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THEORY OF CONTRACTS

The Equivalence of Lending Equilibria and Signalling-Based Insurance Under Asymmetric Information, by Bart Taub (University of Illinois)

I present a model in which a continuum of individuals have stochastic idiosyncratic income shocks. Complete insurance is physically feasible but unattainable due to an information asymmetry; income shocks are observable only by the individuals receiving them. Any insurance institution must therefore rely on self-reporting of income innovations. Two ways of achieving incentive-compatible self-reporting are presented. The first is a debt market with an explicit lending restriction. The second is an insurance contract that linearly filters a signal transmitted by individuals. The two are then demonstrated to be identical. Equilibrium consumption fluctuates in a random walk, which is inefficient given the physical potential for complete insurance, but is efficient given the information constraints. The results are complementary to those of Green (1987) but permit more general stochastic processes of income to be analyzed. Serial correlation of income reduces the efficiency of the insurance. *Rand Journal of Economics*, Vol. 21, No. 3 (Autumn 1990), pp. 389-408. (Reprinted with permission of the *Rand Journal of Economics*).

Moral Hazard and Renegotiation in Agency Contracts, by Drew Fudenberg and Jean Tirole (Massachusetts Institute of Technology)

Previous analyses of principal-agent problems with moral hazard assume the parties can commit to a contract that will not be renegotiated. We allow the contract to be renegotiated after the agent's choice of action and before the observation of the action's consequences. Here, the principal cannot induce the agent to take a high level of effort with probability one, since the principal would renegotiate the contract to shield the agent from risk, and in equilibrium the agent randomizes over effort levels. The optimal contract gives the agent a menu of compensation schemes: safe ones intended for low-effort workers, and risky ones for those whose effort is high. The optimal contract may give the agent a positive rent, in contrast to the case without

renegotiation. *Econometrica*, Vol. 58, No. 6 (November 1990), pp. 1279–1319. (Reprinted with permission of *Econometrica*).

Limited Liability and Incentive Contracting with Ex-ante Action Choices, by Robert D. Innes (University of California, Davis)

This article examines a principal-agent model of financial contracting in which a risk-neutral entrepreneur (agent) makes an unobservable ex-ante effort choice while employing the investment funds of a risk-neutral investor (principal). The key innovation is that the investment contract is subject to statutory liability limits. Given these liability limits, two settings are considered, one in which the investor payoff function is also constrained to be monotonically nondecreasing in firm profit, and another in which no such “monotonic contract” constraint is imposed. In the former case, a standard debt contract is shown to emerge and a “first best” effort choice is not achieved. In the latter setting, the optimum is characterized by a “live-or-die” payoff function, and a “first best” effort level may or may not be realized. *Journal of Economic Theory*, Vol. 52, No. 1 (October 1990), pp. 45–67. (Reprinted with permission of Academic Press, Inc.).

AGENCY THEORY

Agency-Theory Implications for the Insurance Industry: A Review of the Theoretical and Empirical Research, by Joseph A. Fields and Dogan Tirtiroglu (University of Connecticut)

This paper explores the resolution of incentive conflicts in the insurance industry from an agency-theoretic perspective. It concentrates on the role of organizational forms in mitigating conflict. The paper reviews the concept of agency conflicts and resolution, examines agency conflicts and the use of organizational form in insurance, reviews empirical work that examines the structure of incentive/conflict resolution in insurance, and synthesizes the implications of the theory and empirical findings. *Quarterly Journal of Business and Economics*, Vol. 30, No. 1 (Winter 1991), pp. 40–61. (Reprinted with permission of the authors).

RISK PERCEPTION AND ECONOMIC BEHAVIOR

Adverse Selection, Aggregate Uncertainty, and the Role for Mutual Insurance Contracts, by Bruce D. Smith (Cornell University and Rochester Center for Economic Research) and Michael J. Stutzer (University of Minnesota)

A model of insurance markets analogous to that of Rothschild and Stiglitz (1976) is considered, with the additional feature that risk-neutral insurers face aggregate (undiversifiable) risk. In the presence of adverse selection and aggregate uncertainty and under a simple nondegeneracy condition on loss probabilities, we show that any equilibrium has the feature that some agents purchase participating policies (from mutual insurers) while others purchase nonparticipating policies (and hence do not share risk with their insurer).

Specifically, agents with low loss probabilities signal their type by sharing aggregate risks with their insurer. Some empirical support for this prediction is provided. *Journal of Business*, Vol. 63, No. 4 (October 1990), pp. 493-510. (Reprinted with permission of the University of Chicago Press).

Risk Aversion and the Propensities for Self-Insurance and Self-Protection, by Eric Briys (Centre HEC-ISA, Jouy-en-Josas, France) and Harris Schlesinger (University of Alabama, Tuscaloosa)

Increases in risk aversion always imply increases in the level of self-insurance, but not necessarily increases in self-protection. This result is shown to be quite robust; holding also in models with state-dependent preferences or with multiple sources of risk. In all cases, self-protections shift the support of the wealth distribution to the left, while making more favorable outcomes more likely. This shift can be decomposed into the combination of a mean-preserving spread and a mean-preserving contraction, thus precluding any unanimity among all risk averters. *Southern Economic Journal*, Vol. 57, No. 2 (October 1990), pp. 458-67. (Reprinted with permission of the authors).

Do Smokers Underestimate Risks?, by W. Kip Viscusi (Duke University)

This paper uses a national survey of 3,119 individuals to examine the effect of lung cancer risk perceptions on smoking activity. Both smokers and nonsmokers greatly overestimate the lung cancer risk of cigarette smoking, and the extent of the overestimation is much greater than the extent of underestimation. These risk perceptions in turn significantly reduce the probability of smoking, as suggested by an economic model of risky consumption decisions. Cigarette excise taxes in effect endow individuals with additional risk perceptions comparable to their current assessed lung cancer risks. *Journal of Political Economy*, Vol. 98, No. 6 (December 1990), pp. 1253-69. (Reprinted with permission of the *Journal of Political Economy*).

Betweenness Satisfying Preferences and Dynamic Choice, by Faruk Gul and Outi Lantto (Stanford University)

We consider the dynamic choice problem where uncertainty is resolved gradually (i.e., decision trees). We impose *consistency* on the decision maker by requiring that his behavior in trees conform to preference maximization over lotteries. We formulate and defend three different requirements on dynamic behavior and show that for any decision maker whose behavior is consistent with maximizing a continuous, monotone preference relation over lotteries, each one of these conditions is equivalent to the betweenness property of the underlying preferences. *Journal of Economic Theory*, Vol. 52, No. 1 (October 1990), pp. 162-77. (Reprinted with permission of Academic Press, Inc.).

UTILITY THEORY

Lotteries, Insurance, and Star-Shaped Utility Functions, by Michael Landsberger (University of Haifa, Israel) and Isaac Meilijson (Tel Aviv University, Israel)

Most agents insure against risks which entail large losses, but few insure against small losses. The fact that organized lotteries charge low ticket prices exemplifies this spirit. This weakly risk averse behavior pattern seems to be well structured but is at variance with concavity. We derive axiomatically a class of utility functions, *star-shaped*, which accommodate these phenomena. Concavity yields risk aversion everywhere and decreasing *marginal* utility. Star-shaped utility functions exhibit risk aversion at some wealth positions, and *average* utility from any of these is a decreasing function of wealth. *Journal of Economic Theory*, Vol. 52, No. 1 (October 1990), pp. 1-17. (Reprinted with permission of Academic Press, Inc.).

PROBABILITY THEORY

Credibility for Increased Limits, by Stuart Klugman (Drake University)

When computing increased limits factors, data are available on policies sold at the various limits. At some limits the amount of information may be small and therefore it would be desirable to incorporate information from the other limits. However, there is evidence that severity differs from limit to limit, and so a total merging of the data is not appropriate. This is exactly the situation in which a credibility formula is needed, but there are two major obstacles. The first is that losses are often far from normally distributed. The second is that the data from lower limits cannot be used to compute sample means for higher limits. In this paper the usual credibility approach is modified to overcome these problems. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 77-80. (Reprinted with permission of North-Holland Publishing Company).

RUIN THEORY

Simulation of Ruin Probabilities, by P. Boogaert and A. DeWaegenaere (University of Antwerp, Belgium)

In this paper we describe the simulation of ruin probabilities using a new simulation technique based on a martingale transformation. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 95-99. (Reprinted with permission of North-Holland Publishing Company).

When Does the Surplus Reach a Given Target?, by Hans U. Gerber (University of Lausanne, Switzerland)

In the classical model of risk theory a martingale method is used to compute the distributions of the first and last passage times (and of their difference) of the surplus process at a given level. As a byproduct a certain probabilistic

identity related to Lagrange's formula is derived; furthermore Consul's generalized Poisson distribution is explained. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 115-19. (Reprinted with permission of the North-Holland Publishing Company).

A Remark on the Moments of Ruin Time in Classical Risk Theory, by Freddy Delbaen (Vrije Universiteit Brussel, Brussels, Belgium)

We prove that the p th moment of the ruin time in a classical risk process exists if and only if the $(p+1)$ th moment of the claim size exists. The proof uses a theorem of Erdős on the speed of convergence in the law of large numbers. The result can also be obtained using fractional derivatives in Laplace transforms. Our proof is computational and again it shows the link between the limit behaviour in the (continuous time) compound Poisson process and the usual (discrete time) limit theorems in probability theory. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 121-26. (Reprinted with permission of the North-Holland Publishing Company).

Nonparametric Estimators for the Probability of Ruin, by Kristof Croux (University of Antwerp, Belgium) and Noël Veraverbeke (Limburgs Universitair Centrum, Diepenbeek, Belgium)

In this note we show how the general theory for linear combinations of U -statistics with varying kernel can be applied to discuss estimators for the infinite horizon time probability of ruin in the Poisson risk model. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 127-30. (Reprinted with permission of the North-Holland Publishing Company).

Ordering of Risks and Ruin Probabilities, by R. Kaas and A. E. Van Heerwaarden (Universiteit van Amsterdam, The Netherlands)

The concept of stop-loss order is often restricted to the case that the means of the risks to be ordered are equal, so risks with unequal means are incomparable. In this short note we prove that a risk with higher stop-loss premiums than another can be written as the sum of a risk with higher stop-loss premiums, too, but equal mean, and one that is non-negative with probability one. Using this decomposition it is proven that the risk with higher stop-loss premiums generates a higher ruin probability in a compound Poisson process. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 177-8. (Reprinted with permission of the North-Holland Publishing Company).

HEALTH CARE AND INSURANCE

A Geographic Index of Physician Practice Costs, by Stephen Zuckerman and W. P. Welch (Urban Institute) and Gregory C. Pope (Center for Health Economics Research)

This paper develops a geographic index of physician practice costs. A Laspeyres index is derived for each metropolitan statistical area and for the nonmetropolitan portion of each state. Relative prices, by area, are obtained for four practice inputs: physicians' own time, employee wages, office rents, and malpractice insurance. Each input price proxy is weighted by the share of physician gross revenues spent on that input. The index is useful in explaining geographic variation in physician fees. It may be used in reforming the way Medicare pays physicians. *Journal of Health Economics*, Vol. 9, No. 1 (June 1990), pp. 36-69. Reprinted with permission of the *Journal of Economic Literature*.

Consumer Health Information and the Demand for Medical Care, by Don Kenkel (Pennsylvania State University)

The paper is an empirical investigation of consumer health information. Using a new direct measure of information, the econometric approach treats both information and physician visits as endogenous variables when estimating the demand for medical care. The results show that information increases the probability that a consumer uses medical care, but that conditional on use the quantity of care consumed is not related to information. The results contradict specific implications of models where physicians can create or induce demand for their own services. Several results suggest that poorly informed consumers tend to underestimate the productivity of medical care in treating illness. *The Review of Economics and Statistics*, Vol. LXXII, No. 4 (November 1990), pp. 587-95. (Reprinted with permission of Elsevier Science Publishers B.V., North-Holland).

The Poor, the Rich, and the Insecure Elderly Caught in Between, by Karen C. Holden (University of Wisconsin, Madison) and Timothy M. Smeeding (Syracuse University)

Although the elderly are as well or perhaps better off on average than younger groups, measures of the elderly's economic well-being have to gauge the security of their income and assets relative to the financial and health problems they may face. These measures include the adequacy of older Americans' health insurance vis-a-vis their health status, and the sufficiency of their resources to meet possible contingencies, such as severe inflation and costs of long-term care. By applying such measures to the 1984 Survey of Income and Program Participation, 4.5 million elderly may be categorized as economically insecure. Action is needed to ease the insecurity current public and private insurance policy implicitly imposes on this group, which constitutes 20 percent of the elderly population. *The Milbank Quarterly*, Vol. 68, No. 2 (1990), pp. 191-219. (Reprinted with permission of *The Milbank Memorial Fund Quarterly*).

GOVERNMENT INSURANCE PROGRAMS

Deposit Insurance, Risk, and Market Power in Banking, by Michael C. Keeley (Cornerstone Research, Menlo Park, CA)

A fixed-rate deposit insurance system provides a moral hazard for excessive risk taking and is not viable absent regulation. Although the deposit insurance system appears to have worked remarkably well over most of its 50-year history, major problems began to appear in the early 1980's. This paper tests the hypothesis that increases in competition caused bank charter values to decline, which in turn caused banks to increase default risk through increases in asset risk and reductions in capital. *The American Economic Review*, Vol. 80, No. 5 (December 1990), pp. 1183-1200. (Reprinted with permission of *The American Economic Review*).

SOCIAL INSURANCE

Problems of Sample Construction in Studies of the Effects of Unemployment Insurance on Unemployment Duration, by Pedro Portugal (Universidade do Porto) and John T. Addison (University of South Carolina)

Conventional analyses of the effect of unemployment insurance on unemployment duration have neglected the issue of sample construction. The authors show that such studies, by failing to account for job finding among those eligible for unemployment insurance within intervals corresponding to the waiting time and filing delays associated with drawing benefits, overstate the expected unemployment duration of unemployment insurance recipients while understating that of nonrecipients; ignore a dominant line of causation running from duration to unemployment insurance benefit status; produce misspecified hazard function; and may overstate by as much as 50 percent the effect of the unemployment insurance replacement rate on jobless duration. *Industrial and Labor Relations Review*, Vol. 43, No. 4 (April 1990), pp. 463-77. (Reprinted with permission of the *Journal of Economic Literature*).

Personal Characteristics, Unemployment Insurance, and the Duration of Unemployment, by Dean A. Follmann (National Heart Lung and Blood Institute, Bethesda, MD), Matthew S. Goldberg (Institute for Defense Analyses, Alexandria, VA) and Laurie May (Center for Naval Analyses, Alexandria, VA)

This paper develops a methodology to accommodate the 'spikes' in reemployment probabilities that are observed when unemployment insurance expires. Previous studies apply the Cox regression model, which has the advantage of a nonparametric baseline hazard function. However, even the Cox model constrains the explanatory variables to have the same effect throughout the entire spell of unemployment. By contrast, our new model allows the explanatory variables to have different effects at and away from the spike. After a simple data transformation, our model may be estimated using readily available software. An empirical example is provided and generaliza-

tions are discussed. *Journal of Econometrics*, Vol. 45, No. 3 (September 1990), pp. 351–366. (Reprinted with permission of Elsevier Science Publishers B.V., North-Holland).

Unemployment Insurance, Recall Expectations, and Unemployment Outcomes, by Lawrence F. Katz (Harvard University and National Bureau of Economic Research) and Bruce D. Meyer (Northwestern University and National Bureau of Economic Research)

This paper empirically examines the importance of explicitly accounting for the layoff-rehire process in the analysis of unemployment outcomes in the United States. We find that the spells of individuals who initially expect to be recalled account for much more of the unemployment of unemployment insurance (UI) recipients than do spells actually ending in recall. Our results indicate that the recall and new job escape rates from unemployment have quite different time patterns and are often affected in opposite ways by explanatory variables. We also find that the probability of leaving unemployment both through recalls and new job finding increases greatly around the time that UI benefits lapse. *The Quarterly Journal of Economics*, Vol. CV, No. 4 (November 1990), pp. 973–1002. (Reprinted with permission of *The Quarterly Journal of Economics*).

LIFE INSURANCE AND ANNUITIES

Interest and Mortality Randomness in Some Annuities, by John A. Beekman and Clinton P. Fuelling (Ball State University)

A model is presented which can be used when interest rates and future lifetimes are random, for certain annuities. Expressions for the mean values and the standard deviations of the present values of future payment streams are obtained. These can be used in determining contingency reserves for possible adverse interest and mortality experience for collections of life annuity contracts. Several complete examples are considered. Certain boundary crossing probabilities for the stochastic process component of the model are obtained. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 185–96. (Reprinted with permission of the North-Holland Publishing Company).

Marginal Tax Rates and IRA Contributions, by James E. Long (Auburn University)

A national sample of individual tax returns is employed to investigate whether the dollar amount of IRA contributions is related to the marginal tax rate. Taxpayers residing in low-tax states are found to report smaller IRA deductions on average than residents of high-tax states. This simple evidence of a positive tax rate effect on IRA contributions is confirmed by econometric estimation using an instrumental variable approach to identify the tax rate impact on contributions. An important implication of the paper is that private saving is positively related to the net rate of return. *National Tax Journal*, Vol.

XLIII, No. 2 (June 1990), pp. 143-53. (Reprinted with permission of the *National Tax Journal*).

The Parameters of a Multiple Criteria Model of Actuarial Assumptions for Pension Plan Valuations, by Arnold F. Shapiro (Penn State University)

Most defined benefit pension plans require a periodic actuarial valuation, so valuations are a very common procedure. Nonetheless, many of the criteria underlying the assumptions of a valuation are only vaguely defined or not defined at all. The purpose of this paper is to set the stage for resolving this problem. This is done by documenting and describing major criteria underlying the choice of actuarial assumptions for pension plan valuations and pinpointing some of the unresolved issues related thereto. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 197-206. (Reprinted with permission of the North-Holland Publishing Company).

Pensions, the Option Value of Work, and Retirement, by James H. Stock (Harvard University) and David A. Wise (National Bureau of Economic Research, Cambridge, MA)

The effects of firm pension plan provisions on the retirement decisions of older employees are analyzed. The empirical results are based on data from a large firm, with a typical defined benefit pension plan. The "option value" of continued work is the central feature of the analysis. Estimation relies on a retirement decision rule that is close in spirit to the dynamic programming rule but is considerably less complex than a comprehensive implementation of that rule, thus greatly facilitating the numerical analysis. *Econometrica*, Vol. 58, No. 5 (September 1990), pp. 1151-80. (Reprinted with permission of *Econometrica*).

INSURER MANAGEMENT AND REGULATION

The Retrospective Premium Reserve, by Henk Wolthuis (University of Amsterdam, The Netherlands) and Jan M. Hoem (University of Stockholm, Sweden)

For an ordinary single- or multiple-decrement life insurance policy, there is essentially only one retrospective premium reserve and its definition is given in standard textbooks on life contingencies. By contrast, for a multi-state policy, each state has its own retrospective (as well as its own prospective) reserve, there is considerable freedom of choice in its definition, and there is a corresponding variation in its properties. One natural retrospective reserve has been defined previously by the second author. This paper introduces a whole new class of sets of retrospective reserves. The new reserves automatically satisfy Thiele's differential equation and also have other desirable properties. Each member of the class is defined by the selection of initial prospective premium reserves for states other than the conventional initial state. We note two obvious alternative choices of these parameters and show that one of them makes the corresponding set of retrospective reserves coincide with our

previous suggestion in certain cases but not in general. As an application, we point out the implications for surplus accumulation. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 229-34. (Reprinted with permission of the North-Holland Publishing Company).

Is Deposit Insurance Necessary? A Historical Perspective, by Charles W. Calomiris (Northwestern University)

The motivation and structure of various banking insurance experiments in U.S. history are analyzed, along with their political alternative, branch banks. In both the antebellum period and in the 1920s, insurance systems that relied on self-regulation, made credible by mutual liability, were successful, while compulsory state systems were not. Branch banking increased stability and resiliency to shocks. *Journal of Economic History*, Vol. 50, No. 2 (June 1990), pp. 283-95. (Reprinted with permission of the *Journal of Economic Literature*).

RISK MANAGEMENT

Insurance vs. Loss Prevention - an Actuarial Approach, by W. R. Heilmann (University of Karlsruhe, FRG)

Typical activities of a risk manager are loss prevention and risk transfer (eg. by taking insurance). In this paper we present a model by which risk managers are enabled to find an optimal combination of loss prevention and insurance taking. This approach is built upon the collective model of risk theory and the Bernoulli principle of decision theory. *Insurance: Mathematics and Economics*, Vol. 9, No. 2/3 (September 1990), pp. 179-84. (Reprinted with permission of the North-Holland Publishing Company).

INJURY COMPENSATION

The Duration of Post-Injury Absences From Work, by William G. Johnson (Arizona State University) and Jan Ondrich (Syracuse University)

We used three duration models to estimate the effects of disability benefits on the hazard of returning to work and on the expected duration of work absences. The results show that disincentives exist, even when disability benefits are not conditioned on the recipient remaining out of work. In addition, blacks and women are found to be absent longer than white men. Durations of work absences are also influenced by available wages, the type and severity of injury, the physical demands of the jobs for which the worker is qualified, and the willingness of employers to help the worker return to work. *The Review of Economics and Statistics*, Vol. LXXII, No. 4 (November 1990), pp. 578-86. (Reprinted with permission of Elsevier Science Publishers B.V., North-Holland).

SAFETY AND LOSS OF CONTROL

An Accident Cost Impact Model: The Direct Cost Component, by Anthony Veltri (Oregon State University)

Organizations are becoming increasingly aware of the impact of the direct costs of accidents on financial performance. The current annual cost of accidents incurred by industrial enterprises is more than \$44.5 billion (National Safety Council, 1989). Increasingly, organizations are discovering that the degree of operating leverage (i.e., the ratio of percentage change in operating income to the percentage change in operating costs and/or sales or units sold) is adversely affected. Reducing the cost of accidents will lower the degree of operating leverage.

I describe here an accident cost impact model that a variety of enterprises can use to disclose the direct costs of accidents and the economic impact on cost-volume-profit performance standards and profitability potential. The indirect costs of accidents are not calculated into this model formula, chiefly because no suitable model for verifying them with any reasonable accuracy has been developed. A pilot study to verify the efficiency of the direct cost accident model was performed on cost-volume-profit data supplied by a self-insured marine operation on the west coast.

Every effort has been made to keep this accident cost impact model compatible with the loss-report accounting systems in use in today's organizations. The model is designed to be simple to understand and implement, to provide timely feedback for improved analysis and decision-making, and to cost little to operate. *Journal of Safety Research*, Vol. 21, No. 2 (Summer 1990), pp. 67-73. (Reprinted with permission of the National Safety Council).

Profitability and Product Quality: Economic Determinants of Airline Safety Performance, by Nancy L. Rose (Massachusetts Institute of Technology)

This study investigates product safety choices in the airline industry, with particular attention to the role of financial conditions. The analysis uses data on 35 large scheduled passenger airlines over the 1957-86 period to estimate the effect of profitability and other aspects of financial health on accident and incident rates. The results indicate that lower profitability is correlated with higher accident and incident rates, particularly for smaller carriers. These findings support a broad class of theoretical models that suggest links between financial conditions and product quality and may have significant implications for the allocation of safety inspection and enforcement resources. *Journal of Political Economy*, Vol. 98, No. 5, Part 1 (October 1990), pp. 944-64. (Reprinted with permission of the *Journal of Political Economy*).

Editors' Note: Correct citation for abstract appearing December 1990 issue: "Principal-Agent Problems in S&L Salvage," by Edward J. Kane (Ohio State University) is *The Journal of Finance*, Vol. 45, No. 3 (July 1990), pp. 755-64. (Reprinted with permission of *The Journal of Finance*).

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