

Some Difficulties with Sunspots and Mr Macleod: Adding to the Bibliography of W.S. Jevons

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Abstract: This paper discusses and reprints two additions to the bibliography of published works by W. Stanley Jevons. The first, concerning Jevons's sunspot theory of commercial fluctuations, is a signed letter, published by the *Athenaeum* in February 1879. The second item is a review of the first volume of Henry Dunning Macleod's *Economical Philosophy*, published by the *Manchester Guardian* in June 1873. Unlike the sunspots letter, the review was unsigned. I suggest, however, that it can be attributed to Jevons with a high degree of probability and that it helps explain some puzzling aspects of Jevons's comments regarding Macleod in his *Theory of Political Economy*.

The recent bibliography of published works by W. Stanley Jevons compiled by Takutoshi Inoue and myself adds further information to a number of known entries and identifies six new items (Inoue and White 2002).¹ The purpose of this article is to identify two additional entries. The first, considered in Section 1, concerns Jevons's sunspot theory of commercial fluctuations. It is a signed letter, reprinted here as Appendix 1, published by the *Athenaeum* in February 1879, where Jevons defended his switch in dating the sunspot period by referring to the work of the meteorologist, J.A. Broun. The second item, considered in Section 2, requires a more detailed discussion. It is a review of the first volume of Henry Dunning Macleod's *Economical Philosophy* (Macleod 1872), published by the *Manchester Guardian* in June 1873 and reprinted here as Appendix 2. Unlike the sunspots letter, the review was unsigned. I suggest, however, that it can be attributed to Jevons with a high degree of probability. After some preliminary remarks regarding Jevons's published comments about Macleod, Section 2.1 discusses the review, showing the degree of congruence with Jevons's comments elsewhere in his work. Section 2.2 then considers two possible criticisms of the attribution. The conclusion shows how the review helps explain some puzzling aspects of Jevons's comments regarding Macleod in his *Theory of Political Economy* (TPE).

1 The *Athenaeum* Letter

Following the failure of his first attempt in 1875 to explain commercial fluctuations in terms of sunspots, Jevons presented a revised story in a paper to the British Association for the Advancement of Science in August 1878. He followed that with an article, published in November by *Nature*, amplifying his analysis.² The 1878 argument differed from the initial analysis in two ways. First, Jevons argued that the link between sunspots and European commercial fluctuations was via the demand in 'tropical and sub-tropical regions' (especially India and China) for European exports. In 1875, the posited link was via European harvests. Second, in 1875, Jevons used an average sunspot period of 11.1 years, as calculated by the astronomer, J.R. Wolf. In 1878, Jevons argued

that the average period was 10.45 years, referring to the calculations of J.A. Broun. The argument was highly questionable, as Jevons acknowledged both that his dating of a number of commercial crises was suspect and that the crises 'recur more regularly on the whole than the maxima and minima of sun-spots' (Jevons 1884, p. 234).³

Critical responses were published by the *Economist* and *The Times* in January 1879. Both were unsigned, although the astronomer and journalist, R.A. Proctor, subsequently identified himself as the author of *The Times* critique.⁴ Proctor argued that, taking Jevons's dating of commercial fluctuations as given, crises should occur 'within a year or so' of spot minima. There was, however, no such systematic relationship, and some crises were associated with spot maxima. While there was no printed response from Jevons to the *Economist* article, he quickly replied to Proctor's critique in a letter to *The Times*.⁵ He argued, not unreasonably, that because the link between spots and crises was via the tropical regions, the lag would be 'a good many years' and hence longer than that suggested by Proctor (Black 1973-81, v, p. 11). The trouble with this argument, however, was that the precise lag was unspecified (although it appeared to be approximately five years). Proctor's critique required a demonstration (in the form, for example, of a table) of the timing of sunspot variations and commercial fluctuations, with a clear discussion of the lags involved. Jevons did not do so in *The Times* letter nor in his subsequent work on the topic.

Jevons's argument thus rested, in large part, on the posited symmetry between the average periodicity of the sunspot and commercial fluctuations. In his critique, Proctor had suggested that a verdict on the different calculations of Wolf and Broun remained '*sub judice*'. Not surprisingly, in his response Jevons insisted on the accuracy of Broun's periodisation, adding that 'Wolf has been proved by Mr. Brown (*sic*) to have made a mistake of eight months in the average solar period' (Black 1973-81, v, p. 11).⁶ This reference added a new element to the debate in that Jevons's papers from the previous year had simply noted Broun's results with no mention, and certainly no criticism, of Wolf. Someone then stirred the pot in that regard. The following item appeared in the 'Science gossip' column of the *Athenaeum* at the beginning of February:

PROF. JEVONS, in reply to a sound and scientific article which appeared recently in the The Times on the hypothetical connexion between sun spots and commercial crises, impugned some of the data of Dr. Wolf. On writing to a friend in England, after reading Prof. Jevons's letter, Dr. Wolf says: 'I must tell you that I cannot enthuse over his type of discussion, which is based on inadequate material, and even often on "hearsay", to refute well founded results. The sole fact, that the parallelism of these fluctuations and the spots is now observed once again in a remarkable way, has more weight for me than all these hazardous reasonings'.⁷

It is evident that the author of the item had a particular interest in Jevons's *The Times* reply, having sent that to Wolf for comment.⁸ While the precise meaning of the quotation from Wolf's letter is not clear, in that it could refer to either or both of the claimed periodicity for spots and commercial fluctuations, Jevons read it as a discussion of the spot periodicity. His response, in a long letter published in the next number of the *Athenaeum* (see Appendix 1), is noteworthy in two respects. First, it provided his most detailed defence for using Broun's periodisation. Jevons's previous references to Broun simply cited a summary of

his results that appeared in *Nature* (Broun 1877), rather than the detailed analysis published in the *Transactions* of the Royal Society of Edinburgh (Broun 1876) to which Jevons now referred. Second, the response provided a number of illustrations of Jevonian rhetoric. Arguing that he had not ‘impugned’ Wolf’s data (that ‘duty’ had fallen to Broun), Jevons suggested, nevertheless, that the ‘credibility’ of Wolf’s data was highly doubtful because he had (according to Broun) ‘overlooked’ one spot maximum and confused another maximum with a minimum. Jevons closed the letter with a comment to the effect that Wolf’s numbers could not be relied on because they ‘are found to give a minimum where a maximum should be’ and that his own calculations of the number of commercial fluctuations ‘rest upon a wide groundwork of facts’. Once again, he had sidestepped the problem raised by Proctor of whether a clear (lagged) relationship could be shown in the timing of spot and commercial fluctuations. An editorial comment, probably written by the author of the original item, appended to Jevons’s letter had the last word in the exchange, noting that Jevons had failed to establish that point.

2 The Macleod Review

Comments on and mention of Macleod’s work by Jevons can be found in his two editions of *TPE* (Jevons 1871, p. 17; 1970, pp. 47, 56-7, 65, 161, 261), *Money* (Jevons 1875b, pp. 81, 230), three papers on sunspots and commercial fluctuations (Jevons 1884, pp. 209, 227, 239; Black 1973-81, vii, p. 108) and the unfinished *Principles of Economics* (Jevons 1905, pp. 4, 14-15, 17, 49, 134-5). They show that Jevons was a close and continuing reader of Macleod, referring to his *Theory and Practice of Banking* (1855, 1856), *Elements of Political Economy* (1858), a paper presented to the 1862 meeting of the British Association for the Advancement of Science, *Dictionary of Political Economy* (1863), the two volumes of *Economical Philosophy* (1872, 1875a) and *Economics for Beginners* (1878). Since this article is concerned with comparing the remarks in the *Manchester Guardian* review with comments Jevons made elsewhere, it will not be necessary to consider Macleod’s work in any detail. Nor will it be necessary to attempt an unravelling of all the, at times puzzling, comments Jevons made about Macleod.⁹ One matter, however, is important to note at the outset. Macleod was a vehement critic of John Stuart Mill’s political economy. Although some of his criticisms were not without point, they were often expressed in an inaccurate, dismissive and polemical manner. His comment, when referring to Mill’s value analysis, that ‘it is discreditable to this age and this country that a book setting forth such doctrines should be tolerated for an instant’ (Macleod 1875a, pp. 281-4) was typical. As this might suggest, Macleod had an abrasive manner. The combination of those attributes helps explain why economists such as J.E. Cairnes responded to his work with incandescent rage (Cairnes 1857, pp. 66-7, 80-1, 173-7). It was not only economists who expressed hostility. In 1888, C.L. Dodgson (Lewis Carroll) attempted to block Macleod’s (unsuccessful) application for the Drummond chair at Oxford by writing to the University Chancellor that Macleod was ‘not “right” in the head’ (Brandis 1980; Howey 1981).¹⁰

Although Jevons noted in *TPE* that he disagreed with Macleod ‘on many important points’ (Jevons 1970, p. 57), he took a different tack when compared with other critics. This was epitomised by his remarks, in *TPE* and elsewhere, about the ‘noxious influence of authority’. He opened the Preface to the first

edition of *TPE* by complaining about the authority of Mill's work and closed the text with a more detailed analysis, arguing that the result was analytical stagnation (Jevons 1871, pp. vi-vi, 265-7). In the second edition he added Macleod's name to the list of authors whose work had been 'neglected ... because the excellence of their work was not comprehended by ... the orthodox Ricardian school' (Jevons 1970, p. 261). Those comments are important when considering the review in the *Manchester Guardian*.

2.1 The Contents of the Review

That the review of Macleod was unsigned has no significance, as reviewer anonymity was standard practice for the *Manchester Guardian* (and other newspapers) at the time. It does not appear that evidence external to the review is available to identify the author, as the present *Guardian* has no records to do so.¹¹ Some reviewers from the 1870s can, however, be identified in published correspondence. The banker and Jevons's sometime collaborator in analysing commercial fluctuations, John Mills, reviewed the first edition of *TPE* in 1871.¹² E.J. Broadfield, who reviewed Jevons's primer, *Political Economy* (1878), and the second (1879) edition of *TPE* for the *Manchester Examiner and Times*, 'also contributed to the *Manchester Guardian*' (Black 1973-81, iii, p. 70n).¹³ In 1874, Jevons informed Cairnes that W.H. Brewer, his substitute lecturer at Owens College, was to review Cairnes's *Leading Principles* for the newspaper.¹⁴ The same letter revealed that Jevons had previously reviewed Cairnes's *Essays in Political Economy* and *Political Essays*.¹⁵ Jevons also reviewed *Currency and Banking* by Bonamy Price in 1876 (Jevons 1876).

While four possible candidates for the Macleod reviewer can be identified, it will be argued here that internal evidence from the review suggests Jevons was the author.¹⁶ Of the seven previously identified reviews or notices of political economy texts written by him, six were unsigned (Jevons 1864, 1870, 1873c, 1876, 1877, 1878). The exception was the review of Edgeworth's *Mathematical Psychics* (Jevons 1881). I have been unable to find a common pattern – such as the use of particular words and phrases, style of analysis, argument or presentation – in those publications. A possible explanation for this, in part, is that the reviews or notices were very different in length and considered different issues. Two issues mentioned in (two of) the reviews appear in that for Macleod's text and will be noted below. Those references are, however, too brief to attach any particular significance to them when taken alone. Some of the reviews adopt a similar style to that for the Macleod in that they cite quotations from the reviewed text and provide a commentary. Again, however, this did not constitute a systematic pattern that could clearly identify Jevons as the reviewer.

The burden of the argument thus falls on the internal evidence from the review. In reprinting the review as Appendix 2 below, paragraphs have been numbered sequentially to facilitate the commentary in this section and cited as (paragraph ...). The reference to a paper presented to the Manchester Statistical Society (paragraph 8) suggests that the reviewer was a member of the Society. While Jevons was an active member and a former President of the Society, it was the particular topics considered, from a text of nearly seven hundred pages, and the manner in which they were discussed that suggest he was the reviewer. The topics will be considered under three heads: the critique of Mill; the analysis of utility and value; and the discussion of debt and 'negative signs' in political economy.

(i) *The Critique of Mill*

After opening with the comment that there was ‘much difficulty’ in both characterising and assessing Macleod’s work, the reviewer argued that his books had been ‘practically ignored by English economists’ in part because of Macleod’s embarrassing self-aggrandising style (paragraph 2).¹⁷ A ‘possible reason’, however, for why his views had ‘obtained so little currency in England’ was that Macleod was ‘in dire opposition to Mr. J.S. Mill’ (paragraph 3). The reviewer added that ‘One such independent writer, although often wrong-headed and absurd in his opinions, may do more good to science than ten slavish commentators who cannot believe that there is any truth beyond the works of the master they are following’ (paragraph 9). The explanation for the reception of Macleod’s work was consistent with Jevons’s complaints in *TPE* about the ‘noxious influence of authority’ and with his adding Macleod’s name in 1879 to the list of authors who had been ‘neglected’ by the ‘orthodox school’.

While the reviewer noted there was a good deal of ‘bold and unsparing criticism’ of Mill in *Economical Philosophy*, the particular example cited was Macleod’s critique of Mill’s ‘apparently different and inconsistent statements’ when defining wealth (paragraph 3). The same critique, albeit presented in a more extended form, can be found in Jevons’s *Principles of Economics*, which clearly acknowledged his debt to Macleod in that regard (Jevons 1905, pp. 14-18).¹⁸ After criticising Mill for stating that there was no need for ‘metaphysical nicety’ when defining wealth (Mill 1909 [1987], p. 2), Jevons noted that Mill’s initial definition turned on the exchangeability of commodities: ‘Everything forms therefore a part of wealth which has a power of purchasing; for which anything useful or agreeable would be given in exchange’ (*ibid.* p. 6; see also p. 9). Although Jevons complained that the reference to ‘useful or agreeable’ required a ‘theory of utility to which Mill was a stranger’, he agreed that ‘the power of purchasing forms the true criterion of wealth’, referring to the work of Macleod and G.P. Scrope in that context. The problem was, however, that Mill ‘did not adhere’ to that definition (Jevons 1905, pp. 15, 16). For, at other places in his *Principles*, he seemed to define wealth in terms of the ‘materiality’ or durability of commodities, while also referring only to the utility of commodities, neglecting to mention their exchangeability (cf. Mill 1909 [1987], pp. 47, 21).¹⁹

While Jevons’s *Principles* presented a more detailed version of the critique in the Macleod review, he also referred to Macleod’s critique in some unpublished notes that can be found in the Jevons Archive.²⁰ The notes include a discussion of the responses by Mill and J.E. Cairnes to W.T. Thornton’s critique of the wage fund doctrine.²¹ That discussion provides another link to the review. Jevons argued that, while Cairnes’s defence of the doctrine was incorrect, he was a ‘most logical’ thinker, whose work showed ‘masterly and usually faultless reasoning. Even where he is wrong, the error is in the premises – in the matter – not in the form of the argument’ (JA 6/6/14, pp. C8-C9). By contrast, Mill’s response illustrated the key problem with his ‘intellectual character’ – that he was fundamentally illogical.²² In accepting Thornton’s critique in 1869, Mill had shown that he was ‘ever ready to listen to any new suggestions, but oblivious of the logical toils in which he was involved’.²³ Cairnes’s intellectual character was to be preferred because it was ‘most conducive to the progress of science. Error of fact combined with good reasoning soon makes the error patent, & leads to the establishment of the opposite view. *Citius emergit veritas ex errore quam ex*

confusione' (*ibid.*, p. C10). An English translation of that Baconian aphorism²⁴ – 'truth more often emerges from error than from confusion' – appeared in paragraph 9 of the review. Comparing Mill and Macleod, the reviewer argued that, although Macleod's work contained significant errors, it would not mislead an informed reader because he wrote in a 'close and lucid and usually logical' manner. The review's use of the same phrase in the context of discussing Mill, when coupled with the explanation for Macleod's 'neglect' and the citation of Macleod's critique of Mill on wealth, suggests that Jevons was the author.

(ii) *Utility and Value*

The reviewer was less than impressed with Macleod's alternative theoretical approach. In particular, Macleod was criticised for dismissing the role of utility when explaining value in exchange. The reviewer argued that Macleod 'does not see that a true theory of economy must take account of those natural laws relating to the intensity and degrees of satisfaction of human wants'. Like Mill, Macleod rejected the possibility of explaining such wants. However, 'as there is no other science supplying the requisite information, the economist must himself investigate the subject' (paragraphs 6-7). This was very similar to Jevons's discussion of 'The Laws of Human Want' in chapter II of *TPE* (Jevons 1871, pp. 46-51). Mill was criticised for arguing that 'Political Economy ... has nothing to do with the consumption of wealth, further than as the consideration of it is inseparable from that of production, or from that of distribution. We know not of any laws of the *consumption* of wealth, as the subject of a distinct science' (Mill 1874 [1974], p. 132n). For Jevons, however, 'it is surely obvious that Political Economy does rest upon the laws of human enjoyment; and that, if those laws are developed by no other science, they must be developed by economists' (Jevons 1871, p. 47). That argument and critique of Mill was a staple of Jevons's writing. He first referred to it in a notice of Hearn's *Plutology* in 1864 and made subsequent references in the review of Cairnes's *Essays in Political Economy*, his mid-1870s lectures at Owens College, and his introductory lecture at University College, London, in 1876 (Jevons 1864; 1873c; 1905, p. 198; Black 1973-81, vi, pp. 12-13). If the argument was a trademark of Jevons's work, the same could also be said of the reviewer's complaint that Mill had dismissed all further inquiry on the subject of value (paragraph 9; cf. Jevons 1871, v-vi, p. 80) and the use of the phrase 'true theory of economy' (paragraph 6; cf. Jevons 1970, p. 55, see also *ibid.*, pp. 67, 68).²⁵

(iii) *Debt and 'Negative Signs'*

The reviewer also referred to Macleod's analysis of credit and debt, which was part of his more general (and peculiar) analysis of negative and positive algebraic signs in political economy (paragraph 8). Like the reviewer, Jevons was dismissive of Macleod's argument that debts should be included as part of a nation's wealth (Jevons 1905, p. 175). The reviewer also suggested that Macleod's discussion of negative quantities was unsatisfactory: 'He takes the product of past labour to be positive, that of future labour to be negative ... (He) ought to take all possessions to be positive, and all claims to what is not in possession to be negative. This would often include the produce of future labour, because if a man does not possess that which is due from him he must labour to produce it' (paragraph 8). Jevons made similar comments on Macleod and negative quantities in the *Principles of Economics*: 'By far the most important

instance of negative value is labour ... Labour in the economic sense of the term is essentially disutility, because it involves painful exertion; it is that which we give in production in order to obtain commodities' (Jevons 1905, p. 135).²⁶

When compared with comments Jevons made elsewhere, the topics considered, manner of discussion and use of particular phrases in the review suggest that he was the author.

2.2 Possible Objections

Two possible objections to the attribution turn not on the contents of the review but rather on whether Jevons's authorship is consistent with other bibliographical and biographical information. The first is that there is no mention of the review in Jevons's notebook recording his publications, nor in the *Letters & Journal* edited by his wife (H. Jevons 1886). It is now clear, however, that those listings were incomplete. They did not include, for example, Jevons's review of Cairnes's *Essays* published by the *Manchester Guardian* two months before the Macleod review (Jevons 1873c). It could be argued that the latter attribution was possible because Jevons referred to it in a letter to Cairnes (see above) and there is no such reference for the Macleod review. The absence of such a reference is not unique, however, because Jevons nowhere mentioned his review of J.H. Stirling's *Lectures on the Philosophy of Law*, published in July of the same year (Jevons 1873e; Stirling 1873a). The number of items that have been added to Jevons's bibliography over the past thirty years indicate that his failure to list or mention a publication cannot, in itself, serve as a clear objection to the attribution of the *Manchester Guardian* review.

The second objection concerns whether it was possible or likely that Jevons wrote the review. Professor Black has suggested that

At the time of its publication, Jevons was still feeling the effects of the breakdown in health he had suffered in the spring of 1872; he had applied for leave of absence for 1873-74 and left for Norway on June 27 for several months holiday. His wife wrote that 'To the *Contemporary Review* for May [1873] Mr Jevons contributed an article ... but with that exception his time was still devoted to the completion of the *Principles of Science*' [H. Jevons 1886, p. 277].

Now, we know ... that this statement was not strictly correct; nevertheless in view of all that he had on his hands and the poor state of his health, it does seem unlikely that Jevons would have undertaken to add to his commitments an anonymous review of a mediocre work of 676 pages.²⁷

While I agree that these matters are important to consider, two points should be taken into account. First, as noted above, Jevons was a close and continuing reader of Macleod's publications. This suggests that, despite his criticisms of Macleod's work, he did not regard it as mediocre. Second, in the list we now have of his publications or recorded comments for 1873 (Jevons 1873a-1873k), there is the review, published by *Nature*, of Stirling's 'Hegelian' *Philosophy of Law*. Jevons certainly regarded this as a mediocre work, remarking at one point on Stirling's 'generally incomprehensible vindication of Hegel' (Jevons 1873e, p. 241).²⁸ The review was published three days before Jevons left on holiday. Given his response to the book and that he was pressed for time, it might not be surprising if he had returned the book to *Nature*, rather than undertaking the

review. That he did not do so could be taken as indirect evidence for, rather than against, his writing the Macleod review.

As there is no clear external evidence and the review was unsigned, it cannot be attributed to Jevons with certainty. However, because there is evidence which weighs against the two objections, I suggest that, in the light of the textual congruence shown above, the review can be attributed to Jevons with a high degree of probability.²⁹

3 Conclusion

If the length of the Macleod review suggests Jevons thought that his work deserved careful consideration, the contents clarify his assessment of that fierce critic of Mill, whose work had generated considerable hostility. Jevons was hardly averse to criticising various authors for failing to arrive at ‘the true theory’ of political economy. Yet, almost alone among his contemporaries, Jevons both praised and refused to directly criticise Macleod’s work in *TPE*. In the first edition, he simply referred to Macleod having ‘applied algebraic formulae to economic questions’ in his *Theory and Practice of Banking* (Macleod 1855, pp. 189-201), making no comment on the quality of that work. By contrast, William Whewell’s papers on mathematical economics were treated in a dismissive manner (Jevons 1871, pp. 16-7).³⁰ In the second edition, while distancing himself from Macleod, Jevons explicitly refused to make any criticism: ‘it is not my business to criticise his ingenious views, or to determine how far he has really created a mathematical system’ (Jevons 1970, pp. 56-7).

The *Manchester Guardian* review helps to clarify Jevons’s comments regarding Macleod in three ways. First, while Jevons did not explain the ‘many important points’ on which he disagreed with Macleod in *TPE* (Jevons 1970, p. 57), the review indicates that these included the role of utility in explaining value, and the analysis of capital, debts and wealth. The reference to Macleod on utility in the review also throws some light on a cryptic comment in the *Principles of Economics*. Jevons noted that, while Macleod followed Richard Whately in treating value in exchange as ‘the alpha and omega of the science of political economy’, it was necessary to focus on utility because value ‘is but a development of utility’ (Jevons 1905, p. 49). In part, this was a reference to Jevons’s rejection of characterising political economy as concerned only with the ‘science of exchanges’ (Jevons 1871, p. 79). Given the comments in the review, it could also be read as a reference to Macleod dismissing the role of utility in explaining value.³¹

That Jevons did not comment directly on Macleod’s treatment of utility was consistent with his refusal to criticise Macleod in *TPE*. The review is also helpful in clarifying why that was the case. On the one hand, Jevons felt Macleod’s work had been dismissed in an unreasonable manner. That much can be inferred from his adding Macleod’s name to the list of neglected authors in 1879. At the same time, the review indicates the extent to which Jevons regarded Macleod’s particular theoretical approach as deeply flawed (‘wrong-headed and absurd’ [paragraph 9]). The review’s opening sentence – ‘There is much difficulty in knowing how to regard and characterise the economical work of Mr. Macleod’ – neatly captures Jevons’s consequent dilemma. The solution Jevons adopted in *TPE* was to praise Macleod where possible, allude to problems with his work, but refuse to make any direct criticism.

Finally, the review clarifies Jevons's view of the role of critics of the 'noxious influence of authority'. While the review made it clear that the particulars of Macleod's approach were 'usually to be rejected', it also explained why his work should be given a careful reading. In part, this was because he wrote in a 'close and lucid and usually logical' manner so that his 'errors ... are usually too clear to mislead any reader the least acquainted with the subject'.³² Macleod's 'writings are full of suggestive remarks, acute criticism, and abundant learning; and ... will serve to stir up inquiry and direct the reader's thoughts to points requiring solution'. For all his failings, Macleod was to be preferred to the 'slavish commentators' who simply repeated the prevailing orthodoxy (paragraphs 9-10). In the section on the noxious influence of authority in *TPE*, Jevons's defence of 'sedition and even anarchy in matters of philosophy and science' rested on the barriers to the advance of knowledge posed by authority. The role of critics was to provide 'valuable suggestions towards the improvement of the science' and hence to initiate theoretical change (Jevons 1970, pp. 260-1). The review of Macleod indicates that critics could play a valuable role, even if their work made no direct positive contribution toward the process of conceptual 'improvement', by pricking a complacent orthodoxy, posing new questions and adopting a broader perspective in treating the subject.

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Notes

- 1 The joint bibliography was first published as Inoue and White (1993). A corrected version appeared as Inoue and White (2001). In adding further information and new entries, Inoue and White (2002) also includes lists, compiled by Inoue, of obituaries and reviews or commentaries on Jevons's work.
- 2 The 1875 and 1878 papers were reprinted with some additional information in Jevons (1884, chapters vi and vii, and pp. 221-35).
- 3 Jevons relied on the work of Macleod for his identification of some of the crises (see below).
- 4 'The periodicity of panics', *Economist*, 11 January 1879, pp. 32-3; 'Sunspots and commercial panics', *The Times*, 14 January 1879, p. 4. For Proctor as the author of *The Times* critique, see Porter (1880, pp. 26-31) and Jevons (1884, p. 221n).
- 5 'Sunspots and commercial crises', *The Times*, 17 January 1879, p. 6; reprinted in Black (1973-81, v, pp. 10-12).
- 6 The misspelling of Broun's name was apparently due to *The Times* as the same mistake appeared in Proctor's critique.
- 7 'Science gossip', *Athenaeum*, 66 (No. 2675), 1 February 1879, p. 155. The extract from Wolf's letter was quoted in the original French. For the translation here, I am indebted to Peter Groenewegen, who notes (in a personal communication) that the *Athenaeum* printed Wolf's 'taches' in the letter with an accent (meaning 'tasks' or 'work'), rather than without (when it can mean 'spots').

8 Although the point will not be pursued here for reasons of space, I suspect Proctor was the author of the *Athenaeum* item.

9 For brief discussion of Macleod (1821-1902), see Hayek (1937) and Milgate and Levy (1987). Commons (1934 [1961], chapter 9) provides an extended discussion of Macleod on money and credit; see also Skaggs (1997). White (2003) has a detailed discussion of Jevons's commentary on Macleod in *TPE*.

10 For a more detailed discussion of contemporary responses to Macleod, see White (2003).

11 Information provided by Reader Services, *Guardian/Observer*, London. A search of secondary sources concerning the *Guardian* was fruitless.

12 For Mills's authorship of the review (Anonymous 1871), see Petrie-Mills (1899, pp. 324-6).

13 Broadfield, a former student of Jevons, was 'associated with the management of the *Manchester Examiner*' (Black 1973-81, iii, p. 70n). For his authorship of the review of the second edition of *TPE* (Anonymous 1879), see Black (1973-81, v, p. 67). In 1878, John Mills wrote to W.B. Hodgson: 'You would see in Wednesday's *Examiner* Broadfield's review of Jevons's "Primer". When will you do the same for the *Scotsman*?' (Petrie-Mills 1899, p. 331; cf. Anonymous 1878). The review noted that Jevons referred to his sunspot analysis of commercial fluctuations in the primer, suggesting he had drawn on 'Professor Balfour Stuart's (*sic*) researches in solar physics'. Mills was vehemently opposed to the sunspots argument.

14 Jevons told Cairnes that Brewer was to review 'your treatise on Pol Econ' (Black 1973-81, iv, p. 60). While this was presumably a reference to Cairnes's *Leading Principles*, published in the same year, I have been unable to locate the review.

15 Jevons told Cairnes that he had 'previously noticed your two vols of Essays' for the *Guardian* (Black 1973-81, iv, p. 60). The review of Cairnes's *Essays in Political Economy* (Jevons 1873c) was first identified by Neil De Marchi (1972, pp. 359n-360n). I have been unable to locate the review of Cairnes's *Political Essays*.

16 Apart from the evidence in the review considered below, it seems unlikely that Mills was the reviewer, as his approach to value theory was quite different from Jevons's and that in the Macleod review. Broadfield also seems an unlikely candidate, as his two reviews of Jevons do not show the concern for theoretical specificity evident in the Macleod review. It is not possible to make any direct comparison with Brewer due to a lack of identifiable published material by him. The correspondence between Jevons and Brewer in the *Papers and Correspondence* (Black 1973-81) sheds no light on the material in the Macleod review.

17 The reviewer referred in part to Macleod's reprinting of testimonials for his unsuccessful professorial application at Edinburgh University in 1871. The position had been awarded to John Mills's friend, the analytical nonentity, W.B. Hodgson. Jevons provided Hodgson with a testimonial for his application (Black 1973-81, iii, pp. 235-6).

18 In the *Principles*, Jevons referred to Macleod (1872, pp. 85, 86; 1875a, pp. 104, 105). Perhaps the most concise version of the critique can be found in Macleod (1875b, pp. 883-5). Macleod sent Jevons a copy of that article (Black 1973-81, iv, p. 115).

19 See also Jevons (1870), which mentioned the definition of wealth but did not refer to Macleod.

20 Jevons Archive, John Rylands University Library of Manchester, JA 6/6/14, pp. C3-C4.

21 I suspect that the notes now bundled together in the Archive (JA 6/6/14) were meant for two separate and unfinished publications. Some appear to have been written for Jevons's book on Mill. Others seem to be part of a draft for the unpublished chapter on the 'Wage fund theory' in the *Principles* (cf. Jevons 1905, p. xxvii).

22 Jevons first made this argument publicly in an 1874 paper delivered to the Manchester Statistical Society. He claimed that Mill's work consisted 'to a large extent of a series of ingenious fallacies' (Jevons 1875a, p. 6). The result was that 'The mind of England has lost itself in the mazes of the sophistical labyrinth devised by Mr. Mill's most illogical intellect'. The last sentence was deleted from the published address. It can be found in the reports of Jevons's paper by the *Manchester Courier* (12 November 1874, p. 7) and *Manchester City News* (14 November 1874, p. 3).

23 Donoghue (1997) has shown it is misleading to claim that Mill 'recanted' on his wage fund analysis as was claimed by Jevons and subsequent commentators.

24 It appears as Aphorism 20 in Book ii of Francis Bacon's *Novum Organum*. Jevons's 'more often emerges' is usually rendered 'emerges more readily'.

25 In noting that Jevons first used that phrase in 1860, Professor Black has suggested that it was a 'trademark' phrase of his work (personal communication).

26 Note also the reference to George Peacock, the Dean of Ely, on negative numbers and square roots (paragraph 8). In the second edition of *TPE*, Jevons added a discussion of Peacock's treatment of interest (Jevons 1970, pp. 234-5).

27 Personal communication.

28 For discussion of Stirling's Hegelianism, see Bradley (1979, pp. 17-20). Stirling responded to the review with a letter to *Nature* (Stirling 1873b).

29 My use of 'high degree of probability' follows Rod O'Donnell's discussion of 'probabilistic inferences from incomplete evidence' (O'Donnell 1999).

30 There has been some misunderstanding regarding Jevons's comments on Whewell in *TPE*. In the Preface to the second edition, Jevons included Whewell in the group of economists 'who have abundantly employed mathematical apparatus, but misunderstanding its true use, or being otherwise diverted from a true theory, have built upon the sand'. A following comment indicates that Jevons regarded Whewell's mathematical economics as 'nonsense' (Jevons 1970, p. 55). It has been suggested the reason for that verdict 'is still something of a mystery' (Schabas 1990, p. 32). In the first edition, however, Jevons specifically criticised Whewell for adopting 'Ricardo's propositions' and for treating economic categories as 'simply discontinuous amounts' (Jevons 1871, p. 16). (The latter charge presumably refers to Whewell not using the calculus (cf. *ibid.*, p. xi)). The comments in the first edition also make it clear (as noted by Black 1973-81, iv, p. 104n) that it is incorrect to suggest Jevons changed his assessment of Whewell's work between the first and second editions (cf. Jaffe 1965, p. 293; Vasquez 1997, pp. 130, n. 15; 131, n. 35).

31 The comment in the review that Macleod had failed to explain value in terms of 'the intensity and degrees of satisfaction of human wants' (paragraph 6) indicates that, contrary to the suggestion of Robertson (1951, pp. 237-8; see also Hayek 1937), the formulation of Jevons's marginal utility theory owed nothing to Macleod. Robertson's other suggestion, that the marginalist theory of behaviour was based in large part on Richard Jennings's *Natural Elements of Political Economy* (1855), was to the point (Robertson 1951, pp. 234-7).

32 This could explain Jevons's subsequent cryptic comment to H.S. Foxwell that he saw 'no need to dwell upon his [ie. Macleod's] errors because they are unlikely to do any harm' (Black 1973-81, v, p. 79).

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