

# *A History of Appraisal Theory and Practice*

## *Looking Back from IAAO's 75th Year*

**BY J. WAYNE MOORE, PH.D.**

Methods of property tax assessment have changed dramatically in the time since the International Association of Assessing Officers (IAAO) first organized in 1934 as the National Association of Assessing Officers. The task of property assessment has existed in the United States since Colonial times, but it wasn't until the late nineteenth and early twentieth century that scholars and practitioners began to examine the theoretical basis behind property valuation. At the same time, appraisers and assessment officials began to explore the best means to identify property value. These discussions led to the development of methodologies, and eventually computerized valuation models, that today help ensure that property assessment is performed in a fair, efficient, and accurate manner.

This article traces the historical evolution of appraisal practice from the beginnings of the concept of the approaches to value to the introduction of computerized valuation through com-

puter-assisted mass appraisal (CAMA) to the evolution of sophisticated automated valuation models (AVMs). It explores how economic and valuation theories have affected the development of appraisal methods through the years. The article also describes how social, political, and economic forces—most famously, citizen tax revolts—have shaped assessment policy and practices. The article further identifies current topics being vigorously debated among assessment professionals and the continuing challenges facing the property tax system.

Throughout its 75-year history, the International Association of Assessing Officers has had a profound impact upon the development, evolution, standardization, and education in assessment-related valuation, especially as it concerns mass appraisal practices used throughout the world today.

### **Historical Perspective**

Property taxes may be a centuries-old form of taxation, but the principles and

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procedures used to assess them are not nearly as fixed as one might expect. The understanding of basic terms and the real estate appraisal practices and principles used for valuation continue to evolve. For example, the modern definition of *market value* was still being refined as recently as two decades ago (Appraisal Institute 2002, 178). In the nineteenth century, rent capitalization served as the predominant method of value determination. During the twentieth century, two more approaches to value, cost (initially referred to as scientific appraisal) and market comparison, were defined and their use became widespread. Although it may not be generally recognized, all valuation methods are rooted in the concept of the present value of future benefits, whether those benefits are in the form of housing services or an income stream. The foundation of property appraisal theory is economics (Appraisal Institute 1992, 40–44; Appraisal Institute 2001, 33–47; Eckert 1990, 39–73; Gloude-mans 1999, 1–8).

### **The Beginnings of Appraisal Theory**

On March 28, 1874, a groundbreaking paper discussing methods of real estate valuation for taxation purposes was presented to the Social Science Association of Philadelphia. It proposed that standard procedures be established to “arrive at methods for the just and equal distribution of local taxation.” (Cochran 1874) The 24-page paper outlined the problems associated with the existing methods of rent multipliers and price paid (acquisition value). An early definition of market value appears in the reading, “... to wit: what they would sell for separately and singly at a bona fide, or fair sale, after public notice.” (Cochran 1874, 13) The paper also used phrases such as “full value” and “equalization” and seemed to promote use of a market approach. From the text of this paper, it appears that the cost approach was unknown at the time. The phrase “cost to construct” was mentioned only

once, and it was not used in the context of valuation. It is noteworthy that Cochran’s paper was presented only 98 years after the first published work on economic theory (Smith 1776); only 48 years after von Thünen (1826), a German landowner, developed the first serious treatment of spatial economics, relating it to the theory of rent; and 19 years before Marshall (1893) set forth the economic theory for real estate appraisal. The concept of spatial economics is an important topic of current property valuation research. It takes the form of location value response surface analysis (LVRSA), which provides “a means of adjusting smoothly for location in MRA [multiple regression analysis], feedback, or other valuation models.” (Gloude-mans 1999, 193)

The writings of Ricardo (1817) provide another classic influence on modern appraisal theory. His work was based on the premise that given free competition in trade, the exchange value of commodities would be determined by the amount of labor expended in production. *Ricardian rent* is a type of economic rent created by variation in resource quality, which bears directly on valuation theory.

Alfred Marshall was the first economist to investigate techniques for establishing values, but it was incidental to his primary interest—the pricing process in the functioning of the economic system. Near the end of the nineteenth century, Marshall (1893) introduced the economic concept of quasi-rent, which explained how the fundamental concept of land rent could be expanded to include long-term improvements to the land. Marshall (1920) merged supply-cost theory with demand-price theory, which forms the basis for modern-day value theory. His writings provided the theoretical basis for the three basic approaches to value in use today: replacement cost, market comparison, and capitalization of income.

Writing after World War I, Gustav Cassel further developed Marshall’s prin-

ciple of the tendency for long-run cost, market price, and capitalized income to be equal under conditions of equilibrium. He developed what he called the *principle of cost* which represented a normal condition about which actual pricing oscillates (Wendt 1956). By 1934, Cassel's theory had evolved into the concept of *normal value*.

### **First Property Appraisal Book Published**

What may be the first book written on the subject of property valuation (Hurd 1903) was authored by a mortgage company executive after searching in vain for such a book in both England and the United States. The author opens the book by stating, "The basis of agricultural land values has been established since the time of Ricardo, and throws light on the fundamentals of our problem." He then continues on the first page with a brief overview of rent capitalization, which is the only valuation method presented in the book. Hurd devoted considerable text to a discussion of the historical development of cities and echoed some of the same concepts of spatial economics observed by von Thünen. Although land rent seemed to be his focus, Hurd did state that "... 'value' means exchange value, average sales being considered the best test of value." (1903, 2) Three years after Hurd, Fisher (1906) produced the definitive work on income capitalization which continues to be reprinted and cited to this day. Fisher expanded the view advanced by Marshall and others that the value of durable goods was represented by the present worth of future returns. He emphasized the distinction between cost and value, and in his discussion of risk, capitalization rates, and the discounting process, he presented a fully developed form of the income theory of value that became the basis of the work of Babcock (1932) and influenced much of the appraisal literature written during the twentieth century on the topic of present value of future benefits.

Shortly after Hurd's book, and 35 years after Cochran's presentation in Philadelphia, a book was published in London with the practical objective "to give students and candidates in the examinations of the Surveyors' Auctioneers' Institute, &c., a general knowledge of the principles and practice of Valuation of Real Property for the various purposes for which it is required ... and others who are called upon to value land and buildings ..." (Webb 1909, preface). One chapter was devoted to valuation for taxation purposes. Webb offered rent capitalization as the primary valuation method for all types of properties (agricultural, residential, and business). To determine capital value in this method, the annual rent was capitalized at various interest rates, depending upon the risk involved for the type of property. For ordinary houses, he used "rack rent" and noted that "the rate percent of interest to be allowed in calculating the capital value is more difficult to determine ... it depends, generally, on the suitability of the houses to the locality ... the age and condition of the buildings ... whether there is a tendency for rents to rise or fall in the *neighborhood* [italics added] ... improvements in the means of transit between the centre and outlying districts, which has induced a large number of people to live farther out ... building of a large number of flats has also had a great effect." (Webb 1909, 11) To explain the necessity of using variations in the interest rate in income capitalization, Webb applied market and spatial concepts that would be investigated extensively 100 years later (Haurin and Brasington 1996; Lang 2005; Morrow-Jones, Irwin, and Roe 2004; Boarnet and Chalermpong 2001).

Because Webb intended his valuation guide to be used for various purposes, such as the determination of fire insurance loss, he included a chapter on how to value land and buildings separately. He instructed, "It is often necessary ... to form an estimate of the cost of erecting

a building similar to an existing building if built at the present time.” (Webb 1909, 37) This statement is the earliest reference located for the concept of replacement cost. Webb mentioned the quantity survey method (which is done using detailed construction plans) as being too tedious for the purpose of valuation and suggested that a fair estimate might be made “by other methods, such as cubing, pricing for square foot of floor area, or per unit of accommodation.” (p. 37) After discussing several precautions in the use of these methods, he provided a rudimentary cubic-foot cost table.

### Emergence of Appraisal Procedure

Pollock and Scholz (1926) promoted the economic theory of Marshall and Cassel that *normal price* tends to equal *normal cost* in the long run. This theory later gained broad acceptance during the Great Depression years when prices became erratic and unpredictable. It provided the foundation for the view that replacement cost is the most reliable approach for value estimation.

*But in the long run the price of a reproducible good will be determined primarily by production costs, and this so-called normal price will not tend to vary to any great extent . . .* (Pollock and Scholz 1926, 17)

Pollock and Scholz did not apply the normal value theory to land, which was their primary interest. They reasoned that since land could not be reproduced, land value would be determined by supply and demand. For this reason, the authors concluded that the only *scientific method* of land valuation was one based upon the Somers unit system, which used a lot's frontage measurement, with depth tables and corner influence charts to aid in the adjustment of base values derived from available market activity. The influence of their work can still be seen in some state assessment manuals that continue to endorse this method without consideration of evolving theory,

practice, and methodology. The Pollock and Scholz book is an excellent example from the period of transition from economic theory to appraisal practice. Pollock was the chief executive of an appraisal company and Scholz was a professor of economics at the University of Pennsylvania.

Mertzke (1927) linked classical value theory with valuation and appraisal theory. He employed Marshall's concept of *normal value* to translate economic value theories into a workable valuation theory and appraisal methodology, thus establishing a clear foundation for the utilization of the three basic approaches to value. Within 11 years of Mertzke's writing, the “three approaches” and their derivatives had become a standard part of appraiser education as evidenced by the contents of real estate appraisal training materials published in 1938 by the American Institute of Real Estate Appraisers (predecessor to the Appraisal Institute) (Wendt 1956). A diagram of the appraisal process using the three approaches to value soon appeared in a book authored by one of the strong proponents of the procedure (Schmutz 1941). To this day, the three approaches to value have remained central to the teaching of appraisal principles. The Appraisal Institute encourages the use of the three approaches in each appraisal assignment, followed by reconciliation of the three value indications, utilizing appraisal judgment and experience, to arrive at a final opinion of value. Support for this procedure is not universal, however.

An early book written specifically for assessors provided an interesting summary of the early evolution of assessment practice and the need for *scientific appraisal* (Prouty, Collins, and Prouty 1930). It described a system developed by the City of New York in 1910 for appraising land and buildings on a square-foot basis and reported on advances made during the same period in the quantitative methods of scientific appraising that

were introduced by John A. Zangerle, a member of the Board of Appraisers for the City of Cleveland, Ohio. The book noted that besides New York City and Cleveland, cities such as Buffalo, New York; Rochester, New York; Jersey City, New Jersey; St. Paul, Minnesota; and Denver, Colorado, led the way in the adoption of scientific appraisal methods during the period of 1915–1925. However, “In striking contrast to the cities heretofore mentioned is the City of Chicago.” (Prouty, Collins, and Prouty 1930, 4). Several years later, the city’s assessment inequity would provide a major catalyst for the Tax Revolt of 1933.

### **Zangerle Sets Appraisal Standard**

Zangerle’s book on appraising, published in 1924, established a standard mass appraisal methodology that would be used for the rest of the twentieth century. His book introduced the concept of building quality classifications and included construction specifications for each classification, along with square-foot unit rates for each classification. An economist investigating the history of economic theory in appraisal (Kingsbury 1946) stated that Zangerle’s ideas were noteworthy because his work as the tax assessor in Cleveland had called for both the particularistic approach of the appraiser and the general view of the assessor. Zangerle went on to become, in 1934, one of the early members of the organization known today as the International Association of Assessing Officers and served as its president in 1937.

The foreclosures during the Great Depression of the 1930s precipitated intense interest in the improvement of valuation procedures. This interest led to publication of the classic books by Babcock (1932), Bonbright (1937), and others. A contemporary, Jensen, identified the valuation and assessment process as fundamental, by definition, to the administration of an ad valorem property tax. He cited the lack of bona fide market transactions as one of the im-

pediments to accurate assessments and described use of scientific appraisal and constructive market value as possible alternatives (Jensen 1931, 449). Jensen defined a constructive market value as “one constructed synthetically by taking all the factors affecting value into account so that it shall approximate as closely as possible what the market value would be could one be ascertained.” (p. 450)

What Jensen was describing is a form of what is now known as the cost approach. It was referred to at the time as *scientific appraisal* because values were ascertained by considering all the material and labor costs that were used for the various building components. These costs were calculated from engineering estimates organized and placed in manuals for reference by assessors (Moore 1995). Because of the approach’s intuitively scientific nature and its ease of explanation to taxpayers, the method was rapidly adopted in the 1920s and 1930s, enjoying wide and nearly total acceptance until computer-based techniques such as MRA began to emerge in the 1970s.

### **Babcock Formulates Valuation Methods**

Babcock wrote from the perspective of economic theory. His 1932 work represented one of the major milestones in the development of appraisal practice in the twentieth century. He introduced seven valuation methods, which were all special applications of the concept of the three approaches to value. He proposed that each method should be applied according to the type of property being valued (chapter 16) and that *only one method* be used on any one property type (not all three approaches for one property as encouraged by the Appraisal Institute). Babcock appeared to favor the income method, but recommended the market comparison method for properties that did not generate income. He wrote, “In this method of valuation a qualitative analysis is made of the *future amenities* [italics added] offered to the prospective purchasers of the property.” (Babcock

1932, 170) He suggested this method as best for single-family dwellings.

Around the same time, field manuals for appraisers began to appear that built upon the content of Zangerle's 1924 book by offering pictures and specifications organized by construction quality class as well as unit rate table valuation guides. One of the first was issued by the J. M. Cleminshaw Company, an appraisal engineering firm near Cleveland (Cleminshaw 1932). Another widely used appraisal manual, *Boeckh's Manual of Appraisals*, published in 1934, recommended calculating reproduction cost primarily through the use of cubic foot rates. This manual included an innovation called the "Boeckh Index Control" that gave appraisers multiplication factors to use in various cities throughout the country. *Boeckh's* gave little attention to the market comparison approach, but outlined precautions that must be considered concerning sale prices (Boeckh 1934).

### **Tax Revolts as a Catalyst of Change**

It has been postulated that certain historical events with major political and cultural implications have been motivated by tax rebellion (Adams 2001). In the United States, tax rebellion has been an essential element in its political and economic history since the American Revolution when the rallying cry was "no taxation without representation."

Even after the Revolutionary War, the newly independent U.S. citizens continued to object to taxes they perceived as unfair. The first in a series of post-war tax revolts was Shays' Rebellion. This revolt broke out in western Massachusetts in the fall of 1786 over high taxes and a depressed economy. It lasted through the winter into 1787. The sense of urgency created by Shays' Rebellion has been cited as one of the factors that led to the Constitutional Convention in 1787 (Ely 1992). In 1794, the Whiskey Rebellion erupted over a tax on whiskey that was imposed to pay off the national debt. Although the uprising started with

a group of farmers in western Pennsylvania, it managed to gain the attention of President George Washington and Secretary of the Treasury Alexander Hamilton. Eventually, 15,000 U.S. troops were sent to quell the defiant farmers, who were armed mainly with pitchforks. The Whiskey Rebellion appears to have become much more widespread—and threatening to the Union—than its origins might suggest (Adams 2001). Why else would President Washington have personally taken a federal army larger than the one he had at Valley Forge to subdue frontier farmers? Four years later, Fries' Rebellion broke out in Bucks County, Pennsylvania. The issue that sparked the fighting was assessors' attempts to list properties for taxation (Fisher 1996).

In the nineteenth century, the American Civil War was depicted primarily as resulting from a struggle between abolitionist and pro-slavery forces. Another strain between the two sides was a bankrupting tariff placed on the South (Adams 2001).

In more recent times, property tax issues have given rise to two major taxpayer protests. The Tax Revolt of 1933 sought reforms in the property tax system and local government spending (Beito 1986). The Tax Revolt of 1978 produced California's Proposition 13 and other state tax limitation measures.

### **Modern American Tax Revolts**

#### ***Tax Revolt of 1933***

The voter initiative to adopt Proposition 13 is often credited as the beginning of the modern American tax revolt. However, the Tax Revolt of 1933 produced a far more serious threat, as noted by Beito (1986).

*Confronted by the greatest tax crisis of the twentieth century—perhaps since the American Revolution—opinion molders of the Depression Era could not afford the luxury of avoiding the relationship between taxation and legitimacy. ... Measured by*

*the yardstick of numbers of organizations, the tax revolt of the 1970s looks puny by comparison.* (pp. viii, xii)

Distrust and suspicion of bureaucrats, which had always been a hallmark of American life, reached new heights during the Great Depression. The financial hardships of the Depression, compounded by an increasing effective tax burden, appear to have presented powerful motivators for the Tax Revolt of 1933. During the Depression years, taxes as a percentage of national income almost doubled from 11.6 percent to 21.1 percent. Taxpayers responded by threatening to not pay tax bills and began to organize in opposition to local property tax policy. From 1930 to 1933, property tax delinquency rates in cities with populations over 50,000 rose from 10.1 percent to a record-setting 26.3 percent. An estimated 3,000 to 4,000 tax revolt organizations existed by 1932 (Beito 1986).

Property owners were especially hard hit by the Depression and the rising tax burden. In 1928, the property tax contributed 93 percent to local tax revenue in cities with populations over 30,000. Feeling the effects of the local property tax combined with federal and state taxes, property owners perceived they were responsible for a disproportionate portion of the total tax burden. Consequently, the Tax Revolt of 1933 was not directed solely toward federal tax policy, as in the previous tax revolts discussed, but primarily focused on local property tax policy.

The experience of property owners in Depression-era Chicago offers a prime example of the reasons behind local-level tax revolts. At the time, Chicago property owners were responsible for 80 percent of local tax revenues. In addition, real estate values fell by 38 percent from 1928 to 1931, new construction dropped by 86 percent, foreclosures surged 457 percent from 1927 to 1931, and before 1930, "Cook County's corrupt assessment system had become an embarrassing mark of local distinction." (Beito 1986, 68) As

a local Northwestern University economics professor wrote at the time:

*One could sit in the Board of Review and Board of Assessor's offices and see these men come in with their pockets bulging with crumpled tax bills of constituents to be "fixed." The upshot was the assessments fluctuated wildly, both within and between precincts.* (Simpson 1930)

A legal order forcing the Chicago Board of Assessors to go public with its assessments corroborated Simpson's observations. Values deviated almost randomly from the property's true resale value. Newspapers had a field day publicizing the way the political tax racket in Chicago had distorted the assessment rolls. The *Chicago Tribune* published pictures of two very similar adjacent houses. One of the houses, owned by the chief of police detectives, was assessed at \$500. His next door neighbor's assessed value was \$2,450 (Beito 1986, 76).

Beito's work presented an overview of tax resistance and limitation movements across the county during 1932 and 1933. It also reviewed in depth the movements in Atlanta, Milwaukee, Detroit, and New York City in addition to Chicago. His research showed distinct parallels between all the tax resistance movements of the period. Taxpayers made opposition to high real estate taxes the centerpiece of their activism receiving assistance from the National Association of Real Estate Boards. According to Beito, taxpayers had three possibilities for relief available: replacement taxes (for example, substituting income tax for real estate taxes), economy in government, or a combination of both. Replacement taxes alienated potential supporters and gained few allies. Hence, nearly all relief enacted in 1932 and 1933 centered on reducing government budgets. Anti-state sentiment was alive and well in Depression-era America.

What motivated the quiescent taxpayers of the 1920s to rebel in the 1930s? Certainly, economic conditions played

an important role, but Beito postulated that the onset of economic decline was the *catalyst* of taxpayer action, not the cause. Rather, it forced taxpayers to think about their tax burden and the purposes of high taxes. To use a popular term of the period, the Depression motivated taxpayers to become *tax conscious* and to look more critically at how the government bureaucracies they once could afford to ignore were spending their tax dollars (Beito 1986). In doing so, taxpayers focused on budget limitation as a means of controlling real estate property taxes and demanded accurate assessments so that the tax burden among property owners could be fairly apportioned. Considering the intense national interest in professionally conducted assessments, is it any wonder that within one year after the 1933 tax revolt, the National Association of Assessing Officers was founded with its headquarters in Chicago?

### ***California's Proposition 13***

The next major national tax revolt was precipitated by the inflation-ridden years of the 1970s and resulted in the enactment of tax-limiting laws in 18 states between 1976 and 1980. Just as Chicago was a prime example for studying tax revolt at the local level in 1933, California provides a good example of a statewide property tax revolt. Proposition 13 was a property-tax-limiting measure imposed by the citizens of California through direct referendum. The constitutional amendment limited the *tax rate* to a maximum of one percent, and limited annual increases in *assessed values* for existing homeowners to a maximum of two percent (O'Sullivan, Sexton, and Sheffrin 1995). This last provision effectively eliminated assessment uniformity in relation to market value. It is important to note as well that Proposition 13 did not consider budget limitation, which was the focus of the tax revolt of the 1930s. This is a subtle difference.

In the years before Proposition 13, prices for single-family homes in California had increased substantially. From

1976 to 1978, housing prices rose 50 percent, compared to increases of 18–27 percent in other regions of the country. The situation was quite similar to the recent 2001–2006 period of home appreciation. Also, California had amassed a budgetary surplus of \$5 billion by 1978. Unfortunately, the governor and the state legislature could not agree on tax relief measures to appease a brewing tax revolt.

As in Chicago, California property owners believed they were being unfairly burdened by taxes. Howard Jarvis headed the grassroots effort that resulted in Proposition 13. He was supported by several real estate, conservative business, and agricultural groups. By promoting his message through direct mail pieces, talk show appearances, and the now famous slogan, "I'm mad as hell, and won't take it anymore," Jarvis was able to collect over 1.2 million petition signatures to place Proposition 13 on the June 1978 primary ballot. At the polls, Proposition 13 passed by a 2–1 margin with a record-setting 67 percent voter turnout. State and local government officials, the League of Women Voters, the Parent Teacher Association (PTA), environmental and utility groups, and public employee unions tried unsuccessfully to defeat the measure.

With property taxes capped following the adoption of Proposition 13, California municipalities began to rely on other revenue sources such as local sales taxes (Hoene 2000). Also, in some places, user fees were adopted for library and public land usage. New construction fees, sometimes as high as \$3,000, were mandated to offset the property tax reduction. Ironically, Californians ended up paying additional federal income tax because of lower federal property tax deductions. Howard Jarvis had undeniably achieved the goal of relieving the direct real estate tax burden from California property owners. But between tax redistribution and the newly created fees, governments managed to success-

fully replace a substantial portion of their lost revenue because the measure did not impose budgetary constraints. In addition, special assessment districts were created to finance and manage infrastructure projects, which traditionally had been funded through property taxes. The popularity of this device is evidenced by the explosion in the number of special districts throughout the United States—from 23,885 in 1977 to 35,052 in 2002. During the same period, the number of local government bodies (counties, municipalities, towns, and townships) increased by only 241 units (Census Bureau 2003).

Interestingly, the funds collected by special districts throughout the country are classified as benefit assessments and not as property taxes because they are earmarked for projects that benefit specific properties. Most citizens would not recognize the technical difference. Because of new fees and special assessments, combined with no direct budgetary constraints, Proposition 13 may not have succeeded in providing an overall tax reduction for Californians. After researching the history of American government finance, a noted public finance historian concluded: “There is no substantive evidence to suggest that tinkering with the revenue structure will change the size of government.” (Wallis 2000, 80)

### **Crisis Provides Impetus to Establishing Appraisal Profession**

Widespread assessment corruption of the 1920s, the tax crisis of the 1930s, collapse of the real estate market during the Depression, and the ensuing volume of foreclosures, all led to a call for reform. The broadened influence of government in establishing a need for appraisals to support Federal Housing Administration (FHA) real estate loan insurance and guaranties led to the creation of the appraisal profession as a career specialty separate from traditional real estate brokerage. Both the American Institute of Real Estate Appraisers

(Appraisal Institute) and the National Association of Assessing Officers (IAAO) were established during the period of 1932 to 1934. Both organizations began to set standards for property valuation, appraisal practice, and professional ethics. *Assessment Principles and Terminology*, the first assessment book from the National Association of Assessing Officers (1937), was written by members of the Committee on Principles of Assessment Practice, appointed by Association President John A. Zangerle. Phillip W. Kniskern was president of the American Institute of Real Estate Appraisers when his book was published (Kniskern 1933). This book most likely served as an early reference for members of the institute in the years following its founding. During the early years of the Appraisal Institute, members wrote pamphlets, journal articles, and essays on appraisal practice. From these early writings, the work of 10 authors was compiled into 28 chapters of what became known as Volume I of the *Text Material—Real Estate Appraisal* (American Institute of Real Estate Appraisers 1938). This material was used in the institute’s beginning course in appraising (Kingsbury 1946). At the close of each chapter, a list of references was provided for further reading. The selection of authors offers a glimpse at who were the acknowledged appraisal authorities of the period. According to Kingsbury (1946, 136), references cited more than once included Babcock (1932); Bonbright (1937); Clark (1930); Kniskern (1933); McMichael (1932); Prouty, Collins, and Prouty (1930); and FHA (1938).

Kingsbury, as part of the research for her book, examined the original mimeographed copies of *Text Material* in the Appraisal Institute’s Chicago offices. The text presented the three methods of appraising property (replacement cost, market comparison, and income capitalization), but they were termed “approaches” rather than methods. *Text Material* outlined the difficulties

with each approach and recommended using all three approaches if possible, and at least two of the three as standard practice. Then, according to the text, the appraiser would be expected to apply experience and judgment in determining the *opinion of value* that would be best applied for the subject assignment, as bracketed by the two or three approaches. This methodology has been taught by the Appraisal Institute to the present day and constitutes chapter 25 of their text, *The Appraisal of Real Estate* (Appraisal Institute 2001).

This methodology is not without its critics, however. Babcock disagreed and an Opinion of the Fellows of the American Society of Appraisers (1989) stated:

*The College reaffirms its position taken in an earlier Opinion that the so-called “three approaches to value”—a doctrine that requires that all three approaches be applied to any one property, regardless of its characteristics, and then that the three results be “correlated” to reach a conclusion as to value—is economically unsound and produces unreliable results.* (p. 5)

As the 1930s ended, a manual for appraisers published in book form by the Cole-Layer Company, appraisal engineers of Dayton, Ohio, reiterated the period’s preference for cost-based valuation. It stated, “Practically all of the dwelling appraisal systems in use today are based upon some method of arriving at either the reproductive cost or the replacement cost of the building.” (Cole 1939, 6) However, in a chapter on theory, the text, citing an underwriting manual from the FHA (1938), appears to indicate a definite trend toward the use of the market comparison approach.

Speaking as an applied economist, Kingsbury described the progress of the new profession a little more than a decade after its establishment:

*The comparatively new profession of real estate appraising, in spite of having done some excellent work toward “narrowing the margins of uncertainty” in valua-*

*tion, is still unnecessarily burdened with vagueness and inconsistency in regard to several important matters. This is true not only among appraisers in general, but also within the work of individual appraisers.* (1946, 142)

### Value Theory of James C. Bonbright

Academic interest in the improvement of valuation procedures was strong as well in the 1930s, as evidenced by the publication of the classic two-volume, 1,271-page treatise by Bonbright (1937). Bonbright was concerned with the precise legal concept of value used in court cases involving valuation. His research findings are of particular relevance to the issue of just compensation under eminent domain. Bonbright posited that the first and most important problem in any appraisal was to secure a definition of value acceptable for the purpose of the investigation. In Bonbright’s view, there were two basic concepts of value: market value and value to the owner. He embraced value-to-the-owner as the more central and universal concept.

*The value of property should always be taken to mean value to some specific individual or group of individuals, who have or may have an ownership interest in the thing. ... But since any object of wealth may be capable of conferring different advantages on different owners—as in the case of a pair of eyeglasses, which is adapted to Smith’s eyes, but which would be of no possible use to Jones—one cannot speak of the value of a property in general; instead, one must speak of its value to some specific person or group of persons. Strictly construed, therefore, property value should mean invariably value to some particular owner. ... But in law, as in economics and in business, value is often used in an associated sense, as a synonym for market price or market value. “The worth of a thing, is the price it will bring,” in the words of a jingle frequently repeated by judges as well as economists. When the term is thus*

*construed, no property, however valuable it may be to the particular individual for whom it is specially adapted, has any value unless it can be sold to some other person ... Properties like the New York Stock Exchange building [not the land] ... would therefore be deemed utterly valueless (save for a possible salvage value), were this concept of value rigidly adhered to. (Bonbright 1937, 15)*

*The use of "market value" as the verbal basis settling all varieties of legal disputes represents a uniformity of mere words rather than one of principle. The multiformity of value standards is only concealed, not avoided, by the accepted legal definition of market value of the price at which the property would be exchanged between a "willing buyer" and a "willing seller." (p. 65)*

Bonbright was critical of the *willing buyer/willing seller* concept of value for any estimate of value other than for homogeneous goods in active markets. Different assumptions applied in the valuation process, Bonbright posited, could lead to an infinite number of *opinions of value*.

### **Interest in Value Theory Research Declines**

During the first half of the twentieth century, there was considerable scholarly interest in methods of property valuation with academic contributions from Marshall (1920), Cassel (1924), Fisher (1906), Mertzke (1927), Scholz (of Pollock and Scholz 1926), Babcock (1932), Bonbright (1937), and many economists. However, Wendt (1956, 40) observed, "It seems fair to state that there have been no major contributions to appraisal theory since the writings of Babcock and Bonbright ... recent writings have concentrated upon the appraisal process and techniques for establishing values." A more recent assessment of value and valuation theory contributions in the field of real estate appraisal by Canonne and Macdonald (2003) was less kind:

*Competence supposes a professional foundation that includes a solid understanding of theory and its historical development. In real estate appraisal, for example, this theory is that of economic value ... This literature review shows that the core of real estate appraisal literature has little place for this theoretical foundation, and allocates even fewer pages to the history of economic value. Appraisers face the challenge of erecting the edifice of basic concepts, laws, and principles in appraisal so that the field can advance from art to science and from trade to profession. (p. 113)*

*No wonder practitioners short circuit the practice of evaluation; the fundamental notion of value did not enter the classroom because it finds little or no foundation in the literature, with blatant errors in the theory of value and the history of value thought. The state of affairs in appraisal practice is simply the result of the way in which evaluation is taught, and of the way in which research is directed. (p. 114)*

As reported by Canonne and Macdonald (2003), publications on real estate appraisal in the last half of the twentieth century have devoted fewer and fewer pages to the underlying economic theory and history of appraisal. A literature review conducted for this research confirmed Canonne's and Macdonald's finding and revealed that material presented in more recent writings appears to be a reiteration of theory and principles presented earlier, only in condensed form. One of the few university scholars to study the practice of valuation after World War II was Medici (1953), considered, in his time, to be one of the great theoreticians of appraisal. Medici added his scholarly support to the professional disdain of value theory, and from there, its history. He openly renounced any theory of value and attempted to raise appraisal to the level of a science through the merits of its own methodology, asserting that the

foundation of the doctrine of appraisal was its method (Canonne and Macdonald 2003). Medici's influence appears to have had a dampening effect on interest in value theory during the last half of the twentieth century.

### **The Modern Era of Appraisal Practice**

The development of real estate appraisal practice can be divided into three eras according to Boykin and Ring (1993). The first era was roughly 1906 to 1944, when the pioneering work in establishing the theory and practice of appraisal was accomplished; the second era was post-World War II until the early 1960s, when valuation procedures were refined and the term *most probable market price* was introduced; the third era extends from the 1960s to the present. During the third era, most states required accurate disclosure and recording of sale prices as part of the property transfer process. By enabling the collection of accurate sale transaction data, this requirement allowed methods to emerge that could make use of the power of the computer to perform numerical and statistical analysis. The new methods employ multiple regression analysis (MRA) and adaptive estimation procedure (AEP, also called *feedback*). These methods represent analytical extensions of the market comparable sales approach, in which the value of a subject property is determined by comparing its features and description to those of similar properties that have sold for a known price in the same market area. If a sufficient number exist, the comparable sales form a price distribution that, if assumed normal for a market area, produces a sample mean that is a good market value indicator for the subject property.

These statistical methods are considered by their practitioners to produce superior results when compared to the pure cost approach (scientific appraisal of the 1920s and 1930s). This contention was confirmed at a statistically significant level of  $p < .001$  by recent research (Moore 2006). The research project

demonstrated that a diverse group of assessing professionals, given a variety of current tools and procedures, could attain assessment uniformity. However, use of these advanced statistical methods introduces two problems for the typical assessing office:

1. A special skill set is needed to specify and calibrate the statistical models.
2. Explaining the method and statistical model to property owners presents a challenge.

### **The Underlying Economic Theory of Valuation**

Tax assessments in the United States today are almost universally based upon a standard of value that is either directly or indirectly related to market value. The price at which items are exchanged in a free market is determined by the fundamental laws of economics: supply, demand, competition, balance, contribution, marginal utility, substitution, economic rent and quasi-rent, external economies and diseconomies, the supply function, the demand function, and the long-term equilibrium price. A brief explanation of these basic economic laws as they relate to real estate valuation is provided in several reference books (Eckert 1990; Gloudemans 1999; Appraisal Institute, 1992, 2001; Boykin and Ring 1993). Most assessment professionals should be familiar with these references. The economic theory presented in this article relies heavily on the economic classics mentioned earlier and the work of a contemporary economist, Professor Karl E. Case, a Harvard Ph.D. who has been a professor of economics at Wellesley College, Wellesley, Massachusetts, for more than 25 years. His research has focused on real estate markets and prices. Professor Case is co-developer of the Standard & Poor's Case-Shiller Home Price Indices.

Students of economics learn about equilibrium prices that result from a

market-clearing process, but the notion of a single prevailing market price for each commodity is contradicted by empirical observation. Explanations offered for this reality include (1) the products actually differ or are perceived as being different, (2) transaction costs cause price differences, (3) price differences are caused by market segmentation and price discrimination, and (4) buyers and sellers possess imperfect knowledge about product quality and prices. All four realities affect real estate prices, but imperfections in information play an even more important role because housing units are heterogeneous goods that differ in many ways. Buyers and sellers in the real estate market possess unique motivations and all participants can suffer from imperfect information. Hence, even if an assessor had complete and accurate property information and even if ideal procedures were used to adjust for observable characteristics (the perfect AVM), the estimated value would merely be some function of an equilibrium price distribution and the distribution of assessment-sale price ratios would always have a non-zero variance.

The exact amount of variance can be different from market to market and even neighborhood to neighborhood. In reality, there is no possible way for the assessor to improve upon the random variance that is part of market activity. There is no *single* fair market value for each property because a range of possible values influenced by many factors exists. The nature of assessing requires that a single estimate must be chosen for each year's tax roll and this estimate must be as close as possible to what the owner would expect to receive if the property were sold (the mean of the price distribution). However, not all observed variation in assessment-sale price ratios should be attributed to randomness in selling prices and imperfect markets. Assessors can make errors because of incomplete or inaccurate property description data, AVMs that

have been incorrectly specified because of an inadequate understanding of the housing market, or inaccurate model calibration. However, as shown by recent research (Moore 2006), assessors have made tremendous progress in this area in the past four decades.

### **The Theoretical Role of Housing Attribute Value**

In economists' terms, housing utility is obtained through the consumption of a large number of *individually identifiable attributes*, which Babcock (1932) termed amenities. When purchasing a home, buyers simultaneously choose the number of rooms and bathrooms, a kitchen type, a particular lot location and description, a structure type (1-story, 2-story, split-level), a set of neighbors and market area, a school system, a type of street, a perceived crime level, and other attributes. Housing stock is durable and supply response is sluggish. Although some of the components that make up the bundle of individually identifiable attributes, such as decks, air-conditioning, fireplaces, and swimming pools may be added or altered on short notice, the majority, such as house style, room configuration, and size are not easily changed. Others, such as neighborhood attributes, do not change at all except over a long time. As a result, shifts in demand or technology changes, such as the recent emergence of the master suite as a very desirable attribute, can result in positive or negative quasi-rents depending upon whether that attribute exists in a particular housing unit or neighborhood. A brief discussion of rents and quasi-rents is offered in appendix A.

According to Case (1978, 24), "Housing attributes can be broken down into two major groups: structural characteristics {X} and neighborhood characteristics {N}. In a sufficiently large area, a wide variety of alternative packages are available." While buyers may negotiate a bundle price, the existence of alternatives implies that implicit prices are associated with

each bundle component even if buyers are not consciously aware of them. Accordingly, it is possible to represent the estimated market value *MV* of a specific residential housing unit as a function of the attributes {*X*} and {*N*} with a simple linear relationship (Case 1978, 24):

$$(1) \quad MV = P_1X_1 + \dots + P_mX_m + b_1N_1 + b_nN_n$$

where

- MV* = Estimated market value of the bundle
- P<sub>i</sub>* = Price of structural attribute *i*
- X<sub>i</sub>* = Quantity of structural attribute *i*
- b<sub>i</sub>* = Price of neighborhood attribute *i*
- N<sub>i</sub>* = Quantity of neighborhood attribute *i*

Each attribute price is made up of two components: a base price and a quasi-rent. That is,

$$(2) \quad P_i = (C_i + r_i)$$

where

- C<sub>i</sub>* = Construction cost for an additional unit of attribute *i*
- r<sub>i</sub>* = Quasi-rent associated with attribute *i*

The *r<sub>i</sub>* may be negative or positive and will persist only where the supply of the attribute in question is either fixed or responds sluggishly. Where a particular attribute is in fixed supply (such as the land itself), the entire return to that attribute is quasi-rent and *C<sub>i</sub>* = 0; hence, construction cost is immaterial. Essentially all of the *b<sub>i</sub>* neighborhood attribute prices are quasi-rents (site attributes *S<sub>i</sub>* with prices *z<sub>i</sub>* are added in the general model, to be discussed later). Certain attributes, such as view, are site specific, being neither a structure attribute nor a neighborhood attribute. The contributed value of the view is completely in the form of quasi-rent. See appendix A for examples.

Within a clearly delineated market, there will be a single short-run equi-

librium price for each attribute. This framework is applicable to both owner-occupied and rental property. The value of any capital asset is equal to the present value of the net services that it is expected to yield through its lifetime. Owner-occupied housing yields a flow of services (shelter and amenities) for which owners implicitly pay rent. Since such rent is not a recorded transaction, it must be imputed from the value of the home (Case 1978, 26). As Cochran (1874) argued over 135 years ago, Webb (1909) detailed, and the scientific appraisal movement in the first part of the twentieth century attempted to resolve, the practice of imputing market value from expected rental payments—the primary valuation methodology from the seventeenth to the nineteenth century, can be problematic, especially for housing.

Single-family housing parcels can be viewed as bundles of structural, site, and neighborhood attributes. At any point in time, the market value of a property is approximated by the mean of the distribution of value estimates made as a function of the quantity of attributes that it possesses at that point. Moving through time, the quantity of structural attributes {*X*} can change as a result of investment (additions to and replacement of structural components) or physical deterioration (depreciation) that can be voluntary or involuntary in nature. The rate of deterioration and the rate of investment in general maintenance are critical elements in the supply side of the housing market. The rate of investment will depend upon the expected rate of return, either explicit or implicit. A site attribute {*S*} such as view can be changed by the erection of a structure that blocks the view. With the passage of time, the quantity of neighborhood attributes {*N*} will likely change because of changes in the tax and public service package offered by municipalities, changes in the level of environmental attributes such as noise and air pollution, changes in

land-use patterns, relocations of business firms into or out of the area, zoning changes, differences in quality and adequacy of roads, and the like. Spatial analysis offers a method of detecting the continual change in neighborhood attributes. However, structural prices  $P_i$ , neighborhood prices  $b_i$ , or site prices  $z_i$  for attribute  $i$  may change over time.

Thirty years ago when Professor Case was doing the research for his dissertation and subsequent book (1978), he observed a significant need for reform and improvement in assessment methods. The methods employed at the time were less refined than those in current use. In fact, the early forms of statistical methodology such as MRA were just starting to be adopted in some states such as California.

Some observers have speculated that the rapid introduction of MRA in California counties may have been a contributing factor to the Proposition 13 tax revolt. This view is supported by recent research. Martin (2003), as part of his doctoral dissertation research, traced the historical and sociological issues that culminated in the tax revolts experienced in the United States and elsewhere in the previous 30 years. He argued that from a sociologist's perspective, the tax revolts were caused by the delayed modernization of the assessment system in the United States. When the power of the computer was introduced to the assessment process in the 1960s and 1970s, assessment procedures were rapidly modernized. This was done, in some instances, without consideration of the need to limit tax revenue windfalls that the new methods, applied in an era of rapidly rising home values, might produce. In the 1970s, home prices were escalating quickly causing a corresponding rapid increase in property taxes. Local government officials failed to limit the tax increases by reducing tax rates, and the rapid real estate tax increases sparked the revolts that began with Proposition 13 in California.

## Valuation Theory in Assessment Practice

Ultimately, the estimated real estate market values of properties are determined by an elected or appointed assessment official. Conventional wisdom as well as the assumptions of many academic researchers (including Professor Case) holds that equitable distribution of the local property tax burden (its *fairness*) depends upon the quality and accuracy of the annual market value estimates established by the responsible local official. Researchers, including Case, have focused on the activities of assessing officials as well as the uniformity issues in the property appraisal process, but have overlooked recently enacted preferential assessment adjustments that modify assessors' estimates of market value to support or implement social, economic, financial, or politically motivated policies.

Each year, assessors report the assessed value of all real property in an official certified roll as of a certain tax lien date. Moore (2008) showed that the aggregate roll can be stated mathematically as

$$(3) \quad V_A = \sum_{i=1, n} AV_i$$

where

$V_A$  = aggregate assessed valuation of all  $n$  properties in the jurisdiction,

and

$$AV_i = [MV_i + e_i] + [\sum_{j=1, m} (P_j + I_{ej})]$$

which is the assessed value of property  $i$ .

The term  $[MV_i + e_i]$  represents the assessing official's estimated market value of property  $i$ , in which  $MV_i$  is the *true* market value of property  $i$  that cannot be known with certainty, and  $e_i$  represents the market value estimating error which is accounted for by:

$$e_i = r_e + d_e + m_e$$

where

- $r_e$  = the error due to random market factors
- $d_e$  = the error resulting from incorrect property descriptive data
- $m_e$  = the error introduced by the assessing official's estimating model

The  $[\sum_{i,j=1,m} (P_j + I_{ej})]$  term represents the sum of  $m$  preferential assessment adjustments for property  $i$ , where

- $P_j$  = the  $j$ th preferential assessment or exemption for property  $i$ , and
- $I_{ej}$  = the interpretation or error made in applying the  $j$ th  $P$  adjustment.

Without the  $[\sum_{i,j=1,m} (P_j + I_{ej})]$  component, the taxable value of each real property is straightforward and the accuracy of the market value estimate  $[M_i + e_i]$  is easily verified with widely employed standard statistical tests. Much of the academic literature including Case (1978) has focused on the process used to establish the market value,  $[M_i + e_i]$ , and very little attention has been paid to  $[\sum_{i,j=1,m} (P_j + I_{ej})]$ , the preferential assessment adjustment component.

To examine the fairness of the property tax, issues of horizontal equity, vertical equity, and regressivity must be considered. Horizontal equity is generally evaluated through the coefficient of dispersion (COD) that measures average deviation from the median assessment-sale price ratio. Lower coefficients indicate improved equity. Case (1978) used the COD to support his empirical findings that assessment methods must be improved.

In the final analysis, the question of property tax fairness comes down to whether a subject house is being taxed the same as all other houses in the same price range in its neighborhood, and whether higher-valued houses are paying proportionately higher taxes. This is the

ad valorem concept: it is a flat percentage tax on wealth as represented by real estate value. The purpose of the assessment process is simply to determine how the cost of operating the local government, as represented by the local budget, is shared (allocated) among property owners under Adam Smith's first criterion for taxation—equality of sacrifice (Smith 1776, 477).

The amount of an individual property tax bill is ultimately determined by the aggregate cost of providing local services and the operating efficiency of the local government unit. The technical assessing methodology reform called for by Case and many others has been accomplished during the past 30 years. Assessments are now reviewed and adjusted annually in many jurisdictions as recommended by Case, and assessors now have the tools to produce consistently accurate market value estimates (Moore 2006). However, during the 1950s, 1960s, and 1970s, many years would pass between reassessments and changes in assessed values (Martin 2003). When these practices changed with the modernization of the American assessment system, accompanied by the introduction of computer-based methods that could trace a rapidly inflating market, combined with the short-sightedness of local officials who took advantage of property tax revenue windfalls, a property tax revolt ensued. The changes enacted in response to property owner protests have, to some extent, nullified the improvements brought about by modern assessment technology. In many states, property tax equity is now worse than 80 years ago because of the unintended consequences of the tax revolts' so-called reforms (Moore 2008).

### Supply and Demand in House Value Theory

The following discussion addresses nominal valuation theory without consideration of the equity distortions introduced by legislated or imposed tax

reform adjustments made after the assessor determines a statistically valid market value estimate. Market value estimating models used for assessment represent both the supply and demand sides of the real estate market. Modern textbooks such as Thomas and Maurice (2005) provide a description of the generalized demand and supply functions as:

(4)

$$\text{Demand: } Q_d = f(P, M, P_R, T, P_e, N)$$

where  $f$  means *is a function of or depends on* and

$Q_d$  = quantity demanded of the good or service

$P$  = price of the good or service

$M$  = consumers' income (generally per capita)

$P_R$  = price of related goods or services

$T$  = taste patterns of consumers

$P_e$  = expected price of the good in some future period

$N$  = number of consumers in the market

(5)

$$\text{Supply: } Q_s = f(P, P_1, P_r, T, P_e, F)$$

$Q_s$  = quantity supplied of the good or service

$P$  = price of the good or service

$P_1$  = price of inputs used to produce the good

$P_r$  = prices of goods related to production

$T$  = level of available technology

$P_e$  = expectations of producers concerning the future price of the good

$F$  = number of firms (builders) or the productive capacity of the industry

These generalized demand and supply functions show how the variables jointly determine the quantity demanded and supplied (Thomas and Maurice 2005, 35–54). As applied to house value theory, long-run equilibrium occurs when  $Q_d = Q_s$ . If  $Q_s < Q_d$ , then supply cannot keep

pace with demand and home prices rise in proportion to the imbalance. This situation occurred from 2002 to mid-2006 when after the 2001 stock market bubble burst, investors turned to real estate. Fueled by an easy-credit environment that encouraged speculation, home prices toward the end of the boom were rising quickly (and seemingly irrationally). The real estate foreclosures during the 1930s depression as well as after the real estate collapse in 2007 created the opposite situation in which  $Q_s > Q_d$  and the excess supply forced real estate prices lower.

According to the assessment textbooks (Eckert 1990, 310; Gloudemans 1999, 78), the most basic valuation model is

(6)

$$MV = BV + LV$$

$MV$  is the estimated market value,  $BV$  is the estimated building value, and  $LV$  is the estimated land value. This simple linear model can be expanded to the form of Professor Case's model in equation 1,  $MV = P_1X_1 + \dots + P_mX_m + b_1N_1 + b_nN_n$ . The relationship was expressed by Eckert (1985) in a more generalized form:

(7)

$$MV = GQ \times \{(BQ \times BV) + (LQ \times LV)\}$$

where

$MV$  = estimated market value (most probable selling price)

$GQ$  = general qualitative variables

$BQ$  = building qualitative variables

$BV$  = building quantitative variables

$LQ$  = land qualitative variables

$LV$  = land quantitative variables

The qualitative variables in Eckert's model are, in fact, a form of Professor Case's quasi-rent factors. Eckert, who was the general editor of IAAO's 1990 appraisal and assessment textbook, offered a further refinement of the general model structure in that text (pp. 317–319). Parallels to Case's linear model as defined in equation 1 have been added in brackets.

(8)

$$MV = \pi GQ \times \{(\pi BQ \times \Sigma BA) + (\pi LQ \times \Sigma LA) + \Sigma OA\}$$

$\pi GQ$  = product of the general qualitative components

$\pi BQ$  = product of the building qualitative components

$\pi LQ$  = product of the land qualitative components [site  $\{S_i\}$  quasi-rents (in  $b_i N_i$ )]

$\Sigma BA$  = sum of the building additive components [structure costs  $P_i X_i$ ]

$\Sigma LA$  = sum of the land additive components [included in  $b_i N_i$ ]

$\Sigma OA$  = sum of other additive components [not considered by Case].

Case argued that a very significant portion of the overall housing bundle is made up of positive or negative quasi-rents associated with structural attributes that are durable (not easily changed) or returns on scarce neighborhood attributes that are a portion of the land value, such as location desirability (1978, 30). Of particular importance with respect to effective supply and demand within each submarket is the role of expectations. It is significant that the only variables contained in both the demand function  $Q_d$  in equation 5 and the supply function  $Q_s$  in equation 6 are  $P$ , the current price of the good, and  $P_e$ , the expected future price of the good. The expected future stream of rents is the entire basis of capital asset valuation.

Empirical research results reported by Case (1978, 60–63) showed that commonly used assessment manuals did not differentiate between market-produced (malleable) structural characteristics and characteristics that were difficult to add or remove from the house (non-malleable). Values of attributes that are less malleable often diverge from replacement costs as locational quasi-rents arise. The empirical evidence

reported by Case showed that 21 percent of the assessment error discovered was systematic and could be explained by inadequate valuation of neighborhood characteristics. Most of the remainder appeared to result from erroneous valuation of the nonmalleable features of the house. However, Case found that the single most significant contributor to poor assessment quality was infrequent reassessment (1978, 63–67), which is consistent with the recent findings of Martin (2003). Case's results showed that the COD rose 0.82 during each year between revaluations. In the concluding section of his empirical research, Case stated, "Significant improvements in assessing performance, even within the generally accepted assessing technology, can be achieved through more frequent updating and revaluations." (1978, 68–69) Given limited assessment office resources, a less labor-intensive computer-assisted methodology permits more frequent reassessment.

### Where Theory of Property Tax Capitalization Fails

The subject of property tax capitalization has received considerable attention in the literature. Case (1978) devoted an entire chapter to it. The traditional theory of property tax capitalization postulates that the tax causes the price of land to fall by the capitalized value of the tax. Considerable research, including that of Case, has shown that this assertion is questionable. Case presents a strong technical argument that housing capital adjusts slowly to tax rate changes and there is less substitutability than popular hedonic models might imply.

The entire theory of property tax capitalization assumes an equitably administered property tax system. This assumption fails for two reasons. At the time of Case's research, considerable evidence existed that assessments were not accurate and that long periods between reassessments were the norm. Much of this problem has been corrected by

subsequent advances in assessment methodology although some problems remain. The other cause is legislative changes to property tax administration to further social, economic, financial, or politically motivated goals. It is a new problem that has emerged since the time of Case's research (published in the same year that Proposition 13 was implemented in California) and it may have an even greater impact on property tax equity than poor assessment practices. By placing an arbitrary cap on assessed value, tax limitation measures such as Proposition 13 have the same effect as not performing reassessments, which Case identified as the most serious flaw in the assessment process in the early 1970s. Case summarized the impact of inaccurate assessments on tax capitalization theory with an example that applies equally well to the current problem of legislatively imposed inequity.

*Consider the case of a single under-assessed house. Presumably, when the house is sold in the market, the exchange price will be higher than the price of an identical properly assessed house by the present value of the unanticipated tax savings that will accrue to the buyer. The seller of the unit absconds with the entire savings. If the assessment is corrected at a later date, the buyers will have not only lost their tax savings but the unit depreciates [in the market] by the present value of that loss. Hence, the owner at the time of reform [assessment correction] pays the additional tax twice. (Case 1978, 77)*

Case's research involved considerable empirical study of tax capitalization and disclosed shortcomings of prior studies on the subject. However, the real value of Case's research was his technique and the secondary findings that were by-products of his core study. He pointed out that a very real problem in all the research was the possibility of significant omitted variables, which is also a fundamental problem facing AVM builders as well as data collection and storage for use in CAMA. His empirical studies

showed that a substantial number of neighborhood characteristics as well as structural characteristics are statistically significant in determining market value estimates for housing and land. These characteristics can be identified through spatial analysis. When omitted, their effects are attributed to related variables that happen to be included. An example is omission of relative crime rates. A high crime rate would likely make a neighborhood less attractive and result in lower house prices. At the same time, the higher crime rate could require a larger expenditure on law enforcement paid for with a higher tax rate, which, in turn, has its tax capitalization effect on the value of the housing capital stock.

Several challenges face the model builder when specifying a model for use in estimating market value of houses. First, it must be hypothesized that the market value of the house is a function of the physical characteristics of the house, the lot, and the neighborhood. Second, the model builder is limited to the variables that are available, and there may be important variables that are unobserved or omitted. Third, the house descriptive variables that do exist will contain a certain number of random data errors for both sold and unsold properties. Since the model specification and calibration uses data from sold properties, the model builder must ensure that the descriptive data were as accurate as possible at the time of the sale. Fourth, the model builder must recognize that randomness exists in market price formation for reasons, such as imperfect information, that were previously discussed. As a result, nobody can state an exact market value for a specific house because it is unknown and a probabilistic estimate of the mean of a price distribution is the best that can be offered. Finally, the model builder must address the potential problem of simultaneity. It is possible that the selling price and the large bundle of house characteristics are related in a way not accounted for in the model. For example, if buyers use

the existing assessed value as a reference during their search (which has become more widespread as assessment quality has steadily improved and Internet access to property records has made the process more convenient), they may overpay for houses that are overassessed relative to similar houses in the neighborhood. By the same token, sellers may receive less than they deserve as the exchange price if their property is underassessed. Accounting for this situation could be difficult and if it has existed for a considerable period, it could have generated a recursive function in the market price formulation of the neighborhood. Thus, the question becomes: should current assessed value be one of the independent variables?

### What Exactly is CAMA Modeling?

While the IAAO textbook defines a model for appraisal purposes as “a representation (in words or an equation) that explains the relationship between value or estimated sale price and variables representing supply and demand” (Glou-demans 1999, 382), a CAMA model is more properly called an automated valuation model (AVM). According to the IAAO standard, it is

*A mathematically based computer software program that produces an estimate of market value based on market analysis of location, market conditions, and real estate characteristics from information that was previously and separately collected. The distinguishing feature of an AVM is that it is an estimate of market value produced through mathematical modeling. Credibility of an AVM is dependent on the data used and the skills of the modeler producing the AVM. (IAAO 2003, 5)*

The four automated valuation model types most commonly used in mass appraisal are traditional cost (called scientific appraisal in the 1920s and early 1930s); adaptive estimation procedure (AEP), also known as feedback; multiple regression analysis (MRA); and the transportable cost-specified market model

(TCM), also called market-calibrated cost. The value estimate produced by any model is constrained by the errors introduced by random market factors and incorrect property descriptive data beyond the control of the model builder.

### The Assessment AVM

Substituting the terms in the general model structure of equation 8 with those influenced by the theory of the Case linear model of equation 1 gives

$$(9) \quad MV = \alpha_i l_i b_i N_i \times \{ \beta B \times (\sum r_N X_N + \sum C_M X_M) + (z_i S_i \times \sum LA) + \sum OA \}.$$

The  $\alpha_i l_i b_i N_i$  factor replaces  $\pi GQ$  in the general model structure. This term represents the spatial response surface location variable that accounts for the combination of general neighborhood attributes that are not site specific (schools, crime rate, street quality, maintenance, and the like), which Case defined as  $b_i N_i$ , as well as the geospatial factors  $\alpha_i l_i$ , first identified by von Thünen (1826). These factors are indicated for location value response surface analysis (LVRSA) in the mass appraisal textbook (Glou-demans 1999, 193–196). If geospatial capabilities are not available, this variable assumes a value of 1 and the remaining  $b_i N_i$  variable applies uniformly across the specifically delineated neighborhoods, potentially resulting in sharp value changes at neighborhood boundaries. Hence, a spatial response surface variable should produce more accurate value estimates.

Best practice suggests that neighborhoods should be carefully delineated in either case, but this is especially important if a spatial response surface variable is not used. Given geospatial capabilities, the neighborhood variable is not necessary and the  $\alpha_i l_i$  value is computed for each parcel using a technique such as kriging from geostatistics (originally developed for mineral exploration) or by geographically weighted regression (GWR) (Fotheringham, Brunsdon, and

Charlton 2002). The general technique can best be understood as a form of linear prediction. In kriging, a known maximum or minimum value point is selected for each market area and these points together with the nearby known market area value points are used in the algorithm to estimate the  $\alpha_i$  values, generating a value response surface of coefficients as a function of the  $x$  and  $y$  coordinates of each property. GWR employs a function of the  $x$  and  $y$  coordinates of each subject property, but is more sensitive to individual sale property characteristics as they relate to the subject property.

The  $\beta B$  factor replaces  $\pi BQ$ , the product of the building qualitative components, in the general model structure and is directly related to the joint interaction of the generalized demand function  $Q_d = f(P, M, P_r, T, P_e, N)$  and supply function  $Q_s = f(P, P_p, P_r, T, P_e, F)$  in the defined housing market. The supply and demand functions act primarily upon the structural attributes such as architectural style that, at any given point in time, satisfy  $T$ , the varying taste patterns of housing consumers. For this reason,  $\beta B$  acts upon the  $(\sum r_N X_N + \sum C_M X_M)$  term in the model to provide the building qualitative variable. The  $(\sum r_N X_N + \sum C_M X_M)$  term is separated into two terms to account for nonmalleable ( $N$ ) and malleable ( $M$ ) structural components. If the model builder believes that  $\beta B$  should be applied only to the nonmalleable structural components  $r_N X_N$ , as Case might argue, then  $\beta B = 1$  should be indicated for the malleable structural components  $C_M X_M$ .

The  $(\sum r_N X_N + \sum C_M X_M)$  term replaces  $\sum BA$  and is the sum of the building additive components in the general assessment model structure. As described in the Case linear model, each attribute's price  $P_i$  is made up of two components: a base price related to the construction cost and a quasi-rent, so that  $P_i = (C_i + r_i)$ . When a particular attribute is in fixed supply, and therefore nonmalleable, the entire return to that attribute

is quasi-rent  $r_i$  and thus  $C_i = 0$ . Hence, the construction cost for nonmalleable structural component  $X_N$  is immaterial. On the other hand, for an attribute that is reasonably easy to add, change, or remove and therefore can be considered malleable, construction cost  $C_i$ , adjusted for condition, approximates market value and  $r_i = 0$ . Therefore, the model has the construct  $\sum r_N X_N$  for nonmalleable structural components where  $C_i = 0$ , and  $\sum C_M X_M$  for malleable structural components where  $r_i = 0$ . Therefore, in each situation, one variable,  $C_i$  or  $r_i$ , is 0.

The  $z_i S_i$  factor replaces  $\pi LQ$ , the product of the land qualitative components, in the general assessment model structure. This term accounts for the quasi-rent  $z_i$  attributed to site variable  $S_i$  for unique positive or negative site characteristics such as view and other influences.  $\sum LA$ , as the sum of the land additive components, remains unchanged from the general assessment model structure. This factor is most easily described as the standard land valuation rates applied throughout the market area such as price per lot, per square foot, or per acre.  $\sum OA$  remains unchanged as well from the general assessment model structure as the sum of the other additive components in the TCM hedonic model. This term handles the structures and property features that are generally referred to as outbuildings and yard items in mass appraisal. They were not considered in Case's research, but must be given consideration in assessment work.

## Summary and Conclusion

This article has provided an overview of the history of appraisal and CAMA, the economic theory upon which valuation is based, the general concept of CAMA modeling, and a brief explanation of AVM construction. The evolution of appraisal and assessment theory and practice during the past 135 years was explored from the questioning of real estate valuation methods for taxation by Cochran in 1874 through the theoretical foundation for

appraisal provided by Marshall and the contributions of practitioners such as Zangerle, Mertzke, Prouty, Babcock, and Kniskern and scholars such as Bonbright, Wendt, Case, Boykin, and Ring, to the current teachings in textbooks from the Appraisal Institute and IAAO. Much of the relevant economic theory was found in the writings of early scholars, primarily economists, and, more recently, in the modeling work of Professor Karl Case of Wellesley College and Dr. Joseph Eckert and Robert Gloudemans for IAAO. However, recent research by Canonne and Macdonald (2003) which examined nearly 100 major real estate handbooks and real estate appraisal manuals published in North America since 1950 discovered that real estate appraisal literature now offers very little theoretical foundation, and provides even less discussion of the history of economic value or the evolution and history of current appraisal theory. IAAO and Appraisal Institute reference books give superficial attention to economic theory, and completely ignore the work of contemporary economists. For the appraisal field to advance from art to science and from trade to profession, a solid understanding of basic concepts, laws, principles of economic theory, and contemporary academic research must provide the foundation upon which appraisal-specific theory and practice is built. This article has endeavored to begin building that foundation.

### Further Questions for Discussion

Research seeks to answer questions, but in the process, new questions are discovered that need answers. Is the right data being collected? Exactly which structural attributes should be classified as malleable and which as nonmalleable? Should current assessed value be one of the independent variables? A broad selection of recently published and potentially applicable literature needs to be studied and evaluated from the perspective of property appraisal. One possibility is the research into accounting for tastes

conducted by Becker (1996) that studied the  $T$ = consumer taste patterns of the six demand function variables. Numerous other recent studies have looked at such elements as the relationship between zoning and house prices (Glaeser and Gyourko 2002), economics of real estate and land supply (Evans 2004), and the relationship between housing renovations and house prices (Portnov, Odish, and Fleishman 2005). All of this work has been done outside of the appraisal field by scholars interested in predicting housing transaction prices. Their research, however, has direct application to the appraisal process.

Another important question deserving research attention is the relative importance of the geospatial factor  $\alpha_i^l$ , the location value response surface factor in equation 9. When geospatial capabilities are not available, the  $\alpha_i^l$  variable assumes a value of 1 and the remaining  $b_i N_i$  variable applies uniformly across each specifically delineated neighborhood, potentially resulting in sharp changes in value estimates at neighborhood boundaries. Theoretically, a spatial response surface variable should produce more accurate value estimates, but does this happen in the real world? What is the quantitative impact on model performance when a spatial variable is applied to empirical data, compared to results produced with the same data but without the use of the spatial variable? In a future research study, the  $\alpha_i^l$  value should be computed for each parcel and then used in calculating the value estimate through kriging or geographically weighted regression. These results should then be compared to value estimates computed without using  $\alpha_i^l$ .

### The Challenges Ahead

Since the founding of the International Association of Assessing Officers 75 years ago, enormous progress has been made toward providing the education, tools, and methodology needed by assessors to produce the value estimation accuracy

and property tax equity envisioned when uniformity provisions were incorporated into the majority of state constitutions in the nineteenth century. At that time, the capabilities to administer that idealized property tax system did not exist. However, because of the vision and foresight of IAAO founders in 1934, and the efforts of its members since then, a fair and equitable property tax system can exist today.

In addition to the need for further refinement of mass appraisal techniques, the property tax system faces the new challenge created by the unintended consequences of ill-conceived reforms. In some places, these reforms have damaged tax equity to the point that the property tax system is less fair than it was a century ago when efficient tools for administering the system did not exist. Much education of the public and policymakers is needed in this regard. Perhaps it can be accomplished in time for IAAO's 100th anniversary celebration.

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## Appendix A. What is quasi-rent?

An easily understood explanation of economic rent and quasi-rent comes from Professor Bryan Caplan of George Mason University.

*There are many different meanings of the word “rent” in economics, but the number one modern usage is: “An earning in excess of opportunity cost.” A worker earning \$10 an hour, when their alternative on the open market is merely \$9, is considered to earn a \$1 per hour rent. (Why use the word “rent”? Well, it all goes back to Ricardo and other classical economists. Since the land is just “there,” they figured that from some point of view, the opportunity cost of land is zero. The term rent then got expanded to apply to anything “land-like”; i.e., any resource that is “just there,” which will exist whether or not it is paid.) The general assumption is that rents are just useless inefficiencies. They are basically just like the government granting a monopoly on salt; the price of salt then exceeds its opportunity cost, and for no good reason.*

*A quasi-rent is different. It LOOKS a lot like a normal rent; from a superficial viewpoint, it is a reward paid to a factor which exceeds its opportunity cost. But if you look deeper, you see that in fact, the rent is a necessary incentive for something. For example, a patent looks a lot like a monopoly salt grant on the surface. The pricing policies of the patent-holder and the salt-monopolist look a lot alike. But the crucial difference is that the patent-holder had to do something to GET the rent; he had to develop a new product. In the long run, no industry can earn more than the normal rate of return, so the effect of the patent is just to get more people to try to invent products; enough people so that inventing things earns the same average rate of return as anything else.*

*What do quasi-rents compensate for? The obvious example is innovation. Other good candidates include search (a worker*

*earns more money because looking around for better jobs takes effort which must be compensated). Also—quasi-rents may be paid for product variety. When products are heterogeneous, there is room to charge a little above opportunity cost; but the incentive effect of this “breathing space” is to encourage the satisfaction of consumers’ diverse tastes. (Caplan 2006)*

Professor Caplan’s examples can be translated directly to the economic discussion about the theory of housing prices. A home buyer is compensated with positive quasi-rent for conducting a diligent search and gathering extensive market information prior to making a purchase decision. A developer is compensated with positive quasi-rent for the creative design and ingenuity that were required to make a new subdivision heterogeneous by giving each street and each home the appearance of uniqueness (Morrow-Jones, Irwin, and Roe 2004). On the other hand, an identical subdivision in another community with lower-quality schools, as indicated by proficiency test scores, will suffer lower home values (Haurin and Brasington, 1996; Fischel 2001). This example illustrates a negative market-area quasi-rent attribute not related to the specific characteristics of a particular home. A recent study of 28,828 home sales found that certain improvements such as a mother-in-law suite, a professional office, or fencing reduced the selling price by as much as 5.2 percent (Lang 2005). These features are examples of property-specific negative quasi-rents.

Satisfaction of home consumers’ diverse tastes causes demand for certain home styles, floor plans, and architectural features to vary through time, resulting in negative quasi-rent for out-of-fashion styles and positive quasi-rent for those in demand. This is one of several reasons why frequent reassessment is important.

