for monitoring the quality of urban life. It does aspire, however, to serve as a means by which local governments, analysts of urban problems and communities themselves may take advantage of a new generation of urban QoL monitoring strategies that have significant potential for contributing to public decision-making processes.

1. Conceptual approach to urban environmental quality and quality of life

Rapid urbanization is followed by an intense demand for qualitative and quantitative development in physical dimensions and urban systems. This despite the fact that limitation in productive capacity, commensurate with rate of urbanization, not only makes it difficult to meet demand in different dimensions but it is also the cause of urban poverty, injustice, environmental degradation, lack of proper utilization of the capacity of cities in economic development and *etc.* Urbanization in developing countries is inevitable and preventive policies are doomed to failure in controlling the urbanization process. There is a consensus that to confront this problem in under developing countries, efficient urban management is required to tackle and solve the problems of urbanization, especially for mega cities in these countries. Urban management seeks to adopt a set of appropriate policies, effective and co-ordinated, in strategic areas to ensure that not only has the urban population got access to the labour market, housing and urban services, but also urban environments are organized to enhance the quality of life for its citizens. Moreover, cities need to play an effective role in economic development of the country by using their locational relative superiority.

In recent decades, many cities, regions, and countries have established systems for monitoring the QoL that take into account the interest and needs of cities' residents. In Europe, Urban Audit system of Eurostat, which uses more than 300 indica-

tors to monitor QoL in 357 cities, is the widest QoL coverage system [Feldman 2008]. Other less geographic coverage system in the world that can be mentioned are the QoL report covering 12 of New Zealand's cities, which encompasses 186 individual measures across 11 domain area] [*Quality of Life Projects*…. 2009] and initiatives in several cities of Brazil and Colombia from the developing world.

All of these systems share two interesting but problematic traits. The first problem is avoiding subjective variables as much as possible, believing that they limit international comparability. Many important aspects of people's lives do not lend themselves to objective measures, such as the beauty of the urban environment (or the lack of it), feelings of insecurity, or the quality of the relationships among neighbours. However, subjective measures may be misleading as well, because of a lack of public information, cultural biases, habituation, or aspiration factors. The second problematic feature is the inclusion of a large number of topics. Because the very essence of urban life is the meeting of diverse individuals who undertake a variety of activities and may have greatly differing interests and tastes, it may seem necessary for a monitoring system to cover many dimensions of a city's services and amenities and of the ways in which residents use and value them.

To combine objective and subjective information in a coherent manner and to focus on the most relevant dimensions of the QoL in a city or neighbourhood, [Lora *et al.* 2010] use two conceptually basic criteria: the market price of housing and the individual's life satisfaction. They argue that the sale or rental prices of housing in a city are a synthesis of how the market values certain characteristics or attributes - not only those of a house itself but also those of its surroundings. Housing prices therefore are a good synthetic measure of the quality of urban life that residents may enjoy, provided that those prices reflect all of the city's characteristics that have an effect on well-being. Here is where life satisfaction comes into play. Although life satisfaction cannot be measured with the same precision as the price of a house, it can be fairly well approximated by means of a very simple question that is often included in QoL surveys. Life satisfaction is, in turn, a synthetic measure of the recognition that individuals give to all aspects of their lives, including the home and city where they live. Just as housing prices may not reflect all aspects of a city that affect well-being, an individual's life satisfaction may not depend on some of the same variables that affect housing prices. Satisfaction may depend, instead, on other conditions of the city, along with numerous individual factors ranging from friendships and religious beliefs to one's state of health and temperament. Therefore, these two approaches to measuring the factors that affect the quality of urban life-the hedonic price approach and the life satisfaction approach-can be used in a complementary manner to answer such questions relative to QoL concept.

Both approaches first may be used to calculate implicit prices for nonmarket goods; and then, with those prices used as weights, an urban QoL index can be developed. That index would provide a summary of how the salient amenities affect people's wellbeing. Such an index showing how value varies across neighbourhoods and individuals may become a central policy instrument to guide decision-making: neighbourhoods with par-

ticularly low values might become areas for priority actions, or individuals with particular characteristics might become the recipients of targeted polices. Underlying valuations then may be used to make decisions on the value of providing different services, whether involving incentives for improvements in housing quality, urban amenities, and public goods; or involving efforts to reduce the negative impact of urban problems.

The hedonic approach has a long tradition in the urban economic literature as a method of placing monetary values on the welfare impact of city amenities and public goods. Families' location decisions implicitly reflect preferences regarding a set of characteristics pertaining to the house purchased or rented, the neighbourhood where the house is situated, and the amenities offered in that location. In turn, those preferences will affect property prices in the market for land. A better-quality house in a location that offers a wider set of amenities and fewer problems will command a higher price. Given sufficient variation in the house and location combinations present in the market, and assuming that the market functions smoothly, house prices will reflect the value of the full set of relevant housing and neighbourhood features and amenities. As examples of this approach, Blomquist *et al.* [1988] and Roback [1982] use hedonic price methods to estimate implicit values of local amenities, the prices then may be used to construct price-weighted QoL indexes.

An alternative and complementary approach is to ask people how satisfied (or happy) they are with their lives, their cities, or their neighbourhoods. More recent literature has emphasized this use of subjective satisfaction or happiness indicators for evaluating well-being: for example, Di Tella and MacCulloch [1998] Winkelmann and Winkelmann [1998]; Gardner and Oswald [2001]; and Frey *et al.* [2004]. Because income is included as an explanatory variable in the standard LS regression, the marginal valuations of other significant variables included in the analysis may be computed. Under certain circumstances, including income in the regression allows for calculating an implicit price for various QoL attributes-which again may yield a scheme to weight variables to generate an aggregate QoL index.

2. Monitoring quality of life in Iran: the case of Shiraz city

Looking at the world's urbanization growth rate from 1950-2010, urban population in less developed regions has increased more than 7 times, and it is expected that by 2050 this increase will reach up to 16 times greater than the population in 1950. This trend also characterises Iran. During 1950-2010 Iranian urban population has increased more than 10 times with more than 70% of total population living in urban areas; and this trend will be intensified by 2050 [*United Nations* 2009]. Shiraz is the sixth most populous city in Iran and is the capital of Fars Province. The population is around 1.5 million and it is located in the southwest of Iran on the Roodkhaneye Khoshk (Dry river)

seasonal river. As it is illustrated in (Figure 1 on coloured insert, p. 2), the city of Shiraz includes 9 diverse regions in terms of their history and socioeconomic characteristics. No previous academic or policy work has been published related to monitoring QoL of neither Shiraz city nor any other cities in Iran and this makes this research unique and of course essential. Here, the objective is to consider region analysis using primary data gathered through questioners among each region comparing life satisfaction of residents located in different regions.

A basic but critically important question for Shiraz citywide planning authorities, sub-city units of government, and neighbourhood organizations that regularly must make decisions about the provision of public services as they try to improve living standards for urban populations is "Which housing characteristics, neighbourhood amenities, and urban public goods are important in determining individuals' levels of well-being or QoL?" Making such decisions is a particularly challenging task, however, because many such services and amenities are not traded in direct markets, and there is little reason for individuals to disclose their true demands or valuations. This leads the path for another relevant issue, which is, what QoL indicators to monitor?

3. Choice of indicators

The present paper took an open view in that regard, preferring to collect a wide variety of indicators and thus allow the data to reveal which factors are important. Apart from general indicators -such as income, health, age and education - indicators pertaining particularly to urban QoL were collected. Those indicators may be divided into ones related to housing characteristics and ones related to neighbourhood amenities.

Regarding housing characteristics, typical indicators refer to the size of the house (number of bedrooms and bathrooms) and the building's quality of construction (structure, direction, materials). In relation to neighbourhood characteristics, one important focus is the neighbourhood's access to the city as a whole and to other areas. Consequently, the distance to a bus stop, the quality of public transportation services, the quality of roads and pavements, and the degree of traffic congestion are neighbourhood characteristics that may affect QoL. In addition, neighbourhood amenities such as parks, proximity to gardens (in Shiraz case, Ghasrodasht, Eram, Afif Abad, Hafezieh and Sadieh Gardens), neighbourhood cleanness density, and even the abundance of trees are relevant characteristics. The other areas that are highly relevant for QoL are the proximity of educational institutions, commercial centres, health care facilities, leisure related venues, religious places and security stations.

Although those indicators are largely objective in nature, subjective measures and perceptions also may be used, especially in the LS approach. In particular, the surveys included questions about overall life satisfaction and satisfaction with housing quality and various neighbourhood features. However, the overall LS variable is

the key dependent variable to be used in the LS approach, other subjective measures of access to and quality of different local public services and amenities may be incorporated into the analysis.

4. Description of Shiraz regions quality of life survey (RQLS)

Since the objective of any study concerning QoL should focus on the interaction of subjective evaluations of living conditions and on objective indicators of amenities and services availability. This study was designed as a three step data collection process, comprising a household survey, subjective environmental quality indicators collected at the street level and finding the distances (objective environmental quality indicators) of individual urban service from each dwelling using GIS techniques.

The sample size necessary for attaining a degree of representativeness for the city of Shiraz was beyond the resources and time available to do this project. The data collection effort thus was conceived as a pilot program to be conducted. In July 2010, 450 interviews from the households were carried out in the city of Shiraz. The survey was directed at decision makers in the household, those more likely to make location choices and to pay the rent and property expenses.

The upper half of Table 1 summarized the main demographic indicators of RQLS sample. The average age of respondents is 52.75 years higher than the average in regions 1, 4 and 6. The majority of the respondents are male (65%).

Regions 4, 5 and 9 respectively have the highest proportion of respondents with Diploma or lower education. Region 8 has, by far, the highest level of respondents with some upper diploma education. Regions 6 and 1 with 36% and 28% have the highest respondents with Bachelor degree. Finally, regions 7, 3, and 8 have the highest respondents with masters or above education. The total average of household's income in Shiraz is 1.16 million tomans (equivalent to £580) which is less than the average in regions 4, 1 and 6 and much higher in regions 8 and 9. Income *per capita*, household size and number of children behaves in a similar fashion to income, regions 4, 6 and 1 with the highest *per capita* income and regions 6, 4 and 1 respectively having the lowest proportion of house hold size and number of children. Just over 50% of the respondents in Shiraz are working in the private section with region 4 having the highest proportion and 35% working for the government with regions 8 and 2 with the highest proportion. Only 7% of the households are students with region 6 having the highest proportion. Not employment in region 9 is more than 4 times of the average and region 5 with 0.1% have the lowest rate. 63% of the respondents in Shiraz are married, which is higher than the average in regions 1, 4, 5 and 6.

The lower half of the Table 1 presents a series of housing and dwelling characteristics. Region 1 respondents are much more likely to own a houses (instead of renting

Table 1

Summary statistics, household, respondent and dwelling characteristics

Variables	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Average
Household and Respondent characteristics										
Age (years)	42.09	65.04	63.5	48.34	61.93	44.42	60.40	59.77	61.82	56.37
Male respondents (%)	71.00	57.00	61.00	63.00	66.00	55.00	66.00	61.00	81.00	64.56
Diploma or lower education (%)	39.00	40.00	40.00	54.00	46.00	39.00	26.00	38.00	45.00	40.78
Upper diploma education (%)	22.00	34.00	23.00	20.00	23.00	13.00	23.00	46.00	31.00	26.11
Bachelor degree (%)	28.00	17.00	16.00	11.00	16.00	36.00	20.00	0.10	18.00	18.01
Masters degree (%)	7.00	1.00	9.00	11.00	10.00	10.00	23.00	15.00	4.00	10.00
PhD degree (%)	1.00	5.00	9.00	2.00	3.00	1.00	6.00	0.10	0.10	3.02
Total household income (in thousand tomans)	1,333.00	1,142.00	1,036.00	1,334.00	981.00	1,223.00	1,060.00	712.00	770.00	1,065.00
Per capita income (in thousand tomans)	798.00	570.00	447.00	879.00	539.00	818.00	495.00	251.00	321.00	568.70
Household size	2.30	3.01	3.09	2.18	3.30	2.10	2.93	3.76	3.27	2.88
Number of children	0.77	1.79	1.36	0.64	0.97	0.58	1.07	1.85	1.45	1.16
Student (%)	8.00	3.00	2.00	6.00	6.00	21.00	0.10	0.10	0.20	5.16
Private employee (%)	72.00	21.00	33.00	81.00	43.00	55.00	63.00	15.00	36.00	46.56
Government employee (%)	17.00	73.00	61.00	6.00	50.00	15.00	30.00	76.00	45.00	41.44
Not employed (%)	0.70	1.00	2.00	4.00	0.10	7.00	6.00	7.00	18.00	5.09
Married status (%)	51.00	76.00	73.00	52.00	60.00	50.00	86.00	84.00	81.00	68.11

Variables	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Average
Dwelling characteristics										
Owns home (%)	62.00	51.00	54.00	50.00	50.00	47.00	53.00	23.00	9.00	44.33
Home with gardens (%)	40.00	35.00	45.00	36.00	67.00	53.00	63.00	38.00	41.00	46.44
Parking space/garage (%)	95.00	71.00	57.00	77.00	70.00	84.00	70.00	38.00	55.00	68.56
Home is house (%)	41.00	35.00	45.00	36.00	67.00	53.00	67.00	38.00	41.00	47.00
Store (%)	79.00	60.00	38.00	59.00	33.00	61.00	33.00	15.00	18.00	44.00
Years in neighbourhood	14.10	13.60	18.90	11.00	10.60	16.60	7.20	18.40	9.20	13.29
Number of bedrooms	3.03	2.75	2.35	2.15	1.90	2.60	2.16	2.00	1.95	2.32
Number of bathrooms	2.13	2.06	1.83	1.59	1.50	1.42	1.43	1.61	1.63	1.69
Number of stories	3.43	2.38	2.43	3.20	2.10	3.32	2.23	1.85	2.68	2.62
Number of units	7.87	4.42	5.19	7.50	3.90	7.71	5.00	1.77	6.32	5.52
Floor area (m^2)	257.80	347.30	267.60	247.10	157.80	203.50	156.70	207.60	193.30	226.50
Directing towards North-South (%)	93.00	57.00	47.00	61.00	56.00	71.00	40.00	30.00	31.00	54.00
Dwelling price per square meter (in thousand tomans)	1,611.00	703.00	752.00	940.00	819.00	1,341.00	775.00	421.00	677.00	893.20
Rent (in thousand tomans)	1,784.00	906.00	665.00	737.00	535.00	1,221.00	541.00	391.00	476.00	806.20
Average tax block (in thousand tomans)	108.00	63.00	47.00	69.00	34.00	50.00	26.00	142.00	24.00	62.56

Note: In the regressions, Housing and Dwelling Characteristics correspond to HC variable.
Source: Author's calculations, based on the Regional Quality of life Survey (RQLS) (Tables 1-10).

it) than the other regions. In addition, respondents in regions 5 and 7 behave the same, they are more likely to live in houses with gardens (instead of apartments). Average area of the properties is more or less similar among the regions. Respondents in regions 3 and 8 have been living in the same place for more than 18 years. Density of the units is higher in regions 1 and 6 this is the consequence of region's renovation and building new apartments. Dwellers in Shiraz benefit more from the sun light during the day if they are facing towards North-South (instead of facing East-West) therefore there is more demands for such dwellers. As the data shows region 1 dwellers, by far, have the opportunity facing the North-South direction. Rental price are much higher in regions 1 and 6 than in other regions. Finally, by looking at the average tax value for each region, region 8 has the highest tax amount because of its central location and also having the old Bazaar located in this region. The new malls are located mainly in region 1, increasing the average tax value in this region.

The RQLS also collect extensive information on general life satisfaction and subjective satisfaction with a series of life domains. The results from these questions also point to specific patterns among the regions, as shown in Table 2. The neighbourhood levels of satisfaction revealed by answers to these questions are expressed on a 1 to 10 scale, with 10 being the highest possible valuation for the domain. Residents in more affluent regions report significantly higher levels of general satisfaction than do those in worse-off areas. In this case region 1, 6 and 4 are slightly better than Shiraz average general satisfaction and regions 8 and 9 are the regions with the lowest general satisfaction. However, average general satisfaction of 4 out of 10 in Shiraz indicates the unsatisfaction of the residents from general life domains. In general, the lower level of satisfaction are in poorer regions and the higher levels are in richest regions.

Note: On the scale, 10 = the highest possible valuation for the Domain. In the regressions, general life satisfaction corresponds to GS variable. Neighbourhood QoL satisfaction corresponds to RS variable.

Table 2

General satisfaction and satisfaction with life domains *on scale of 1-10*

Type of satisfaction	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Average
General life satisfaction	5.58	3.40	2.33	4.70	2.63	5.00	2.73	2.15	2.72	3.47
Satisfaction with neighbourhood quality	5.28	4.44	4.04	4.61	4.26	4.92	4.06	3.00	3.54	4.24
Satisfaction with owns economic situation	5.11	2.73	2.76	3.20	2.90	4.02	2.73	1.61	1.81	2.99
Job satisfaction	4.33	3.48	3.04	3.65	3.26	3.94	3.10	2.00	2.54	3.26
Satisfaction with home	5.27	3.50	3.07	4.09	3.20	4.73	3.16	2.38	2.54	3.55
Simple average	5.11	3.51	3.05	4.05	3.25	4.52	3.16	2.23	2.63	3.50

Note: On the scale, 10 = the highest possible valuation for the Domain. In the regressions, general life satisfaction corresponds to GS variable. Neighbourhood QoL satisfaction corresponds to RS variable.

Table 3

Subjective evaluation of region characteristics *on scale of 1-10*

Characteristic	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Average
Police performance in neighbourhood	6.57	5.86	5.04	6.18	5.36	6.31	5.30	4.61	4.09	5.48
Traffic in neighbourhood	5.78	6.12	5.76	5.77	5.67	6.58	5.67	5.23	4.64	5.69
Annoying noise during the night	6.02	5.92	6.04	5.5	6.13	6.26	5.86	6.00	5.18	5.88
Air pollution in neighbourhood	6.53	6.92	6.33	6.23	6.13	7.16	6.53	6.77	6.45	6.56
Condition of streets	7.49	5.15	3.90	5.50	5.20	7.37	5.53	3.69	4.82	5.41
Condition of pavements	6.89	5.69	4.28	5.36	4.60	6.50	4.40	3.84	5.36	5.21
Safety for cycling	7.43	5.42	3.81	5.32	4.93	5.42	5.53	3.85	4.91	5.18
Garbage collection in neighbourhood	5.35	5.54	4.71	4.73	4.87	6.42	4.53	3.23	3.45	4.76
Neighbourhood cleanness	5.61	5.00	5.19	5.95	5.26	5.47	5.60	4.61	4.54	5.25
Street and sidewalk lightning at night	6.43	6.23	6.23	5.86	6.00	5.73	6.60	5.69	6.09	6.10
building facades quality and condition	6.93	6.08	6.14	6.09	5.93	6.37	6.53	5.69	6.18	6.22
Density of the neighbourhood	5.69	5.96	5.95	5.36	5.67	5.68	5.33	5.38	5.00	5.56
Overpopulation in the neighbourhood	5.69	5.85	5.95	5.14	5.8	5.68	5.33	5.69	5.45	5.62
Amount and quality of green areas	6.8	4.88	5.33	6.18	5.53	6.00	5.40	4.61	4.90	5.51
Simple average	6.37	5.76	5.33	5.66	5.51	6.21	5.58	4.92	5.08	5.60

Note: On the scale, 10 = the highest possible valuation for the characteristic. Region evaluation corresponds to the SC variable in the regression.

Table 3 presents a set of in-depth subjective evaluation of region characteristics that are relevant for urban QoL. As in Table 2, the answers are on a 1-10 scale, covering such areas as sidewalk and streets conditions, cleaning, security, green areas, population density, dwellers density, air and noise quality, traffic and cycling conditions and building facades quality. Slightly the same pattern in general satisfaction appeared with regions 1 and 6 with the highest average and regions 8 and 9 with the lowest average.

Table 4 presents the percentage of dwellers in the region with proximately of less than 800 meters (network rout) to different urban services, which has been produced using Service Area tool in GIS software after the data were geo-referenced and matched to each surveyed household by block of residence. It is important to mention that in the survey people were asked to choose their desired distance to the services that made them happy and motivated to walk towards it, and the outcome was 8 to 10 minutes (approximately 800 meters).

Although about 86% of the dwellers in Shiraz have access to bus stop and 66% have access to educational facilities access to other services is very limited for all regions especially regions 7, 8 and 9.

From a historical point of view, Shiraz main core was based in region 8 and data's show the low tendency of capitalization on urban services in order for renovate

Table 4

Objective evaluation of region characteristics:
availability of services within 800 meters of the dwelling

Characteristic	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Average
Educational facilities (%)	73	88	74	82	63	68	73	31	45	66.33
Religious places (%)	29	71	43	52	40	24	33	100	45	48.56
Parks (%)	43	21	24	9	33	55	10	0	14	23.22
Bus stops (%)	92	98	93	98	100	100	73	38	82	86.00
Health facilities (%)	53	44	19	16	10	18	3	15	9	20.78
Security stations (%)	29	12	7	16	13	13	10	8	5	12.56
Leisure-related venues (%)	47	29	31	20	3	11	7	8	9	18.33
Commercial facilities (%)	48	29	38	39	47	42	23	38	14	35.33
Gardens (%)	72	2	21	11	0	37	0	0	0	15.89

Note: These Objective Characteristics corresponds to the OC variable in the regression.

and develop new services and also lack of management to direct the capital equally among different regions in the city. These problems can be even more highlighted in region 9 as Shiraz newest region.

The results, so far, indicate the presence of three distinct sets of regions: regions 1, 6 and 4 respectively have higher average of income, degree of satisfaction with their lives and neighbourhoods, regions 2, 5 and 7 with equal average as of the city's, and regions 3, 9 and 8 with lower level of all those indicators.

The rest of the paper will use the indicators presented in a multivariate regression context to study urban QoL in Shiraz through the relationship of neighbourhood characteristics with property price and with life satisfaction.

5. Inferring QoL at the Shiraz regions, using hedonic price regression

The data in Table 1 indicate that there are significant differences in the rent paid (or estimated, in the case of owner) by respondents in each regions. A QoL index can be derived using the variables in the survey, exploiting the greater availability of regions characteristics in the data set.

The results present in Table 5 correspond to an ordinary least square (OLS) regression of the monthly rent value as a function of property characteristics (HC variable, from Table 1) and both objective (OC variable, from Table 4) and subjective evaluations (RS and SC variables, from Tables 2 and 3) in the regression. Therefore, the regression is of the following form:

$$Rent = \alpha + \sum_b \eta_b HC_b + \sum_c \theta_c OC_c + \sum_d \lambda_d SC_d + \gamma RS + \nu \quad (1)$$

The results for housing characteristics in Table 5 are fairly standard. Newly homes with more bedrooms and bathroom in cleaner, less population, less traffic, better road conditions neighbourhoods near to gardens and security stations, command a higher rental prices. The negative and significant coefficient of Availability of Park within 800 m, is possibly reflecting the imposed by the relatively lower levels of peace and quiet. Finally, higher value of tax for dwellers reflects its relative superiority of its location, services and accessibility.

These results (summarized in Table 6) indicate that better neighbourhood quality and accessibility to services increases the rent value. Using Shiraz average amount of rent value from the hedonic price regression (average value = 1317) as a reference we can than compare the implicit price of OC and SC of each region. For example a rental value of a dwelling with two bedrooms and two bathroom, on the bases of

Table 5

Augmented hedonic price regressions for monthly rent

Dependent variable: monthly rent			
Model	B	t	Sig.
(Constant)	-1,467,801,221	-4,549***	.000
Property characteristics (HC variable)			
Home is house	910,007,655	11,166***	.000
Years in neighbourhood	-6,826,479	-1,806*	.072
Bedrooms	471,203,914	10,592***	.000
Bathroom	244,014,068	4,984***	.000
Tax block	2,483	2,320**	.021
Subjective characteristics (SC variable)			
Neighbourhood traffic	-392,322,720	-2,036**	.042
Neighbourhood road condition	674,093,297	3,692***	.000
Neighbourhood recycle collection	293,963,519	1,850*	.065
Neighbourhood cleaning	340,303,424	2,038**	.042
Neighbourhood population	528,116,182	1,951***	.052
Objective characteristics (OC variable)			
Availability of park within 800 m	-151,594,466	-1,670*	.096
Availability of police within 800 m	171,081,991	1,749*	.081
Availability of gardens within 800 m	315,098,318	3,451***	.001
R^2	0,684		

Note: Only variables with coefficients significant at the 10 percent level are included.
* P<.10 ** P<.05 *** P<.01

Table 6

Implicit price differences for RQLS

Region	Percentage of objective characteristics from Shiraz average rent value	Implicit rent price difference base on objective characters (in 1000 tomans)	Percentage of objective and subjective characteristics from Shiraz average rent value	Implicit rent price difference base on objective and subjective characters (in 1000 tomans)
Region 1	13.28	174.96	26.22	345.38
Region 2	-3.14	-41.34	-3.70	-48.72
Region 3	0.41	5.42	-6.43	-84.74
Region 4	0.91	12.05	0.99	13.02
Region 5	-4.87	-64.13	-4.86	-63.97
Region 6	1.45	19.11	13.38	176.22
Region 7	-2.61	-34.39	-2.68	-35.23
Region 8	-1.72	-22.65	-13.91	-183.16
Region 9	-3.72	-49.01	-9.02	-118.79
Shiraz average rent value (in 1000 tomans) = 1317				

only regions objective characteristics (in this case is access to services), in region 1 is 174,969 (more than 13 percent of average value) tomans higher than Shiraz average value and if the identical dweller was located in region 8 the rental value had a decrease of 25,740 tomans. Respectively regions 1, 6, 4 and 3 have and premium of 174960, 19110, 12050 and 5420 tomans on Shiraz average rent value, and regions 5, 9, 2, 7 and 8 respectively have a penalty of 64,130, 49,010, 41,340, 34,390, 22,650 tomans on the average. Inclusion of regions subjective characteristics variable in the equation, larger differences and reordering of some regions can be observed. With regions implicit rent price difference base on objective and subjective characters ranging from decrease of 183160 tomans for region 8 to an increase of 345380 tomans for region 1. Correspondingly environmental quality of regions 1, 6, and 4 having a positive impact on rent value and regions 8, 9, 3, 5, 2 and 7 have a negative impact.

The following section derives another set of measures of environmental quality and QoL from an alternative methodological perspective.

6. QOL in Shiraz regions: LS approach

This section presents a further analysis of QoL, focusing on the interaction of subjective evaluations and objective indicators. The urban economic literature explains difference in QoL by city and sub-city area, assuming that city or neighbourhood amenities are capitalized in property prices and wages [Gyourko *et al.* 1999]. An alternative strand of research, related to the happiness literature attempts to derive

valuations for intangibles and externalities by studying the impact of the relevant factors on life satisfaction.

This section presents an extension of the alternative strand. The main difference consists of joint modelling of the relationships between income and general satisfaction, on the one hand, and between life satisfaction and neighbourhood QoL, on the other hand. This methodology computes the impact of the variables related to urban QoL in monetary terms.

7. Life satisfaction methodological issues

QoL can be approximated through the general life satisfaction (GS) variable included in the RQLS data, whereas the NS variable provides information on neighbourhood satisfaction. A series of conditions need to be met to apply the two-equation valuation method to the neighbourhood QoL setting. First, a relationship must exist between general life satisfaction and Region Satisfaction (RS). Second, an unbiased estimator of the effect of RS on GS must be available. Third, the region's characteristics must be correlated with RS. Finally, these characteristics must affect GS only through their effect on RS (that is, they are exogenous to determination of GS). If these conditions are met, it is possible to estimate the following system of equations:

$$GS = \alpha + \sum_{c} \beta_c X_c + \rho Y + \gamma RS + \nu \tag{2}$$

$$RS = \alpha_2 + \sum_{s} \phi_s SC_s + \sum_{c} \theta_c OC_c + \varepsilon \tag{3}$$

Where the X variables represent individual characteristics; Y is the level of income; RS is region satisfaction; GS is general satisfaction; and the other groups of variable represent objective and subjective region characteristics: OC are objective geographic characteristics; SC are subjective evaluation of region characteristics.

Under the conditions mentioned, equations (2) and (3) can be estimated as a system, instead of sequentially, correcting for the probable endogeneity of RS variable in the GS regression. This endogeneity bias is corrected by instrumenting RS with the region characteristic variable, resulting in an unbiased γ coefficient. A monetary valuation of region amenities and characteristic then can be derived from their impact on general life satisfaction through their effect on regional satisfaction.

8. Life satisfaction regression results

As a first approximation, the two equations in the system can be estimated independently. Because the dependent variables are both ordered on a 1 to 10 scale, the model is estimated by cardinal OLS (COLS), which first transforms all ordered variables

(dependent and independent) to a form similar to the normal distribution and then applies OLS to estimate the model (for methodological details see [van Praag, Carbonell 004].

The results from these simple regressions are presented in the Tables 7 (RS regressions) and 8 (GS regression). Starting with the latter table, the results match well established results in happiness literature [see Oswald 1997], among others): Life satisfaction increases with income, is lower for people with graduate qualifications than under graduation or below, and decreases with age. Marriage, gender family size and employment do not have a significant effect. Last and the most interesting for the purpose of this study, the level of satisfaction with region QOL (the RS variable) has a positive and strongly significant effect on GS.

Regarding the determination of regional satisfaction the results in Table 7 presents the estimation result of RS as a function of OS and SC. Of the objective indicators, having a health care centre, Parks, Leisure-related venues and commercial have a positive effect and only proximately to religious centres have a negative effect on the environment which again could be the consequence of having relatively lower levels of peace and quiet in the region. The entire subjective variables have a positive effect on the environment indicating the importance of regions safety and cleanness with good quality of green areas and the value of infrastructures maintenance.

Table 7

Region satisfaction regression

Dependent variable: region overall satisfaction			
Model	B	t	Sig.
Subjective characteristics (SC variable)			
Neighbourhood safety	0.253	6.883***	0.000
Neighbourhood noise pollution	0.074	1.967**	0.050
Neighbourhood sidewalk condition	0.067	1.848*	0.065
Neighbourhood cleaning	0.065	2.029**	0.043
Neighbourhood lightning condition	0.104	2.314**	0.021
Neighbourhood amount and quality of green areas	0.136	3.489***	0.001
Objective characteristics (OC variable)			
Availability of religious centres within 800 m	-0.028	-1.896*	0.059
Availability of parks within 800 m	0.034	1.985**	0.048
Availability of healthcare centres within 800 m	0.059	3.451***	0.001
Availability of leisure-related venues within 800 m	0.033	1.876***	0.061
Availability of commercial centres within 800 m	0.063	4.103***	0.000
R^2	0.487		

Note: Only variables with coefficients significant at the 10 percent level are included.

* P<0.10 ** P<0.05 *** P<0.01

Table 8

General life satisfaction regression

Dependent variable: general satisfaction			
Model	B	t	Sig.
(Constant)	0.740	4.361***	0.000
Masters	-0.056	-2.228**	0.026
PhD	-0.185	-4.555***	0.000
Region overall satisfaction	0.444	9.321***	0.000
Income	2.58E-08	1.962**	0.050
Log age	-0.312	-2.409***	0.016
R^2	0.525		

Note: Only variables with coefficients significant at the 10 percent level are included.
* P<0.10 ** P<0.05 *** P<0.01

From this preliminary analysis, it appears that there is indeed a relationship between life satisfaction and region satisfaction (GS and RS) and that objective and subjective variables are relevant determinants of region satisfaction. The latter result implies that the OS and SC variables might be appropriate instruments to correct for the potential endogeneity of RS in the GS regression. The region characteristics have an impact on general life satisfaction only through their effect on region satisfaction.

The estimation results from Tables 7 and 8 can be used to compute QoL indicators. Table 9 reports the average valuation of Shiraz regions using only objective characteristics (first results column) and using the objective and subjective characteristics (second results column).

Table 9

Monetized value of LS-Base Region QOL index

Region	Income value of LS index, based on objective characteristics (in 1,000 of tomans)	Income value of LS index, based on all region characteristics (in 1,000 of tomans)	Average monthly income (in 1,000 of tomans)
Region 1	150.47	297.03	1,333
Region 2	-31.01	-36.54	1,142
Region 3	2.44	-38.13	1,036
Region 4	20.49	22.13	1,334
Region 5	-35.27	-35.18	981
Region 6	22.93	211.46	1,223
Region 7	-41.27	-42.28	1,060
Region 8	-11.33	-91.58	712
Region 9	-24.51	-59.40	770
Average	5.88	25.28	1,066

Table 10

Correlation Between Hedonic and LS Index

		Hedonic regression		LS	
		price difference, index based on objective characteristics	price difference, index based on all characteristics	income value of LS index, based on objective characteristics	income value of LS index, based on all region characteristics
Hedonic regression	Price difference, index based on objective characteristics	1.000			
	Price difference, index based on all characteristics	0.675	1.000		
LS	Income value of LS index, based on objective characteristics	0.311	0.201	1.000	
	Income value of LS index, based on all region characteristics	0.157	0.217	0.354	1.000

The first column indicates that objective characteristics are valued relatively very little, on average, for the whole sample 5,880 tomans compared with the average income of 1,066,000. This average, makes a large variability between regions moving from regions 1, 6, 4 and 3 to the synthetic average regions required average compensation of 150,470, 22,930, 20,490 and 2,440, respectively whereas regions 7, 5, 2, 9 and 8 would give up 41,270, 35,270, 31,030, 24,510 and 11,330 tomans to move to the average region.

The second result column of Table 9 computes the compensation based on all region characteristics. The sample average compensation is 25.26, with average ranging from – 91,580 for region 8 to 297,030 tomans for region 1.

Finally Table 10 computes the correlation between the four indexes computed for the RQLS data set – two based on hedonic price regressions and two based on the LS approach, including either objective variables only or all region characteristics. The correlations between indexes based on different methodologies are all positive, indicating that the two methodologies are at least partially accounting for some common underlying level of QoL.

Conclusion

First conclusion from the empirical analysis is the existence of some multi-dimensional QoL factor associated with regions characteristics, as witnessed by the similarity in the distribution of indexes for different methodologies. Moreover, whether based on the reflection of local amenities and characteristics in property

prices or on subjective level of satisfaction, the two approaches suggest the environmental quality is of great importance for the environment that the residents of Shiraz are living in and different objective and subjective environmental characteristic can be monetized which can enhance urban public policy making and improving the QoL. Information on the significant variables in the analysis could be collected on regular basis to monitor the evaluation and impact of these urban public policy interventions.

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