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ECONOMICS OF INFORMATION

COMMON KNOWLEDGE, CONSENSUS, AND AGGREGATE INFORMATION, by Richard D. McKelvey and Talbot Page (California Institute of Technology).

This paper investigates the effect that common knowledge of public information has on individual beliefs. We assume that n individuals start with the same prior beliefs over a finite probability space, and then each observes private information. We prove that if an admissible statistic of their posterior probabilities of an event becomes common knowledge, then everyone's posterior probabilities for that event must be the same. The class of admissible statistics includes any statistic which is an invertible function of a stochastically monotone function. We also prove that if information partitions are finite, an iterative procedure of public announcement of the statistic — where the statistic is publicly announced and then individuals recompute posterior probabilities based on their previous information plus the announced value of the statistic — converges in a finite number of steps to the common knowledge situation described above. The result has applications to asymmetric information models in economics, where private information becomes incorporated into an aggregate, publicly observed statistic such as a price or quantity in a market. *Econometrica*, Vol. 54, No. 1 (January, 1986), pp. 109-127. (Reprinted with permission of *Econometrica*).

REPEATED INSURANCE CONTRACTS AND LEARNING, by Thomas R. Palfrey and Chester S. Spatt (Carnegie-Mellon University).

This article considers a repeated insurance model with incomplete information in which the insurer and the consumer both learn over time about the unknown risk category of the consumer. Care choices by young consumers affect the informational value of the accident history. Under an optimal scheme of long-term insurance

contracts, young consumers will always be "subsidized" by old consumers, and consumers who are reassessed as low-risk types are always subsidizers (i.e., reverse experience ratings). We compare this optimal scheme with the set of contracts that would emerge in a competitive market if only short-term contracting were possible. These sequentially competitive contracts can lead to over-investment in care by both young and old consumers, relative to the optimum, in contrast to the underinvestment problem associated with moral hazard in insurance. *Rand Journal of Economics*, Vol. 16, No. 3 (Autumn 1985), pp. 356-367. (Reprinted with permission of the *Rand Journal of Economics*).

A SIMPLE TAX STRUCTURE FOR COMPETITIVE EQUILIBRIUM AND REDISTRIBUTION IN INSURANCE MARKETS WITH ASYMMETRIC INFORMATION, by Keith J. Crocker (University of Virginia) and Arthur Snow (Georgetown University)

Existence of Nash equilibrium is not a general property of insurance markets when buyers have private information about their riskiness. This paper presents a simple, implementable tax system applied to firms that permits Nash equilibrium always to exist. Also, an infinity of equilibria can be attained, since risk-discriminating redistribution is possible without *a priori* knowledge of any individual buyer's riskiness. *Southern Economic Journal*, Vol. 51, No. 4 (April 1985), pp. 1142-1150. (Reprinted with permission of the *Journal of Economic Literature*).

RISK PERCEPTION AND ECONOMIC BEHAVIOR

ON THE OPTIMALITY OF PORTFOLIO INSURANCE, by Simon Benninga (Hebrew University, Israel) and Marshall Blume (University of Pennsylvania)

This paper examines the optimality of an insurance strategy in which an investor buys a risky asset and a put on that asset. The put's striking price serves as the insurance level. In complete markets, it is highly unlikely that an investor would utilize such a strategy. However, in some types of less complete markets, an investor may wish to purchase a put on the risky asset. Given only a risky asset, a put, and noncontinuous trading, an investor would purchase a put as a way of introducing a risk-free asset into the portfolio. If, in addition, there is a risk-free asset and the investor's utility function displays constant proportional risk-aversion, then the investor would buy the risk-free asset directly and not buy a put. In sum, only under the most incomplete markets would an investor find an insurance strategy optimal. *The Journal of Finance*, Vol. 40, No. 5 (December, 1985), pp. 1341-1352. (Reprinted with permission of *The Journal of Finance*).

RELATIVE RISK AVERSION AROUND THE WORLD, by George G. Szpiro, (University of Pennsylvania).

In this letter the hypothesis of constant relative risk aversion is examined for 15 countries, using property/liability insurance data. For more than half the cases it is shown that CRRA can not be rejected. Following that, the degree of relative risk aversion is estimated, and found to usually lie between one and two. *Economics Letters*, Vol. 20, No. 1 (1986), pp. 19-21. (Reprinted with permission of North-Holland Publishing Company).

RISK THEORY AND SERENDIPITY, by Karl Borch (Norwegian School of Business)

The paper gives a short presentation of a model which determines equilibrium premiums in an insurance market, and a series of examples and potential applications. The paper also reviews De Finetti's model of optimal dividend policies, and argues that this model gives the utility functions required by the equilibrium model. *Insurance: Mathematics and Economics*, Vol. 5, No. 1 (January 1986), pp. 103-112. (Reprinted with permission of North-Holland Publishing Company).

PROPERTIES OF PREMIUM CALCULATION PRINCIPLES, by Axel Reich (Kölnische Rückversicherungs-Gesellschaft, Federal Republic of Germany)

All theoretical premium principles, which use a utility function (such as exponential principle, mean value principle, zero utility principle, Swiss premium calculation principle, Orlicz principle, Esscher principle) are analyzed in the light of practical properties such as homogeneity (as usual for quota shares) and sub-additivity. It is proved that a theoretical premium principle, which fulfills only very weakened forms of both practical properties, reduces necessarily to the net premium principle. Therefore it is impossible that the principles and the properties above are reasonable simultaneously. *Insurance: Mathematics and Economics*, Vol. 5, No. 1 (January 1986), pp. 97-101. (Reprinted with permission of North-Holland Publishing Company).

THE REINSURER'S MONOPOLY AND THE BOWLEY SOLUTION, by Fung-Yee Chan (University of Winnipeg) and Hans U. Gerber (University of Lausanne)

The reinsurer has a monopoly in the following sense: He will select a random variable P that determines the reinsurance premiums. The first insurer can purchase a payment of R (a random variable) for a premium of $\pi = E[PR]$. For known P , the first insurer chooses R to maximize his expected utility. Knowing this, i.e., the demand for reinsurance as a function of P , the reinsurer chooses P to maximize his utility. The resulting pair (P,R) is called the Bowley solution. Assuming exponential, quadratic and/or linear utility functions, some explicit results are obtained. *ASTIN Bulletin*, Vol. 15, No. 2 (November 1985), pp. 141-148. (Reprinted with permission of the *ASTIN Bulletin*).

UTILITY THEORY

THE RELATIVITY OF UTILITY: EVIDENCE FROM PANEL DATA, by Huib van de Stadt (The Netherlands Central Bureau of Statistics), Arie Kapteyn, and Sara van de Geer (Tilburg University)

The paper addresses the question whether utility may be viewed as a completely relative concept. In a dynamic setting this means that one has to model both habit formation and utility interdependence. The resulting model contains unobservable variables and requires panel data to be estimated. Using the first two waves of an annual panel in The Netherlands, different specifications of the model are estimated, involving alternative sets of identifying restrictions. It turns out that the data are compatible with the hypothesis that utility is completely relative, but we cannot

exclude the possibility that utility is partly relative and partly absolute. *The Review of Economics and Statistics*, Vol. 67, No. 2 (May 1985), pp. 179-187. (Reprinted with permission of *The Review of Economics and Statistics*).

COGNITION AND BEHAVIOR IN STUDIES OF CHOICE, by Howard Rachlin and A.W. Logue (State University of New York at Stony Brook), John Gibbon (New York State Psychiatric Institute and Columbia University) and Marvin Frankel (Sarah Lawrence College)

Kahneman and Tversky's cognitive model of human choice is compared with Herrnstein's behavioral model of animal choice. The two models have many corresponding concepts. A means is proposed for translating between the models so as to provide behavioral descriptions of cognitive experiments and cognitive descriptions of behavioral experiments. One important bridge between the two models is the correspondence between the concept of probability in the cognitive model and the concept of delay in the behavioral model. The behavior of human subjects who fail to choose a gamble of the highest expected value may correspond to the behavior of animal subjects who fail to choose the highest overall rate of reward. In the cognitive model such inconsistent behavior is ascribed to nonlinear subjective weighting of amounts or probabilities. In the behavioral model such behavior is ascribed to the sharp discounting of delayed rewards — a problem of self-control. We argue that these are just two competing descriptions of a single fundamental process. *Psychological Review*, Vol. 93, No. 1 (January 1986), pp. 33-45. (Reprinted with permission of The American Psychological Association, Inc.)

RUIN THEORY

ORDERING OF RISKS AND RUIN PROBABILITIES, by F. Broeckx (University of Antwerp, Belgium), M. Goovaerts (K.U. Leuven, Belgium, and University of Amsterdam, The Netherlands) and F. De Vylder (Université Catholique de Louvain, Belgium)

Upper and lower bounds for the ruin probability over infinite time in the classical actuarial risk model are derived (usual independence and equidistribution assumptions, the claim number process being Poisson). Some recent results on bounds for certain classes of integrals are adapted to the case of a convolution transform in order to derive applicable (from the actuarial point of view) bounds. *Insurance: Mathematics and Economics*, Vol. 5, No.1 (January 1986), pp. 35-39. "Discussion," by G. C. Taylor (E. S. Knight & Co., Sydney, Australia), pp. 41-44. (Reprinted with permission of North-Holland Publishing Company).

HEALTH CARE AND INSURANCE

THE EFFECT OF PROVIDER CONTROL OF BLUE SHIELD PLANS ON HEALTH CARE MARKETS, by Richard J. Arnould and Lawrence M. DeBrock (University of Illinois at Urbana-Champaign)

Blue Shield plans often are granted regulatory advantages by the states in which they operate. Run efficiently, such not-for-profit firms should use these lower costs to eliminate their less advantaged rivals, the commercial insurers. However, these higher-cost commercial providers have been able to offer insurance coverage at prices competitive with the Blues, as evidenced by the fact that Blue plans have, on average,

less than 50 percent market share. Similar prices with lower overall costs implies that economic rents are being earned, rents which a not-for-profit firm cannot distribute to owners. In this paper we argue that when there are competing goals among the groups controlling the Blue Shield plans, the different possible "uses" of the regulatory advantage become endogenously determined, necessitating the use of simultaneous equation estimation. Testing this model we find the major effect of doctor-control of Blue Shield plans is to raise doctors' fees while lowering the amount of rents captured by both consumers and administrators. *Economic Inquiry*, Vol. 23, No. 3 (July 1985), pp. 449-474. (Reprinted with permission of *Economic Inquiry*).

HEALTH AND RETIREMENT

A MODEL OF DECLINING HEALTH AND RETIREMENT, by John R. Wolfe (Michigan State University)

The declining U.S. average retirement age has been difficult to reconcile with cross-section evidence that poor health is a primary cause of early retirement. This paper reconciles those observations by building a Grossman-type model of investment in health, distinguished from its predecessor by a more formal treatment of initial conditions. A discontinuous mid-life increase in health investment (retirement) is shown, in general, to be part of the optimal investment strategy. Time-series productivity increases are shown to lower the optimal retirement age, while varying health endowments and depreciation rates are shown to be able to account for cross-section retirement age variations. *Journal of Political Economy*, Vol. 93, No. 6, (December 1985), pp. 1258-1267. (Reprinted with permission of the *Journal of Political Economy*).

THE EFFECT OF MANDATORY RETIREMENT ON MORTALITY, by Kathryn H. Anderson, (Vanderbilt University)

To explain the effect of an unexpected change in mandatory retirement rules on post-retirement health, a rationing model is applied to the Grossman health demand model. If health is a time-intensive commodity, the model predicts a deterioration in health if additional time is allocated to the labor market. To test this implication, health demand is estimated using data from the Retirement History Survey (RHS) matched to individual mortality records. The results indicate that if the mandatory retirement age is increased, health (measured as the probability of survival) will significantly decline. *Journal of Economics and Business*, Vol. 37, No. 1 (February 1985), pp. 81-88. (Reprinted with permission of the *Journal of Economics and Business*).

SOCIAL INSURANCE

PAYING FOR THE MEDICARE PROGRAM, by Alicia H. Munnell (Federal Reserve Bank of Boston)

Although the hospital insurance (HI) trust fund acted as a source of strength for the old-age, survivors, and disability insurance program during its recent financial crises, projections by HCFA AND CBO reveal that the Medicare program will experience financing problems of its own within the next decade. No one would argue that Medicare's financing problems should be solved simply by raising more money.

However, the prospect of insolvency in the HI trust fund and the increasing strain on general revenues from the Supplementary Medical Insurance trust fund require policymakers to survey the options for increasing Medicare revenues while cost-control devices are being developed. Indeed, even if cost-control efforts are completely successful, additional revenues may be needed in the future to finance new initiatives in the Medicare program. Therefore, this paper will look briefly at current efforts to regain control of soaring hospital and physician costs and then examine some of the more feasible options for increasing Medicare revenues. *Journal of Health Politics, Policy and Law*, Vol. 10, No. 3 (Fall 1985), pp. 489-511. (Reprinted with permission of the *Journal of Health Politics, Policy and Law*).

MEDICARE REFORM: SOCIAL AND ETHICAL PERSPECTIVES, by Ronald Bayer and Daniel Callahan (The Hastings Center)

Despite Medicare's success as a social program, its future is in question because of the program's enormous costs. Because the issue of Medicare reform has been forced upon us at this juncture by a crisis of finance rather than by the long-standing inequities in the present system of paying for the health care of the elderly, questions about how best to secure its fiscal integrity have seized the attention of the public. Yet, such questions are hard to contain; they force an examination of broader and more fundamental issues. In this article, we examine the validity of the ultimate moral and social rationales for continuing Medicare in something approximating its present form; the legitimacy of a social entitlement program that is age- rather than means-based; the implications for the future of health care reform if significant changes were to be made in the Medicare program and its underlying rationale; and the possibility that changes in that program may jeopardize the chances for a more rational, just, and systematic approach to the provision of health care to all Americans. *Journal of Health Politics, Policy and Law*, Vol. 10, No. 3 (Fall 1985), pp. 533-547. (Reprinted with permission of the *Journal of Health Politics, Policy and Law*).

ON THE INDEPENDENCE OF FINANCING METHODS AND REDISTRIBUTIVE ASPECTS OF PENSION PLANS, by H.A.A. Verbon (University of Amsterdam)

In this paper a pension scheme is considered in which lifetime income is redistributed between individuals from different income classes but out of the same generation. The within generations redistribution is not necessarily restricted to a linear form. Non linearities due to e.g. maximum earning limits are admitted as well. It is proved that if the pension fund considers the real rate of interest as an exogenous variable, the redistributive aspect of the pension scheme can be made independent from its financing method. The condition governing the choice of the financial method is a generalization of Aaron's (1966) condition. Our condition differs from Aaron's condition in the sense that a once-and-for-all decision might not be optimal for all present and future generations. (*Public Finance/Finances Publiques*).

SOME REDISTRIBUTIVE ASPECTS OF SOCIAL SECURITY AND THEIR IMPACT ON THE SUPPLY OF LABOR, by Fadle M. Naqib (University of Waterloo, Ontario, Canada)

This paper examines the impact of a social security program on an individual's retirement decision and lifetime work pattern. Such a program is shown to be analytically equivalent to the introduction of a set of time dated wage-taxes/subsidies. The exact time-pattern of equivalent taxes and subsidies depend on two features of the

social security program. The first is the difference between the rate at which the program accumulates the individual's contributions in calculating his social security fund and the rate of interest the individual can get on his private savings, that is, the inter-generational redistributive feature of the scheme. The second is the difference between the value of the fund accumulated by the individual at his date of retirement and the present value (at retirement) of the stream of benefits received by the individual, that is, the intra-generational redistributive feature of the scheme. It is shown that a program free of these two features has no effect on either work effort or the age of retirement. A redistributive program, on the other hand, has a clear effect on both. Some individuals may be induced to increase work effort and others may decrease it. More importantly, some may be induced to shift work activity from one stage to another during the life-cycle. The model is simulated to give a numerical example of the analysis. *Public Finance/Finances Publiques*, Vol. 40, No. 2 (1985), pp. 230-246. (Reprinted with permission of *Public Finance/Finances Publiques*).

FINANCING SOCIAL SECURITY, by John A. Turner (U.S. Department of Labor)

Using a simple accounting framework, social security financing is divided into its component elements, and changes in these elements are examined. In the 1940s and 1950s, start-up effects were the most important source of social security financing. In the 1960s and 1970s, legislated increases in the payroll tax rate were most important. With the decline in other financing sources, the growth in population and in earnings has increased in relative importance as a source of social security financing. *Review of Social Economy*, Vol. 42, No. 2 (October 1984), pp. 105-116. (Reprinted with permission of the *Journal of Economic Literature*).

WORKERS' COMPENSATION INSURANCE, EXPERIENCE-RATING, AND OCCUPATIONAL INJURIES, by John W. Ruser (U.S. Bureau of Labor Statistics).

This article examines how an increase in workers' compensation indemnity benefits affects injury rates when firms are experience-rated to varying degrees. The theoretical model shows that an increase in benefits has a smaller effect on injury rates in more highly experience-rated firms. Since an institutional characteristic of workers' compensation insurance is that larger firms tend to be more highly experience-rated, the empirically testable hypothesis is that there is a smaller relationship between benefits and injury rates in larger firms. The hypothesis is tested with injury rate regressions estimated by using data on 25 three-digit U.S. manufacturing industries for the year 1972-1979. Support for the hypothesis is found when the frequency of all injuries is the dependent variable, but the evidence for the hypothesis is less strong when the dependent variable is the frequency of lost-workday injuries. *Rand Journal of Economics*, Vol. 16, No. 4 (Winter 1985), pp. 487-503. (Reprinted with permission of the *Rand Journal of Economics*).

EMPLOYEE BENEFIT PROGRAMS

WAGE SUPPLEMENTS THROUGH COLLECTIVE AGREEMENT OR STATUTORY REQUIREMENT? by Robert A. Hart (International Institute of Management, Berlin)

Wage supplements in the form of private fringe benefits and statutory contributions to social welfare account for around 25 percent of the typical firm's total labor costs

throughout OECD countries. Economic reasons for both forms of non-wage payment are critically assessed. On the private side, these embrace human capital and union median voter approaches while, on the statutory side, the discussion covers general social welfare, government employment policy, and employer-union relations. It is argued that governments should provide a fiscal framework designed to stimulate more effective individual and firm-level choice between equivalent forms of private and statutory supplementary compensation. *Kyklos*, Vol. 38, No. 1 (June 1985), pp. 20-42. (Reprinted with permission of the *Journal of Economic Literature*).

LIFE INSURANCE

USE OF LIFE INSURANCE TO FUND THE FARM PURCHASE FROM HEIRS, by Loren W. Tauer (Cornell University)

General stochastic dominance is used to analyze the use of life insurance versus installment payments to fund the purchase of a decedent's business interest from off-farm heirs. Generally, a risk preferer prefers an installment purchase. The percentage of insurance funding preferred increases as aversion to risk increases. Higher income tax rates, lower discount rates, and lower premium costs move the preference for greater percentages of life insurance to lower levels of risk aversion. The funding decision clearly depends upon the characteristics of the individuals involved in the business. Nevertheless, partial funding with life insurance appears optimal in many cases. *American Journal of Agricultural Economics*, Vol. 67, No. 1 (February 1985), pp. 60-69. (Reprinted with permission of the *Journal of Economic Literature*).

INSURER MANAGEMENT AND REGULATION

A MODEL FOR THE DETERMINATION OF "FAIR" PREMIUMS ON LEASE CANCELLATION INSURANCE POLICIES, by James S. Schallheim (University of Utah) and John J. McConnell (Purdue University)

Lease cancellation insurance protects the lessor against early termination of a cancellable operating lease. This paper presents a contingent claims model for determining the "fair" premium for this type of insurance policy. Comparative statics are considered, and some numerical examples are presented to illustrate the model. Among other things, the insurance premium is sensitive to the expected rate of economic depreciation of the leased asset and to the leased asset's systematic and nonsystematic risk. *The Journal of Finance*, Vol. 40, No. 5 (December 1985), pp. 1439-1457. (Reprinted with permission of *The Journal of Finance*).

RISK-RETURN TRADEOFF, INCOME MEASUREMENT AND CAPITAL ASSET PRICING FOR LIFE INSURERS: AN EMPIRICAL INVESTIGATION, by Sandra G. Gustavson (University of Georgia) and Cheng F. Lee (University of Illinois at Urbana-Champaign)

This study examines the risk-return tradeoff relationship and the behavior and components of both total and systematic risk for a sample of 40 stock life insurers for the period 1968 to 1978. Contrary to the results for industrial firms, nonsystematic risk is found to be relatively more important than systematic risk in explaining returns. Variables which partially explain the variation in risk measures are premium and asset growth rates, dividend payout, standard deviation of earnings and accounting beta. Related areas of investigation include several alternative income measures

and an extension of the application of the cost of capital concept for life insurers. *The Geneva Papers on Risk and Insurance*, Vol. 11, No. 38, January 1986, pp. 23-43. (Reprinted with permission of the Geneva Association).

THE CAPITAL ASSET PRICING MODEL AND THE DETERMINATION OF FAIR UNDERWRITING RETURNS FOR THE PROPERTY-LIABILITY INSURANCE INDUSTRY, by Jorge L. Urrutia (Loyola University of Chicago)

The paper develops and empirically tests a financial model for pricing property liability insurance. The model, based on the CAPM, attempts to clarify the controversial issue of insurance price regulation and represents an effort to overcome the shortcomings of previous models strongly criticized by the insurance industry. Empirical results show that different tax rates for underwriting profit and investment income and the probability of bankruptcy of the insurer are relevant factors in pricing insurance. Sensitivity analysis indicates the impact of variability of underwriting betas is not significant. The proposed model is considered appropriate for implementation by the State Insurance Department for insurance price regulation in the United States. *The Geneva Papers on Risk and Insurance*, Vol. 11, No. 38, January 1986, pp. 44-60 (Reprinted with permission of the Geneva Association).

DRAFT OF A SYSTEM FOR SOLVENCY CONTROL IN NON-LIFE INSURANCE, by Ragnar Norberg and Björn Sundt (University of Oslo)

An outline is given of a proposed system for solvency control in non-life insurance that has recently been discussed within a Working Party appointed by the Norwegian supervisory authorities. According to this system the factual technical reserves must at any time be sufficient to meet, with high probability, all future liabilities stipulated by insurance contracts that have either expired or are currently in force. The system is applied to a provisional, simple model that has been fitted to claims data assembled from Norwegian non-life companies. The numerical examples illustrate, *inter alia*, how the required reserve depends on the volume of the business, the portfolio mix, and the reinsurance cover. *ASTIN Bulletin*, Vol. 15, No. 2 (November 1985), pp. 149-170. (Reprinted with permission of the *ASTIN Bulletin*).

A SURVEY OF THE RELATIONSHIP BETWEEN CLAIMS RESERVES AND SOLVENCY MARGINS, by J. F. Byrnes (Willis Faber Johnson & Higgins, Australia)

The extent to which the valuation of claims reserves for regulatory purposes is influenced by the existence of solvency margins is necessarily an administrative and legal problem rather than actuarial. However, actuarial concerns are considered and this paper compares various approaches to the solvency margin that were current when the Australian supervisory legislation was developed. If any of them were actually consulted then it would appear that the Australian solvency margin is not to provide a buffer on claims reserves, which must be provided separately. Moreover it was a relatively stringent margin. The paper further explains how it came to be further tightened. *Insurance: Mathematics and Economics*, Vol. 5, No. 1 (January 1986), pp. 3-29. "Discussion" by Charles C. Hewitt (Metropolitan Reinsurance Company, New York), pp. 31-33. (Reprinted with permission of North-Holland Publishing Company).

DISCUSSION OF METHODS OF CLAIM RESERVING IN NON-LIFE INSURANCE by D. H. Reid (Eagle Star Insurance Company Limited, London)

The paper attempts to chart a path through some of the more commonly used methods of claim reserving, starting from the simple chain ladder. A critical evaluation of the weaknesses of each is made by reference to a particular example, leading to the next method of the series. In the course of this survey one novel approach occurs quite naturally as the logical extension of a particular series, but this is itself found to be inadequate. The main thrust of the paper is to direct attention to the study of the joint distribution of claim by size and settlement time in reserving, and certain original data are adduced in order to exemplify claim development properties which were applicable are of considerable assistance in understanding the experience of 'incomplete' years, and extrapolating this to reserves. *Insurance: Mathematics and Economics*, Vol. 5, No. 1 (January 1986), pp. 45-56. "Discussion" by D. G. Hart (A.M.P. Fire and General Insurance Co. Ltd., Sydney, Australia), pp. 57-58. (Reprinted with permission of North-Holland Publishing Company).

A STATISTICAL APPROACH TO IBNR-RESERVES IN MARINE REINSURANCE, by Joakim Hertig (Baltica-Nordisk Re, Copenhagen)

The run off-pattern of long-term reinsurance treaties is described by means and standard deviations of logarithmic increments of premiums and loss ratios in a normal distribution. From this description forecasts of ultimate claims and current IBNR-reserves are derived, with associated distributions and confidence limits. Aggregation from individual treaties to portfolio level is proposed by normal approximation. Security loading of IBNR-reserves is proposed by a contingency reserve at portfolio level. *ASTIN Bulletin*, Vol. 15, No. 2 (November 1985), pp. 171-184. (Reprinted with permission of the *ASTIN Bulletin*).

LIABILITY RULES

PRODUCT SAFETY, LIABILITY RULES AND RETAILER BANKRUPTCY, by Marilyn J. Simon (U.S. Department of Justice) Robert G. Wolf (Tufts University) and Jeffrey M. Perloff (University of California, Berkeley)

In this paper, the authors examine the levels of care that would be chosen by a monopolistic manufacturer and a competitive retailer, when both the manufacturer and retailer can affect the probability of an accident and when the manufacturer cannot observe *ex ante* the care chosen by the retailer. If retailer bankruptcy is possible, the equilibrium contract between the manufacturer and retailer will include positive profits for the retailer and inefficient levels of care. Society can improve on the equilibrium contract by increasing the retailer's "due care standard." If bankruptcy costs are sufficiently high, the positive profits and inefficiencies are eliminated. *Southern Economic Journal*, Vol. 51, No. 4 (April 1985), pp. 1130-1141. (Reprinted with permission of the *Journal of Economic Literature*).

JUDICIAL REGULATION OF THE ENVIRONMENT UNDER POSNER'S ECONOMIC MODEL OF THE LAW, by Margaret S. Hrezo (Virginia Polytechnic Institute and State University) and William E. Hrezo (Radford University, Virginia)

This article questions Posner's argument that because the market's emphasis on wealth maximization complements the American notion of justice, the American judiciary should and does utilize an economic model of the law in reaching decisions.

The authors use content analysis to examine the decisional grounds of 415 cases brought to the U.S. Supreme Court and the federal Circuit Courts of Appeals between 1978 and 1983 under federal laws regulating the environment and workplace health and safety. The results suggest that in these two areas of litigation, judges do not rely on economic risk analysis in reaching their decisions. *Journal of Economic Issues*, Vol. 18, No. 4 (December 1984), pp. 1071-1091. (Reprinted with permission of the *Journal of Economic Literature*).

SAFETY AND LOSS CONTROL

CONTRACT RISK ANALYSIS FOR TURN-KEY PROJECT BID: A CASE STUDY, by C. B. Chapman and Dale F. Cooper (University of Southampton, Acres International Management Services and Spicer and Pagler Associates, London)

This paper describes a risk analysis undertaken for a consortium of engineering consulting firms who were favoured bidders for a turn-key thermal electric power project in the Middle East. The risk analysis pursued two areas: the development of a cash-flow model for the project; and the development of an understanding of project risk in qualitative terms with respect to individual sources of risk and their combined effect. Integration of these two areas produced results which demonstrated a relatively large spread in the total project cost. Means of reducing this spread through contractual countermeasures, contingency plans and balancing uncorrelated risks are presented, along with an assessment of their implications. *The Geneva Papers on Risk and Insurance*, Vol. 10, No. 37 (October 1985), pp. 293-305. (Reprinted with permission of the Geneva Association).

A TACTICAL DECISION ALGORITHM FOR THE OPTIMAL DISPATCHING OF OIL SPILL CLEANUP EQUIPMENT, by Harilaos N. Psaraftis and Babis O. Zioogas (Massachusetts Institute of Technology and IMI, Inc. New York)

We develop an optimization procedure for assisting decision-makers in the allocation of resources for cleaning up a specific oil spill. The objective function is to minimize a weighted combination of spill-specific response and damage costs. Inputs to this problem include information about the outflow of oil, availability and performance of spill cleanup equipment, as well as costs of equipment transported and on-scene operation. A general (albeit separable) damage function is assumed. The algorithm is deterministic and is based on a dynamic program within which a series of 0-1 knapsack problems are solved repeatedly. Although this algorithm is approximate, its worst-case performance is quantified and we argue that under realistic inputs the procedure can be expected to produce solutions very close to optimality. Under prescribed conditions we prove that the algorithm produces optimal solutions. A realistic example based on the *Argo Merchant* oil spill is presented to provide insight into the structure of this problem. Finally, we discuss possible uses of this model within the existing and alternative operational and policy environments. *Management Science*, Vol. 31, No. 12 (December 1985), pp. 1475-1491. (Reprinted with permission of *The Institute of Management Sciences*).