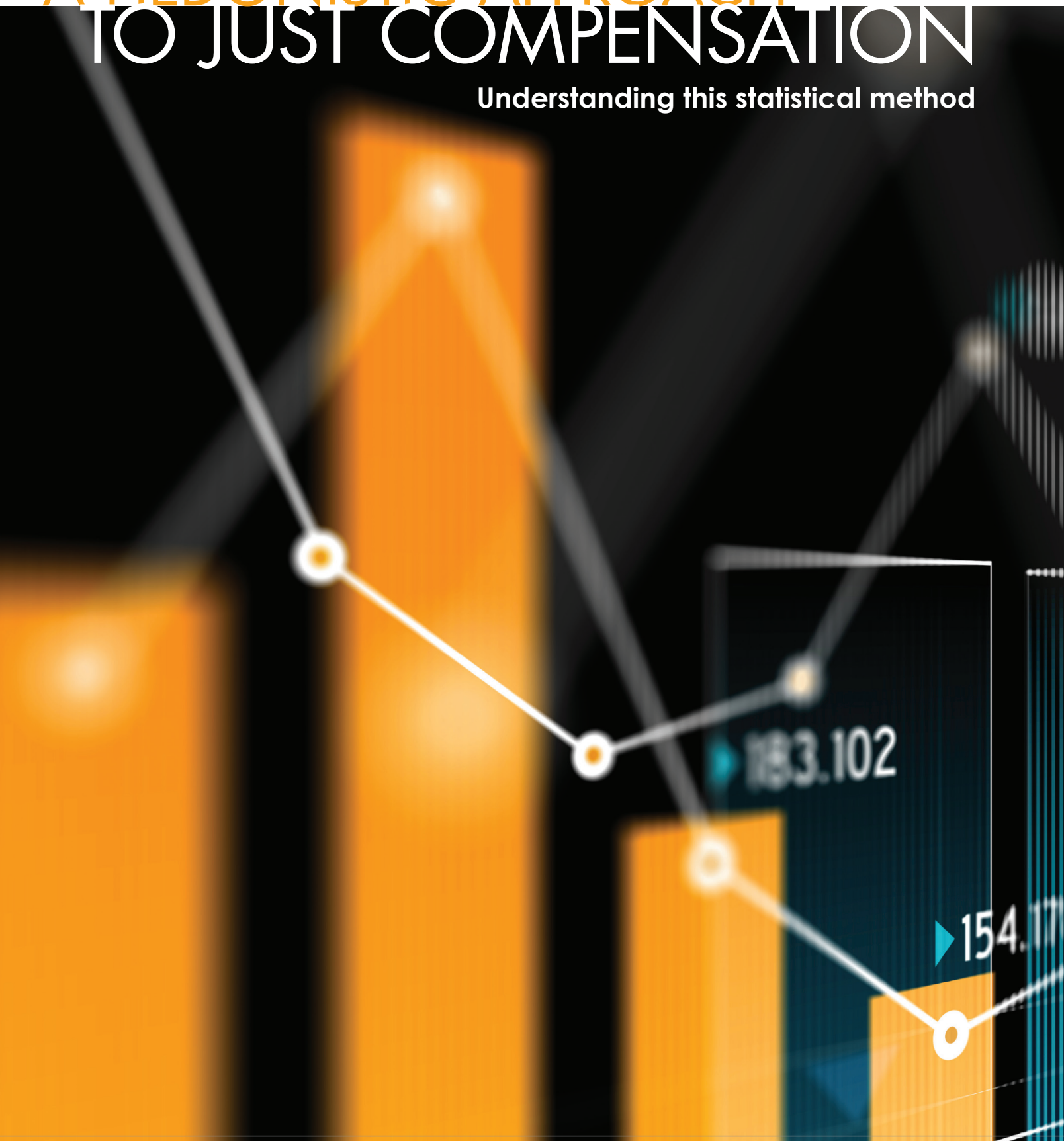



# A HEDONISTIC APPROACH TO JUST COMPENSATION

Understanding this statistical method





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Consider a vacation in Spain during the annual running of the bulls in Pamplona. Pretend that the price of this vacation package depends on the airfare, trip length, dinner menu, number of bulls and likelihood of surviving. Your likelihood of surviving, in turn, might depend on other factors such as age, agility, shoe choice and alcohol intake the night before. Appraisers and other real estate experts apply a similar approach when attempting to decompose the price of real estate into the marginal price of different independent variables. In valuation and real property damage economics, such a study is known as hedonic regression analysis. Hedonic regressions are statistical models that estimate the impact of different characteristics on the price of a good or service.

### Understanding Hedonistic Regression Analysis

Real estate professionals (and recipients of junk mail in general) are familiar with real estate agency fliers effusively announcing three bedrooms, two bathrooms and maybe even a peekaboo cityscape view (if the buyer has a stepladder). Marketing campaigns in real estate illustrate a common-sense idea that some attributes contribute to house values more than others. To quantify the contribution of each attribute, valuation professionals and real estate economists often turn to hedonic regression analysis, a statistical method that allows us to estimate the marginal contribution of various characteristics to the overall price of an item.

In simple terms a hedonic regression analysis requires first collecting a sufficiently large sample of property sales data and property characteristics data, and then selecting and testing different characteristics—such as room counts, floor size, year built and waterfront access—to measure the marginal contribution of each characteristic to the prices of homes in the sample. It is intuitive to most of us that ten bathrooms in a three-bedroom house do not necessarily add to market value. For many reasonable buyers, the time and effort involved in grouting the tile floors of ten bathrooms would outweigh any benefits. Similarly, those that have bought or sold homes may know that the cost of building a pool does not increase market value dollar-for-dollar, but rather contributes to market value at a much lesser amount. On the other hand, a larger residential lot and an ocean view are usually both a plus, at least here in

suburban Southern California. But how much does each additional square foot add? How about each degree of an ocean viewshed? Using hedonic regression analysis, answers to these questions may be estimated to a dollar amount or percent indication.

Hedonic regression analysis brings together a 20<sup>th</sup> century theory of consumer demand (the hedonic model) and a 19<sup>th</sup> century statistical technique (regression analysis). Hedonic models need not employ regressions, and regressions need not be hedonic price models. A hedonic model is one that represents a single good or service as consisting of a set of attributes—with each attribute subject to its own demand in the market (and thus having its own implicit price). Members of the IRWA may have heard appraisers refer to real property ownership as a bundle of rights. Likewise, a good such as a pair of brand name blue jeans may be considered a bundle of attributes—branding, quality of fabric, color, labor,

shipping and even rent at the mall. This concept is the basis for the adjustment grids used by real estate valuers. In a sense, the traditional appraisal grid is a hedonic model without the regression and with significantly less data.

Properly estimating the contribution of each attribute in a hedonic model requires some technique that can measure the dependence of a variable (price) on one or multiple other variables (time, beds, baths, cityscape views). The tool used for this job is regression analysis. At its simplest, regression analysis is the familiar practice of finding a line of best fit through a scatter plot. In the case of real estate, this could translate to finding a line of best fit through a scatter plot of property sales with price on the y-axis and time on the x-axis. The equation of the line would provide a rough estimation of the dependence in general of price on time—what is commonly referred to as the market trend. Multiple regression

analysis generalizes this method to an arbitrary number of independent variables.

### Bedrooms, Bathrooms and Beyond

Prospective buyers of homes and retail centers do not simply consider the physical attributes of properties. Neither does a residential appraisal only consider room count and cabinetry. The power of the hedonic pricing model comes from its ability to reach beyond bedrooms and bathrooms to include any other factor that may contribute to value. The model can be used to price attributes that are external to the property but potentially influential to value, such as school district, zoning, highway access and proximity to a commercial center.

In the past three decades, hedonic price models have been applied to a wide variety of conditions to quantify their influence on property values. Subjects include hazardous sites, incinerators, prisons, groundwater contamination, high-voltage transmission lines, pig farms, freeway noise, pipelines, light rail, substations, utility-scale solar farms and wind farms. Also popular are less location-specific factors such as air quality, water quality and ambient noise.

Natural resources are not market goods, so their value cannot be observed directly from prices. The hedonic regression has become an especially popular tool for researchers studying the extent to which stakeholders are willing to pay (or not willing to pay) for natural resources such as wetlands, air quality and open space. Along with other methods such as qualitative choice modelling and contingent valuation surveys, hedonic regressions are widely used in Natural Resource Damage Assessments (NRDA). The NRDA process, through CERCLA (Superfund) and the Oil Pollution Act, assesses and restores “bugs, bunnies and flowers,” along with other resources impacted by events such as accidental petroleum releases and shipwrecks.

These models are similarly useful for pricing public goods and services such as energy and transmission infrastructure, hazardous site cleanup and transportation corridors. Like natural resources, these are public goods and services not traded in an open market. Researchers must indirectly value them to conduct cost-benefit analyses for government accountability and to





ensure the efficient allocation of public funds. In fact, much of the empirical economic research that utilizes the hedonic regression is motivated by such policy concerns. For example, there is a large amount of research and funding dedicated to the costs and benefits of the Superfund program as reflected in proximate home prices. Another active area of research is the study of any observable impacts of transmission line corridors on proximate property values. In addition to measuring the role of proximity, researchers use hedonic methods as well as survey methods to determine whether different pylon shapes, vegetation buffers or increased community involvement in the planning and development process can have a mitigating impact on any observed price impacts.

### Hedonic Methods in Practice

Condemnation assignments frequently require appraisers to determine whether negative project externalities will impact the market value of adjacent properties along the entire length of a proposed corridor. Likewise, during the acquisition process, right of way agents frequently face challenges to their initial offers by property owners alleging severance damages. In general, both public and private developers often face opposition from landowners or other stakeholders based on the perceived financial risks the project presents over the entire project lifecycle. Property value diminution may be traced to cost, use and risk issues before construction, during construction and after project completion. For residential property owners, a house is often a household's largest asset and infrastructure projects present the threat, real or not, of a large uninsured loss.

In completing these assignments, appraisers often must weigh the various potential severance damages and any offsetting benefits of a proposed project to the remainder parcel. In 1998, Rik Neustein and I published an article in Right of Way Magazine containing a summary checklist for partial takings that set out a comprehensive list of the elements of possible damages and benefits. What we offered in 1998 was a subjective approach to identify elements for consideration by the right of way community. When the data is available, hedonic regression analysis grants us the ability to quantify into dollar amounts and percent indicators the different elements of damages and benefits. This cannot be done on a mass level using traditional approaches.

Scalable methods such as hedonic regression can be useful in budgeting, project planning, litigation and policymaking. They can aid in researching the impact a proposed project could have on multiple properties and property types. In a more general sense, they can provide valuable estimates during the costing and budgeting phases of large-scale proposed projects, especially those with a potentially long and complex acquisition process. They can also aid in decision-making during the planning process. For example, a range of indications of the impact of transmission lines on proximate residential property values can guide in deciding whether the high initial costs of placing a 500-kV transmission line below ground are cost-effective considering potential damage claims due to an above-ground transmission line. Likewise, quantitative estimations can be used to determine whether to allocate public funds to the building of sound walls along new freeway projects.

### Conclusion

A full hedonic analysis requires the availability of data, as well as the time and budget to design and implement the hedonic model. Even when the data are available, this can be an expensive and time-consuming process. But valuation experts, right of way professionals and real estate professional in general can benefit from the time, energy and funding dedicated by both academia and industry to estimating diminution in value (if any) from large-scale proposed projects or existing environmental contamination. A familiarity with this body research can both inform an existing analysis and provide guidance for developing case studies, designing surveys and selecting comparables. Whether an appraiser or other expert carries out a full hedonic regression analysis depends on the availability of data, as well as the scope and budget of the assignment. But a general familiarity with the body of research allows for a more informed opinion—even for an experienced bull runner. 🍀



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