# Effect of Environmental Service by Hedonic Pricing Model

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*Abstract— Environmental services refer to qualitative functions of natural non-produced assets of land, water and air (including related ecosystem) and their biota, which implies natural environment providing particular important uses or benefits that can be captured under the concept of "services." Our objective is to analyze the benefits associated with such environmental services in order to make them more visible. The hedonic pricing method uses the value of a surrogate good or service to measure the implicit price of a non-market good. The basic idea of the hedonic pricing method is that the price of a market good is related to its characteristics or the services it provides rather than the good itself. This article focuses on assessing residential property rate influenced by environmental services by applying hedonic pricing model. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes. The paper defines Hedonic Pricing method (HPM) and its methodology. Data required that influences the residential property rates will be collected and are analyzed using regression analysis which relates to statistically estimate a function that relates property values to the property characteristics, including the distance to open space. Thus, the effects of different characteristics on price can be estimated. The results can be used to evaluate the variations of property rates for small change in characteristics holding all other characteristics constant. Price prediction model is than prepared.*

**Keywords**—Environmental services, Hedonic Pricing method, implicit price, surrogate good.

## I. Introduction

The housing sector is very much associated with the economic health and wealth of a nation. A high demand for housing would trigger growth in many other economic sectors. Thus, research into the variables that impact property prices is essential because the purchase of a residential property is both an investment decision as well as a consumption decision. In the attempt to model the housing prices, two approaches have been widely used. The first approach is the monocentric model, where housing price is assumed to be a function of proximity to a single employment centre or workplace. The relative housing prices then reflect the relative savings in commuting costs associated with different locations.

However, unlike other consumption goods, the housing market is unique because it manifests the characteristics of durability, heterogeneity, and spatial fixity. Thus, to model this differentiation effectively, the second approach of the hedonic price model has been introduced. The hedonic price model posits that goods are typically sold as a package of inherent attributes

(Rosen, 1974). Therefore, the price of one house relative to another will differ with the additional unit of the different attributes inherent in one house relative to another house. The relative price of a house is then the summation of all its marginal or implicit prices estimated through the regression analysis.
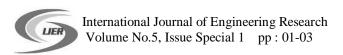
Numerous studies have utilised this technique to examine the relationship between attribute preference and the price of properties (Gillard, 1981; Li & Brown, 1980; Sirpal, 1994; Walden, 1990). This is because the market price of a housing unit can be determined by the buyers' evaluations of the housing unit's bundle of inherent attributes, such as locational, structural, or neighbourhood attributes (Freeman, 1979).

First, extant literature on the hedonic pricing approach, particularly pertaining to the housing industry, was critically reviewed. The theoretical background of the model is discussed, together with its advantages and inherent shortcomings. This is followed by a discussion on some major empirical issues related to the hedonic price model and the application of the model to the housing market. Empirical studies that highlight the importance and usefulness of the hedonic analysis in examining the effects of several physical and neighbourhood-related housing attributes on the urban property markets are then presented. Attributes used in previous studies on the hedonic price model are examined to establish housing attributes that are pertinent and applicable to Southold, Long Island.

## II. Concept of HPM

The term "hedonics" is derived from the Greek word *hedonikos*, which simply means pleasure. The Hedonic Pricing Method (HPM) here after referred to as HPM method is used to estimate economic prices for ecosystem or environmental services that directly affect market prices. It is also known as Hedonic Regression Method (HRM) or Hedonic Demand Method (HDM).

Hedonic Pricing Method is based mainly on work by Grilichcs (1961) and Rosen (1974) originated in the development of value indices for manufactured products that measure of quantity and quality. Grilichcs (1961) rived a hedonic price index for motorcars. The technique centres on consumers' choices regarding composite goods. The assumption is that goods are valued for their utility bearing attributes and that these attributes are internalised into the price of the good. A house has several attributes, for instance, number of rooms, bathrooms and the availability of car park spaces. All of these attributes make different contributions to the price of the house. In addition to house characteristics, neighbourhood characteristics also contribute to house prices. If you have a large enough sample of housing market transactions, it is possible to use econometrics to

separate out the implicit price of the attributes. This is done using a hedonic house price model.

# III. Methodology

**Step 1:**

The first step is to collect data on residential property sales in the region for a specific time period (usually one year). The required data include:

1. Selling prices and locations of residential properties.
2. Property characteristics that affect selling prices, such as lot size, number and size of rooms, and number of bathrooms.
3. Neighborhood characteristics that affect selling prices, such as property taxes, crime rates, and quality of schools.
4. Accessibility characteristics that affect prices, such as distances to work and shopping centers, and availability of public transportation.
5. Environmental characteristics that affect prices.

In this case, the environmental characteristic of concern is the proximity to open space. The researcher might collect data on the amount and type of open space within a given radius of each property, and might also note whether a property is directly adjacent to open space.

Often, this type of data may be obtained from computer-based GIS (geographical information systems) maps.
Data on housing prices and characteristics are available from municipal offices, multiple listing services, and other sources.

**Step 2:**

Once the data are collected and compiled, the next step is to statistically estimate a function that relates property values to the property characteristics, including the distance to open space. The resulting function measures the portion of the property price that is attributable to each characteristic. Thus, the researcher can estimate the value of preserving open space by looking at how the value of the average home changes when the amount of open space nearby changes.

**How Do We Use the Results?**
The results can be used to evaluate agency investments in open space preservation. For example, specific parcels may be under consideration for protection. The hedonic value function can be used to determine the benefits of preserving each parcel, which can then be compared to the cost.

# IV. Case Study
Values of Environmental Amenities in Southold, Long Island

**The Situation**
The town of Southold, Long Island, New York has coastlines on both the Peconic Bay and Long Island Sound. Compared to the rest of Long Island, it is a relatively rural area, with a large amount of farmland. However, population and housing density are rapidlyincreasing in the town, resulting in development pressures on farmland and other types of open space.
**The Challenge**
The Peconic Estuary Program is considering various management actions for the Estuary and surrounding land areas.

In order to assess some of the values that may result from these management actions, a hedonic valuation study was conducted, using 1996 housing transactions.

**The Analysis**
The study found that the following variables that are relevant for local environmental management were had significant effects on property values in Southold:

Open Space: Properties adjacent to open space had, on average, 12.8% higher per-acre value than similar properties located elsewhere.
Farmland: Properties located adjacent to farmland had, on average, 13.3% lower per-acre value. Property values increased very slightly with greater distance from farmland.
Major Roads: Properties located within 20 meters of a major road had, on average, 16.2% lower per-acre value.
Zoning: Properties located within an area with two- or three-acre zoning had, on average, 16.7% higher per-acre value.
Wetlands: For every percentage point increase in the percent of a parcel classified as a wetland, the average per-acre value increased by .3%.

**The Results**
Based on the results of this study, managers could, for example, calculate the value of preserving a parcel of open space, by calculating the effects on property values adjacent to the parcel. For a hypothetical simple case, the value of preserving a 10 acre parcel of open space, surrounded by 15 "average" properties, was calculated as $410,907.
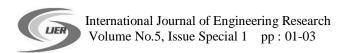
# V. Discussion and Suggestion
In general, the price of a house is related to the characteristics of the house and property itself, the characteristics of the neighborhood and community, and environmental characteristics. Thus, if non-environmental factors are controlled for, then any remaining differences in price can be attributed to differences in environmental quality. For example, if all characteristics of houses and neighborhoods throughout an area were the same, except for the level of air pollution, then houses with better air quality would cost more. This higher price reflects the value of cleaner air to people who purchase houses in the area.

The price of the property is related to its characteristics and the environmental characteristics, the data collected of the study area through surveys are examined using regression analysis. This regression analysis results will represent how the property values will alter with a small change in the each characteristics; holding all other characteristics as constant. The house price is a function of all the elements relating to the house and the resulting constants are the marginal implicit price of the elements. Thus, the hedonic price function takes the resulting form:

$$PRICE = f(N, S) + e$$

Where, the "price" is a function of the house's structural characteristics, neighbourhood or locality characteristics and environmental characteristics, "e" is an error term. In this way, the effects of different characteristics on price can be estimated.

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