Measuring the Impact of Government Canyon State Natural Area On Surrounding Property Values with the Hedonic Pricing Method

By

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Applied Research Project

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Submitted to the Department of Political Science
Texas State University-San Marcos
In Partial Fulfillment for the Requirements for the Degree of
Masters of Public Administration

Fall 2012

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ABSTRACT

Purpose. The purpose of this study is to assess the impact of proximity to public greenspace on the sales prices of surrounding properties. *Methods*. The data used in this study are from properties located within four miles of the boundaries of Government Canyon State Natural Area that have been sold within the past eight years. This research uses the hedonic pricing method which utilizes multiple regression analysis to isolate the impact of individual commodity characteristics. *Results*. The results of this study indicate that increased proximity to Government Canyon State Natural Area significantly increases the sales values of nearby homes. *Conclusion*. The development and preservation of greenspace has the quantifiable benefit of adding value to surrounding properties as consumers are willing to pay a significantly higher amount for this attribute than other attributes commonly perceived to increase property values.

About the Author

Michael McAlear was born in Manvel, Texas in 1987 and raised in Madison, Alabama. He attended the University of Alabama in Tuscaloosa and graduated with a Bachelor of Arts in Political Science with a minor in Philosophy in 2010. Michael also attended Texas State University, graduating with a Master in Public Administration with a concentration in Environmental and Urban Planning in 2012. While performing this research, Michael worked for the City of Windcrest, Texas. Michael can be contacted at michaelpmcalear@gmail.com.

Acknowledgements

I would like to thank Dr. Hassan Tajalli for his support and guidance throughout the process of conducting this research. Dr. Tajalli's instruction was instrumental to the completion of this project as well as to my overall educational experience at the University.

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Chapter 1. Introduction

Boston built the first public park in the United States in 1634; the Boston Common (Tajima 2003). Since that time, early proponents of public parks included the likes of John Muir, the founder of the Sierra Club, renowned poets Ralph Waldo Emerson and Henry David Thoreau, Alfred Marshall, and famous architect Fredrick Law Olmstead (Ise 1978; Miles 2009; Nelson 1985).These historical figures urged for the setting aside of natural areas for the enjoyment of the public at large. Public parks and preserved natural spaces were an essential part of establishing an American identity throughout the country's early history. The establishment of which was thought to be a way by which Americans could establish a national identity separate of the cathedral and castles of the old world (Everhart 1983). Instead, Americans took pride in their country's landscape, geographical features and monuments, and natural beauty.

Historically, American voters have overwhelmingly supported land use conservation measures. "Between 1998 and 2004, 935 out of 1,215 conservation ballot measures in the United States passed, raising close to $25 billion in funding for land conservation in 44 states" (Cho et al. 2006, 485). However, development and land conversion often precedes land use policy (Bowman et al. 2009). "Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions" (Costanza et al. 1997: 253). Consequently, the study of

the economic benefits of open-space and greenspaces to residential development is essential to developing responsible land development policies.

Open space can be defined as "undeveloped land that retains most of its natural characteristics" (Fausold and Lilieholm 1999, 308). Examples of such land include: natural areas, national and state parks, neighborhood parks, greenbelts, and agricultural lands. Parks and greenways are classified as "green open-space" (Cho et al.2007). For the purposes of this research, the term "greenspace" includes all open-space which is not available for development or utilized for agricultural purposes.

Research Purpose

The purpose of this research is to determine whether proximity to greenspace significantly impacts the values of surrounding properties. This explanatory study will utilize the hedonic pricing method which isolates the impact of an attribute of a good by introducing other attributes into a multiple regression analysis. Controlling attributes that will be included into the analysis are: number of bedrooms, number of bathrooms, property size, living area, building age, and sale date. The research will add to the growing literature of studies that evaluate the Proximate Principle and the resulting implications.

Chapter Organization

There are five chapters in this research, including the current chapter. Chapter 2 will examine the scholarly literature surrounding the benefits of greenspace, the valuation of greenspace, and greenspace planning. Chapter 3 describes the methods used to analyze the property data. The variables introduced within the analysis are operationalized and presented as a table within this chapter. The results of the statistical analysis are described in Chapter 4. Chapter 5 presents the conclusions and suggests future research within the field of greenspace research.

Chapter 2. Literature Review

Chapter Purpose and Organization

The purpose of this chapter is to review the literature on the relationship between greenspace and property values. The literature review is divided into four sections. The first section discusses the benefits of greenspace. This section discusses the general benefits of greenspace as well as the concept of "nature's service". The second section discusses the monetary valuation of greenspace. Three methods of valuation are discussed: travel cost method, contingent valuation method, and the hedonic pricing method. Discussion of the hedonic pricing method will include the proximate principle, the operationalization of the proximate principle, the theoretical foundation of hedonic pricing, control variables, and problems with hedonic pricing.

The third section of this literature review discusses greenspace scarcity, development and distribution. In this section, the scarcity principle, urban greenspace, and greenspace planning, distribution and development will be discussed, as well as different types of greenspace. The fourth section of the chapter discusses the tax revenue associated with greenspace. The relationship between tax revenue and greenspace allocation and distribution will be discussed within this section.

Benefits of Greenspace

Although the many values which greenspaces may provide can be easily described, they have typically been harder to quantify (Nicholls 2004; Nicholls and

Crompton 2005; Fausold and Lilieholm 1999). Commonly the preservation of greenspace has been predicated solely on the value of natural amenities such as wildlife habitat, aesthetics, or biodiversity (Irwin 2002; Jim and Chen 2010). However, the benefits that can be gained from greenspace go far beyond that of which may only be directly experienced by biologists or outdoor-recreationalists.

For instance, greenspaces can provide significant economic benefits. An example of such benefits is the tourism and recreational revenue associated with greenspaces that make significant contributions to local, state, and national economies on an annual basis (Fausold and Lilieholm 1999). Preserved greenspace is also an effective tool for the mitigation of urban sprawl (Nelson 1985; Correll et al. 1978; Nicholls and Crompton 2005). The benefits of protected greenspace can provide a vast array of pragmatic solutions for problems which directly impact citizens on a regular basis. These benefits are collectively known as "nature's service", otherwise known as "ecosystem services" (Conway et al. 2010; Costanza et al. 1997).

Nature's Service

From an economic and policy perspective, greenspaces can provide indirect and direct benefits at a lower cost than artificial methods to achieve similar benefits. These benefits are known as "nature's services". A study by Costanza et al. (1997) estimated the net benefits to the United States as a result of ecosystem (nature's) services to be $3.3 trillion dollars. One of the most important functions which greenspaces can provide is solutions for effective ecosystem management. For instance, greenspaces have been

shown to decrease storm water runoff and accelerate groundwater recharge (Nelson 1985; Luley 1998; Fausold and Lilieholm 1999, Costanza et al. 1997). Greenspaces can also assist in the mitigation or elimination of damage from natural disasters. Greenspaces have been shown to reduce excessive wind speeds (Scott et al.1999). Thus, the preservation of greenspace is instrumental in storm damage prevention (Fausold and Liliehom 1999).

Greenspaces such as wetlands may also serve as natural flood barriers (Nelson 1985). In one case, the U.S. Army of Engineers acquired 8,500 acres of wetlands in Massachusetts at a cost of $10 million to act as a flood barrier. The alternative was to construct dams and levees which would have cost in excess of $100 million (Kusler and Larson 1993). In addition, preserved greenspace can assist in the abatement of air pollutants, and sequestion of urban carbon outputs (Nelson 1985; McPherson 1992; Dwyer et al. 1992, Costanza et al. 1997, Jim and Chen 2010). The preservation of which is also instrumental in preventing and reducing occurrences such as excessive heat island effects (Scott et al. 1999). Consequently, greenspace preservation can be an influential tool for climate moderation (Costanza et al.1997).

The Monetary Valuation of Greenspace

As mentioned above, the monetary valuation of greenspace has often been difficult to quantify, despite the many services which directly benefit the public. There are three methods by which scholars have attempted to quantify the monetary value of greenspace. These three methods are the travel cost method, the contingent valuation method, and the hedonic pricing method. Essentially, the three methods attempt to

identify consumers' "willingness-to-pay" for the aforementioned benefits, thereby placing a monetary value on the good.

Travel Cost Method

The first method is the "travel cost method". The travel cost method attempts to quantify the monetary value of greenspace by ascertaining data on capital spent on travel costs and the direct and indirect benefits associated with these expenditures to local, state, and national economies (Cho et al. 2006; Jim and Chen 2010; Tajima 2003; Bowman et al. 2009). This method is most commonly used to estimate the economic impact of large greenspaces such as national and state parks. The travel cost method identifies the monetary value of the greenspace in question as the costs associated with the utilization of the amenity. These costs include "travel costs, fees, on-site expenditures, and outlay on capital equipment necessary for consumption," (Tajima 2003, 644). This method is often unsuitable for measuring the value of neighborhood parks or urban greenspaces because travel costs are often limited and uniform (Tajima 2003; Jim and Chen 2010). The method is also typically unsuitable for measuring the value of greenspaces in or near large cities because the expenses are likely linked to visitation of more than just the greenspace (Tajima 2003).

Contingent Valuation Method

The second method of the monetary valuation of greenspace is "contingent valuation". The contingent valuation method attempts to quantify the monetary value of greenspace by asking consumers hypothetical questions about their "willingness-to-pay"

for access to greenspace amenities (Cho et al.2006; Jim and Chen 2010; Tajima 2003; Bowman et al.2009). This method is useful for the estimation of benefits from hypothetical scenarios since it does not rely on observed economic behavior. For example, the method is often used to assess the potential benefits of future greenspace amenities that haven't yet been established. However, it is limited by virtue of the survey method, since consumers are often unable to express exact or reliable values (Jim and Chen 2010; Tajima 2003).

Hedonic Pricing Method

The third method of the monetary valuation of greenspace is the economic technique known as hedonic pricing. Hedonic pricing is used to ascertain the increase in property values experienced by properties solely by virtue of their proximities to greenspaces (Scott et al.1999; Nowak et al. 2000; Constanza et al. 1997).

The Proximate Principle

The application of the hedonic pricing method to the monetary valuation of greenspace relies upon the "proximate principle". The proximate principle is the notion that property values increase by virtue of their proximity to greenspace amenities (Crompton 2001; Nicholls and Crompton 2005). One of the earliest examiners of the proximate principle was Frederick Law Olmstead. In the late 19th century, Olmstead used the principle as one of the justifications for the development of New York City's Central Park (Nicholls 2004; Fausold and Lilieholm 1999; Nelson 1985). The purpose for which Olmsted designed New York's Central park was to "provide for the masses of the city a

brief equivalent of a visit to the countryside" (Nelson 1985, 43). Leinberger and Berens summarized his findings:

> He found that by 1864, when the park was only half-finished, it had begun generating net revenue of $55,880. He also charted the average increase in property value in the three wards surrounding the park and in the city's other wards. If the three wards around the park had increased in value 100 percent between 1856 and 1873, as did other wards throughout the city, their appraised value would have been $53 million; instead, it was $236 million. Although Olmstead's analysis was simple, the difference was striking (Leinberger and Berens 1997, 27-28).

Operationalizing the Proximate Principle

Many of the benefits that are provided by greenspaces are "public goods". Greenspaces may be considered "public goods", themselves. Public goods are nonexcludable and nonconsumptive. Nonexcludable means that it is difficult or impossible to exclude a party from the use of such goods. Nonconsumptive means that the usage of a good by a party does not prevent or inhibit the use of the good by another party. Consequently, the private development of greenspace generally suffers from market failure (Fausold and Lilieholm 1999). As a result, geenspaces are often the subject of public ownership. Therefore, preserved greenspace is normally a free commodity. As a free commodity, exclusion is primarily based upon distance from the greenspace (Correll et al.1978).

Distance to greenspace has been shown to significantly impact property values, where proximity is positively correlated with property value (Nelson 1985; Nicholls and Crompton 2005; Kaufman and Cloutier 2006; Hammer et al.1978; Weigher and Zerbst

1973; Correll et al. 1978). Specifically, the common finding is that greenspaces can have positive impacts on property values within a distance of one-quarter to one-half mile (Cho et al.2006.) However, a property within close proximity to greenspace may still be exclusionary without accessibility. Thus, accessibility to greenspace amenities also may positively impact property values (Nicholls and Crompton 2005). In order to accurately quantify this principle, many scholars have turned to the hedonic pricing method.

Theoretical Foundation of Hedonic Pricing

The proximate principle can be quantified through the use of hedonic pricing. The theoretical foundation behind hedonic pricing is that utility is not generated by a good, in itself. Rather, utility is generated by the attributes of that good (Lancaster 1966). With regard to property values, the hedonic pricing method economically quantifies the effect which various attributes may have on a property's value (Lutzenhiser and Netusil 2001; Nicholls 2004; Crompton 2001; Irwin 2002; Correll et al.1978, Jim and Chen 2010; Jim and Chen 2006). As housing and properties are immobile, the value of attributes such as greenspace amenities is capitalized into the sales price of the home or property (Irwin 2002). Thus, the influence which proximity to greenspace bears on a property's value can be more readily ascertained. In order to operationalize the hedonic pricing method, multiple regression is utilized. Within the multiple regression, various coefficients act as indicators of "willingness to pay" for the attributes which they represent (Nicholls and Crompton 2005).

Control Variables

In order to isolate the effect which proximity bears on property values, various attributes of the properties being examined must be inserted into the regression. Typically, these attributes include property characteristics such as age, number of bedrooms, number of bathrooms, square footage of the building, square footage of the lot, and improvements made upon the property which differentiate it from neighboring properties. In addition, external attributes of the property may be inserted into the regression such as views, neighborhood characteristics, year of sale and accessibility to other major amenities.

Generally, building age is negatively correlated with property values because of maintenance costs and poor utility efficiency (Jim and Chen 201; Cho et al.2006; Cho et al. 2008; Correll et al.1978; Nicholls and Crompton 2005). Existence of a swimming pool has been shown to positively influence property values (Jim and Chen 2010; Cho et al.2006, Cho et al. 2008, Nicholls and Crompton 2005). Number of bedrooms, presence of a garage, square footage of residence, number of stories, and size of the property lot has also been shown to significantly affect property values, positively (Cho et al.2006; Cho et al.2008, Correll et al.1978; Nicholls and Crompton 2005; Jim and Chen 2010; Jim and Chen 2006). Homes with all-brick exteriors also experience significantly higher property values than homes with exteriors made from other materials (Cho et al.2006). Presence of a fireplace within a home can also significantly increase property value (Cho et al. 2006).

The effects of most external characteristics cannot generally be predicted to show a positive or negative impact. However, external characteristics are generally significant. Inserting dummy variables into the regression to control for individual neighborhood usually yields a significant coefficient (Cho et al. 2006). In addition, the year of sale has also been shown to significantly impact property values (Cho et al. 2006).

There are, however, external characteristics which have generally shown positive significant impacts. Proximate distances to water bodies have been shown to yield positive property value impacts (Jim and Chen 2010; Cho et al.2006). Proximate distance to amenities such as shopping areas and central business districts can provide for significant positive property value impacts (Cho et al.2008; Bowman et al.2007; Jim and Chen 2010). There are also external influences which have generally been shown to yield negative property value impacts. Proximate distance to transportation infrastructure such as railroads and highways has been shown to yield a negative impact on property values (Cho et al.2006; Tajima 2003).

Problems with Hedonic Pricing

Various issues with the hedonic pricing method have been identified in the literature. Multicollinearity may present issues to the accuracy of the hedonic pricing method, and lead to artificially low significance levels (Irwin 2002; Correll et al.1978; Jim and Chen 2010; Cho et al. 2010; Jim and Chen 2006). Multicollinearity occurs when two or more independent variables show significant correlation (Cho et al. 2010; Lutzenhiser and Netusil 2001). The homogeneity of many communities may also impact

the regression analysis (Irwin 2002; Correll et al.1978; Jim and Chen 2010; Cho et al.2010; Jim and Chen 2006).

Hedonic pricing may also be limited by the fact that it can only measure values that accrue to nearby residents (Irwin 2002; Tajima 2003). The value for visitors to the park is therefore not included within the results and may be better ascertained through the contingent valuation method or travel cost method. In addition, hedonic pricing requires the observation of economic behavior. Consequently, the method is not applicable to hypothetical projects (Tajima 2003). Furthermore, hedonic pricing assumes that the property market from which data is drawn is at, or near, equilibrium (Nicholls and Crompton 2005). Some scholars have also criticized the use of hedonic pricing in the analysis of property values as missing essential property value determinants within research models (Cho et al. 2006).

Greenspace Scarcity, Development, and Distribution

The proximate impact that greenspace may have on property values may also be influenced by the amount of greenspace amenities which are readily available to a community (Chesire and Shepard 1995). Other scholars agree that the valuation of preserved open space is contingent upon the scarcity of such amenities (Jim and Chen 2010; Tajima 2003; Correll et al.1978; Fausold and Lilieholm 1999). The scarcity of greenspace in inner-city neighborhoods has also been linked to many social problems, including community health, environmental health, and environmental justice (Conway et al. 2010). As the expansion of low-density development in outer-metropolitan regions

accelerates, the availability of open-space decreases. Consequently, the value of greenspace in urban communities may be exponentially higher than that of communities with several greenspace amenities readily accessible (Jim and Chen 2010; Tajima 2003; Correll et al.1978; Fausold and Lilieholm 1999).

Urban Greenspace

There are many benefits which greenspaces can provide in urban settings. Greenspaces such as neighborhood parks can make neighborhoods "healthier, cooler, more attractive for walking and cycling and infiltrate and clean storm water runoff, therefore enhancing the quality of life for older urban communities," (Conway et al.2010, 165). Generally, urban and neighborhood greenspaces can provide for a range of activities such as exercise, social interaction, and relaxation (Jim and Chen 2010). Furthermore, urban greenspace maximizes utility by benefitting more people, as these areas typically attract more visitors (Tajima 2003).Greenspaces such as neighborhood parks can also assist in the absorption of urban noise (Dwyer et al.1992; Jim and Chen 2010). The preservation of greenspace in urban areas may ultimately increase the quality of life of residents living in a limited spread, and entice future property owners, potentially increasing residential property values (Jim and Chen 2010).

According to the scarcity principle outlined above, greenspaces should generally have a greater positive impact on urban communities with limited access to greenspace amenities than to communities that have prevalent access to such amenities. However, there are other factors to consider. For instance, adjacency to heavily-used residential

parks can negatively affect property values (Weigher and Zerbst 1973; Schultz and King 2001). Scholars have also observed significant differences in property values for properties facing and backing onto parks, where property values for properties facing parks were significantly higher than that of properties backing onto parks (Weigher and Zerbst 1973). These findings might be explained by the fact that residents with properties adjacent to greenspaces may have privacy concerns (Nicholls and Crompton 2005; Weigher and Zerbst 1973).

In addition, high inner-city land prices often result in an inability to purchase adequate park acreage (Conway et al.2008). Park acreage has been shown to significantly influence property values in a positive manner (Nicholls and Crompton 2005; Hammer et al.1971, Schultz and King 2001; Cho et al.2006; Lutzenhiser and Netusil 2001; Cho et al.2008). The demolition of developed property is not a feasible option in most urban communities, as affordable housing is often a priority (Conway et al.2008). Furthermore, property value increases associated with the preservation of greenspace may displace renters because of the increased property price (Tajima 2003).

Nonetheless, small neighborhood parks and greenspaces can still produce significant positive impacts (Conway et al.2008). As a shifting global economy and dependence on telecommunication technology make it more difficult for the establishment of high-income households in rural areas, the viability of such parks may increase, along with the demand efforts (Fausold and Liliholm 1999, Jim and Chen 2010). The development or preservation of urban amenities such as parks and greenspace

are increasingly being recognized by cities as a strategy by which they can attract skilled workers and firms (Tajima 2003). A minimum amount of greenspace per person is often included within modern planning standards at the local and regional level (Jim and Chen 2010).

Scholars have also recognized the impediment which scarcity of greenspace can have on future real estate development (Conway et al. 2010). Simple green landscape additions to alleys and streets can provide a feasible solution to limited open-space availability, as these attributes also significantly increase property values (Cho et al. 2008; Conway et al.2008). Morancho found that the establishment of a large number of small greenspaces is preferable to the establishment of a small number of large greenspaces (Morancho 2003). The distribution of greenspace is therefore an essential component to regional government planning, as the consideration of which can provide for extra benefits and possible alternatives for urban areas which lack large tracts of land for greenspace preservation.

Greenspace planning, distribution and development

The integration and distribution of parks and greenspaces into neighborhoods can also influence the impact on property values. Correll et al. (1978) found that the significance of a greenspace's impact on property values was dependent on whether the property was developed before or after the preservation of the greenspace. The authors found that the proximate principle only applied when properties had been built after the development of the greenspace. Developers were able to take full advantage of the

greenspace in terms of neighborhood design. Properties developed before establishment of the greenspace showed no significant impact (Correll et al.1978). Likewise, Bowman et al. (2009) found that open space or conservation features which were embedded within subdivisions were responsible for positive property value impacts.

Desirability of different types of greenspace characteristics may also differ in urban and rural areas. Cho et al. (2008) found that in urban areas where greenspace amenities are relatively scarce, "smoothly trimmed and man-made" forest patches were more highly valued than "woodlots with rougher and more natural looking" characteristics. Conversely, within areas where greenspace amenities were not scarce, the natural forest patches were more highly valued than smoothly landscaped forest patches (Cho et al. 2008, 415). Properties with views of greenspaces have also been shown to experience significantly higher property value impacts than those that do not (Jim and Chen 2010). However, greenspace may negatively affect property values when created by large-lot zoning or in rural areas where zoning restrictions may reduce farm-value (Nelson 1985).

Types of Greenspace

The impact of several types of open space on property values has previously been evaluated. Types of open-space which can positively impact property value include urban greenbelts, wetlands, urban parks, and community gardens (Mahan et al. 2000; Morancho 2003; Voicu and Been 2008; Crompton 2001; Lindsey et al.2004; Nicholls 2004.)

The proximate principle may also be influenced by whether the open space is developable or permanent, where permanent open space is significantly more valuable than developable open space (Geoghegan 2002; Fausold and Liliholm 1999). For instance, proximity to natural areas provide for greater positive impacts to property values than urban parks (Lutzenhiser and Netusil 2001; Schultz and King 2001,). Generally, proximity to larger, greener spaces provide for greater positive property value impacts than that of proximity to smaller parks (Schultz and King 2001; Cho et al.2006; Lutzenhiser and Netusil 2001; Nicholls and Crompton 2005; Cho et al.2008; Hammer et al.1971; Weigher and Zerbst 1973).

Greenspace preservations such as greenbelts have the ability to expose the largest amount of urban property holders to the impacts and benefits associated with natural areas as well as limiting urban sprawl. A greenway, or greenbelt, is "a linear open space established along a natural corridor such as a riverfront or stream valley, an abandoned railroad right-of-way, a canal or some other linear route" (Nicholls and Crompton 2005, 323). There are two main purposes for the development of "greenbelts": preservation of natural habitat and the mitigation of urban sprawl (Correll et al.1978; Nelson 1985). As a result, greenbelts have become a major element in regional planning (Nelson 1985).

Tax revenue

The preservation of greenspace, especially by local governments, often demands fiscal justification. Scholars generally agree that one of the primary benefits of greenspace is the additional tax revenue associated with such preservation (Correll et al.

1978; Crompton 2004; Fausold and Liliholm 1999; Cho et al.2008). If the yearly surplus income generated by additional property taxes equals or exceeds the cost of acquiring, maintaining and developing such land, then a municipality may experience a net-surplus from the preserved land. Correll et al. (1978) found that potential property tax revenue exceeded that of the cost of purchasing open-space by three to five hundred percent. Furthermore, Geoghegan et al. (2003) found that an additional 1% of agricultural land would increase property tax revenue enough to fund the procurement of 88 additional acres of open-space within one year.

However, Conway et al. (2008) did not find greenspace acquisition to be fiscally self-sustainable in high-density urban areas. Concerns have also arisen about the removal of private lands from the tax rolls and the related opportunity cost of eliminating other possible sources of property tax revenue (Nicholls and Crompton 2005). However, greenspace is generally fiscally preferable to residential development as residential development service requirements may generate a net-deficit, while undeveloped land may often be self-sustainable or create a net-surplus (Fausold and Liliholm 1999).

Greenspace allocation and property tax revenue

There are two manners by which the allocation and distribution of greenspace can maximize property tax revenues. First, greenbelts may do so by maximizing the number of properties with proximity to greenspace (Nicholls and Crompton 2005). Second as stated above, Morancho found that a large number of small greenspaces are preferable to a small number of large greenspaces (Morancho 2003). Greenspace development in this

manner follows the same principle of greenways and greenbelts, whereas the maximum amount of property owners can be exposed to the benefits of greenspace proximity (Nelson 1985.)

Table 2.1: Conceptual Framework

Variables	*Supporting Literature*
Dependent Variable: DV1: Property Value	
Independent Variables: IV1: Proximity to Greenspace	Nelson 2001, Nicholls and Crompton 2005, Kaufman and Cloutier 2006, Hammer, Coughlin and Horn 1978, Weicher and Zeibst 1973, Correll, Lillydahl, and Singell 1978)
Control Variables:	
IV2: Number of Bedrooms	Chen and Jim , 2010, Cho, Bowker and Park 2006, Cho, Poudyal and Roberts 2008, Correll, Lillydahl, and Singell 1978, Nicholls and Crompton 2005
IV3: Number of Bathrooms	Cho, Bowker and Park 2006, Cho, Poudyal and Roberts 2008, Correll, Lillydahl, and Singell 1978, Nicholls and Crompton 2005, Jim and Chen 2010
IV4: Living Area	Cho, Bowker and Park 2006, Cho, Poudyal and Roberts 2008, Correll, Lillydahl, and Singell 1978, Nicholls and Crompton 2005, Jim and Chen 2010
IV5: Property Size	Cho, Bowker and Park 2006, Cho, Poudyal and Roberts 2008, Correll, Lillydahl, and Singell 1978, Nicholls and Crompton 2005, Jim and Chen 2010
IV6: Building Age	Chen and Jim , 2010, Cho, Bowker and Park 2006, Cho, Poudyal and Roberts 2008, Correll, Lillydahl, and Singell 1978, Nicholls and Crompton 2005
IV7: Date of Sale	Cho , Bowker and Park 2006

Conceptual Framework: Table 2.1

Table 2.1 shows the conceptual framework for the operationalization of the study. Variables to be included within the multiple regression model are included in the left – hand column. The dependent variable is the property value, or sale price, of the properties included within the sample. The primary Independent Variable (IV1) is proximity to greenspace. Independent Variable 2 through 7 (IV2-IV7) are included into the regression as part of the hedonic pricing method, in order to assist in isolating the effect which IV1 (proximity to greenspace) has on DV (property value). Supporting literature for the use of each variable is listed in the right-hand column. Each variable has been included based on its previous use in hedonic pricing studies of property values.

Chapter 3. Methodology

Chapter Purpose

The purpose of this chapter is to describe the methods used to test the hypothesis of this study. The chapter will address the operationalization of the variables, methods of data collection, the sample used, the design of the research, and the statistical procedure being utilized.

The purpose of this study is to ascertain whether proximity to greenspace significantly impacts property value when controlling for other variables which may affect property value.

Hypothesis: Controlling for other factors which affect property values, proximity to greenspace will have a significant positive impact on property values.

Operationalization

Data for this study was collected from local realtors and homes.com for the Dependent Variable and Independent Variables 1-7. Homes.com collects all of its data from government resources. Individual property distances from greenspace were collected through the use of GIS software.

Table 3.1: Operationalization Table

Variable	*Operationalization*	*Source of Data*
Dependent Variable:		
DV1: Property Value	Sale Price	Homes.com/ Local Realtor Data
Independent Variables:		
IV1: Proximity to Greenspace	Distance to Government Canyon State Natural Area in feet	GIS Software
Control Variables:		
IV2: Number of Bedrooms	Number of bedrooms	Homes.com/ Local Realtor Data
IV3: Number of Bathrooms	Number of bathrooms	Homes.com/ Local Realtor Data
IV4: Living Area	Air-conditioned/ heated area in Square Feet	Homes.com/ Local Realtor Data
IV5: Property Size	Property Lot Size in Square Feet	Homes.com/ Local Realtor Data
IV6: Building Age	Age of House at the time of sale in years	Homes.com/ Local Realtor Data
IV7: Sale Date	Number of days since sale as of 10/01/2012	Homes.com/ Local Realtor Data

The above table lists both the dependent and independent variables. The dependent variable is the sale price of the property. The independent variables are factors which may affect the sale price of property.

Data Collection

Data for this study was compiled from three sources: a local realtor's database, homes.com, and GIS software. The local relator's database lists data about properties sold by that realtor. www.homes.com is a realtor website which compiles real estate data from existing government sources. Data from the local realtor's webpage, www.homes.com, and the Bexar County Appraisal District website were compared to insure validity. GIS software was used to measure the distance between properties and Government Canyon State Park. Because of the quantitative nature of hedonic pricing analysis, any other method of data collection would have been inadequate. The other methods of monetary greenspace valuation, the travel-cost method and contingent valuation, often use the survey method; however contingent valuation is primarily utilized for the assessment of hypothetical scenarios and the travel-cost method is not appropriate for the study of greenspaces close to large metropolitan areas.

Sample

The units of analysis in the study are properties within four miles of the Government Canyon State Natural Area. The four mile distance was measured from the property line to the closest point of the Government Canyon Stat Natural Area boundary line. The sample size of 74 was dependent on the availability of sale's data. All homes

within four miles of Government Canyon State Park that were included in the local realtor's database were included within the sample. Sampling from homes.com can be most appropriately classified as snowball sampling. Once a property with sales data was selected, the website listed the closest properties with available sales data. All properties within four miles of Government Canyon State Natural Area that were prompted through this method were selected until a sample size of 74 was reached. All properties included within the sample were sold within the past 8 years as of October 1, 2012

Design

The design of the study is the analysis of existing data. The study follows the established hedonic pricing method. This method utilizes multiple-regression analysis. A single independent variable, proximity to greenspace, and a dependent variable, sale price, is included to test the hypothesis. Other independent variables are included as control variables. The control variables are factors which have previously been found to affect the sales price of a property. Presence of these control variables will enable us to assess the possible impact that proximity to greenspace has on the sales prices of properties.

Human Subjects

Human subjects were not impacted by this study. The research used data collected from existing real estate records and property data.

Chapter Summary

The chapter presented the purpose of the study, identified the hypothesis and presented an operationalization table describing the variables to be examined. This chapter also addressed the methods of data collection and sampling. Finally, the chapter presented the design of the study, and the statistical procedure to be utilized.

Chapter 4. Results

Chapter Purpose

The purpose of this chapter is to evaluate the impact of proximity greenspace on the values of properties within four miles of the boundaries of a greenspace. This research uses the hedonic pricing method which includes several control variables that may impact property values. Hedonic pricing is a multiple regression analysis that isolates the impact of proximity to greenspace on property value. The results of the multiple regression analysis will demonstrate whether property values increase, decrease, or stay the same with proximity to greenspace while controlling for other factors which may influence property value. A summary of the regression results is presented in Table 4.1.

Selection of Control Variables

Control variables that were integrated into the regression were limited to attributes listed in Table 4.1 because of the characteristics of the study area, the limited data available for the study area, and to avoid an artificially inflated R as a consequence of the sample size. The monthly prime interest rate and a dummy variable for the economic recession were initially inserted into the regression. A test was run to detect multicollinearity. It was found that these variables did not significantly impact the results, nor did they increase the R . The variable did, however, contribute to significant multicollinearity. A high amount of multicollinearity was found between sales date, the recession dummy variable, and monthly prime interest rate. This finding demonstrates

that since the entire sample was subject to the same national economic events, sales date suffices to control for such factors. Consequently, the recession dummy variable and the monthly prime interest rate were removed from the regression. Absent these variables, the results did not indicate any significant multicollinearity.

Table 4.1: Regression Results

Independent Variables	Coefficients B	95% C1	
		Lower	Upper
Distance (in feet)	-11.759**	-16.867	-6.651
Number of Bedrooms	37195.657	-6161.396	80552.709
Number of Bathrooms	-7650.434	-73138.011	57837.143
SF Living Area	-1.272	-51.77	49.227
SF Property Area	.072	-1.154	1.298
Building Age	-119.968	-2785.121	2545.185
Sales Date	7.07	-29.206	43.346
Constant	180419.272		
R^2	.413		
F	6.627**		

Statistical Results

The results of the multiple regression analysis indicate that only one variable has a significant impact on sales price when controlling for other factors. Increased distance to greenspace had a significantly negative impact on sales price when controlling for other factors which may impact sales price. For every foot increase in distance between a property and the greenspace, sales price can be expected to be reduced by $11.76. With 95% confidence we can say that for every foot of increased distance from Government Canyon State Natural Area, sales prices of properties decreases between $6.65 and

$16.84. The number of bedrooms or bathrooms had no significant impact on sales price when controlling for other factors which may impact sales price. The property size and living area also had no significant impact on sales price when controlling for other factors which may impact sales price. The date of the sale and the age of the building had no significant impact on sales price. Our model indicates that 41.3% of sales price can be attributed to the combination of the independent variables of the study.

Chapter 5. Conclusion

A review of the literature indicated that the proposed benefits of greenspace are expansive and difficult to quantify. One manner by which the quantification of the benefits of greenspace has been attempted is through its monetization. There are several methods by which this has been attempted, as demonstrated by the literature, however this study utilized the hedonic pricing method to identify a greenspace's impact on local property values. The purpose of this research was to determine whether proximity to greenspace significantly impacts the sales prices of nearby properties. The literature review predominately indicated that increased proximity, or decreased distance, to greenspace significantly increases the sales prices and property values of nearby properties. A review of the literature also indicated that proximity to greenspace significantly increases property values even when the influences of other factors which may influence property values are eliminated by means of the hedonic pricing method and multiple regression analysis.

The statistical analysis performed upon the data indicated one statistically significant finding. The results indicated that there is a significant negative correlation between increased distance from Government Canyon State Natural Area and sales price of properties within four miles of the greenspace's borders. This result confirms the study's hypothesis that even while controlling for other factors which affect property values, proximity to Government Canyon State Natural Area will have a significant positive impact on property values. This finding is consistent with the Proximate

Principle. In fiscal terms, property owners are willing to pay an additional $11.76 for each foot of increased proximity to Government Canyon State Natural Area. Thus, a mile of increased distance from Government Canyon State Natural Area could amount to a $62,092.00 decrease in sales price.

Recommendations for Future Research

There are several areas in which the hedonic pricing method can be similarly applied with different variables and purposes. Future research may include a variable to account for the individual neighborhood a property resides in if the study area provides for greater neighborhood exclusivity. There are also several opportunities for research to determine the tax benefits of greenspace to local governments and other political subdivisions. One such opportunity would be for a researcher to determine how the additional revenue provided by properties' proximities to greenspace compares to that of lost revenue as the result of public lands being excluded from tax rolls.

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