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Index Numbers of Prices

Author(s): A. Sauerbeck

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INDEX NUMBERS OF PRICES.

THE March number of the ECONOMIC JOURNAL contained an article on Mr. Pierson's paper on 'Scarcity of Gold,' which, comparing my index numbers of the prices of commodities with the Hamburg prices published by the eminent statistician, Soetbeer, arrives at the conclusion that the latter's results are more trustworthy than mine, because they comprise a greater number of articles. It is true that the difference is mainly, but not exclusively, as will presently be shown, caused by the inclusion of more commodities, a great many of which are of very small importance, but this in itself does not prove greater correctness. I wrote a long letter on the subject to the late Dr. Soetbeer in November, 1886, explaining the various points, and alluded to the matter in my evidence before the Gold and Silver Commission.

In both tables the standard period is called 100, and the movements of the articles are calculated in proportion to the standard period, the proportionate figures or percentages being added together, and the arithmetical mean drawn by dividing the total by the number of articles. This comparison by index numbers, as it is usually called in this country, can never give an exact result, not even if checked by quantities, but if it is carefully done it may give a fair illustration of the actual course of prices. The method of calculation is alike, but otherwise the two tables cannot very well be compared, because the prices are not given according to the same system, and the starting point or standard period of comparison differs.

When I worked out my tables I carefully selected a number of commodities which were sufficiently important, and the

No. 18.—VOL. V

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descriptions taken were good standards and representative for the whole period from 1867–85, and they have remained so to the present time. Only in the case of two out of forty-five commodities—timber and export coals—I had reluctantly to take the averages of the official trade statistics, as no trustworthy standard prices were available for timber, and as I assumed that the export average of coals would better represent the value of this article than any other quotation. In the case of two other articles—tea and flax—I joined the import average to my quotation in the hope of improving the latter, and of making the fluctuations less violent, particularly those of tea. The actual number of articles is thirty-five—or thirty-eight if flour, bacon, and bar iron are considered as separate articles—represented by forty-five proportionate figures, as seven articles have on account of their great importance received two figures—viz., wheat, beef, mutton, sugar, coals, cotton, and wool.

Soetbeer's table comprises 114 figures, of which only eight may be termed 'prices,' representing the average prices paid by the Hamburg public institutions, all of the others are average values, ninety-two based on the Hamburg trade statistics, and fourteen on British exports. Now such trade averages, be they British or German, are on the whole of doubtful use; the declarations are frequently made with great carelessness by agents who often know nothing about the real values; though by the principle of averages, the errors in both directions may balance each other, and the average may still be fairly useful provided that the composition of the articles and the classification has remained practically the same. This may or may not be the case; of many articles, such as corn, metals, coals, some oils, &c., the imports may remain practically unaltered for a number of years; but there are others—for instance wool—which have greatly changed, and again others—for instance wine—which vary largely from year to year. At any rate trade averages follow the actual movements of prices more slowly than standard descriptions, as in a falling market the declarations must necessarily be higher, and in a rising market lower than the actual prices realised.

For the *standard period of comparison* Soetbeer chose the years 1847–50, a period of low prices, in sympathy with the tables of the *Economist*, where the years 1845–50 were taken. These latter were started by Mr. Newmarch in order to examine whether there had been a rise in prices, and were of course continued by the *Economist* on the same uniform level. But if it is a

question of showing whether there has been a fall it is infinitely better to start from a high period. At first sight this may appear immaterial, but on a closer examination it will be found that it makes some difference, even if that difference should on the average of a large number of commodities be a small one. The reason is that extraordinary movements of some commodities affect the general average to a much greater extent if calculated from a low basis upwards, than from a high basis downwards. For instance, if an article—say cotton—rises from 6d. to 24d., with proportionate figures 100 and 400, the influence is at the rate of 300 on the general number of commodities, while if it falls from 24d. to 6d.—or from 100 to 25—the influence is only at the rate of 75. This fact greatly affected the *Economist* index numbers from 1862 to 1865, particularly as cotton had received four out of twenty-two numbers. If now in a certain period—say 1861–70, or 1871–80—a number of commodities have risen a great deal more than the others, and a later period—say 1881–83—is compared with it, a simple re-calculation of the total index numbers in relation to the total index numbers of that former period is not exact. Of course if the movements of all articles were alike it would not matter, but as they always differ according to the laws of supply and demand affecting each article in a different degree, the result cannot be relied upon.¹

Mr. Pierson selects the period of 1861–70 for his comparison, and finds that in Soetbeer's tables the years 1881–83 show no fall in prices, while my tables indicate a not unimportant decline. I quite agree with Mr. Pierson that a comparison with the years of inflation only—1872–73—is objectionable, as they do not afford a fair basis; but to leave these years out altogether, or as he does even five years, 1871–75, is quite as objectionable. The inflation extended principally to metals, coals, and wool, while a number

¹ Example: Take ten articles and assume that with reference to a low level one article rises to 300, the others to 150, that afterwards the first article remains unchanged, and that the others fall 50 per cent.

1st Period.	2nd Period.	3rd Period.
1 = 100	1 = 300	1 = 300
9 = 900	9 = 1,350	9 = 675
<hr/>	<hr/>	<hr/>
10 = 1,000	10 = 1,650	10 = 975
<hr/>	<hr/>	<hr/>

Rise 65 per cent.

Fall 40·9 per cent.

Assume the same movements and call the 2nd Period 100.

1 = 33·3	1 = 100	1 = 100
9 = 600	9 = 900	9 = 450
<hr/>	<hr/>	<hr/>
10 = 633·3	10 = 1,000	10 = 550
<hr/>	<hr/>	<hr/>

Rise 57·9 per cent.

Fall 45 per cent.

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of commodities were even in those years but little affected, and others were higher in subsequent years; the higher prices of corn were in consequence of moderate harvests from 1871-73. Prices reached their highest level in 1872-73, but this is no reason why these years should be struck out of the history of commerce altogether, and the best plan is to minimise their influence by joining to them a sufficient number of other years in which prices were lower. This was done by me in taking as my basis the eleven years, 1867-77, and it was found that in the aggregate their average was equivalent to the twenty-five years 1853-77.¹ In the case of my figures it would not matter much if the comparison were made with 1861-70, as my average for that period is also 100, but it is different in the case of the Hamburg prices where this latter period was lower, and there is no doubt that the difference of prices between Germany and England before 1873 was much greater than it is at present. Professor Conrad adopted for one of his tables, based on Mr. Heinz's new price-lists, the years 1871-80, which is certainly more satisfactory for Hamburg prices, and which practically agrees with 1867-77.

For more detailed comparison of the two price lists I have compiled three tables with the average *actual* price numbers of the periods 1861-70, 1867-77, and 1881-83 as found by Soetbeer's method, and *new* numbers for 1881-83, taking the average of Soetbeer's index numbers for 1867-77 as 100 in the case of *each description* as had been done in my lists.

The first table (A) gives the thirty-five articles which are contained in both lists. In addition to these my list has still four important articles with the following proportionate numbers for 1881-83: maize 88·3, bacon 100, jute 84, and petroleum 52·7, while six articles of the thirty-five are duplicated, making a total of forty-five descriptions with an average index number of 83·7, or practically the same as for the thirty-five articles only. The average for 1861-70 was 99·1 or barely 1 per cent. less than the average of 1867-77, while the Hamburg prices were 3·5 per cent. lower in the earlier period, the difference being principally caused by the lower Hamburg prices for meat and butter. If the prices

¹ My index number for 1894 is 63; if for the standard period of comparison somewhat lower prices are substituted for the following articles: wheat, flour, barley, oats, potatoes, butter, iron, coals, cotton, wool, silk, and soda, by excluding all exceptional fluctuations, my average for 1894 would be 66, but then the price movements from 1867-77 would be comparatively higher and the curves in the diagram of prices would remain the same. If the two years 1872 and 1873 are left out altogether the average of the remaining nine years of the standard period would be 97·8, and the index number for 1894 would be raised from 63 to 64·4.

in 1881-83 are compared with the standard period 1867-77, columns 4 and 6, the average decline in my figures amounts to 16·6 per cent. (index number 83·4) against 12·8 per cent. (index number 87·2) in Soetbeer's, making a difference of 3·8 per cent., which to the extent of two thirds is explained by a smaller fall in Hamburg for corn, potatoes, rice, meat and butter. For these articles my figures are 91 points less, which on thirty-five articles amounts to 2·6 per cent. The table proves that for 1867-77 also, or at least for the greater part of the period, prices must still have been lower in Hamburg than in England, particularly for meat, butter, and corn.

A.—ARTICLES CONTAINED IN BOTH TABLES.

	Soetbeer.				Sauerbeck. 1867-77 = 100.†	
	Actual Numbers 1847-50 = 100.			1867-77 = 100.	Actual numbers.	Actual numbers.
	1861-70.	1867-77.	1881-83.	1881-83.	1861-70.	1881-83.
Wheat	112·5	122·0	105·1	86·1	93·7	83·7
Wheat flour...	103·9	111·5	108·6	97·4	98·9	84·0
Barley	121·6	142·8	135·2	94·7	92·1	81·3
Oats	136·0	150·7	134·4	89·2	91·1	83·3
Potatoes	103·6	117·9	104·9	89·0	85·7	78·3
Rice	68·4	64·2	56·3	87·7	105·9	79·3
Beef	123·6	154·5	160·2	103·7	87·4	100·2
Mutton	108·6	131·5	164·2	124·8	91·1	110·5
Pork	119·2	124·2	135·3	108·9	98·8	98·7
Butter	154·2	183·3	197·5	107·7	92·1	98·7
Sugar	103·9	114·7	107·0	93·3	96·7	87·7
Sugar, refined	116·4	119·8	101·7	84·9	99·9*	89·3*
Coffee	161·3	189·5	146·1	77·1	84·3	76·3
Tea	108·1	100·6	74·0	73·6	108·5	61·7
Iron, raw	92·7	116·2	81·1	69·8	79·2	70·3
Iron, bar	100·3	112·8	84·0	74·5	84·6	72·0
Copper	101·6	99·3	80·4	81·0	105·5	85·0
Tin	138·8	143·2	121·9	85·1	101·2	91·7
Lead	110·0	125·3	82·5	65·9	97·6	69·3
Coals	100·2	114·9	80·5	72·2	81·9	76·0
Cotton	215·0	138·2	96·7	70·0	175·8	66·0
Flax	158·3	146·5	124·4	84·9	107·8	66·3
Hemp	97·5	103·3	83·9	81·2	94·8	89·3
Wool	95·1	86·2	73·5	85·3	103·0	74·0
Silk	107·1	116·3	82·3	70·8	106·5	68·0
Hides	129·7	151·0	141·2	93·5	87·0	100·0
Leather	146·5	126·2	125·7	99·6	90·4	94·3
Tallow	107·4	106·5	101·7	95·5	102·4	99·7
Oil, palm ...	117·2	120·9	99·7	82·5	102·3	92·3
Oil, olive	110·0	102·8	86·2	83·9	112·8	74·0
Oil, linseed ...	125·9	112·8	92·9	82·4	111·2	76·0
Soda	77·5	83·1	57·9	69·7	90·5**	70·1
Nitrate	102·8	104·8	100·4	95·8	101·3	93·0
Indigo	174·1	176·2	156·9	89·0	101·5	89·7
Timber (wood)	109·3	97·0	97·1	100·1	106·6	89·3
35 Articles..	4158·3	4310·7	3781·4	3050·8	3470·1	2919·3
1861-70 = 100	100·0	103·7	90·9	—	—	—
1867-77 = 100	96·5	100·0	87·7	87·2	99·1	83·4

† 1867-77 = 100 for each description.

* Another quotation of raw sugar.

** 1867-70 only.

B.—ARTICLES CONTAINED IN SOETBEER'S BUT NOT IN SAUERBECK'S TABLES.

	Actual Numbers, 1847-50 = 100.			1881-88 if 1867-77 = 100.
	1861-70.	1867-77.	1881-88.	
Rye	134·6	147·2	137·0	91·7
Rye flour.....	146·3	159·5	145·3	91·1
Malt	120·4	138·7	144·7	104·3
Buckwheat	120·8	134·9	143·9	106·7
Peas	132·6	153·4	156·1	101·8
Beans	118·5	120·3	119·4	99·3
Hops.....	241·3	288·8	395·2	136·8
Clover seed	173·1	185·3	170·4	91·9
Rape seed	121·8	118·9	113·6	95·5
Rape oil	109·7	99·2	86·5	87·2
Oilcake.....	145·8	166·4	158·3	95·1
Spirits of corn, etc.	133·4	135·6	134·9	99·5
Meat, veal	116·1	149·4	132·7	122·3
Milk	121·4	167·3	171·4	102·5
Cheese	134·9	153·2	148·3	96·8
Lard	118·7	116·2	117·4	101·0
Calf skins	160·6	160·4	125·4	78·2
Horse hair	126·3	143·0	116·3	81·3
Bristles	136·2	179·5	225·8	125·8
Bed feathers	109·6	138·5	109·4	79·0
Bones	127·1	156·1	157·6	101·0
Horns	177·1	196·4	252·3	128·5
Glue (<i>Leim</i>)	126·9	147·5	133·5	90·5
Eggs.....	128·1	144·9	155·9	107·6
Herrings	138·2	150·2	175·2	116·6
Fish, dried	159·2	163·1	185·6	113·8
Cod liver oil	140·5	117·1	111·1	94·9
Raisins.....	125·1	129·4	132·4	102·3
Currants	77·5	88·0	92·2	104·8
Almonds	119·3	121·5	131·6	108·3
Plums, dried	110·5	131·2	120·9	92·1
Wine, French still	175·2	205·0	308·0	150·2
Wine, champagne	107·3	117·7	127·6	108·4
Cocoa	174·2	165·7	224·8	135·7
Pepper	130·4	181·4	208·9	115·1
Pimento	49·9	58·4	83·8	143·5
Cassia lignea	116·0	101·8	44·3	43·5
Sago	84·5	78·4	68·0	86·7
Arrack	123·0	147·2	132·3	83·1
Rum	142·7	178·5	209·6	117·4
Tobacco	137·3	144·1	122·8	85·2
Cochineal.....	68·6	60·3	34·4	57·0
Dyewood, blue	115·0	124·9	122·5	98·1
Dyewood, red	74·7	71·7	61·5	85·8
Canewood	151·6	161·7	180·9	111·9
Ivory.....	145·0	173·9	189·4	108·9
Steel	101·6	95·0	67·4	70·9
Zinc	128·7	143·5	117·0	81·5
Quicksilver	53·9	79·5	46·7	58·7
Sulphur	103·6	98·1	93·6	95·4
Salt	54·7	60·4	47·8	79·1
Lime (<i>Kalk</i>)	89·8	95·2	90·7	95·3
Cement.....	104·5	106·5	95·0	89·2
Cordage	122·8	132·1	116·7	88·3
Rags	117·6	111·4	99·8	89·6
Guano	117·6	94·7	71·1	75·1
Indiarubber.....	119·7	130·1	171·4	131·7
Gutta percha	159·1	156·3	151·6	97·0
Resin	291·0	160·5	133·6	83·2

B.—ARTICLES CONTAINED IN SOETBEER'S BUT NOT IN SAUERBECK'S TABLES.—
(Continued.)

	Actual Numbers 1847-50 = 100.			1881-83 if 1867-77 = 100.
	1861-70.	1867-77.	1881-83.	
Alkali	71·6	72·3	68·4	94·6
Pitch	151·6	122·7	108·6	88·5
Potash	85·6	89·0	69·0	77·5
Candles	74·9	68·2	52·2	76·5
Tar	113·4	119·5	108·1	90·5
Wax	114·0	100·2	69·0	68·9
Total 65 Hambarg Articles	8122·7	8607·0	8646·8	6810·2
1861-70 = 100	100	106·0	106·4	—
1867-77 = 100	94·4	100·0	100·5	97·1

C.—ARTICLES CONTAINED IN SOETBEER'S BUT NOT IN SAUERBECK'S TABLES.

	1861-70.	1867-77.	1881-83.	1881-83 if 1867-77 = 100.
Cottons, yarn	188·7	155·9	111·9	71·8
„ pieces goods, plain	137·9	109·8	85·7	78·0
„ „ „ printed	119·4	109·1	84·1	77·1
„ stockings	89·9	86·7	77·8	89·7
„ thread	169·8	182·0	165·1	90·7
Glass, common bottles	86·5	88·7	82·6	93·1
Linen yarn	144·4	144·2	126·6	87·8
„ manufactures, plain	108·2	105·7	99·4	94·0
„ „ „ sail cloth	139·6	148·7	130·5	87·8
Woollens and worsted yarn	155·2	152·6	107·1	70·2
„ „ „ cloths, etc. ..	122·2	131·0	119·7	91·4
„ „ „ flannels, etc..	124·9	120·8	100·8	83·4
„ „ „ stuffs	118·3	105·8	79·6	75·6
„ „ „ carpets, etc...	107·1	113·0	87·6	77·5
Total, 14 British Export Articles	1806·6	1753·5	1458·5	1168·1
1861-70 = 100	100·0	97·6	80·7	—
1867-77 = 100	102·5	100·0	83·2	83·4

Table B gives the sixty-five Hamburg articles of Soetbeer's statistics which are not contained in my list. It comprises a few commodities of importance, but the great majority are small articles. As compared with 1861-70 they were on the average of 1867-77 = 6 per cent. and in 1881-83 = 6½ per cent. *higher*, and the first period cannot therefore be called a satisfactory one for a comparison. According to Soetbeer's numbers the years 1881-83

are still $\frac{1}{2}$ per cent. *higher* than the average of 1867-77 ; but if for this period *each article* is called 100—instead of taking the actual percentage figures—it will be found that the average is 3 per cent. *lower*, and that the two methods of calculation cause a difference of $3\frac{1}{2}$ per cent. This is principally due to some articles having reached a much higher percentage figure in 1867-77 than other articles and rising still more afterwards instead of declining like the bulk of commodities. Examining the figures more closely we find the movements of the following particularly striking : *Veal*, *herrings*, and *dried fish* rose probably for the same reason as other animal food, the prices before 1873 having been on a lower level in Hamburg than in England. *Hops* : an article experiencing enormous fluctuations which is hardly fit to be included in an index number ; they were particularly high from 1881-83, when the proportionate figures rose from 255 in 1881 to 413 in 1882 and to as much as 517 in 1883, to decline to 243 in 1885 and 213 in 1886. That Soetbeer's index numbers did not fall in 1882 and 1883¹ can be ascribed to this single article, as its rise affected the two years to the extent of 1·4 and 2·3 per cent. respectively. *Wine* and *rum* : some years ago I worked out the averages of British imports to see whether they would throw light on the movements of prices, and the following are the figures in shillings per gallon :

	1867-77.	1881-83.
Wine, French red	5·93*	5·27
„ Port	6·28	6·27
„ Spanish white	6·88*	6·20
„ all, including sparkling ...	6·97	6·96
Rum (proof)	2·16	1·98

* Average of 1868-77.

The Hamburg figures show a very great rise, while the above indicate a fall ; and I only give them to show how untrustworthy such averages are, as in the case of French wine there can hardly be a doubt that in the latter period prices were higher in consequence of the ravages of the phylloxera, though how much higher it is difficult to say, but there is no article in which the difference of quality is so great as in the case of wine and where it varies to such an extent from year to year. With the great increase of wealth in Germany after the war better qualities of wine may have been imported. Had I used the English import figures I should have obtained an entirely different result, and as the English averages are untrustworthy in this particular article, so may the Hamburg figures be in the very same or in other articles.

¹ Soetbeer's index numbers—1881, 121·07 ; 1882, 122·14 ; 1883, 122·24. My index numbers—1881, 85 ; 1882, 84 ; 1883, 82.

Bristles, horns, pepper, and pimento, which were higher in 1881-83, are articles of little importance; *cocoa, ivory, and indiarubber* have certainly become dearer.

It is still worth noticing that amongst the articles there is a very small one which at one time influenced the average considerably—viz., resin (*Harz*); it jumped from 110 in 1860 to 480 in 1862, 542 in 1863, and 605 in 1864, and during these years affected the general average even more than the extraordinary rise of cotton. Had it not been included Soetbeer's price level in 1864 would have been 125·07 instead of 129·28 or 3·3 per cent. lower.

Table C comprises fourteen exports of British manufacture, all but one textiles, which on the average declined 16·6 per cent., or in the same proportion as my forty-five commodities.

The following is the summary of Soetbeer's numbers:—

	1861-70.	1867-77.	1881-83.	1881-83 if 1867-77 = 100.
35 articles	4158·8	4310·7	3781·4	3050·8
65 articles	8122·7	8607·0	8646·8	6310·2
14 export articles	1806·6	1753·5	1458·5	1168·1
Total	14087·6	14671·2	13886·7	10529·1
Average	123·6	128·7	121·8	92·4
1861-70 = 100	100	104·1	98·6	—
1867-77 = 100	96	100	94·7	92·4

As compared with 1867-77 the actual proportionate numbers show a fall of 5·3 per cent., but if for the period of comparison each article is called 100 the fall amounts to 7·6 per cent. or 2·3 per cent. more. The decline according to my table is 16·3 per cent. and therefore 8·7 per cent. larger. The difference is partly due, as already pointed out, to the Hamburg prices having before 1873 probably been lower than the British prices, but principally, as observed by Mr. Pierson, to the larger number, mostly of small articles, contained in Soetbeer's tables.

If we make allowance for the importance of the various articles in the trade of the United Kingdom in 1881-83, and assume that the articles not comprised in my tables have moved in the same proportion as at Hamburg, we obtain the following figures:—

	1881-83 Arithmetical Average Index Nos. (1867-77 = 100.)	1881-83 Value Million £.	Value raised to Average of 1867-77. Million £.
45 commodities in my table.....	83·7	490	585·4
65 commodities not in my table ¹ .	97·1	50	51·5
14 British exports, manufactures..	83·4	85	101·9
Average and total.....	90·7	625	738·8
Ratio of prices	—	84·6	100

The home production of the sundry articles, one third of which is not produced here at all, is not included, but as the home consumption of British manufactures is also left out, the two omissions may balance each other. Or disregarding the export articles altogether, and taking an extreme estimate of the 65 sundry articles with £100 millions, the values in the two periods would be £590 and £688·4 millions, giving a ratio of 85·7. My average index number for 1881-83 is 83·7, which if all the other articles are simply added will be increased to 90·7, but if account is taken of quantities it will only be raised to 84·6 or 85·7 or 1·2 points. This is in conformity with a statement of prices in 1885, which I submitted to the Gold and Silver Commission, and which appeared in their first report (1887, pp. 318-321). The average of my forty-five descriptions was 72 in 1885, but

¹ The importance of the sixty-five articles in the imports or exports of the United Kingdom was as follows in 1882, leaving out rye, buckwheat, malt, veal, and steel, which are sufficiently represented by other descriptions consumed, in million £ and decimals :—

Peas	£0·84	Cod liver oil.....	£0·42	Sulphur (Pyrites?)...	£1·42
Beans	0·81	Raisins	1·03	Salt (export)	0·57
Hops	2·96	Currants	1·35	Lime	?
Clover seed	0·76	Almonds	0·26	Cement (export).....	0·89
Rape seed and oil ...	1·51	Plums, dried	0·05	Cordage	0·53
Oilcake	1·46	Wine and champagne	5·46	Rags	1·12
Spirits of corn.....	1·20	Cocoa	0·60	Guano	0·89
Milk	?	Pepper	0·58	Indiarubber	2·75
Cheese	4·75	Pimento	?	Guttapercha	0·54
Lard	1·87	Cassia lignea	0·10	Resin	0·40
Calfskins	?	Sago	0·22	Alkali (export)	2·07
Horsehair.....	0·15	Arrack	?	Pitch	?
Bristles	0·41	Rum	0·75	Potash	?
Bed feathers	0·14	Tobacco	1·15	Candles.....	0·53
Bones	0·44	Cochineal.....	0·26	Tar	0·13
Horns	0·22	Dyewood	0·24	Wax	0·13
Glue	?	Canewood.....	?		
Eggs	2·38	Ivory	0·46		
Herrings	0·41	Zinc	0·71		
Fish, dried	1·66	Quicksilver	0·28		
					<u>£47·36</u>

by simply adding 112 articles of British imports and exports the ordinary index number was raised to 77·5, while by taking account of the importance of each article, the new index number was reduced to 74·2, thus being only 2·2 higher than my ordinary figure.

The outcome of the whole inquiry must therefore be that, although it is desirable to include as many articles as possible, small articles should not be taken account of in an index number constructed like Soetbeer's. If they agree generally with the larger articles they are not required at all, but if their fluctuations differ widely from the general course they will upset the system of index numbers in an unwarrantable degree. It is evident that if a small article moves in a different manner something special affecting its supply or demand must have occurred. And the smaller the article the greater may be the divergence from the general line: if many of the large articles of consumption are cheap, people can afford to pay practically any price for a small article, for which there is a great demand. The great fluctuation will seriously affect the system of index numbers—arithmetical mean of all the proportionate figures—while if measured with allowance for quantities it will scarcely have any influence whatever.

If the great bulk of articles is to be included in such a calculation, and if the declared trade values with all their weaknesses are to be accepted instead of market prices, then the only proper course is to re-calculate the whole trade of a country on the basis of a certain year or of a certain period as has been done by Mr. Giffen¹ on the basis of 1873. If that year is called 111 in accordance with my index number, the comparison will be as follows :—

	Imports into United Kingdom and Exports of British Produce according to Mr. R. Giffen.		Ratios, 1873 = 111.		
	Declared Values, Million £.	Values at 1873 Prices, Million £.	British Trade.	Sauerbeck.	Soetbeer.
1873	626	626	111	111	111
1883	667	861	86	82	98·1
1884	623	844	81·9	76	91·7
1885	584	835	77·7	72	87·3
1886	562·5	858	72·8	69	83·5

Although the figures based on Mr. Giffen's results are some-

¹ Report on recent changes in the prices of exports and imports 1888.

what higher than mine, they prove that the decline must have been much heavier than it would appear from Soetbeer's figures.

I have so far confined myself to the comparison of the period 1881-83 specially referred to by Mr. Pierson. From 1881 the figures agree fairly well as may be gathered from a statement of Soetbeer's.¹

	Soetbeer.			Sauerbeck.
	114 Articles.	100 Hamburg Articles.	Total German Import and Export Trade. ²	45 Articles.
1881	100	100	100	100
1882	100·9	100·8	100·3	98·8
1883	101·0	100·9	94·4	96·5
1884	94·4	93·7	93·1	89·4
1885	89·8	88·9	85·8	84·7
1886	85·9	84·9	84·6	81·2
1887	84·3	83·2	84·5	80·0
1888	84·3	83·4	85·0	82·4
1889	87·6	87·0	87·9	84·7
1890	89·8	89·0	87·7	84·7
1891	—	—	84·5	84·7

If the average of the three years 1881-83 had been taken for this comparison (Soetbeer 100·6, mine 98·4) the figure for Soetbeer's 114 articles and for my forty-five commodities would have been exactly the same in 1888—viz. 83·8. Soetbeer's figures for 1889 and 1890 are on a somewhat different basis owing to the admission of Hamburg into the German Customs Union, and they cannot be exactly compared.

With regard to the new calculations by Mr. Pierson of 137 Hamburg articles³ and by Professor Conrad of 163 Hamburg articles (*Jahrbücher für Nationalökonomie*) they cannot be critically examined as no details are given, but both tables are no doubt affected in the same way as Soetbeer's—viz., that Mr. Pierson's is based on a low-priced period and that both include too many small articles. They are constructed on the basis of a new list of

¹ Conrad's *Jahrbücher für Nationalökonomie*, III. 3rd vol. 1892. Figure for 1891 communicated by Dr. Soetbeer in a private letter to the writer.

² German trade according to changes in values from year to year.

³ I may remark that in the comparison by Mr. Pierson in *De Economist* (Hague, January 1895) his 137 articles are calculated on the basis of the year 1850, while he gives my numbers on the basis of 1847-50. 1847 was a year of high prices, and my average for the four years was 81, but for 1850 only 77: if the latter year had been taken for my figures also, my numbers would have been all round 5 per cent. higher than stated by Mr. Pierson.

prices of the imports by sea only, worked out by the Hamburg Statistical Office under the control of Mr. Heinz. The comparison is as follows, taking 1871-80, Professor Conrad's standard period, as 100 (the actual figures of Mr. Pierson, 1850 = 100, and of my numbers, 1867-77 = 100, are in parenthesis in small type).

	Pierson.	Conrad.		Sauerbeck.
	137 Articles.	163 Articles.	19 Articles, allowing for Quantities.	45 Articles.
1871-80	(126.22) 100	100	100	100 (96.5)
1881-85	(114.78) 90.9	87.80	81.83	82.7 (79.8)
1886-90	(105.58) 83.6	83.86	67.88	72.7 (70.2)
1891	(111.55) 88.4	87.46	85.06	74.6 (72.0)
1892	(106.09) 84.1	82.76	76.85	70.5 (68.0)
1893	(103.18) 81.7	83.06	65.55	70.5 (68.0)

Note here the difference between Mr. Pierson and Professor Conrad, though both tables are based on the same materials, in the period 1881-85 and in the movements from 1891-93. My figures are much lower than their arithmetical means, but it is worth observing that the nineteen articles in the case of which allowance is made for quantities are still lower than mine except in 1891 and 1892; corn, which was dear in 1891, must have received a greatly preponderating weight in this calculation, as otherwise the high figure is incomprehensible. If both statisticians in their calculation of the greater number of articles had made allowance for quantities, they would probably have found that their results did not differ widely from mine. With the material at Professor Conrad's disposal, this could easily be done at least for one year, say for 1893 or 1894, as a test, by taking the values of the total imports of the various articles into Germany and making some allowance for the home production, and by re-calculating the same on the basis of values during the standard period.

The fact that my figures are regularly checked by the test of quantities is generally ignored in Continental writings. Two systems are adopted for this purpose¹—the one by using the same index numbers, but calculating each article according to its importance in the United Kingdom; the other by calculating the quantities in the United Kingdom in the respective year at their actual values (the production on the basis of my price tables, the imports at Board of Trade values, and consequently a considerable

¹ See the Statistical Society's *Journal*, 1886, pp. 612-619, and 1893, pp. 218, 219.

portion according to a different set of prices), and at the nominal values on the basis of the average prices from 1867-77. I give the result in the three first columns of the following table, and I add a fourth column in continuation of Mr. Giffen's estimate of the total imports into the United Kingdom and the exports of British produce at the prices in 1873 (=111, my index number for that year), calculated according to the valuable figures of Mr. Stephen Bourne and of the *Economist*, of the trade movements and variations in values from year to year.

1867-77 = 100. 1873 = 111	Index Numbers, Arithmetical Mean.	Index Numbers, making Allow- ance for Quantities.	Total Trade in the same Articles.	Total External Trade of the United Kingdom.
1887	68	66.7	67.4	72.1
1888	70	68.8	69.2	73.4
1889	72	71.8	72.2	74.6
1890	72	72.1	74.1	75.9
1891	72	72.0	74.5	75.7
1892	68	67.7	70.3	72.3
1893	68	67.1	68.0	70.9
1894	63	62.0	64.3	66.5

The figures in the third and fourth columns follow the movements more slowly, as one column is partly, the other altogether, based on trade declarations. The greater difference in 1890-92 in the third column is merely due to the high export prices of coal, which article forms such a large item in the production of this country.

I am convinced that my index numbers do not exaggerate the decline of the wholesale prices of the various articles treated; in fact there are several commodities among them—for instance meat, butter, flour, tallow, &c.—of which the lower sorts, now imported in large quantities, have fallen even more than my standards, and there is plenty of evidence that if allowance is made for quantities, the great bulk of commodities composing international trade have declined in a similar proportion—within a few per cent.—to the forty-five descriptions in my tables. The figures were intended to prove that there had been a considerable fall of wholesale commodities, and consequently an important appreciation of gold, but it cannot be pretended that such calculations will give more than a very rough idea of the real course of prices. They cannot comprise everything, and it was never asserted by myself that the appreciation of gold was in exactly the same proportion.

A. SAUERBECK