Preface

John Creedy

Francis Ysidro Edgeworth was a leading figure in the rapid development of economics during the last quarter of the nineteenth century and the first quarter of the twentieth century, by which time it was firmly established as an academic subject. He held the Drummond Chair at Oxford and was regarded as second only to the great Cambridge economist Alfred Marshall. He was a prolific and highly original author who, in a cosmopolitan age, had probably the widest correspondence with economists all over the world. He was a man of enormously wide reading and considerable linguistic skills. He was the first editor of the *Economic Journal*, published by the newly formed Royal Economic Society. He was President of Section F of the British Association in 1889 and 1922. He achieved eminence as a statistician as well as an economist, becoming a Guy Medallist (Gold) of the Royal Statistical Society in 1907, and was President of the Society in 1912–14.

His name is familiar to all students of economics, if only from learning about the 'Edgeworth box', one of the most widely used analytical devices in the subject. This diagrammatic tool was first introduced by Edgeworth in 1881 in his first publication in economics, *Mathematical Psychics: An Essay on the Application of Mathematics to the Moral Sciences*. This small book is remarkable for its highly original and far-reaching contributions to economics; indeed Marshall began his review with the statement: 'This book shows clear signs of genius'. However, it was written in such a terse and unique style that it took many years before its contributions were fully appreciated, despite the fact that Edgeworth became one of the most prominent economists of his age. The title itself does not clearly signal a book on economics, and his use of mathematics put it well beyond the reach of most of the economists of the period. The technical difficulty of much of his published output contributed to its slow assimilation into textbooks and he continues to remain relatively neglected in texts on the history of economic analysis.

Mathematical Psychics, written right at the start of Edgeworth's career as an economist, also provides the key to all his later work and his lasting importance to economists. He wrote extensively on a wide range of topics,

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

but the central importance of his *Mathematical Psychics* means that some discussion and clarification is perhaps warranted here. Before discussing the book, it is worth remembering that the period, the last quarter of the nineteenth century, marks a distinct change of emphasis in the study of economics, in the transition to neoclassical economics from the classical economics associated with Adam Smith. Instead of concentration on the dynamic themes of growth and development and the important monetary debates associated with the numerous banking crises of the first half of the nineteenth century, the emphasis of the neoclassical economists was on the nature of exchange. This was seen as the 'central' problem. As Hicks stressed when discussing the neoclassical economists, 'It was possible, they found, to construct a "vision" of economic life out of the theory of exchange, as the classics had done out of the social product. It was quite a different vision.'[1] Edgeworth himself was later to remark that 'in pure economics there is only one fundamental theorem, but that is a very difficult one: the theory of bargain in a wide sense'.[2] The period in question was also one of intense debate in moral philosophy, with utilitarianism as the dominant principle. There were also significant developments in experimental psychology, and of course Darwin's theory of evolution was being hotly debated, with extensions being made towards forms of social Darwinism. Edgeworth's book reflects all these strong influences. Many of his allusions are perhaps unclear to a modern reader, but they would have been familiar to his contemporaries.

Taking Jevons's basic analysis of exchange of two goods between two traders, also examined by Walras, as his starting point, Edgeworth supposed that the objective of each trader is to maximise utility, considered to be a general function of the quantities of the goods held and consumed after trade is concluded. The utility maximising approach was immediately congenial to Edgeworth, who was steeped in utilitiarian moral philosophy. He first concentrated on the nature of barter, instead of describing the characteristics of an equilibrium set of prices, that is, one which ensures that the individuals' responses are mutually consistent. If the traders in barter are allowed freely to vary the terms of provisional 'contracts', Edgeworth showed that there is a range of 'final settlements', from which no further 'recontracting' would take place. In a rectangular box where the base and height are determined by the initial stocks of the two goods, these final settlements define what Edgeworth called the 'contract curve'. These settlements are also efficient trades, in the sense that if a settlement is not on the contract curve, movement to it can make one person better off without the other being worse off: this original idea of efficiency later came to be called Pareto efficiency. Movement along the contract curve involves one trader becoming worse off while the other gains.

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

Edgeworth then defined indifference curves for a trader as showing combinations of amounts consumed for which utility is constant. Using several approaches, he demonstrated that the contract curve is the locus of points of tangency between traders' indifference curves, between limits given by their pre-trade curves (those going through the initial endowment point in the box). The existence of a range of final settlements has important implications. First, without introducing further structure to the barter framework, it is not possible to say what the implied rate of exchange is, given only information about the preferences and endowments of individuals. It results in 'indeterminacy' whereby all that can be said is that the actual trade depends on the relative bargaining strength of the traders.

On the argument that such higgling is widespread, Edgeworth stated in his unique style: 'The whole creation groans and yearns, desiderating a principle of arbitration, and end of strifes' (1881, p. 51). His next argument involved two steps. First, he showed that the utilitarian principle of maximising total utility places individuals on the contract curve, because the mathematical conditions are equivalent to the tangency of indifference curves. Indeed, if it is possible to make someone better off without someone else being worse off, total utility cannot be at maximum and individuals cannot be on the contract curve. While this may seem a small step, to Edgeworth it was of great significance:

> It is a circumstance of momentous interest that one of the in general indefinitely numerous settlements between contractors is the utilitarian arrangement . . . the contract tending to the greatest possible total utility of the contractors. (1881, p. 53)

However, he recognised that this result is not sufficient to justify the use of utilitarianism as a principle of arbitration; it is only a necessary condition. Edgeworth's justification for utilitarianism as a principle of justice, comparing points along the contract curve, was as follows:

> Now these positions lie in a reverse order of desirability for each party; and it may seem to each that as he cannot have his own way, in the absence of any definite principle of selection, he has about as good a chance of one of the arrangements as another . . . both parties may agree to commute their chance of any of the arrangements for . . . the utilitarian arrangement. (1881, p. 55)

The important point to stress about this statement is that Edgeworth clearly considered willingness to accept the utilitarian arbitration in terms of choice under uncertainty. His argument is that the contractors, faced with uncertainty about their prospects but viewing alternatives along the contract curve as equally likely, would choose to accept an arrangement

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

along utilitarian lines. Thus a crucial component of this argument is the use of equal a priori probabilities, something that was later important to Edgeworth in his statistical work. In taking this second step, Edgeworth believed that he had provided an answer to an age-old question, stating, 'by what mechanism the force of self-love can be applied so as to support the structure of utilitarian politics, neither Helvetius, nor Bentham, nor any deductive egoist has made clear' (1881, p. 128).

The importance to him of this new justification of utilitarianism cannot be exaggerated. Indeed the whole of *Mathematical Psychics* seems to be imbued with a feeling of excitement generated by his discovery of this justification based on a 'social contract'. This provided the crucial link between 'impure' and 'pure' utilitarianism in a more satisfactory way than his earlier appeal to evolutionary forces, made in his book entitled *New and Old Methods of Ethics*, written before turning to economics.

The nature of price-taking behaviour – involving an equimarginal principle whereby the ratio of prices must be equal, for both traders, to the ratio of their marginal utilities for each of the relevant goods – had been explored with great originality by Jevons with his 'equations of exchange'. Edgeworth made important extensions to this analysis, as well as providing his succinct diagrammatical synthesis (which included showing how Marshall's 'offer curves' can be derived from indifference curves). He showed how his box diagram can be used to illustrate a price-taking equilibrium. This arises where one or more of the mutual tangency positions of indifference curves along the contract curve also corresponds to tangency with a straight line going through the endowment point. This line represents a common budget constraint for the choices of the individuals, whereby the slope represents the exchange ratio and hence the relative price. In equilibrium, individuals acting in isolation and taking prices as given (in contrast to those engaged in barter) have mutually consistent demands and supplies. A price-taking equilibrium, as such a tangency position, must therefore correspond to a point on the contract curve.

Edgeworth was thus able to clarify the sense in which a price-taking (often called competitive) equilibrium is 'optimal', fully recognising that it is just one of many Pareto optimal points. This gives rise to what is now referred to as the 'first fundamental theorem' of welfare economics – that a price-taking equilibrium is Pareto efficient. The use of price taking also provides a considerable reduction in the amount of information required by traders compared with barter. Individuals only need to know the equilibrium prices, whereas in barter they have to learn a considerable amount of information about other individuals' preferences and endowments. Of course, this merely describes the properties of an equilibrium and does not, as Edgeworth was fully aware, explain how it might be achieved in

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

practice. However, he later showed that a sequence of price adjustments, where trading – at the minimum of demand and supply – takes place at disequilibrium prices, leads to a point on the contract curve, although precisely where is indeterminate.

Edgeworth then returned to indeterminacy in barter, asking whether this indeterminacy results from the absence of competition in the simple two-person market. He quickly moved on to examine the implications of introducing further pairs of traders. The analysis of barter with numerous traders again involves Edgeworth's stylised description of the recontracting process of barter mentioned above. With more traders, the importance of the recontracting process, apart from allowing the dissemination of information, lies in the fact that it makes it possible to analyse the use of collusion among some of the traders. Individuals are allowed to form coalitions in order to improve bargaining strength. Recontracting enables the coalitions to be broken up by outsiders who may attract members of a group away with more favourable terms of exchange.

The analysis of many traders, where coalitions can be temporarily formed and broken up by the offer of improved terms from other traders, would appear to present formidable difficulties. Yet Edgeworth rapidly demonstrated, again using his famous box diagram, that the introduction of further similar pairs of traders gradually reduces the range of indeterminacy; that is, the length of the contract curve shrinks. With a sufficiently large number of traders, the range of indeterminacy shrinks to the finite number of price-taking equilibria. Barter thus replicates price-taking behaviour. Given that coalitions among traders are allowed in the recontracting process, a price-taking equilibrium cannot be 'blocked' by a coalition of traders. In this sense the competitive equilibrium is robust.

The argument that a complex process of bargaining among a large number of individuals produces a result which is identical to a price-taking equilibrium is an important result that is far from intuitively obvious. The recontracting process can be said to represent a competitive process, and the contract curve shrinks essentially because of the competition between suppliers of the same good, although it is carried out in a barter framework in which explicit prices are not used. The price-taking equilibrium, in contrast, does not actually involve a competitive process. Individuals simply believe that they must take market prices as given and outside their control. They respond to those prices without any reference to other individuals. But the result is that the price-taking equilibrium looks just like a situation in which all activity is perfectly coordinated.

Great stress was placed by Edgeworth on comparison with Lagrange's 'principle of least action' in examining the overall effects produced by the interactions among many particles. The connection with Edgeworth's

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

analysis of competition, involving interaction among a large number of competitors to produce a determinate rate of exchange, is clear. The fact that in the natural sciences so much could be derived from a single principle was important for both Jevons and Edgeworth. But Edgeworth took this to its ultimate limit in arguing that the comparable single principle in social sciences, that of maximum utility, would produce results of comparable value. Referring to Laplace's massive work, *Mécanique Celeste*, he suggested that:

> 'Mécanique Sociale' may one day take her place along with 'Mécanique Celeste', throned each upon the double-sided height of one maximum principle, the supreme pinnacle of moral as of physical science . . . the movements of each soul, whether selfishly isolated or linked sympathetically, may continually be realising the maximum energy of pleasure, the Divine love of the universe. (1881, p. 12)

A strong belief in the value of mathematical analysis in economics, even where the precise numerical form of the relevant relationships cannot be known, imbues all of Edgeworth's work. When this is combined with his strong adherence to utilitarianism, it is not difficult to see how Edgeworth was excited to be showing not only why this principle may be accepted in the form of a 'social contract', but how the actions of many utility maximising individuals in a market can lead to a determinate solution. Thus, while the comparison with Laplace may seem fanciful to some readers, it was far from fanciful to Edgeworth. These elements provide the 'plan' with which virtually all his work in economics could be viewed. It is no wonder that Alexander Pope's statement, in his *Essay on Man*, that it presents 'A mighty maze, but not without a plan' was borrowed by Edgeworth to describe the competitive barter process. It also nicely fits Edgeworth's own oeuvre. Although he went on to write on a wide range of economic topics, and to make original contributions to mathematical statistics which alone would guarantee a lasting reputation, an appreciation of the preoccupations leading towards, and nature of, this first work is important in placing everything else in perspective.

It is clear from even a small sample of Edgeworth's work that the writer brings to it not just a deep and fertile originality, but also a vast range of knowledge covering natural sciences and literature. His writing is highly allusive and contains quotations from Greek and Latin classics as well as a range of English poets. It displays a sharp wit of a kind found in no other writing in the subject. It cannot fail to raise curiosity about the background, training and character of the man which went into generating such a prolific and ingenious author. Yet, very little has previously been known about Edgeworth, despite the fact mentioned above that he

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access

held prominent positions as editor of the *Economic Journal* and as the Drummond Professor at Oxford, and corresponded extensively with a wide range of economists. Furthermore, Edgeworth's aunt was the famous novelist Maria Edgeworth, his grandfather was the highly colourful inventor Richard Lovell Edgeworth, and other family connections link him with a large number of other eminent families. Much has been written about these other relatives and indeed several members of the family have produced extensive historical records of their own. Yet very little indeed was known about his mother's background and family – Edgeworth combines Spanish ancestry with one featuring prominent Anglo-Irish intellectuals. Edgeworth turned to economics at a relatively late age, but his activities during the period between his university education and his first publication in economics have previously only partially been known. Earlier writers have even had to speculate about the ways in which Edgeworth might have acquired his proficiency in mathematics.

The present biography is therefore especially welcome in providing a considerable amount of fresh information about Edgeworth's life and background. The author of this book has carried out a vast amount of exhausting primary research in a range of archives in several countries. He has managed to assemble much interesting detail which provides a fresh view of Edgeworth's life and his relationships with many of his contemporaries.

In writing a book of this kind a difficult decision is required about the mixture of biographical and technical material – a tricky balancing act has to be performed. The author places greater emphasis on the biographical detail, which indeed represents the fruits of his extensive scholarship and will be new even to those with considerable familiarity with the development of the subject and its main authors during the relevant period. Of course, in some respects such a deep and complex subject must always remain an enigma, and Edgeworth himself left no introspective writing. But we can be grateful to the author for bringing us closer to one of the truly great and creative figures in economics.

NOTES

1. See Hicks (1984a) p. 250.
2. 'On the Application of Mathematics to Political Economy', in Edgeworth (1925), II, p. 288.

John Creedy - 9781849803229
Downloaded from Elgar Online at 09/20/2019 12:52:28PM
via free access