

Economic Decisions under Uncertainty

by Hans-Werner Sinn

North Holland: Amsterdam, New York and Oxford 1983

List of Abbreviated Journals, Bibliography, Author Index, Subject Index

List of Abbreviated Journals

Acta Psychologica	ActPs
The American Economic Review	AER
American Journal of Physiology	AJPh
The American Journal of Psychology	AJPs
American Psychologist	APs
Annals of Mathematics	AM
Annalen der Physik	AP
Annual Review of Psychology	ARPs
Astin Bulletin	AstB
Bell System Technical Journal	BSTJ
Economica	Ec
European Economic Review	EER
The Economic Journal	EJ
Econometrica	Em
Financial Analysts Journal	FAJ
International Economic Review	IER
The Journal of the Acoustical Society of America	JAcousSA
The Journal of the American Statistical Association	JASA
Journal of Business	JB
Journal of Cellular and Comparative Physiology	JCCPh
Journal of Economic Literature	JEL
The Journal of Economic Theory	JET
Journal of Experimental Psychology	JExPs
The Journal of Finance	JF
Journal of Financial and Quantitative Analysis	JFQA
Journal of General Physiology	JGPh
The Journal of Law and Economics	JLE
Journal of Mathematical Psychology	JMPs
Journal of Neurophysiology	JNPh
Jahrbücher für Nationalökonomie und Statistik	JNSt

Journal of Political Economy	JPE
Journal of Physiology	JPh
Journal of Psychology	JP _s
The Journal of Risk and Insurance	JRI
Management Science	MS
Naval Research Logistics Quarterly	NRLQ
Oxford Economic Papers	OEP
Zeitschrift für Operations Research	OR
Perception & Psychophysics	P & PsP
Psychological Review	PsR
The Quarterly Journal of Economics	QJE
Review of Economic Studies	REStud
The Review of Economics and Statistics	REStat
The Scandinavian Journal of Psychology	ScJP _s
The Southern Economic Journal	SEJ
The Swedish Journal of Economics	SJE
Skandinavisk Aktuarietidskrift/Scandinavian Actuarial Journal	SkAtsk
Schweizerische Zeitschrift für Volkswirtschaft und Statistik	SZVSt
Science	Sc
Unternehmensforschung	Ufo
Zeitschrift für die gesamte Staatswissenschaft	ZgS
Zeitschrift für Nationalökonomie	ZN
Zeitschrift für Psychologie	ZPs
Zeitschrift für die gesamte Versicherungswissenschaft	ZVersWiss

Bibliography

- ACZÉL, J. (1966): *Lectures on functional equations and their applications*, New York and London.
- ADRIAN, E.D. (1928): *The basis of sensation. The action of the sense organs*, London.
- (1932): *The mechanism of nervous action. Electrical studies of the neurone*, London and Philadelphia.
- (1947): *The physical background of perception*, Oxford.
- AKERLOF, G.A. (1970): 'The market for "lemons": quality uncertainty and the market mechanism', *QJE* 84, pp. 488-500.
- ALBERT, H. (1977). 'Nationalökonomie als sozialwissenschaftliches Erkenntnisprogramm', in: H. Albert, M.C. Kemp, W. Krelle et al., eds., *Ökonometrische Modelle und sozialwissenschaftliche Erkenntnisprogramme. Beiträge zu einem Symposium anlässlich des 90. Geburtstages von W.G. Waffenschmidt*, Mannheim, Vienna, Zurich 1978, pp. 49-71.
- ALIBER, R.Z. (1970): 'Speculation in the flexible exchange revisited', *Kyklos* 23, pp. 303-314.
- ALLAIS, M. (1952): 'Fondements d'une théorie positive des choix comportant un risque', in: *Colloques internationaux du Centre National de la Recherche Scientifique* 40: *économétrie*, Paris 12-17 mai 1952, Paris 1953, pp. 127-140. Appendix: 'Fondements d'une théorie positive des choix comportant un risque et critique des postulats et axiomes de l'école américaine', *ibid.*, pp. 257-332.
- (1953): 'Le comportement de l'homme rationnel devant le risque: Critique des postulats et axiomes de l'école américaine', *Em* 21, pp. 503-546.
- ALT, F. (1936): 'Über die Meßbarkeit des Nutzens', *ZN* 7, pp. 161-169.
- AMOROSO, L. (1938): 'Vilfredo Pareto', *Em* 6, pp. 1-21.
- APPELBAUM, E. and E. KATZ (1981): 'Market constraints as a rationale for the Friedman-Savage utility function', *JPE* 89, pp. 819-825.
- ARROW, K.J. (1951): 'Alternative approaches to the theory of choice in risk-taking situations', *Em* 19, pp. 404-437.
- (1963): 'Uncertainty and the welfare economics of medical care', *AER* 53, pp. 941-973.
- (1965): *Aspects of the theory of risk-bearing*, Helsinki.
- (1970): *Essays in the theory of risk-bearing*, Amsterdam and London.
- (1974a): 'The use of unbounded utility functions in expected utility maximization: Response', *QJE* 88, pp. 136-138.
- (1974b): 'Optimal insurance and generalized deductibles', *SkAtsk*, pp. 1-42.
- ARROW, K.J. and M. KURZ (1970): *Public investment, the rate of return, and optimal fiscal policy*, Baltimore and London.

- ATTNEAVE, F. (1962): 'Perception and related areas', in: S. Koch, ed., *Psychology: A study of a science*, vol. 4, *Biologically oriented fields: Their place in psychology and in biological science*, New York, San Francisco, Toronto, and London, pp. 619-659.
- AUMANN, R.J. (1962): 'Utility theory without the completeness axiom', *Em* 30, pp. 445-462.
- BAILEY, M.J., M. OLSON, and P. WONNACOT (1980): 'The marginal utility of income does not increase: Borrowing, lending, and Friedman-Savage gambles', *AER* 70, pp. 372-397.
- BAILEY, R.A. and L.J. SIMON (1960): 'Two studies in automobile insurance ratemaking', *AstB* 1, pp. 192-217.
- BANERJEE, D. (1964): 'Choice and order: or first things first', *Ec* 31, pp. 158-165.
- BARROIS, M.T. (1834): 'Essay sur l'application du calcul des probabilités. Aux assurances contre l'incendie', in: *Mémoires de la Société Royale des Sciences, de l'Agriculture et des Arts*, Lille, pp. 85-282.
- BAUMOL, W.J. (1952): 'The transactions demand for cash: An inventory theoretic approach', *QJE* 66, pp. 545-556.
- (1963): 'An expected gain-confidence limit criterion for portfolio selection', *MS* 10, pp. 174-182.
- BAYES, T. (1763): 'An essay towards solving a problem in the doctrine of chances', The Royal Society of London, *Philosophical Transactions* 53, pp. 370-418.
- BÉKÉSY, G.v. (1930): 'Über das Fechnersche Gesetz und seine Bedeutung für die Theorie der akustischen Beobachtungsfehler und die Theorie des Hörens', *AP*, 5th series, vol. 7, pp. 329-359.
- (1956): 'Current status of theories of hearing', *Sc* 123, pp. 779-783.
- BELLMAN, R. (1957): *Dynamic programming*, Princeton.
- BERNOULLI, D. (1738): 'Specimen theoriae novae de mensura sortis', *Commentarii academiae scientiarum imperialis Petropolitanae* 5, St. Petersburg, pp. 175-192. German translation by A. Pringsheim: *Versuch einer neuen Theorie der Wertbestimmung von Glücksfällen*, Leipzig 1896. English translation by L. Sommer: 'Exposition of a new theory on the measurement of risk', *Em* 22, 1954, pp. 23-36.
- BERNOULLI, J. (1713): *Ars conjectandi*, Translation: *Wahrscheinlichkeitsrechnung*, third and fourth parts, Ostwald's Klassiker der exakten Wissenschaften, vol. 108, Leipzig 1899.
- BERTRAND, J. (1907): *Calcul des probabilités*, Paris.
- BICKSLER, J.L. (1974): 'Theory of portfolio choice and capital market behavior: an introductory survey', in: J.L. Bicksler and P.A. Samuelson, eds., *Investment portfolio decision-making*, Lexington, Toronto, and London.
- BÖHM-BAWERK, E.v. (1884); *Kapital und Kapitalzins*, part I, *Geschichte und Kritik der Kapitalzinstheorien*, 4th edition, Jena 1921.
- (1888): *Kapital und Kapitalzins*, part II, *Positive Theorie des Kapitals*, 4th edition, vol. 1, Jena 1921.
- BORCH, K.H. (1961): 'The utility concept applied to the theory of insurance', *AstB* 1, pp. 245-255.
- (1962): 'A note on utility and attitudes to risk', *MS* 9, pp. 697-700.
- (1968a): *The economics of uncertainty*, Princeton.
- (1968b): 'Indifference curves and uncertainty', *SJE* 70, pp. 19-24.
- (1969): 'A note on uncertainty and indifference curves', *REStud* 36, pp. 1-4.
- BORING, E.G. (1942): *Sensation and perception in the history of experimental psychology*, New York.
- BOSKIN, J.M. (1978): 'Taxation, saving, and the rate of interest', *JPE* 86, special issue, pp. 3-27.

- BOUGUER, M. (1760): *Traité d'optique sur la gradation de la lumière*, edited posthumously by Académie Royale des Sciences, Paris.
- BRAESS, P. (1960): *Versicherung und Risiko*, Wiesbaden.
- BREIMANN, L. (1960): 'Investment policies for expanding business optimal in a long-run sense', *NRLQ* 7, pp. 647-651.
- BREWER, K.R.W. (1963): 'Decisions under uncertainty: Comment', *QJE* 77, pp. 159-161.
- BRITO, D.L. (1975): 'Becker's theory of allocation of time and the St. Petersburg paradox', *JET* 10, pp. 123-126.
- BROWN, E.C. (1957-58): 'Mr. Kaldor on taxation and risk bearing', *REStud* 25, pp. 49-52.
- BÜHLMANN, H. (1968): 'Individual, co-operative, and competitive pricing of risks, in: K. Borch and J. Mossin, eds., *Risk and uncertainty*, London, Melbourne, Toronto, and New York, pp. 265-274.
- BUNDESAUFSICHTSAMT FÜR DAS VERSICHERUNGSWESEN (1974): *Geschäftsbericht 1973*, Berlin.
- CARTERETTE, E.C. and M.P. FRIEDMAN, eds. (1974): *Handbook of perception*, vol. 2, *Psychophysical judgement and measurement*, New York, San Francisco, and London.
- CHERNOFF, H. (1954): 'Rational selection of decision functions', *Em* 22, pp. 422-443.
- CHERNOFF, H. and L.E. MOSES (1959): *Elementary decision theory*, New York and London.
- CHIPMAN, J.S. (1960): 'Foundations of utility', *Em* 28, pp. 193-224.
- CHURCHMAN C.W. (1961): *Prediction and optimal decision*, Englewood Cliffs.
- COASE, R.H. (1960): 'The problem of social cost', *JLE* 3, pp. 1-44.
- COELHO, P.R.P. (1975): 'Externalities, liability, separability, and resource allocation: Comment', *AER* 65, pp. 721-723.
- CONRAD, K. and D.J. JÜTTNER (1973): 'Recent behaviour of stock market prices in Germany and the random walk hypothesis', *Kyklos* 26, pp. 576-599.
- CRAMER, G. (1728): letter to Nikolaus Bernoulli, published in: D. BERNOULLI (1738), pp. 56-60.
- CRAMÉR, H. (1930): 'On the mathematical theory of risk', *Försäkringsaktiebolaget Skandia* 2, pp. 7-84.
- DAVIS, O.A. and A. WHINSTON (1962): 'Externalities, welfare, and the theory of games', *JPE* 70, pp. 241-262.
- DELBOEUF, J.R.L. (1873): '*Étude psychophysique. - Recherches theoretiques et experimentales sur la mesure des sensations et spécialement des sensations de lumière et de fatigue*', Mémoire couronnés et autres mémoires, l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, ed., collection in -8° - vol. 23, Brussels.
- DIAMOND, P.A. (1967): 'Cardinal welfare, individualistic ethics, and interpersonal comparisons of utility', *JPE* 75, pp. 765-766.
- DIAMOND, P.A. and J.E. STIGLITZ (1974): 'Increases in risk and in risk aversion', *JET* 8, pp. 337-360.
- DOMAR, E.D. and R.A. MUSGRAVE (1944): 'Proportional income taxation and risk-taking', *QJE* 58, pp. 388-422.
- EBEL, J. (1971): *Portfeuilleanalyse: Entscheidungskriterien und Gleichgewichtsprobleme*, Cologne, Berlin, Bonn, and Munich.
- EDWARDS, W. and L.D. PHILLIPS (1964): 'Man as transducer for probabilities in Bayesian command and control systems', in: M.V. Shelley, II, and G.L. Bryan, eds., *Human judgements and optimality*, New York, London, and Sydney, pp. 360-401.
- EHRlich, I. and G.S. BECKER (1972): 'Market insurance, self-insurance, and self-protection', *JPE* 80, pp. 623-648.

- EISEN, R. (1976): 'Unsicherheit und Information, Unkontrollierbares Verhalten und das Problem des moralischen Risikos', *JNSI* 191, pp. 193-211.
- EISLER, H. (1962): 'On the problem of category scales in psychophysics', *ScJPs* 3, pp. 81-96.
- (1963): 'Magnitude scales, category scales, and Fechnerian integration', *PsR* 70, pp. 243-253.
- EKMAN, G. (1964): 'Is the power law a special case of Fechner's law?', *Perceptual and Motor Skills* 19, p. 730.
- EKMAN, G. and L. SJÖBERG (1965). 'Scaling', *ARPs* 16, pp. 451-474.
- ELLSGERG, D. (1961): 'Risk, ambiguity, and the Savage axioms', *QJE* 75, pp. 643-669.
- (1963): Reply (on ROBERTS (1963)), *QJE* 77, pp. 336-342.
- ENCARNACIÓN, J. (1964a): 'Constraints and the firm's utility function', *REStud* 31, pp. 113-120.
- (1964b): 'A note on lexicographical preferences', *Em* 32, pp. 215-217.
- (1965): 'On decisions under uncertainty', *EJ* 75, pp. 442-444.
- FAMA, E.F. (1965): 'Random walks in stock market prices', *FAJ* 21, pp. 55-59. Reprinted in: H.K. Wu and A.J. Zakon, eds., *Elements of investments*, 2nd edition, New York, Chicago, etc. 1972, pp. 615-623.
- (1968): 'Risk, return and equilibrium: Some clarifying comments', *JF* 23, pp. 29-40.
- FAMA, E.F. and M.H. MILLER (1972): *The theory of finance*, New York, Chicago, etc.
- FARNY, D. (1961): *Die Versicherungsmärkte. Eine Studie über die Versicherungsmarkttheorie*, Berlin.
- FARRAR, D.E. (1962): *The investment decision under uncertainty*, Englewood Cliffs.
- FECHNER, G.T. (1860I): *Elemente der Psychophysik*, vol. 1, Leipzig.
- (1860II): *Elemente der Psychophysik*, vol. 2, Leipzig.
- (1877): *In Sachen der Psychophysik*, Leipzig.
- (1888): 'Über die psychischen Maßprinzipien und das Weber'sche Gesetz', in: W. Wundt, ed., *Philosophische Studien* 4, Leipzig, pp. 161-230.
- FELDSTEIN, M.S. (1968): 'Uncertainty and forward exchange speculation', *REStat* 50, pp. 182-192.
- (1969): 'Mean-variance analysis in the theory of liquidity preference and portfolio selection', *REStud* 36, pp. 5-12.
- (1973): 'The welfare loss of excess health insurance', *JPE* 81, pp. 251-280.
- FERGUSON, C.E. (1966): 'The theory of multidimensional utility analysis in relation to multiple-goal business behavior: A synthesis', *SEJ* 32, pp. 169-175.
- FINETTI, B. DE (1937): *La prévision: Ses lois logiques, ses sources subjectives*, Annales de l'Institut Henri Poincaré, Recueil de conférences et mémoires de calcul des probabilités et physique théorique 7, Paris.
- (1949): 'Le vrai et le probable', *Dialectica* 3, pp. 78-92.
- (1952): 'Rôle de la théorie des jeux dans l'économie et rôle des probabilités personnelles dans la théorie des jeux', in: *Colloques internationaux du Centre National de la Recherche Scientifique* 40: *économétrie*, Paris 12-17 mai, Paris 1953, pp. 49-61.
- FISHBURN, P.C. (1970): *Utility theory for decision making*, New York, London, Sidney, and Toronto.
- FISHER, I. (1906): *The nature of capital and income*, London.
- (1930): *The theory of interest*, New York.
- FISHER, L. and J.H. LORIE (1970): 'Some studies of variability of returns on investments in common stocks', *JB* 43, pp. 94-134.
- FISZ, M. (1970): *Wahrscheinlichkeitsrechnung und mathematische Statistik*, Berlin.
- FREUND, R.J. (1956): 'The introduction of risk into a programming model', *Em* 24, pp. 253-263.

- FRIEDMAN, M. (1952): 'La théorie de l'incertitude et la distribution des revenus suivant leur grandeur', in: *Colloques internationaux du Centre National de la Recherche Scientifique 40: économétrie*, Paris 12-17 mai. Paris 1953, pp. 63-78.
- (1957): *A theory of the consumption function*, Princeton.
- (1959): 'The demand for money: Some theoretical and empirical results', *JPE* 67, pp. 327-351.
- FRIEDMAN, M. and L.J. SAVAGE (1948): 'The utility analysis of choices involving risk', *JPE* 56, pp. 279-304.
- (1952): 'The expected-utility hypothesis and the measurability of utility', *JPE* 60, pp. 463-474.
- FRISCH, R. (1932): *New methods of measuring marginal utility*, Tübingen.
- FRÖHLICH, F.W. (1921): *Grundzüge einer Lehre vom Licht und Farbensinn. Ein Beitrag zur allgemeinen Physiologie der Sinne*, Jena.
- FUORTES, M.G.F. (1959): 'Initiation of impulses in the visual cells of Limulus', *JPh* 148, pp. 14-28.
- FUORTES, M.G.F. and G.F. POGGIO (1963): 'Transient responses to sudden illumination in cells of the eye of Limulus', *JGPh* 46, pp. 435-452.
- FURLAN, L.V. (1946): 'Bemerkungen zum Petersburger Problem', *SZVSt* 82, pp. 444-448.
- GALAMBOS, R. and H. DAVIS (1943): 'The response of single auditory-nerve fibers to acoustic stimulation', *JNPh* 6, pp. 39-58.
- GALANTER, E. and S. MESSICK (1961): 'The relation between category and magnitude scales of loudness', *PsR* 68, pp. 363-372.
- GARNER, W.R., H.W. HAKE, and C.W. ERIKSEN (1956): 'Operationism and the concept of perception', *PsR* 63, pp. 149-159.
- GEORGESCU-ROEGEN, N. (1936): 'The pure theory of consumer's behavior', *QJE* 50, pp. 545-593.
- (1954): 'Choice expectations and measurability', *QJE* 68, pp. 503-532.
- GETTY, D.J. (1975): 'Discrimination of short temporal intervals: A comparison of two models', *P&PsPh* 18, pp. 1-8.
- GIFFORD, A., JR. and C.C. STONE (1975): 'Externalities, liability, separability, and resource allocation: A comment', *AER* 65, pp. 724-727.
- GORMAN, W.M. (1959a): 'Separable utility and aggregation', *Em* 27, pp. 469-481.
- (1959b): 'The empirical implications of a utility tree: A further comment', *Em* 27, pp. 489.
- GOTTINGER, H.W. (1971/72): 'Bernoulli's utility theory and historical ramifications', *JNSt* 186, pp. 481-497.
- (1974): *Subjektive Wahrscheinlichkeiten*, Göttingen.
- GOULD, J.P. (1969): 'The expected utility hypothesis and the selection of optimal deductibles for a given insurance policy', *JB* 42, pp. 143-151.
- GRAAF, J. DE and W. BAUMOL (1949): 'Three notes on expectation in economics', (second note), *Ec* 16, 1969, pp. 338-342.
- GRANIT, R. (1955): *Receptors and sensory perception*, New Haven.
- GREENE, M.R. (1964): '"Insurance mindedness" - implications for insurance theory', *JRI* 21, pp. 27-38.
- GREENWOOD, P., C. INGENE, and J. HORSFIELD (1975): 'Externalities, liability, separability, and resource allocation: Comment', *AER* 65, pp. 728-729.
- GROTEFELT, A. (1888): *Das Webersche Gesetz und die psychische Relativität*, Helsingfors.
- GRUBEL, H. (1965): 'Profits from forward exchange speculation', *QJE* 79, pp. 248-262.
- (1966): *Forward exchange, speculation, and the international flow of capital*, Stanford.
- (1971): 'Risk, uncertainty, and moral hazard', *JRI* 38, pp. 99-106.

- GUILFORD, J.P. (1932): 'A generalized psychophysical law', *PsR* 39, pp. 73-85.
- (1936): *Psychometric methods*, 2nd edition, 1954, New York, London, and Toronto.
- HAEHLING VON LANZENAUER, C. (1971): 'The expected cost hypothesis and the selection of an optimal deductible for a given insurance policy', *JB* 44, pp. 306-315.
- HAEHLING VON LANZENAUER, C. and D. WRIGHT (1975): Selecting rational insurance coverage, *OR* 19, pp. 49-62.
- HAKANSSON, N.H. (1969): 'Optimal investment and consumption strategies under risk, an uncertain lifetime, and insurance', *IER* 10, pp. 443-466.
- (1970a): 'Optimal investment and consumption strategies under risk for a class of utility functions', *EM* 38, pp. 587-607.
- (1970b): 'Friedman-Savage utility functions consistent with risk aversion', *QJE* 84, pp. 472-487.
- (1971): 'Capital growth and the mean-variance approach to portfolio selection', *JFQA* 6, pp. 517-557.
- HAMBURG, M. and W.F. MATLACK (1968): 'Maximizing insurance buyer's utility', *MS* 14, pp. 294-301.
- HARSANYI, J.C. (1955): 'Cardinal welfare, individualistic ethics, and interpersonal comparisons of utility', *JPE* 63, pp. 309-321.
- HARTLINE, H.K. (1938): 'The response of single optical nerve fibers of the Vertebrate eye to the illumination of the retina', *AJPh* 121, pp. 400-415.
- HARTLINE, H.K. and C.H. GRAHAM (1932): 'Nerve impulses from single receptors in the eye', *JCCPh* 1, pp. 277-295.
- HARTWIG, H. (1956): 'Naturwissenschaftliche und sozialwissenschaftliche Statistik', *ZgS* 112, pp. 252-266.
- HAUSDORFF, F. (1914): *Grundzüge der Mengenlehre*, Berlin.
- HAUSSMANN, F. (1968/69): 'Probability of survival as an investment criterion', *MS* 15, pp. 33-48.
- HAYNES, J. (1895): 'Risk as an economic factor', *QJE* 9, pp. 409-449.
- HECHT, S. (1934): 'Vision: II. The nature of the photoreceptor process', in: C. Murchison, ed., *A handbook of general experimental psychology*, Worchester/Mass., pp. 704-828.
- HEISENBERG, W. (1954): 'Atomforschung und Kausalgesetz', *Universitas* 9, pp. 225-236. Reprinted in: W. Heisenberg, *Schritte über Grenzen, Gesammelte Reden und Aufsätze*, Munich 1971, pp. 128-141.
- (1955): *Das Naturbild der heutigen Physik*. Hamburg. Reprinted in: W. Heisenberg, *Schritte über Grenzen. Gesammelte Reden und Aufsätze*, Munich 1971, pp. 109-127.
- HELMHOLTZ, H. (1869): 'Über die Schallschwingungen in der Schnecke des Ohres', *Verhandlungen des naturhistorischen medizinischen Vereins Heidelberg* 5, pp. 33-38.
- HELPMAN, E. and J.-J. LAFFONT (1975): 'On moral hazard in general equilibrium theory', *JET* 10, pp. 8-23.
- HELSON, H. (1947): 'Adaption-level as frame of reference for prediction of psychophysical data', *AJPs* 40, pp. 1-29.
- (1964): *Adaption level theory. An experimental and systematic approach to behavior*, New York, Evanston, and London.
- HELTEN, E. (1971): 'Zur Bayes-Analyse', *JNS* 185, pp. 528-545.
- (1973): *Statistische Entscheidungsverfahren zur Risikopolitik von Versicherungsunternehmen*, habilitation thesis, unpublished, University of Cologne.
- (1974): 'Statistische Probleme der Tarifierung in der Kraftverkehrsversicherung', *ZVersWiss* 63, pp. 153-177.
- HICKS, J.R. (1931): 'The theory of uncertainty and profit', *Ec* 11, (old series) pp. 170-189.
- (1933): 'The application of mathematical methods in the theory of risk', lecture

- presented at: The meeting of the Econometric Society in Leyden, September–October 1933, summarized by J. Marschak, *Em* 2, 1934, pp. 187–203, p. 194 f.
- (1962): 'Liquidity', *EJ* 72, pp. 787–802.
- (1967): *Critical essays in monetary theory*, Oxford.
- HICKS, J.R. and R.G.D. ALLEN (1934): 'A reconsideration of the theory of value', *Ec* 1, pp. 52–76 and 196–219.
- HIRSHLEIFER, J. (1965): 'Investment decision under uncertainty: Choice-theoretic approaches', *QJE* 79, pp. 509–536.
- (1970): *Investment, interest, and capital*, Englewood Cliffs.
- HOCHGESAND, H. (1974): *Theorie der Devisenspekulation*, Berlin.
- HOFFLANDER, A.E., E.R. RENSHAW, and V. RENSHAW (1971): 'Optimal insurance', *JRI* 38, pp. 322–340.
- HOLWAY, A.H. and C.C. PRATT (1936): 'The Weber-ratio for intensive discrimination', *PsR* 43, pp. 322–340.
- JEAN, W. (1971): 'The extension of the portfolio analysis to three or more parameters', *JFQA* 6, pp. 505–515.
- JOHNSON, D.M. (1955): *The psychology of thought and judgement*, New York.
- KAHNEMAN, D. and A. TVERSKY (1973): 'On the psychology of prediction', *PsR* 80, pp. 237–251.
- KATZ, B. (1950): 'Depolarization of sensory terminals and the initiation of impulses in the muscle spindle', *JPh* 3, pp. 261–282.
- KELLY, J.L. JR. (1956): 'A new interpretation of information rate', *BSTJ* 35, pp. 917–926.
- KENEN, P.B. (1966): 'Trade, speculation, and the forward exchange rate', in: *Trade, growth, and the balance of payments. Essays in honour of G. Haberler*, Amsterdam, pp. 143–169.
- KEYNES, J.M. (1921): *A treatise on probability*, London.
- KIHLSTROM, R.E. and L.J. MIRMAN (1974): 'Risk aversion with many commodities', *JET* 8, pp. 361–388.
- KNIGHT, F.H. (1921): *Risk, uncertainty and profit*, New York.
- KÖNIG, A. and E. BRODHUN (1888): 'Experimentelle Untersuchungen über die psychophysische Fundamentalformel in Bezug auf den Gesichtssinn', *Sitzungsberichte der königlich preussischen Akademie der Wiss. zu Berlin*, Berlin, pp. 917–931.
- (1889): 'Experimentelle Untersuchungen über die psychophysische Fundamentalformel in Bezug auf den Gesichtssinn. Zweite Mittheilung', *Sitzungsberichte der königlich preussischen Akademie der Wissenschaften zu Berlin*, Berlin, pp. 641–644.
- KÖNIG, H. (1968): 'Einkommenskreislaufgeschwindigkeit des Geldes und Zinssatzveränderungen: Eine ökonometrische Studie über die Geldnachfrage in der BRD', *ZgS* 124, pp. 70–90.
- KOLMOGOROFF, A.N. (1933): *Grundbegriffe der Wahrscheinlichkeitsrechnung*, Berlin.
- KOOPMANS, T.C. (1960): 'Stationary ordinal utility and impatience', *Em* 28, pp. 287–309.
- KRANTZ, D.H. (1972): 'A theory of magnitude estimation and cross modality matching', *JMPs* 9, pp. 168–199.
- KRELLE, W. (1957): 'Unsicherheit und Risiko in der Preisbildung', *ZgS* 113, pp. 632–677.
- (1961): *Preistheorie*, Tübingen and Zürich.
- (1968): *Präferenz- und Entscheidungstheorie*, Tübingen.
- KRIES, J.v. (1886): *Die Principien der Wahrscheinlichkeitsrechnung. Eine logische Untersuchung*, Freiburg.
- LANGE, O. (1943): 'A note on innovations', *REStat* 25, pp. 19–25. Reprinted in: *Readings in the theory of income distribution*, Philadelphia and Toronto 1949, pp. 181–196.
- LAPLACE, P.S. DE (1814): *Théorie analytique des probabilités*, Paris.
- LATANÉ, H.A. (1959): 'Criteria for choice among risky ventures', *JPE* 67, pp. 144–155.
- (1960): 'Income velocity and interest rates: A pragmatic approach', *REStat* 42, pp. 445–449.

- LEES, D.S. and R.G. RICE (1965): 'Uncertainty and the welfare economics of medical care: Comment', *AER* 55, pp. 140–154.
- LEEUVEN, S. VAN (1949): 'Response of a frog's muscle spindle', *JPh* 109, pp. 142–145.
- LELAND, H.E. (1971): 'Optimal forward exchange positions', *JPE* 79, pp. 257–269.
- (1974): 'Optimal growth in a stochastic environment', *REStud* 41, pp. 75–86.
- LEVY, H. (1974): 'The rationale of the mean-standard deviation analysis: Comment', *AER* 64, pp. 434–441.
- LEVY, H. and H.M. MARKOWITZ (1979): 'Approximating expected utility by a function of mean and variance', *AER* 69, pp. 308–317.
- LEVY, H. and M. SARNAT (1972): 'Safety-first – an expected utility principle', *JFQA*, 1829–1834.
- LIPPS, T. (1902): 'Das Relativitätsgesetz der psychischen Quantität und das Weber'sche Gesetz', *Sitzungsberichte der philosophisch-philologischen und der historischen Classe der königlich bayrischen Akademie der Wissenschaften zu München* 10, Munich 1903, pp. 3–58.
- (1905): *Psychologische Studien*, 2nd edition, Leipzig.
- LITTLE, I.M.D. (1950): *A critique of welfare economics*, Oxford.
- LOISTL, O. (1976): 'The erroneous approximation of expected utility by means of a Taylor's series expansion: Analytic and computational results', *AER* 66, pp. 904–910.
- LUCE, R.D. and H. RAIFFA (1957): 'Games and decisions. Introduction and critical survey', New York, London, and Sydney.
- LUTZ, F. and V. (1951): *The theory of investment of the firm*, Princeton.
- MAGNUSSON, G. (1969): *Production under risk. A theoretical study*, Uppsala.
- MAHR, W. (1951): *Einführung in die Versicherungswirtschaft. Allgemeine Versicherungslehre*, Berlin.
- (1972): 'Zur Interdependenz von Prämien und Schäden: Das moralische Risiko', in: P. Braess, D. Farny, R. Schmidt, eds., *Praxis und Theorie der Versicherungsbetriebslehre. Festgabe für H.L. Müller-Lutz zum 60. Geburtstag*, Karlsruhe, pp. 241–282.
- MALINVAUD, E. (1952): 'Note on von Neumann-Morgenstern's strong independence axiom', *Em* 20, p. 679.
- (1969): 'Risk-taking and resource allocation', in: J. Margolis and H. Guitton, eds., *Public economics. An analysis of public production and consumption and their relations to the private sectors*, London and Basingstoke, pp. 223–246.
- MARCHAL, J. (1949): 'Essai de révision de la théorie des prix à la lumière de progrès de la psychologie moderne', *ZN* 12, pp. 127–149.
- MARCHAND, J.R. and K.P. RUSSEL (1973): 'Externalities, liability, separability, and resource allocation', *AER* 63, pp. 611–620.
- (1975): 'Externalities, liability, separability, and resource allocation: Reply', *AER* 65, pp. 730–732.
- MARKOWITZ, H. (1952a): 'Portfolio selection', *JF* 7, pp. 77–91.
- (1952b): 'Utility of wealth', *JPE* 60, pp. 151–158.
- (1970): *Portfolio selection. Efficient diversification of investments*, 2nd edition, New Haven and London.
- MARSCHAK, J. (1938): 'Money and the theory of assets', *Em* 6, pp. 311–325.
- (1950): 'Rational behavior, uncertain prospects, and measurable utility', *Em* 18, pp. 111–141.
- MARSHALL, A. (1920): *Principles of economics. An introductory volume*, 8th edition, London.
- MARSHALL, J.M. (1976): 'Moral hazard', *AER* 66, pp. 880–890.
- MASSON, R.T. (1972): 'The creation of risk aversion by imperfect capital markets', *AER* 62, pp. 77–86.

- MATTFELDT, H. (1973): *Das Geldmengenproblem. Empirische Untersuchungen in der Bundesrepublik*, Berlin.
- MATTHEWS, B.H.C. (1931): 'The response of a single end organ', *JPh* 71, pp. 64–110.
- MEINONG, A. (1896): 'Über die Bedeutung des Weberschen Gesetzes. Beiträge zur Psychologie des Vergleichens und Messens', *Zps* 11, pp. 353–402.
- MELTZER, A.A. (1963): 'The demand for money: The evidence from the time series', *JPE* 71, pp. 219–246.
- MENGER, K. (1934): 'Das Unsicherheitsmoment in der Wertlehre. Betrachtungen im Anschluß an das sogenannte Petersburger Spiel', *ZN* 5, pp. 459–485.
- MENGES, P. (1970): *Die Prämienpolitik der Feuerversicherer*, doctoral dissertation, University of Hamburg.
- MERTON, R.C. (1969): 'Lifetime portfolio selection under uncertainty: The continuous-time case', *REStat* 51, pp. 247–257.
- METZLER, L.A. (1951): 'Wealth, saving, and the rate of interest', *JPE* 59, pp. 93–116.
- MILNOR, J. (1954): 'Games against nature', in: R.M. Thrall, C.H. Coombs, and R.L. Davis, eds., *Decision processes*, New York and London, pp. 49–59.
- MISES, R.v. (1936): *Wahrscheinlichkeit, Statistik und Wahrheit*, Wien.
- MODIGLIANI, F. and R. BRUMBERG (1955): 'Utility analysis and the consumption function: An interpretation of cross-section data', in: K. Kurihara, ed., *Post-Keynesian economics*, London, pp. 388–436.
- MONOD, J. (1971): *Zufall und Notwendigkeit. Philosophische Fragen der modernen Biologie*, Munich.
- MOSSIN, J. (1968a): 'Optimal multiperiod portfolio policies', *JB* 41, pp. 215–229.
- (1968b): 'Aspects of rational insurance purchasing', *JPE* 76, pp. 553–568.
- (1969): 'A note on uncertainty and preferences in a temporal context', *AER* 59, pp. 172–174.
- (1973): *Theory of financial markets*, Englewood Cliffs.
- MOSTELLER, F. and P. NOGEE (1951): 'An experimental measurement of utility', *JPE* 59, pp. 371–404.
- NACHTKAMP, H.H. (1969): *Der kurzfristige optimale Angebotspreis der Unternehmen bei Vollkostenkalkulation und unsicheren Nachfrageerwartungen*, Tübingen.
- NEUMANN, J.v. and O. MORGENSTERN (1947): *Theory of games and economic behavior*, 2nd edition, Princeton.
- NIEHANS, J. (1948): 'Zur Preisbildung bei ungewissen Erwartungen', *SZVSt* 84, pp. 433–456.
- PARETO, V. (1906): *Manuel d'économie politique (ophélimité)*. English translation of the 2nd edition 1927, in: A.N. Page, ed., *Utility theory: A book of readings*, New York, London, and Sydney 1968, pp. 168–181 and 375–383.
- PASHIGIAN, B.P., L.L. SCHKADE, and G.H. MENEFEY (1966): 'The selection of an optimal deductible for a given insurance policy', *JB* 39, pp. 35–44.
- PAULY, M.V. (1968): 'The economics of moral hazard: Comment', *AER* 58, pp. 531–537.
- (1970): 'The welfare economics of community rating', *JRI* 37, pp. 407–418.
- (1974): 'Overinsurance and public provision of insurance: The roles of moral hazard and adverse selection', *QJE* 88, pp. 44–62.
- PERDIKAS, P. (1966): 'Die Entstehung der Versicherung im Mittelalter. Geschichtliche Grundlagen im Verhältnis zu Seedarlehen, Überseekauf, Commenda und Bodmeierei', *ZVersWiss* 55, pp. 425–509.
- PFANZAGL, J. (1959a): *Die axiomatischen Grundlagen einer allgemeinen Theorie des Messens*, Würzburg.
- (1959b): 'A general theory of measurement. Applications to utility', *NRLQ* 6, pp. 283–294.
- PHELPS, E.S. (1962): 'The accumulation of risky capital: A sequential utility analysis', *Em* 30, pp. 729–743.

- PHILLIPS, L.D. (1970): 'The "true probability" problem', *ActPs* 34, pp. 254–264.
- PIEL, D. (1976): '...denn die Kasse zahlt's. Urlaub auf Krankenschein', *Die Zeit* 18, 23 April, p. 31.
- PIGOU, A.C. (1932): *The economics of welfare*, London.
- PLATEAU, J. (1872): 'Sur la mesure des sensations physiques, et sur la loi qui lie l'intensité de la cause excitante', *Bulletins de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique* 23, Brussels, pp. 376–388.
- POLLAK, R.A. (1970): 'Homogeneous von Neumann-Morgenstern utility functions', *IER* 11, pp. 117–130.
- PRAAG, B. VAN (1958): *Individual welfare functions and consumer behavior*, Amsterdam.
- PRATT, J.W. (1964): 'Risk aversion in the small and in the large', *Em* 32, pp. 122–136.
- PRATT, J.W., H. RAIFFA, and R. SCHLAIFER (1965): *Introduction to statistical decisions theory*, New York, St. Louis, etc.
- PYE, G. (1967): 'Portfolio selection and security prices', *REStat* 49, pp. 111–115.
- (1972): 'Lifetime portfolio selection with age dependent risk aversion', in: G.P. Szegö and K. Shell, eds., *Mathematical methods in investment and finance*, Amsterdam, London, and New York, pp. 49–64.
- PYLE, D.H. and S.J. TURNOVSKY (1970): 'Safety-first and expected utility maximization in mean-standard deviation portfolio analysis', *REStat* 52, pp. 75–81.
- RAIFFA, H. (1961): 'Risk, ambiguity, and the Savage axioms: Comment', *QJE* 75, pp. 690–694.
- (1968): *Decision analysis. Introductory lectures on choices under uncertainty*, Reading, Menlo Park, London, and New York.
- RAMSEY, F.P. (1928): 'A mathematical theory of saving', *EJ* 38, pp. 543–559.
- (1931): 'Truth and probability', in: *The foundations of mathematics and other logical essays*, London, pp. 151–198.
- RAZIN, A. (1976): 'Rational insurance purchasing', *JF* 31, pp. 133–137.
- REICHENBACH, H. (1925): 'Die Kausalstruktur der Welt und der Unterschied zwischen Vergangenheit und Zukunft', *Sitzungsberichte der mathematisch-naturwissenschaftlichen Abteilung der Bayrischen Akademie der Wissenschaften zu München*, Munich, pp. 133–175.
- (1935): *Wahrscheinlichkeitslehre. Eine Untersuchung über die logischen und mathematischen Grundlagen der Wahrscheinlichkeitsrechnung*, Leiden.
- RICHTER, M. (1959/60): 'Cardinal utility, portfolio selection, and taxation', *REStud* 22, pp. 152–166.
- RIGGS, L.A. (1971): 'Vision', in: J.W. Kling and L.A. Riggs, eds., *Woodworth & Schlosberg's experimental psychology*, 3rd edition, New York, Chicago, etc., pp. 273–314.
- ROBBINS, L. (1935): *An essay on the nature and significance of economic science*, London and New York.
- ROBERTS, H.V. (1963): 'Risk, ambiguity, and the Savage axioms: Comment', *QJE* 77, pp. 327–336.
- RÖDDING, W. and H.H. NACHTKAMP (1978): 'On the aggregation of preferences', *NRLQ* 25, pp. 55–79.
- (1980): 'Mechanismen der sozialen Wahl', in: D. Duwendag and H. Siebert, eds., *Politik und Markt. Wirtschaftspolitische Aufgaben des nächsten Jahrzehnts. Festschrift für H.K. Schneider*, Stuttgart.
- ROLL, R. (1973): 'Evidence on the "growth-optimum" model', *JF* 28, pp. 551–566.
- RONNING, G. (1974a): 'Changes of German share prices – random or not random?' *Diskussionsbeiträge des Fachbereichs Wirtschaftswissenschaften der Universität Konstanz* 42 (April).
- (1974b): 'Das Verhalten von Aktienkursveränderungen. Eine Überprüfung von Unabhängigkeits- und Verteilungshypothesen anhand von nichtparametrischen Testverfahren', *Allgemeines statistisches Archiv* 58, pp. 272–302.

- ROSENSTEIN-RODAN, P.N. (1934): 'The rôle of time in economic theory', *Ec* 1, pp. 77-79.
- ROSETT, R.N. and L. HUANG (1973): 'The effect of health insurance on the demand for medical care', *JPE* 81, pp. 281-305.
- ROSNER, B.S. and W.R. GOFF (1967): 'Electrical responses of the nervous system and subjective scales of intensity', in: W.D. Neff, ed., *Contributions to sensory physiology*, New York, pp. 169-221.
- ROY, A.D. (1952): 'Safety first and the holding of assets', *Em* 20, pp. 431-449.
- ROY, R. (1943): 'La hiérarchie des besoins et la notion des groupes dans l'économie de choix', *Em* 11, pp. 13-24.
- RUBINSTEIN, M. (1976): 'The strong case for the generalized logarithmic utility model as the premier model of financial markets', *JF* 31, pp. 551-571.
- RYAN, T. (1974): 'The use of unbounded utility functions in expected-utility maximization: Comment', *QJE* 88, pp. 133-135.
- SAMUELSON, P.A. (1936/37): 'A note on measurement of utility', *REStud* 4, pp. 155-161.
- (1952a): 'Utilité, préférence et probabilité', in: *Colloques internationaux du Centre National de la Recherche Scientifique 40: économétrie*, Paris 12-17 mai, Paris 1953, pp. 140-150.
- (1952b): 'Probability, utility, and the independence axiom', *Em* 20, pp. 670-678.
- (1960): 'The St. Petersburg paradox as a divergent double limit', *IER* 1, pp. 31-37.
- (1963): 'Risk and uncertainty: A fallacy of large numbers', *Scientia* 57 (6th series), pp. 108-113.
- (1967): 'General proof that diversification pays', *JFQA* 2, pp. 1-13.
- (1969): 'Lifetime portfolio selection by dynamic stochastic programming', *REStat* 51, pp. 239-246.
- (1970): 'The fundamental approximation theorem of portfolio analysis in terms of means, variances and higher moments', *REStud* 37, pp. 537-542.
- (1971): 'The "fallacy" of maximizing the geometric mean in long sequences of investing or gambling', *Proceedings of the National Academy of Sciences* 68, pp. 2493-2496. Reprinted in: J.L. Bicksler and P.A. Samuelson, eds., *Investment portfolio decision-making*, Toronto, Lexington, and London 1974, pp. 271-280.
- (1977): 'St. Petersburg paradoxes: Defanged, dissected, and historically described', *JEL* 15, pp. 24-25.
- SANDMO, A. (1968): 'Portfolio choice in a theory of saving', *SJE* 70, pp. 106-122.
- (1969): 'Capital risk, consumption, and portfolio choice', *Em* 37, pp. 586-599.
- SAUERMAN, H. and R. SELTEN (1962): 'Anspruchsanpassungstheorie der Unternehmung', *ZgS* 118, pp. 577-597.
- SAVAGE, L.J. (1951): 'The theory of statistical decision', *JASA* 46, pp. 55-67.
- (1952): 'Une axiomatisation de comportement raisonnable face à l'incertitude', in: *Colloques internationaux du Centre National de la Recherche Scientifique 40: économétrie*, Paris 12-17 mai, Paris 1953, pp. 29-33.
- (1954): *The foundations of statistics*, New York and London.
- SAX, E. (1892): 'Die Progressivsteuer', *Zeitschrift für Volkswirtschaft, Socialpolitik und Verwaltung* 1, pp. 43-101.
- SCHLAIFER, R. (1959): *Probability and statistics for business decisions. An introduction into managerial economics under uncertainty*, New York, Toronto, and London.
- (1969): *Analysis of decisions under uncertainty*, New York, St. Louis, etc.
- SCHNEEWEISS, H. (1963): 'Nutzenaxiomatik und Theorie des Messens', *Statistische Hefte* 4, pp. 178-220.
- (1964): 'Eine Entscheidungsregel für den Fall partiell bekannter Wahrscheinlichkeiten', *Ufo* 8, pp. 86-95.
- (1967a): *Entscheidungskriterien bei Risiko*, Berlin, Heidelberg, and New York.
- (1967b): 'Bemerkungen zur lexikographischen Ordnung', in: R. Henn, ed., *Operations-Research-Verfahren* 3, Meisenheim am Glan, pp. 336-352.

- (1968a): 'Die Unverträglichkeit von (μ - σ)-Prinzip und Dominanzprinzip', *Ufo* 12, pp. 180-184.
- (1968b): 'Spieltheoretische Analyse des Ellsberg-Paradoxons', *ZgS* 249-256.
- (1968c): 'Die angebliche Ausschaltung des Risikos durch das Gesetz der großen Zahlen', *Ufo* 12, pp. 96-105.
- SCHNEIDER, D. (1979): 'Meßbarkeitsstufen subjektiver Wahrscheinlichkeiten als Erscheinungsformen der Ungewißheit', *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung* 31, pp. 89-122.
- SCHNEIDER, H. (1964): *Der Einfluß der Steuern auf die unternehmerische Investitionsentscheidung*, Tübingen.
- SCHRÖDER, J. (1969): *Zur Theorie der Devisenmärkte*, Berlin.
- SCHULTZ, H. (1933): 'Frisch on the measurement of utility', *JPE* 16, pp. 95-116.
- SCHUMPETER, J.A. (1942): *Capitalism, socialism and democracy*, New York.
- SEIDL, CH. (1972): 'Moral Hazard: Die individuelle Maximierung des Erwartungsnutzens als Quelle von Wohlfahrtsminderungen', *ZN* 32, pp. 425-448.
- SELDEN, R.T. (1956): 'Monetary velocity in the United States', in: M. Friedman, ed., *Studies in the quantity theory of money*, Chicago and London, pp. 179-257.
- SENETTI, J.T. (1976): 'On Bernoulli, Sharpe, financial risk, and the St. Petersburg paradox', *JF* 31, pp. 960-962.
- SHACKLE, G.L.S. (1952): *Expectation in economics*, second edition, Cambridge.
- (1955): *Uncertainty in economics and other reflections*, Cambridge.
- SHELL, K. (1972): 'Selected elementary topics in the theory of economic decision-making under uncertainty', in: G. Szegö and K. Shell, eds., *Mathematical methods in investment and finance*, Amsterdam, pp. 65-75.
- SIEGEL, S. (1957): 'Level of aspiration and decision making', *PsR* 64, pp. 253-262.
- SIMON, H.A. (1957): *Models of man. Social and rational mathematical essays on rational human behaviour in a social setting*, New York and London.
- SINN, H.-W. (1975): 'Das Marxsche Gesetz des tendenziellen Falls der Profitrate', *ZgS* 131, pp. 646-696.
- (1977): 'Die Allokationswirkungen der Versicherung', *ZVersWiss* 66, pp. 507-538.
- (1978): 'The efficiency of insurance markets', *EER* 11, pp. 321-341.
- (1980): 'A rehabilitation of the principle of insufficient reason', *QJE* 94, pp. 493-506.
- (1982): 'Kinked utility and the demand for human wealth and liability insurance', *EER* 17, pp. 149-162.
- SINN, H.-W. and U. SCHMOLTZI (1981): 'Eigentumsrechte, Kompensationsregeln und Marktmacht - Anmerkungen zum "Coase-Theorem"', *JNSSt* 196, pp. 97-117.
- SLANEC, E. (1972): 'Versicherung - Produkt und Faktor in der Wirtschaft', *Österreichische Hochschulzeitung* 24, pp. 15-16.
- SMITH, V.L. (1968): 'Optimal insurance coverage', *JPE* 76, pp. 68-77.
- SOHMEN, E. (1966): *The theory of forward exchange*, Princeton.
- (1973): *Wechselkurs und Währungsordnung*, Tübingen.
- SPENCE, M. and R. ZECKHAUSER (1971): 'Insurance, information, and the individual action', *AER* 61, pp. 380-391.
- (1972): 'The effect of the timing of consumption decisions and the resolution of lotteries on the choice of lotteries', *Em* 40, pp. 401-403.
- STANGE, K. (1970): *Angewandte Statistik*, Vol. 1, *Eindimensionale Probleme*, Berlin, Heidelberg, and New York.
- STARBUCK, W.H. (1963a): 'Level of aspiration', *PsR* 70, pp. 51-60.
- (1963b): 'Level of aspiration theory and economic behavior', *Behavioral Science* 8, pp. 128-136.
- STEGMÜLLER, W. (1973): *Personelle und statistische Wahrscheinlichkeit*, vol. 2, Berlin.
- STEINDL, J. (1941): 'On risk', *OEP* 5, pp. 43-53.

- STEINMANN, G. (1970): *Theorie der Spekulation*, Tübingen.
- STEVENS, S.S. (1951): 'Mathematics, measurement and psychophysics', in: S.S. Stevens, ed., *Handbook of experimental psychology*, New York and London, pp. 1-49.
- (1956): 'The direct estimation of sensory magnitudes', *AJPs* 69, pp. 1-25.
- (1959): 'Cross-modality validation of subjective scales for loudness, vibration, and electric shock', *JExpPs* 57, pp. 201-209.
- (1961): 'The psychophysics of sensory function', in: W.A. Rosenblith, ed., *Sensory communication. Contributions to the symposium on principles of sensory communication*, New York and London, pp. 1-33.
- (1962): 'The surprising simplicity of sensory metrics', *APs* 17, pp. 29-39.
- (1966): 'Matching functions between loudness and ten other continua', *P&PsP* 1, p. 5-8.
- (1975): *Psychophysics. Introduction to its perceptual, neural, and social prospects*, edited posthumously by G. Stevens, New York, London, Sydney, and Toronto.
- STEVENS, S.S. and E.H. GALANTER (1957): 'Ratio scales and category scales for a dozen perceptual continua', *JExpPs* 54, pp. 377-411.
- STIGLER, G.J. (1950): 'The development of utility theory', *JPE* 58, pp. 307-327 and 373-396. Reprinted in: A.N. Page, ed., *Utility theory: A book of readings*, New York, London, and Sydney 1968, pp. 55-119.
- STIGLITZ, J.E. (1969a): 'The effects of income, wealth, and capital gains taxation on risk-taking', *QJE* 83, pp. 263-283.
- (1969b): 'Aspects to the theory of risk bearing', review of ARROW (1965). *Em* 37, p. 742 f.
- STROTZ, R.H. (1955/56): 'Myopia and inconsistency in dynamic utility maximization', *REStud* 23, pp. 165-180.
- (1957): 'The empirical implications of a utility-tree', *Em* 25, pp. 269-280.
- (1959): 'The utility tree - a correction and further appraisal', *Em* 27, pp. 482-488.
- TASAKI, I. (1954): 'Nerve impulses in individual auditory nerve fibers of guinea pig', *JNPh* 17, pp. 97-122.
- TELSE, L.G. (1955/56): 'Safety first and hedging', *REStud* 23, pp. 1-16.
- THORP, E.O. (1971): 'Portfolio choice and the Kelly criterion', *Business and economics statistics section proceedings of the American Statistical Association*, pp. 215-224. Reprinted in: J.L. Bicksler and P.A. Samuelson, eds., *Investment portfolio decision-making*, Lexington, Toronto, and London 1974, pp. 253-270.
- THURSTONE, L.L. (1927): 'Psychophysical analysis', *AJPs* 38, pp. 368-389.
- (1929): 'Fechner's law and the method of equal appearing intervals', *JExpPs* 12, pp. 214-224.
- TINTNER, G. (1941): 'The theory of choice under subjective risk and uncertainty', *Em* 9, pp. 298-304.
- TITCHNER, E.B. (1905a): *Experimental psychology. A manual of laboratory practise*, vol. 1, *Quantitative experiments: part I. Students' manual*, New York and London.
- (1905b): *Experimental psychology. A manual of laboratory practise*, vol. 2, *Quantitative experiments: part II. Instructor's manual*, New York and London.
- TOBIN, J. (1956): 'The interest-elasticity of transactions demand for cash', *REStat* 38, pp. 241-247.
- (1958): 'Liquidity preference as behavior towards risk', *REStud* 67. Reprinted in: D.D. Hester and J. Tobin, eds., *Risk aversion and portfolio choice*, New York, London, and Sydney 1967, pp. 1-26.
- (1965): 'The theory of portfolio selection', in: F.H. Hahn and F.P.R. Brechling, eds., *The theory of interest rates. Proceedings of a conference held by the International Economic Association*, New York, pp. 3-51.
- (1968): 'Notes on optimal monetary growth', *JPE* 76, pp. 833-873.

- (1969): 'Comment on Borch and Feldstein', *REStud* 36, pp. 13–14.
- TODHUNTER, I. (1865): *A history of the mathematical theory of probability. From the time of Pascal to that of Laplace*, Cambridge.
- TÖRNQVIST, L. (1945): 'On the economic theory of lottery-gambles', *SkAtsk* 28, pp. 228–246.
- TSIANG, S.C. (1959): 'The theory of forward exchange and the effects of government intervention on the forward exchange', *International Monetary Fund Staff Papers* 7, pp. 75–106.
- (1972): 'The rationale of the mean-standard deviation analysis, skewness preference, and the demand for money', *AER* 62, pp. 354–371.
- (1974): 'The rationale of the mean-standard deviation analysis: Reply and errata for original article', *AER* 64, pp. 442–450.
- TURVEY, R. (1949): 'Three notes on "expectation in economics"', (1st note) *Ec* 16, pp. 336–338.
- VIKAS, C. (1975): 'Wealth effect on the demand for money', *JPE* 83, pp. 615–631.
- WALD, A. (1945): 'Statistical decision functions which minimize the maximum risk', *AM* 46, pp. 265–280.
- WARD, W.D. (1954): 'Subjective musical pitch', *JAcousSa* 26, pp. 369–380.
- WARREN, R.M. (1958): 'A basis for judgements of sensory intensity', *AJPs* 71, pp. 675–687.
- WEBER, E.H. (1934): *De pulsu, resorptione, auditu et tactu. Annotationes anatomicae et physiologicae*, Lipsiae.
- (1846): *Die Lehre vom Tastsinne und Gemeingefühle auf Versuche gegründet*, Braunschweig 1851. Reprinted in: *Wagners Handwörterbuch der Physiologie*.
- WEBER, M. (1908): 'Die Grenznutzenlehre und das "Psychophysische Grundgesetz"', in: J. Winckelmann, ed., *Gesammelte Aufsätze zur Wissenschaftslehre von M. Weber*, 3rd edition, Tübingen 1968, pp. 384–399.
- WESTPHAL, U. (1970): *Theoretische und empirische Untersuchungen zur Geldnachfrage und zum Geldangebot*, Tübingen.
- WINKLER, R.L. (1967a): 'The assessment of prior distributions in Bayesian analysis', *JASA* 62, pp. 776–800.
- (1967b): 'The quantification of judgement: Some methodological suggestions', *JASA* 62, pp. 1105–1120.
- WOLD, H. (1952): 'Ordinal preferences or cardinal utility?', *Em* 20, pp. 661–663.
- WOLL, A. (1969): 'Die Theorie der Geldnachfrage: Analytische und statistische Ergebnisse für die Bundesrepublik Deutschland', *ZgS* 125, pp. 56–81.
- WUNDT, W. (1863): *Vorlesungen über die Menschen- und Tierseele*, 5th edition, Hamburg and Leipzig 1911.
- (1908): *Grundzüge der physiologischen Psychologie*, vol. 1, 6th edition, Leipzig.
- YAARI, M.E. (1965): 'Convexity in the theory of choice under risk', *QJE* 79, pp. 278–290.
- ZECKHAUSER, R. (1970): 'Medical insurance: A case study of the tradeoff between risk spreading and appropriate incentives', *JET* 2, pp. 10–26.

Author Index

- Aczél 94, 149, 150
 Adrian 142
 Akerlof 319
 Albert XVI
 Aliber 279
 Allais 7, 23–26, 48, 70, 77–79, 177
 Allen 1, 77, 133
 Alt 77
 Amoroso 77
 Appelbaum 176
 Archimedes 80–82, 86–88, 90, 110, 178
 Arrow 45, 72, 86, 99, 113, 114, 117, 127,
 148, 149, 158, 159, 161, 162, 182, 183,
 186–190, 194, 221, 227, 231, 269–272,
 274, 296, 314, 316, 325, 332
 Attneave 135
 Aumann 3
 Bach, J.S. 141
 Bailey, R.A. 15
 Bailey, M.J. 176
 Banerjee 59
 Barrois 74, 76, 296
 Baumol 9, 66, 270, 271
 Bayes 14
 Becker 185, 296, 311, 313, 314, 319
 Békésy, von 129, 134, 146
 Bellman 225, 240, 243
 Bernoulli, D. XV, 44, 69, 70, 72–75, 77,
 79, 112, 124–127, 131, 145, 147, 148,
 159, 161, 183–185, 208, 224
 Bernoulli, J. 26, 208
 Bernoulli, N. 69
 Bertrand 186
 Bicksler 161
 Böhm-Bawerk, von 219, 232, 248
 Bohr 146
 Borch 96, 97, 125, 296
 Boring 129, 141
 Boskin 246
 Bouguer 127, 128
 Braess 16
 Breimann 224
 Brewer 19
 Brito 185
 Brodhun 129, 130, 144
 Brown 49
 Brumberg 124, 231, 239
 Bühlmann 74
 Bundesaufsichtsamt für das Versiche-
 rungswesen 77
 Carterette 139
 Cattel 133
 Chernoff 30
 Chipman 59, 62, 68, 185
 Churchman 54
 Coase 329, 330
 Cobb 240, 252
 Coehlo 330
 Concordet 185
 Conrad 257
 Cournot 185
 Cramer, G. XV, 44, 69, 70, 72, 73, 77,
 79, 124, 184, 185
 Cramér, H. 44, 58, 59, 65
 D'Alembert 33, 34
 Davis, H. 143, 146
 Davis, O.A. 330
 Delboef 139
 Descartes XVI
 Diamond 235, 236
 Domar 44, 46, 48–52, 58, 91, 101, 150
 Douglas 240, 252
 Ebel 157
 Edgeworth XVII

- Edwards 14
 Ehrlich 296, 311, 313, 314, 319
 Einstein 12
 Eisen 319
 Eisler 140, 142, 146
 Ekman 135, 137, 140–142
 Ellsberg 18, 19, 21, 25, 26, 37
 Encarnación 44, 59, 65, 66
 Eriksen 135
 Fama 58, 113, 257
 Farny 161
 Farrar 102, 110
 Fechner 128–132, 136–145, 148
 Feldstein 118, 275, 284, 286, 316
 Ferguson 59
 Fick 125
 Finetti, de 9, 10, 12
 Fishburn 2
 Fisher, I. 11–13, 44, 50, 57, 64, 76, 157, 161, 219, 232, 316
 Fisher, L. 260
 Fisz 58
 Freund 152, 153, 157, 160, 212, 213
 Friedman 8, 80, 124, 139, 175, 176, 220, 269, 270, 279
 Frisch 77
 Fröhlich 142, 143
 Fullerton 133
 Fuortes 143
 Furlan 185
 Galambos 143, 146
 Galanter 140
 Garner 135
 Georgescu-Roegen 3, 18, 59, 68, 81, 86
 Getty 129
 Gifford 330
 Goff 143
 Gorman 124
 Gossen XVII
 Gottinger 9, 186
 Gould 296
 Graaf 9
 Graham 143
 Granit 143
 Greene 310
 Greenwood 330
 Grotenfelt 133, 145, 146
 Grubel 275, 276, 277, 311, 316
 Guilford, 133, 139, 140, 146
 Haehling von Lanzenauer 296
 Hakansson 176, 224, 234, 235
 Hake 135
 Hamburg 296
 Harsanyi 236
 Hartline 143
 Hartwig 12
 Hausdorff 59, 66
 Haussmann 44, 59, 68
 Haynes 315, 316
 Hecht 129
 Heisenberg 12
 Helmholtz 146
 Helpman 319
 Helson 139, 140, 239
 Helten 14, 15, 17, 35, 74, 78, 161
 Hicks 1, 44, 50, 58, 77, 98, 99, 114, 133, 151, 156, 157, 177, 268
 Hirshleifer 7, 113
 Hochgesand 112, 275, 284
 Hofflander 296
 Howay 129
 Horsfield 330
 Huang 316
 Hurwicz 18
 Ingene 330
 Jean 58
 Jevons XVII
 Johnson 140
 Jüttner 257
 Kahnemann 17
 Kaldor 324, 331
 Katz 143, 170
 Kelly 223
 Kenen 281
 Keynes 10, 26, 185, 186, 220
 Kihlstrom 235
 Knight XVII, 12, 16, 212
 König, A. 129, 130, 144
 König, H. 270
 Kolmogoroff 11
 Koopmans 231, 236, 252, 253
 Krantz 146
 Krelle 4, 9, 18, 19, 30, 33, 35, 44, 52–55, 68, 72, 77–79, 92, 101, 149, 151, 159, 207, 216, 235
 Kries, von 33
 Kurz 231
 Laffont 319
 Lagrange 108, 263
 Lange 44, 46–48, 58, 72, 90
 Laplace 12, 16, 26, 70, 113, 125, 184
 Latané 214, 223–225, 229, 269, 270
 Lees 325
 Leeuwen, van 143
 Leland 234, 275, 284
 Levy 61, 102

- Lipps 141, 145
 Little 3, 77
 Loistl 102, 109
 Lorie 260
 Luce 10, 11, 13, 18, 30, 35
 Lutz, F. 44, 50, 113
 Lutz, V. 44, 50, 113
 Lyapunow 57
 Magnusson 157
 Mahr 314, 315
 Malinvaud 80, 325
 Marchal XVI
 Marchand 330
 Markowitz 8, 25, 44, 45, 50, 51, 80, 90,
 96, 97, 99, 100, 102, 114, 150,
 175-177, 255, 258, 265, 274
 Marschak XVII, 22, 23, 44, 48, 50, 58,
 81, 114
 Marshall, A. 71, 125
 Marshall, J.M. 319
 Masson 176
 Matlack 296
 Mattfeldt 270
 Mathews 143
 Meinong 133, 145
 Meltzer 269, 270
 Menefee 296
 Menger 183-186, 194
 Menges 319
 Merton 234
 Messick 140
 Metzler 246
 Miller 58, 113
 Milnor, 1, 18, 30
 Mirman 235
 Mises, von 13
 Modigliani 124, 231, 239
 Monod 12
 Morgenstern XV, 5, 7, 18, 22, 44, 69,
 79, 80, 90, 147, 150
 Moses 30
 Moskowitz 134
 Mossin 74, 160, 225, 245, 246, 260, 296,
 305
 Mosteller 113, 114, 162
 Musgrave 44, 46, 48-52, 58, 91, 101, 150
 Nachtkamp 2, 4, 9, 44, 59, 61, 65, 66,
 68, 69
 Neumann, von XV, 5, 7, 18, 22, 44, 69,
 79, 80, 90, 147, 150
 Niehans 1, 18, 212
 Nogee 113, 114, 162
 Nurkse 279
 Olson 176
 Palander 157
 Pareto 1, 77, 78, 133, 314, 323
 Pashigian 296
 Pauly 316, 319, 325
 Pavlov XVI
 Perdikas 314
 Pfanzagl 153, 157
 Phelps 230
 Phillips 14, 17
 Piel 316
 Pigou 233, 268, 330, 331
 Plateau 133, 139
 Poggio 143
 Poisson 185
 Pollak 148
 Praag, van 77
 Pratt, C.C. 129
 Pratt, J.W. 10, 102, 113, 114, 117, 127,
 148, 149, 157-160, 162
 Pringsheim 185
 Pye 157, 227, 240, 268
 Pyle 61
 Pythagoras 98
 Raiffa 10, 11, 13, 18, 20-22, 30, 35
 Ramsey 9, 10, 231, 252
 Razin 296
 Reichenbach 12, 35
 Renshaw, E.R. 296
 Renshaw, V. 296
 Rice 325
 Richter 49, 91, 96, 104
 Riggs 129
 Robbins XVII
 Roberts 19, 35
 Rödding 4
 Roll 224, 229
 Ronning 257
 Rosenstein-Rodan 249
 Rosett 316
 Rosner 143
 Roy, A.D. 48, 59-61, 66, 262
 Roy R. 44, 59, 66
 Rubinstein 183
 Russel 330
 Ryan 188
 Samuelson 21, 22, 24, 48, 80, 102, 113,
 185, 186, 194, 212, 214, 225, 231, 234,
 249, 252, 324
 Sandmo 230
 Sanford 140
 Sarnat 61
 Sauermann 4

- Savage XVII, 1, 8–10, 18, 22, 24, 25, 34,
 35, 48, 80, 125, 175, 176, 220, 253
 Sax 125
 Schkade 296
 Schlaifer 10, 11, 13, 18, 35
 Schmoltzi 330
 Schneeweiss 4, 17, 19, 35, 45, 48, 57, 68,
 71, 74, 75, 77, 78, 86, 90, 97, 113,
 118, 157, 164, 172, 207, 212–217
 Schneider, D. 9
 Schneider, H. 44, 52–55, 72, 92–95, 101,
 149
 Schröder 277
 Schultz 77
 Schumpeter 64
 Scitovsky, de 324
 Seidl 164, 319
 Selden 269, 270
 Selten 4
 Senetti 185
 Shackle 8, 9, 24, 44, 52, 53, 72, 90
 Shell 271
 Siegel 4
 Simon, H.A. 4
 Simon, L.J. 15
 Sinn 7, 26, 164, 270, 310, 330
 Sjöberg 140–142
 Slanec 314
 Smith 296
 Sohmen 275, 279
 Spence 246, 316, 319
 Stange 56, 60
 Starbuck 4
 Stegmüller 9
 Steindl 44, 50
 Steinmann 287
 Stevens, S.S. 78, 130–148, 238
 Stigler 68
 Stiglitz 113, 156, 235, 271
 Stone 330
 Strauß 149
 Strotz 124, 231–233
 Tasaki 143
 Taylor 103, 109
 Telser 66
 Thorp 224
 Thurstone 3, 130, 140, 146
 Tintner 5, 35, 36, 38, 44, 50
 Titchner 140
 Tobin 44, 50, 57, 59, 113, 118, 171, 225,
 230, 255, 258, 263, 269, 270, 271, 274
 Todhunter 33, 185, 208
 Törnqvist 8, 150, 175, 176
 Tsiang 102, 110, 112, 151, 278
 Turnovsky 61
 Turvey 9
 Tuttle 224
 Tversky 17
 Vikas 270
 Wald 18
 Ward 142
 Warren 134
 Weber, E.H. 55, 128–133, 136, 141,
 144–147, 149
 Weber, M. 77
 Westphal 270, 271
 Whinston 330
 Winkler 35
 Wold 24
 Woll 270
 Wonnacott 176
 Wright 296
 Wundt 77, 133, 141, 145
 Yaari 177
 Zeckhauser 246, 316, 319

Subject Index

- action alternatives 1f., 4f.
- action current 142
- actual (or net) distribution vs. balance sheet (or gross) distribution 163f., 22f., 229
- adaption level 139
- age dependence
 - of insurance demand 309f.
 - of portfolio structure 266f.
 - of risk aversion 246f.
- Ätialprinzip 12 (footnote 12)
- allocation of liability risks 166, 327f.
- approximation
 - of a discrete probability distribution by a continuous density function 42
 - of a lexicographic ordering by a von Neumann-Morgenstern index 87f.
 - of the von Neumann-Morgenstern function by indifference curves in a (μ, σ) -diagram 102f.
- arbitrage 277f.
- Arrow's hypothesis of increasing relative risk aversion 182f., 269f.
- aspiration level 4 (footnote 9), 64f.
- asset portfolio 222, 255f.
- asymptotic efficiency of the variance 102f.
- axiom
 - Archimedes – 81, 87, 188f., 235f.
 - consistency – 153 (footnote 55)
 - continuity – 81 (footnote 33)
 - information – 19
 - Koopmans – 236
 - monotone continuity – 186f. (esp. 188)
 - of independence 21f., 80, 235
 - of non-saturation 81, 87, 237
 - of ordering 2, 7f., 80, 151, 176f., 235
 - substitution – 23
 - strong relativity – 239
 - sure-thing – 22 (footnote 31)
 - weak relativity – 147
- banks 276, 288f.
- Bayes's formula 15f.
- Bellman's principle of optimality 225, 240
- Bernoulli's relativity law 124f., 150
- Bernoulli's theorem 208
- Bloos rule 163f., 222, 246, 288, 300, 303, 331f.
- Bouguer's experiment 127f.
- case studies 30
- capital output ratio 270
- cardinal utility 77f., 147
- central limit theorem 57 (footnote 22)
- certainty equivalent
 - with two-parametric substitutive criteria 47
 - with the expected-utility criterion 71, 126
 - with the Weber function 149f.
- Chebyshev's inequality 60, 208
- Coase theorem 329f.
- coefficient of caution 76 (footnote 19)
- coefficient of correlation 210f., 261
- community rating 318f.
- compulsory insurance 325, 331f.
- consistency axiom 153 (footnote 55)
- consumption (definition) 123, 164 (footnote 2)
- consumption theory (Keynes vs. Friedman) 220f.
- continuity axiom 81 (footnote 33)

- labor income 222
- Lange's criterion 47f., 90
- law
 - Bernoulli's relativity – 124f., 150
 - Fechner's – 130f., 137f., 237
 - Gossen's first – 71
 - of large numbers 208f., 224
 - psychophysical – 130f., 137f.
 - Stevens's – 132 f.
 - Weber's – 128f., 145f., 237
- lexicographic ordering 59f., 86f., 178f., 185, 191f., 300
- lexicographic order of moments 108
- liability risks
 - allocation of – 327f.
 - insurance demand for – 165, 299f., 327f.
- life-cycle planning 230f.
- light sensation 130, 133f.
- linear distribution classes 56, 115f., 260 (normal distribution), 280, 289
- local quadratic approximation 102f.
 - for portfolio analysis 258
- local relative risk aversion 149
- logarithmic sensation function 130f.
- long position speculation 275f.
- loss prevention 311f., 318f., 325f.
- loss quota 77
- lottery ticket as action result under uncertainty 5
- marginal rate of substitution 232
- maximin principle 18
- mean-semivariance criterion 51, 99
- mean-value criterion 45, 208f.
 - on the subjective continuum 250
- metathetic scale 142 (footnote 35)
- minimax-regret principle 18
- μ criterion for multiple risks 212
- (μ, σ) criterion 50, 96f.
- (μ, σ) diagram 62, 97, 111f., 153f., 167f., 178f.
 - two-sided – 282f.
- moments of a distribution 56 (esp. footnote 18), 108
- money holding and portfolio optimization 282f.
- monotone-continuity axiom 188
- moral hazard 315f.
- multiperiod planning under uncertainty 219f.
- net distribution vs. gross distribution 163f., 222f. 229
- Neumann-Morgenstern index 79f.
- neurological measurement 142
- non-symmetry of the preference relation 2 (esp. footnote 4)
- normal distribution 57f., 174, 212f., 260
- normative analysis XVI
- nullchance 54, 93
- number matching 133f., 147
- numéraire (for sensation estimates) 135f.
- objective probability and real indeterminateness 12f.
- Occam's razor XV
- optimism-pessimism index 18
- paradox
 - Ellsberg – 18f., 37
 - of homogeneous grouping 16
 - St. Petersburg – 72, 183f.
- Pareto optimum
 - and loss prevention policy 311f., 318f.
 - under different information levels 294, 332
- peakedness of a probability distribution 56
- Petersburg paradox 72, 183f.
- portfolio diversification 261f.
- portfolio structure
 - age dependence of the – 266f.
 - and money holding 269f.
 - wealth independence of the – 268f.
- portfolio theory 255f.
- positive analysis XVI
- power function of sensation 132f.
- preference functionals under uncertainty (overview, cf. utility function) 44
- preference for right-skewed distributions 112 (footnote 27), 114, 161
- preference ordering 1f.
 - under uncertainty 4f.
 - completeness of the – 2
- preference relation 2
- principle
 - Bellman's – of optimality 225, 240
 - maximin – 18
 - minimax-regret – 18
 - of indifference 26 (footnote 41)
 - of insufficient reason 26
 - of sufficient reason 12
- probability
 - equivalent objective – 17f.
 - subjective – 9
 - and indeterminateness 11f.
- probability distribution 41
- probability hierarchies 35f.

- pseudo indifference curves 62, 67, 110f., 179f., 289
 pseudo insolvency 64
 psychophysical law 130f., 137f.
 psychophysics 127f., 239
 random walk 257, 279
 ratio language 147, 254
 rational behavior under risk 41f.
 rationality XVI
 reflexivity of the preference relation 2
 relativity axiom
 strong – 239
 weak – 147f., 237f.
 result matrix 8
 risk and uncertainty 17
 risk aversion, -neutrality, -loving 46, 72, 79, 164f.
 risk aversion
 constant relative – 127, 148
 decreasing absolute – 161, 182f.
 increasing relative – 182f., 269f.
 level of relative – 179f., 247f., 304, 309f.
 measure of relative – 149
 risk shifting 288f., 327f.
 saturation probability 64f.
 sensation function 130f., 238
 sensation
 – of color saturation 133, 139
 – of frequency 140, 146
 – of heaviness 128, 133
 – of length 129, 133
 – of light 130, 133f.
 – of loudness 130, 133, 140, 146
 – of musical pitch 129, 141f., 146
 – of numbers 133f., 145
 – of vibration 133
 – of visual area 133
 separation
 – of the choice of the optimal risk project from wealth 226, 245f., 268f.
 – of the choice of the optimal risk project from the consumption decision 245
 – of the structure of the risk portfolio from its size 263
 – of the loss prevention policy from the choice of insured coverage 313
 Shackle's criterion 52, 90
 shares 222
 short position (def.) 276
 skewedness 56 (footnote 18)
 sound sensation (loudness) 130, 133, 140, 146
 specific risk aversion 78
 – in multiperiod planning 233f.
 speculation 275f.
 – with excessively short position 288f.
 – and changes in expectation 284f.
 – with safety margins 276, 290
 spot market speculation 277f.
 standard deviation (def.) 44
 standard risk project 221f.
 states of the world, class of – 5f.
 statistical decision criteria 55f.
 step theory of probability 35f.
 Stevens's law 132f.
 stimulus thresholds 4 (footnote 8), 68, 127f., 177
 absolute vs. differential – 127f.
 stochastic constant returns to scale 221, 257, 279, 297
 stochastic dominance 97 (footnote 15), 181
 stochastic dynamic optimization 225f.
 subjective price of risk
 – with the BLOOS rule 165
 – with the expected-utility criterion 72
 – with the two-parametric substitutive criteria 47
 – with Weber's law 148, 159f.
 subjective probabilities 9
 substitution axiom 23
 substitution effect of insurance under ideal conditions 311f.
 substitution marginal rate of – 232
 sure-thing axiom 22 (footnote 31)
 survival probability 60f., 86f., 178f., 190f.
 taxation 55f., 92f., 331f.
 technical scales 141
 theorem
 Bernoulli's – 208
 central limit – 57 (footnote 22)
 Coase – 329f.
 utility-boundedness –
 time and decision-making under risk 219f.
 time dependence of risk aversion 246f.
 – and portfolio structure 266f.
 – and insurance demand 309f.
 time preference
 reasons for – 232
 rate of – 233
 transitivity 2

- tree diagram 30f.
- uncertainty and risk 17
- unconditional cost compensation 318
- utility-boundedness theorem 72, 189f.
- utility, elasticity of marginal – 149
- utility function
 - according to Freund 152f., 157, 212
 - according to the relativity law 148f.
 - according to von Neumann and Morgenstern 80f.
- Bernoulli's – 70f., 124f.
- boundedness of the – 182f., 229
 - derived from a multiperiod approach 228f., 244f.
 - derived from the Bloos rule 164f.
 - implied by two-parametric substitutive criteria 90f.
- local quadratic approximation of the – 102f.
- ordinal vs. cardinal – 2, 80f.
- period – 232f. 238
 - two-parametric – 46f.
- utility tree 124 (footnote 3)
- variance
 - definition of the – 44
 - asymptotic efficiency of the – 102f.
- velocity of money circulation 270f.
- von Neumann-Morgenstern index 79f.
- wealth 42, 123f. (def.), 164 (footnote 2)
- wealth effect
 - of currency speculation 286
 - of a government budget deficit 272f.
- wealth elasticity of cash demand 269
- Weber function (def.) 149
- Weber's law 128f., 145f., 237
 - and the von Neumann-Morgenstern index 148f.
 - in the (μ, σ) diagram 153f.
 - in multiperiod analysis 238
- welfare state and insurance 325