AN ACTUARY ON WALL STREET?

by Joseph H. Dowling

There is a tendency, all too human, for many actuaries to define their profession rather narrowly, as though it related only to those few functions traditionally described as actuarial work. If this limited point of view were correct, there would be no place on Wall Street for the actuary as such. If, on the other hand, one views the actuary as having the benefit of a special education and experience which permits him to accure a breadth and a depth of understanding of insurance unattainable by other routes, then there not only is a place for such an individual on the Street, there is a need for him. Few industries are so poorly understood by the investor as insurance and any area of misunderstanding in the investment world is taken by the less than ethical as an opening for exploitation.

Wall Street’s principal business is publicly-traded securities—e.g., bonds, stocks, warrants, etc.—and most of the Street’s people are concerned with them—analyzing, selling, and trading them, or providing support for those who do.

A small number of people are engaged

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To Our Readers

Please note that the address is now

THE ACTUARY
15th Floor — 1740 Broadway
New York, N. Y. 10019.

INPUT-OUTPUT OR INPUT-INPUT ANALYSIS

by James C. Hickman

We are served by a multiplicity of complex systems that provide such diverse products and services as protection, information, transportation, energy, and three square meals a day. There is usually more than one way of constructing each of the systems and this suggests the desirability of establishing measures of efficiency for the alternatives so that we may rationally choose among them. Indeed, the richness of the options open to managers in constructing business and governmental systems requires, if these systems are to avoid some of the pain and suffering of evolutionary trial and error, that measures of efficiency be designed.

In some areas these measures can be satisfactory. Although the degree of sophistication in the computation of their respective efficiency indices may have differed, both Charles Wilson with his desire to provide “the biggest bang for the buck” and Robert McNamara with his elaborate cost effectiveness studies, sought to allocate the nation’s defense funds so as to maximize national security as it was perceived by the administrations they served. The quantification of the efficiency of engines converting heat energy to mechanical energy may require ingenious technology, but the final measurement has objective certainty. In many private businesses the market provides an almost immediate judgment on the success of a system in

MOSES REVISITED

(Extract from a recently discovered Dead Sea Scroll)

by Ian M. Charlton

The Supreme Ecumenical Association to Research Clerical Heresay (hereinafter referred to as SEARCH) had been studying more palatable and salable verbiage for the Ten Commandments, with benefit illustrations. The chief governing supervisor of the Security and Investment Council (affectionately called SIC) was alleging that adherence to said Ten Commandments was indeed an investment in the hereafter, should be subject to SIC regulations, and should no longer be referred to as the Ten Commandments but rather Measures for Modern Morality—A Ten-Point Plan for Investing in the Hereafter. This would mean:

(a) Any promotional material designed to interest a parishioner, which included illustrations depicting benefits incidental to profitable investment in the hereafter through observance of the Ten Commandments, must contain the following disclaimer (or words which are not, in the judgment of the Supervisor, “not less unfavorable”):

“For illustration only. Investment results are based on past experience which may or may not be reflected in the future.”

(b) Prior to introducing a parishioner, regardless of age, to the Ten Commandments as a method of investing in the hereafter, a representative of SEARCH, now considered an associate of a Broker/Dealer, must precede his message with a prospectus to provide the potential investor with an adequate basis for judging the offering.

The proposed prospectus would have to include the following:

(Continued on page 6)
EDITORIAL

THERE is a story, probably bogus, of the dark days of World War II. The Chiefs of Staff of the United States and Britain, sitting in joint session, heard a motion from the Americans to table a certain measure. “Tabling would be most unwise,” said the British. The resulting dispute brought the two sides close to declaring war on each other. Fortunately, it was then discovered that “to table” the motion meant from the Americans to table a certain measure. “Tabling would be most unwise,” fully reflected in recent columns of The Actuary dealing with adjusted earnings. Reserves and Gross Premium Valuation. It would appear that Natural Reserves are which had been in hiding, came forth and the Allies went back to fighting Germany to scupper it to the Americans and the opposite to the British. So sweet Concord, Participants in the adjusted earnings game limit themselves to two concepts: Natural reserves based on my one or more of the following:

1. Assumptions on which the gross premiums were actually based. These assumptions may be (i) sanguine, (ii) realistic, or (iii) gloomy.
2. Assumptions inherent in the gross premiums,
3. Assumptions thought perhaps to be inherent in the gross premiums of the large stock company from which the gross premiums were, as an act of faith, copied, after deducting 5 cents per $1,000.
4. Assumptions inherent in the gross premiums or the assumptions deemed realistic at the time of the valuation, whichever is the less favorable (or the more favorable).
5. Any other assumptions not specified but deemed proper.

Gross premium valuation is defined the same way, with the added option that profit margins may be included, if positive or negative.

One becomes a participant by taking a strong stand in favor of Natural Reserves and twice as strong a stand against Gross Premium Valuation, or the reverse. There is no requirement that the participant say what he means by either term. In taking his stand, a participant may take spirited issue with any statement which a previous writer in The Actuary did not make. As to inconsistencies, the Editorial Staff takes a kindly view. Substituting facts for appearances and demonstrations for impressions is all very well, but we have a newspaper to fill up each month.

K.T.C.
Management and the Actuary
(Continued from page 2)

Understanding and other managerial skills. Or again, he must describe duties and responsibilities fully and clearly but must leave room for the worker to exercise initiative. At every turn a manager is seeking to achieve a fine balance. Thus a manager is practicing an art in which there are no final absolute answers.

Anyone who finds himself thrust into a management position can appreciate the complexity and delicacy of his task. His first question is likely to be, "Is it possible to learn something about this delicate balancing act without making most of the mistakes which have been made many times before?"

It would seem that something can be learned by talking to others who have had more abundant experience. Any manager would likely have access to a more mature manager who probably has a responsibility to train his subordinate. One could undoubtedly gain from contact with a wider range of experience obtained in management training seminars which may be formally or informally organized for this purpose.

Serious management scholars have attempted to distill significant factors from the past experience of managers and present them in an organized manner. Two of them, Harold Koontz and Cyril O'Donnell, have organized management principles into five functional areas: Planning, Organizing, Staffing, Directing, Managing. Their book, Principles of Management published by McGraw-Hill, contains extensive bibliographies which can lead the manager into more extensive consideration of each of the functions.

An Actuary on Wall Street?
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in providing investment banking services to corporate managements including, when necessary, the construction and distribution of new securities and/or merger and acquisition assistance. Others are engaged in the management of portfolios.

The natural place for the actuary to employ his prior insurance experience on Wall Street while building his investment acumen is in the research department as a security analyst following insurance issues. Analysts work for retail brokerage houses (doing business with the public), institutional brokerage houses (doing business only with institutions such as mutual funds, pension funds, insurance companies, etc.), and institutional investors (such as I.D.S., Dreyfus, Mellon or Morgan Banks, Prudential, Travelers, U.S. Steel Pension Fund, General Electric Pension Fund, and thousands of others).

Regardless of the affiliation, the responsibilities are similar: the identification and quantification of those characteristics of a company and its securities that determine the worth of the securities and to relate that worth to its price and to the price level of other securities in the market. The ideas developed must then be communicated through others to the buying or selling of securities for that is the purpose of the exercise.

Taught like a science, practiced like an art, security analysis is no easier to describe than it is to perform. In the short run, it becomes for the devotee the supreme test of skill and ego as one plays in a 50,000-sided contest for very real and very high stakes. In the long run it is the supreme leveller of men, as—in the long run—one is almost al-

IBNR

The Boleslaw Monic Fund of Amsterdam, Holland, announces an essay competition offering prizes for the best papers submitted to the Fund on the following question:

The reserve position of an insurance or reinsurance company must include a component for IBNR (Insured But Not Reported) losses, and IBNR losses are an important factor in liability excess of loss reinsurance underwriting. What scientific and quantitative method(s) can be used for determining the IBNR both for reserve and underwriting purposes?

N.B. Actually reserves for IBNR are also meant to cover increases required in future in respect of reserves for claims already known.

The closing date for the submission of papers is Oct. 31, 1971. The distinguished committee of the Boleslaw Monic Fund consists of Sir George Maddex, chairman; Dr. H. Ammeter, prof. P. D. J. Engelfriet, prof. E. Francx, and E. J. Slager, secretary-treasurer.

Further information about the competition may be obtained from E. A. Law.

DEATH

Frank A. Shaiber

ways wrong, and the market goes on as if the man and his mistakes and successes never really mattered.

The analyst may choose to stay in research for his entire career: most of the actuaries who have come to the Street have done so thus far. However, one should not overlook the alternatives open if other interests should develop. Analysts who find the communication of ideas, particularly in man-to-man contact, more interesting than the in-depth review of the technical and accounting aspects of a company, frequently become institutional salesmen. If the market as a mechanism itself captures their fancy and if, also, they develop the undefinable skill of having market judgment, analysts become money managers. Industry itself has not overlooked the analyst's experience as a training ground and a number of analysts have gone into the industry they followed at high levels or have exercised their entrepreneurial interests by starting new companies. The best men in the industry prepared themselves for the job.

Nothing is so overstated about the stock market as the income of its practitioners. Research analysts in retail house presumably earn between $15,000 and $50,000. Senior analysts of institutional houses earn between $50,000 and $200,000. In addition, the opportunity to develop ideas for one's own account and to take positions in new ventures can be capitalized on.

Last year, the Year of the Bear on Wall Street if not in China, saw a high unemployment rate among Wall Streeters, with some people estimating that a quarter to a third of all security analysts were unemployed. Part of the compensation obviously is meant to offset this risk, which occurs about once every three years.

The question is often asked, "Would I recommend others join this business?" The answer is simple, "Probably not now." The changes taking place on Wall Street are beyond prediction as the number of firms declines and turmoil and fear still exist. When things straighten out, "Yes", but only with the realization of the hazards of the business and the necessity for a high level of tolerance for the intolerable vagaries of an unpredictable but fascinating world.
Adjusted Earnings

Sir:
The latest Exposure Draft, dated December 1970, of the AICPA Committee on Insurance Accounting & Auditing is a most disturbing document with a highly idealistic and theoretical approach and exhibiting a lack of understanding of the practical aspects of many of the factors that affect the operations of a life insurance company.

The most alarming feature is that there will inevitably be very wide variations in the many assumptions, especially the expense and lapse assumptions, used in arriving at the natural reserves. Such assumptions can be unduly optimistic, too conservative or downright wrong, and will obviously have widely differing effects upon the so-called adjusted earnings. The lack of any uniform standard will result in a situation in which it will still be impossible to compare earnings of company with any degree of confidence.

Consider the matter of expense allocation. As is well known, there are wide and perfectly justifiable differences of view regarding the methods and philosophy used to determine what items of expense should be regarded as acquisition expense. To name but a few—compensation of managers, subsidies to new managers or general agents, agent financing, advertising and sales promotion, and even general overhead.

A large number of companies now contribute to the LOMA Cost Study and, in spite of rather complete instructions, it is obvious from the results that there are wide differences in the methods used. One of the recent studies showed, in a group of 40 prosperous and mature companies, initial unit costs ranging from 40% to 117% of first-year premiums, while direct maintenance expense varied from $2.34 to $10.35 per policy. It is difficult to believe that variations of this magnitude, especially in maintenance expense, would result if uniform methods were used.

Many companies, especially the smaller ones, simply do not know the facts about their unit costs. I have even seen expense assumptions used to determine premium rates, or to test them, based upon the long discredited 10-to-1 method, all on a per policy basis. It is wishful thinking to say that the expenses and other assumptions inherent in the premium rate structure will necessarily give realistic and natural reserves. They will not do so unless the assumptions themselves were realistic, which is frequently not the case.

It is surprising that so little has been said about the enormous expense of performing the proposed natural reserve calculations using select mortality and withdrawal rates, possibly more than one interest rate, and reflecting the actual incidence of expenses. Many of the smaller companies do not have the staff or facilities to do this formidable job and, moreover, cannot afford the expense involved.

One rather important aspect of adjusted earnings that I have not seen discussed concerns the treatment of new or immature companies which are financing part of their expenses from capital funds. Most companies less than, say, about 10 years old will incur expenses considerably in excess of the expenses generated by the application of asset share expense assumptions to the new business and the business in force; and such excess expenses are clearly capital investments. Furthermore, it would be quite difficult in the case of a new company to determine whether or not the actual expense rates were reasonably close to those assumed in testing the premium rates. Here, again, is an area where there is room for considerable difference of opinion regarding the methods used and the judgments which must be made.

Lest I should be thought an old-fashioned reactionary, is it too late to ask that serious consideration be given to a much simpler and more practical solution? I refer to the use of a CRVM reserve on a realistic interest basis such as 4% or 4½%. This, at least, would provide a highly desirable uniform standard of adjustment. It might be desirable to increase this adjusted reserve for the excess of cash values over such reserves using an appropriate termination rate.

Perhaps the most disturbing feature of all, as revealed by the wording used in many places in this draft, is the extent to which accountants appear to be attempting to usurp the proper functions of the actuary and taking positions on matters upon which an accountant is not qualified to express an informed view.

C. F. B. Richardson

Continuing Dilemma

Sir:
A recent article published in the January edition of The Actuary, entitled An In-

Letters

Sir:
I was somewhat disheartened to see the comments on modern “computerism” begin to turn toward recommending APL

(Continued on page 5)
Another problem area is the qualification of programmers. Although this is not really in the realm of actuarial solution, its implications really cannot be ignored. If one considers the cost of the non-productive programmer, the training cost of the programmer, and, above all, the expense of computer time wasted by the inexperienced programmer, it is likely that it costs an insurance company more for a successful programmer than for any agent. In addition, the productive lifetime of a programmer may likely be less than an agent's productive lifetime. Therefore, it is absolutely necessary that some attention be given to the adequate selection and training of programmers.

Joseph R. Brzezinski

National Notions

Sir:

Ardian Gill in the February 1971 issue of The Actuary presented a very interesting and informative review of Actuaries and Financial Planning, published by the Institute of Actuaries Students' Society. One entertaining feature of this review is an account of the notionally funded pension schemes of the British Government.

Let it not be said that the British are unique in this area! The same procedure has been followed in the United States for some time in connection with the Retired Servicemen's Family Protection Plan (originally, the Uniformed Services Contingency Option Act, which was described in a paper in TSA VI).

This program is also unique in being the first federal legislation to mention the Society of Actuaries. The law prescribes that one of the three members of the program's Board of Actuaries is to be a member of the Society (the other two being named government actuaries). Walter Klem served in this capacity for about 10 years, and Andrew Delaney has subsequently served.

Robert J. Myers

GAAPosis and GAAMon

Sir:

Recent issues of The Actuary have featured many articles on generally accepted accounting principles and the term GAAP has begun to take root in insurance circles.

To counter this trend, you may wish to adopt an expression which I have employed for several months; namely, generally accepted actuarial methods (GAAM). Most of our clients and, in fact, many CPA's agree that GAAM is at least as important as GAAP (and furthermore, gains are prettier).

Robert C. Tookey

LETTER TO ALL SOCIETY MEMBERS

From the Committee on Professional Development

Have you given us your opinions about the Society? We have been collecting them for the past six months, in informal seminars, discussions among our Committee, and over 20 actuarial club meetings thus far.

We think this is the best way to do our job: to comment on how the Society of Actuaries can relate better to its younger members. Relating starts with recognizing major hangups, whether they have to do with organization, communications, education, accreditation, research, or membership classifications. It includes pointing out and emphasizing what's good about the Society, too.

Our Committee is large and diverse; our opinions should represent a pretty good cross section, and we have all been doing a lot of heavy thinking about this subject. But, we want to feel we are speaking for the majority, not just expressing isolated points of view.

You can help us make our report truly representative. If you haven't spoken up yet, or if you feel you haven't fully expressed a point of view, there is still time for you to invest a few minutes to get your ideas into our thought process. Send me a letter and describe your feelings on whatever aspect of the Society you wish to discuss; I'll make sure it gets proper attention.

Remember, this is our objective: “To identify and explore opportunities for the Society to help its younger members gain professional and personal benefit from membership and contribute effectively to the actuarial profession and the Society.”

Paul A. Campbell, Chairman
Moses Revisited
(Continued from page 1)

The Commandments are a ten-point plan for investing in the here and hereafter. While originally designed for the morality of persons of all ages, this plan will be espoused particularly by the middle-aged group, casually referred to as those too young for Medicare but too old to enjoy the new morality.

The substance of the ten-point plan is alleged to have been drawn from two tablets of stone. These tablets of stone have not been filed with the SIC; therefore, the SIC cannot pass on the accuracy or adequacy of the content and any representation to the contrary may be deemed to be an offense. Notwithstanding, however, the content has been drawn from a source deemed to be reliable.

This was in addition to the suggested wording received from the local Director, charged with the responsibility of being sure all text material used clear and precise language. The following was suggested for the Second Commandment:

Unless in conflict with the laws or regulations of the jurisdiction in which said commandments are to be practiced, no member shall bow down to any graven image (except such graven image as may be specifically exempted by the Supervisor as not being discriminatory in favor of the highly esteemed); nor to any likeness, including but not limited to idols (graven or otherwise, or any attempt thereof) of anything in heaven, which is alleged to be above, or in the earth, allegedly beneath, nor in the water under the earth, whose said phrase shall be deemed to include moisture or precipitation, surrounding subterraneal, terraneal, celestial and/or space travel or residence; moreover, adherence hereto shall be given extragenerational effect, bearing through to the third and fourth generation of any covered member, as prescribed by any enabling legislation decreed since the inception of time.

Input-Output
(Continued from page 1)

adding value, as perceived by customers, to the cost of the input resources.

However, there are social systems within the experience of each of us whose output is only imperfectly judged in the market or where the market judgment is long delayed. Yet the necessity to make decisions about such systems compels us to develop measures of efficiency for these systems. Because of the inherent difficulty in measuring the effectiveness of health, education, and defense systems, the professionals who manage these systems tend, as a convenience, to define operational management goals that only indirectly relate the ultimate output to the input of the system.

If you ask a hospital administrator, in confidence, to rate the hospitals in his area, he will have no difficulty in establishing a quality ordering. Chances are that the ordering will not be based on any measure of improvement in the quality of the patients entering and leaving the institutions being rated. Instead it will be based on the size and academic qualifications of the staff and the amount of technical equipment available.

Other Examples

If you discreetly inquire of a school superintendent or a college president the rating of the institutions that fall in the same general class as his, once again you will observe no great trouble in making the ordering. The chances are overwhelming that the rating will be a function of class size, the credentials of the faculty, and measures of library, laboratory and computer size. Seldom will the ratings depend on the relative educational impact on the students who move through the various institutions.

Military history contains instances where measures of combat effectiveness devised in peacetime seemed to have an inverse relationship to subsequent battlefield success.

Professional groups have a responsibility to create quality standards for the systems they administer. However, as indicated in the examples, these quality standards are often a function of the inputs to the system rather than the outputs. Only the ultimate requirement that society value the output of the system administered by a professional group prevents the group from living perpetually in a closed system in which the quality standards of the profession alone prevail.

The health professions are finding mounting public resistance to allocating ever more resources to purchase higher quality medical care where this quality can be perceived only by professionals. In a similar way educators are finding it rather hard to secure financial support for achieving higher educational quality, as measured solely by the standards of professional educators. Even science, the great generator of the new ideas that have fueled our twentieth century civilization, is no longer allowed to measure the quality of the nation's scientific enterprise by the size of the resources allocated to science. This input must now be related to the outputs that the public values.

How do we actuaries shape up? All too often, I fear, our standards are input-oriented. I venture a few suggestions for improvement in these areas:

The actuarial education system

The body of knowledge that is defined by the current syllabus of examinations does not exhaust actuarial science.

The purpose of actuarial education is not the passing of actuarial examinations.

The private pension system

The purpose of pension planning is not primarily to secure I.R.S. qualification.

The individual life insurance system

The purpose of equity based insurance is not to provide the possibility of a speculative gain.

Insurance price-benefit structure should not be designed with the primary objective of supporting a particular administration or distribution system.

The health insurance system

The purpose of health insurance is not only to spread the burden of health costs but also to play a role in an integrated system that encourages efficiency and does not distort treatment practices.

The automobile insurance system

The purpose of automobile insurance is not solely to mitigate the financial consequences of fault or to support a particular system of allocating fault. It must also relate to the broader problem of creating a safe and economical transportation system and allocating the cost of this system equitably.
HURT NOT THE EARTH!
by Arthur Pedoe

Actuaries are much interested in human mortality; what about the survival of the human race?

"Put bacteria in a test tube, with food and oxygen, and they will grow explosively, doubling in number every 20 minutes or so, until they form a solid, visible mass. But finally multiplication will cease as they become poisoned by their own waste products."

This is the first sentence of a recently published book by Gordon Rattray Taylor, the author of a world best-seller, The Biological Time Bomb, reviewed in The Actuary, October 1969. This dealt with the biological achievements which predicted an addition of 50 years to man's life expectancy by the year 2000.

The new work, The Doomsday Book, has the theme that mankind is heading for a catastrophic population crash, possibly within the next 30 years. It is not science-fiction. The introduction gives some 70 acknowledgments for assistance to authorities throughout the world (a majority in the United States). He selected references cover 20 pages.

When the book appeared some months ago, much publicity was given to the reference to the environmental (ecological) disaster arising from the Aswan Dam in Egypt, a project which was abandoned by the United States and later taken over by the Russians. Lake Nasser, some 200 miles long, was created. The rich organic silt which used to flow through the Nile and which created Egypt, was held back by the dam and artificial fertilizer has now to be used. The loss of water by evaporation in a semi-tropical area may result in less water being available for irrigation than before. The slow-moving warm water in the irrigation ditches has proved an ideal breeding ground for billiards, the disease from which it is said 70% of Egyptians in Lower Egypt suffer. Among other ecological disturbances is the destruction of the fishing grounds in the Nile Delta, which was the main industry of a population of 19,000 people.

This detail illustrates what has been going on in various parts of the world. In 1970, the use of nitrogen fertilizer in the United States has increased 14-fold and much of this is washed into the rivers and lakes where it fertilizes the algae. In decay they extract oxygen from the water, with the result that fish, bacteria, and other forms of life die.

Lake Erie has received much publicity regarding pollution, as some 80,000 tons of nitrogen pass into it each year from farmlands and municipal sewage (untreated). It is stated that Lake Michigan is in a worse condition. The ever growing need for power poses a problem. Power plants require huge volumes of water for cooling, and nuclear power stations need about a hundred times that of others. Around Lake Michigan, apart from 24 fossil fueled power plants, are two nuclear power plants and seven others under construction. In a hot summer, with ever increasing power plants this thermal pollution can become serious.

Rattray Taylor has been accused of sensationalizing the situation, but he feels that the public does not realize the dangers of the coming ecological disaster. There is scarcely a page in the book from which a point supporting this could not be quoted. Jet aircraft contrails stimulate the formation of clouds so that with increasing air travel and increasing size of airplanes we could have permanent cloud cover, seeing blue skies only on rare occasions.

Much publicity has been given to the dangers of mercury poisoning and the increasing use of mercury in industry. Years ago when beaver hats were the fashion for men and the fur played an important part in Canada's infant economy, the hat makers dressed the furs to a mercury compound, the fumes from which gave them mercury poisoning which caused a curious mental disturbance. This is why hatters are verbally mad and explains The Mad Hatter at Alice's Tea Party.

The book deals with many other pollutants: lead (gasoline), asbestos (brake lining), oil spills from ships, D.D.T., carbon dioxide and carbon monoxide; also man-made earthquakes. Reference is made to the problem of radio-active wastes which affect living tissue, transmitting mutations from offspring to offspring for an indefinite period. Taylor is very critical of what some public authorities call "acceptable doses."

The problem is dual: the increase in population and the destructive potential of modern technology. According to current forecasts the world's population is doubling every 35 years and will be at or near 7 billion by the year 2000 and may double again by the year 2030 if the world has found out how to feed 14 billion people.

Even now starvation is rampant in many parts of the world. The book refers to the shanty towns thrown together from discarded gasoline cans and what have-you which adjoin many cities in South America, Turkey, and India.

With much opposition to any moves for population control, it is surprising to note how little such moves as contraceptive practices will reduce the overall growth rate of population—as at present, perhaps 5%. Formerly the high death rates in infancy and childhood solved the problem of large families. Can we convince couples that the number of children per family should not exceed two? Governments and industry favour large populations and many encourage such in their systems of social welfare.

Rattray Taylor believes that before inadequate food pressure becomes critical there will be a population collapse in certain parts of the world due to stress which has been observed among animals after a population explosion.

There has been a dramatic increase recently in public interest in the matters dealt with in this book. How can we increase this? With the increasing and serious nature of the problem one can well be shocked at the lack of knowledge of some of its important aspects, the poverty of research on them, and the trivial amounts spent on investigation.

The preface to the book gives a description of a Population Crash taken from The Revelation of St. John the Divine from which the title of this article is also taken; the angel of mercy pleads: "Hurt not the earth, neither the sea, nor the trees . . ."

(The Doomsday Book (335 pp.) is published by Thames and Hudson, London; World Publishing Co., New York; Oxford University Press, Toronto).
No Mean City


by Gordon D. Shellard

This book presents a mathematical model of a city, and uses it to study the effects of various urban improvement programs. A mathematical model would normally appeal to only few readers, but the city and its intractable problems are the objects of such concern that the book should interest many, particularly actuaries who may reasonably form some judgments on the validity of the model and on some of the conclusions drawn.

The model primarily concerns three components of a city: its business, people, and housing. Each component is divided into three classes. Business is classified as new, mature, or declining. Families are classified, by employment status of the family head, as full time employed professional-managerial, other full time employed, and under-employed. Housing is classified according to that normally occupied by each class of family listed above. The number of units in each class of each component is represented by a variable. There are thus nine class-component variables which are related in various ways.

Typical of the ways in which the class-component variables are related are those arising from the facts that business enterprises require workers, and that families require housing. These relations can be made more specific, such as, a unit of new enterprise requires x professional-managerial type employees and y other workers. Each of these requires housing of a certain type, and so on. Each such relation is written in the form of an equation. Variables other than the basic class-component variables enter into some of these equations.

Units of one class of a component may pass into another class—e.g., new enterprises may become mature, and mature enterprises may become declining. Similarly, workers may pass from one employment class to another, back and forth, and units of housing may similarly change class. Rates of change of units from one class to another may be thought of as rates of flow, and are expressed mathematically as first derivatives of the appropriate variables. These rates of flow are considered dependent functions of the various variables themselves. The relations give rise to further equations, so that the complete set is quite complex and extensive.

A final concept entering the model is that of a limitless environment surrounding the city but not a part of it. Units can freely migrate between the two according to the relative desirability of conditions within and without the city. Thus, if conditions seem relatively favorable within the city, enterprises or people will migrate into the city. On the other hand, enterprises or people will move out if conditions within the city are relatively unfavorable. Throughout this book the outer environment surrounding a city is assumed constant as conditions within the city are varied. Resulting changes within the city would necessarily be different if conditions also changed in its outer environment—e.g., in rural areas and other cities.

Once all the relations are specified and initial values entered, the model can run, or runs itself, from the end of one time period to the next, indefinitely. The process generates not only values of the class-component variables, but also ratios such as those of the number under-employed to the number of available jobs, of persons to housing and to the fraction of land occupied, and tax ratios.

Perhaps the most troublesome part of constructing this model lies in properly specifying in detailed numerical form the many functional relationships involved. It appears to the reviewer that, because detailed data are lacking, judgment, impression, and general observation have had to be substituted. The model has then been run, and the functional relationships adjusted, until the values assumed by the variables over a period of time appear reasonably like those that have been observed in the development of real cities. This means that the variables assume values indicative first of growth, then of maturity, and finally of decay. This is the primary validation of the model; that it appears to develop as actual cities have.

At this point various changes are introduced to learn their effect upon the model. For example, a low-rent housing construction program is introduced, financed by some outside source, so that construction costs are not borne by the city. The model indicates that the increased low rent housing will draw additional under-employed to the city, will dampen other building activity in both business and housing, and will end by increasing the ratio of under-employed to available jobs, decreasing the amount of business in the city, and increasing the tax rate.

Other urban improvement programs actually tried or suggested for cities were tested on the model with little favorable and generally somewhat unfavorable results. Among these were the external creation of additional jobs, inauguration of a job training program, and a direct external subsidy. The favorable results of such programs were largely offset by an influx of under-employed drawn by the programs themselves.

Other programs were tried, to test their effect. Construction of any type of housing had generally unfavorable effects. Neither a forced increase in new enterprises nor the forced retirement of declining business had much net effect.

Somewhat surprisingly, the demolition of slum housing resulted in generally unfavorable results: an increase in the number of new and mature business enterprises, an increase in housing for all fully employed workers, a decrease in the ratio of under-employed to available jobs, and a decrease in the tax ratio. These results were enhanced when further accommodated by a policy encouraging the introduction of new business enterprises.

What value can be placed on inferences drawn from tests on the model? Because of the large element of judgment necessary in setting the individual functional relationships, certainly results obtained from the model must be accepted only with considerable caution. No one should be surprised if in a live test results should differ from those obtained with the model. Some idea of the extent and likelihood of such a discrepancy might be obtained if tests were run on the model with various combinations of different possible functional relationships.

But uncertainty of the model's results must be viewed against the certainty or uncertainty with which results of urban improvement programs can be predicted without a model. Results from programs that have been put into effect have not been too successful thus far. Indeed, for these programs, results have been closer to those suggested by the model than to those hoped for when the programs were initiated. The model can be refined and altered as more data become available. Analysis of what goes on within the model to cause some of the results may offer insights of value.