

JAMES A. GRAASKAMP COLLECTION OF TEACHING MATERIALS

VII. INDUSTRY EDUCATIONAL COURSES - LONG TERM

A. EDUCARE

9. Published Articles and Newspaper Clippings
about EDUCARE

EDUCARE Course I, a product of the corporation that is jointly sponsored by the Society of Real Estate Appraisers, the American Society of Real Estate Counselors, and the American Institute of Real Estate Appraisers, helps the appraiser in several ways, according to Professors Graaskamp and Knitter.

"Computer power simply places comprehensive information and data processing methods in the appraisal office with a quality and at a cost which overwhelmingly favor the appraiser," they state.

"On the first day, Course I teaches the student to sign on and off the system via telephone-handly time sharing system, and to gain access to the library of programs freely available on the General Electric Mark-II System from almost any point in the United States.

"On the second day the program proceeds to teach both statistics and terminal use of statistical programming, as well as the process of building property sales files for use of an automated market comparison system. EDUCARE presumes no particular knowledge of algebra and assists the appraiser to use techniques that he has feared to try because his mathematics might betray him.

"On the third day EDUCARE teaches both modern capital budget theory and the use of internal rate of return programs, cash flow investment programs, and a valuation program designed for appraisers by M. B. Hodges, Jr., SRA, MAI, and Thomas Prince.

"On the fourth day EDUCARE introduces several sophisticated services for real estate analysis such as Realmetrics and Omnimetrics, plus current developments in cost estimating, property management accounting, aerial photography and model building.

"On the fifth and last day of the program, the dollar costs of terminal rental and usage are presented, together with discussion of equipment choices, the appropriate application of electronic calculators, and new developments in hardware which will reduce further the cost and expand the applications of time-sharing techniques in the next few years."

Some other common questions about the course are answered by Professors Graaskamp and Knitter, as follows:

Must one be a programmer to attend or appreciate EDUCARE? It is unnecessary to know programming to use a terminal to advantage, and Course I will in no way prepare its attendees to be programmers.

Will the course teach nothing but computer usage? Within 30 minutes of the start of class on Sunday night, the student will be doing Ellwood complete with the J factor and more points for the Ellwood chart than he may be prepared to graph. Course I necessarily introduces modern theory of capital finance before introducing cash flow models and demonstrates statistical theory, information process and other subjects before showing quick and easy ways to execute these techniques.

Why is Course I so expensive? In paying \$475 for a one-week course, the student should remember that the price includes room and board, and the expensive cost of technical support. With at least one teletype and one telephone line for every two students and computer time for each student, the cost amounts to \$100 per student despite educational discounts. Including the staff and lab instructors, the costs are substantial enough to require 25 students to break even.

What benefits and help result after the course? Computer time-sharing services are available throughout the country through a host of computer time-sharing vendors. An attendee at an EDUCARE course has exclusive access to all of the programs of a newly-formed subsidiary of EDUCARE and of G. E. Mark II. The G. E. programs are available without the corporation's usual \$100 minimum charge. The EDUCARE Computer Network system offers a number of programs which are typically used by appraisal offices but not always available from other vendors—for example the complete Ellwood model. Several cash-flow models, a market comparison model, some basic statistical linear regression models and others are available.

appraisal briefs

WEEKLY NEWSLETTER OF THE SOCIETY OF REAL ESTATE APPRAISERS

Convinced Registrants Hail EDUCARE Course As Source of Progress

Reactions to EDUCARE Course 1 by the capacity enrollment at the final 1972 presentation suggest that this program may have an unprecedented impact on the appraisal and counseling professions.

"I don't know anywhere that the superstitions of the profession are broken as logically as here," Joseph W. Marshall, ASA, president of Marshall and Swift of Los Angeles commented. "The whole profession is to be congratulated for sponsoring this very forward-looking program. This is exactly what our profession needs—a multi-disciplinary view of all that affects our field."

"I'm a believer," said Edward F. Heberger, SRPA, MAI, of Bristol, Connecticut. "We try to be progressive in our office, and while I am here at the EDUCARE course, my partner is at the Society's 301 Course in Maryland. These are the places the profession can go now to get the most important information currently available."

"Several years down the road, I think the one-man office will be obsolete, except in rare cases," Mr. Heberger added. "Once an appraiser comes here and learns this system well, he can train someone in his office to do the basic input. One of the great things about the Course is Dr. (James) Graaskamp's insight into the future of the profession—and his realization that appraisers have to learn these things or others will take over their functions. The members of our profession who are progressive *have to come here.*"

"This is really a good Course in which to understand the transition from the old traditional approaches to the new," said Ralph A. Pifari, SRPA, MAI, of Boise, Idaho. "It bridges that gap, and does the additional important thing for the appraiser of building his image of staying abreast of the latest that is going on in the profession. Though the immediate application to his practice might be somewhat limited, these techniques will be

(Continued on page 4)

Additional Information Urgently Needed For Expanded '73 Directory of Members

A much expanded Directory of Designated Members will be published by the Society of Real Estate Appraisers in 1973, and the cooperation of the members is urgently requested to accomplish this upgrading of the Directory service.

The members title, business and home addresses and telephone numbers, typically will be included.

Cards have been mailed to each designated member to obtain the additional information needed for 1973 listings, and they should be returned by November 1, 1972, in order to assure both a complete listing and an earlier publication date for the Directory.

The Society's Directory automatically is provided to several thousand users of appraisal services, and is available for purchase by members to provide to clients and other interested parties.

EDUCARE Schedules 6 Courses in 1973

A growing appreciation for the quality and practical benefit of the courses of the Educational Foundation for Computer Applications in the Real Estate Industry, Inc. (EDUCARE) indicates a considerable interest in the six 1973 courses that recently have been announced by the co-sponsors.

The Society of Real Estate Appraisers is a sponsor of the University of Wisconsin (Madison) program, along with the American Society of Real Estate Counselors and the American Institute of Real Estate Appraisers.

EDUCARE courses have two objectives: first, to provide primary training in the use to the appraisal and counseling office and application of a time-sharing computer terminal; and secondly, to suggest the potential of the computer terminal to reshape the practice of real estate over the next decade.

Registration is limited to 30 per course, and the \$375 fee includes "hands on" computer terminal training time, and instruction by a staff of 10 professors and teaching assistants at Wisconsin's School of Business. The courses are held at the new Lowell Hall Conference Center, where a single room with meals costs an additional \$100.

To be eligible, a registrant must have earned either the SRA, SRPA, SREA, MAI or CRE professional designation, *or be sponsored by an employer who is so certified.*

The EDUCARE Course schedule for 1973 is as follows:

- | | |
|------------------------|------------------------------|
| 1. February 4-9 | 4. April 8-April 13 |
| 2. February 25-March 2 | 5. September 16-September 21 |
| 3. March 25-March 30 | 6. October 7-October 12. |

A registration form, to be returned to the University of Wisconsin is provided on page 3.

Market Data Center's Total Membership Grew Over 100% Last Year

An increase of more than 100% in the total membership of the SREA Market Data Center marked the period ending July 15, 1972, according to the Center's President, Joseph A. Nowicki of Chicago.

The figures for Class B members increased from 282 to 516 on a year-to-year basis, while the number of Class C members went from 316 to 707 in the same period.

Established nationally in 1968, the Market Data Center has demonstrated an exceptional rate of growth as a source of market data to subscribers. Eighteen centers now are in operation with the recent activation of centers in Philadelphia,, New York City and North Carolina.

The most important expansion of the Center's program will occur around the first of the year 1973 with the national publication of data on industrial and commercial properties.

The Center's growth is indicated by the following figures, presented to the Center's Board of Directors at the recent meeting in San Francisco:

PAID MEMBERSHIP MEMBERSHIP CLASS

Period Ending	B	C	Cumulative B & C
12-31-69	291*	172	463
7-31-70	371*	264	635
1-31-71	259	245	504
6-30-71	282	316	598
1-15-72	426**	548	974
7-15-72	516**	707	1,223

* Includes lessee members.

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** Includes all members of the California Corporation, SREA Market Data Center, Inc. These members transferred to Illinois Corp., SREA Market Data Center, Inc. July 1, 1971

News Briefs

SEC Head Demands Better Information on Risk

The sales literature of real estate syndicators usually omits the more significant information needed to assess the investment risk and the sponsor's profits, William J. Casey the Chairman of the Securities and Exchange Commission recently charged.

"Uniform standards for disclosure and analysis must be developed and the complications must be simplified to allow an informed investment decision in a product which is commonly being offered to the public," Mr. Casey said. "Without such an approach, disillusionment will again set in and the real estate limited partnership security will fade away for another 30 years. We're all too old to wait for the cycle to bring it back again."

Mr. Casey's warning would seem to be a call for the syndicators to use objective appraisals and analyses of the investments they were offering. "More often than not, the sales literature contains optimistic projections of the economic return anticipated from the investment without disclosing the assumptions on which the projections are made," he said.

"Real estate syndicators should be aware of the considerable liability they risk by the use of such literature," he warned.

Magazine Warns Condominium Buyers on Pitfalls

"Don't bank too heavily on rental income to help finance your unit," *Business Week* warns purchasers of condominiums, in resort areas.

"You may be able to rent it in the winter—and even take depreciation on it for that part of the year. But finding suitable tenants in the summer may not be all that easy. Some communities will help you find tenants, but others will positively discourage it. Renters don't care what happens and this can run down the property in a hurry."

It is also essential to evaluate properly the size of the rental market, *Business Week* says. "Obviously, as more and more condominiums are built in an area, it becomes harder and harder to find desirable tenants."

The generally negative report on condominiums advised that vocal minorities could push through assessments for extras that might be excessive or hold down assessments to a point that the property begins to deteriorate, or hire a management firm that does not maintain the property adequately. "I recommend that anyone buying a condominium get an attorney," the head of the Florida Condominium Commission told the magazine.

Registrants' Reactions to EDUCARE



(Cont.)

useful on the more important assignments, and will become increasingly important in the near future."

Mitchell R. Shell, SRPA, MAI, of Manassas, Virginia, observed that "Some of this has been around for years, but appraisers have ignored it. I don't think they can anymore. These techniques are not hard to understand, though they are hard to program. However, you have technical

people to do that for you. And the cost of using this equipment is very reasonable. We had an example today of a \$2,000 appraisal report that only required about \$25 of computer-related cost. If appraisers don't learn these techniques, mortgage bankers and others will supply the services we now are called upon to supply."

**appraisal
briefs**

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NEWSPAPER TREATMENT

Business Wisconsin State Journal Finance

SUNDAY, MARCH 4, 1973

SECTION 2, PAGE 1

Realtors Learn Computer Use to Ask New Kinds of Questions

By ROGER A. GRIBBLE
Of The State Journal Staff

At the University of Wisconsin School of Business, realtors are learning to use computers to ask new kinds of questions.

Through a series of seminars, they're getting first-hand experience in the mechanics of computer terminal use and learning to use them creatively in their business.

"UNLIKE OTHER professions such as engineering, where computers are used to do things faster, the real estate profession isn't doing anything worth doing on a computer," contends Real Estate Prof. James Graaskamp.

"We have to suggest, 'Here is a tool,' and provide examples of how to use it," adds Graaskamp, one of the two professors teaching the seminar.

The week-long seminars, one of which is now in progress at Lowell Hall, are conducted in a workshop-lab kind of setting. Participants get first-hand experience by actually using the 15 computer terminals and specialty terminals.

"We teach for a half-hour and they then use the computers," Graaskamp explained. "Then we critique their use."

"THE REAL estate profession gets paid for time, so when people take time off, they lose time and pay," Graaskamp notes. "Because of that, we feel that for a majority of the time we should work on very practical techniques."

In the real estate profession, computers can be used for



FIRST-HAND EXPERIENCE — William Forrest of Dallas, Tex., right, gets first-hand experience at a computer terminal which he can put to use in his real estate practice. Prof. Robert Knitter, left, director of the

such things as on tax assessments, land use studies, and the determination of consumer behavior.

"The number of questions being asked of the real estate

amount of data available to the profession has exploded. You have to edit it and use it professionally, are expanding," says Graaskamp. "Also, the

School of Business Data Processing Center, offers some practical advice. Alan Hayes, center, a program coordinator, also assists in the instruction.

—State Journal Photo

THE SEMINARS, six of which are scheduled this year, are sponsored jointly by the American Institute of Real Estate Appraisers, the Society of Real Estate Ap-

praisers, and the Society of Real Estate Counselors.

In 1970, the three organizations banded together to form the Educational Foundation for Computer Applications in the Real Estate Industry (EDUCARE), a non-profit corporation.

According to the foundation's by-laws, one of its purposes is "the improvement of the real estate profession through the study of and research in the application of modern developments and technology to real estate practice."

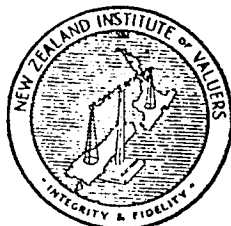
EDUCARE has established a computer network which provides minimum cost access to its continually-expanding library of programs. Realtors completing the seminar are eligible to subscribe its services.

GRAASKAMP estimates that about 65 firms in the nation are now on the computer terminals, with four-fifths of them using them regularly.

The three organizations in EDUCARE got together to provide the capital for the seminars, which are a joint venture of the School of Business, UW Extension, and EDUCARE.

"With the revolution in information," Graaskamp said, "we need to find new models to focus on the information the profession is being asked."

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EDUCARE

THE SHAPE OF THINGS TO COME

by Rodney L. Jefferies, Dip. Urb. Val, B.C.A., A.N.Z.I.V.

INTRODUCTION:

"It is not a question of **whether** this (computer) will ever be appropriate to real estate, it is now only a question of whether you will use it **now** or wait till 1975 or 1976. The question is **no longer will** it be useful—the question is only a matter of when you are going to adapt. Some may never adapt—but anybody under the age of 35 will be obsolete by the time he is 45, unless he does adapt."

This quote from Professor James A. Graaskamp PHD, CRE, CPCU, which I recorded during the opening Sunday evening session of an Educare I Course at The School of Business, University of Wisconsin, sums up the basic thesis of and reason for attending this week long intensive course, in September of this year.

EDUCARE (Educational Foundation For Computer Applications In The Real Estate Industry, Inc.) is jointly sponsored by The American Institute of Real Estate Appraisers, the Society of Real Estate Appraisers, and the Society of Real Estate Counselors. It has established a number of real estate computer programs in its library, available through the General Electric International Time-Sharing Network, requiring only a telephone, an "acoustic coupler", and a teletype terminal in an appraiser's office to operate these modern appraisal techniques.

The Educare I Course, run by the Foundation, has two objectives: First it provides primary training in the use and applications of a time-sharing computer to the appraisal and counseling office. Secondly, it suggests the potential of the computer terminal to reshape the practice of real estate over the next decade so that professionals can begin to modify their educational policies, programs, and accreditation standards in their professional organisations

The Course:

To a "Kiwi" attending this course, I considered they did a fine and efficient job achieving the first objective—but alas the G.E. Network is not (yet) available in New Zealand. Also, because of our differing real estate tax, depreciation, and financing methods, some programs would need significant rewriting to be applicable here. The second objective, for me, had the most impact, as it is in

This Article replaces the normal Editorial Comment appearing in this Journal, as the writer attended an Educare Course at the University of Wisconsin during 16/21 September 1973. A grant of \$200.00 from the N.Z.I.V. towards the cost of attending was made, one of the conditions being that an article be published giving views on the value of such courses to a New Zealand valuer and the possibility of applying any of the techniques or theories to New Zealand practice.

this very area of reshaping our valuation methods, and adapting ourselves to utilise the potentials of the computer, that I am sure attendance at this course will prove beneficial. To me it was a walk into the future, to see in very practical terms the areas in valuation methods, and potential applications in investment analysis, which the computer will revolutionise. Provided we do the research and educational training to prepare the profession for the time (which is fast approaching) when the technical means, through over the phone time-sharing computers, becomes economically viable, we here in New Zealand will see computer power placing comprehensive information and data processing methods at the disposal of the small private valuing office. Computers are not just for mass appraisal government use. In fact, Educare 1 dealt solely with applications suitable for the one, two, or three man band or small office set up. It did not take many hours at this course to put kaput to many of my pre-conceived ideas about the potentials for computers.

Because of the heavy concentration of "hands on terminal training", the courses are limited to 30 registrants, although for various reasons, only 21 were at the course I attended. There were 12 terminals and separate phone lines in the teaching lab, and instruction consisted of a fast moving pace of alternating lecture followed by on-line terminal exercising, running the various "programs". There were four main lecturers, and numerous teaching assistants while on the terminals. Teaching methods included a good mix of films, audiovisual slides, as well as long highly sophisticated and absorbing lectures by Professor Graaskamp. Fortunately I recorded these on cassette tape for later reabsorption. A large and detailed instruction and course material manual was given to us, and there was not time to read it! On-line terminal, training was exciting and a learn as you go process. No programming tuition was given, or necessary, as many programs were of a "conversational type", where the computer typed out brief and often coded questions, to which the user was expected to respond by typing in the requested data or items. A faster method employed in the later part of the course was to prepare a "file" of the input data (i.e. costs, rents, expenses, rates of return, time periods, tax rates, etc.) for the project, to be run on a program. This was prepared on the teletype on paper tape, and fed into the computer at the maximum speed of the teletype terminal once "on-line", significantly reducing connect time and thus the cost components of a time-sharing system.

Course Outline:

It is not possible to give details of the various programmes run during the course, but a brief outline of the activities of the week will give some idea of the ground covered.

The course started on a Sunday evening with introductory sessions by the principal lecturers, Bob Knitter and Prof. James Graaskamp, covering an outline of the course, followed by running a conversational programme called P.V. ELWOOD. This program gave a valuation (and tables of proof) based on the Elwood mortgage-equity method. Also we ran a programme SIGNIN, where we all recorded our names, address, etc., in an amusing talk-back type program. I fed in some data on a commercial property that I'd recently valued, on the P.V. ELWOOD program and was surprised at how this program could be used for New Zealand situations. It is, however, one of the least sophisticated programs and subject to constraints which limit its usefulness. The evening concluded with a lecture on the limitations of the Elwood Method and the challenge of the computer to the appraisal business.

Monday brought some hard work on the computer terminal learning the mechanics of ringing in, getting on-line, learning to feed in data, correct mistakes, preparing a "file", etc. We ran a number of practice programs especially prepared for training purposes and during the day I made up some conversational programs of my own, one being a very simple program for determining the capital value of a proposed office building by putting in the gross floor area, efficiency ratio, expected rentals, expense ratios, and nett capitalisation rates. These exercises gave us some confidence in the computer and how to handle data. The day concluded with a long evening lecture on investment analysis and Capital Budgeting Theory including discussions of internal rates of return and including running a program called RATES, determining the internal rate of return from any series of inputs and outputs over a future period. This was a kind of sophisticated discount cash flow program. Tuesday was dealing mainly with Cash Flows and running various programs such as MINIMOD (an investment analysis cash flow program on a before and after tax basis); T.A.P. (after tax equity yield program determining investment market value of an income property); A.I.P. (An Income Property Analysis Program providing a cash flow analysis, loan summary, depreciation summary, loan amortization schedule, cash flows and financial analysis on Income properties); and other sophisticated programs.

Wednesday started with a lecture on statistics starting from the simplest of discussions of averages and modes progressing to an understanding of multi linear regression. We then ran programs used in market comparison valuation techniques including a program specially compiled by Educare called MKT-COMP (a market comparison program in which an appraiser can combine his insight, experience and judgment with a semi-automatic, mathematical technique in order to arrive at market values from a set of comparable sales). This program, without any need for adaption, could be used by a valuer under New Zealand conditions. The day concluded with a lecture on the manipulation of market data and the application of computer programs in this field.

Thursday saw us being introduced to some new techniques, some still in the laboratory stage and we had an introduction to the applications of the computer in land use planning, feasibility analysis, and environmental impact studies.

On the last day came the soft sell on the dollar costs of terminal rental and usage as available throughout the United States by becoming a member of the Educare Computer Network whereby a subscriber can have the benefits of the computer service in his own office. The low dollar costs of terminal rental and usage were presented together with discussion of equipment choices, the appropriate application of electronic calculators, and new developments in hardware which will further reduce costs and expand the application of time-sharing techniques in the next few years particularly as related to the United States scene.

Technical Feasibility for New Zealand:

The question I which must answer now is to what extent does the computer have potential for application in New Zealand. I restrict this to consideration of non-government use. The main current restraint on the potential for application in our Country is the non-availability of on-line computer services as are provided as user/pay utilities in the U.S.A. A very large market is required to support these facilities and in fact the whole of the United States under the G.E. Network is tied in to one centralised computer. It is probable that as

computers become smaller in size and of greater storage capacity, we may find a New Zealand or TransTasman time-sharing computer facility becoming available in the future. The most likely application in New Zealand in the next few years would be by buying time on a computer operated by a Bureau, but this would not be available over the phone. It is technically feasible for a New Zealander to use the G.E. Network by putting a toll call through to the nearest terminal which is in Honolulu but the costs of the toll call would make its use prohibitive.

Practical Applications:

A number of the programs available through the Educare Network would not be applicable here due to the differing tax laws in particular, though a number of them could be used with some modifications. Ideally, we need our own indigenous applications, programs written for New Zealand conditions of finance, depreciation methods, and tax situations. Some of the statistical programs would be quite useful without modification.

This brings us back to the old need for indigenous research followed by education of valuers in new methods on the local scene. I consider that in the future there will be a need to have a greater emphasis on statistics and quantitative methods in the valuers education, to give an understanding of what processes are involved in such modern methods as Multiple Regression Analysis. I see this as essentially a post-qualifying education initially, which may ultimately become part and parcel of a valuers normal education as these new methods become accepted over time. As to timing, I would see the research work for these methods and applications to be made over the next five years and within 10 years the mystique will have disappeared and valuers will frequently be using these new techniques and tools. It is dangerous to say humbug to these ideas and sweep them aside as being the product of ivory towered people who have crazy ideas about the future. I might agree that at present we have little client demand for the services which valuers can provide through the application of these modern techniques but this is just a communications problem. If the doctors had waited until the patients asked for penicillin then penicillin would probably never have been discovered. Ralph Nader made a significant point in stating that to him the most important single function of a profession is to have the ability to pioneer new policies that are not brought into effect by market incentives and to introduce better ways of doing things before the customer has necessarily asked for them.

The Value of attending EDUCARE 1:

As to the usefulness of a New Zealander attending such a course as Educare, I consider that to me personally it was and will be most rewarding. I treat the cost of attending (the course fees and accommodation alone for the week amounting to \$580.00 plus travel), a high but worthwhile investment. As for other New Zealanders, I would say that it would be well worthwhile if they could see their way clear to having access to computer time and programing assistance in New Zealand, on their return, to put the knowledge gained into research and development of New Zealand programs. A knowledge of programing or statistics is not a pre-requisite to attending, but some knowledge of these fields would assist in being able to pilot applications in New Zealand and get more out of the course as well as being able to talk to and learn from the instructors and those who developed the Educare Library.

The travel costs merely to attend this course and not combined with any other study or travel, would probably be so expensive as to be unwarranted. I was fortunate in being able to study appraisal methods in Philadelphia, New York, and Chicago as well as attend the Pan-Pacific Congress in San Francisco. There are a number of other courses mainly of two weeks duration which cover a wide range of real estate appraisal techniques and practices offered by both the American Institute of Real Estate Appraisers and the Society of Real Estate Appraisers which could well warrant attendance by New Zealanders either separately or possibly in conjunction with attendance at an Educare Course.

RESULTS OF EDUCATION

"Perhaps the most valuable result of all education is the ability to make yourself do the thing you have to, when it ought to be done, whether you like it or not . . . however early a man's training begins, it is probable the last lesson that he learns thoroughly."—Thomas Henry Huxley.

Adjusting Land Comparables for Size Variation: Another EDUCARE Application

by Theodore Reynolds Smith

INTRODUCTION

Appraisers are fortunate to have several professional educational opportunities of which they may avail themselves to learn more about new technological developments in their field. The most renowned of these professional educational efforts is the EDUCARE course, sponsored jointly by the American Institute of Real Estate Appraisers, the American Society of Real Estate Counselors, and the Society of Real Estate Appraisers. The majority of appraisers who are presently using a time-sharing mode of computer assistance in their offices have participated in EDUCARE and possess access to the EDUCARE network.

One of many options available to the EDUCARE user is the complete library of statistical routines on the General Electric computer system. We have attempted to demonstrate in the following example one in-

This paper is based on a presentation by the author before the 7th Annual Pan Pacific Congress, September, 1973, San Francisco, California.

The author would like to express his appreciation to the Lincoln Foundation for support of his research into land valuation techniques.

Theodore Reynolds Smith is a Research Associate at the International Tax Program, Harvard University Law School, Cambridge, Massachusetts. He received his A.B. and M.A. degrees in International Relations from the University of Southern California, and Ph.D. degree in Economics from the Claremont Graduate School. A former real property appraiser with the State of California Departments of Investments and Water Resources, Mr. Smith is currently a candidate for the MAI designation of the Institute.

stance where the appraiser may utilize this wealth of analytic capability available to him when he undertakes the adjustment of comparable sales as part of a land valuation assignment.

THE PROBLEM

A major problem confronting the appraiser when valuing suburban acreage is the comparison of parcels comprised of varying sizes. It is seldom that he encounters uniform parcel sizes when appraising land at the urban fringe, or for that matter, land in general. Table 1 depicts 12 acreage sales which are similar in all respects with the exception of the number of acres included in the transaction. Prices per acre range from \$450 for 45 acres to \$3,000 for three acres. The experienced appraiser is aware that the wholesale discount for land sales (negative plottage) tends to increase as parcel size increases, but not on a directly proportional or linear basis. The difficulty which he must deal with is that the discount for purchasing more acres at one time is not what statisticians would term a "linear function" of size. In other words, the appraiser cannot merely reduce the price per acre by a constant dollar amount based upon the number of acres comprising the sale.

Table 1
SUMMARY OF ACREAGE SALES

Sale Number	Number of Acres	Price per Acre
1	3	\$3,000
2	3	2,600
3	6	2,500
4	14	1,700
5	45	450
6	30	700
7	17	1,300
8	23	1,200
9	4	2,500
10	8	2,000
11	30	500
12	26	1,100

CREATION OF THE FILE

Based upon our previous experience with acreage sales, we decided to explore the relationship between price per acre and total number of acres through the use of our time-sharing terminal and the EDUCARE system. As a preliminary step, we prepared a paper tape which included the information summarized in Table 1 with respect to price per acre and parcel size. We instructed the computer that the price per acre is dependent upon parcel size; therefore, the price becomes the dependent variable and the parcel size becomes the independent variable.

Table 2 depicts the procedure followed once we gained access to the computer network through our EDUCARE user number. Our first step was to create a file which we termed LAND. This new file is established by informing the computer of its creation by typing NEW LAND. After the computer accepts this instruction and informs the user that it is READY, it is instructed that a TAPE will be used to enter the data file. The computer once again responds that it has accepted the command and is READY. Table 2 shows that the data were entered into the computer and the file was saved.

Table 2

```
NEW LAND

READY
TAPE
READY

100 3000,2600,2500,1700,450,700,1300,1200,2500,2000,500,1100

200 3,3,6,14,45,30,17,23,4,8,30,26
SAVE

READY
OLD STATSYST***

READY
RUN

STATSYST 14:38CDT 01/25/74

VERSION 14 JAN 74-LIST STATINF*** FOR UPDATES

READY
?READ(PRICE,ACRES)FROM LAND BY VARIABLE

ENTER NO. OF CASES/VARIABLE FOR DATA BEING READ?12
```

THE STATISTICAL SYSTEM

Once the file is established, we instruct the computer that we would like to use the General Electric package of statistical analysis programs. The existing statistical system is accessed by typing OLD STATSYST***. The computer accepts this command and is instructed to RUN. After the computer replies that the statistical system is READY for use, we must instruct the computer to go to its storage area and bring forth the LAND file which we created previously. Up to this point we have named only the file and not the two variables. The variables are named at the time the computer is instructed to READ (PRICE, ACRES) FROM LAND.

The first data entered in line 100 was our price per acre, while the data entered in line 200 was the corresponding parcel size in acres for each sale. The first entry for sale price and the first entry for parcel size should be a matched pair (i.e., data from the same sale), just as the remaining data should be matched pairs.

We have instructed the computer to read the data from our file BY VARIABLE. This means it reads all information from one variable first, and then reads all of the information from the second variable. Because the computer reads continuously without stopping, it must be told where the first variable ends and the second variable starts. This is accomplished by answering the question: ENTER NO. OF CASES/VARIABLE FOR DATA BEING READ? Because we have 12 sales in the present example, we responded that there were 12 cases for each variable.

FITTING AN EQUATION

Once the file has been brought from storage and the variables named, we can instruct the computer to run one of the many programs available in the statistical systems package. Because our intention was to explore the relationship between price per acre and the parcel size, we decided to run a statistical program which fits six separate curves to the sales data and then informs us how well each of the six estimated equations fits. In other words, the program provides us with six equations which may be used to estimate sale price based upon parcel size. If price is calculated for a series of possible acreage sizes, we would be able to plot a line on a graph. At a later point, we will, in fact, calculate such a graph relating estimated sale prices with actual sale prices per acre.

The program we select is termed CURVILINEAR-FIT, and it has been instructed to run at the top of Table 3, using the variables PRICE and ACRES. The first thing the computer informs us is that price has been entered as the dependent variable, or Y, and acres have been entered as the independent variable, or X.

FLOATING POINT NUMBERS

Our second element of output is the mean (average) value for X (acres) and Y (price). For the purpose of internal economy of operation, the computer prints its numerical responses using a "floating point" system. Thus, the mean value of X may appear strange at first glance, in that it reads 1.741667E+01. Most of us will not have any trouble with the 1.741667 portion of the number; it is the E+01 which no doubt creates a problem. The E tells us we are dealing with a floating decimal point. Under these conditions, the decimal point always will be initially printed one place to the right of the first digit (as we read the number from left to right); just as in this case, it came after the 1 and before the 7 in 1.741667.

Table 3

READY
?RUN CURVILINEAR-FIT (PRICE,ACRES)

Y VARIABLE: PRICE
X VARIABLE: ACRES

XMEAN: 1.741667E+01 YMEAN: 1.629167E+03

NUMBER	CURVE	INDEX	A	B
1	$Y=A+B \cdot X$	0.89680	2.70721E+03	-6.18970E+01
2	$Y=A \cdot \text{EXP}(B \cdot X)$	0.93759	3.10707E+03	-4.68996E-02
3	$Y=A \cdot (X \uparrow B)$	0.86010	6.56999E+03	-6.27739E-01
4	$Y=A+(B/X)$	0.82676	7.72331E+02	6.81194E+03
5	$Y=1/(A+B \cdot X)$	0.86763	1.20821E-04	4.45875E-15
6	$Y=X/(A \cdot X+B)$	0.45178	1.36126E-03	-3.68783E-03

FOR WHICH CURVE ARE DETAILS DESIRED (NUMBER OR DONE) ?2

COEFFICIENTS:

	EXPECTED VALUE	95 PCT CONFIDENCE LIMITS	
A:	3.10707E+03	2.58127E+03	3.73997E+03
B:	-4.68996E-02	-5.54445E-02	-3.83546E-02

TYPE 1 FOR CONFIDENCE LIMITS ON ESTIMATED Y,
OR 2 FOR PREDICTION LIMITS ON OBSERVATIONS OF Y.
WHICH ?1

X-ACTUAL	Y-ACTUAL	Y-ESTIM	95 PCT CONFIDENCE LIMITS	
3.00000E+00	3.00000E+03	2.69927E+03	2.28749E+03	3.18518E+03
3.00000E+00	2.60000E+03	2.69927E+03	2.28749E+03	3.18518E+03
6.00000E+00	2.50000E+03	2.34499E+03	2.02351E+03	2.71755E+03
1.40000E+01	1.70000E+03	1.61137E+03	1.43726E+03	1.80658E+03
4.50000E+01	4.50000E+02	3.76514E+02	2.90213E+02	4.88478E+02
3.00000E+01	7.00000E+02	7.60859E+02	6.52117E+02	8.87734E+02
1.70000E+01	1.30000E+03	1.39988E+03	1.25329E+03	1.56362E+03
2.30000E+01	1.20000E+03	1.05653E+03	9.36669E+02	1.19173E+03
4.00000E+00	2.50000E+03	2.57560E+03	2.19638E+03	3.02029E+03
8.00000E+00	2.00000E+03	2.13504E+03	1.86217E+03	2.44789E+03
3.00000E+01	5.00000E+02	7.60859E+02	6.52117E+02	8.87734E+02
2.60000E+01	1.10000E+03	9.17861E+02	8.03816E+02	1.04809E+03

The +01 informs us that the decimal point should be moved one place to the right of its initial position; or, it should read 17.41667, rather than a mean X value of 1.741667. Our average parcel size is therefore about 17.4 acres. Concomitantly, we would move the decimal for the mean Y value of 1.629167E+03 three places to the right, yielding an actual mean Y of \$1,629.167.

Other instances will be encountered where the floating decimal point must be moved to the left. For example, the value of A for equation number 5 is 1.20821E-04. In this instance, we would move the decimal four places to the left of its initial position between the 1 and 2, indicating a value for A of .000120821. The reader should be able to see that when large numbers are encountered, the floating point approach does provide a significant space economy.

SELECTION OF THE BEST EQUATION

The computer printout depicted in Table 3 indicated the six equations tested on the sample data and estimated values for each equation's constant (A) and regression coefficient (B).¹ Equations of the type we are considering have a starting point, known as the constant, and a regression coefficient, which indicates the bases of calculating changes in the dependent variable attributable to changes in the independent variable. The computer routine performs a series of mathematical computations, using the material provided in the data file, to calculate specific values for A and B.

The expression which most of us probably are acquainted with in some form is the linear relationship where $Y=A+BX$; this appears as the first equation tested in Table 3. In the use of a linear equation, the line which is drawn would be straight, with the value of Y increasing at a constant amount for each corresponding increase in X. It was indicated above that we did not feel a linear relationship existed between sale price per acre and the number of acres sold. Our objective is to find an equation which would enable us to draw a line through our data in such a manner that the line we select would fit the data better than any other possible line we might draw. One way of testing each of the suggested equations is to determine which expression explains the greatest proportion of variance in the dependent variable, or in the present case, which expression best explains sale price per acre. A statistic which is commonly used for this purpose is formally termed the Coefficient of Determination and is referred

1. For a discussion of the basic statistics involved in this example, see: Ron Brown and Karl J. Clettenberg, "Statistics: Some Applications for the Real Estate Analyst," *The Appraisal Journal*, Vol. XL:4, October, 1972. We attempt to go slightly beyond the linear regression technique discussed by Brown and Clettenberg and show how a nonlinear equation may be used by the appraiser.

to generally as r^2 . Our computer program calculates this same statistic, but it is called an INDEX on the computer printout. We can compare the performance of each of our six possible equations by looking to find which estimated expression explains the greatest percent of variance in sale price.

Looking at the calculated INDEX in Table 3, it will be seen that the basic linear expression explains 89.6% of the variance in sale price per acre. This linear expression is only second best when compared to the other estimated expressions. The expression which fits the data best and explains the highest percentage of variance of sale price is equation number 2, with an INDEX of .93759 (it explains 93.7% of the variance in sale price).

A NONLINEAR RELATIONSHIP

As we had hypothesized, the relationship between sale price per acre and parcel size was nonlinear. The form of the equation is stated in our computer output as: $Y=A*EXP(B*X)$. To those unfamiliar with mathematical notation, it is likely that the equation appears frightening and certainly not worth struggling over. Although the appraiser is encouraged to learn the foundation of the equations used, he need not necessarily become conversant with mathematical notation. At first glance, the Ellwood formulations tend to boggle the minds of most of us, yet most appraisers today are thoroughly versed in concepts of mortgage-equity capitalization.

The expression we have selected as "best fitting" our sales data comes from the classification termed exponential functions. This form of exponential function uses as its base a number generally represented by the letter e . Most appraisers have used the expression πr^2 to assist themselves when calculating the area of a circle. It will be recalled that we probably accepted, without too much argument, the statement that π was equal to the number 3.1417 . . . , although there did exist an explanation based upon radians with which we were not concerned. In the case of e , it is equal to the number 2.7182 The symbol e possesses several unique mathematical properties which enable it to function well as a base for exponential expressions and for natural logarithms.² Because the origin of e is found in the study of calculus, it is beyond the scope of our present discussion. Rather, we will concern ourselves with how the expression may be used.

MANUAL CALCULATIONS

The standard way of writing expression number 2 would be as follows: $Y=Ae^{BX}$. When written in this manner, it is presumed that the sign preceding the term BX is positive. If, however, we look at the value of B

2. Chester G. Jaeger and Harold M. Bacon, *Introduction to College Mathematics*, Second Edition (New York: Harper & Brothers, 1962), pp. 223-24.

corresponding to expression number 2, we will see that $B=-4.68996E-02$, or $B=-.0468996$. For our purpose, it would be all right to round off the value of B so that $B=-.047$. The exponent BX will become $-BX$ if we insert our estimated value for B .

One rule we should learn is that if an exponent possesses a negative sign, the exponent and its base may be given a positive sign by placing them in the denominator. When we do this and insert the estimated values for A , B , and e , our equation becomes:

$$Y = \frac{A}{e^{BX}} = \frac{3107}{e^{.047(x)}} = \frac{3107}{2.7182^{.047(x)}}$$

We are fortunate that our computer program possesses the capability to provide us with the estimated sales prices per acre, upon request. Nevertheless, we will calculate some estimates of Y for the reader to use as a guide in the event the necessity presents itself in the future. This appraiser has found that his Hewlett-Packard HP-80 is exceedingly helpful when performing this type of calculation.

The one term which changes each time a new parcel is used is the exponent. Table 4 depicts a breakdown of the steps followed when calculating our estimates of sale price per acre.

Table 4
CALCULATION OF ESTIMATED SALE PRICES

(1)	(2)	(3)	(4)
Acres	.047(x)	2.7182 ^{.047(x)}	$\frac{3107}{2.7182^{.047(x)}} = Y$
1	.047	1.04812	2964
2	.094	1.09856	2828
3	.141	1.15142	2698
4	.188	1.20683	2574
.	.	.	.
.	.	.	.
.	.	.	.
20	.940	2.55991	1213

Column 2 depicts the calculation of the exponent corresponding to each parcel size considered. These exponents then are used in raising the base e (2.7182) to its appropriate level. This procedure is best accomplished using the HP-80 calculator. Because the value of e is used repeatedly, the appraiser may decide to store the number 2.7182 in the calculator and recall the number when needed. If 2.7182 is stored in the calculator, it is first recalled and then saved. Next, the appraiser enters the exponent and then presses the y^x button. For example, in the case of 3 acres, the value of .047(x) is equal to .047(3), or .141. The appraiser enters the base value

2.7182 and presses the *save* button. Next, the exponent .141 is entered and the y^x button is pressed, yielding the value 1.15142. To calculate the estimate of Y, the appraiser need only divide the values calculated in column (3) into the constant, i.e., 3107. This last procedure has been completed and entered in column (4).

COMPUTERIZED CALCULATIONS

After presenting us with an INDEX from which we may select the equation with a "best fit," the computer program inquires whether further information is desired for one of the estimated equations. Because equation number 2 did the best job of fitting our data, we have responded in Table 3 by entering the number 2.

The computer once again prints the values for A and B, as well as the range we might expect A and B to assume 95% of the time if they were subjected to repeated samples of sales taken from the same population.³ We are instructed further to type 1 for the confidence limits on estimated Y, or 2 for prediction limits on observations of Y. We have responded in this example by entering a 1. This provided us with the values of X, the values of Y, and the estimated values of Y, plus 95% confidence limits for our estimated value of Y, as depicted at the lower portion of Table 3.

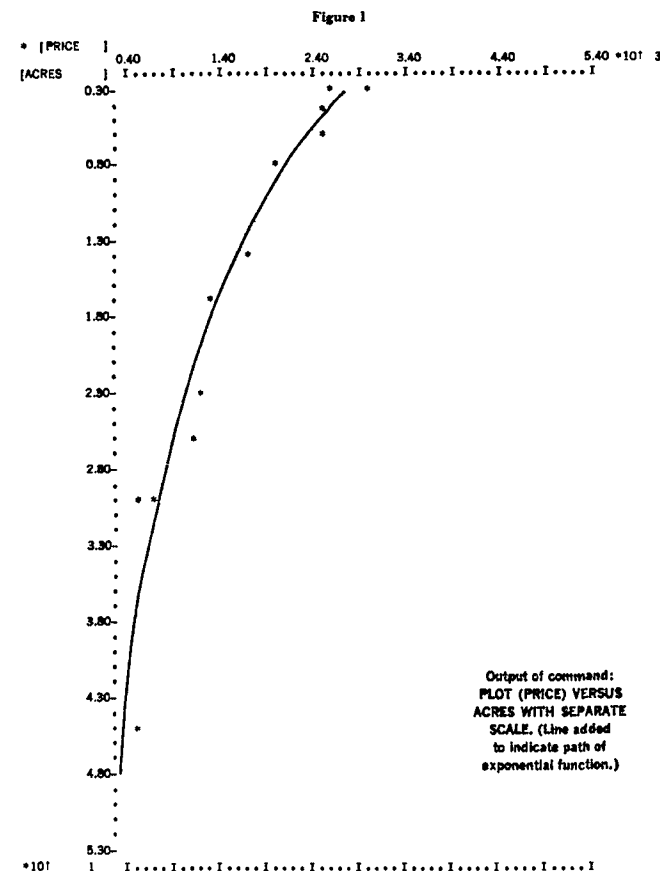
GRAPHIC ANALYSIS

Once we have the estimated values for Y, we are ready to proceed with adjusting our acreage sales. However, before terminating our computer run, we have instructed the machine to use the program for plotting data. In order to accomplish this command, we merely entered the following command: PLOT (PRICE) VERSUS ACRES WITH SEPARATE SCALE. Our output is depicted in Figure 1. This particular computer program is designed to fit an 8½ x 11 sheet of paper, and, therefore, it may be included easily in an appraisal report. We have drawn a line which represents the path of our exponential function. The reader will observe that for the lower number of acres, the price per acre is higher than for the larger size parcels. The line of "best fit" declines, however, at a decreasing rate. As we greatly increase the parcel size, the line of "best fit" asymptotically approaches our axis.

AN ACREAGE ADJUSTMENT FACTOR

The original purpose for calculating the regression equation was to evaluate the relationship between sale price per acre and the parcel size. Once this relationship was understood, it was felt that greater insight would exist

3. For an explanation of confidence intervals, it is suggested the appraiser again refer to Brown and Clettenberg, *op. cit.*



into the proper adjustment of sales data with regard to variations in size.

One technique which we have found to be helpful is the creation of a series of acreage adjustment factors. To compute them, it is first necessary to estimate the value for each acreage sale using the regression equation. This has already been done for us on the lower portion of Table 3. These estimated prices per acre may serve as a basis for determining the acreage size adjustment factor.

The appraiser should establish the estimated price per acre for the size parcel being appraised as the base value in the adjustment factor. For example, we shall presume that a subject parcel of 20 acres is being appraised; the estimated regression valuation for 20 acres is \$1,213 per acre. A table of acreage adjustment factors may be prepared by dividing the other estimated values by the estimated value for a 20-acre parcel. An example is the

acreage adjustment factor for 14 acres; using the estimated price per acre for 20 acres as a base, it is divided into the estimated price per acre for a 14-acre parcel: $\$1,611 \div \$1,213 = 1.328$. Table 5 summarizes acreage adjustment factors for all of the estimated sale prices. It will be noted that the adjustment factor for 20 acres—the base value—is 1.000; i.e., there need not be an adjustment if the parcel is already the size of the base lot. Stated another way, if we divide the estimated price per parcel for 20 acres by itself, the result would be 1.000.

Table 5

ACREAGE ADJUSTMENT FACTORS

Acres	Estimated Value	Adjustment Factors	Actual Price Per Acre	Adjusted Price Per Acre
3	\$2,699	2.225	\$3,000	\$1,348
3	\$2,699	2.225	\$2,600	\$1,168
4	\$2,576	2.124	\$2,500	\$1,177
6	\$2,345	1.933	\$2,500	\$1,293
8	\$2,135	1.760	\$2,000	\$1,136
14	\$1,611	1.328	\$1,700	\$1,280
17	\$1,400	1.154	\$1,300	\$1,127
20	\$1,213	1.000	SUBJECT	SUBJECT
23	\$1,057	.871	\$1,200	\$1,377
26	\$ 918	.757	\$1,100	\$1,453
30	\$ 761	.627	\$ 700	\$1,116
30	\$ 761	.627	\$ 500	\$ 797
45	\$ 377	.311	\$ 450	\$1,446

ADJUSTING THE SALE PRICES

The acreage adjustment factors are used to bring the comparable sales closer to reflecting the size of the subject property. A series of adjustment factors based upon a subject parcel of 20 acres has been calculated in Table 5. In order to adjust the sale prices per acre, the appraiser would merely divide the actual sale price per acre by the corresponding acreage adjustment factor. A list of the adjusted sale prices is provided in the far right column of Table 5. The range of these adjusted sale prices is much narrower than before: \$797 to \$1,453.

Even more important is that most of the sales are now grouped in the range \$1,100 to just over \$1,300. This provides the appraiser with a much better foundation from which he may prepare his estimate of value.

CONCLUSION

The case we have presented is special in some respects. Most notably, we have not concerned ourselves with some very important items, such as locational variations, zoning, soil characteristics, or timing of the sales. We have

implied that the parcels being considered are uniform in all respects with the exception of the parcel size; this caveat need not be observed. When our sales data are not as pure as those presented in our case study, we may elect to make our other adjustments first and then attack the problem of size variation.

The problems of vacant land valuation can be enormous, and it has not been our intent to minimize these difficulties. Rather, we have attempted to deal directly with one small aspect of an acreage valuation assignment through the application of newly developed tools of analysis available to appraisers. There is no reason to believe that this approach could not be used in the valuation of land in general.

Our purpose in this undertaking has been twofold. First, it is our opinion that the approach to acreage size adjustments used in this case study significantly improves the valuation results. Hopefully, the demonstration presented herein will be of some assistance to appraisers in land valuation assignments. Second, this article was intended to show appraisers the potential for new applications of knowledge they have gained through EDUCARE and other educational programs.⁴ Our goal has been to encourage appraisers to develop further uses for many of the valuable tools they now have at their disposal.

4. It should be stated that the companies mentioned in this article are by no means endorsed by the author or any organization with which he is affiliated. There are many fine firms offering comparable services. We have mentioned specific company or brand names where it was felt the appraiser would be familiar with the equipment or service available.