

Francis Ysidro Edgeworth | Encyclopedia.com

International Encyclopedia of the Social Sciences COPYRIGHT 2008 Thomson Gale

[Francis Ysidro Edgeworth](#) (1845–1926) was raised on the family estate of Edgeworthstown, County Longford, Ireland. His father died when Edgeworth was two years old. Edgeworth studied under tutors and spent considerable time reading and memorizing the classics and English poetry. From an early age he also read widely in Spanish, French, German, and Italian. This interest in Continental literature may well have been strengthened by the fact that his mother was the daughter of a Spanish political refugee. One of Edgeworth's aunts was the famous novelist [Maria Edgeworth](#), and the poet Thomas Lovell Beddoes was his cousin.

At the age of 17, Edgeworth entered Trinity College, Dublin, and then proceeded to Balliol College, Oxford, where he received first class honors in *litterae humaniores*. After several years of practicing law in London, he accepted a lectureship in logic at King's College and was later appointed Tooke professor of political economy.

In 1891 he became Drummond professor of political economy at Oxford and a fellow of All Souls College. Never marrying, he resided principally at All Souls for the remainder of his life, although he maintained rooms in London for over fifty years and inherited the family estate in 1911.

Although he was highly respected as a teacher and original thinker by both economists and statisticians of his time, Edgeworth does not seem to have profoundly influenced the then current thinking in either field. Present readers, however, find much that is stimulating and informative in Edgeworth and not uncommonly note with some surprise that ideas they believe to have originated recently are, sometimes clearly, sometimes vaguely, anticipated in Edgeworth's work.

When he became professor emeritus at Oxford in 1922, Edgeworth was serving his second term as president of the economic section of the British Association and was a vice-president of the Royal Economic Society. He had earlier served as president (1912) and council member of the Royal Statistical Society; he had been awarded its Guy medal in 1907. He was also a fellow of the British Academy.

Undoubtedly, Edgeworth's greatest professional contribution, in addition to teaching and writing, was his editorship of the *Economic Journal*. He became its first editor in 1891 and was later chairman of the editorial board. At the time of his death in 1926, Edgeworth was joint editor with Keynes.

He is reported (L. L. P. 1926) to have been an effective and stimulating teacher, attracting good students and encouraging many vigorous discussions. Frequently he would become one of the less active participants, intervening occasionally to expose an error or to bring a neglected but fruitful problem to the attention of his class.

Edgeworth's main written contributions to economics are contained in seven small books and numerous journal articles and reviews. In 1925 his principal articles and reviews were published in three volumes entitled *Papers Relating to Political Economy* (see 1891–1921) under his own editorship and under the sponsorship of the Royal Economic Society.

Mathematical Psychics, published in 1881, is probably Edgeworth's most important writing. His "contract curve" and its generalization, the set of "Edgeworth-allocations" (Debreu & Scarf 1963; Vind 1964) or "core," are still basic concepts for the theoretical study of exchange equilibrium and welfare economics; and his theory of barter has provided a valuable point of departure for recent research on dynamic economic adjustments (Uzawa 1962). Edgeworth discussed a number of interesting bargaining situations in light of the theory presented.

Edgeworth's arguments in the first section of *Psychics* against the common view that mathematics could be applied only to numerical phenomena were quite advanced and provocative then but will appear awkward and unnecessary to a current reader who has studied set theory and topology. Much of the remainder of the book is concerned with attempts to establish practical implications of utilitarian ethics. These views were, and remain, highly controversial.

Edgeworth's collected works include a group of related papers (1897a; 1897b; 1899; 1911; 1912) on taxation, price discrimination, and monopoly that involve original theoretical developments, which are still of considerable interest. In these papers are a number of famous paradoxes, such as: A tax on one of two monopolized commodities which are appropriately related in production, consumption, or both may cause prices of both commodities to fall; and the introduction of price discrimination into a competitive market might benefit both producers and consumers (where consumer benefit is taken to be aggregate consumer surplus). The 1912 paper contains a very good discussion of the difficulties of establishing a theoretical equilibrium for duopolists or monopolists who sell related commodities. A number of other papers deal with tax problems of Edgeworth's time and with utilitarian principles for determining equitable taxation. Quantitative problems encountered in contemplated applications of utilitarianism are also treated in his first book, *New and Old Methods of Ethics* (1877).

Edgeworth served several years as secretary of the Committee on Value of the Monetary Standard of the British Association for the Advancement of Science. This interest is reflected in ten articles on index numbers and the value of money. Two memoranda prepared for the British Association for the Advancement of Science (1887–1889) contain what can still be regarded as a fairly comprehensive discussion of theoretical problems of index number constructions.

Metretike draws a number of interesting parallels between utility and its measurement and application, on the one hand, and probability and its measurement and application, on the other (1887a). Although there are some interesting observations, there is no fundamental interrelationship such as that later achieved through the axiom systems of Ramsey, Savage, and others.*

The other four of Edgeworth's books are lectures on war finance delivered during the war and immediately afterward (1915a; 1915b; 1917; 1919). These works, like most of his writings on current policy issues, drew more criticism than praise from his colleagues: "[He] might descend eventually on one side or the other of the fence, but, . . . he kept himself so long poised evenly midway that the final movement when, and if, it happened, was apt to be unnoticed" (L. L. P. 1926). Keynes remarked:

He feared a little the philistine comment on the strange but charming amalgam of poetry and pedantry, science, and art, wit and learning, of which he had the secret; and he would endeavor, however unsuccessfully, to draw a veil of partial concealment over his native style, which only served, however, to enhance the obscurity and allusiveness and half-apologetic air with which he served up his intellectual dishes. (Keynes [1926] 1963, p. 227)

Some basis for these complaints must be admitted. Even in his theoretical and highly mathematical writings, Edgeworth's expository skill is notably less than his insight and logical ability. The overapologetic tone Keynes mentions is frequently apparent; it is illustrated by Edgeworth's description of his correction of a colleague's misinterpretation as: "points of detail on which the critical shoemaker corrected the masterpiece of the Grecian painter ([1891–1921] 1963, vol. 1, p. 143).

Another factor which frequently led to lengthy and sometimes complicated passages in Edgeworth and drew critical comments from his contemporaries was his desire to account explicitly for every logically possible combination of circumstances. Many current readers are more patient on this score. A more mathematically inclined generation is better aware of the advantages of carefully keeping track of the exact relations that exist between alternative conditions and consequences.

Among Edgeworth's other publications that should be noted are his article on the law of error in the 1902 *Encyclopaedia Britannica*, his article on probability in the 1911 edition, and his biography of Mill and article on index numbers in *Palgrave's Dictionary of Political Economy*.

Edgeworth's best-known work on distribution theory is a series which gives an asymptotic approximation to a fairly general class of distribution functions and is still sometimes used (Cramer 1945, pp. 228–231). Under the heading "The law of error," Edgeworth used this series to derive several versions of the central limit theorem and to approximate a number of empirical frequency distributions (1883; 1898–1900; 1905; 1926; and with Bowley, 1902). He also extended Galton's work on correlation, and he developed a formula for the general multivariate normal density, and considered some of its properties (1893; 1905).

Following Bernoulli, Laplace, and Mill, Edgeworth was basically Bayesian in his approach to statistical inference. His "genuine inverse method" (1908–1909) consisted of finding a normal approximation to the posterior distribution of unknown parameters (*quaesita*, or frequency constants, in his terminology), assuming a diffuse prior distribution, and equating the means of the posterior distribution to their maximum likelihood estimates (called "most probable values"). He properly objected to forming a uniform prior on the basis of ignorance, since this would imply a specific non-uniform prior on any transformation of the original parameters. However, as Edgeworth also recognized, any reasonably smooth and unconcentrated prior will lead to results that differ little from those obtained from either a uniform distribution or a diffuse distribution when the number of observations is large. Thus Edgeworth's genuine inverse method was based on some of the same underlying ideas as the theory of stable estimation examined earlier by Fisher and Jeffreys and recently emphasized by Bayesian statisticians (Edwards et al. 1963).

Not all of Edgeworth's work on inference was developed from this approach. He believed the prior distribution would often be unknown and looked for other principles and devices. He discussed the difference of two means (1905; 1908–

1909) and the possible significance of an estimate of trend (1886) in language much like that of the Neyman-Pearson theory of hypothesis testing.

Several of Edgeworth's papers are concerned with the problem of the "best" mean (e.g., 1887a). This usually means an estimate of a population parameter, optimal according to some stated criterion; but the case of finding a suitable descriptive representative for a collection of empirical data is also considered. A criterion frequently employed is that of minimizing expected loss (called "least detriment" or "minimum disadvantage"), and a number of inquiries proceed under the assumption that all that is known of the loss function is that it is symmetric and an increasing function of the deviation of an estimate from the true value. This assumption led Edgeworth to criticize Laplace for advocating widespread use of least-squares. Edgeworth advocated use of the median in many circumstances. Noting that the median of a univariate sample minimizes the sum of absolute deviations, he developed a method for fitting a straight line to bivariate data to minimize this sum (1923).

Edgeworth never developed his many original contributions to either economics or statistics to make a comprehensive coordinated work. He dealt with questions only dimly understood in his time (many are still controversial and not fully developed), and although he made significant contributions, I suspect that he himself was not satisfied with the state in which he left most of his topics. He was still working with enthusiasm shortly before his death at the age of 81. His work, however, has retained much more interest than that of some who had greater impact on their contemporaries. Modern mathematical economists and statisticians find him a stimulating and reassuring intellectual forebear, surprisingly up-to-date in many respects and still instructive.

Clifford Hildreth

[For discussion of the subsequent development of Edgeworth's ideas, see [Bayesian inference](#); [Utility](#).]

WORKS BY EDGEWORTH

1877 *New and Old Methods of Ethics*. London: Parker.

(1881) 1953 *Mathematical Psychics: An Essay on the Application of Mathematics to the Moral Sciences*. [New York](#): Kelley.

1883 The Law of Error. *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* Fifth Series 16:300–309.

1886 Progressive Means. *Journal of the Royal Statistical Society* [1886]: 469–475.

1887a *Metretike: Or the Method of Measuring Probability and Utility*. London: Temple.

1887b Observations and Statistics: An Essay on the Theory of Errors of Observation and the First Principles of Statistics. Cambridge Philosophical Society, *Transactions* 14, part 2:138–169.

(1887–1889) 1963 Measurement of Change in the Value of Money. Volume 1, pages 195–297 in [Francis Ysidro Edgeworth](#), *Papers Relating to Political Economy*. [New York](#): Franklin. → Consists of two memoranda prepared for the British Association for the Advancement of Science.

(1891–1921) 1963 *Papers Relating to Political Economy*. 3 vols. New York: Franklin. → Contains and reviews articles which appeared in the *Economic Journal* ... 1891–1921 inclusive.

1893 Exercises in the Calculation of Errors. *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* Fifth Series 36:98–111.

(1897a) 1963 The Pure Theory of Monopoly. Volume 1, pages 111–142 in Francis Ysidro Edgeworth, *Papers Relating to Political Economy*. New York: Franklin. → First published in Italian.

(1897b) 1963 The Pure Theory of Taxation. Volume 2, pages 63–125 in Francis Ysidro Edgeworth, *Papers Relating to Political Economy*. New York: Franklin.

1898–1900 On the Representation of Statistics by Mathematical Formulae. *Journal of the Royal Statistical Society* 61:671–700; 62:125–140, 373–385, 534–555; 63 (Supplement): 72–81.

(1899) 1963 Professor Seligman on the Theory of Monopoly. Volume 1, pages 143–171 in Francis Ysidro Edgeworth, *Papers Relating to Political Economy*. New York: Franklin. → First published as "Professor Seligman on the Mathematical Method in Political Economy."

1902 Edgeworth, Francis Ysidro; and Bowley, A. L. Methods of Representing Statistics of Wages and Other Groups Not Fulfilling the Normal Law of Error. *Journal of the Royal Statistical Society* 65:325–354.

1905 The Law of Error. Cambridge Philosophical Society, *Transactions* 20:36–65; 113–141.

1908–1909 On the Probable Errors of Frequency Constants. *Journal of the Royal Statistical Society* 71: 381–397; 72:81–90.

(1911) 1963 Use of Differential Prices in a Regime of Competition. Volume 1, pages 100–107 in Francis Ysidro Edgeworth, *Papers Relating to Political Economy*. New York: Franklin. → First published as "Monopoly and Differential Prices."

(1912) 1963 Contributions to the Theory of Railway Rates. Part III. Volume 1, pages 172–191 in Francis Ysidro Edgeworth, *Papers Relating to Political Economy*. New York: Franklin.

1915a *The Cost of War and Ways of Reducing It Suggested by Economic Theory: A Lecture*. Oxford: Clarendon.

1915b *On the Relations of Political Economy to War*. Oxford Univ. Press; New York and London: Milford.

(1917) 1918 *Currency and Finance in Time of War: A Lecture*. Oxford: Clarendon; New York and London: Milford.

1919 *A Levy on Capital for the Discharge of Debt*. Oxford: Clarendon.

1923 On the Use of Medians for Reducing Observations Relating to Several Quantities. *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* Sixth Series 46:1074–1088.

1926 Mr. Rhodes' Curve and the Method of Adjustment. *Journal of the Royal Statistical Society* New Series 89:129–143.

WORKS ABOUT EDGEWORTH

Bowley, Arthur L. 1928 F. Y. *Edgeworth's Contributions to Mathematical Statistics*. London: Royal Statistical Society.

Keynes, John Maynard (1926) 1963 Francis Ysidro Edgeworth: 1845–1926. Pages 218–238 in John Maynard Keynes, *Essays in Biography*. New York: Norton. L. L. P. [Obituary of] F. Y. Edgeworth. 1926 *Journal of the Royal Statistical Society* 89:371–377.

[Obituary of] F. Y. Edgeworth. 1926 *London Times* February 16, p. 21, cols. 2–3.

Uzawa, Hirofumi 1962 On the Stability of Edgeworth's Barter Process. *International Economic Review* 3:218–232.

Vind, Karl 1964 Edgeworth: Allocations in an Exchange Economy With Many Traders. *International Economic Review* 5:165–177.

SUPPLEMENTARY BIBLIOGRAPHY

Cramer, Harold (1945) 1951 *Mathematical Methods of Statistics*. Princeton Mathematical Series, No. 9. Princeton Univ. Press.

Debreu, Gerard; and Scarf, Herbert 1963 A Limit Theorem on the Core of an Economy. *International Economic Review* 4:235–246.

Edwards, Ward; Lindman, Harold; and Savage, Leonard J. 1963 Bayesian Statistical Inference for Psychological Research. *Psychological Review* 70:193–242.

Marshall, Alfred 1881 Review of *Mathematical Psychics*. *Academy* 19:457 only.

