Economics and Ethics meet under the same umbrella: Edgeworth's 'exact utilitarianism' (1877-1881) / Shiri Cohen (Ph.D.)

This paper discusses the intellectual context and motivations that stand behind Francis Ysidro Edgeworth's original mathematical formalization of utilitarianism. Such a project may sound familiar to the readers (today, mostly historians of economics) of Edgeworth's 1881 monograph, *Mathematical Psychics*, one part of which was devoted to the 'economic calculus' and the other to the 'utilitarian calculus'. But the somewhat misleading structure of the monograph notwithstanding, it is significant that Edgeworth was engaged with the utilitarian long before he started to deal with the economical part.[1]

Tracing Edgeworth's motivations in formulating what he ascribed with the name of *exact utilitarianism* reveals two major tendencies. The first one is his concern to argue in favor of utilitarianism (Henry Sidgwick's version of the doctrine, in particular), his arguments being made in the context of intensive disputes between the three camps in the field of ethics: *intuitionism*, utilitarianism and *ethical egoism*. The second is Edgeworth's attempt to deliver these arguments by presenting utilitarianism in the most scientific way (according to the way science was perceived at the time, of course).

It is interesting to see how, while Edgeworth's formalization of utilitarianism was not at all the consequence of an awareness of theoretical developments within economics of the time (contrary to the impression that may arise on a reading of *Mathematical Psychics* only), the field of ethics, nevertheless, was influenced and inspired by the same trends in science as was the field of economics. This insight has some significance for those historians of economics who, in recent years, have explored the ways in which economists of this time (Jevons in particular) were inspired by the natural sciences.[2]

In addition, this paper will deal with the implications of Edgeworth's decision, made following his acquaintance with Jevons's economics, to put the two moral sciences, economics and utilitarianism, together under the one umbrella of "mathematical psychics". This decision, so I argue, locates his book retrospectively as an illustration of a very intriguing phase in the history of the relation between

[1] This was also noticed by Creedy (1986), Mirowski (1994), Uemiya (2008) and Barbé (2010).
[2] Prominent examples would be: Mirowski (1989), Schabas (1990, 2005), White (2004), Maas (2005).

utilitarianism and economics; a phase in which utilitarianism was not only considered as a meta-criterion for economic policy but was addressed in new - not necessarily the most applicable, but highly theoretical – ways, and translated into the language of formal mathematics. This phase/episode reflects scholars' lack of satisfaction with general estimations of aggregate utility alone, as opposed to their predecessors, and as a consequence a turning up-side-down of the traditional relations between economics and utilitarianism: addressing utilitarianism as a branch of economics,[3] and not (only) the other way around.

Thus, the first and the last sections of the paper will locate *Mathematical Psychics* in the context of the relations between economics and utilitarianism, while the inner three sections will attempt to recapture Edgeworth's motivations in his project (ending with his 1881 work).

1) Mill and Jevons: keeping utilitarianism and mathematics apart

From the point of view of English economists in the second half of the 19th century, it seems almost inevitable that two of their greatest (albeit disputed) leanings - on the one hand, mathematization, and on the other, utilitarianism - would be somehow theoretically unified. Then again, it had not occurred in previous generations. Interestingly enough, this characteristic of earlier scholars to hold the two apart was shared by the two prominent yet very distinct economists (and utilitarians), J.S. Mill and W.S. Jevons.

Both Mill and Jevons considered themselves faithful utilitarians, but each offered very distinct interpretation of the doctrine.[4] Indeed, the divergence between their interpretations might lead to the following question: what makes them both utilitarians? Furthermore, how are we to understand the doctrine in our current discussion? For present purposes, I would suggest *utilitarianism* be understood as an acceptance of two postulates: (i) that *social utility* is an aggregate (estimated or precise) of individual utilities (reflecting individuals' pleasure, happiness etc); (ii) that

[3] That is, 'economics' in a later sense, such as welfare economics or social choice theories; but back then it was referred to as 'mathematical ethics'.

[4] Mill presented a modified and detailed version of the moral doctrine in his celebrated *Utilitarianism* (1861), and Jevons made it perfectly clear in his article in the *Contemporary Review* (1879) that he (not a philosopher, yet a scientist interested in the subject) did not accept Mill's interpretation and considered himself as a better follower of Bentham's idea. Thus, Jevons rejected Mill's differentiation between kinds of pleasures on a qualitative basis, addressing it as a paternalistic as well as a more 'genial' but less progressive and up-to-date approach. See Jevons (1879).

making social utility as great as possible is the ultimate moral imperative (for an individual or a governor). While accepting both of these two utilitarian principles, Mill and Jevons were nevertheless very much divided on the interpretations and implementations of the doctrine. In the narrow context of this paper, however, our main concern is the way in which the two scholars viewed the relations between utilitarianism and their economic theories. As far as this question is concerned it seems that the two had a lot in common.

Thus, both of them considered utilitarianism as highly relevant for economic practical policy decision making (in a general estimation manner).[5] Policy decisions, however, were not considered by either as a scientific task, but as a general estimation, a part of the field of policy making, open for disputes and discussions.[6] In addition, neither of them considered utilitarianism to be a precise doctrine, nor did either of them formulate it mathematically, i.e. as (what we would address) a branch of economics.[7]

From an economic-theoretical point of view, and as a part of the classical tradition (yet having 'sensitivities' and considerations of his own[8]), Mill avoided using the concept of utility in any quantitative-mathematical context within his economic science.[9]

As for Jevons, although he does suggest the possibility of a "higher calculus of moral right and wrong" he did not engage in it.[10] While formulating a mathematical

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[5] S. Peart has shown how Jevons was at one with Mill in using utilitarian evaluations, together with the criterion of promoting liberty, in order to assess and justify a wide range of policy issues. Peart (1996) pp. 152-169

[6] "We cannot expect to agree in utilitarian estimates, at least without much debate. We must agree to differ, and though we are bound to argue fearlessly, it should be with the consciousness that there is room for wide and bona fide difference of opinion." Jevons (1887) p. 166

[7] Utilitarianism was considered by Mill as a meta-justification for policy as a whole, a general-estimation compass. This is how one should understand, for instance, Mill's comment in a letter that he was but a part of a chain of political economists that also included Smith, Turgot, Say, Ricardo and James Mill, "none of whom regarded political economy as anything but a subordinate though necessary branch of utility..." Letter to Lalor, 27 June 1852.

[8] See De Marchi (1973); Hollander (1985), 934-936; Hollander (2000), chapter 9 Also see my account of the subject in: "The 'Utility' and Economics of John Stuart Mill: A Reexamination", paper submitted to HOPE.

[9] Thus, in Mill's economics, utility does not play a central role in the theory of value, nor does it serve for an account of consumer choice, satiation, or pleasure-pain tradeoffs. It is simply not linked to the scientific relation of quantitative causality in any basic sense.

[10] As mentioned above, the utilitarian imperative was considered by utilitarians as a normative guidance, not only for rulers, but also for individuals. Jevons calls this imperative "the higher motive", but he famously separated it from the scientific-economic discussion: "I have no hesitation in accepting the Utilitarian theory of morals which does uphold the effect upon the happiness of mankind as the criterion of what is right and wrong. "But… My present purpose is accomplished in pointing out this hierarchy of feeling, and assigning a proper place to the pleasures and pains with which the Economist

representation of individual utility (focusing on the 'lower feelings') and, indeed, basing his whole theory on it,[11] he nevertheless did not use it as a platform for a mathematical formulation of social aggregate utility. As he insisted:

> The reader will find, again, that there is never, in any single instance, an attempt made to compare the amount of feeling in one mind with that in another. I see no means by which such comparison can be accomplished... Every mind is thus inscrutable to every other mind, and no common denominator of feeling seems to be possible.[12]

A consequence of the inability to compare different individual's utilities is the uselessness of attempting to sum up those utilities in an aggregate.

2) Edgeworth's 'Exact Utilitarianism' in philosophical context

It was Jevons's acquaintance, Edgeworth, who did not hesitate to combine mathematics and utilitarianism in the most celebrated and explicit manner, and in addition integrated in some cases a utilitarian apparatus within his economic models (i.e. as a part of the individuals' motives while negotiating an exchange, as will be shown). Born in 1845 to an Anglo-Irish family, Edgeworth was tutored as a child in classics and mathematics, and after four years at Trinity College, Dublin, he entered Oxford, where he took first class honours in *Literae Humaniores* i.e. Classics (1867-1869). The following years he spent in London, studying mathematics, law and philosophy, living on a modest private income (and later, from 1880, lecturing on Logic and Political Economy at Kings College).[13] His initial knowledge in economics was acquired as late as 1879-1880, with the guidance of his neighbor in Hampstead – Jevons. In contrast to Jevons, however, and as already noted, Edgeworth used the tool of differential calculus extensively,not only to address questions in economics but also (using integral functions) in order to address questions concerning the aggregate level of utility in his work in ethics. But that engagement was the product of separated earlier circumstances which will be presented below.

While, for Edgeworth, Jevons was the model for an *economist*, it was Henry Sidgwick who was for him the greatest *utilitarian*. Published in 1874, Sidgwick's

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deals. It is the lowest rank of feelings which we here treat". Jevons (1888) [1871] "Relation of Economics to Ethics" paragraphs 29,35.

[11] "My principal work now lies in tracing out the exact nature and conditions of utility. It seems strange indeed that economists have not bestowed more minute attention on a subject which doubtless furnishes the true key to the problem of Economics" Jevons (1888) Chapter 3 paragraph 12.

[12] Jevons (1888) [1871] paragraph 20.

[13] Keynes (1963) [1933] pp. 223-224, Newman (1987) p. 85, Baccini (2011) pp. 234-235.

Methods of Ethics had an enormous influence on Edgeworth and apparently converted him into a follower of Sidgwick's version of the doctrine. Hence, Edgeworth directed the readers of his works of 1877-1881 to take his theory of Utilitarianism as a mathematical interpretation *consistent* with Sidgwick's philosophical account (equipped with the tools of the cutting edge scientists of the period). It was in his *New and Old Methods of Ethics* (1877) that Edgeworth presented for the first time his interpretation, titled 'exact Utilitarianism' (allegedly derived from the combination of two disconnected set of ideas):

> The doctrine of Fechner and Sidgwick may be termed exact utilitarianism, as distinguished from Hume's non-quantitative principle of utility, and the not very explicit greatest-happiness principle of Bentham and his followers, including J.S. Mill.[14]

Edgeworth expresses here - and in the rest of the monograph - an aspiration to demonstrate a new kind of implementation of the utilitarian apparatus, albeit one based on the solid existing philosophical grounds provided by Sidgwick and supported by the modern scientific justifications provided by Fechner. I will first discuss the philosophical and than the scientific aspects.

Sidgwick, the Cambridge philosopher (a purely *academic* philosopher, as opposed to previous prominent utilitarians such as Bentham and Mill), presented in his *Methods of Ethics* a meticulous analysis of what he took to be the three basic competing doctrines of ethics: ethical egoism, intuitionism and utilitarianism. The later was defined by him as such:

> By Utilitarianism is here meant the ethical theory, that the conduct which, under any given circumstances, is objectively right, is that which will produce the greatest amount of happiness on the whole; that is, taking into account all whose happiness is affected by the conduct. It would tend to clearness if we might call this principle, and the method based upon it, by some such name as "Universalistic Hedonism".[15]

Sidgwick famously examined the rationality of each one of the three methods as an ethical guidance (mostly for individuals), distinguished carefully between

[14] Edgeworth (1877) p. 35.
[15] Sidgwick (1962) p. 411.

them,[16] and ultimately attempted to argue for the validity and superiority of utilitarianism, or *universal hedonism*. Nevertheless he did *not* dismiss the other two, nor adhere to 'pure utilitarianism'.[17] In fact, he cautiously argued, helped by observation and introspection, in favor of a mixture of motivations, self-regarding and extra-regarding, both in his descriptive and in his normative accounts. In addition he did not dismiss intuitive elements from his philosophy and attempted to bridge the divide between intuitionism and utilitarianism.[18]

The controversy between the three doctrines of ethics turned out to be a lively one, and from 1876 it was in part argued through the newly established journal *Mind*.[19] Thus, the first issues contained important criticisms of Sidgwick by Idealists and Intuitionalists such as T.H Green[20] and H. Calderwood[21] directed at Sidgwick's account, alongside critical articles from the other side of the spectrum, such as that by Alfred Barratt.[22] Edgeworth was well aware of this lively controversy and accepted Sidgwick's analysis, expressing his admiration for him in many places in his *New and Old Methods of Ethics*.[23] Even so, his own grasp of the controversy was different from that of his philosophical mentor.

These differences were reflected in Edgeworth's 1877 monograph where he was clearly more concerned with handling the ethical-egoist side than with the intuitionist side of the spectrum,[24] whereas his philosophical mentor, at the very least, gave both sides a comprehensive and detailed treatment. Sidgwick's treatment of intuitionism was in fact an expression of what was considered as the main matter of

[16] While the distinction between utilitarianism and intuitionism was generally acknowledged (based primarily on *a priori* versus *a posteriori*/consequential reasoning), it was a harder task, or so it seems, to make people fully aware of the distinction between ethical egoism and utilitarianism. Both J.S. Mill and Henry Sidgwick made an effort in this direction. See Mill (2000) chapter 3, Sidgwick (1962) pp. 411-412.

[17] See Schneewind (1986) chapter 6. see also Schultz's description of Sidgwick's cautious and impartial analysis; Schultz (2004) pp. 137-151

[18] See Schneewind's discussion of previous attempts to bridge the two and Sidgwick's continuation of those attempts. Schneewind (1986) chapters 5, 9.

[19] *Mind* was founded by Alexander Bain (see footnote 48) and its first editor was George Croom Robertson. In its first years the journal put emphasis on connections between philosophy and the new psychology of the time.

[20] Green (1877).

[21] Calderwood (1876).

[22] Barratt (1877), Barratt (1888).

[23] Edgeworth mentions Sidgwick 28 times in his short monograph, always in a highly positive manner and at times as an admired figure (see instances in Edgeworth 1877 pp. 11, 13, 14, 32, 60, 68).

[24] As the full title of the 1877 book suggests: *New and old methods of ethics: or "Physical ethics" and "Methods of ethics"* (the former refers to Barratt's book, the later to Sidgwick's).

dispute at the heart of ethics before 1870.[25] Edgeworth, on the other hand, and as will be explained further below, devoted only a brief discussion in his monograph to the intuitionist side, and shoved aside most of it to the appendix.[26]

The first section (out of two) of Edgeworth's monograph therefore provides a sympathetic presentation of the point of view of ethical egoism, that of Barratt in particular. Barratt might have been known to Edgeworth from his years at Oxford, as he was about the same age, an outstanding scholar,[27] and shared the same fields of interest. Edgeworth had still been at Oxford when Barratt's *Physical Ethics* was published back in 1869. Barratt's objection to utilitarianism could be traced in his early book as in his later *Mind* articles. Through these later articles, Barratt characterized Sidgewick's *Methods* as an obsolete form of ethics, based on the old fashioned method of introspection rather than on scientific methods alone.[28]

Barratt's objection to utilitarianism was connected, as he had already argued in his 1869 early work, with his aspiration to provide a scientific formulation of ethics. His view of 'scientific ethics' included, first a separation between pure ethics and applied ethics (an approach that Sidgwick and Edgeworth shared), with a declaration to focus on the pure aspect,[29] second, an aspiration to connect pure ethics with sciences such as physics and psychology (treating ethics 'as one of their branches'),[30] and third, a severe skepticism with regard to any traditional views of ethics.[31] In Barratt's view when one adopts such an approach one cannot but justify a 'physics of ethics' based on a physiological leaning of individuals towards actions that have their own pleasures as their ends. In other words, he argues for a reductionist psychological egoism which, for him, must conclude in ethical egoism and nothing more.

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[25] Harrison (2008), Schneewind (1986) chapter 5.
[26] Edgeworth (1877) pp. 33-34 and Appendixes pp. 80-90 devoted mostly to Green.
[27] In 1866 Barratt achieved the unequalled distinction of five first classes from the commencement of his residence at Balliol College. He obtained a fellowship at Brasenose a year later, and in January 1869 he published his 'Physical Ethics,' with which he had 'amused himself' in leisure hours at Oxford (he passed away in 1881, at the age of 37, attacked by paralysis). From the Dictionary of National Biography, 1885-1900, Volume 03 (written by Lesley Stephen)
[28] Barratt (1877), Barratt (1878)
[29] Barratt (1869) p. 1.
[30] "In the appendices I have attempted… to explain in an imperfectly connected series the relations of the moral system upheld in the text to those wider principles of mental and physical science with which as one of their branches it must necessarily come into contact." Ibid. p. iv; see also analogies and attempts to connect ethics to science for instances pp. 4, 25.
[31] Ibid. p. 3.

Obviously, he also rejected utilitarianism because, whereas egoistic conduct is scientifically based, in his opinion a utilitarian conduct lacks scientific account.[32]

Edgeworth in his 1877 work attempted to give a fair account of Barratt's view, which he then tried to reconcile with what he took to be Sidgwick's ultimately superior perspective.[33] Edgeworth's reaction to Barratt was ambivalent: On the one hand the attempt to provide a scientific account of ethics both appealed to and challenged him. Moreover, the fact that his motivation to combine ethics and science was not shared by intuitionists explains why Edgeworth was less interested in, while nevertheless expressing sympathy for the ethical-egoist side.[34] On the other hand, from an ethical point of view he (as had Sidgwick) took Ethical-egoism to be inadequate. Thus, while finding Barratt's ideas appealing to some extent, they were presented by Edgeworth as premature and insufficient; still in need of the method of introspection[35] and still needing to be completed by the ethics of utilitarianism. Before turning to his mathematical interpretation of utilitarianism, then, Edgeworth, in opposition to Barratt, was coming down in favor of the possibility of reconciliation between (psychological) egoism and utilitarianism.[36] For that purpose he recruited Hume, Mill and Sidgwick alongside various arguments drawn from the theory of evolution provided by Herbert Spencer.

> For it is not *inconceivable* that one's greatest pleasure – in those calm moods which give the character to one's life – should invariably consist in the contemplated pleasures of others…[37]
>
> The egoist, then, may have the power and the motive to cultivate a desire for the general good, not, indeed, to the pitch of pure utilitarianism, but to a degree asymptotically approaching it, in the progress of evolution, in the course of generations.[38]

Edgeworth, in the second section of this work (as in his later 1879 and 1881 works) provided a solid answer to Barratt's criticism and together with his acceptance

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[32] Ibid. pp. 70-75, 252-254.
[33] Uemiya (2008) presents Edgeworth's philosophy as an outcome of the Sidgewick-Barrat controversy; but I disagree with his 'symmetrical' interpretation, which ascribes the two scholars an equal weigh as influences on Edgeworth.
[34] Note his defense of 'physical ethics' from eight possible intuitionistic attacks: Edgeworth (1877) pp. 18-22.
[35] "But if the dawn of Physical Ethics is not yet at hand, we ought not in the meanwhile to neglect the domestic light of introspection" Edgeworth (1877) p. 22.
[36] Edgeworth (1877) pp. 28-33.
[37] Edgeworth (1877) p. 28.
[38] Edgeworth (1877) p. 33.

of Sidgwick's account of ethics, he went on to formulate utilitarianism in a most scientific way.[39] Thus what Edgeworth had to offer in his *New and Old Methods of Ethics* was similar to Sidgwick, *vis.* an ethical stand which does not deny egoism as a motive, but yet leans toward the validity of utilitarianism as a normative compass. The more scientific character of his exact utilitarianism, however, helped him to present the same doctrine in a more modern fashion and in so doing to improve the philosophical argument. To the intuitionist he would be able to say (in addition to Sidgwick's philosophical arguments): your doctrine is not sufficiently in accordance with the science of the age; to the ethical egoist he would answer: my doctrine is not only more subtle and human, but it is also *no less* scientific than yours.

3) The Scientification of Utilitarianism

Edgeworth's exact utilitarianism was considered by him as consistent with Sidgwick's philosophical account. This was because, while on the practical level a utilitarian apparatus of aggregation was held by Sidgwick to be no more than a 'rough' estimatation combined with other considerations,[40] it could also be based, so Sidgwick suggested, on as accurate as possible *theoretical* account:[41] "an attempt to introduce precision of thought into a subject usually treated in a too loose and popular way".[42] Sidgwick obviously held a completely different understanding as to what would be a precise exploration of the field.[43] Nevertheless, this was sufficient for Edgeworth to consider himself as a mathematically well-equipped follower of the philosopher.

Interestingly enough, the path to ascribing ethics with a *new* scientific character entailed passing through and connecting it with 'psychophysics',

[39] And, indeed, Barratt's view of Edgeworth's work was much more sympathetic than his view of Sidgwick's; see: Barratt (1878).

[40] In Sidgwick's view, exact estimations were possible only to a limited extent, and addressing the question of distribution, for example, required some other values *external to* utilitarianism to supplement it (such as justice); Sidgwick ibid. p. 416

[41] Sidgwick writes: "…its show of exactness is grotesquely incongruous with our consciousness of the inevitable inexactness of all such calculations in actual practice. But, that our practical Utilitarian reasoning must necessarily be rough, is no reason for not making them as accurate as the case admits; and we shall be more likely to succeed in this if we keep before our mind as distinctly as possible the strict type of the calculation that we should have to make, if all the relevant considerations could be estimated with mathematical precision." Sidgwick ibid. p. 416 see also book I chapter I and Schneewind (1986) chapter 6 p. 191.

[42] *Memoir* p. 295 quoted in Schneewind p. 191.

[43] Thus, Sidgwick's project was ultimately about providing systematic, objective, nuanced and comprehensive philosophical research into the alternative methods of ethics, and was not concerned with mathematization of the field whatsoever.

mathematical formalizations, and theories of evolution (with regard to at least the first two, in common with developments in economics in the same period, those of Jevons in particular).

With regard to 'psychophysics', with its emphasis on a more empirical approach to "the new psychology"[44] and its vision of a unified science of physical and mental phenomena, this was very much 'in the air' and greatly attracted many philosophers (and economists[45]). It is important to notice how the emergence of these new ideas served British thinkers of all kinds, ethicists in particular, both as a great challenge and as an opportunity. The challenge was to reconcile the new approach of treating mind and body interconnected and using the method of physiological experiments, with traditional and well rooted ideas of volition, the uniqueness of the human mind, and the use of introspection as a method of investigation. This challenge was shared by scientists and philosophers jointly[46] (presented also through *Mind)*. On the two extreme poles of reaction to this challenge (very much connected with the two extreme sides in the ethical dispute) stood, firstly, reductionists like Henry Maudsley, a pioneering psychiatrist admired by Barratt who held that mental states could be reduced to specific brain states, and completely rejected introspection as a valid scientific method;[47] and secondly, thinkers who held to the Cartesian dualism of mind and body and argued for a separation of the study of the human mind from the natural sciences (such as the earlier William Hamilton, and the later T.H. Green). In between there were many English psychologists and philosophers attempting to offer different suggestions of a middle- way; among them Mill and Bain,[48] and later, Spencer, and Sully. These thinkers had a tremendous influence on Edgeworth. It should be noted

[44] Note the use of the distinction between "new" and "old" which was used in psychology as well as in ethics (and economics). see Hatfield (2008) p. 94.

[45] Regarding economists see Schabas (2005) pp.134-136 and Maas (2005) 159-169. Schabas locates the emergence of economists' growing interest in psychology with Mill's version of associationism as a preliminary stage to 'psychophysics'. Maas puts more emphasis on the essential differences between Mill's approach to psychology and later economists such as Jevons's approach to the subject. Note that Edgeworth and Jevons were apparently independently influenced by this trend.

[46] See: Daston (1978), Hatfield (2008)

[47] The main problem with introspection was for him that it was subjective by definition and thus could not serve as an objective scientific method of investigation; see Daston (1978) p. 195, Hatfield (2008) p. 96.

[48] Alexander Bain (1818-1903), combined associationist psychology with an analogy between the mental and the physical phenomena that allowed for the employment of measurement procedures in researching mental phenomena. His main two works: *Senses and the Intellect* (1855) and *Emotions and the will* (1859) attempted to reconcile the associationistic concept of the mind and the new ideas while protecting the concept of the freedom of will, i.e. Bain did not accept an extreme reduction of the mental to the physical. (Note that Barratt referred to Bain extensively in his *Physical Ethics*, not as a supporter).

that, for Edgeworth, connecting utilitarianism with a more up to date psychology was an opportunity to advance the status of the philosophical doctrine, hitherto connected to the now apparently old-fashion associationist psychology.[49]

Edgeworth had the best mediator to access these developments in mental science: his neighbor and friend, James Sully, who helped him with his book.[50] Sully, who would subsequently become one of the founders of the Psychological Society in England (1901), and one of the first to write English textbooks in psychology,[51] had but recently returned from philosophical studies in Göttingen and Berlin, where one of his teachers had been Helmholtz.[52] Sully himself referred many times in his *Sensation and Intuition* (1874) to the experiments and works of Gustav Theodor Fechner, the German pioneer experimental psychologist who is considered the founder of psychophysics. Edgeworth adopted both Sully's approach and his adherence to the German scientists, Fechner and Wundt - hence his reference to Fechner as allegedly one of the fathers of exact utilitarianism.

What Fechner and Wundt had to offer to the utilitarian was a programme of psychophysics based on experimentation, complementing the method of introspection, within which the effects of a physical stimulus on an individual's sensations (pleasures or pains) were expressed *as a mathematical function,*[53] reflecting the tendency of the effect of a stimulus at some point to *decrease* with every sequential pulse.[54] An *expansion* of that formalization (using functions of similar kind[55]) from an

[49] Rizvi, for instance, suggests that Utilitarianism was at mid-century in a defensive position, lacking a scientific basis and not incorporating results from psychophysics. see Rizvi (1992) p. 8.

[50] Edgeworth devoted the acknowledgment in his book to Sully alone: "I have to thank my friend Mr. James Sully, author of "Sensation and Intuition", "Pessimisn" &c., for having revised and corrected the following pages during their passage through the press, and for many suggestions." Edgeworth (1877).

[51] Valentine, E. (2001) p. 405.

[52] On Helmholtz see Cahan (1993).

[53] Fechner's famous psychological law suggested that sensation varies as the log of the stimulus value times a constant (which means that felt intensity goes up arithmetically while the stimulus intensity increases geometrically). See Hatfield (2008) p. 99. Edgeworth did not uphold the logarithmic functions in his own mathematical interpretations.

[54] That feature economists associated with diminishing 'marginal utility', 'final degree of utility' in Jevons's words. Note that Edgeworth used that principle as a *postulate* basing it on 'every-day experience', recognized by Laplas, and confirmed by the new formulations of Fechner and Wundt (apparently disconnected with Jevons's formulation); Edgeworth (1877) p. 41, 69, Edgeworth (1879) p. 397.

[55] "The sort of proof initiated by Fechner is not peculiar to the Fechnerian law, but may be extended to an indefinite number of similar formula, involving, instead of the logarithm, some function which shares with the logarithm the following properties"; Edgeworth (1877) p. 40.

individual to a group of individuals could generate a new expression of the utilitarian apparatus, and thereby provide a service for the new utilitarian- Edgeworth.[56]

Thus, in *New and Old Methods of Ethics*, as in his sequential 'The Hedonical Calculus' published in *Mind,* Edgeworth presents abstract problems of allocation (of stimulus[57], and then of 'means to stimulus'[58] such as wealth and labor[59]) so that the aggregate of pleasures/happiness, the result of that allocation, will be at a maximum. Each and every problem entails few possible mathematical interpretations, and the author selects his preferred interpretation based on the philosophical and ethical nuances that it captures (i.e. the one that fits the most with his idea of exact utilitarianism).

Edgeworth's could deal with these theoretical questions, due to the properties of the basic functions of pleasure- producing,[60] and due to the posing of the problem as a minimum-maximum one, using 'the calculus of variations'; in which the aggregates are formulated as integrals.[61] (Edgeworth referred to the English mathematician Isaac Todhunter as an authority in the field of calculus.[62])

'The Hedonical Calculus', then, was a natural continuation to the second part of *New and Old Methods of Ethics*, in which Edgeworth focused on mathematical interpretations of the distribution problem, using his exact utilitarianism, inspired by Sidgwick,[63] as the best presentation of the problem. A prominent feature of Edgeworth's exact utilitarianism in both works was the interpretation they embody of

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[56] See Edgeworth's references to Fechner and Wundt: Edgeworth (1877) pp. 20, 35, 40-42, 61, 72, 75 and Edgeworth (1879) pp. 396, 397, 399, 404 [The same as Edgeworth (1881) pp. 60, 62, 65, 75]. "This 'moral arithmetic' is perhaps to be supplemented by a moral differential calculus, the Fechnerian method applied to pleasures in general. For Wundt has shown that sensuous pleasures may thereby be measured…" Edgeworth (1879) p. 396.

[57] Two basic problems were presented in *New and Old Methods of Ethics*. *'Problem I'*: "Given a certain quantity of stimulus to be distributed among a given set of sentients (with the condition that every element is to have *some* stimulus), to find the law of distribution productive of the greatest quantity of pleasure." *Problem II* will be the same not including the condition. Edgeworth (1877) pp. 43-44.

[58] See the rewording of the same two problems with terms of wealth in *New and Old Methods of Ethics*, ibid pp. 54-55.

[59] The basic question presented in 'The Hedonical Calculus' is: "To find the distribution of means and of labour, the quality and number of population, so that there may be the greatest possible happiness." Edgeworth (1879) p. 394.

[60] A central exemplar mentioned by Edgeworth is Wundt's curve of pleasure of which: "the higher part is concave, the lower part is convex". Edgeworth (1877) pp. 41, 69.

[61] See the many presentations of mathematic integrals in both works. Edgeworth (1877) pp. 38, 44-53, 58-59, 67. Edgeworth (1879) pp. 394, 399, 400, 402, 403.

[62] The works Edgeworth referred to are Todhunter's *History of the Calculus of Variations* (1861) and *Researches in the Calculus of Variations* (1871). Note that Jevons referred in his works to De Morgan, Todhunter's teacher, as a great mathematician.

[63] See Edgeworth (1879) pp. 397, 405, 406.

the different 'capacities' of individuals (and groups) to acquire pleasure. In 'The Hedonical Calculus' he defines the concept of capacity:

> An individual has greater *capacity for happiness* than another, when for the same amount whatsoever of means he obtains a greater amount of pleasure, *and also* for the same increment (to the same amount) whatsoever of means a greater increment of pleasure.[64]

The very idea of difference in 'capacities' is inspired by evolutionary theories. It was Herbert Spencer's version of evolution in particular that had the greatest influence on Edgeworth.[65] It should be noted that a reconciliation of Spencer and Sidgwick, as demonstrated in Edgeworth's works, is not so obvious, since there was a tension between the two approaches regarding the relation between ethics and evolution.[66]

In *New and Old Methods of Ethics*, when discussing the possibility of ascribing different capacities within exact utilitarianism, Edgeworth quotes Spencer (from the first edition of *Mind*):

> …the higher the evolution rises the stronger do the emotions become. For as the increasingly-complex emotions successively developed result from integration of pre-existing groups of actual and nascent sensations, the resulting totals must grow continually larger, &c.

Edgeworth continues: "With greater quantity may, perhaps, be enumerated more pleasurable quality, more sympathy, easthetic feelings, sense of dignity…"[67]

Within those of his works discussed here, Edgeworth aspired to provide a mathematical interpretation of these insights, representing an individual's 'capacities' and a (privileged) future generation's utilities inside the integrals.[68] In this he demonstrated originality in coping with the challenge of reconciling the *static* nature

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[64] Edgeworth (1879) p. 395; in addition, the different capacities in acquiring pleasures is paralleled with different capacities to suffer labor.

[65] Contrary to Peart and Levy's interpretation, according to which Edgeworth was a reconciler of Darwin and utilitarianism. Levy and Peart first offer a distinction between Spencer's and Darwin's approaches to the question of equality, and then place Edgeworth in Darwin's 'camp' (with the 'bad guys'); see: Levy and Peart (2005) pp. 208-233. Nevertheless, the two do not address the fact that Edgeworth actually did not refer at all to Darwin (or to biology) in his earlier works, in which he developed his ideas, and only mentioned him in the later *Mathematical Psychics* appendixes. Moreover, it is no wonder that he leaned heavily on Spencer, since the latter served for him as an example of a reconciler of utilitarianism, social evolutionism and the new insights of psychology. Naturally, Edgeworth saw himself as continuing this legacy.

[66] Sidgwick rejected Spencer's view of ethics and referred to them as 'deductive hedonism', i.e. an approach that deduced moral principles out of systems external to morals such as biology and evolution. See Weinstein (2000), Sidgwick (1876).

[67] Edgeworth (1877) p. 72.

[68] See Edgeworth (1877) p. 67-68 Edgeworth (1879) p. 400.

of utilitarianism with the *dynamic* character of evolutionism, a challenge that intrigued and troubled scholars of the period (as reflected in debates in *Mind*).[69]

The implication of this presumption, however, as Edgeworth explicitly suggests, is the separation of *exact* utilitarianism from *equality*, the formal omission of the '…for the greatest number' clause from the utilitarian apparatus. It may be better to have a few strong lamps than many weak ones when you have limited resources and maximum light as your goal.[70] Having said that, however, an important feature of exact utilitarianism should be emphasized: the *exact* part of the concept not only represents a highly scientific version of the doctrine, it also stands for the *purely theoretical* aspect of it. Thus, the intention of the project is to capture the idea of maximizing aggregate happiness in its most purified formulation, not at all to provide a sufficient practical guide. For example, while discussing the theoretical possibility that people in society will gain a negative utility in order to promote the sum total social utility, he comments:

> *Nothing indeed appears to be certain from a quite abstract point of view*"... "It may be admitted however that a limit below the zero of happiness, even if abstractedly desirable, would not be humanly attainable;…Let Politics and Political Economy fix some such limit above zero.[71]

This important distinction between purely theoretical versus practical interpretations of utilitarianism is crucial to the understanding of Edgeworth's project. It also explains how it was that despite his departure from the maxima of equality (on a theoretical level), Edgeworth still saw himself as a loyal interpreter of Sidgwick's ethics and as developing Spencer's ideas, while both had a tendency to ideas of equality.

4) Mathematical Psychics: bringing economics and ethics together

The two years following the publication of 'The Hedonical Calculus' in *Mind* were the years in which Edgeworth delved into the new developments in economic theory. In 1879 he apparently read for the first time Jevons's *Theory of Political Economy* (the second edition was published in that year) as well as Marshall's *Pure*

[69] A previous attempt to reconcile the two was made by Spencer (using a different concept of utilitarianism i.e. an 'indirect' one; within this account evolution brings about an increasing amount of happiness, and by that resolves itself into utilitarianism). See Weinstein (1998). See also Jevons (1879) and Sidgwick's rejection of the use of evolution as a part of the account of ethics in Sidgwick (1876).

[70] Edgeworth (1877) p. 74, Edgeworth (1881) p. 117.

[71] This is a case were the distribution of wealth is at a maximum "when the lower classes sacrificed to that of the higher classes. And again the happiness of part of the second generation may be sacrificed to that of the succeeding generations." Edgeworth (1879) p. 404.

'Theory of Domestic Value'.[72] The new approach to economics embedded in these works had a massive impact on Edgeworth's economics, and in his *Mathematical Psychics* (1881) he highlighted his shared views with Jevons as to the crucial role of individuals' utilities as "the true key to the problem of Economics", and a mutual adherence to the centrality of the differential calculus as the main tool to address problems in economics.[73] Edgeworth was probably enthusiastic, not only as to the genius of the ideas, but also as to the similarities and connections between his approach to ethics, and the economists' new approach to their discipline (both being inspired by the same trends in science). This is probably what led to the decision to put the two subjects of research into one monograph under the one title: *Mathematical Psychics: an essay on the application of mathematics to the moral sciences*.

As presented in *Mathematical Psychics,* 'the calculus of feelings/ Pleasures' is subdivided into two fields in a symmetrical manner:

> …Economics and Utilitarian Ethics. The economical Calculus investigates the equilibrium of a system of hedonic forces each tending to maximum individual utility; the Utilitarian Calculus, the equilibrium of a system in which each and all tend to maximum universal utility. The motives of the two species of agents correspond with Mr. Sidgewick's Egoistic and Universalistic Hedonism'.[74]

The part in the book titled 'Utilitarian Calculus' (pp. 56-82) is actually 'The Hedonical Calculus' in its entirety, as briefly noted by Edgeworth,[75] while the only changes (traced by Barbé[76]) are the title, and two additional footnotes in which he mentions Jevons and Marshall.[77]

The 'Economic Calculus' includes some genuine development of the theory inspired by the works of political economists such as Marshall, Walras, Cournot, and

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[72] Howey (1960) p. 101. See also Edgeworth's comment in *Mathematical Psychics* that while writing the *Mind* article he was not aware of Jevons's ideas of the subject.

[73] Famously, this adherence to the differential calculus was heavily inspired by the mathematical physics of the period; see Mirowski (1989) pp. 217-222. Edgeworth himself couldn't be more explicit about the many poetical analogies to the natural sciences in the book. Note that the title of the book is itself an allusion to 'Mathematical Physics'. A prominent figure for him in this respect was the Irish physicist, William Rowan Hamilton (a friend of the family; see Newman p. 87).

[74] Edgeworth (1881) p. 15-16

[75] "The Economical thus leads up to the Utilitarian species of Hedonics; some studies in which already published (under the title of ' Hedonical Calculus ' — the species being designated by the generic title) are reprinted here by the kind permission of the Editor of Mind." Ibid p. vii.

[76] Barbé (2010) p. 87.

[77] These footnotes provide another indication that Edgeworth was not familiar with Jevons and Marshall's writings before 1879.

of course Jevons, who receives the most praise.[78] Edgeworth and Jevons were probably introduced by their mutual friend (and neighbor in Hampstead), Sully.[79] The original contributions of Edgeworth to the science of economics, 'the economic calculus', have been broadly discussed in the literature.[80] The economic devices presented there, such as the indifference curves, the contract curve and the graphical representation that led to the 'Edgeworth box', are all still used in economic courses today.

In the context of this paper, one aspect of Edgeworth's economics is of particular interest[81] (and this is not discussed in today's classrooms). In the concluding part of 'the economic calculus' a general case is presented in which under the circumstances of imperfect competition the barter between two (or more) agents, will not result in one point, i.e, one relative price of the two commodities, but in a set of points (inside the 'core' and on the contract curve). This is the famous 'indeterminacy' of a contract[82] (see the appendix below). Now, aware of the fact that 'a principle of arbitration' is required,[83] Edgeworth suggests the utilitarian apparatus as the best candidate to come to the rescue. Other possible candidates, he suggests, such as distribution based on other conceptions of equity,[84] are less preferable solutions, and the utilitarian apparatus (used by the agents themselves) is the justified one:

> Justice requires to be informed by some more definite principle, as Mill and Mr. Sidgwick reason well. The star of justice affords no certain guidance—for those who have loosed from the moorings of custom—unless it reflects the rays of a superior luminary—utilitarianism.
>
> Now, it is a circumstance of momentous interest—visible to common sense when pointed out by mathematics —that one of the in general indefinitely numerous settlements between contractors is the utilitarian arrangement of the articles of contract, the contract tending to the greatest possible total utility of

[78] It was Jevons who probably introduced him to the rest. Barbé (2010) 92.
[79] Sully met Jevons around 1879 and later that year introduced him to Edgeworth. Note that the three were also members of the same London clubs (Savile and Athenaeum). Barbé (2010) pp. 87-89.
[80] See Creedy (1986) chapters 3,4,6.
[81] See other discussions of this idea in: Creedy (1984), Creedy (1986) pp. 80-81, Barbé (2010) pp. 98-99, Uemiya (2008) p. 14.
[82] In Edgeworth's theory as opposed to Jevons's this case warranted a theoretical account. As pointed out by Creedy (1984) p. 614, Jevons mentioned (under the subtitle 'Failure of the Equations of Exchange') exceptional cases of 'indeterminate bargains', that should be resolved somehow; see Jevons (1888) [1871] chapter IV pargraph 74
[83] Edgeworth (1881) p. 51.
[84] Ibid.

> the contractors. In this direction, it may be conjectured, is to be sought the required principle.[85]

The significant implication of this solution is that economic man is expected to demonstrate other motives apart from the maximization of his individual utility as a part of the process of exchange. In this, the ethical account of Henry Sidgwick (in which the agent is presented as motivated by a mixture of 'egoistic' and 'universal' hedonism i.e. utilitarianism[86]) was actually penetrating the sphere of economic theory.

5) Changing the relations between economics and utilitarianism: Edgeworth and Marshall

Although the starting-point of Edgeworth's project of 1877-81 had not much to do with the field of economics, it nevertheless concluded with a monograph which reflected an original relation between economics and utilitarianism. As explained in the first section of this paper, British economists who accepted utilitarianism as an ethical guide tended to refer to it as a meta-criterion for assessing economic policy. From Edgeworth's point of view, and as exemplified by the way he edited *Mathematical Psychics*, there was at the very least symmetry between the two fields: both are branches of the moral sciences, expressed with the same concepts and formalized with the language of mathematics. From a 21st century point of view, one can interpret this in a more radical way as the inclusion of ethics within the economic discipline.[87]

I would like to argue briefly in this concluding section that Edgeworth's new point of view was not an idiosyncratic caprice, but was shared, at least to some extent, with Alfred Marshall, and is indeed a part of a wider tendency that should be identified within the intellectual tendencies of the time.

Following his reading Marshall's works in 1880,[88] Edgeworth sent him a copy of *New and Old Methods of Ethics*, to which Marshall's responded:

> I have now nearly read all the book you sent me and am extremely delighted by many things in it. There seems to be a very close agreement between us as to the promise of mathematics in the sciences that relate to man's actions. As to the interpretation of the Utilitarian dogma, I think you have made a great

[85] Ibid. p. 52 and 53
[86] This point is elaborated in appendix IV in *Mathematical Psychics*. Edgeworth (1881) pp. 102-104.
[87] See for example John Broome's essays: *Ethics out of Economics* (1999). Edgeworth's work could actually be interpreted as a pioneer work of this kind.
[88] *The Pure Theory of Foreign Trade and Domestic Values* (1879) and *Economics of Industry* (1879).

advance: but I have still a hankering after a mode of exposition in which the dynamical character of the problem is made more obvious.[89]

More striking than this reaction is Marshall's note (probably written at the beginning of the 1880s[90]) titled 'On Utilitarianism: A Summum Bonum'. Within this note we find Marshall playing with mathematical representations of the utilitarian apparatus,[91] using and improving Edgeworth's basic integral (the same one presented in 'The Hedonical Calculus' and therefore also in *Mathematical Psychics*).[92] As mentioned by Whitaker, little trace remained in the *Principles,* but Marshall still proposed to use the ideas as late as 1912.[93] In between these two responses by Marshall to Edgeworth's exact utilitarianism, Marshall's review of *Mathematical Psychics* appeared in *The Academy* (18 June 1881), focusing on Edgeworth's economic developments.[94]

There has been a broad debate in recent years as to how much of a utilitarian Marshall was.' was broadly discussed in the literature.[95] In our current discussion it is only important to observe that while clearly not as thoroughgoing a utilitarian as was Edgeworth, Marshall nevertheless had some tendencies to the doctrine, studying Bentham and Mill's philosophies in his youth, albeit mixing it with other philosophical influences,[96] and combining it with an evolutionary approach (in the spirit of Spencer). As opposed to Edgeworth, Marshall, the economist, was not interested in engaging directly with the philosophical disputes of his time, nor did he want to fully commit to any particular ethical school.[97] Famously, he also promoted the establishment of a new economics faculty in Cambridge, taking it out of the Moral Sciences Tripos where it had been taught throughout the second half of the nineteenth century.

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[89] Letter of 8 February, 1880.
[90] As assessed in Whitaker (1975) p. 317.
[91] While at the same time he notes in a very Marshallian manner: "write as much as can be done without mathematics before beginning mathematics" Ibid. p. 317 (footnote 3).
[92] Ibid. p. 318-319.
[93] Ibid p. 317.
[94] Marshall was very supportive in his review: "This book shows clear signs of genius, and is a promise of great things to come". Nevertheless he expressed also his impression that the work was too mathematical and not enough clear and applicable. Whitaker (1975) pp. 266, 267; for further discussion of the two different approaches to economics see Creedy (1990) pp. 21-22.
[95] See Black (1990), Cready (1990) p. 23, Raffaelli (1996), Dardi (2010).
[96] Idealism and neo-Hegelianism in particular (through the interpretations of Maurice and Grote). See Cook (2009).
[97] See for example Marshall's comment in a meeting of the British Economic Association (1893): "Now it was true that some of the greatest economists had been utilitarians: but that was an accident. Their analysis was wholly independent of the utilitarian doctrine; it was, when rightly understood, common property to all ethical creeds". *Economic Journal 3:11* p. 388.

Nevertheless, and regardless of the particular extent of his commitment to utilitarianism, Marshall did share with Edgeworth the aim of expressing utilitarian ideas by 'translating' them into the language of science. One way to do this was in the spirit of abstract ideas of evolution (i.e. social evolution as a utilitarian promoter),[98] the other, which is more relevant here, was Marshall's attempts to 'capture' utilities, that in his view *could not* be directly represented mathematically, by finding other representatives of them (such as market prices) that could actually be expressed mathematically. Marshall's development of the concept of 'consumer surplus' is an early example of this tendency.[99]

Marshall's own way of internalizing utilitarian reasoning within his economic theory (without accepting hedonism or using philosophical jargon), taken together with his positive reaction to Edgeworth's formalization of utilitarianism, suggests that the two indeed shared a similar new approach to the relation between economics and utilitarianism.

This new way of coping with utilitarianism would subsequently generate some reactions, both as inspiration to scholars and as an approach that drew some harsh criticism. But from the scholars' point of view in the 1870s and the 1880s it could be understood as a part of the 'spirit of the age'.[100] In particular it was their mutual belief that one could ascribe more force to an idea by presenting it in a scientific and mathematic fashion.[101] It is not an accident that both scholars used the title 'new and old' to describe their intellectual challenges.[102] Within those *new* frameworks there was a place for expressing good old ideas such as utilitarianism in an up-to-date manner.

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[98] Dardi (2010) pp. 418-422.

[99] For further discussion of this point see Dardi (2010) pp. 411-417. Dardi nicely names this 'monetary utilitarianism' (p. 415).

[100] See Winch's resent discussion of the debates between economists and their critics in the 1880s and the 1890s under the title of "the old generation of political economists and the new" (of which, see in particular the interpretation ascribed to the 'new' framework by Foxwell and Marshall pp. 241-250) Winch (2009) chapter 9.

[101] For the particular role of professionalization in Marshall's economics, and the difference between his approach to mathematics and Edgeworth's see Maloney (1985) pp. 181-185; Creedy (1990) pp. 21-22.

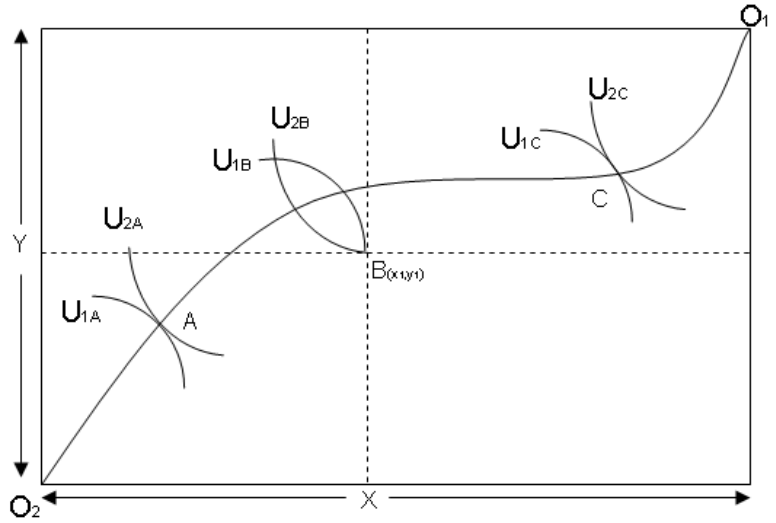
[102] Edgeworth *New and Old Methods of Ethics* of 1877 and Marshall's use of the title: "The old generation of economists and the new" in his address delivered in Cambridge (Oct 1896) see Marshall (1897).

Appendix:

We can use the later pedagogical devise that captures Edgeworth's theoretical framework, "Edgeworth box", as an illustration of the need of utilitarianism as a Principle of Arbitration. The line that connects O1 and O2 is the contract line. Which mean that all the points on it reflect the equation:

$$\frac{du_1}{dx} = \frac{du_2}{dy},$$

The initial endowment is represented by the point B. Any point inside the core (between the two indifferent curves U_{1B} and U_{2B}) and on the contract line are optional as a solution to the problem (and each of them resolves into a different relative price). Therefore another principle is needed in order to decide between them.



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