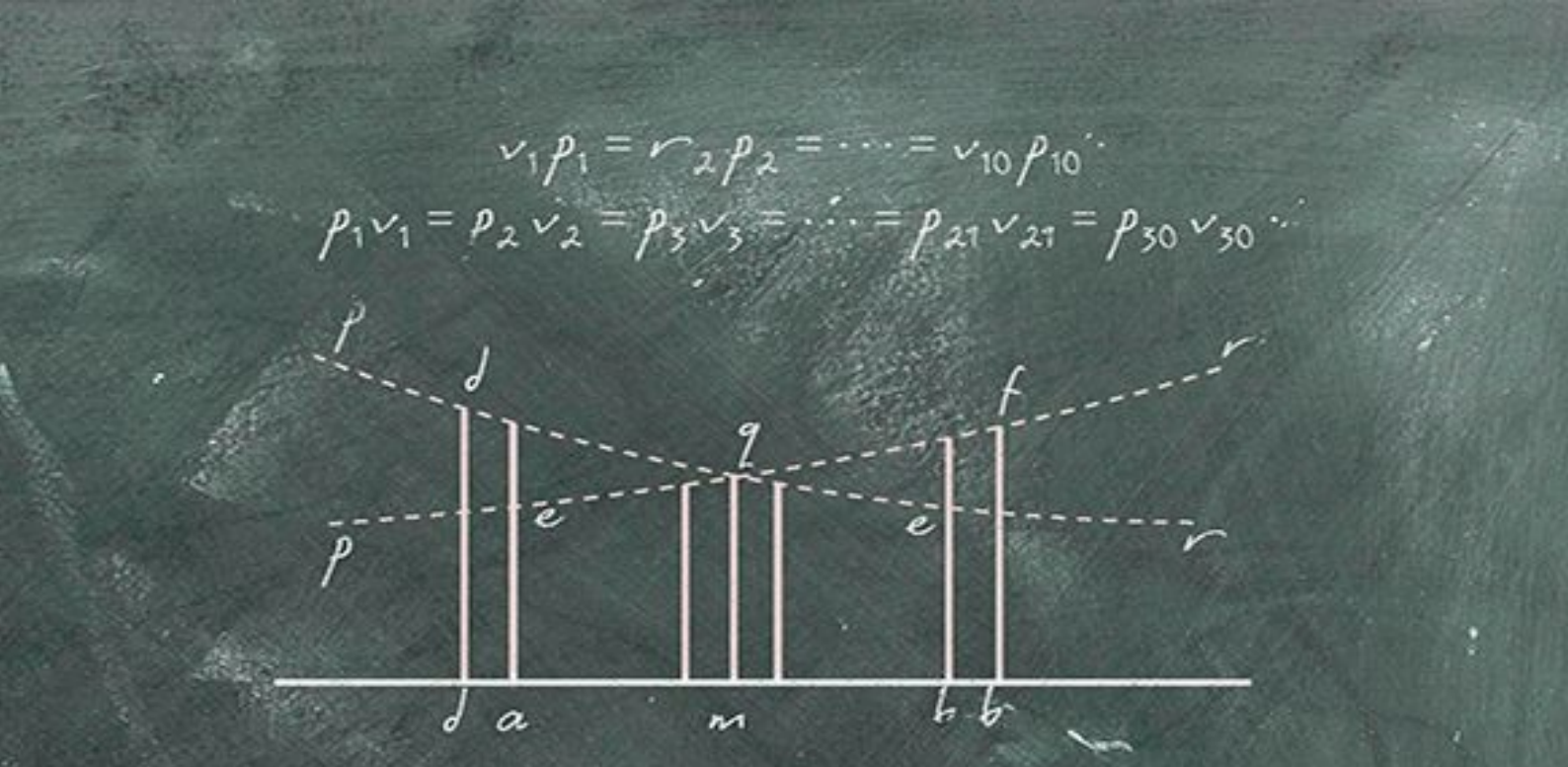

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The Theory of Political Economy

Fourth edition

W. Stanley Jevons

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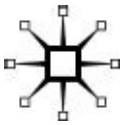

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Introduction

Harro Maas

William Stanley Jevons (1835–1882) is unquestionably one of the great minds in the history o economics. Today, he is remembered as one of the "fathers" of the so-called marginalist revolution i economics. First published in 1871 and then in 1879 considerably revised and extended with bibliography of mathematical works in economics, *The Theory of Political Economy* analysed th decisions of economic agents in mathematical form in terms of deliberations over margin increments of utility. In this "mechanics of utility and self-interest," economic agents – whether their role of consumers, workmen or other – maximized a balance of pleasure and pain in the directio of pleasure. Utility, expressed in functional form, became the basis of a new theory of value th substantially departed from the classical political economists' labour theory of value. Value becam identified with exchange value, and this with what we now refer to as marginal utilities, not with cos of production. The book replaced the central problems addressed by classical political economist dynamic questions of long-term growth and distribution, for that of price formation on markets. In th *Theory* Jevons formulated the central problem of economics differently: as a static optimizatio problem – how to maximize overall utility given a certain amount of means of production. But he als promised to tackle the problem of market price formation, and in this he did not succeed.

The introduction of utility theory and the calculus might obscure other changes in the form economic arguments that are perhaps no less important for the transformation of economics Jevo instigated. In the *Theory* Jevons used diagrams and – on a small scale – statistical data to provi evidence for his theoretical claims. Graphs and diagrams play an even more prominent role in h innovative empirical studies in which he also introduced index numbers to make causal inferences c changes in the value of gold following the gold discoveries in California and Australia. Much of h empirical endeavours were devoted to graphical comparisons in the movements of sunspots and th price of wheat to establish a causal nexus between the activity of the sun and commercial fluctuation

Such tools and instruments, which a modern reader may take for granted, were as alien to politic economy as the calculus. Thus, Jevons developed a number of tools that are used in mode economics, but as is often the fate of an innovator, he did not manage to coherently integrate them a His monumental *Principles of Science*, which he considered his magnum opus, was published short after the *Theory* in 1874. But his *Principles of Economics*, on which he worked for much of the 1870 remained unfinished, perhaps not only because of his untimely death in 1882. In his centennial essa on Jevons, Lord Robbins wrote that Jevons "time and again seems to be on the brink of the mode theory," without getting there, "all of which is very disappointing" (Robbins, 1936). But he also wro that Jevons' genius was perhaps not located in his theoretical work, but in the variety and diversity his contributions.

The sense that Jevons built a halfway house between political economy of the nineteenth centu and modern-day economics helps explain the mixed reception of Jevons' *Theory* by h contemporaries. Inoue and Mosselmann's recent collection of reviews and comments by Jevon contemporaries shows that most of them were far from negative (Inoue and Mosselmann, 2002). B some of the more important ones were. An anonymous review in the *Saturday Review* for 1

November 1871, possibly from George Wirgman Hemming, a mathematician and fellow of St John College, Cambridge, was puzzled by the mathematics that seemed to merely state what could be sa in words, and did not seem to do much work of its own. John Elliot Cairnes, the last of the classic economists, wrote in the 1875 re-edition of his influential *Lectures on the Character and Logic Method of Political Economy* that the work of his "able friend" did not give him reason to alter th views on method he had expressed as early as 1857. In a famous letter of December 1871, John Stua Mill, not having read the book, wrote to Cairnes about his general reservations against Jevons' "man for encumbering questions with useless complications, and with a notation implying the existence greater precision in the data than the questions admit of" (Mill 17, 1862–1863).

Even Alfred Marshall took issue with the book. But, as Collison Black rightly noted, Marshall wa thinking along similar lines as Jevons, and may have felt robbed of the opportunity to publish firs Marshall was also concerned with the aggressive way in which Jevons distanced himself from h predecessors, especially in the last section of the *Theory*, while he himself tried to strike a balanc between the merits of the old school and the new mathematical and utility-based way of theorizin Finally, the fact that a senior Cambridge wrangler was trumped by a second-rate mathematician fro the north may have added to the tone of Marshall's comments and criticisms.

If one does not judge Jevons' accomplishments from the vantage point of present theory, as Lor Robbins did, one can see how extremely good and versatile Jevons was in forging new tools an instruments to unravel the questions he posed to the data. John Maynard Keynes' portrayal of Jevon scrutinizing his data, spending "hours arranging his charts, plotting them, sifting over them, tintin them neatly with delicate pale colours like the slides of an anatomist, and all the time poring ov them and brooding over them to discover their secret," rightly describes him as pursuing an anatom or physiology of society. Indeed, as well at home in theory as in the "black arts of inductiv economics," Jevons was, as Keynes perceptively notes, "the first theoretical economist to survey h material with the prying eyes and fertile, controlled imagination of the natural scientist" (Keyne 1936). It was left to the next generation of (political) economists to discover the potential of the too and instruments that Jevons had bequeathed to economics and to further develop the consequences his pioneering work.

In what follows, my aim is to show how Jevons translated his knowledge of the research metho used in the natural sciences to political economy in order to radically transform the substance an scientific image of economics. The radicalism of Jevons' new approach to political economy will b better understood against the background of Victorian discussions of its proper method.

Jevons' Early Life and Years of Study

Stanley Jevons was born in Liverpool as the ninth child in a middle-class Unitarian family on the fir of September 1835.[1] Like the Booths, Huttons, and Martineaus to whom they were related, the Jevo family formed part of the self-confident Unitarian circles who lived in the heartland of the Industri Revolution and shared a belief in rational argument and the advancement of science to promote th social good. Unitarians were heavily involved in the establishment of literary, philosophical an statistical societies, and pioneers in the emerging sanitary movement.

His father, Thomas Jevons, was an iron merchant with utilitarian sympathies who is said to hav invented the first floating iron ship. His mother, Mary-Ann Roscoe, was the daughter of Willia Roscoe, a Liverpool banker and important collector of Flemish and Italian masters.[2] His mother die in 1845; his much-beloved eldest brother, Roscoe, went insane; and his father's iron business wen bankrupt in the Great Railway Crisis of 1847. The family moved to Manchester and never recover from its financial difficulties, which shifted Stanley and his siblings from the commercial elite to th

so-called “uneasy classes” – intellectually gifted, but without the means to leisurely pursue the interests. Thus, Jevons’ youth exemplifies what Thomas Carlyle in *Past and Present* called the “He of the English,” a life in which family fortunes became ambushed by financial concerns.

Given his background it is unsurprising that Jevons’ early education was in the natural science which he naturally combined with an interest in the needs and wants of society. Jevons first went t Liverpool Mechanics’ High School, and, after an interlude at a grammar school that was less to h liking, to the preparatory school of University College, London. At the age of only 16 he lived i London, visited the Great Exhibition, and wandered through the “dark alleyways of Spitalfields” observe the conditions of the working poor. In 1851 he enrolled at University College itself to stud mathematics and chemistry.

At University College, Jevons enrolled in courses in experimental philosophy and chemistry, an the mathematics class of Augustus De Morgan, the first mathematics professor at University Colleg and son-in-law of the radical Unitarian mathematician William Frend. The Cambridge Mathematic Tripos paled in comparison to De Morgan’s mathematics course, which was known, at the time, as th most demanding course of its kind in England. De Morgan was a great propagator of French analysi an approach to mathematics that by 1850 was still received with considerable scepticism in th Oxbridge system because of its concurrent mechanical worldview.

De Morgan’s mathematics and his mechanical worldview had a lasting impact on Jevon intellectual life. In his *Formal Logic* (1847, 26), De Morgan wrote that “with respect to the min considered as a complicated apparatus, we are not even so well off as those would be who had examine and decide upon the mechanism of a watch, merely by observation of the function of th hands, without being allowed to see the inside.” In his *Principles of Science* (1874, 222), Jevo similarly wrote that “we are in the position of spectators who witness the productions of a complicate apparatus, but are not allowed to examine its intimate structure.” Jevons’ reliance on mechanic analogies shifted the grounds for studying the “laws of the mind,” what we now would ca psychological laws, from an introspective to the outsider’s perspective that we find in the *Theory*; th outside observer could not gauge the inner motives of another mind. But this did not prevent the scientific analysis. The task of economic theory was to uncover the mechanism behind econom phenomena, whether these were to be found in nature or in the functioning of the human mind.

Though Jevons performed well, he never considered himself a mathematician (and was n considered so during his lifetime). Jevons’ forte was in chemistry and the experimental sciences. H won several medals, a gold medal in chemistry amongst others. Through the intervention of his cous Harry Roscoe, the later professor of chemistry at Owens College, Manchester, Jevons was offered th opportunity to become gold assayer at the newly established mint in Sydney. After some hesitatio (and prodding by his father), Jevons accepted the extremely well-paid job (£675 a year), whic considerably lifted the financial burdens of the family. Jevons sailed off to Australia in 1854 to sta there for a five-year period. Just two weeks before he would get a job offer for Australia, he picture himself living the life of a Manchester businessman, amusing himself in the evenings in the baseme with instrument-making and “not altogether useless” chemical experiments.

Jevons’ Antipodean Interlude

Jevons’ “Antipodean interlude” significantly influenced his further intellectual career. Not only di the work at the Sydney Mint offer Jevons ample opportunities to pursue his manifold scientif interests, but also the social environment of the Mint itself was highly favourable to scientif pursuits. As a typical Victorian colonial institute the Mint functioned as a nucleus of scientif activity that turned its “imperial gaze” upon Australian nature and society.

The most important Australian science periodical was the *Sydney Magazine of Arts and Sciences*, which Jevons made several contributions, most of them on meteorology. Jevons published o experiments on the formation of clouds, in which he attempted to reproduce clouds on a miniatu scale in accordance with Howard's classification of clouds. He made these experiments on stron mechanical assumptions and in the hope of rendering his results in mathematical form – somethin that proved far beyond his reach. Lord Rayleigh, the later Nobel Laureate in physics, reproduce Jevons' experiments in the early 1880s at the Cavendish in Cambridge in order to study diffusio processes in fluids and gases. Jevons also contributed to Waugh's statistical almanac, in which h extensively reported on his statistical observations on the Australian weather. Accompanied by hi barometer and thermometer he made excursions to the newly discovered gold mines of New Sou Wales, and his notebooks are filled with pages of meteorological observations made during thes trips.

There was a fluid line between such experimental and statistical investigations, and h investigations into the "moral and physical condition of the working classes." Using approach similar to those utilised by the statistical societies he knew from his youth, Jevons started working o a social survey of Sydney. He published his findings in the *Sydney Morning Herald*. Though on fragments of the original survey remain, his notebooks make clear that he considered his survey th beginning of a "science of towns" that was a prelude to a general "science of man."[3]

Another example of his early interest in social research is his work on a spectacular stratigraph th would visualise the British "industrial system of society" and link its division of labour to Ada Smith's distinction of human needs.[4] These investigations date from Jevons' early Sydney period. It an indication of the continuity in Jevons' interests that the subtitle of his unfinished and posthumousl published *Principles of Economics* (1905) was the "industrial mechanism of society."

These examples may serve as early witnesses of how Jevons translated his natural and acquire skills in decomposition and classification of natural phenomena to the social realm, and how he use visualizing techniques from the natural sciences in the social domain. For a long time historians economics considered Jevons' turn of interest to political economy the result of a volte face, for whic a lecture on Jeremy Bentham's felicific calculus served as catalyst. Jevons' appraisal of this lecture seen as a premonition of the hedonic theory of value that was to become the core of his *Theory*. Als the great interest Jevons showed for the Australian railway debate (on which he made som contributions in the *Empire*, an Australian newspaper) and the ensuing interest in Dionysius Lardner *Railway Economy*, that was influenced by Antoine-Augustin Cournot's work on oligopolies, is seen i that connection. But from the foregoing it should be clear that natural and social investigations fro early on were pursued in parallel, and using the same tools and instruments he was familiar with fro his childhood and university training and education. From a very young age Jevons aimed at al embracing explanations of society that were deeply rooted in a thorough engagement with th experimental method and statistics and fuelled by a predilection for mechanistic explanations.

This short summary of Jevons' scientific pursuits in Australia shows him to be the kind of Victoria who felt more indebted to the Belgian astronomer and revolutionary of statistics, Adolphe Quetele than to Mill or August Comte. Quetelet's *De l'homme* was among his books in Sydney. In a sho essay for *Nature* (1875), Jevons explicitly paid tribute to Quetelet as the "true founder" of the soci sciences because he turned his telescope to society. According to Jevons, by focusing on averag values, rather than on particular data, the mechanisms could be uncovered that governed the natur and the social world.

Ideally, mathematics spelled out these mechanisms, but this proved not always possible. When h started collecting materials for his Statistical Atlas project, in the early 1860s, he approvingly quote Sir John Herschel, who had used the "graphical method" in astronomy when "analytical difficultie

prevented attending a “rigorous solution of equations,” and where the data were “uncertain, irregula and embarrassing” (Maas, 2012). When he wrote to his sister Henrietta that he considered devoting h life to the study of political economy, he described the subject as some sort of “vague mathemati which calculates the causes and effects of man’s industry, and shows how it may best be applied” (L letter of 28 February 1858). Jevons would spell out the meaning of these words only after his return London to take up his studies in political economy at University College, London.

The Mid-century Split between Theory and Statistics

Jevons enrolled once again at University College, London, at the age of 25, now to study politic economy. He quickly became disappointed in its teachings. Early in the 1860s Jevons started writin on his mathematical theory of political economy, for which not only Bentham’s utilitarianism but als physiological reductionist theories of the mind served as important inputs. In his *Principles* Jevo considered that future research would reduce “the tender mechanism of the mind” to “nitrogen an phosphorus.”(735–736) Jevons also started working on his Statistical Atlas project – a highl ambitious project in which he aimed to visualize the history of Great Britain in some 39 diagrams Jevons’ disappointment with contemporary economics was not just a matter of (emerging) divergin insights on one of the cornerstones of classical political economy, the theory of value; it was also disappointment in its methods of research.

Halfway through the century, Mill’s views in the matter reigned supreme. In Mill’s footsteps Joh Elliot Cairnes ardently defended the so-called a priori or deductive method of political econom against the inductive, statistical method in his 1857 essays for the Whately Chair of Politic Economy at Trinity College, Dublin. Mill had explained both methods, first in his seminal essay o 1836 on the definition and method of political economy that was reprinted in his *Essays on Som Unsettled Questions of Political Economy* (1844, Vol. 4 *Collected Works*) and then in the famou Book VI of *Logic* (1843) that was devoted to the method of the “moral sciences.”

Mill wrote his 1836 essay in a deliberate defence of Ricardian economics, which in the early 183 had come under serious attack. Mill was adamant there was nothing wrong with Ricardian economi and that its most distinguishing “vice” – its deductivism – was just the way the science shou proceed. Mill’s argument for this was quite innovative and had little to do with Ricardian economi per se. Leaning on the philosophy of Adam Smith’s first biographer Dugald Stewart, Mi categorically distinguished between two different fields of science, the sciences of mind and matte The natural sciences studied the laws of matter. They had either the luxury of simplicity or contro and so could reason from data to exact laws, either by sustained observation, as in astronomy, or b the controlled experiment, as in chemistry or mechanics. The sciences of mind (or the “mor sciences”) by contrast were plagued by the complexity of the social realm. For that reason, it w considered impossible to find social laws by means of induction. Mill agreed with the politic economists from the Oxford school that such attempts would only lead to incoherent collections data, numerical or otherwise, from which no law-like regularities could be expected to be deduced.

For political economy Mill constructed an ingenious escape route. Rather than studying mankind its full complexity, political economy was to be limited to the study of a set of motives on whic observations, or mental experiments, could be made within the “private laboratory” of the scientist mind. These motives were man’s pursuit of wealth, counteracted by his aversion for labour and h preference for immediate gratification. No economist, Mill added, was so “absurd” to assume the motives exhausted man’s complexity, but this was, inevitably, the “mode” in which the science o economics had to proceed.

Confronted with nature’s boundaries (the population principle, marginal lands), the effects of thes

motives played out with necessity – with equal necessity as the laws of mechanics. It was on because of society's complexity, because of the many confounding factors that exercised the influence as well, that the ensuing laws of political economy could not be observed in their pure form Therefore, political economy was a science of tendency laws. In Mill's words, "disturbing causes turned political economy into a science of tendencies. Mill's defence of (Ricardian) political economy was extremely successful and settled disputes on its proper method for most of the nineteenth centur Mill's solution was original, and at the time even won over his greatest adversary in matters of method, the Cambridge polymath and philosopher of induction William Whewell.

In his own lectures on the method of political economy, John Elliot Cairnes drew the immediate consequences for the relation between theory and evidence. Political economists did not need the "tedious route of induction" of the natural sciences that was emulated by statistical societies. Politic economy was an a priori science and the "business" of the political economist was finished once he had traced an event back to a mental motive. More explicitly than Mill, Cairnes argued that politic economy lacked the exactness of the natural sciences, because principles of the mind, by their natur were not the kind of material fit for measurement. For that reason mathematics and statistics were unfit to bring "numerical exactness" to political economy. Thus, Cairnes' lectures reflect the "curious separation between abstract theory and empirical work" in which the work of political economists and statisticians became worlds apart (Blaug, 1976).

This was, we have seen, not in agreement with the manner in which Jevons had practiced his soci investigations during his years in Australia. The differences in approach can be illustrated wi Jevons' study into the fall of the value of gold. Jevons published this study in 1863, and it was his fir public success.[6] He sent a copy to Cairnes, who replied he had written on the "gold question" from a "a priori" perspective, but was pleasantly surprised that Jevons independently and by "entirely distin methods of inquiry" had come to similar conclusions (PC 3: 16–17). Cairnes was so enthusiastic th he sent a letter to the *Times* to call attention to Jevons' pamphlet. Following this success, Jevon started working on the future exhaustion of the British coal mines and its consequences for Britis prosperity. The publication of *The Coal Question* in 1865 was favourably greeted by Mill, and led questions in Parliament on the long-term viability of the British budget and to an invitation b William Gladstone to Jevons to Downing Street 10. By the age of 30, Jevons had established a nam as an able statistician, but not as an able political theorist.

If we consider Cairnes' reaction to Jevons' gold study in more detail, we can understand why Making use of index numbers, Jevons showed that gold had fallen in value as a result of the Australia and Californian gold influx. But Jevons' small tract contained a great many other statistic innovations: a logarithmic chart picturing the price of 39 individual commodities against a ba period and graphs representing the movements of the average (and individual commodity prices) ov time. These were all sufficient innovations to revolutionize a field. Not so then. Cairnes brushed ov the differences in method and zoomed in on the details Jevons provided on his private experienc while in Australia as gold assayer of the newly established mint. His conclusion was that politic economy, as practiced in Britain, was in good shape and in no need of an improvement or change of i tools of inquiry.

> The testimony which you bear to the coincidence of my speculations on the local effects of the go discoveries with your experience in Australia is very valuable: perhaps I might make bold to say considering that they were the speculations of one who had never visited that country – that it ad something to our grounds for confidence in the essential soundness of economic science as it cultivated in the u.kingdom [sic]. (PC 3: 22–23)

But Jevons did not think as highly of the “essential soundness” of political economy. From the ear 1860s onwards Jevons attempted to redefine the boundaries created by Mill and Cairnes. Cairn responded favourably to statistical studies authored by Jevons, but became sceptical when Jevon work touched on theory.

In his lectures on the method of political economy, Cairnes observed that “every economist, so soo as an economic fact has been traced to a mental principle, considers the question solved.”(Cairne 1965, 179) He was critical of two authors in particular who transgressed the lines drawn by Mi Richard Jennings and Henry Dunning Macleod. Both men claimed that the ultimate foundations of t laws of political economy were to be found in man’s physiological constitution. But if authors lik Jennings and Macleod considered political economy to consist in the study of man’s “afferent trunk nerve-fibre” it was “evident” that political economy would soon “become a whole different stuc from that which the world has hitherto known it”(Cairnes, 1965, 231).

In the early 1860s, and in notable contrast to Cairnes, Jevons enthusiastically embraced Jennings suggestion to ground the laws of political economy in man’s physiology. In the *Theory* he would wri that Jennings “most clearly appreciated the nature and the importance of the laws of utility” b treating the “physical groundwork of Economy, showing its dependence on physiological laws” (187 65). While Cairnes dismissed Jennings’s suggestion to “exhibit” the “result of the principles of huma nature … by the different methods of Algebra and Fluxions,” Jevons considered this “a cle statement of the views which I have also adopted” (1871: 18).

In February 1860, he wrote in his diary that he had arrived at a “true comprehension of *Valu* regarding which I have lately very much blundered” (PC 7:120). Immediately preceding this rema we find Jevons “reading up the *Nervous System*,” a plausible reference to Marshall Hall’s *Memoirs the Nervous System* of 1837 (White, 1994a). In June, Stanley Jevons famously wrote to his broth Herbert that he had found the decisive elements of his new theory of utility, especially “the mo important axiom” of the declining degree of what he then called the “ratio of utility,” on th assumption that, “on an average,” this ratio of utility was “some continuous mathematical function the quantity of commodity”Jevons (LJ: 151).

In the *Theory*, Jevons approvingly referred to Jennings’ suggestion that “sensations vary in degr with changes in quantities.” According to Jevons, political economists had assumed this law “und the more complex form and name of the Law of Supply and Demand” (LJ: 151). Thus, Jevon engagements with psychophysiology and his attempt to mathematise the theory of value we intimately connected. Jevons used Bentham’s felicific calculus to formulate his theory of pleasure an pain, but psychophysiology helped Jevons to think of these feelings in functional form. Degrees pleasure, diminishing inversely with quantities consumed, explained market prices.

Jevons gave two examples how numerical precision could be given to his theory. The first was small table of prices and quantities of wheat that went back to the political arithmeticians Grego King and Charles Davenant, the second (self-)experiments on work and fatigue that he first publish in *Nature*. Both examples show the same attitude to research Jevons had shown during his Australia years. Throughout the nineteenth century, the King-Davenant table had served as a reference point discussions about the possibility of mathematising political economy, for example, for Thomas Took and William Whewell but also for Cairnes (Creedy, 1992). Jevons showed how this table could giv numerical exactness to the notion of the final degree of utility, the “all important element of politic economy,” and so how statistical data could give precision to theory (Stigler, 1994; White, 1989 These examples thus explicitly challenged those “uninquiring and unhoping spirits” – Mill an Cairnes – who despaired about the possibilities of measurement and mathematisation in economic

As his examples aimed to show, the fact pleasures and pains were weighted "in the bosom of th mind" did not prevent economics from becoming a mathematical and exact science.

Indeterminacy in Exchange

Jevons' first airing of his new mathematical theory of value was the short *Notice* of 1862 that was rea in his absence to the British Association for the Advancement of Science (BAAS) and published i 1866 as the *Brief Account*. Jevons felt prompted to write down an extended version of his theory aft William Thornton's challenge to the classical wages fund theory in 1867 and the ensuing debate. Th debate would also colour the reception of Jevons' *Theory*.

The context of Thornton's intervention was the controversy about the role of trade unions in th economy. Most political economists were of the opinion that the collusion of workmen in unio would only disturb the working of the labour market, and would not lead to a permanent rise of th wage rate because of the Malthusian "iron law of wages." At the time, this principle was expressed Mill's version of the wages fund theory, which said that the wage rate followed from the availab fund for the payment of wages divided by population.

Thornton argued that classical political economy was wrong in assuming that wages wou necessarily be pushed to subsistence level. While political economists assumed that the law of supp and demand would automatically lead to one price, some well-chosen examples helped to show th prices could be indeterminate. The upshot of his argument was that there was no unalterable wag fund that resulted in wages being pushed back to their minimum level, but that this fund, the capit from which wages were paid, was itself subject to change. This offered trade unions the opportunity bargain for higher wages, a conclusion that was in marked contrast with the received opinions political economists.

At the time, rightly or wrongly, the wages fund theory was considered central to classical politic economy, and when Thornton's challenge led to Mill's famous recantation of the theory, th provoked vehement debates as to the character of the "law of supply and demand." Jevons' extensiv exchange of letters with the engineer H. C. Fleeming Jenkin on the subject was the immediate reas to speed up publishing an extended version of his mathematical theory of utility of which his *Bri Account* of 1866 had only given a glimpse. When Fleeming Jenkin published his "Graphic Representation of the Laws of Supply and Demand" in 1870, Jevons clearly feared that he would lo the opportunity to publish his mathematical theory first, and as a result, in just half a year l completed the *Theory*.

In his *Essay* of 1836 Mill had relegated the "laws of the consumption of wealth" outside the doma of political economy. Jevons, by contrast, made these "laws of human enjoyment" the cornerstone his new theory. To articulate these laws, Jevons used Bentham's felicific calculus, but he grounde this calculus in man's physiological dispositions. Rather than thinking of pleasures and pains motives on which the mind decides, Jevons transformed them into physical forces that drive mechanical balance to equilibrium. The cover image of this edition sums up the main characteristi of Jevons' theory. Two utility curves for two commodities x and y of one person ("trading body") a superposed and inverted upon one another. The final degree of utility is pictured vertically (though n axis is drawn), with commodities on the horizontal. The diagram shows how one person would make net gain in utility by extending trade from a′ in the direction of m, and would lose in utility wh trading beyond that point. Hence, there emerges an equilibrium for this individual at m.

This balancing model was taken to represent the individual's balancing of pleasures and pains at th margin. As Jevons put it in the *Theory*: "the will is our pendulum and its oscillations are minute registered in the price lists of the markets." This theory enabled Jevons to state relative prices in term

of marginal utilities. But Jevons could only do so on the assumption of the "law of one price," exact
the condition Thornton had problematised in his criticism of Mill's wages fund theory. As a result h
was unable to contribute to the contemporary debate on price formation; this had been pointed out
him in correspondence with Fleeming Jenkins. Jevons' theory did not explain price formation; rathe
it only showed how individuals adjusted demand and supply at a given price.

It was therefore quite understandable that his contemporary economists did not quite know what
make of the book. If it only rearticulated prices in terms of utilities, but did not actually solve th
problem opened up by Thornton's intervention, then what exactly was its contribution? It did not he
that Jevons limited the scope of his book to statics, while "the real condition of industry is one
perpetual motion and change." In the "purely static case" economic agents – "trading bodies"
exchanged fixed amounts of commodities at a given price until they reach equilibrium. How they d
so remained unexplained, and it fell to next generations of economists to tackle that question. B
Jevons had changed the tools to do so.

Jevons' Investigative Spirit

Jevons drowned near Hastings on 13 August in 1882 at the age of only 47, leaving his wife, Harri
Taylor, and three young children. At the time he was working, amongst others, on his *Principles*
Economics, a book that even in its unfinished form shows the continuities with his scientif
endeavours in Australia. In retrospect, it is undeniable that the theory of utility brought Jevons th
fame he had hoped for. The publications dating after the *Theory* (1871) and *Principles of Scien*
(1874) are generally considered of less importance. During the 1870s Jevons turned his attention
the study of the business cycle, in which he attempted to establish a causal connection between sol
activity and commercial crises. Though not as far-fetched as sometimes thought (the famou
astronomer William Herschel, John Herschel's father, had in fact voiced similar ideas in the earl
nineteenth century), the causal mechanism and the statistical evidence were problematic an
increasingly cast doubt on the whole enterprise. Jevons also wrote a number of highly successf
primers; the primer on logic went through numerous reprints (up to 1931), and his *Money and th*
Mechanism of Exchange (1875) sold very well too. Jevons also worked on the second edition of th
Theory, which appeared in 1879 and which contained an extensive survey of precursors
mathematical economics.

In *The State in Relation to Labour* (1882) and a posthumous collection of essays on social refor
(1883), Jevons engaged with the social and political issues of his day, issues that had been close to h
mind from his formative years in Australia. At the end of the 1870s he wrote a number of veheme
attacks on Mill's philosophy that, given the towering status of Mill as a political economist an
philosopher, actually harmed Jevons' own intellectual status. Having moved from Owens College
University College, London, in 1876 to take up the professorship in political economy, he resigned
1880, partly because of problems of health, but more importantly to be able to devote all his time
writing. His untimely death in 1882 left his last large project, the *Principles of Economics*, unfinishe
It was published, with some additional essays, in 1905.

Jevons' statistical work in the 1850s and 1860s, his imaginative, but among economis
unfortunately less well-known, work in formal logic, published as *Pure Logic, and Other Minor Wor*
(1890), his *Coal Question* (1865) that I only touched upon briefly, and his *Theory of Politic*
Economy and *Principles of Science* stand out as landmark contributions to economics and to th
philosophy of science. A genuine Victorian polymath, Jevons worked in many different fields of th
sciences, that he all engaged in the same investigative spirit.

Jevons' belief in the power of mathematics to capture the mechanism of the subject under stud

irrevocably altered the image of economics, and is perhaps still with us. In many of the sciences, satisfactory explanation nowadays requires the description of a mechanism, and economics is n exception to this. Robert Lucas once described economic theory as providing an "explicit set instructions for building … a mechanical imitation system" (1980, 697). In retrospect we may hear th echo of Jevons' approach to economics in these words.

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