The Problem of Faulty Analyses

Can we rely on current methods in determining right of way impact on neighboring properties?

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Much has been written in the past several decades concerning the influence of Right of Way (ROW) on neighboring property values, whether the ROW involved is highway, pipeline, High-Voltage Transmission Lines (HVTL), cell phone towers or something else. A substantial portion of the literature discussing this issue has come from the academic community and frequently indicates that neighboring property values are negatively impacted by ROWs. Much of this literature is based on faulty analyses and this article seeks to provide a brief overview of some these problems.

The first issue is the confusion in some of the literature concerning the difference between "damage" and a "locational premium". [1]

A locational premium—whether it results from a factor that enhances value, such as a nice lake, or one that is not desirable such as a landfill—is simply the premium that the market attaches to the value of the subject due to physical location. It is in fact the embodiment of the old adage of "location, location, location." It may prove to be true in certain circumstances that properties adjacent to a ROW carry a negative locational premium, but that is not necessarily a damage to value.

A damage to value is specific to the ownership of the property and in particular is specific to a negative change to the market value imposed after purchase.

For example, suppose that a residential development takes place next to a pre-existing HVTL and the property developer offers the lots adjacent to the line for sale at a discount from similar lots elsewhere in the development. This represents a negative locational premium, but not a damage. The developer was well aware of the presence of the lines prior to purchase and presumably discounted for their existence at the time of purchase, if any discount was applicable.

The parties purchasing the discounted lots, so long as they enjoy the same or a similar rate of appreciation compared to other property owners in the area after purchase, also do not suffer a damage because their market value — although starting at a lower point due to the discount — is increasing at the same rate, and therefore their return on investment is the same. An analysis of sales in the development may indicate a negative locational premium for those properties adjacent to the line, but it is not a damage under these circumstances.

It is not the absolute difference in market values between two otherwise similar properties that determines a damage, but whether or not the owner of a specific property has suffered a reduced rate of return on investment as a result of the imposed condition. When viewed in this way, using the fundamental definition of real estate value [2] , many alleged damages to value are found not to exist.

In recent years, statements have indicated that the existence of a damage to value must be based on a condition of "full knowledge" on the part of the buyer, implying that the price paid must reflect information that the analyst believes should be in the buyer's possession.

This is an erroneous idea and not in keeping with the Uniform Standards of Professional Appraisal Practice (USPAP). A fact or piece of information is important to the analysis of market value

if the market participants generally are concerned with it at the date of value. If the market participants are generally not concerned with or are not aware of it, then it is inappropriate to include that factor in a market value analysis.[3]

An example of a situation where a known issue did not influence value — contrary to expectations — is the contamination of an aquifer by chlorinated solvents and a surface water spill of approximately 5,000 gallons of nitric acid, plus the allegation of nuclear waste having been disposed of on the plant site in the immediate vicinity of residential property in Grafton, Massachusetts.

A careful study of nearly 500 repeat sales of residential properties within 2,000 feet of the plant and in nearby control areas clearly demonstrated that these issues had no influence on sale prices.[4] Anecdotal interviews with several buyers and sellers in the immediate area revealed that the attitude was simply that, since the conditions had no influence on the owner's use or enjoyment of the property, no discount was considered necessary or acceptable. This attitude was apparently the controlling factor in the marketplace, not the knowledge of the contamination of the nearby plant. Similar situations have appeared in conjunction with highways, pipelines, powerlines, cell towers and the like.

DOES A LOCATIONAL PREMIUM EXIST?

It is interesting to note that much of the literature simply assumes that a ROW creates a negative locational premium and then proceeds to attempt to measure it without first testing to determine if it actually exists. In some cases, the analyst at least gives a passing reference to this issue by stating that the coefficient representing damage in a "hedonic analysis" is "statistically significant" and therefore is measuring a negative locational premium. However, that statement is mathematically unsupportable.[5]

To demonstrate a negative locational premium, it is necessary to show, by independent analysis, that there are scientifically sound reasons to believe that such a premium exists. This might be demonstrated by a sufficient number of paired sales analyses using carefully validated sales, or through a set of explicit statistical tests of similar information. In the few instances reported in the literature where such tests have been carried out by competent appraisers and/or statisticians, the results have frequently shown that a negative locational premium does not exist.[6]

This may be a surprising result given the large number of articles and studies that appear to state the contrary, but many of those are based on badly flawed analytical approaches. The gold standard of property value analysis has been, and is, the proper application of the three classic approaches and particularly the sales comparison approach.

Other methods, such as "hedonic analysis" or "contingent valuation," contain flaws that compromise the reliability and accuracy of any results to the point where they provide not just incorrect results, but misleading results with the aura of scientific precision.

TWO FLAWED APPROACHES

Two methods frequently used in the attempt to analyze the influence of ROWs on neighboring property values are "hedonic analysis" and "contingent valuation" or more properly hypothetical market surveys.

Hedonic Analysis

Hedonic analysis is an attempt by economists to interpret the results of a statistical regression. Regression, as a mathematical technique, is a powerful tool that can assist the user in predicting the probable sale prices of properties. In that application, it is both mathematically supportable and develops error rates that can be analyzed and employed in property valuation. The mathematically appropriate objective of a regression is the estimation of the most likely sale price for the average property in the database.[7]

A regression relationship might take the form of:

Sale Price =
$a_0 + a_1$ Size + a_2 Bedrooms + a_3 Baths + a_4 Garage + ... + a_i Pipeline + ...

Where:
a_0 = Intercept
a_1 = Coefficient of independent variable 1 (Size of House)
a_2 = Coefficient of independent variable 2 (Bedrooms)
a_3 = Coefficient of independent variable 3 (Baths)
a_4 = Coefficient of independent variable 4 (Garage)
...
a_i = Coefficient of independent variable i (Distance to pipeline)

This relationship, for the purpose of estimating the value of Sale Price, may be quite acceptable and does a reasonably precise job of making that estimate.

Hedonic analysis, however, attempts to quantitatively interpret the coefficients of the independent variables (the **a**'s in the above relationship) as meaningful estimates of the contribution of that variable to the sale price. For example, the value of **ai** — the coefficient of the distance of the house from the pipeline, say some number like -250 — would be interpreted by the hedonic analyst as indicating that for each foot the house is closer to the pipeline the sale price of the house would be decreased by $250.

This interpretation has virtually no mathematical support and the results are generally both highly misleading and prone to very wide confidence intervals. The mean 95% confidence interval for such relationships would indicate that the true value would lie between $90 and $-590. That is, the pipeline might subtract $590 from value for each foot closer, or it might add $90, or it might be anything in between. This level of precision is virtually meaningless, and because the range of values within the confidence interval includes zero, the value of the coefficient cannot be mathematically distinguished from zero. That is, the distance to pipeline variable mathematically has no influence on value. This is a very common occurrence with hedonic analyses.

When an analyst using hedonic analysis states that a given coefficient should be interpreted as in the foregoing example, for instance, there is absolutely no guarantee, nor any means of guaranteeing that this value has any meaning whatever. An analysis of the confidence intervals surrounding predicted "damage" coefficient values from 37 published articles indicates that the average confidence interval is plus or minus 136%–assuming that the "damage" variable has any meaning at all. Any confidence interval equal to or greater than 100% means the variable has no influence on value.

To add to the unreliability issue for hedonic analysis, the regression relationship on which the hedonic analysis is formed and the data used in the analysis are subject to manipulation to achieve desired results without any objective means of determining if the results are in fact appropriate or in some sense the "best" results for the situation. The analyst can construct a relationship to achieve almost any desired result.

Without going into great mathematical detail, the primary problem is that there are, as all appraisers are well aware, a very great number of factors that influence the sale price of a property. For each such factor that one wishes to include in a hedonic analysis, a reasonable rule of thumb is that at least 20 and preferably 30 sales are needed. To simply form a regression for the basic factors of size of living area, number of bedrooms, number of bathrooms, size of garage, size of lot, style of house, and age of house, a regression would have to be based on sales of similar houses in similar locations within a reasonable period of time as of the date of value. Just this simple regression would require 210 to 350 sales from a database of homogeneous (similar) property sales. There are many more factors to consider such as condition, treed lots versus no trees, schools, crime rates, access to shopping and work, and others.

To appreciate this issue, consider how difficult it can be to find just three or four good comparable sales, and try to imagine finding 300 more. The point is that it is virtually impossible to develop a regression relationship that would allow even a reasonable chance of having sufficient data to allow for a quantitative analysis of the independent variable coefficients.

There is, however, an even larger issue. Many of the "independent" variables are not independent. Consider size of house and number of bedrooms. Generally, the larger the number of bedrooms, the larger the house size. Further, there are variables that may be related to others that are not included in the regression relationship, the omitted variable problem. This interrelationship, referred to mathematically as correlation, means that if one of the variables is omitted or a variable is related to other variables, the existing coefficients will be increased or decreased to an unpredictable extent. The value of the existing coefficients are generally unreliable and do not represent what they are said to represent.

Put simply, hedonic analysis is generally meaningless and frequently very misleading — a statement that may be made for very sound scientific reasons and that is generally not difficult to prove for any given situation.

Contingent Valuation

The use of so-called "contingent valuation" methods, more accurately hypothetical market surveys, has gained prominence recently in the valuation literature. This method calls for setting up a hypothetical transaction involving a specific alleged disamenity of interest, such as a cell phone tower or pipeline ROW, then surveying a group of individuals to determine how much they would discount a property's value in return for purchasing it when close to the alleged disamenity. Loosely, this methodology is based on the Contingent Valuation (CV) method sometimes used in natural resource damages cases where the rights to be valued do not trade in a traditional market.

The list of requirements on how to properly conduct a CV study is quite lengthy and very expensive to fulfill.[8] The consequence of failure to fulfill those requirements are the degradation of the results even beyond the already high error rates normal to the method. Essentially, however, they are moot since even the strong advocates of CV as an approach for valuing public and quasi-public goods clearly state that the methodology is not applicable to private goods.[9]

The results obtained from even a very carefully constructed hypothetical market survey will tend to be useless for other reasons as well. For example, most such surveys look only at the buyer's side of the relationship – that is, how much do you want taken off the purchase price? The seller's side is rarely examined, resulting in no information as to whether such a discount would receive serious consideration, let alone acceptance.

A SPECIFIC EXAMPLE: "THE IMPACT OF CELL PHONE TOWERS ON HOUSE PRICES IN RESIDENTIAL NEIGHBORHOODS"

A recent article by Bond and Wang[10] concerning the alleged impact of cell phone towers on house prices stated that, "The opinion survey results were generally confirmed by the market sales analysis using a hedonic house price approach. The results of the sales analysis show prices of properties were reduced by around 21% after a CPBS (Cellular Phone Base Station) was built in the neighborhood." This article provides an excellent example of the issues outlined above for surveys and hedonic analysis.

Bias: This article appears to be biased in favor of a high damage result. First, it rejects two studies conducted by professional appraisers that could find no statistically significant difference in property values between homes close-to and not close-to cell phone towers.[11] Second, the authors discounted their own survey results of respondents close-to the cell phone towers in favor of significantly higher results from respondents who were in areas without cell towers on the basis of the authors' apparently unsupported belief that those close-to were unwilling to provide honest answers to the survey.[12] Note, however, that the answers from the close-to respondents were still used in the analysis.

Survey: There is no evidence in the article that the survey was subjected to pre-testing for respondent understanding, bias, or other critical issues as required by recognized survey protocols, or that it would provide a comprehensive understanding of the respondents answers (no questions in evidence to determine if respondents were not providing unbiased and well-considered answers).

The results of the survey are inconsistent. For example, most of the close-to respondents (51.4%) said that the cell towers had no influence on value, but 71% also said that they would pay less for a home in the area. If we assume that the survey is honestly representative of the area residents, then these results would strongly indicate something other than the cell phone towers is undesirable about the close-to area. This issue was apparently not investigated by the researchers.

Of primary concern is the fact that the results of the survey are not statistically meaningful with respect to the universe of residents. The survey was conducted by mail and, although the response rate after prompting was reasonable (46%), mail survey respondents are not randomly selected from the underlying population – they are self-selected. As noted by the Blue Ribbon Panel report and in the "Reference Guide on Survey Research"[13], a mail survey will not provide a scientifically reliable basis for drawing any generally applicable conclusions concerning cell phone tower effects.

Hedonic Analysis: The hedonic exercise reported in this article is particularly poor for a number of reasons. There was no reported attempt to test the null hypothesis of no effect except by the professional appraisers and, as noted above, these analyses were discounted. The authors are therefore assuming, in the face of contrary evidence, that the cell towers negatively influence value.

There were at least six regression models employed in order to achieve the four reported results. This strongly implies specification searching to achieve a desired result. It appears that the authors chose to ignore the indications from the survey of another problem in the area and kept searching for specifications that would support their pre-conceived notions. Hedonic analysis is a nearly perfect tool for exactly this type of manipulation–whether conscious or unconscious on the part of the authors.

Excepting gross land area, gross living area and age, none of the other recognized factors of value consistently appear in the regressions. Inconsistently used in the reported models were such factors as whether the property was single family or multifamily, whether it has a particular type of siding or roof construction, and the quality of the property. Other key known value-influencing factors were not used (e.g. number of bedrooms, number of bathrooms, number of garage spaces, etc). In addition, income producing property (rental units) was included in the regression database along with owner-occupied property sales. A regression model that does not consistently use the recognized factors of market value and separate clearly distinct types of property (income producing versus owner-occupied) must be considered highly suspect.

In their literature review, the authors noted that high voltage overhead transmission lines—an artifact they consider similar to cell towers–have a reported impact on value ranging from positive (i.e. they increase the value of neighboring properties) to negative. In a separate study by one of the authors, a maximum negative influence on value of 20% at 10 meters from a high voltage tower declining rapidly to zero at 100 meters was cited. Further, the authors stated that another study reported 50% of all high voltage studies indicated no impact on value, and 50% indicated from 2% to 10% negative impact. For a less obtrusive artifact (the cell towers are described as being significantly less obtrusive), the authors report a significantly greater damage estimate–10% to 23% for properties within 300 meters.

IN SUMMARY

In summary, the hedonic approach is unreliable and the particular regression models employed in this article are illogical, unrepresentative of the market, and produce results that are not credible.

The following key points should be noted:

1) Generally, when traditional appraisal methodologies are properly employed and the results analyzed, a positive or neutral influence on market value will frequently be indicated. This statement applies generally to existing and upgraded ROWs, but may not apply to a new ROW.

2) The hedonic analysis and hypothetical surveys (frequently referred to as contingent valuation (CV) surveys) are methods that cannot yield scientifically reliable or creditable results.

3) Virtually every article using these two methods examined by this author and other competent researchers, particularly when the raw data supporting the analyses has been available, show that the research is fatally flawed. Particularly with hedonic analysis, it is easily possible to show that, using the same data and software, an opposing result can be obtained.

The published research is of very poor quality and the peer review process that allows publication is unreliable. The literature may be badly flawed when certain analytical techniques are employed.

To add to the problem, it appears that most of the "peer reviewed" journals in the field have a policy of refusing to publish articles that directly contradict or point out the flaws in a previously published article. On this basis, the reader will never be informed of the existence of serious flaws in a published article. Citation to these articles as authoritative should be undertaken only with very great caution. ▨

References

[1] Wilson, Albert R., Peter D. Bowes, Douglas C. Brown, Damage to Market Value and Locational Premiums, Real Estate Issues, Winter, 2005, Volume 29, Number 4.

[2] "Value: (2) The present worth of the future benefits that accrue to real property ownership." The Appraisal of Real Estate, Twelfth Edition, Appraisal Institute, Chicago, 2001, page 20

[3] Advisory Opinion 22 of the Uniform Standards of Professional Appraisal Practice states in pertinent part: "A market value appraisal is also based on whatever the "normal" or "typical" conditions are in the marketplace for the property appraised in a time frame that is consistent with the date of value in the appraisal." Electronic USPAP 2005 Edition, The Appraisal Foundation.

[4] Wilson, Albert R. Proximity Stigma: Testing the Hypothesis, The Appraisal Journal, June, 2004.

[5] For example, see Neter, John, Michael Kutner, Christopher J. Nachtsheim, William Wasserman, Applied Linear Regression Models, Third Edition, Irwin, Chicago, 1996, pages 9, 10, or 14.

[6] SEE for an example of appropriate tests Wolverton, Marvin L, Steven Bottemiller, Further Analysis of Transmission Line Impact on Residential Property Values, The Appraisal Journal, July, 2003. This analysis indicates no basis to believe that any locational premium–and therefore damage–results from proximity to HVTLs.

[7] NOTE: A regression can assist in the prediction of sale prices, but sale prices are not necessarily market values. This discussion would be too lengthy for this paper but the distinction is very important, particularly in litigation.

[8] FEDERAL REGISTER, Vol. 58, No. 10, Proposed Rules, Department of Commerce, 15 CFR Chapter IX, Natural Resource Damage Assessments Under the Oil Pollution Act of 1990, 58 FR 4601, Appendix I–Report of the NOAA Panel on Contingent Valuation dated January 15, 1993 (the "Report"). SEE ALSO Wilson, Albert R., Contingent Valuation: Not an Appropriate Valuation Tool, The Appraisal Journal, forthcoming in Winter, 2006.

[9] Carson, Richard T., Nicholas E. Flores, Norman F. Meade, Contingent Valuation: Controversies and Evidence, Environmental and Resource Economics, Vol. 19, 2001. SEE ALSO Carson, Richard T., Nicholas E. Flores, Kerry M. Martin and Jennifer L. Wright, Contingent Valuation and revealed Preference Methodologies: Comparing the Estimates for Quasi-public Goods, Land Economics, February, 1996, 72(1):80-99. SEE specifically footnote 6.

[10] Bond, Sandy, PhD Ko-Kang Wang, The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods, The Appraisal Journal, Summer, 2005.

[11] "Two studies have been conducted to ascertain the adverse health and visual effects of CPBSs on property values. Telecom commissioned Knight Frank (NZ) Ltd to undertake a study in Auckland in 1998/00 and commissioned Telfer Young (Canterbury) Ltd to undertake a similar study in Christchurch in 2001. Although the studies show that there is not a statistically significant effect on property prices where CPBSs are present, the research in both cases involves only limited sales data analysis. Further, no surveys of residents' perceptions were undertaken, and the studies did not examine media attention to the sites and the impact this may have on saleability of properties in close proximity to CPBSs. Finally, as the sponsoring party to the research was a telecommunications company it is questionable whether the results are completely free from bias." Bond, ibid, pages 260, 261.

[12] "In general, those people living in areas farther from CPBSs were much more concerned about issues related to proximity to CPBSs that residents who lived near CPBSs. ... Alternatively, the apparent lower sensitivity to CPBSs of case study residents compared to the control group residents may be due to cognitive dissonance reduction. In this case, respondents may be unwilling to admit, due to the large amounts of money already paid, that they may have made a poor purchase or rental decision in buying or renting property located near a CPBSs. Similarly, the homeowners may be unwilling to admit there are concerns about CPBSs when the CPBSs were built after they had purchased their homes, because to do so might have a negative impact on property values." Bond, ibid, pages 265, 266.

[13] Diamond, Shari Seidman; Reference Guide on Survey Research, Moore's Federal Practice: Reference Manual on Scientific Evidence, Federal Judicial Center, Washington, DC, 1994 and later. S. J. Bond and J. Hopkins, The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, New Zealand, Pacific Rim Property Research Journal 6, No. 2 (2000).C. Kroll and T. Priestley, The Effects of Overhead Transmission Lines on Property Values: A review and Analysis of the Literature, Edison Electric Institute (July 1992).