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Research paper

# Integrating property value and local recreation models to value ecosystem services from regional parks

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## HIGHLIGHTS

- Use an integrated hedonic housing price and recreation demand model.
- Find the amenity and recreation access value captured by house prices.
- The optimal percentage of surrounding land in parks one-half mile around a home is around 20%.
- An improvement in the quality of parks for recreation by 30% increases the property value of homes five to ten miles away by 0.04–0.06%.
- Programs that improve recreation access to parks can increase the property values of a community.

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## ABSTRACT

Multiple ecosystem services of parks may be capitalized into the property values of nearby houses. A joint hedonic housing price model and recreation demand model evaluates how park services are capitalized into property values for two regional parks in Portland, Oregon. The hedonic model suggests parks are an amenity of bundled positive and negative services. A non-linear variable for the percentage of park land surrounding a home explains how parks affect property values the best. The optimal percentage within a half-mile neighborhood is around 20%. An improvement in the quality of parks for recreation by 30% increases the property value of homes five to ten miles away by 0.04–0.06%. Thus, programs that improve recreation access to parks can increase the property values of a community.



## 1. Introduction

Parks and reserves in cities increase the richness of services provided by urban ecosystems. The ecosystem services of parks include the use of natural areas for recreation, and also amenity services such as esthetics, improved air quality, storm water pollution reduction, and mitigation of urban heat islands. Some of the benefit of these services is incorporated into the value of housing surrounding the parks. Although studies have produced estimates of the increase in property values associated with proximity (the amenity service) of parks, the literature has not revealed if property value rises are attributable to recreation access and how this compares to the property value increases from amenities. Knowing how much each park service contributes to property values will help to improve the planning related to the design and management of parks. The planning inevitably involves tradeoffs among the services provided by the parks. An efficient use of land should account for how the gain in one service compares to the loss of other services, and even whether the land is suited for a public park or better left for development.

We use a model that integrates revealed preference methods of valuation to measure recreation and amenity values provided by regional parks to homeowners in Multnomah County, Oregon. The selection of the house and neighborhood is influenced by the access to nearby parks for short recreation trips. A measure of the recreation access of the neighborhood to regional parks adjusted for park quality is treated as an attribute of that neighborhood. The measure, based on data collected on surrounding homeowners' recreation behavior at the parks, is used to relate recreation value to their housing choice and then to the property value of the home. McConnell (1990) indicates that depending on how the property value market functions, the recreation access value can be entirely, partially, or not at all incorporated into property values. Thus, it is an empirical question whether enhancing the quality of the park system for recreation increases the property values.

Two regional parks in the study area receive visits from the majority of the sample from a survey of regional park use, and the

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application of our empirical model focuses on these parks. If the access service of the parks has a statistically measurable influence on property values, this should be obvious from the highly visited parks. To examine how the amenities of the parks affect property values, we use a large sample of homes sales from the County assessor spanning several years to measure the relationship between the land surrounding a home in parks and property values. We use a non-linear hedonic model specification to test whether unwanted disamenities (such as noise or criminal activity) are reflected in property values.

We consider a policy that adjusts the amount of land in parks surrounding a home, and observe through changes in the amenity service how the property values of nearby properties change. Another policy question considers how increasing three types of park recreation quality (hiking trails, cleanliness, and parking) affects the value of the recreation access, and then as a result the property value. We consider scenarios that could help planners responsible for cost-benefit analysis evaluate how much, if any, recreation value is incorporated into property values. The scenarios also allow for a comparison of the influence of recreation access versus amenity values on home prices to evaluate tradeoffs among programs that enhance one service or another.

The remainder of the paper is organized as follows. Section 2 reviews the literature related to the influence of parks on property values. Section 3 provides a description of the study area and summarizes the data. Section 4 outlines our estimation approach. Section 5 details the results and reviews the policy scenarios. The last section discusses the general implications of our findings.

## 2. Related literature

Phaneuf, Smith, Palmquist, and Pope (2008) is an empirical study using an integrated model of recreation and amenity services by combining a random utility model (RUM) of recreation with a hedonic property value model to examine how changes in water quality affect the property values of homeowners. They find evidence that proximity to water, access to recreation sites, and water quality at the sites are all positively related to property values. Our paper uses a similar revealed preference approach to estimate the influence of amenity and recreation access services of parks on property values. The main methodological difference is the use of a count model of recreation demand to measure expected consumer surplus from the visits to the parks.

A count model is used because our visitation data include the frequency of visitation to a few regional parks as opposed to knowing only whether a trip is taken to a destination. RUM models of recreation demand must determine how to define the choice set of alternatives, make the assumption of the constant marginal utility of income, and do not adequately account for seasonal behavior (Phaneuf & Smith, 2005). Phaneuf et al. (2008) perform robustness checks and find that differences in the characterization of choice alternatives does not change the measured influence of local recreation on property values. Our approach with the count models can however better incorporate income effects and account for seasonal demand. We believe the recreation access index based on the consumer surplus estimated with this model can better represent the access value from choosing a home at a particular proximity to the park, which in turn may affect the property value.

Tapsuwan, MacDonald, King, and Poudyal (2012) measure the effect on property values of recreational attractiveness in the Murray–Darling Basin of Australia using a hedonic model. A recreation index is constructed from the list of park and recreational facilities offered at each site, and the value of a home is found to increase by $27,000 for areas with high recreational attractiveness. While park and recreational facilities are related to the number of trips taken to a site, other factors such as the distance from urban areas and availability of substitute recreation sites also have role. An index of consumer surplus based on all the reasons for a site visit seems a preferred measure of recreational attractiveness.

Several studies have considered the influence of the amenity values of park proximity on property values in Portland, Oregon (Bolitzer & Netusil, 2000; Lutzenhiser & Netusil, 2001; Netusil, 2005). Some of the results of these papers indicate the property values of homes do not always fall with distance from parks. Based on the linear hedonic model and the use of dummy variables for proximity to parks, Bolitzer and Netusil (2000) find homes less than 100 feet from an open space do not have a statistically higher property values, while homes 100 and 400 feet from an open space have statistically higher values, and homes even farther away at 400–700 feet have still higher values. Lutzenhiser and Netusil (2001) observe lower sales prices for homes within 200 feet from a natural park than for the homes between 200 and 400 feet away. Finally, Netusil (2005) find that urban parks within 200 feet to one-half mile from a home have a statistically significant and negative influence on property values.

Based on the evidence that the distance from parks does not always lower property values, our hedonic property price model uses a continuous variable with linear and quadratic terms for the percentage of surrounding land in parks in a half-mile neighborhood around the home. This variable simultaneously accounts for the proximity and amount of the park near a home, which we believe represents well how people perceive the amenity service from a park. Kuminoff (2009b) use a similar variable with linear and quadratic terms to show that cropland is a disamenity if adjacent to a home but an amenity for homes close to but not adjacent to the cropland.

## 3. Study area and data

The housing and recreation data come from Multnomah County in Oregon (Fig. 1) where the state's largest city, Portland, is located. Portland straddles the Willamette River immediately south of its confluence with the Columbia River, and Interstate 5 (I-5) goes through the center of the city. The city of Portland has five regions known as North, Northwest, Northeast, Southwest, and Southeast. The metropolitan area has 37,000 acres of parks including two regional parks that are the focus of this paper: the 5000-acre Forest Park covering a ridge of mountains in the Northwest of the city and the 196-acre extinct cinder cone called Mount Tabor. Forest Park is a natural area with an extensive network of hiking trails, while Mount Tabor offers hiking opportunities as well as other recreational activities such a volleyball courts and picnic tables (Table 1).

### 3.1. Housing market data

The data for the hedonic model are compiled from a variety of sources. Data on arms-length detached single-family home transactions are from the Multnomah County assessor (2002) between January 1997 and June 2002. The data include the sales prices of the 51,055 transactions in addition to the lot and structure characteristics of every property. The dependent variable in all hedonic models is the natural log of the observed arms-length transaction price adjusted to real 2000 dollars with the Portland-Salem all-urban housing consumer price index (U.S. Bureau of Labor Statistics, 2010). The median sale price of the homes in real 2000 dollars is $169,759.

In general, property prices are determined by the lot and structure and neighborhood characteristics (Table 2). Lot and structural characteristics include the square footage of the lot (*lotsqft*), the