# BASIC ECONOMIC THEORY FOR AN INSURER'S RATE OF RETURN AND FOR ITS REGULATION

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Summary.- Up to the present, insurance researchers and theorists have tried to devise a special economic theory of insurance rather than trying to fit insurance operations into the existing economic theory. The theme of this paper is that there is not and need not be a special economic theory of risk, of insurance, or of insurers. Managerial theory fully and precisely covers the entrepreneurial (including risk-creating and risk-assuming) factor of production. Insurance, as part of security management, has already been fully fitted into managerial theory.

The basic elements of economic return to an insurance enterprise have some years ago been accurately and completely identified and mathematically modelled. This model is now supplemented with what is believed to be the first complete specification of the contingencies and profit factors for which an allowance in rates is required. Based on these developments, a theory (and a basis for its practical application) is worked out that can guide rate regulators as well as others respecting (a) the six specific needs for such returns and (b) how much such returns should be.

## THEORETICAL BACKGROUND AND DEVELOPMENTS TO THE PRESENT

Writers have been trying for eighty years or more to develop an "economic theory of risk and insurance". Among the first was Allan Willett, whose doctoral dissertation of 1901[1] has been used as text material during several decades for courses of the Insurance Institute of America and the American Institute for

Property and Liability Underwriters (which grants the CPCU designation), and is quoted in many other texts.[2] This work was reprinted in a golden anniversary edition by the S. S. Huebner Foundation and does provide some useful and original insights. It does not provide a complete theory, however, as has been pointed out by Karl Borch, a professor of economics at Bergen's Collegiate School of Business as well as an actuary of international repute.[3]

Professor Borch has also tried during a lengthy period to develop a separate economic theory of insurance. His two most important papers resulting from this attempt were published in 1964[4] and 1977. In the second paper he forthrightly agrees with some of his readers that in neither paper has he achieved his end of developing the theory referred to. He has, however, accomplished several important things.

The bibliographies accompanying his two papers introduce those on either side of the Atlantic to many works covering both insurance and economics that they have not previously encountered. This scholarly and extremely broad survey of the literature is quite enlightening to the majority of Americans, who have been led to believe by all important domestic insurance textbooks that Allan Willett's was the only work until Irving Pfeffer's[5] on insurance and economic theory.

Professor Borch reveals to readers of his two papers some of the gaps in existing theory, a not inconsiderable aid to those who might try to reduce or close them. The gaps he brings to light tend to lead one to explore general economics texts for edification. They do not provide much.

This failure to edify appears to result from a generally imprecise coverage of the fourth factor of production, which is usually referred to as "entrepreneurship". For example, one text defines the term as "the function of making fundamental policy decisions in a firm."[6] Another describes it as organizing the . . . enterprise, assuming the risk, and combining the other factors of

production . . . to produce the final product.[7] A third text combines these two definitions.[8] Perhaps the most widely sold text practically ignores the matter, incidentally reducing the fourth factor of production to "technical knowledge" [9] and not acknowledging it to be a separate factor at all.[10] None of these authors makes the key distinction between the nature of the factor of production called labor (directly producing economic value by work on things) and the nature of managing (getting productive work done through other persons). The one word "management" is also used to refer in different places to the function of managing, to the managers who perform it, and to the result of their performance, leading to lack of precision and clarity.

Managing: the Fourth Factor of Production.- The imprecision in all these authors' expressed thought can be neatly cured by recognizing managing to be the fourth factor. This does not mean the limited concept of managing--planning, organizing, commanding, coordinating, and controlling--that is widely held. Rather, it refers to the comprehensive definition originated in 1916 by Henri Fayol, already chief executive in the nineteenth century of a coal and steel conglomerate:

> to lead the enterprise toward its objective by making the best possible use of all the resources at its disposal, i.e. to assure the performance of the six essential functions.[11]

"The six essential functions are (1) technical, that which distinguishes one type of enterprise from another; (2) external relations, such as purchasing, sales, and public relations; (3) financial; (4) intelligence, including accounting and managerial information; (5) security; and (6) administrative."[12]

Fayol defined his fifth essential function, security management, as "protection of property and persons." With the benefit of further knowledge developed during the subsequent six decades, this definition can be detailed and clarified. Actuaries will not fail to note Fayol's clear distinction between security management (within which their peculiar expertise falls) and the

part of management that embraces accounting and its different type of expertise.

Part of the knowledge developed subsequent to his work is the concept of risk developed by Albert Mowbray, an early president of the Casualty Actuarial Society. His text divides economic risk, defined as "the chance of loss," into pure risk and speculative risk. Pure risk is an existing, unavoidable chance of loss. It is inherent to the existence of destructible property or other value, the preservation of which does not of itself yield any increase in value or profit. Speculative risk is created risk, one possible outcome of which is a profit. Both gambling and a new commercial or manufacturing enterprise create speculative risks.[13] Ongoing operation of an economic enterprise continues speculative risk of varying types and degrees for the former's entire lifetime.

Insurance deals almost exclusively with pure risk. Hence, texts on risk management, which was developed by corporate insurance managers and insurance educators, are typically limited also to dealing with pure risk.[14] Risk management, which has come into vogue since World War II, assigns to insurance a subordinate role that comes into play only after an enterprise has first surveyed its pure risks and has designed and applied all cost-effective steps to eliminate risk where possible, to reduce risk where it cannot be eliminated, and to assume as much of the remaining risk as its finances conveniently permit. Responsibility for the risk-management function is usually organizationally separate from that for the physical-security functions of guards, watchmen, and sprinkler systems.

Quite separately from insurance and risk management, a body of knowledge has been developed about handling speculative risks. Professor Samuelson refers to the work of Frank Knight, who theorized that all true profit is linked with uncertainty or risk.[15] Informal techniques for making decisions under uncertainty have existed since intelligent life began, but particularly since the 1930's mathematically rigorous, formalized, methods have been developed. The Neyman-

Pearson method of testing hypotheses, for example, substituted an identified numerical level of confidence for less precise standards such as the age-old Anglo-Saxon legal concept of "beyond a reasonable doubt". It also formalized the making of difficult choices, e.g. if it is considered worse to convict an innocent person than to let a guilty person go unpunished, the null hypothesis to be tested and possibly disproved to a high numerical probability is that he is innocent. Operational research techniques have been developed since World War I. They include such decision-making methods as mathematical programming, queuing theory, and critical path methods (which analytically replaced the primarily geometric Gantt chart of the latter nineteenth century in the routing and scheduling of work). All these and similar techniques are primarily tools for increasing managerial control and reducing risk. They can be applied to both pure and speculative risk.

Unlike risk management, Fayol's beautifully simple definition of security management easily embraces all the activities and tools for dealing with both pure risk and speculative risk:

a. pure-loss prevention: measures taken to prevent injury or loss to persons and property. This relates both to tangible loss (physical injury to or loss of persons or objects) and to intangible loss (e.g. employee or fiduciary peculation, libel, false arrest).

b. pure-loss reduction: measures taken to minimize the cost of a loss that happens. Examples are automatic sprinklers, alarms, and automatically closing barriers.

c. the three other activities of risk management:

(1) identifying existing and potential pure risks.

(2) controlling assumption of pure risk

(3) securing insurance protection.

d. speculative-loss prevention, such as hedging against trading or

foreign exchange losses, or operating rented rather than owned premises in foreign countries.

e. speculative-loss or risk reduction, such as use of stop-loss orders for owned securities, diversifying maturities of owned debt securities, or only engaging in ventures with very high reward-to-risk ratios.

Some activities and tools embraced by security management but not by risk management can be mentioned. Statistical inventory control limits risk of loss from adverse changes in sales volume and selling prices, and of loss of return on funds tied up in excessive inventory. Equating the assets and liabilities that are measured in each currency minimizes foreign exchange losses. Breakeven analysis can reduce the risk of a wrong or poor choice of whether to add a new product line, or poor choice from alternative brands or types of equipment. Life-cycle management techniques offer a more comprehensive and thus more accurate basis of comparison for alternative pieces of costly equipment. Critical path techniques can be used to minimize surety losses by controlling the progress of bonded construction projects. Planned maturity diversification of owned debt securities minimizes the risk of a crucial cash shortage in the event of a catastrophe loss or similar need. An adequate development scheme for managerial personnel (recruiting, selection, training, motivation, delegation of responsibility, job rotation and progression, evaluation of results achieved), possibly based on life-cycle management techniques, can reduce the risks of a deteriorating or deficient future group of top managers in a firm.

These tools, and a number of others limited only by the ingenuity of the prospective users, are available for security managers to apply to speculative risks. The foregoing examples of how such tools can be applied to ordinary operations point up the fact that the speculative risks faced by an enterprise offer a threat to its life and health that is at least as great as that offered

by the pure risks it faces. The proportion of bankruptcies resulting from speculative risk (including mismanagement) reportedly far exceeds the number that are due to losses from pure risk. Allen Mayerson, based on his experience as an insurance department actuary and insurance commissioner, intuitively came to an equivalent conclusion, namely that most insolvencies of insurers arise from misfeasance or malfeasance by top management.

The fact that speculative risk is at the very least a major element in the fortunes of an insurer or other enterprise makes inappropriate for explaining its operations and their actual or likely results any theory of risk that is based only on random fluctuations. The statistical bias inescapably arising from managerial decisions , and from the speculative risk that they create or affect, makes necessary the use of analytical tools that are capable of dealing competently with non-random fluctuations as well. This extremely important point appears consistently to be ignored in the writings of some actuaries and often to be ignored by others.[16]

A Firm Foundation.- To sum up this first section of the paper, it has been shown that managing--realistically defined--necessarily and sufficiently completes the factors of production and thus a comprehensive economic theory of production.[17] This theory neatly embraces all kinds of risk faced by an enterprise, whether it be an insurer or other type. A special economic theory of risk and insurance is thus seen to be unnecessary.

The theory coincides with actual practical experience in making clear that quantitative methods and theories of risk that are fit to deal only with random fluctuations are insufficient to handle real-world circumstances. It makes clear that both pure risk and speculative risk must be effectively managed (and exemplifies how to do this) in order for an enterprise to prosper. It thus for the first time provides a firm theoretical foundation for considering what an appropriate rate of profit, or of return on sales or investment,

of an insurer might be.

Important Implications of This Foundation.- Recognition of the security management function has several interesting organizational implications. Although they are peripheral to the theme of this paper, their major importance to both accountants and actuaries makes two of them worthy of specific mention.

The roles or jobs of persons with probabilistic expertise--economist or mathematical economist or economic forecaster, actuary, operational researcher, statistician, managerial scientist, financial analyst, investment analyst, marketing analyst, inventory control specialist, etc.--are now typically scattered throughout an organization. The first important implication is that these complementary and somewhat overlapping specialties will tend to be assembled into a single staff department in the next decade or two. This assembly of a multi-disciplinary team or teams will greatly increase the usefulness to top managers of this type of expertise, just as the operational research teams of World War II assumed a major staff role where they were instituted.

Few risk managers have probabilistic expertise. Even fewer of those in charge of physical security have it. Actuaries are required by current examinations to have it only with respect to the restricted realm of pure risk, and not for all of that realm.

Actuaries already face strong competition from accountants for their functions in analyzing loss reserves. Actuaries are not even considered to be competition by operational researchers and most of the other above-listed specialists, but some of each of these others are actively in competition with actuaries despite lack of "actuarial" training. The second important implication is thus that actuaries run an important risk of being supplanted by

specialists from one or more of the other listed fields during the next twenty years, unless they demonstrably broaden their expertise to all of risk management and to at least a basic coverage of the broader and more challenging realm of speculative risk as well. Each of the other specialists already covers a major portion of the faster developing realm of speculative risk technology, while actuaries cover almost none.

## APPROPRIATE RATES OF PROFIT FOR INSURERS

Rates of profit can conveniently be studied by use of an input-output approach. First the kinds of available input, then the possibly needed uses or outputs of the inputs are looked at. Finally, how these can be fitted to each other is considered.

Kinds of Return.- The four basic types of return or income from any insurer's operations were fitted into a mathematical model twenty-five years ago and are:

1. Operational (underwriting) return.

2. Direct regular investment return (dividends, interest, and rents from the assets representing the insurer's net worth.

3. Indirect regular investment return: any excess of dividends, interest, and rents from the assets allocated to cover direct liabilities to policyholders (policy reserves or unearned premium reserves and reserves for unpaid claims) above the rate of interest either guaranteed on policy reserves or applied in discounting claim reserves.

4. Irregular investment return: capital gains net of capital losses, related expenses, and income taxes.[18]

These can for different purposes appropriately be ratioed to premium revenues, assets, or net worth. Different ratios may in turn be appropriate for the industry as a whole and for individual insurers or groups of insurers.

If insurance prices were not regulated, the appropriate upper limit on profit would be that set by competitive forces. The remainder of this paper will relate only to regulated liability and property insurance operations, however. A basis for proper and reasonable limits on the profit element in rates and in actual results will therefore be sought. It should be helpful

first to review present practice and the major steps that led to it.

Effects and History of Regulating Underwriting Returns.- Although an allowance in rates to offset the costs of the 1906 San Francisco earthquake and fire was apparently introduced by the companies at that time, prior to 1921 there appears to be no record of consideration by regulators of profit levels in rates. In that year the National Convention of Insurance Commissioners adopted a report that established an allowance of 5 per cent of premiums for underwriting profit plus 3 per cent of premiums for conflagrations.[19] In 1949 the second part of the formula was changed to provide "one per cent for catastrophes".

The underwriting profit and contingencies allowance in Canadian rates has been 2½ per cent for close to fifty years, although in at least one of the larger provinces the average actual underwriting loss for automobile insurance was 2.42 per cent during a recent twenty-one year period.

All of these allowances were based purely on judgment. There was mention well over a decade ago that the allowances for contingencies and catastrophes in property insurance rates had since 1906 paid several times over for the insurance costs of the San Francisco disaster. It is questionable that allowance was made in any such computation for loss of interest prior to recovery of the "reimbursed" funds, or for the costs of other catastrophes that occurred between 1906 and the time the computation may have been made. But the implied criticism of the failure by both regulators and insurers to make any check is quite valid.

It is contrary to good managerial practice (and good regulatory practice) not to provide feedback or control information that will substitute available facts for judgment and allow measured posterior adjustment of prior estimates as soon as that is feasible. It is remarkable that even rough adjustments on an industry-wide basis to conform contingency allowances in property insurance

rates to actual losses have only been introduced during the last decade by ratemakers.

History of Regulating Investment Returns.- Until the early 1960's, regulation of non-life insurance rates was not concerned with investment income. The rate regulatory statutes of most states still refer to "underwriting profit and contingencies". When these statutes were enacted, underwriting profit was clearly understood not to apply to any form of investment income. Investment income was in effect an added cushion against occasional severely adverse underwriting results, i.e. a secondary contingency allowance. It also helped build net worth at a rate that could support a more rapidly growing premium volume.

Subsequently, many regulators became aware that a large proportion of investment income (Item 3 above) is derived from funds generated from premiums rather than from owners' contributions of capital. They felt it appropriate to reflect this income in ratemaking and saw to it that this was done. Little attention seems to have been given to the effect of such a change on the over-all profitability of the industry, on the rate at which it could internally build capital to support greater premium volume, or on its ability to attract additional outside capital. Although two costly studies were made by insurer trade associations of the industry's profitability, no attempt to measure the effects of the changes or to devise any needed remedies has been evident.[20]

The Need for Profits.- Profits are needed by the industry as a whole, and by individual insurers as well, for several mutually exclusive purposes:

a. to keep real economic net worth from being reduced by inflation. The higher the rate of inflation, the higher is the rate of nominal profit (after taxes) needed for offsetting it.

b. to meet increasing needs for capacity that are due to growth of the

economy. For the industry, the need equates with the rate of real economic growth, other things being equal. For an individual insurer, the need equates approximately with the rate of real economic growth of its premiums. (More exactly, it equates with the real rate of growth of its expected amount of claims per unit time.)

c. to provide a high enough additional rate of return on investment to retain existing capital and to attract any additional outside capital that is needed, beyond internally generated additional capital, to support any other demand or requirement for increased capacity.

d. to provide a high enough rate of return in relation to exposure to yield at least a predetermined probability or degree of assurance that random variation in results will not drop real underwriting return during any one year below zero.

e. to provide a high enough rate of return in relation to exposure to yield at least a predetermined probability or degree of assurance that non-random variation in results due to unpredictable outside causes will not drop real underwriting return during any year below zero. (This predetermined probability must at least in part be subjective. Examples of this type of variation are a court decision changing loss of hearing by workers from a non-compensable injury to a compensable injury; an administrative decision prohibiting fair discrimination in automobile insurance rates on the basis of sex, age, place of garaging, or similar factors; or passage of a federal statute prohibiting discrimination in employment on the basis of sex that is interpreted by the courts as outlawing fair discrimination in pension rates and benefits.)

f. to provide a high enough rate of return on invested assets to yield, in conjunction with measures to diversify investment risk in space and time, a predetermined probability or degree of assurance that the value of such

assets will not decrease by more than a preset percentage during a twelve-month period due to fluctuation in securities prices.

The foregoing list makes clear that a contingency allowance is needed in conjunction with other measures to cover both underwriting catastrophes and also investment catastrophes such as those of 1933 and 1975. Unless Accounting Standard No. 5 of the Financial Accounting Standards Board is amended or nullified, any such allowance must be made in after-tax dollars.

Until it is possible to meet the six listed needs with fully worked out answers based on a sound theoretical footing, the regulatory profit problem and the security-managerial problem of adequately measuring a firm's needs for protection against pure and speculative risk will not be satisfactorily solved. No theory of risk or application thereof yet developed is adequate to provide all the needed answers, if for no other reason than that the full problem to be solved has not previously been stated. Theory of risk may, however, provide some parts of the needed answers. It is now appropriate to examine which answers are available, how good they are, and what research may be needed to improve them and to provide the missing answers.

Measuring the Need for Profit.- The first role of an allowance for profit and contingencies is to help protect net worth from the effects of inflation. To assure such protection, both the assets that represent net worth and all assets that offset inflatable liabilities need protection if net worth is to be protected. The latter are principally the assets behind claim and unearned premium liabilities.

If all these assets are liquid and are turned over in a relatively short time (most in five years, all in ten years), there is a reasonable chance that the rate of return can be kept at or above the rate of inflation and that capital losses will be avoided. If a large proportion of a firm's assets is invested in an illiquid form of fixed monetary value (long-term bonds with a

fixed interest rate are an example) and if both the rate of inflation and interest rates move sharply upward, the rate of return will probably be insufficient to offset inflation.

The income stream available to meet this need is the third kind listed above. It does not appear to have been generally recognized that the need to offset inflationary increases in longer-term non-life claim liabilities is as definite as the need to meet contractual interest obligations on life policy reserves. This offset can in some measure be made by trending of loss costs in ratemaking. It can most accurately be met, however, by using type three income to meet the measured need (measured by actually recorded "development" of claim liabilities) and allocating only any excess of such income to the ratemaking process. Both methods should be used in tandem.

All the factors mentioned need to be coordinated in a measured manner. The details require working out and could then well be made part of the annual statement so that claim reserves can better be monitored for accuracy.

The second role of a profit allowance is to provide enough additional capital to support the larger insurance needs of a growing economy. An estimate of this need is that insurers' net worth needs to grow in proportion to the economy, i.e. at the same rate as real gross national product. The degree of correlation between the total amount of insurance losses and the gross national product (and perhaps alternative indicators) each year over a long period needs to be tested to determine the most suitable measure of need. Any change in the proportions of insurers of different size must also be considered.

If adequate profits are permitted insurers, as measured by the rate of return on competing investment opportunities that are available, this need will be met. It is possible that real economic profits of insurers must be at a high enough level to generate the needed capital internally. This is an

adequate and feasible answer to the problem and would require only a very small percentage allowance in rates. If the economy has real growth of 3 per cent per annum, for example, and an insurer earns three times as many premium dollars as its net worth, an allowance of 2 per cent in rates would provide the needed rate of after-tax growth in net worth. But the problem merits and needs careful and thorough additional research before the optimal answers will be found.

The third role of a profit allowance can be illustrated by the sudden appearance of nuclear energy and a demand for insurance on nuclear power plants and vessels. The increasing amount of hazardous wastes and increasing governmental control of the methods and locations of their disposal, and development of new types of stored-energy installations, represent two other new sources of demand for insurance and capital to support it.

Such developments are individually almost completely unpredictable. Collectively, the time and rate of their appearance and the degree or amount of new insurance capital they will require can at best be crudely averaged. At the present state of knowledge, the best that can be done may be to include any allowance for this purpose as part of that for real growth of the economy. The new installations and their output will eventually be included in GNP, even though the needed insurance capital will be called for several years prior to that time.

Just as with the preceding item, allowance by regulatory authorities of an average level of profit by insurers that is at least as great as that available from competing and generally equivalent investments of other types should result in an adequate flow of capital to meet this need.

The fourth role, for a contingency allowance, lends itself to the use of risk theory. This writer prefers the tools of individual risk theory, since they seem able more accurately to take account of differences in amounts at

risk, coverages, contagion or catastrophe exposures, existence of partial losses, and other factors requiring discriminate treatment in developing an over-all result.[21]

The current allowances in rates appear poorly matched with the degree of uncertainty accepted in customary ratemaking formulas. Against at most a 6 per cent profit and contingency allowance, it has been pointed out that in insurance ratemaking there has usually been at least a 10 per cent probability that automobile claims will vary 10.6 per cent or more from expected and that general liability losses will vary 13.4 per cent or more from expected.[22] This involves deficient accuracy rather than imprudence, since (1) ratemaking credibility is used for weighting two or more sets of existing data (which cannot be changed, although sometimes more (older) data can be added) and (2) setting a higher credibility standard in ratemaking will not give an insurer any greater safety margin or contingency allowance.

Any greater safety margin that is needed must be in the form of a higher contingency allowance in rates. This can only be secured with agreement of rate regulators. It also needs to be adapted to each individual insurer. The number and amount of claims expected from an insurer's own portfolio, and the variation therefrom--not those of a ratemaking body or of the industry as a whole--are the relevant basis for that insurer's contingency allowance.

The individual insurer's ratio of expected claims to net worth must also be considered. This can be linked through the expected loss ratio(s) to the ratio of premiums to net worth. If other things are equal, an adverse fluctuation of 5 per cent in the amount of claims will be 5 per cent of the net worth of an insurer with a 1:1 ratio, but will be 20 per cent of net worth of an insurer with a 4:1 ratio.

Financial Accounting Standards Board Standard 5 has been allowed to prevent accumulation of pre-tax contingency reserves, through which unused contingency allowances from prior years could be used to offset or reduce the impact of an

important adverse fluctuation in a current year. The needed size of such an allowance is therefore greater, since each separate year must be handled alone. In other words, FASB Standard 5 has increased risk by removing the ability of an insurer efficiently by itself to use spread over time to smooth out chance fluctuations in operating results.

A further factor is the increasing stability of an insurer's portfolio as it grows. If this stability increases in proportion to the square root of the rate of growth in expected claims amount, the appropriate increase in contingency allowance for a doubling in the ratio of expected claims to net worth would be $\sqrt{2}$. The contingency allowance for an insurer that is half as large as another insurer but has the same ratio of expected claims to net worth should also be $\sqrt{2}$ times as great as that of the larger insurer.

The retention scheme of an insurer is another pertinent factor. It must of course be considered in tandem with the insurer's program of reinsurance. A hypothesis that merits study is that the total of contingency allowances in an insurer's rates should pay for all the reinsurance needed to cover the excess part above its underwriting retentions of all claims of any size.

Some fact-based research on the proper size of the contingency allowance is clearly needed. The research needs clearly to relate primarily to the individual insurer's needs, not to a hazy industry total need that accurately fits no one company. The series of yearly underwriting results of a number of representative insurers over a 20 to 50 year period, and the variance of each series, seem the appropriate first subjects of study. The differences in results among companies of different size, different proportions of premiums by line and by geographic area, are the second relevant subject.

The fifth role, of the contingency allowance, is to protect against adverse fluctuations in underwriting results from non-random events. No kind of risk theory applies to this type of risk, as Harald Cramèr has pointed

out,[24] yet the potential harm it can do insurers can be as large as that from a natural catastrophe.

Although hard to model, the actual events that have occurred during several decades can be recorded along with their estimated extra costs. Beyond the types of events to be included in the review that have already been mentioned are delays exceeding three months in approval of rate increases that meet generally acceptable quality standards (rigidly defined) for rate-making methods and supporting data. Also are the effects of limitations on the ability of underwriters fairly to discriminate among risks of measurably different average loss costs.

National Council on Compensation Insurance has for years used "law factors" to adjust rates to statutory changes in benefit levels, a non-random change. Most other such changes are not specifically announced or so readily measurable. Measured adjustments to other changes when the needed facts are available, and inclusion of other changes in the inflationary allowance, seem the best possibilities at present for providing this fifth type of allowance.

The sixth role, for a contingency allowance, is primarily a role for preventive measures and only secondarily one for such an allowance. The role is to assure that the value of invested assets will not decrease by more than a preset percentage during a year.

The main preventive measures that are available involve spread of risk. Holding securities of firms in industries with different cyclical patterns; holding only longer term debt securities of which the maturity dates are evenly dispersed over time; maintaining a disproportionately high percentage of assets in debt securities with early maturities (not over five years); holding shares that do not exceed in total value the net worth of the insurer; and maintaining a geographic diversity of any municipal bonds that are owned, are examples of the preventive measures available.

Investment grade bonds or other debt securities yielding a rate of return on cost to the insurer that is at the peak historical levels of today should have little risk of a price decline. Any debt securities yielding a variable rate of return that is adequately attuned to changing market conditions should also offer little risk. Debt securities with only one to three years to maturity offer small price risk of a measurable amount. Other debt securities, held to meet fixed-cost future obligations, that yield enough to meet or exceed the interest assumptions on which the present value of such obligations is based and which mature at the time(s) the obligations become payable, have interim price risk but have little ultimate price risk on a going-concern basis. Regulatory practice in North America that allows insurers to value debt securities in their annual statements at amortized cost effectively removes most price risk as respects governmental requirements (although not as respects others at interest). It thus appears unlikely that most regulators would find it appropriate or necessary to allow a rating element to cover this type of risk. It appears incumbent, however, on those managing insurers to minimize real price risks as far as possible , by use of the suggested methods of securities selection and other methods of risk minimization.

The price risk offered by equity securities cannot be as neatly handled. Formula investment plans for buying and selling have not worked as well during a long period of rising prices (such as the two decades following World War II) as they had in more irregular markets. Despite considerable research on predicting movements in equity prices that has been carried out at the University of Chicago and elsewhere, satisfactory methods that will sufficiently reduce the risk of adverse price changes during periods shorter than about ten years are not available and probably will not be in the foreseeable future. An

accounting method, such as setting up a voluntary, after-tax contingency reserve deducted from net worth, or failing to take credit for part or all of unrealized capital gains, appears to be the extent of what managers can presently do with respect to this risk. Since it cannot yet be accurately measured, justification for making an allowance for it in rates seems scant at best. The existence of the risk simply needs to be recognized for their own purposes by investors, investment analysts, managers of insurers, and regulators of insurers, and adjusted for as befits those purposes.

A security-management survey of the investment market risks to which an insurer's assets are exposed and a mathematically modelled system to keep such risks minimized are appropriate steps for every insurer to take. This area still needs much research and few insurers if any appear to have tried to take such steps. Few if any actuaries or others appear to have tried to create such a model, of which the securities analysts' "beta method" might rightly form a part.[25]

Totalling the Need for Profit.- To the extent it has been possible to quantify the six needed types of profit, they can be summed up as follows:

a. a return equal to the rate of inflation, on both net worth and on all other assets that offset inflatable liabilities.

b. a return on an insurer's net worth, to provide needed growth in capacity, approximating $(W_i \div P_i) \times (1 \div (1 - T)) \times ((P_{i+1} \div P_i) - 1)$ when stated in terms of premiums, where $P_i$ = net premiums earned during period i, T = effective rate of income tax, and $W_i$ = net worth at end of period i. The rate needed for the insurance industry as a whole approximates the real growth rate of the economy, i.e. of real gross national product.

c. a return on an insurer's net worth sufficient, when taken together with the other elements of profit, to hold existing capital and attract any further capital required by special demand beyond the average growth of the

economy. The individual insurer can handle any special need for capacity in its plans for item b. No research appears to have been done to determine the size of the other part of this element, although it seems quite possibly to be nominal. That size must be a matter of conjecture or estimate until such research is accomplished.

d. Only one specific legal basis for a contingency allowance against random underwriting fluctuations now exists. American statutes typically limit the amount an insurer may expose to loss from a single risk or loss to 10 per cent of the insurer's net worth. If this rather generous or venturesome limit per loss is moderated to be instead a limit per year on total excess losses, or in other words the "maximum allowable chance fluctuation" (MACF)[21], it is easy to divide it by planned premiums and to determine the appropriate contingency allowance in rates. For a range of premium:net worth ratios from 1:1 to 4:1, the resultant contingency allowance would range from 10 per cent to 2.5 per cent of premiums, several times the current 1 per cent allowance. Conversely, this allowance of 1 per cent of premiums represents, for the same range of premium:net worth ratios, a range in MACF's of from 1 per cent to 4 per cent of net worth. This is a more prudent range, but one that the cited ratemaking credibility data and other available evidence suggest is quite impossible of regular attainment by most insurers. A more realistic allowance, in the light of available experience during the twentieth century and until further research provides more precise facts and measures their effects, appears to be where the two alternative ranges approach most closely: 2.5 per cent of premiums.

e. An insurer can record for each year of allengthy period the difference between its loss ratio (or of its ratio of underwriting profit) from that expected, and can compute the mean and the standard deviation of these

deviations. It can also try to find the curve of best fit and test whether the standard error of estimate around that curve is significantly smaller than the standard deviation around the mean. These measures would reflect both the random variation and the non-random variation that had occurred and had been reflected in the reported figures.

The mean ( or the value projected for each operating year from the fitted line) plus a multiple of the standard deviation or standard error sufficient to give the desired degree of assurance, would be the appropriate contingency allowance. It would include, rather than being in addition to, allowance d. for random fluctuations.

The one indication known to the writer of an appropriate size for allowance e. can be derived from public rate filings of a very large insurer. The filings report pre-tax underwriting profit during a period of twelve years equalling 1.28 per cent, which contrasts with a targeted profit of 5 per cent of premiums. There is stated to be an after-tax need of 6 per cent for premium growth (which, although not mentioned, could prudently support up to a 24 per cent actual premium growth) and 5 to 10 per cent for inflation. Investment income that has averaged 6.3 per cent pre-tax during the twelve years is counted on to meet inflation and 1 per cent for growth, leaving a reported 5 per cent needed underwriting profit to finance the rest of the planned growth. This part of the filing applies only to items a. and b.

But the filing also reports standard deviations around the two means. They are 4.83 per cent around the mean underwriting profit of 1.28 per cent (indicative of the very high variability in underwriting results) and 3.25 per cent around the mean investment income of 6.33 per cent (proportionately only one-seventh as much variability as for underwriting!). Although these standard deviations are probably smaller than average, they can be used as an approximate basis for a combined d. + e. allowance.

For a confidence level of 95 per cent (using a t-table for the small sample of twelve) at one end of a distribution, a factor of 1.796 standard deviations applies. This makes the allowance 1.796 x 4.83 per cent or 8.67 per cent of premiums, pre-tax. Since this particular insurer was subject to a mean income tax rate of only 1.6 per cent of premiums, the post-tax allowance is 7.07 per cent. Deducting the post-tax 4.46 per cent allowance already calculated for item d. leaves an indicated 2.61 per cent for item e.

f. There does not yet exist a firm theoretical basis either for measuring the risk of fluctuations in prices of securities or for linking such risk with premium rates or revenues. It accordingly appears inappropriate to suggest an allowance in premium rates for such risk.

Based on the foregoing, a table can be constructed to show approximate smallest, average, and largest indicated pre-tax allowances for profit and contingencies. The table appears on the next page.

Until and unless the effects of inflation are offset in corporate income taxation in a country (as such effects are now offset in personal income taxation in Canada), and inflation accounting becomes commonly accepted for insurers, there seems little likelihood that a direct allowance for the effects of inflation on net worth and on liabilities will be permitted in rates. The size of the allowance needed for such an offset is a sobering reality nevertheless. It is worth calculating and setting forth in order to show the important deleterious effect of inflation on insurers' financial health.

The important strain (quite aside from the burden of reserving for 100 per cent of unearned premiums) on an insurer's finances from too rapid growth, and the virtual impossibility of securing profit and contingency allowances that are adequate totally to eliminate such a strain, are also made clear by the figures. Based on the unrefined data available, it also appears that

Illustrative Indicated Allowances for Profit and Contingencies for Non-Life Insurers

| | Minimum Allowances | Average Allowances | Maximum Allowances |
|---|---|---|---|
| Premiums:net worth ratio | 1:1 | 2:1 | 4:1 |
| Income tax rate | 44% | 44% | 44% |
| Yearly growth in premiums | 0% | 10% | 50% |
| Rate of inflation | 0% | 5% | 10% |

Liabilities are three times net worth in all cases.

| | % of Net Worth | % of Premiums | % of Liabilities | % of Net Worth | % of Premiums | % of Liabilities | % of Net Worth | % of Premiums | % of Liabilities |
|---|---|---|---|---|---|---|---|---|---|
| Item a. | 0 | 0 | 0 | 35.72 | 17.86 | 11.91 | 71.43 | 17.86 | 23.81 |
| Item b. | 0 | 0 | 0 | 8.93 | 4.46 | 2.98 | 89.28 | 22.32 | 29.76 |
| Item c. | ? | ? | ? | ? | ? | ? | ? | ? | ? |
| Item d. | 4.46 | 4.46 | 1.49 | 8.93 | 4.46 | 2.98 | 17.86 | 4.46 | 5.95 |
| Item e. | 2.61 | 2.61 | .87 | 5.22 | 2.61 | 1.74 | 10.44 | 2.61 | 3.48 |
| Item f. | No theoretical relation to premiums yet established. | | | | | | | | |
| Total | 7.07 | 7.07 | 2.36 | 58.80 | 25.39 | 19.61 | 189.01 | 47.25 | 63.00 |

present allowances in rates are insufficient to meet their objectives. An adequate research study to secure better facts and to provide a sound basis for such allowances seems clearly to be called for.

Conclusions.- Risk and insurance require no special or separate economic theory, but rather fit easily into general economic theory. With proper recognition of the role of managing, existing theory forms a firm basis for analyzing the roles of profit in fostering the health of insurers and in enabling them to compete with alternative investments and to provide all the capacity needed by a growing and changing economy.

For some of the roles of profit there already exist adequate and accurate means of determining need or appropriate size. For the other roles much research is still needed. A basis for a reasoned and largely fact-based determination of appropriate allowances for profit and contingencies for regulated insurers has nevertheless been set forth.

Specific results, cautions, and conclusions arising from the analysis are:

1. All the roles of, and an insurer's need for, profit and allowance for contingencies have been specified for the first time.

2. The natural links have been shown between the roles or needs for profit (outputs) and the sources (inputs) of profit from insurance operations.

3. A method for determining how much profit an insurer needs has been developed for the first time directly from basic theory and from recorded facts, and a range of measured needs calculated from it has been set forth.

4. The method and the illustrative profit allowances are first approximations that need refinement based on further research, some of which has been described.

5. Insurers' results are clearly more than the effects of random processes.

Managers' strategies, responsive counter-strategies, and errors are non-random, hence quantitative methods beyond risk theory, ruin theory, and other passive stochastic methods are needed to plan and control results (they cannot be forecasted). Among the other needed methods are economists' statistical tools such as time-series analysis, game theory, information theory, decision theory, and statistical quality control. Use of these tools must be leavened by objective observation and corrective feedback from practical experience in order to keep their use suitably linked to the real world and its changing conditions. A managerial game for insurers could not exist without all player choices being forecordained if insurer results were completely random.

6. The need for stating risk-reducing actions and tools that are required for minimizing some of the needs for profit shows that the size of needed profit allowances is indissolubly linked with how well the security-management function is performed.

NOTES

1. Willett, A., The Economic Theory of Risk and Insurance (New York: Columbia University Press, 1901). Reprinted (Philadelphia: University of Pennsylvania Press, 1951)

2. An example is Mowbray, A. H., Insurance, 3d ed. (New York: McGraw-Hill Book Company, 1946), p. 3

3. Borch, K., "Problems in the Economic Theory of Insurance", ASTIN Bulletin, Vol. X (1977), pp. 1-11, esp. p. 2.

4. Borch, K., "The Economic Theory of Insurance", ASTIN Bulletin, Vol. IV (1964), pp. 252-264.

5. Pfeffer, I., Insurance and Economic Theory (Homewood: Richard D. Irwin Inc., 1956)

6. Bach, G. L., Economics: An Introduction to Analysis and Policy (Englewood Cliffs: Prentice-Hall, Inc., 1974), p. 38.

7. Hailstones, T. J., Basic Economics (Garden City: Doubleday & Company, Inc., 1969), p. 8.

8. Havens, P. M., J. S. Henderson, and D. L. Cramer, Economics: Principles of Income, Prices, and Growth (New York: The MacMillan Company, 1966), p. 5.

9. Samuelson, P. E., Economics, 8th ed. (New York: McGraw-Hill Book Company, 1970), p. 4.

10. Ibid., pp. 572-573 and 593 ff. On pp. 90-93 he treats quite generally the economic role of managers and on pp. 756-759 treats entrepreneurship, but neither comes to grips with exactly what managers do or need to do, nor sees the part of their role that is professional risk-taking for themselves if owners or as surrogates if others are the owners.

11. Fayol, H., Administration Industrielle et Générale (Paris: Dunod, 1966), p. 5. This concept and its background are described in detail in English in McGuinness, J. S., "A Dynamic Concept of Making Plans for an Insurer" (1), CPCU Annals, Vol. 28, No. 3 (September 1975), pp. 143-144.

12. Ibid., p. 144.

13. Mowbray, op. cit., pp. 2-4.

14. Cf. Mehr, R., and B. Hedges, Risk Management: Concepts and Applications (Homewood: Richard D. Irwin Inc., 1974)

15. Samuelson, op. cit., pp. 595-596.

16. McGuinness, J. S., "Catastrophe Concepts for Retentions, Reserving, and Ratemaking" (2), Transactions, 20th International Congress of Actuaries, Vol. 4, pp. 607-614.

17. It does not appear to have been by accident or error that the Nobel Prize Committee chose as the 1978 laureate in economics Herbert Simon, a distinguished managerial scientist, and an economist only to the extent that economics embraces management.

18. McGuinness (1), p. 146.

19. Proceedings, National Convention of Insurance Commissioners, December 1921 (Adjournment of the 52d Annual Session), pp. 19-29.

20. Little, A. D., Inc., "Prices and Profits in the Property and Liability Insurance Industry", report to the American Insurance Association, 1967; and "Rates of Return in the Property and Liability Insurance Industry: 1955-1967", report to the National Association of Independent Insurers, 1969.

21. An approach to this problem appears in McGuinness, J. S., "Controlling the Effects of Catastrophes in Insurance Against Floods and Other Elemental Perils" (3), Transactions, 15th International Congress of Actuaries (1957), Vol. 4. The MACF referred to can be equated with a catastrophe allowance in rates.

22. Mayerson et al., op. cit., pp. 183-184.

23. Cf. McGuinness (3).

24. Cramèr, H., "Collective Risk Theory", in Skandia Insurance Corporation: 1855-1955 (Stockholm: the Corporation, 1955), pp. 5, 7.

25. See Christy, G. A., and J. C. Clendenin; Introduction to Investments (New York: McGraw-Hill Book Company, 1978), pp. 253-254 and 539-540; Levine, S. N., editor, Financial Analysts' Handbook: II: Analysis by Industry, Vol. 2 (Homewood: Dow Jones-Irwin, Inc., 1975), pp. 1224, 1271, 1279-1280, and 1286-1289; and Lorie, J. H., and M. T. Hamilton, The Stock Market: Theories and Evidence (Homewood: Richard D. Irwin, Inc., 1973), reference pages cited in the index.