Published in *Cities* doi.org/10.1016/j.cities.2018.04.008

Exploring Preference Homogeneity and Heterogeneity for Proximity to Neighbourhood Amenities

Ali Ardeshiri
Institute for Choice, Business School, University of South Australia

Ken Willis
School of Architecture, Planning and Landscape

Mahyar Ardeshiri
Department of Urban Planning, Shiraz University, Iran

Abstract

Given that the majority of the world's population live in urban places, the quality of the urban environment has emerged as an issue of fundamental concern for citizens, academic researchers, and policy makers. This study explores residents' preferences and valuation of living in proximity to urban amenities in the built environment. The study demonstrates that environmental evaluation techniques can be used as a tool to help relevant decision makers (e.g., urban managers, developers, city officials, planners, realtors and researchers) with policy making, effective decision making and efficient city management procedures. The models indicate how household preference for proximity to urban amenities change as a function of the cost of provision as exemplified by a change (increase or decrease) in annual property tax. The study reports the results for two different models: one which assumes preference homogeneity and the other preference heterogeneity in the sampled population. The results show that older residents and higher educated people are more likely to be willing to pay a higher property tax for having proximity to parks. Middle and low income residents prefer close proximity to bus stops and local shopping centres. This research suggests that a win-win strategy for residents and local government lies in increasing and maintaining residents' accessibility to urban amenities, and in increasing an urban area's sustainability.

Keywords

Urban Public Services; Proximity; Willingness to Pay; Urban Environmental Quality; Preference Homogeneity and Heterogeneity; Policy and Decision Making

1. Introduction

Providing appropriate proximity to urban amenities in neighbourhoods provides communities with essential services, as well as comfort, safety, and aesthetic amenity in addition to various other environmental, social, health and economic benefits (Kim & Nicholls, 2016).

Distribution and accessibility of urban amenities plays an important role in people's movements (Geertman & Ritsema Van Eck, 1995), shaping cities and places (Nilsson, 2014; Talen, 1998), densities (Guzman & Bocarejo, 2017), and importantly living quality in the city (Ardeshiri, 2014; D'Acci, 2014; Knox, 1980; Madden, 1993). Among objective neighbourhood characteristics related to the physical environment, living in close proximity to work, shopping centres, schools, leisure activities, parks and other public services affects community welfare, spatial equity and the environment in which we live (Gregory, Johnston, Pratt, Watts, & Whatmore, 2011). The presence of local resources can have an impact on the likelihood of initiating and maintaining social links with community members as well as improving neighbourhood social capital, and health (Altschuler, Somkin, & Adler, 2004), environmental quality (Ardeshiri, Ardeshiri, Radfar, & Hamidian Shormasty, 2016), and spatial equity (Hewko, Smoyer-Tomic, & Hodgson, 2002). Much effort has been invested in urban restructuring, but many restructured neighbourhoods fail to attract more affluent households by not providing the essential "needs" to improve the quality of life in the neighbourhood (Koopman, 2012). Thus understanding how individuals value each amenity, and make trade-off between different urban amenities in a neighbourhood, is important to successful neighbourhood planning. Is proximity to parks more preferable to proximity schools? Or is it the other way around? Is safety important or having access to public transportation is more preferable?

Different methods such as hedonic pricing (Ardeshiri, 2014; Irwin, Jeanty, & Partridge, 2014; Li, Wei, Yu, & Tian, 2016; McGranahan, 2008; Nilsson, 2014), life satisfaction (Ardeshiri, Ardeshiri, Radfar, & Hamidian Shormasty, 2016; Lora, Powell, Van Praag, & Sanguinetti, 2010), conjoint analysis (Adamowicz, Louviere, & Williams, 1994; Boyer & Polasky, 2004) has been used to value proximity to urban amenities by either having the land value or the house price/rent as the dependent variable.

This paper presents a model for estimating price gradients for several urban amenities that departs from traditional techniques. It examines household behaviour by looking at individuals responses to series of hypothetical choices to determine resident's preferences for proximity to chosen urban amenities. Thus, the main objective of this study is to meet the demands for measuring the monetary value of proximity to urban amenities as a non-market good.

The remainder of the article proceeds as follows. First we review some of the relevant literature. We follow that with a description of the method and data used for the study. In the penultimate section we report the results of our detailed empirical analysis of preferences for proximity to the selected amenities. We conclude with a discussion of the implication of our findings.

2. Literature review

Since the work of Schuler (1974) a growing literature has emerged focusing on amenities and their relation to regional growth and developments and persuading researchers to extended the urban land-use model suggested in the Alonso 1964 work (Nilsson, 2014). For example

Yang & Fujita (1983) studied the different income groups location decision optimisation and the influence of urban open space amenities on their choice, Deller et. al (2001) looked at the role of amenities and quality of life in rural economic growth, McGranahan (2008) studied the influence of amenities in rural population growth, Partridge et. al (2007) examined the relationship between job growth and proximity to urban amenities.

Provision of public amenities such as parks, recreational facilities and social and cultural services are beneficial to residents' well-being (Witten, Exeter, & Field, 2003). They provide venues for health-promoting activity, as well as informal meeting-places, outside home and work, where social relationships can be formed and maintained (Olenburg, 1997; Warin, 2000; Witten, et al., 2003). Amenities are location specific goods and services that attracts migrants and residents (Li, et al., 2016). Opportunity structures vary across different localities, so too do residents' perceptions of their neighbourhood, their satisfaction with the social and physical attribute of place and the nature of the social relations that occur in different places (Macintyre, Maciver, & Sooman, 1993). People's feelings about residential housing, and the market value of housing, are affected by proximity to valued public amenities (Ardeshiri, 2014; Ardeshiri, Ardeshiri, Radfar, & Hamidian Shormasty, 2016). Witten et al. (2003) argued that the social inequities can be mitigated or at least offset by compensatory distribution of public amenities and facilities. Access or lack of access to such environments and facilities could potentially have greater impact on the health and well-being of residents in low socioeconomic neighbourhoods compared with higher socioeconomic neighbourhoods because of cost and mobility barriers to the use of private or non-local services and facilities (Talen & Anselin, 1998).

Along with urban amenities, accessibility is an important determinant of residents' preference for a neighbourhood. Evaluation of the community resources accessibility responds to calls for the inclusion of measures of the physical environment, access to services and the social environment in area-level indices (Kearns & Paddison, 2000). For households with limited mobility and personal resources, the availability and quality of local services, facilities and amenities is likely to be of heightened importance (Kearns & Paddison, 2000). In the 1980s, location-allocation models were developed to determine the optimal location of services, such as health services (Askew, 1983; Ayeni, 1987; McLafferty & Broe, 1990) and libraries (Cole & Gatrell, 1986). Advances in GIS have prompted a number of investigations into the contributions such systems can make to community and resources planning and analysis of accessibility to local amenities (Bullen, Moon, & Jones, 1996; Gatrell, Bailey, Diggle, & Rowlingson, 1996). For instance, accessibility to health care services (Lovett, 2000; Parker & Campbell, 1998; Pearce, Witten, & Bartie, 2006), green space (Cetin, 2015; Comber, Brunsdon, & Green, 2008), public parks (Nicholls, 2001), public transport (O'Sullivan, Morrison, & Shearer, 2000; Orford, 2017). The advantage of the GIS analysis and the location based measures used in the accessibility studies are related to the operationalisation, interpretability and communicability criteria. They are undemanding of data and are easy to interpret for researchers and policy maker to visually asses the homogeneity distribution of

the amenity throughout the city, measure the space per capita, etc. However, they clearly do not satisfy the theoretical criteria related to individual utility based accessibility measures (Geurs & Van Wee, 2004). The measure do not take individuals' perceptions and preferences into account, in other words, the measure implies that all opportunities are equally desirable, regardless of the type of the amenity (Geurs & Van Wee, 2004).

Valuing changes in access to and the quality of services has long been the domain of resource economists (see [Bockstael, McConnell, & Strand., 1991; Braden & Kolstad., 1991; Freeman, 1993]). The notion of accessibility and the efficient allocation of services that has merged from economic theory is a powerful idea. Economist have devised and refined methods for measuring the value of having access to services (Freeman III, Herriges, & Kling, 2014). Measurement is an essential part of the approach because it allows the idea of efficiency and equity to be applied to an array of services; and it serves as the basis for decisions that can improve service allocation and increases in neighbourhood environmental quality (Haab & McConnell, 2002).

Much of the empirical literature on valuing urban amenities have used two distinct methodologies. One group of studies have attempted to measure the value of amenities by its proximity on either land values or housing values using the hedonic pricing theory (Albouy, 2016; Cheshire & Sheppard, 1995; Diamond & Tolley, 2013; Irwin, et al., 2014; Polinsky & Shavell, 1976). While a second and more recent group concentrated on individual preferences and derived a willingness to pay (WTP) estimate for amenities using the utility maximisation theory.

Two main approaches which had a great contribute towards the theoretical work on hedonic prices are Lancaster's (1966) consumer theory and Rosen's (1974) model. They posit that a good possesses a number of attributes that combine to form bundles of utility-affecting attributes that the consumer values (Garrod & Willis, 1992). Both of these approaches aimed to assign prices of attributes based on the relationship between the number of attributes and the observed prices of differentiated products. Typically, studies using the hedonic pricing method, estimates the amount an individual is willing to pay for a given property as a function of the various characteristics of the house (Willis, Powe, Garrod, & Brunsdon, 1997) and its spatial accessibility to a particular type of services such as parks and green spaces (Chiesura, 2004; Jim & Chen, 2009), schools (Burgess, Wilson, & Lupton, 2005; Gibbons & Machin, 2008), public transportation (Dubé, Legros, Thériault, & Des Rosiers, 2014; Phanikumar & Maitra, 2006) healthcare (Drummond & McGuire, 2001; Johannesson, 1996; Sloan, 1996) post office (Richard, Hutton, & Smith, 2008) local shopping centre (Dunse & Colin Jones, 1998; Rosiers, Antonio Lagana, Marius Thériault, & Marcel Beaudoin, 1996; Tse & Love, 2000; Willis, Powe, & Garrod, 1995) and police station (Moller, 2001).

Despite the fact that the main strength of the hedonic methods is that it is based on observed behaviour (revealed preference data), however, the methods suffer from several weaknesses (Earnhart, 2001). First, these models depend critically on the control of all important factors

behind location choices (Freeman III, et al., 2014). To manage with this dependency, hedonic studies include numerous explanatory variables, yet may still omit important variables. Second, hedonic analysis does not capture effectively preferences for uncommon attributes (Earnhart, 2001; Freeman III, et al., 2014). Third, hedonic analysis suffers from collinearity between explanatory variables, especially when many are included (Freeman III, et al., 2014); this aspect precludes the isolation of factors, including environmental factors, and generates coefficients with wrong signs or implausible magnitudes (Greene, 2003). Fourth, given limited information on households' search strategies, analysis of housing purchases requires the researcher to specify arbitrarily the feasible choice sets of housing locations that were considered by households (Earnhart, 2001; Freeman III, et al., 2014). Moreover, the size of the specified feasible choice set may be computationally intractable, forcing the analysis to reduce dimensionality through information-depleting means (Earnhart, 2001).

Additionally, revealed preference techniques such as hedonic pricing infer individuals' preferences from observed choices made within the market place. This means that responses can only be observed in response to current market conditions. It can be difficult to observe the effect of sufficiently large variations in the variables of interest using revealed preference data (Madden, 1993; Permain & Swanson, 1991). Revealed preference data is typically restricted in the width of variation of current or past product/service attribute levels. As a result, researchers can only calculate accurately a small section of a consumer utility function. Given that revealed preference data is based on observed behaviour, the use of these techniques proves difficult when forecasting demand for new services or products (Louviere, Hensher, & Swait, 2000; Permain & Swanson, 1991). It is not possible to observe an individual's behaviour in response to market conditions that do not yet exist.

Clearly the use of revealed preference techniques for identifying consumer preferences and/or forecasting demand in some scenarios is difficult. It is largely as a result of these problems encountered using revealed preference techniques that researchers have developed alternative methods of estimating consumer utility functions, and so forecast demand. These alternative methods rely on the observed responses individuals make to hypothetical choices.

Like the early hedonic price studies, discrete housing choice models also began by focusing primarily on housing characteristics. Inspiring from the work of Quigley (1976) and Lerman (1976), McFadden (1978) introduced a family of probabilistic choice models that assumes that the classical, economically rational individual will choose a residential location by weighing the attribute of each available alternative - such as accessibility to shopping, schools, public services, etc. and any cost associated (i.e. property tax and travel cost) - and by choosing the alternative that maximises their utility. In order to develop a greater understanding of utility theory, stated preference (SP) experiments using hypothetical choice were designed and developed which could produce data consistent with economic theory (Louviere & Hensher, 1982; Louviere, et al., 2000). Louviere et al. (2000) reason that SP data collected through Discrete Choice Experiments (DCE) are especially rich in attribute trade-off information and

useful for forecasting changes in behaviour, although they may be affected by the degree of 'contextual realism' one establishes for respondents. DCE's now have a mature microeconomic foundation that allows for measurement of the relative importance of various attributes in individuals' behaviour through their repeated selection of goods with different combinations of attributes (Hanemann & Kanninen, 1998). This method gives the value of a certain good by separately evaluating the preferences of individuals for the relevant attributes that characterize that good, and in doing so, it also provides a large amount of information that can be used in determining the preferred design of the good.

Discrete choice experiments have become a commonly used technique to elicited preferences for non-market goods such as public amenities. There are several reasons for the increased interest in discrete choice experiments. It reduces some of the potential biases of contingent valuation methods, more information is elicited from each respondent and the possibility of testing for internal consistency (Adamowicz, Boxall, Williams, & Louviere, 1998; Hanley, MacMillan, et al., 1998). DCE can create decision scenarios very similar to the real-world decision making situation where the decision maker behaviour can be examined (Mark & Swait, 2004). DCE does a better job than contingent valuation in measuring the marginal value of changes in the characteristics of the goods (Hanley, MacMillan, et al., 1998). This is often a more useful focus from a management/policy perspective than focussing on either the gain or loss of the good, or on a discrete change in its attributes.

Moreover, DCE's are often employed to calculate welfare measures in valuation studies (Li, Adamowicz, & Swait, 2015; Swait, Adamowicz, & van Bueren, 2004). DCE's give welfare-consistent estimates for four reasons (Ardeshiri & Ardeshiri, 2015; Bateman, et al., 2002). First, they encourage the respondents to trade-off changes in attribute levels against the costs of making these changes. Second, the respondents can opt for the status quo, that is, no increase in environmental quality at no extra cost to them. Third, it can represent the econometric technique used in a way which is exactly parallel to the theory of rational, probabilistic choice. Fourth, it can derive estimates of compensating and equivalent surplus from the 'output' of the technique.

Although DCE have become popular for modelling consumer behaviour, however, welfare value estimates obtained with DCE are sensitive to study design (Hanley, Mourato, & Wright, 2001). For example the choice of attributes, the levels chosen to represent them, and the way in which choices are relayed to respondents (for example, through the use of photograph pairs) may all impact on the values of estimates of consumers' surplus and marginal utilities (Hanley, et al., 2001). Another concern with DCE is the choice complexity. Swait and Adamowicz (1996) found an inverted V-shaped relationship between choice complexity and variance of underlying utility amounts; whilst Mazotta and Opaluch (1995) found that increased complexity leads to increased random errors. Bradley and Daly (1994) have found that respondents become fatigued the more choices they are presented with, whilst Hanley et al. (2002) found that value estimates for outdoor recreation changed significantly when respondents were given eight rather than four choice pairs. Ben-Akiva and Morikawa (1990)

and Ardeshiri (2014) found evidence of inconsistent responses that increase as the number of rankings increase. This implies that, whilst the researcher might want to include many attributes, and also interactions between these attributes, unless very large samples are collected, respondents will be faced with daunting choice tasks. This may lead them into relying on shortcuts to provide answers, rather than solving the underlying utility-maximisation problem. Finally, Lancaster and Swait (2014) argue that it is essential that the analyst chooses a representative process validity when analysing a DCE. Lancaster and Swait explain further that by process validity they mean that the decision process described by a mathematical and/or statistical model should be plausible/valid at the desired level of representation because it bears a semblance to the actual decision process(es). For example, if decision makers are actually using threshold-based satisficing as their decision rule, while the mathematical representation of the process employs instead utility maximisation, then we would understand that the process validity of the model is lower than if it were to represent the actual decision rule.

Since we view the latter empirical approach as more instructive, we propose in this paper to utilize the discrete choice framework to focus explicitly on the choice of accessibility to amenity problem (which had previously been studied mainly using hedonic price models).

3. Study Area

Shiraz is the sixth-most-populous city of Iran and the capital of Fars Province. At the 2011 Census, the population of the city was 1,335,358. Shiraz with a total area of 240 km^2, is located in the southwest of Iran. Shiraz is constitute of nine municipalities zones as represented in Figure 1. Where district 4 has the highest population and district 8 has the lowest with almost 4.1%. Except for district six and eight, on average the population has been distributed relatively equal among the remaining districts.

Table 1: Shiraz population distribution by district

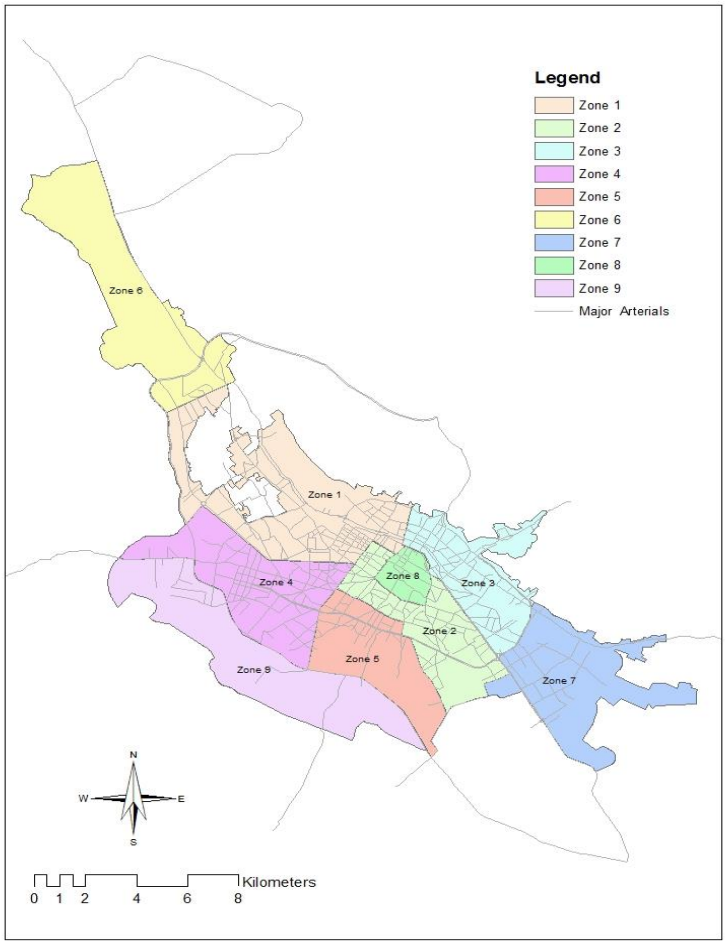
Municipalities	Population	Percentage from total
Zone 1	167,628	12.6%
Zone 2	173,866	13.0%
Zone 3	157,668	11.8%
Zone 4	186,032	13.9%
Zone 5	163,042	12.2%
Zone 6	111,949	8.4%
Zone 7	171,952	12.9%
Zone 8	55,194	4.1%
Zone 9	148,027	11.1%
Total	1,335,358	100.0%

Source: General Population and Housing Census 2006

Shiraz was selected for three reasons. First, the natural and geographical limitation that hindered the development of Shiraz in past has increased the intensity of density in the central area of the city. The concentrated population in the central area resulted in

agglomeration of urban amenities in the central. This in turn has led to better access to these services in the central region and has attracted more population for housing in this area. In other words, the mutual relationship between population and urban amenities has resulted in having high population density with agglomeration of urban amenities in the central and low population density and urban services in marginal areas of the city. Second the supply of urban amenities in the city lacks from having a hierarchical system. This leads to the formation of all municipal services, regardless of their functional scale. They are usually located around the main streets to benefit from accessibility factor, causing the middle tissues to act as residential complex and attract fewer investments. In other word the body of Shiraz streets, depending on the antiquity, are covered with services land uses in a way that is difficult to distinguish among arterial streets and services streets in Shiraz. Third, ease of accessibility to reliable primary data such as census data, housing data, maps and GIS layers.

Figure 1: Shiraz Municipality Zones

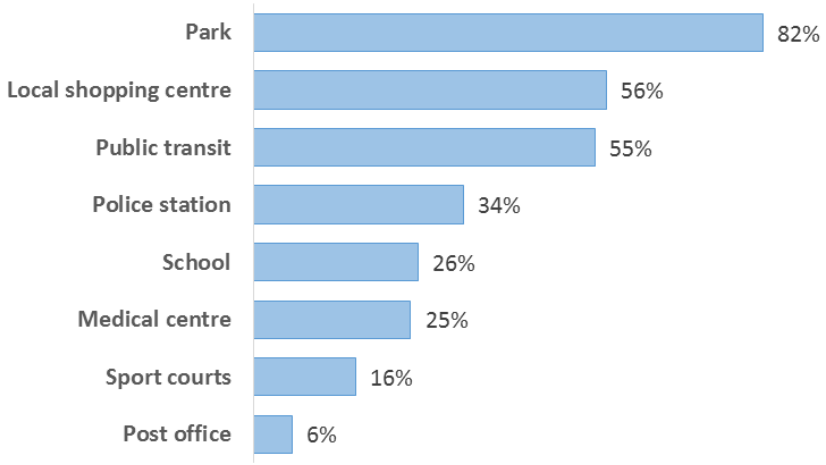


Source: Shiraz Master Plan

4. Discrete Choice Experiment and Materials

For a typical DCE exercise different ways are available to choose the right attributes such as literature review, focus group discussions and direct questioning. For this research, prior to the DCE survey, 450 households were directly questioned to choose from a list of eight public amenities, which they preferred to have proximity with when choosing a neighbourhood to live in. Figure 2, highlights that park, local shopping centre and public transit are the amenities which more than 50% of respondents had preferred to have proximity with when choosing the residential neighbourhood. Thus, for maximising any policy recommendation arising from this study, these three public amenities are selected to be studied in the DCE. In a recent study in Stockholm, residents also had highly ranked access to park and public transportation facilities as important elements on apartment prices. Similar urban quality models have been applied to cities such as Oslo and Copenhagen with comparable findings (Nilsson, 2014).

Figure 2: Preference for proximity to different public amenities when selecting a neighbourhood to live in.



In DCE, money values are used to express people's willingness to pay (WTP) or willingness to accept compensation (WTA). A payment vehicle needs to be introduced and selected for the WTP question (Hanley, Wright, & Adamowicz, 1998; Ian J. Bateman & Willis, 1999). The format of the payment vehicle used is likely itself to influence the motivations in eliciting the non-use values. Property tax has been found a more credible payment vehicle for this study, since many studies have related property values to local public good levels and local property tax rates (Friedman, 1981; Guimaraes, Figueiredo, & Woodward, 2004; Nechyba & Strauss, 1998). Price tags have been set as the percentages increase (resp., decrease) as additional to the current property tax that each household needs to pay (resp., receives) for having proximity to the studied amenities[1]. Figure 3, presents the average property tax values for each census block in 2011. The tax values ranged from 250,000 to 1,800,000 Riyals per annum (in 2011, 3500 tomans= US$1). Focus groups with Shiraz municipality authorities were conducted to elicited the range of acceptable property tax increase/decrease and it was consensually agreed that the tax values can be increased upto 100% of the current amount.

[1] In this study it has been assumed that for households that are renting the property any changes to the property tax will affect their rental payment.

Figure 3: Shiraz property tax blocks average value in 2011.

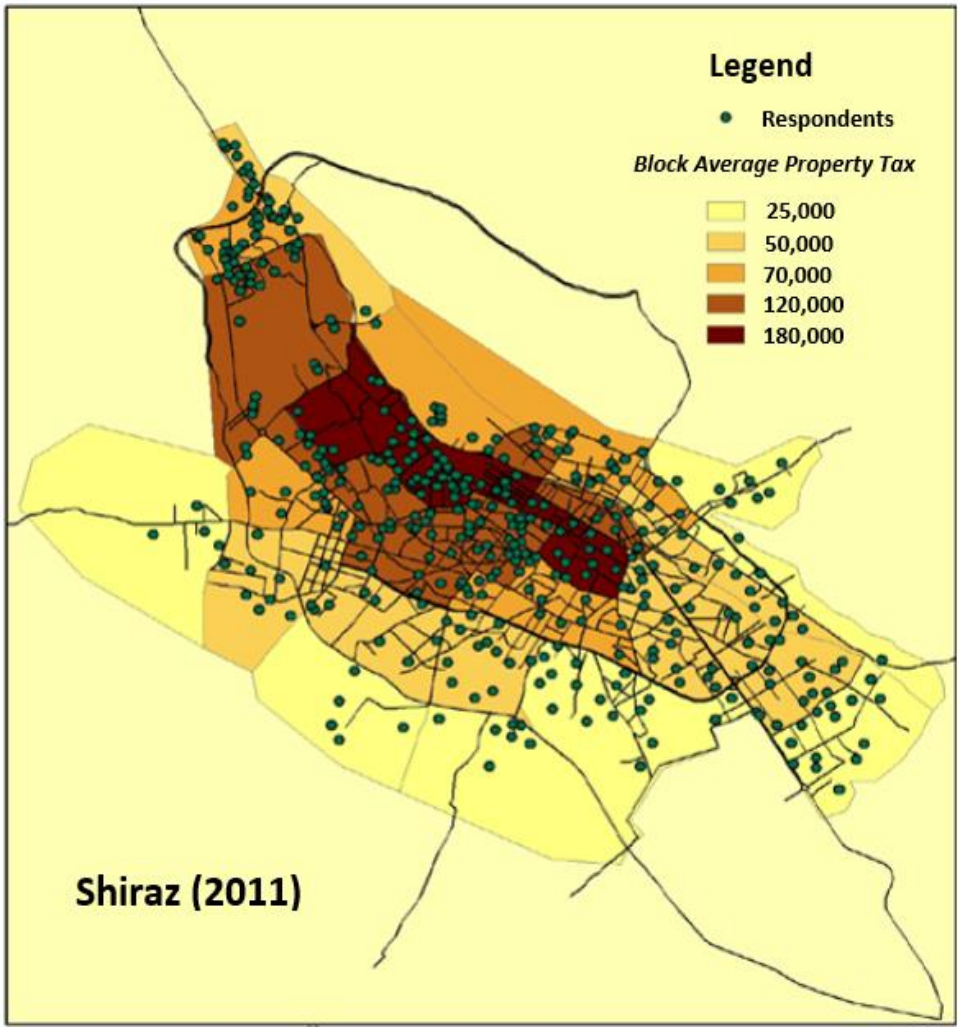


Table 2: Stages of the Choice Experiment Exercise

Stage	Description
1. Selection of attribute	Parks and green spaces, Bus stops (as public transportation), Local shopping centres Monetary cost
2. Assignment of levels	*Proximity of service*; 500m, 800m and 1200m[2]

[2] In planning and building regulations section of Shiraz detail plan, accessibility to services in the scale of a neighbourhood is defined and assessed in three level of walking distances. These levels are less than 500m, 500m-800m and 800m-1200m which is respectively set to be equivalent to average walking distance of 5 minutes, 10 minutes and 15 minutes.

	Monetary cost as percentage changes to the current property tax value; 10%, -5%, 0, 20%, 40%, 60%,80%,100%
3. Choice of experiment design	*D-efficient optimal design;* Using SAS software, from the full possible designs ($3 \times 3 \times 3 \times 8 = 216$), 72 alternatives where chosen.
4. Construction of choice sets	The 72 alternatives have been presented as 36 choice sets. These 36 sets have been blocked into 6 blocks and each responded was given 6 sets to make trade-offs. For each set the "do nothing" or *status quo* level was included.
5. Measurement of preferences	Choice of a survey procedure to measure individual Preferences was the *choice* between two options and the *status quo*.
6. Estimation procedure	Maximum likelihood estimation was undertaken using a mixed multinomial logit model and traditional multinomial logit.

5. Data

Data for our analysis came from a sample of 360 households from Shiraz in September 2011. The survey was paper-based, and conducted using trained interviewers. Respondents were randomly sampled, based on the relatively equal distribution of the population within the 9 municipalities that constitute Shiraz (Figure 1). Forty respondents were sampled from each municipality making for a total of 360 respondents from households in Shiraz. The survey was directed at the head of the household, i.e. the person most likely to make location choices and to pay the rent and property expenses. The questionnaire included a brief introduction and initial background questions, followed by a presentation of the DCE scenarios.

As mentioned in Table 2, the 36 choice sets were been split into 6 blocks and each respondent was offered only one block of 6 different choice cards. From each of these six choice cards, individuals could make one of three choices: choose option A, choose option B, or choose neither (i.e., prefer the status quo). In this case study the number of observations is 2160 ($360 \times 6 = 2160$) and the number of cases is 4320 ($360 \times 12 = 4320$).

Figure 4 presents an example of a choice card presented to a respondent during the stated preference experiment. For example in this choice set (Figure 4) the respondent had option (A) of having a park within a distance of 500 metres, having a bus stop within a distance of 800 metres and a local shopping centre within a distance of 800 metres of his/her property but with a 60% higher tax amount than the current situation. In option (B) the distance to the park increases to 1200 metres, the bus stop becomes closer and within 500 metres and distance to a local shopping centre remains the same, but with a tax decrease of 20% compared to the current amount. Alternatively the respondent could choose neither i.e. the status quo if he or she is happy with the current situation. In order to represent the status

quo option for the DCE, each respondent were asked to best of their knowledge to pinpoint the location of the property on the map. Later using GIS and the associate layers identifying the location of the studied amenities, the nearest distance to the three amenities for that individual is calculated. Moreover, the current property tax was extracted from the GIS layer representing the property tax map. Despite having the level "zero percent" increase in the annual property tax, however this is different to the status quo since the proximity to the selected urban amenities may differ to the current residential location but no additional cost is associate to it.

Figure 4: Illustrative Choice Experiment Question

"Which residential unit do you prefer to live in given the two options as proximity to mentioned services?"

Choice set No. 1	**Option A**	**Option B**
Park	500	1200
Public Transportation	800	500
Local Shopping Centres	800	800
Tax	60%	-20%
Chosen option	☐	☐
Choose neither	☐	

Since the survey was presented in the paper based format and the vehicle payment used in the DCE was dynamic and varied depending on the location of the residential unit and to assure respondents understand the equivalent money value representing the given property tax in the DCE, a property tax convertor table (represented in table 3) was shown to each respondent. This tax convertor is based on the average value of property tax associate to the census block (shown in Figure 3) which the respondent has identified their residential property is located at.

Table 3: Property tax convertor

Property Tax Converter		**Percentage change to the current average property tax value**							
		-10%	**-5%**	**0**	**20%**	**40%**	**60%**	**80%**	**100%**
Census block average property tax value per annum	**25,000**	22,500	23,750	25,000	30,000	35,000	40,000	45,000	50,000
	50,000	45,000	47,500	50,000	60,000	70,000	80,000	90,000	100,000
	75,000	67,500	71,250	75,000	90,000	105,000	120,000	135,000	150,000
	120,000	108,000	114,000	120,000	144,000	168,000	192,000	216,000	240,000
	180,000	162,000	171,000	180,000	216,000	252,000	288,000	324,000	360,000

*Note all values are in Toman currency

6. Estimation Method

The CE technique is an application of the goods' characteristics theory of value (Lancaster, 1966), combined with random utility theory (Manski, 1977; Thurstone, 1927). It thus shares

strong links with the random utility approach to recreational demand modelling using revealed preference data (Bockstael, et al., 1991). The individual's utility function can be specified as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad [1]$$

Where U_{ij} is the utility individual i obtains from alternative j. This utility is known to the individual but not the researcher. The individual is assumed to choose alternative j over alternative t if $U_{ij} > U_{it}$. The researcher observes attributes of the alternatives considered by the individual, and specifies a function V_{ij} relating these observed factors to the individual's utility. Since there are aspects of utility the researcher does not observe, ε_{ij} captures the factors that affect utility but not included in V_{ij} . The multinominal logit model is well suited for behavioural modelling of polychotomous choice situations (see McFadden, 1973). The MNL model states that in a choice situation *t,* the probability that alternative *i* is chosen from the set of available alternatives A_t is given by:

$$P(i : A_t) = \frac{U_{it}}{\sum_{j \in A_{t,r}} U_{jt}} = \frac{e^{V_{it}}}{\sum_{j \in A_t} e^{V_{jt}}} \quad [2]$$

Where V_{jt} is the utility of alternative *j* in choice situation *t*, the value of any V_{jt} is assumed to depend on the values of the attributes presented in the alternative (i.e. proximity and tax) which we denote $x_{i1}, x_{i2}, \dots, x_{it}$ as well as individual characteristics $z_{i1}, z_{i2}, \dots, z_{it}$ as expressed in equation [4].

$$V_{jt} = \beta_i X_{it} + \gamma_i z_{it} \quad [3]$$

The MNL model imposes the condition that the random component (error term) is independent and identically distributed (IID) extreme value type 1 with probability distribution function;

$$\mathrm{f}(\varepsilon_{\mathrm{ij}}) = \exp\left[-\varepsilon_{ij} - \exp(\varepsilon_{ij})\right] \quad [4]$$

The IID assumption is restrictive in that it does not allow for the random component of different alternatives to be correlated. To overcome this restriction, the random utility expression for U_{jt} can be restated in a more general form as:

$$U_{jt} = V_{jt} + \varepsilon_{jt} = \beta_i X_{it} + \gamma_i z_{it} + \varepsilon_{jt} = \beta_i X_{it} + \gamma_i z_{it} + \Omega_{jt} Y_{jt} + \varepsilon_{jt} \quad [5]$$

Where Y_{jt} is a vector of loadings that map error components according to the desired model structure, and Ω_{jt} is a vector of stochastic components which follow a distribution with zero mean and unknown variance. Models of this form are called *mixed logit* because the choice probability P_{it} is a mixture of logits with f as the mixing distribution. For good revisions and discussions of the literature related to this general form and its applications, see Hensher and Greene (2003) and Train (2009).

Thus in this study we analyse the data from the CE questioner in three stages. In the first stage the main effects are being estimated using the multinominal model (MNL) which only

estimates the main attributes used in the CE. For the second stage the socioeconomic variables were included and interacted with the main attributes to assess how these variables can affect the model and goodness of fit using the multinominal logit model. In the third stage we will use the MMNL model to allow the heterogeneity for preferences using all the socioeconomic variables, combined with the urban amenities attributes and the price attribute.

7. Results and Estimations

We start with respondents demographic Analysis who participated in the survey. From the 360 respondents to the CE questioner more than 70% are male and only 29.7% were female. This is due to males usually being the main head of household in the family. The age group of the households varied from 18 years old to 86 with mean value of 35.4 years. The respondents had different levels of education. The majority had a diploma or lower with 43%, respondents with upper diploma and bachelor level both were represented equally with each having 22% of the total sample and 11% had master or higher level of education. With regards to occupational status, 65.3% worked in private company or organization and 18.3% worked for the governmental organizations and the remaining were either students, not employed or retired. In 2011, the Iran Centre of Statistics had announced that families with income less than 7,000,000 Riyals a month are below the poverty line in Iran. From all the respondents only 10 people did not answer to the question related to income. Of the remaining sample of 350, 100 households had income below 7,000,000 which is equivalent to nearly 28.6% of the total. More than 51.7% had incomes of 7,000,000 to 15,000,000 Riyals and 19.7% earned more than 15,000,000 Riyals a month. Table 4, presents the demographic variables and summary statistics of the choice experiment participants.

Table 4. Demographic Variables and Summary Statistics of Choice Experiment Participants

Variable	Shiraz
Number of respondents	
Male	253
Female	107
Total Participate	360
Average Age (years)	35.4
Average No. of Individuals in Household	2.4
Educational Background (%):	
High School Diploma	43
Some College	22.8
Bachelor's Degree	22.2
Master's Degree	9.2
Professional Degree	2.8
Occupation (%)	
Private company	65.3

Government agencies	18.3
Student or retired	16.4
Household Income Level (%):	
Less than 7,000,000 Riyals	28.6
7,000,000 to 15,000,000 Riyals	51.7
Over 15,000,001 Riyals	19.7

For this research the SAS software program has been used to estimate the MNL models and Mixed multinomial logit model. From the socioeconomic analysis of the respondents section, respondent have been categorized by their socioeconomic factors such as age, gender, income, education level as well as their residential municipality zone. In Ardeshiri et al. (2016) three distinct set of municipality zones were identified based on residents neighbourhood satisfaction scores. Zones 1, 4 and 6 as the first set with relatively higher satisfaction score; zones 2, 5 and 7 as the second set with medium satisfaction scores, and finally zones 3, 8 and 9 with low satisfaction scores. Thus, in this study we have categorised the municipalities accordingly to represent relatively high quality, medium quality and low quality zones. Table 5 presents the full categorisation of respondent's socioeconomic information as well as municipality zone quality.

Table 5. Respondents socioeconomic and municipality zone categorisation.

Factors	**Variable**
Age	Age_L = age ≤ 35 Age_M = 36 ≤ age ≤ 53 Age_H = 54 ≤ age
Gender	G_Fl = Female
Income (in Tomans)	Inc_L = income ≤ 700,000 Inc_M = 700,001 ≤ income ≤ 1,500,000 Inc_H = 1,500,001 ≤ income
Education level	Edu_L = Dummy variable (if education level is high school diploma or some college) Edu_M = Dummy variable (if education level is bachelor) Edu_H = Dummy variable (if education level is master or PhD)
Municipality Zones	ZNE_H = Dummy variable (if the respondent lives in any of zones 1, 4 & 6) ZNE_M = Dummy variable (if the respondent lives in any of zones 2, 5 & 7) ZNE_L = Dummy variable (if the respondent lives in any of zones 3, 8 & 9)

Table 6 presents the estimation results. Status quo was never selected as an option and this was anticipated since in Ardeshiri et al. (2016) Shiraz residents are unsatisfied with their neighbourhood quality. Table 6 shows the MMNL and MNL with demographics included models perform better than the MNL with main effects only, model. In other words the interaction of individual's sociodemographic information with the main attributes provides a better prediction of the behaviour. The goodness of fit of the mixed multinomial logit model is slightly higher (McFadden LRI value of 0.1673) compared to the MNL models.

For all urban amenities in the three models (park, bus stop, and local shopping centre) it can be observed that the further away they are from the house the less tax residents are willing

to pay; and this is significant at 0.01 significance level. With regards to access to park and green space, people from the low income group (Income group 1) are not willing to pay more tax for having access to parks due to the income status (significant at 0.09 significance level) this is the same for the high income families (significant at 0.05 significance level). For this group distance to a park is not so important in buying a house or having a park in their neighbourhood. Households with age 54 and above are willing to pay more tax to have a better access to parks due to having more free time to use the facility. Usually by this age an individual their life has reached to certain stability and they can organize more time to use these facilities in a neighbourhood with family (significant at 0.10 significance level).

Table 6. Comparing the goodness-of-fit between both MNL models and MMNL

	Multinomial logit model *(main effects only)*			**Multinomial logit model** *(demographics included)*			**Mixed multinomial Logit**		
	Value	*Std. err.*	*t*	*Value*	*Std. err.*	*t*	*Value*	*Std. err.*	*t*
Park (mean)	-1.25	0.10	-12.5	-1.52	0.21	-7.24	-3.07	1.14	-2.69
Park (Std.)	-	-	-	-	-	-	4.0	1.68	2.38
Bus Stop(mean)	-1.15	0.10	-11.5	-0.64	0.20	-3.20	-1.19	0.53	-2.25
Local Centre (mean)	-1.17	0.10	-11.7	-1.43	0.14	-10.21	-3.09	1.09	-2.83
Local Centre (Std.)	-	-	-	-	-	-	-6.65	2.19	-3.04
Tax (mean)	-0.44	0.09	-4.9	-0.49	0.09	-5.44	-0.89	0.31	-2.87
Park * Inc_L				0.45	0.24	1.88	0.95	0.59	1.61
Park * Inc_H				0.68	0.27	2.52	1.22	0.66	1.85
Park * Age_H				-0.59	0.32	-1.84	-1.05	0.73	-1.44
Park * Edu_H				-1.13	0.36	-3.14	-1.99	0.91	-2.19
Park * G_Fl				-0.38	0.22	-1.73	-0.74	0.49	-1.51
Park * ZNE_HQ				0.40	0.21	1.90	0.72	0.47	1.53
Bus Stop * Inc_L				-0.41	0.27	-1.52	-0.80	0.58	-1.48
Bus Stop * Inc_M				-0.86	0.25	-3.44	-1.68	0.72	-2.33
Bus Stop * Edu_H				-0.58	0.35	-1.66	-1.26	0.77	-1.64
Local Centre * Inc_H				0.39	0.21	1.86	0.83	0.52	1.60
Local Centre * Edu_H				1.03	0.35	2.94	1.95	0.94	2.07
Model Statistics									
N. Parameters	4			15			17		
Number of Obs.	2160			2160			2160		
Number of Cases	4320			4320			4320		
Int. LL	-1497			-1497			-1497		
Final LL	-1284			-1253			-1247		
McFadden's LRI	0.142			0.162			0.167		
AIC	2576			2537			2527		
Number of cases	4320								

Note: variables that where not significant at 85% level have been omitted from the model.

Household with higher education are willing to pay more tax to have better access to parks this could be due to their greater knowledge of the role of park in individual quality of life

(significant at 0.02 significance level). In Shiraz, female households are willing to pay more to have a park nearby. Residents living in set 1 of the joint municipalities (which represents the better quality zones in Shiraz) are not willing to pay more tax for having proximity to parks relative to individuals living in set 2 and 3 (the medium and low quality zones in Shiraz). This could be due to a better distribution and quality of parks that is already exist in these zone, although this is only significant at the 0.14 level.

With regards to access to bus stops, respondents from the middle and low class income prefer to be close to a bus stop rather than using their private transportation. This may be reflective of their income status and price of public transport compare to personal transports (significant at 0.05 significance level for low income and 0.01 significance level for middle income group). In addition, people with higher level of education also prefer to pay more tax to have access to bus stops since they understand the benefits that will provide to themselves as well as to the community in which they live (significant at 0.08 significance level).

Finally in Shiraz city, residents from the high income group as well as residents with a higher degree are not willing to pay more tax to have better access to local shopping centres (relatively significant at 0.08 and 0.02 significance level).

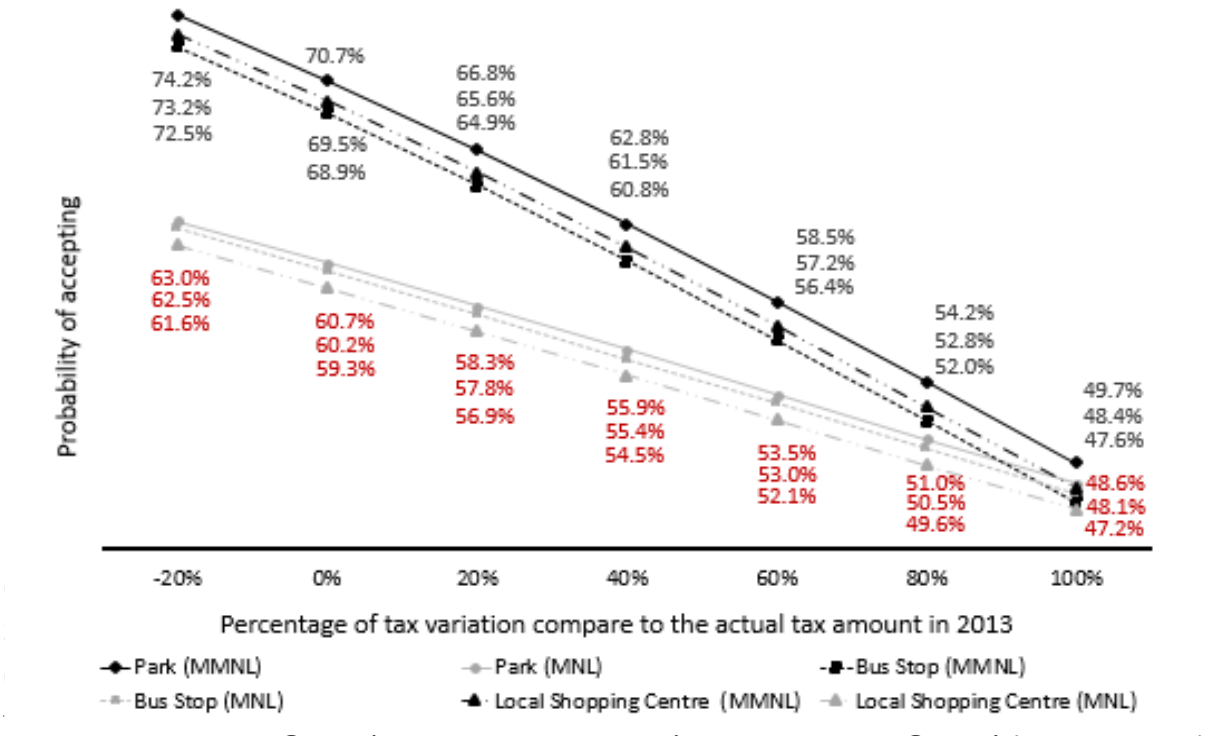
8. Implication for public policy and decision making

The results from this study can help the urban management system, developers, city officials, planners, realtors and researchers etc. with their policy making, effective decision making and efficient city management procedures. Imagine a scenario where the local authorities want to distribute and provide equal access to an urban public service, however, due to lack of resources and capital they have to prioritise between a set of services. Thus, they are interested in policies related to property tax as a source of sustainable income to maintain and keep the service quality up to standards. Assume local authorities in Shiraz want to use the results from this study in areas in which medium to high income families live (municipality zone of 1, 4 and 6). The authorities have the following information about these zones. On average 18% of the population are earning less than 700,000 Toman and are considered as low income families, 69% are from the middle class of income and the remaining 13% are from the higher income class. 25% have an age of 54 and above and 12% have a master or PhD qualification. Finally 55% of the population are female. Currently, on average, all households living in these zones are within 800 metres proximity to a park, a bus stop and local shopping centre and paying the existing amount as their property tax value. Figure 5, presents the probability of accepting one of the studied services within the 500 meters proximity while the other two stay at the 800 metres using the MMNL and MNL results. The results presented in the following figures for the MMNL model is the average from 1000 simulated draws from the population.

As expected, the tax coefficient is negative, meaning that the residents are less likely willing to accept an increase in the tax amount. Furthermore, when allowing for preference heterogeneity in the sampled population, the MMNL result indicates that for a higher

property tax, households respectively prefer to have proximity to parks and green areas, local shopping centres and finally bus stops. However, when preferences are homogeneous, results differ. The MNL results indicate that although proximity to park stays as the preferred option nonetheless residents second preferences shifts from local shopping centres to bus stops. Finally for the given tax range, the MMNL model shows respondents are more sensible to changes in the tax amount as the slope is much greater than the MNL prediction line.

Figure 5: Probability of Accepting to Pay Some Tax Amount (in %) Compare to the Actual Tax Amount in 2013 if the Proximity to One of the Studied Public Services Change from 800 Metres to 500 Metres.



and homogeneity (MNL model) if the proximity to one of the studied services decreases to 1200 metres while the other two stay at the 800 meters. Results from both models indicates that a decrease in proximity to a park will result in a lower possibility of accepting a higher tax. In the sample population when allowing for preference heterogeneity, households are more likely to be willing to pay a higher tax if the proximity to bus stops decreases in comparison with the other two services. Whereas, if population preferences are considered to be homogeneous, households are willing to increase their distance to a local shopping centre.

In the third and final case, imagine a case where local authorities are considering increasing the tax amount while the proximity to all services stay the same at 800 metres. Figure 7 presents the probability of accepting to pay a higher tax compared to the current amount.

Figure 6: Probability of Accepting to Pay Some Tax Amount (in %) Compared to the Actual Tax Amount in 2013 if the Proximity to One of the Studied Public Services Changes from 800 Metres to 1200 Meters.

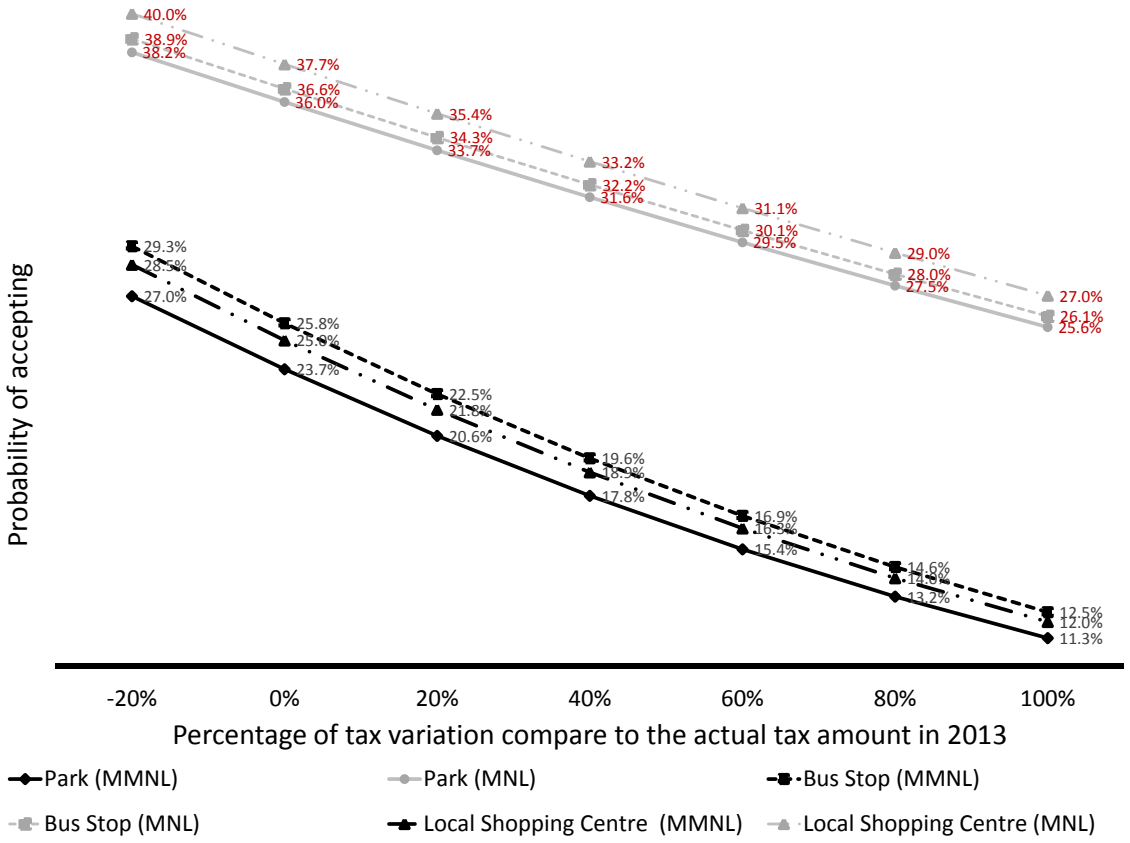
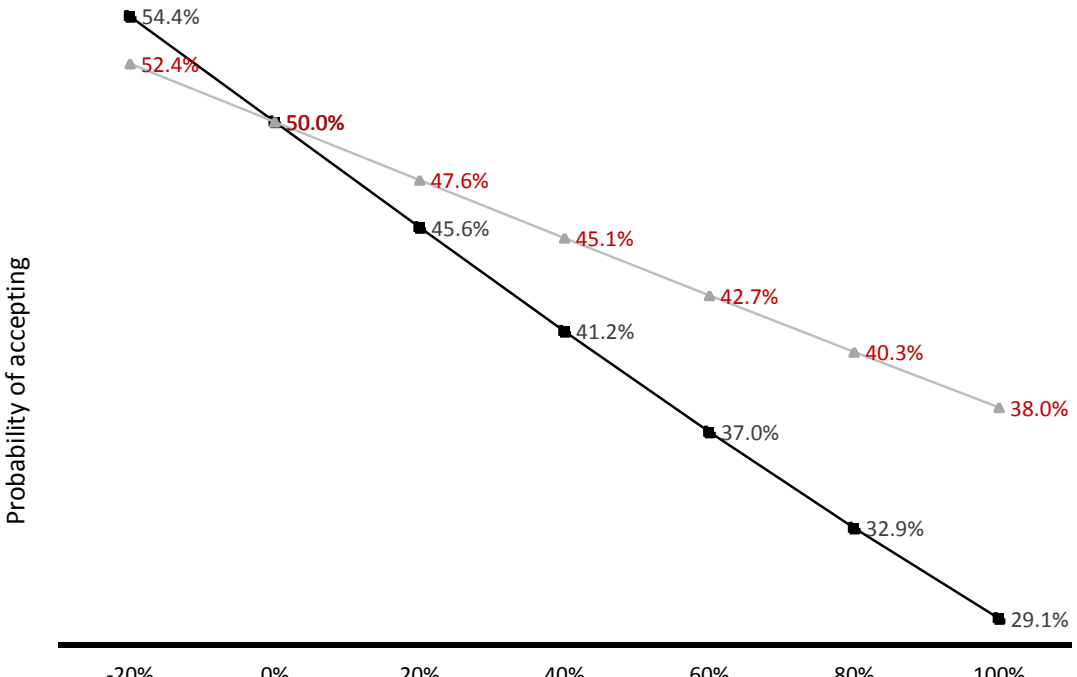


Figure 7: Probability of Accepting to Pay Some Tax Amount (in %) Compared to the Actual Tax Amount in 2013 if the Proximity to Public Services Remain at 800 Metres



9. Discussion

The study and analysis demonstrates the use of discrete choice stated preference methods in estimating residents' preferences for the future provision of different urban services. It also reveals the importance of preference heterogeneity in the demand for urban services: different households exhibit differing demands based on socio-economic characteristics. But even after socio-economic determinants have been taken into account, there still exists preference heterogeneity, which may be due to cultural or psychological differences between households. Future analysis could explore this segmentation of demand for urban services further through latent class models, to identify which groups of residents demand which types of urban services.

Future analysis could also look at the interactions in preferences between urban services themselves, as distinct from interactions with socio-economic variables. This requires an experimental design which allows second and possibly higher order interactions effects to be identified. There may be significant interaction effects between attributes e.g. between public parks and bus stops, public parks and toilet facilities, transport and safety, etc. These interaction effects might be complement (positive) or substitution (negative) effects.

The study presented here only explores a limited number of urban services. Discrete choice experiments can be expanded to account for a wider set of neighbourhood amenities. This would require assessing urban services in blocks, and then assessing preferences and values between discrete blocks of services. Extending the analysis to a wider set of neighbourhood amenities might result in a different preference ordering and WTP values for existing amenities. Economics points out that the value of a good is context dependent: increasing the set of amenities for improvement can alter residents' WTP, especially if they have a budget constraint. Clearly there are wider issues of sustainability of municipal areas, such as renewable energy use, etc., which are not addressed in this paper. But households' adoption of the use of other sustainable consumption goods, such as renewable energy, can and have been analysed by discrete choice experiments (Scarpa and Willis, 2010).

10. Conclusion

This study uncovered how residents from different socioeconomic backgrounds are willing to pay for different services, and how important distance is to certain services with regards to their socio-economic status. Since this study is the first economic valuation study done on Shiraz city, the study was not intended to actually define the extent of the market for each service, but to determine if there was a basis for attempting to define the market and the

value of the urban amenities and determine if distance affects willingness to pay. Therefore, it is critical that future research focuses more specifically on relating the extent of benefits relative to the distribution of services and their characteristics. Another stream for future work is to identify latent decision rules (such as yea-saying, nay saying, minimising cost, etc.) that respondents incorporate when answering environmental related studies which requires the respondent to pay a tax amount.

Finally, this research and its findings can be very beneficial for policy makers to estimate the economic benefits of policy measures to improve the quality of life in cities in general and proximity to urban amenities specific to this study. By employing the perspective of welfare economics to identify the structure of public preferences, including preference differences between socioeconomic groups, this study provides valuable information which can help to inform public policy deliberations over city management and land use planning. This kind of research can prioritize among different services to be developed in the neighbourhoods with residents from different socioeconomic background. By knowing which service is more preferred or demanded in the neighbourhood, and which residents are willing to pay the relevant tax price, then the maintenance of those services can be more easily sustained for the local government. As a consequence the quality of the life of the residents will increase by providing the essential services within their preferred distance from their residential location. This kind of research can be seen as a win-win strategy for residents and local government; and can be beneficial in increasing and maintaining residents' quality of life and the sustainability of a city.

References:

Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated preference approaches for measuring passive use values: choice experiments and contingent valuation. *American Journal of Agricultural Economics, 80*, 64-75.

Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining revealed and stated preference methods for valuing environmental amenities. *Journal of Environmental Economics and Management, 26*, 271-292.

Albouy, D. (2016). What are cities worth? Land rents, local productivity, and the total value of amenities. *Review of Economics and Statistics, 98*, 477-487.

Altschuler, A., Somkin, C. P., & Adler, N. E. (2004). Local services and amenities, neighborhood social capital, and health. *Social science & medicine, 59*, 1219-1229.

Ardeshiri, A. (2014). *Evaluating urban services using economic valuation techniques: towards better urban environmental quality and promotion of sustainable development.*

Ardeshiri, A., & Ardeshiri, M. (2015). What Residents Want from Their Neighbourhoods: Inferring Willingness to Pay for Urban Services using Discrete Choice Experiment. In *The Regional Studies Australian Conference* RMIT University, Melbourne.

Ardeshiri, A., Ardeshiri, M., Radfar, M., & Hamidian Shormasty, O. (2016). The values and benefits of environmental elements on housing rents. *Habitat International, 55*, 67-78.

Ardeshiri, A., Ardeshiri, M., Radfar, M., & Shormasty, O. H. (2016). The values and benefits of environmental elements on housing rents. *Habitat International*.

Askew, I. (1983). The location of service facilities in rural areas: a model for generating and evaluating alternative solutions. *Regional Studies, 17*, 305–314.

Ayeni, B., Rushton, G. And Mcnulty, M. J (1987). Improving the geographical accessibility of health care in rural areas: a Nigerian case study. *Social Science and Medicine, 25*.

Bateman, I. J., Carson, R. T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., & Pearce, D. (2002). Economic valuation with stated preference techniques: a manual. *Economic valuation with stated preference techniques: a manual.*

Ben-Akiva, M., & Morikawa, T. (1990). Estimation of switching models from revealed preferences and stated intentions. *Transportation Research Part A: General, 24*, 485-495.

Bockstael, N., K., McConnell, & Strand., I. E. (1991). "Recreation." Measuring the Demand for Environmental Quality. J.B. Braden and C.D. Kolstad, eds. In. Amsterdam: North-Holland.

Boyer, T., & Polasky, S. (2004). Valuing urban wetlands: a review of non-market valuation studies. *Wetlands, 24*, 744-755.

Braden, J. B., & Kolstad., C. D. (1991). *Measuring the Demand for Environmental Quality*. Amsterdam: North-Holland.

Bradley, M., & Daly, A. (1994). Use of the logit scaling approach to test for rank-order and fatigue effects in stated preference data. *Transportation, 21*, 167-184.

Bullen, N., Moon, G., & Jones, K. (1996). Defining localities for health planning: a GIS approach. *Social Science & Medicine, 42*, 801-816.

Burgess, S., Wilson, D., & Lupton, R. (2005). Parallel lives? Ethnic segregation in schools and neighbourhoods. *Urban Studies, 42*, 1027-1056.

Cetin, M. (2015). Using GIS analysis to assess urban green space in terms of accessibility: case study in Kutahya. *International Journal of Sustainable Development & World Ecology, 22*, 420-424.

Cheshire, P., & Sheppard, S. (1995). On the price of land and the value of amenities. *Economica*, 247-267.

Chiesura, A. (2004). The role of urban parks for the sustainable city *Landscape and Urban Planning, 68*, 129-138.

Cole, K., & Gatrell, A. (1986). Public libraries in Salford: a geographical analysis of provision and access. *Environment and Planning A, 18*, 253-268.

Comber, A., Brunsdon, C., & Green, E. (2008). Using a GIS-based network analysis to determine urban greenspace accessibility for different ethnic and religious groups. *Landscape and Urban Planning, 86*, 103-114.

D'Acci, L. (2014). Monetary, subjective and quantitative approaches to assess urban quality of life and pleasantness in cities (hedonic price, willingness-to-pay, positional value, life satisfaction, isobenefit lines). *Social Indicators Research, 115*, 531-559.

Deller, S. C., Tsai, T.-H., Marcouiller, D. W., & English, D. B. (2001). The role of amenities and quality of life in rural economic growth. *American Journal of Agricultural Economics, 83*, 352-365.

Diamond, D. B., & Tolley, G. S. (2013). *The economics of urban amenities*: Elsevier.

Drummond, M., & McGuire, A. (2001). *Economic Evaluation in Health Care: Merging theory with practice*: Oxford University Press.

Dubé, J., Legros, D., Thériault, M., & Des Rosiers, F. (2014). A spatial Difference-in-Differences estimator to evaluate the effect of change in public mass transit systems on house prices. *Transportation Research Part B: Methodological, 64*, 24-40.

Dunse, N., & Colin Jones. (1998). A hedonic price model of office rents. *Journal of Property Valuation and Investment, 16*, 297 - 312.

Earnhart, D. (2001). Combining revealed and stated preference methods to value environmental amenities at residential locations. *Land Economics, 77*, 12-29.

Freeman III, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: theory and methods*: Routledge.

Freeman, M. (1993). *The Measurement of Environmental and Resource Values: Theory and Methods.* Washington DC: Resources for the Future.

Friedman, J. (1981). A conditional logit model of the role of local public services in residential choice. *Urban Studies, 18*, 347-358.

Garrod, G. D., & Willis, K. G. (1992). Valuing goods' characteristics: An application of the hedonic price method to environmental attributes. *Journal of Environmental Management, 34*, 59-76.

Gatrell, A. C., Bailey, T. C., Diggle, P. J., & Rowlingson, B. S. (1996). Spatial point pattern analysis and its application in geographical epidemiology. *Transactions of the Institute of British geographers*, 256-274.

Geertman, S. C., & Ritsema Van Eck, J. R. (1995). GIS and models of accessibility potential: an application in planning. *International journal of geographical information systems, 9*, 67-80.

Geurs, K. T., & Van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography, 12*, 127-140.

Gibbons, S., & Machin, S. (2008). Valuing school quality, better transport, and lower crime: evidence from house prices. *Oxford Review of Economic Policy, 24*, 99–119.

Greene, W. H. (2003). *Econometric analysis*: Pearson Education India.

Gregory, D., Johnston, R., Pratt, G., Watts, M., & Whatmore, S. (2011). *The dictionary of human geography*: John Wiley & Sons.

Guimaraes, P., Figueiredo, O., & Woodward, D. (2004). Industrial location modeling: extending the random utility framework. *Journal of Regional Science, 44*, 1-20.

Guzman, L. A., & Bocarejo, J. P. (2017). Urban form and spatial urban equity in Bogota, Colombia. *Transportation Research Procedia, 25*, 4495-4510.

Haab, T. C., & McConnell, K. E. (2002). *Valuing Environmental and Natural Resources; The Econometrics of Non-Market Valuation*. Cheltenham: Edward Elgar Publishing Limited.

Hanemann, M. W., & Kanninen, B. (1998). The statistical analysis of discrete-response cv data, California agricultural experiment station giannini foundation of agricultural economics. Working Paper No 798. California Agricultural Experiment Station, Berkeley.

Hanley, N., MacMillan, D., Wright, R. E., Bullock, C., Simpson, I., Parsisson, D., & Crabtree, B. (1998). Contingent valuation versus choice experiments: estimating the benefits of environmentally sensitive areas in Scotland. *Journal of agricultural economics, 49*, 1-15.

Hanley, N., Mourato, S., & Wright, R. E. (2001). Choice modelling approaches: a superior alternative for environmental valuatioin? *Journal of Economic Surveys, 15*, 435-462.

Hanley, N., Wright, R. E., & Adamowicz, V. (1998). Using choice experiments to value the environment. *Environmental and Resource Economics, 11*, 413-428.

Hanley, N., Wright, R. E., & Koop, G. (2002). Modelling recreation demand using choice experiments: climbing in Scotland. *Environmental and Resource Economics, 22*, 449-466.

Hensher, D. A., & Greene, W. H. (2003). The mixed logit model: the state of practice. *Transportation, 30*, 133-176.

Hewko, J., Smoyer-Tomic, K. E., & Hodgson, M. J. (2002). Measuring neighbourhood spatial accessibility to urban amenities: does aggregation error matter? *Environment and Planning A, 34*, 1185-1206.

Ian J. Bateman, & Willis, K. G. (1999). *Valuing Environmental Preferences*. New York: Oxford University Press.

Irwin, E. G., Jeanty, P. W., & Partridge, M. D. (2014). Amenity values versus land constraints: The spatial effects of natural landscape features on housing values. *Land Economics, 90*, 61-78.

Jim, C. Y., & Chen, W. Y. (2009). Value of scenic views: Hedonic assessment of private housing in Hong Kong. *Landscape and Urban Planning, 91*, 226-234.

Johannesson, M. (1996). *Theory and Methods of Economic Evaluation of Health Care*: Kluwer Academic Publishers.

Kearns, A., & Paddison, R. (2000). New challenges for urban governance. *Urban Studies, 37*, 845-850.

Kim, J., & Nicholls, S. (2016). Influence of the measurement of distance on assessment of recreation access. *Leisure Sciences, 38*, 118-139.

Knox, P. L. (1980). Measures of accessibility as social indicators: A note. *Social Indicators Research, 7*, 367-377.

Koopman, M. (2012). *Economic analysis of neighbourhood quality, neighbourhood reputation and the housing market* (Vol. 44): IOS Press.

Lancaster, K. J. (1966). A new approach to consumer theory,. *Journal of Political Economy,, 74*, 132-157, E-journal, Online.

Lancsar, E., & Swait, J. (2014). Reconceptualising the external validity of discrete choice experiments. *Pharmacoeconomics, 32*, 951-965.

Lerman, S. R. (1976). Location, housing, automobile ownership, and mode to work: a joint choice model. *Transportation Research Record, 610*, 6-11.

Li, H., Wei, Y. D., Yu, Z., & Tian, G. (2016). Amenity, accessibility and housing values in metropolitan USA: A study of Salt Lake County, Utah. *Cities, 59*, 113-125.

Li, L., Adamowicz, W., & Swait, J. (2015). The effect of choice set misspecification on welfare measures in random utility models. *Resource and energy economics, 42*, 71-92.

Lora, E., Powell, A., Van Praag, B., & Sanguinetti, P. (2010). *The Quality of Life in Latin American Cities: Markets and Perception*. Washington DC: The Inter-American Development Bank and The World Bank.

Louviere, J., & Hensher, D. (1982). On the Design and Analysis of Simulated Choice or Allocation Experiments in Travel Choice Modeling. *Transportation Research Record, 890*, 11-17.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: analysis and applications*: Cambridge University Press.

Lovett, A., Haynes, R., Su¨ Nnenberg, G. And Gale, S. , . (2000). *Accessibility of Primary Health Care Services in East Anglia.* Norwich: University of East Anglia, .

Macintyre, S., Maciver, S. A., & Sooman, A. (1993). Area, class and health: should we be focusing on places or people? *Journal of Social Policy,, 22*, 213–234.

Madden, G. G. (1993). *A Brief Introduction to the Methodology of Optimum Stated-preference Experimental Design*: Curtin University of Technology, School of Economics and Finance.

Manski, C. F. (1977). The structure of random utility models. *Theory and Decision, 8*, 229-254.

Mark, T. L., & Swait, J. (2004). Using stated preference and revealed preference modeling to evaluate prescribing decisions. *Health Economics, 13*, 563-573.
Mazzotta, M. J., & Opaluch, J. J. (1995). Decision making when choices are complex: a test of Heiner's hypothesis. *Land Economics*, 500-515.
McFadden, D. (1978). Modeling the choice of residential location. *Transportation Research Record*.
McGranahan, D. A. (2008). Landscape influence on recent rural migration in the US. *Landscape and Urban Planning, 85*, 228-240.
McLafferty, S., & Broe, D. (1990). Patient outcomes and regional planning of coronary care services: A location-allocation approach. *Social Science & Medicine, 30*, 297-304.
Moller, V. (2001). Monitoring quality of life in cities: The Durban case. *Development Southern Africa, 18*, 217-238.
Nechyba, T. J., & Strauss, R. P. (1998). Community choice and local public services: A discrete choice approach. *Regional Science and Urban Economics, 28*, 51-73.
Nicholls, S. (2001). Measuring the accessibility and equity of public parks: A case study using GIS. *Managing leisure, 6*, 201-219.
Nilsson, P. (2014). Natural amenities in urban space–A geographically weighted regression approach. *Landscape and Urban Planning, 121*, 45-54.
O'Sullivan, D., Morrison, A., & Shearer, J. (2000). Using desktop GIS for the investigation of accessibility by public transport: an isochrone approach. *International Journal of Geographical Information Science, 14*, 85-104.
Olenburg, R. (1997). *The Great Good Place.* New York: Marlowe & Co.
Orford, S. (2017). *Valuing the built environment: GIS and house price analysis*: Routledge.
Parker, E., & Campbell, J. (1998). Measuring access to primary medical care: some examples of the use of geographical information systems. *Health & Place, 4*, 183-193.
Partridge, M. D., Rickman, D. S., Ali, K., & Olfert, M. R. (2007). The landscape of urban influence on US county job growth. *Review of agricultural economics, 29*, 381-389.
Pearce, J., Witten, K., & Bartie, P. (2006). Neighbourhoods and health: a GIS approach to measuring community resource accessibility. *Journal of Epidemiology & Community Health, 60*, 389-395.
Permain, D., & Swanson, J. (1991). Stated Preference Techniques: A Guide to Practice, Steer Devies. *Gleave and Haque Consulting Group, London*.
Phanikumar, C. V., & Maitra, B. (2006). Valuing Urban Bus Attributes: An Experience in Kolkata. *Journal of Public Transportation, 9*.
Polinsky, A. M., & Shavell, S. (1976). Amenities and property values in a model of an urban area. *Journal of Public Economics, 5*, 119-129.
Quigley, J. M. (1976). Housing demand in the short run: An analysis of polytomous choice. In *Explorations in Economic Research, Volume 3, number 1* (pp. 76-102): NBER.
Richard, H., Hutton, D. D., & Smith, I. R. (2008). The challenges and opportunities facing UK postal services, An initial response to evidence In.
Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition, . *Journal of Political Economy, 82*, 35-55.
Rosiers, F. D., Antonio Lagana, Marius Thériault, & Marcel Beaudoin. (1996). Shopping centres and house values: an empirical investigation. *Journal of Property Valuation and Investment, 14*, 41 - 62.
Scarpa, R. & Willis, K. (2010). Willingness-to-pay for renewable energy: primary and discretionary choice of British households' for micro-generation technologies. *Energy Economics, 32*, 129-136.
Schuler, R. E. (1974). The interaction between local government and urban residential location. *The American Economic Review, 64*, 682-696.
Sloan, F. A. (1996). *Valuing health care: Costs, benefits, and effectiveness of pharmaceuticals and other medical technologies*: Cambridge University Press.

Swait, J., & Adamowicz, W. (1996). The effect of choice environment and task demands on consumer behavior: discriminating between contribution and confusion.

Swait, J., Adamowicz, W., & van Bueren, M. (2004). Choice and temporal welfare impacts: incorporating history into discrete choice models. *Journal of Environmental Economics and Management, 47*, 94-116.

Talen, E. (1998). Visualizing fairness: Equity maps for planners. *Journal of the American Planning Association, 64*, 22-38.

Talen, E., & Anselin, L. (1998). Assessing spatial equity: an evaluation of measures of accessibility to public playgrounds. *Environment and Planning A, 30*, 595-613.

Thurstone, L. L. (1927). A law of comparative judgment. *Psychological review, 34*, 273.

Train, K. E. (2009). *Discrete choice methods with simulation*: Cambridge university press.

Tse, R. Y. C., & Love, P. E. D. (2000). Measuring residential property values in Hong Kong,. *Property Management, 18*, 366-374.

Warin, M., Baum, F., Kalucy, E. . (2000). The power of place: space and time in women's and community health centres in South Australia. *Social Science and Medicine, 50*, 1863–1875.

Willis, K. G., Powe, N. A., & Garrod, G. D. (1995). Valuation of urban amenities using an hedonic price model. *Journal of Property Research, 12*, 137-147.

Willis, K. G., Powe, N. A., Garrod, G. D., & Brunsdon, C. F. (1997). Using a geographic information system to estimate an hedonic price model of benefits of woodland access. *Forestry, 70*, 139-149.

Witten, K., Exeter, D., & Field, A. (2003). The quality of urban environments: mapping variation in access to community resources. *Urban studies, 40*, 161-177.

Yang, C., & Fujita, M. (1983). Urban spatial structure with open space. *Environment and Planning A, 15*, 67-84.