

# Introduction

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## Introduction

William Stanley Jevons was one of the great Victorian polymaths, his published work encompassing political economy (economics), logic, statistics and the epistemology and methodology of science. This collection focuses on his work in political economy, including texts which are both theoretical and applied in their content. This is appropriate because Jevons is remembered today for his innovations in both theoretical and statistical work in economics.

The principal reason for publishing this collection is that a number of Jevons' key political economy texts are now very difficult to obtain. For example, it is extremely difficult to obtain copies of the first edition of his principal theoretical work, the *Theory of Political Economy (TPE)*, first published in 1871, and of the more applied *The Coal Question*, first published in 1865 and although the later editions have been more accessible, most of those are also out of print. Yet a comparison of the different editions is necessary to understand and explain the ways in which Jevons modified, altered and added to his arguments over time. In the case of *TPE*, three editions (one edited by his son) are reprinted here to facilitate such comparisons. The only edition of *The Coal Question* available for some time was that edited by A.W. Flux, published in 1906. That edition both changed and added a good deal of new material to the original work so that it is sometimes difficult to identify Jevons' arguments. This collection thus makes available the very rare first edition of that text.

Jevons' training and work in aspects of physics, and especially chemistry and meteorology, can be seen in the Bibliography of his published work reproduced in this volume. A particular feature of his

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work in political economy was his use of that training in generating new concepts and frameworks of analysis, two aspects of which can be noted here. The first was in the *Theory of Political Economy*, where Jevons presented a new approach to value and distribution using metaphors from mechanics. That text, in conjunction with the work of Leon Walras, laid the analytical groundwork for what subsequently was termed microeconomics. The second aspect was in his analyses of commercial fluctuations (today: business cycles). Here Jevons used his training in meteorology in both graphing complex groups of economic variables and in using statistical techniques to analyse them.

While Jevons' work encompasses texts of a theoretical and applied form, it is also important to note that he wrote for a wider audience than those interested in some of the more technical work referred to above. This collection thus includes his collection of essays, *Methods of Social Reform*, where Jevons discussed questions of political economy in a far broader framework than that considered, for example, in the *Theory of Political Economy*. The general theory which he used in all his work, to both analyse and suggest policies for social phenomena, was a particular version of utilitarianism. The *Methods* uses this approach in considering a number of contemporary policy questions while not restricting itself to political economy questions. Perhaps the most detailed explanation of Jevons' utilitarianism as applied to policy questions can be found in *The State in Relation to Labour*, first published in 1882. Here, although specifically concerned with questions regarding labour (working conditions and the distribution of income and wealth), Jevons provided a detailed rationale for his use of utilitarianism both to analyse issues and to prescribe associated policies.

Jevons' attempts to discuss issues of political economy for a wider audience can also be seen in two other texts reprinted in this collection. The first is in his *Political Economy* (1878), a rather rare text today, which was composed for teachers and pupils in secondary schools. This little book was important also because it explained a number of concepts which he used but did not explain in his *Theory of Political Economy*. The second is his *Principles of Economics*, which was incomplete at the time of Jevons' death. Because of difficulties with assembling the text and problems associated with the first editor, this text was not published until 1905, edited by Henry Higgs. There has sometimes been a tendency to characterise the *Principles* as unimportant because of its incomplete form. It does, however, contain some valuable information regarding Jevons' initial work in political economy from the 1860s and his later work. The volume is also important because it reprints a number of

pamphlets and talks by Jevons, which both amplify his theoretical approach and provide a clear illustration of how he thought that approach should be applied to policy questions.

### Jevons' Life<sup>1</sup>

William Stanley Jevons was born in Liverpool on 1 September 1835. His family was Unitarian and part of a large group of intellectual and progressive families knotted together by intermarriage. His father Thomas Jevons (1791–1855) was an iron merchant who combined the practical sense of a man of business with much intellectual curiosity and a flair for invention. His mother, Mary Anne Roscoe (1795–1845), grew up in an intellectual and artistic milieu and showed much interest in poetry, chemistry, logic, botany and political economy. She died in 1845, when Jevons was ten years old. His elder sister, Lucy Jevons (1830–1910), became a substitute mother, supporting Jevons morally and encouraging him in his intellectual development. He was, however, much closer to his younger sister Henrietta (1839–1909): they both loved music, exchanged their ideas about religion and shared their emotions. Henrietta (Henny) lost her mental balance in 1869, a few months after the death of Jevons' oldest brother Roscoe Jevons (1829–1869). Roscoe was interested in poetry, chemistry and mathematics and should be seen as a major intellectual influence on young William Stanley. Unfortunately, he became insane shortly after his mother's death. Another brother was Herbert Jevons (1831–1874). Herbert had bad health, was unable to settle to a career for many years, and finally became employed in New Zealand, where he died at the early age of forty-two. Jevons' youngest brother Thomas or Tommy (1841–1917) is portrayed as a very intelligent but somewhat lazy young student. He emigrated to America and became a successful businessman.

The early death of his mother and the mental and physical illnesses of his brothers and sisters left their mark on the development of the young Jevons. The so-called railway boom crisis of 1847 should also be

1. Most of the biographical information contained in this chapter is derived from Könekamp (1962, 1972), the daughter of Jevons' eldest son. Other shorter biographical surveys include Keynes (1936b:109–12), Schabas (1990:12–30), Peart (1996:1–4), Black (1987), Alvey (1982:351–3) and H. W. Jevons (1934). Much biographical information can also be derived from Jevons' published diary and letters (seven volumes edited by R. D. C. Black, see Black (1982) for more information on these volumes). His wife Harriet A. Jevons edited a volume with extracts from his journal and letters, which was published in 1886. The work of Harriet A. Jevons after Jevons' death is investigated by Könekamp (1982).

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seen as an important event in his life, as it caused the bankruptcy of his father's firm. The railway crisis resulted from the pressure of increasingly vast accumulations of capital for investment; the capital glut encouraged bad investments and therefore the production of capital-absorbing railways was growing at a high rate. When profits remained absent, railway production was checked and the demand for iron, which had grown during the 'railway boom', fell dramatically. The Jevonses were some of the unfortunate iron merchants driven into bankruptcy.

William Stanley Jevons went to University College School in London in 1850, at the age of fifteen, and in 1851 he became a student at the University College. He remained there until 1852, but did not finish his education. Instead, he accepted the position of an assayer at the Australian Mint (see below). He studied chemistry under Graham and Williamson, two pioneers in the development of atomic theory and the theory of molecular motion. Chemistry remained important during Jevons' life, and he even published two papers on Brownian Motion in 1870 and 1878. Another major influence at University College was Augustus De Morgan (1806–1871), with his courses on mathematics and logic. Jevons' own approaches to scientific method, probability, logic and mathematics were influenced by De Morgan. Jevons had also a lively interest in botany, which probably stemmed from his mother. Jevons' interest in political economy is not surprising, given his non-conformist intellectual and family background, but it can also be explained by the context of economic development he lived in, with both its dark and good sides. We already mentioned above Jevons' 'hereditary reasons' for not overlooking business fluctuations, as many members of his family had been bankrupted. But London's situation in the early 1850s as such already encouraged an interest in social and economic life. Outbreaks of cholera and bad sanitary conditions came to light as major social problems. Könekamp writes about the 'sanitary age' and states that Dickens' propaganda for sanitary and social reform influenced Jevons, who was brought up in Unitarian circles concerned with social improvement. Jevons undertook long walks through the poor and manufacturing parts of London. But the 1850s were years of rising British economic power as well, reflected in the Great Exhibition of the Works of All Nations, held in 1851. This exhibition quickened the pride of everyone, and Jevons visited it several times. It probably aroused Jevons' interest in 'the industrial mechanism of society' which also dates from 1851 (see Jevons' remark in Jevons 1905:vii). All those contextual elements help explain why much of Jevons' economic work is concerned with business cycles, economic growth and decline, and improvement of social conditions and education.

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Jevons left University College without taking his degree. He planned to go into business in Liverpool at the end of the 1853 session. In his diary entry for January 16th 1853 he elaborates on his willingness to pursue a business career and to continue his education in his spare time (Black & Könekamp 1972:77–80). His dream was to collect financial means in his business career, and then to retire and to devote the rest of his life to scientific inquiries. His father regarded these aspirations as somewhat illusory. In this context, the lucrative job offer as an assayer came up. Jevons was not at all keen to leave for Australia, but the interesting salary of an assayer would lighten the financial burdens of his family.

Jevons sailed from Liverpool on 29 June 1854, and he arrived in Melbourne on 6 October. At first his financial position was rather tight, but this changed in January 1855 when he was offered full-time employment at the Mint. At first Jevons found the assaying business exciting: he experimented and even wrote an article on 'Gold Assay' which appeared in Watt's *Dictionary of Chemistry* (1864). However, after April 1855 it became a sinecure and he devoted much more time to other scientific investigations. Jevons' 'science of man' project entailed an interdisciplinary utilitarian approach to different aspects of individual and social life. His work covered many different areas, as is shown by the bibliography collected by Inoue and White (1993) and reproduced in this collection: railway policy, meteorology, protection, land policy, cloud formation, gunpowder and lightning, geology, etc. Jevons established a detailed meteorological account of Australia and studied the city of Sydney, and not surprisingly the problem of sanitation received a central place in these investigations. Another study in this context is Jevons' work on 'division of labour' and 'classification of occupations': Jevons wanted to investigate how the interaction of different kinds of labour resulted in 'the industrial mechanism of society'. Much has been written about Jevons' early influences in Australia. An important road to Jevons' political economy may be the 'railway discussion' to which he devoted three articles. According to Jevons, the extension of railways is acceptable only if the gains are in accordance with the outlays, and this should be measured by people's willingness to pay higher fares. It is clear that this applies to the case of direct benefits, but Jevons states that the same must hold true for so-called indirect benefits. If people are not willing to pay higher fares, then it proves that they do not see possible indirect effects in the future that would justify higher expenses in the present. Insolvent railways would mean 'unproductive expenditure' and a public debt, and this would limit

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the productive powers of the country.<sup>2</sup> Jevons' 'science of man' project not only included his surveys on the mechanism of society, the division of labour and social and moral improvement through the establishment of sanitation, but also an investigation of the role of art and especially of music in a person's life (Mosselmans & Mathijs 1999).

Jevons left Australia in 1859 and returned to University College in London to complete his education. The justification for his departure home is couched in economic terms regarding 'preparation' and 'performance' or even (human) 'capital' and 'labour'. It is better to spend some years in acquiring skills than to start hammering at once, and Jevons would like to continue his education in order to receive a higher social position in the future (Black 1973:359–60). The early 1860s are important for Jevons' intellectual development, and he reports in his diary that he received significant insights in both economics and logic: a 'true comprehension of value' (Black 1981:120, La Nauze 1953) and the 'substitution of similars' (Black 1972:179, Mosselmans 1998).

Jevons received his MA degree in 1862, and was awarded the gold medal 'in the third branch' which included logic, moral philosophy, political philosophy, history of philosophy and political economy. He became a member of the Volunteer Movement, a 'home guard' formed to oppose the French armies of Napoleon III in case of an invasion. Jevons wanted to be a publicist and earn his living by writing and publishing articles; he must have had in mind the ease with which he contributed to the Australian press. It proved to be more difficult than Jevons expected: most of his contributions were rejected. All his articles appearing in journals in 1862 were concerned exclusively with meteorology and natural science (see Inoue & White 1993:128–9). He published two diagrams at his own expense, but they did not receive much attention. The first diagram shows "all the Weekly Accounts of the Bank of England, since the passing of the Bank Act of 1844", and the second diagram depicts "the Price of English Funds, the Price of Wheat, the Number of Bankruptcies, and the Rate of Discount, Monthly, since 1731". Both diagrams were updated and reprinted in *Investigations in Currency and Finance* (see Volume 7). Jevons presented two papers at the 1862 meeting of the Economic Science and Statistics Section of the British Association: "On the Study of Periodic Commercial Fluctuations" and his famous paper "Notice of a General Mathematical Theory of Political Economy". This latter paper can be seen as a summary of his later work *The Theory of Political Economy*, first published nine years later.

2. See Jevons' letters from 19 July 1856 (Black 1973:235–7), 10 February 1857 (Black 1973:262–8) and 7 April 1857 (Black 1973:282–7).

Neither paper received much attention, and Jevons was very disappointed by this lack of interest (see Black 1962).

In 1863 Jevons was appointed as a tutor at Owens College, Manchester, and finally his financial worries came to an end. It must have been a rather difficult job, as it included giving tuition to backward students, and the general standard of the students was rather low. At first Jevons did not like Manchester's smoky environment at all, but he could appreciate the city's "distinguished literary position".<sup>3</sup> Jevons visited many libraries, started an impressive collection of private books and undertook much bibliographical work.<sup>4</sup> 1863 was not only the year of his appointment to Owens College, it is also the starting point of his successful publication career. In 1863 *A Serious Fall in the Value of Gold* was published (reprinted in *Investigations in Currency and Finance* (see Volume 7) ), and for the first time Jevons became recognised as a political economist. In 1865 *The Coal Question* appeared (see Volume 9), a work which was quoted by John Stuart Mill in the House of Commons. Jevons was appointed lecturer in political economy and logic for the 1865–6 session at Owens College, and could therefore resign his tutorship.<sup>5</sup> He disliked teaching in Manchester, but it served as a means to overcome his fear of speaking in public. The evening classes were especially hard and they took place in unhealthy conditions. Moreover, Jevons seriously damaged his health because he would not let his teaching interfere with his research. Black (1993:175–6) argues that precisely Jevons' attitude towards research should be seen as an improvement regarding the institutionalisation of economics at British universities. Like his cousin, H. E. Roscoe, Jevons pursued the 'new academic policy of research' that resulted in the conception of a university as something more than simply a teaching institution.<sup>6</sup> Jevons' research resulted in two important

3. Jevons' period in Manchester has been investigated by Chaloner (1972). Black (1993:171–9) provides much information on Jevons' activities as a teacher in Manchester.

4. A result of this bibliographical work is Jevons' impressive (partly annotated) bibliography of logic, to be found in the John Rylands University Library of Manchester (JA6/5/11–220).

5. During the 1864–5 session, Jevons held a 'small professorship' in logic, mental and moral philosophy at Queen's College, Liverpool. He combined this activity with his tutorship in Manchester. See (Black 1993:173–4) for more details.

6. Black (1993:182) continues by arguing that Jevons should be seen as a transitional figure not only in both economic theory and policy (see below), but also in the process of the institutionalisation of economics at British universities. He was trained outside the ancient universities, but had a career as a teacher of political economy in the new university colleges.

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works in the history of science: *The Theory of Political Economy* (1871) (see Volumes 1,2 and 3 for the editions of 1871, 1879 and 1911) and *The Principles of Science* (1874).

In 1867 Jevons married Harriet A. Taylor, and they subsequently had one son and two daughters. He and his family moved to London in 1876, on his taking up a chair at University College. The fact that Jevons accepted a loss of income as a result of this move indicates that he did not take the new job in London out of professional ambition. On the contrary, for health reasons Jevons wanted less responsibility (Black 1993:180). Moreover, he had always wanted to live the life of a 'literary man', and this was only possible through a reduction of teaching responsibilities. London was also a literary centre, and Jevons liked having libraries and publishers within reach. In 1878 Jevons published two works written for a larger audience: *Money and the Mechanism of Exchange* (Volume 4) and *Political Economy* (Volume 5). In the last period of his short life Jevons focused on his well-known sunspot theory (several articles are published in *Investigations in Currency and Finance*, Volume 7) and on social reform (e.g. *The State in Relation to Labour*, 1882, see Volume 5). Rosamond Könekamp describes the circumstances of his death: "Jevons's life was ended by a tragic accident; he was drowned near Hastings on 13th August, 1882, when nearly 47. (...) He was drowned on almost the last day of his stay at the seaside with his family. He had loved swimming since childhood, but his health was not good at this time and he knew he should not bathe. (...) However, as the last day drew near he could no longer resist, and he did go for a bathe without telling his wife. No one saw what happened, but the sea was quite rough at the time, and his strength cannot have been equal to it" (Könekamp 1962:272–3). *Methods of Social Reform* (1883) (Volume 6) and *Investigations in Currency in Finance* (1884) (Volume 7) are posthumously published collections of earlier essays. In 1905 Jevons' unfinished manuscript *The Principles of Economics* (Volume 8) appeared.

### **The Theory of Political Economy**

Although Jevons published a good deal of work on applied economics (see below), he is still best known to economists for his *Theory of Political Economy* (1871; 1879). This set out his basic theoretical explanation for the relative prices of commodities (involving the question of 'value') and the distribution of output as income. While the analysis showed some degree of theoretical continuity with the work of his predecessors, such as John Stuart Mill, it rested on four components which together

constituted an analytical break with preceding discussions of value and distribution. The four components were characteristic of what subsequently became known as 'neoclassical' or 'marginalist' economics.

The first was to represent economic behaviour as a type of mechanics. In formulating the theory as "the mechanics of utility and self-interest" [Jevons 1879, p.XX], Jevons drew on his training and work in particular aspects of the natural sciences. The nub of *TPE* was formulated between 1860 and 1862, when Jevons made behaviour analogous to 'forces' in physics, such as those for gravity. By 1871, he regarded his approach as broadly consistent with the new physics of 'energy', which had been developed since the 1850s (Schabas; Mirowski).

The second component was the extensive use of mathematics which, for Jevons, meant the calculus and the mid-Victorian representation of Euclidean geometry. The mathematics were necessary for the third component which was the representation of behaviour and market activity in functional forms. The functional approach was consistent with the underlying stimulus-response 'model' of behaviour. Adapting the utilitarian theory of Jeremy Bentham, Jevons argued that all behaviour was driven by the pursuit of pleasure (utility) and the avoidance of pain (disutility). Given the assumption of wealth maximisation, economic activity was depicted in terms of equilibrium positions where there was a 'balance' of marginal utility and disutility. While the motive 'forces' referred to individual behaviour, individuals *per se* played no part in the analysis, as the theory depicted 'representative' or 'average' economic actors who did not actually exist. Jevons claimed, however, that, statistically, an average of aggregate behaviour – the 'fictitious mean' – would mirror the behaviour depicted in the theoretical model. It should be noted that while *TPE* assumed actors were driven solely by the maximisation of wealth, Jevons made clear that wealth was only one aspect to be taken into account when assessing the results of economic policies and the overall social utility of human actions.

The fourth component of the analysis was to recast the theoretical problem posed in a value and distribution analysis. For Jevons, the 'problem of economics' was to maximise the utility of the output obtained from a set of given resources: "Given, a certain population, with various needs and powers and production, in possession of certain lands and other sources of material: required, the mode of employing their labour which will maximise the utility of the produce" (Jevons 1879a:267). In depicting economic activity as a form of constrained maximisation, Jevons illustrated the importance of the physics metaphors which underpinned *TPE*. At the same time, the statement above

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announced a substantial departure from the work of his predecessors for whom variations in population, explained by some form of the Malthusian 'population principle', were an integral component of a theory of value and distribution. It should be noted that while the population principle was reduced to a parameter in Jevons' core analysis, he used the principle elsewhere, as in *The Coal Question* when explaining a series of possible long-period changes in the economy.

Jevons presented the analysis of the *TPE* in seven chapters. After an Introduction, which defended the use of mathematics and alluded to some of the difficulties in statistically 'verifying' the analysis, chapters II and III set out the utilitarian theory of behaviour and its application in the form of the marginal utility theory to explain the consumption (or purchasing) of commodities. Chapter IV used that theory to discuss trading or exchange in a market period, where the supply of commodities was given. In the basic model, exchange took place between 'trading bodies' in wholesale markets such as for raw cotton and wheat. In general, such markets were deemed to be 'perfectly' competitive in that all commodities were homogenous and there were no restraints on trading with large numbers of transactors. At any moment, brokers set a uniform price, which Jevons called 'the law of indifference', although the price would change with each set of trades. The equilibrium condition then entailed that the ratio of exchange for two commodities would equal the reciprocal of the ratio of the marginal utilities of the commodities (Jevons 1879a:95). The marginal utility ratio would in turn equal the commodity price ratio. The formulation of the equilibrium condition was a striking example of Jevons' use of mechanical metaphors. As he explained in the second edition, it was based on that for a lever (or 'balance') in static equilibrium.

The remainder of *TPE* was principally concerned with long-period positions toward which the economy would tend in a series of market periods. Chapter V dealt with changes in production levels (and hence changes in supply conditions for different market periods), describing a long period position where the ratio of the cost of production of commodities was equal to their marginal utility and price ratios. This analysis of cost of production, which appeared in the second edition, now appears odd, for the only costs considered were those of labour although the workforce was clearly working with raw materials.

The last three chapters outlined Jevons' distribution analysis. Chapter VI explained that rent, the return to owners of land used to produce raw materials, was not part of the cost of production as it was price determined. It depended on the relative fertility of the land with the last

unit employed paying no rent. This was, as Jevons acknowledged, a result very similar to that of his predecessors. Chapter VII then provided an explanation of the rate of interest on capital in a highly original, if flawed, analysis. Interest was the return for abstaining from consumption in providing capital which increased productivity by lengthening production periods. 'Free' capital was defined as a sum of money or a bundle of commodities used to maintain the workforce for constructing an investment project. The amount of capital invested would, however, depend on both the quantity of capital and the time for which it was invested. The rate of interest, which would tend to equality across the economy due to competition, depended on the rate of increase of output compared with the amount of capital invested. Because output would increase at a decreasing rate, the interest rate would tend to fall. Jevons regarded this as a statistical 'fact'. The analysis assumed a given workforce whose share of the output produced was depicted as a residual, depending on the amount of capital invested.

Jevons drew on that explanation in the last chapter when he summarised the distribution analysis. In a long-period position with given prices and rent put to one side as price-determined, the distribution of the remaining output was explained in a sequence with the interest rate determined first. Investment in new industries or products would initially produce above average returns, but these would be reduced under the pressure of competition from new investments, reducing the interest rate to a competitive minimum. While wage rates would initially depend on the state of competition in an industry, in the long run wages would depend on the demand and supply for different types of labour. This meant, according to Jevons, that "the competition to obtain proper workmen will strongly tend to secure to the latter all their legitimate share in the ultimate produce ... Every labourer ultimately receives the due value of his produce after paying a proper fraction to the capitalist" [Jevons 1879, pp.XX]. Jevons was dissatisfied with that analysis and, in the Preface to the second edition, he announced a new approach, where rent would form part of the cost of production and wages would be explained in analogous terms. A detailed explanation of this approach would have necessitated recasting much of the text, but that task was never undertaken. It may have been described in the *Principles of Economics*, but that text was largely unfinished when Jevons drowned. Some hints regarding the wages analysis can, however, be found in *The State in Relation to Labour* (1882).

The second edition of *TPE* was important not only for signalling a new approach to distribution but also because Jevons considerably expanded

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the text, explaining concepts and arguments which were only hinted at or briefly referred to in the first edition. Of particular importance, as was noted above, is his explanation of how his basic equation of exchange was taken from that for a lever in static equilibrium in mechanics. Other passages were added dealing with, for example, cost of production and a long-period equilibrium position for the economy (chapter V). In the fourth edition, also reprinted here, his son, Herbert Stanley Jevons, added a number of editorial comments to the text and three new Appendices. One Appendix consisted of a series of notes on capital which Jevons had intended for publication in the *Principles of Economics*. These notes, which had apparently been overlooked, serve to reinforce the point that *TPE* was by no means a complete statement of Jevons' approach to value and distribution.

It should also be noted that *TPE* was incomplete in another respect as a number of important concepts and arguments were not explained. For example, Jevons insisted that his marginal utility theory of exchange provided the analytical basis for 'the laws of supply and demand', but did not explain what he meant by those laws. Again, he argued that labour was 'the first element of production', which underpinned his odd definition of cost of production as consisting of labour costs alone. He did not explain why that was the case and why capital was of subordinate importance. An explanation for those matters can, however, be found in his primer, *Political Economy*, and in the *Principles of Economics*. Jevons apparently considered the explanations to be so 'obvious' or elementary that they could be omitted from *TPE*. The meaning of the arguments is certainly not 'obvious' today and yet they are essential for understanding a number of Jevons' arguments. The *Primer* and the *Principles* also help explain a number of other aspects of Jevons' approach, such as what matters could be included in the 'science' of political economy, a topic only briefly discussed in *TPE*. Further examples of the same point could be given regarding Jevons' analysis of 'value' and the distribution of wealth. Further discussion would, however, only serve to reinforce the conclusion that that the *Primer* and *Principles* help explain key topics in *TPE*. There has sometimes been a tendency to regard the *Primer* and the *Principles* as 'minor' texts which are of little importance in explaining Jevons' basic theoretical approach to value and distribution. A more fruitful approach would be to regard the three texts as one set, with the two less 'abstract' texts providing a series of keys for understanding concepts and arguments which, for differing reasons, Jevons omitted from *TPE*.

## Monetary Economics and Business Cycles

### Methodological Achievements

Jevons' contribution to empirical economics is substantial (see Stigler 1982, Aldrich 1987, Morgan 1990). *A Serious Fall in the Value of Gold* (1863, reprinted in *Investigations in Currency and Finance*) computes index numbers using a geometric mean, which was a remarkable and novel methodology for Jevons' time. These calculations were then used to investigate the influence of the Australian and Canadian gold discoveries of 1851 on the general price level. Jevons justified the use of the geometric mean by arguing that multiplicative disturbances would be balanced off against each other. Since there was no empirical verification of this hypothesis, Stigler argued that the absence of a probabilistic analysis should be seen as an anomaly in Jevons' work. His *Principles of Science* (1874) contains, however, an elaborate discussion of probability: it enters when complete knowledge is absent, as a measure of ignorance.<sup>7</sup> Aldrich argues that Jevons used probability in two main patterns of argument. The first approach entails the application of the 'inverse method' in induction: if many observations suggest regularity, then it becomes highly improbable that these result from mere coincidence. In *A Serious Fall*, a large majority of commodities show a rise in price and thus a rise in exchange value relative to gold. Here, Jevons argued that a depreciation of gold is much more probable than mere coincidences leading to the rise in prices. The second approach was the method of least squares, which Jevons used when he gave more weight to commodities that were less vulnerable to price fluctuations. He thus tried to fit empirical laws starting from *a priori* reasoning about the form of the equation. Although these approaches show that Jevons had at least some concern for probability and the theory of errors, his analysis remains incomplete when judged by present standards. We should, however, keep in mind that Jevons was a pioneer in econometrics and that he worked within the limits of his mathematical understanding. *A Serious Fall* is not so much remembered for its limited use of probability theory, but rather for its construction of index numbers.

7. Jevons' explorations in economic methodology, statistics and probability are in close accordance with his contributions to logic and philosophy of science. See Mosselmans (1998) for a discussion of Jevons' 'extent in meaning in logic and economics'.

**Jevons' Monetary Economics**

Jevons' work on money and monetary economics can be found in many surveys and articles, most of them reprinted posthumously in *Investigations in Currency and Finance* (1884). A popular treatment of the subject also appeared in his *Money and the Mechanism of Exchange* (1875). Laidler (1982) argues that Jevons' ideas are in accordance with the monetary orthodoxy of his time, and that he should be considered conservative for defending the 1844 Bank Charter Act. This Act established a system of gold coin with convertible paper. Whereas the issue of convertible paper was regulated by the government in accordance with the bullion holdings of the Bank of England, most other banking matters remained unregulated. For Jevons, monetary institutions should be aware of seasonal fluctuations and business cycles and alter the amount of money in circulation accordingly to meet the demand of the public. All other forms of intervention should be avoided. Jevons favoured the gold standard over the silver standard: silver coins would be needlessly heavy; the natural course for prosperous nations was to adopt a single gold standard; and the gold supplies seemed to be sufficient to fulfil this role, whereas silver supplies were so abundant that they should be used for other purposes. Jevons argued that a double standard (of gold and silver) would be less exposed to fluctuations than a single standard, but preferred the gold standard for reasons of simplicity. Moreover, a bimetallic standard would revert to a silver standard because of the relative depreciation of the latter metal (Jevons 1884:278–303).

**Business Cycles and Sunspots**

Jevons first began serious work on the analysis of 'commercial fluctuations' (now termed business cycles) in a large unpublished work of the early 1860s which he called the "Statistical Atlas". Two principal results from this project appeared in 1862. The first was two large statistical diagrams (subsequently reprinted in *Investigations*), one of which dealt with the long term effects of changes in the price of wheat on economic activity. The second was a paper entitled "On the Study of Periodic Fluctuations", presented to the British Association for the Advancement of Science, dealing with a similar topic, albeit on a quarterly and annual basis. This showed average variations from month to month of the rate of discount, the total number of bankruptcies, the average price of consols and the average price of wheat over the last fifteen years. Jevons' study of business cycles was influenced by meteorology, another field to which he made significant contributions. This influence can be seen in

two ways. First, Jevons believed that commercial fluctuations were comparable to meteorological fluctuations, and suggested that similar methods and empirical techniques could be used in both cases. Second, Jevons looked for meteorological explanations of business cycles (the sunspot theory, see below). His work on business cycles is also connected with his work on monetary economics, as fluctuations in the money market receive an important place in his analysis. Jevons used averages to eliminate the influence of seasonal fluctuations. He argued that there was an excess of payments in summer, due to agriculture, building, outdoor trades and travelling: more wages were paid and money was used for buying harvest produce. Many labourers did not use banks, and would hold (in the aggregate) considerable amounts of cash, especially of metallic money (which shows a greater variation than bank notes). At first this drain is met by the reserves of private firms and smaller banks, and these are replenished by the dividends that are paid in October. Normally the dividends are placed in deposit, but in October they are generally withdrawn. The Bank of England is therefore acting as a bank of last resort in this month. The note circulation decreases rapidly in November and December. Jevons argues that the system of restricted issuing is perfectly able to meet the problems caused by the annual cycle.

The next step in the development of Jevons' theory of the business cycle was taken when he looked for outward, meteorological, explanations of the cycle. In "The Solar Period and the Price of Corn" (1875) he investigated whether a statistical relationship could be established between the sunspot period and the prices of agricultural products. He first used English agricultural prices between 1259 and 1400, which were supposed to be almost completely determined by local (and thus weather) circumstances. While dissatisfied with the results, Jevons thought the survey revealed an influence of sunspots on the harvest. While Jevons argued that economic fluctuations were 'mental' in nature, such mood fluctuations should be explained by outward causes, and he suspected that the sunspots might be influential in that respect. In "The Periodicity of Commercial Crises and its Physical Explanations" (1878), he tried to prove that a decennial periodicity existed in the activity of trade between 1700 and 1870. The mental state of merchants and bankers was influenced by the success of the harvest, with a connection between the credit cycle and solar activity. Unfortunately it was impossible to detect a similar variation in the price of corn, because the climatic conditions were much too complicated and the success of the harvest depends on multiple causes. Jevons argued however that outside Europe, for instance in India, a clear decennial tendency was visible in

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periods of abundance and scarcity (Jevons 1884:187–200). “Commercial Crises and the Sun-Spots” (1878) has mainly the same content as the previous paper, but relies upon more evidence and the conclusions are extended. Jevons now argued that the recurrence of crises depends mainly on commerce with the East, and especially with India and China, where famines occur with the same periodicity as sunspots. The failure of harvests in the East leads to a reduced exportation of European goods. There is no relationship between the extent of manias or crises and the variation of foreign trade, but this variation forms the impulse for commercial changes in the West. “The impulse from abroad is like the match which fires the inflammable spirits of the speculative classes” (Jevons 1884:221).

Much has been written about the absurdity of Jevons’ sunspot explanation for business cycles.<sup>8</sup> Peart (1991) emphasises however that this theory is much more than a simple meteorological explanation of economic phenomena, because of Jevons’ attention to mood fluctuations. Price fluctuations due to harvest failures give rise to changed ‘moods’ of economic agents. This results in altered investment decisions that multiply the effect of the harvest cycle, especially when ‘mistaken’ decisions are involved. In any case, Jevons’ sunspot theory was not taken seriously by most of his contemporaries. The arguments were far-fetched and his ‘inverse method in induction’ – the numerical correspondence between business cycle and sunspots is too close to suggest a mere coincidence – did not convince his opponents. The assumption of a period cycle caused from outside the economy was unattractive to most economists and the empirical methodology was new and unusual in the 1860s and 1870s. Nevertheless, Jevons was one of the first economists to build theories utilising statistical regularities and relationships in the data. It was not until the 1930s that similar macroeconomic models were formulated in economics.

## Social Reform

In 1882 Jevons published *The State in Relation to Labour*, in which he elaborates on labour relations and legislation. In 1883 a posthumous collection of earlier essays on social reform and policy was published, entitled *Methods of Social Reform*. Both works were influenced by utilitarianism and Unitarianism. Utilitarianism appears when Jevons tries to evaluate policy measures according to the principle of ‘the greatest good

8. See Morgan (1990:21–6) for a discussion of the reactions of some of Jevons’ contemporaries.

of the greatest number'. Utilitarianism is visible in Jevons' vision of the goal of social policy and legislation: amelioration of working-class conditions through morally elevating policy measures that give rise to an improvement of working-class 'character' (see White 1994b). For example, Jevons (1879b:533) discusses the choice between building a free library and establishing a new racecourse. Jevons claims that an analysis of the effects of these measures using Bentham's categories (intensity, length, certainty, ...) shows that a free library delivers more pleasure than a race course. Peart (1990) remarks that this analysis is unclear and that Jevons' application of utilitarianism contains implicit value judgments "concerning the general development of society and the amelioration of working class conditions". This humanitarian orientation was quite common in intellectual middle-class circles in Victorian England, and especially among Unitarians (to which movement Jevons belonged). *Methods of Social Reform* contains several studies that justify policy measures directed to intellectual and moral improvement: establishment of libraries, suppression of the drink traffic in order to diminish drunkenness, establishment of museums (with all items put in a logical order). Jevons pleads for "experimental legislation": society is too complex for large reforms based upon an elaborate theoretical framework, and therefore each problem should be studied separately. Legislators should listen to specialists from different relevant fields and to the general public, and for each proposed policy measure costs and benefits should be balanced against each other. The result is a quest for incremental social reform based on practical wisdom and not on general abstract principles.

Jevons' writings on labour relations fit into this framework. Jevons is not opposed to trade unions as such, but he argues that their actions should be directed to the general good and not to the interests of a specific class or trade. For instance, by establishing entry barriers trade unions artificially limit the supply of a certain skill, and may therefore extract an additional scarcity rent that would disappear in the case of an entirely free market. Such a situation, where one trade would receive a larger share than is justified by economic theory, would therefore lead to an inefficient resource allocation. In this sense monopolistic trade unions are injurious to the consumers, and therefore to working-class people as well. High wages for hat-makers imply high prices for hats, payable by hat-wearers that are mostly members of the working class. A rise in wages for the plasterers would result in less demand for houses, which would lower the wages of bricklayers or carpenters. Workmen belong to the same class, but "they are and must be competitors". Moreover, preventing the surplus labour in one trade to enter another

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results in a decrease in producing power. Jevons concludes that a general increase in wages is impossible, and that monopolistic actions within one trade result in injury to the community in general and to working-class people in particular (Jevons 1882:106–9).

Jevons votes for heterogeneous co-operative positions instead, as these do not consist in making specific skills artificially scarce. A partnership binding together the interests of employer and workman should be the solution for the labour problem. The employer would advance only a subsistence wage to the labourer, enabling him and his family to survive during the period in between manufacture and sale. After this period, the labourer would receive his share in the surplus profits, or that part “beyond the necessary charges for interest, wages of superintendence, cost of depreciation of capital, reserve to meet bad debts, and all other expenses of production for which the employer can fairly claim compensation” (Jevons 1882:143–7). Industrial divisions should be perpendicular, not horizontal: the workman’s interests should be bound up with those of his employer’s. The workman will then become a shareholder of the firm (Jevons 1882:149).

In a lecture delivered to the Trade Unionists’ Political Association, Jevons identifies three different kinds of objectives of trade unions: (1) acting as insurance societies in favour of the unfortunate workmen; (2) rendering factories more wholesome and safe; (3) struggling with capitalists in order to raise wages. Only the last activity is illegitimate according to Jevons, as we saw earlier. In the case of insurance activities, trade unions should be organized by combining many grades of workmen and several branches of industry, as this may reduce the amount of selfishness and raise the notion of solidarity instead. Even more important is the second activity, because a single workman is mostly unable to enforce concessions from his employer concerning labour conditions. Workmen should unite in order to force employers to adopt policy measures that improve safety, but also to reduce working hours – especially regarding their children and wives (Jevons 1883:105–10).<sup>9</sup> In this sense trade unions may foster wealth, morality

9. It is clear that these activities would be harmful for the capitalists as well, but a struggle for higher wages would be injurious to the economy as a whole and to the labouring class in particular. It is clear that *The State in Relation to Labour* is written from a social and moral point of view, and it does not choose sides in the struggle between capitalists and labourers – rather, it denies the existence of this struggle. Everybody should receive his proper share of the produce, but the labour should take place in acceptable conditions. Insurance activities and improvements in safety are socially and morally acceptable, whereas actions devoted to an artificial increase of certain wages are not.

and intelligence, through an alteration of the attitude and the behaviour of the working class. Jevons refers explicitly to an encouraging saving, which would lead, in the long run, to a situation where workmen “may become in a degree their own capitalists” (Jevons 1883:120–1). Labourers are, due to the ‘character’ of the class to which they belong, less inclined to devote much attention to the future. Economic policy should try to change this labour class ‘character’ and thus encourage saving.

### The Coal Question

The signing in 1860 of the Cobden-Chevalier treaty, which prohibited the use of import duties on coal between Britain and France, was followed by claims that exporting coal to ‘the enemy’ would undermine British industrial supremacy as coal supplies would be exhausted. In 1863, however, the weapons manufacturer, Sir William Armstrong, argued that the relevant question was not the absolute size of coal reserves, but rather the increasing costs of extracting coal from deeper mines and thinner seams. It was this which would lead to decreasing international competitiveness (White 1991:229–30). Jevons used that argument as the basis for his analysis in *The Coal Question* (1865), a book which established his public reputation as an economist after it was cited in Parliament in 1866 by both John Stuart Mill and William Gladstone, the Chancellor of the Exchequer. The book contained an elaborate application of the ‘Malthusian’ population principle to an industrial economy. With population growth increasing with the prosperity of the country, which was, in turn, dependent on coal, the increasing costs of extraction would mean a loss of international competitiveness compared with low cost producers such as the United States of America. No other conceivable energy source was available and technological innovation would, by lowering costs, only increase coal use. As the growth rate fell, capital and skilled labour would emigrate, which meant, Jevons suggested, that Britain would become a nation of handicraft manufacturers. The British Empire, with its culture, science and traditions would thus be a period of “brief but true greatness” (Jevons 1865, pp.454–60).

This analysis was different from much of Jevons’ other work in political economy because it was concerned with a series of long periods in a specific historical setting. The timing of the Empire’s demise was clearly long-term, although Jevons was not particularly clear on the dating. What was evident in the first edition, however, was a rather apocalyptic tone. Subsequently, Jevons expressed less acute pessimism about both the extent of the decline of competitiveness and the effects

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on the economy. He continued to believe, however, in the general validity of the analysis. Just as Marx waited for the workers' revolution, Jevons waited for the effects of rising coal prices.

**Conclusion**

Jevons was a great polymath of the nineteenth century and his contributions to economics, logic and natural science are still regarded today as outstanding. It is therefore surprising to find that Jevons did not establish a real 'school' or followers, in the way that many economists and scientists did before and after him. One part of the explanation is certainly his early death. It is, however, also possible to find reasons that are related to the peculiar position of Jevons' work within the scientific context of his time. His methodological and statistical proposals were original and novel and it was therefore difficult to find contemporaries that recognised their significance. The limited availability of relevant statistical material further diminished the perceived usefulness of statistical methods, and the association of Jevons' empirical work with the sunspot theory of business cycles did not increase its respectability. Jevons' theoretical work received several critical reviews, which pointed out that he did not always pay enough attention to all the details and consequences of his arguments. The form of his particular enthusiasm for mathematics and mechanics was not shared by most other economists, and his *Theory of Political Economy* was superseded by the work of Alfred Marshall in his own country and the work of others (notably Walras) elsewhere.

Jevons was, nevertheless, an important model for the professional economist in the twentieth century, with his combined emphasis on theory, practice and policy and his academic attitude of combining teaching with scientific research. His work in such disparate fields as economics, logic and meteorology may have prevented him from working out all the precise details of his projects. On the other hand he gained a general image of science and methodology from his interdisciplinary research that would be a characteristic of later 'modern' economics. Jevons recognised that economics needs mathematical clarity and that statistics may serve as a means to bridge the gap between economic facts and theory. His intellectual heritage from the natural sciences (especially mechanistic physics and atomistic chemistry) inspired him to develop a mechanical exchange theory that examined static equilibria. His conception of atomistic 'trading bodies' and economic subjects as 'representative agents' was derived from

psychology, which, in conjunction with the calculus, Jevons used to formulate a theory of human behaviour in a functional form, an extraordinary development in the second half of the nineteenth century. The concept of 'utility', derived from the utilitarian tradition in moral philosophy (e.g. Bentham), entered the functional representation of human behaviour and replaced 'labour' as the determinant of value. His practical experience of an assayer at the Australian Mint improved his practical knowledge of economics directly, but it also led him to formulate important metaphors in his *Theory of Political Economy* (e.g. the balance). His work in the field of meteorology inspired him to study business cycles and time series and led to the development of important statistical tools (e.g. index numbers). *The Coal Question* relied heavily upon his knowledge of the physical characteristics of coal and should be seen as one of the first major works in the field of 'energy' economics. In his social writings Jevons examined the political consequences of his economic theory in a typically utilitarian fashion. Recent research has suggested other possible important influences on Jevons' economics (such as Darwin or Spencer's theory of evolution, his Unitarian religion and his early work on music theory), although further work is required to both explore and explain such links. Such work does, however, serve to emphasise that research on Jevons remains an important undertaking today and that it was his interdisciplinary approach which underlay many of his path-breaking achievements.