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The Statistics of Wages in the Nineteenth Century. Part XIX.--The Cotton Industry. Section V. Changes in the Average Wage of all Employed, with some Account of the Forces Operating to Accelerate or Retard the Progress of the Industry

Author(s): George Henry Wood

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The STATISTICS of WAGES in the NINETEENTH CENTURY. Part XIX.
—*The COTTON INDUSTRY. Section V. CHANGES in the*
AVERAGE WAGE of all EMPLOYED, with some ACCOUNT of the
FORCES OPERATING to ACCELERATE or RETARD the PROGRESS
of the INDUSTRY.

By GEORGE HENRY WOOD, F.S.S.

[Read before the Royal Statistical Society, May 24, 1910, the President,
Sir J. A. BAINES, C.S.I., in the Chair.]

As the title of this Paper indicates, I propose, in the present instance, to depart from the practice of merely estimating the advance or reduction of wages in the industry under consideration, and discussing the statistical significance of the final estimates, hitherto adopted in the Papers of this series¹, by considering the various changes which have taken place in the structure and *personnel* of the cotton industry; its Collective Bargaining; the effects of Factory Legislation; and such other features as may assist us in interpreting the very great advance in average wages which has taken place during the past century.

In various sections of the series of papers dealing with the cotton industry, published in the January to April numbers of the Society's Journal, there have been given estimates of the changes in average wages of cotton operatives employed in factories at various large centres of the industry, and of the course of wages of hand-loom weavers from 1797 to 1838. For convenient reference, the estimates for factory operatives are reproduced in the following table:—

¹ The papers containing estimates of the course of wages during the Nineteenth Century in this series are, "Agriculture," *Journal*, September, 1899; "Building," March, 1901; "Wool and Worsted of the West Riding," March, 1902, by A. L. Bowley; and "Printers," December, 1899; and "Engineering and Shipbuilding," March, 1906, by A. L. Bowley and G. H. Wood.

TABLE 35.—*Estimates of changes in average earnings of cotton operatives employed in factories in the chief centres of the industry.*

1886 = 100.

District.	1806.	1810-16.	1817.	1818-20.	1821-22.	1823-25.	1826.	1832-33.
Manchester } and district }	75½	79½	78½	77½	71½	73	73½	71

District.	1833.	1836.	1840-41.	1845.	1849-50.	1855.	1860.	1863-64.	1866.	1870.
Manchester....	71	72½ 1837.	65½	74½ 1846.	65½	70½	71½	—	81½	88½
Bolton	62½	63½	65½	68½	67½	71½	81½	80½	89½	—
Oldham	61½	67½	66½	—	64	—	79	—	86	90½
Ashton	65	67½	63½	—	—	—	—	—	—	—
Stockport	80½	91½	80	—	—	—	—	—	—	—
Preston	—	—	55 1842.	56	54	56	71	71	85	—
Blackburn	—	—	55	56	56	60	77	73	87	—
Clitheroe	53	—	52	—	51	—	76	—	—	103
Burnley	—	—	—	—	—	—	—	—	—	—
Bury and Rochdale }	63	66	63	69 1844.	—	—	—	—	—	—
Scotland	65½	—	59½	69½	61	70	73½	69½	79½	86½

District.	1871.	1874.	1877.	1880.	1883.	1886.	1891.	1896.	1900.	1906.
Manchester....	92½	100	105½	97	104½	100	—	—	—	112½
Bolton	93	101	106½	101½	103½	100	110½ 1890.	113	119	121½
Oldham	—	97½	101½	97½	102½	100	107	110½	116½	122
Ashton	—	—	—	—	—	100	—	—	—	119½
Stockport	—	—	—	—	—	100	—	—	—	137½
Preston	91	97	105	96	100	100	110	109	111	121½
Blackburn	94	98	105	96	100	100	110	113	119 1901.	124½
Clitheroe ...	—	107	108	98	102	100	114	—	123 1902.	131*
Burnley	—	—	—	—	—	100	111	—	118 1899	133
Bury and Rochdale }	88	—	—	—	—	100	—	—	—	134½
Scotland	—	99½	—	—	96½	100	114½	—	—	120½

* 1909, 143.

While this table is before us, we may note the similarity in the course of wages at Bolton and Oldham, and the few numbers we have for Ashton suggest that a complete series for that centre, if we had them, would not differ greatly from these two spinning centres. At Manchester, as would be expected, the course has been peculiar, but not so peculiar as at Stockport, where the relatively small advance between the "thirties" and 1886, and the great advance from that date to 1906, suggests that the year 1886

was abnormal. At Preston and Blackburn the courses have been so much alike that we are able to interpolate missing years in one series from the known figure in the other. At Clitheroe, beginning with very low wages in 1833, we have a greater advance than is found in any other district.

TABLE 36.—*Estimates of average earnings of cotton factory operatives for an ordinary week's work in the chief centres of the industry, 1806-1906.*

(Expressed in pence per week.)

District.	1806.	1810-16.	1817.	1818-20.	1821-22.	1823-25.	1826.	1832-33.
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Manchester	131	137	135½	134½	134	126½	127	123

District.	1833.	1836.	1840-41.	1845.	1850.	1855.	1860.	1863.	1866.	1870.
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Manchester	123	125 1837.	113	129 1846.	114	122 1853.	124	—	141½	154
Bolton	111½	114	117	123	120	127½	146	144	160	—
Oldham	127	139	137	—	132	—	163	—	177½	187
Ashton	127	132	124	—	—	—	—	—	—	—
Stockport	134	153	133	—	—	—	—	—	—	—
Preston	—	—	101 1842.	102½	99	102½	130	130	156	—
Blackburn.....	—	—	105	107	107	114½	147	139½	166	—
Clitheroe	93	—	92	—	89	—	133	—	—	181
Burnley.....	—	—	—	—	—	—	—	—	—	—
Bury and Rochdale }	110	115	110	120 1844.	—	—	—	—	—	—
Scotland	96	—	88	102	89	103	108	103	117	—

District.	1871.	1874.	1877.	1880.	1883.	1886.	1891.	1896.	1900.	1906.
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Manchester	160	177	182½	168	180½	173½	—	—	—	195
Bolton	166	181	190	181	188	179	198	203	213	218
Oldham.....	—	201½	209	201½	210	206	221 1890.	228	240	252
Ashton	—	—	—	—	—	195	221	—	—	233
Stockport	—	—	—	—	—	167	—	—	—	230
Preston	166½	177½	192	176	183	183	201	200	203 1901.	222
Blackburn.....	180	187	201	183	191	191	210	216	227 1902.	248
Clitheroe	—	188	189	173	179	176	200	—	217 1905.*	231
Burnley.....	—	—	—	—	—	214	238	—	253 1899.	286
Bury and Rochdale }	153	—	—	—	—	174	—	—	—	234
Scotland	130	146	—	—	142	147	168	—	—	177

* 1909, 252.

When the history of the industry in Scotland is borne in mind, the course of wages there has not differed from that in Lancashire to so great an extent as would, perhaps, be anticipated. From 1833 to 1886 the advance nearly equalled that of the Lancashire spinning centres; from 1870 to 1874 a greater advance is found than in any other place; and from 1886 to 1906 the rate of increase fell in relation to Lancashire, and only equalled two-thirds of the increase of the Lancashire and Cheshire district taken as a whole, though it exceeded that of Manchester and Ashton.

From these index-numbers, with the aid of the Wage Census of 1886 and of 1906, we are able to estimate the average weekly wage per head of all employed in these centres at these dates, and this is the next stage in combining all these figures into an average for the United Kingdom.² This is done in Table 36.

This table speaks for itself. The wages are stated in pence per week, and our business is now to combine them into an average for the United Kingdom.

We know from the Wage Census of 1886 that the average for the United Kingdom in that year was 15s. 2d., and from that of 1906 that in that year the average was 19s. 7d. per head of all employed. In 1833, the census taken for the Children's Employment Commission, covering Manchester, Bolton, Oldham, Ashton, and Stockport, showed an average of 10s. 5d. per head for that district, comprising practically the whole of South Lancashire and Cheshire. In the same year, if what happened on the average at those Lancashire centres for which we have information happened also at Preston, Blackburn, and Clitheroe, the average at these places was rather more in 1833 than in 1840-42. In these years we have estimated in Table 36 that the average wage per head at Preston was 8s. 5d., at Blackburn 8s. 9d., and at Clitheroe 7s. 8d. We are probably safe in assuming that the wage at Blackburn may be taken as typical of the average at Bury, Rochdale, Accrington, and Burnley, while Preston adequately represents Chorley, and Clitheroe would be typical of the lower average earned in the North of Lancashire. Roughly weighing these figures in the proportion of Blackburn 50, Preston 20, and Clitheroe 2, which is a quite sufficient relative proportion of their importance, we get as the average for this district (which I will call the North and North-East Lancashire district, to distinguish it from the part covered by the Children's Employment Census, which I will call the South Lancashire and Cheshire district) 8s. 8d. per head of all employed in 1840-1,

² Ireland, which has had a small cotton industry, is omitted from these figures, as the number employed there has always been too small to have any effect on the result.

indicating about 8s. 10d. in 1833. In Glasgow in 1833, a census given in the Returns of Wages shows an average of 8s. per head, and it is not probable that the inclusion of the other Scottish centres, such as Lanark, would materially affect this. In 1835 and 1839, the Factory Inspectors' Returns of Numbers Employed in Cotton Factories showed that about one-seventh of the total number so employed were in Scottish factories, and by the 1851 Census, when the hand-loom weavers had been so reduced in number as to make the census numbers of persons employed in the cotton industry roughly typical of the comparative numbers employed in factories, we find that of 197,000 persons, about 100,000 were employed in towns covered by the 1833 Census (South Lancashire and Cheshire), and 97,000 were in the rest of Lancashire and Cheshire. Between 1833 and 1851, the industry in North and North-East Lancashire had probably grown proportionately more rapidly than in the southern portion, so that if we take for 1833—

North and North-East Lancashire	2½
South Lancashire and Cheshire	3½
Scotland	1
Total	7

as our weights for that year we are probably as near as we need be to the actual truth. In 1886 the Wage Census returns for the centres comprised in these districts were:—

		Average wage.	
		s.	d.
North and North-East Lancashire	10½	15	1
South Lancashire and Cheshire	7½	15	9
Scotland	1	12	3
Combined	19	15	2

and the average for the United Kingdom is not affected by the inclusion of Yorkshire and Derbyshire (other than Glossop, included with Stockport). In 1906 the Wage Census shows:—

		Average wage.	
		s.	d.
All Lancashire and Cheshire	22	19	9
Scotland	1	14	9
Combined	23	19	6½

while the inclusion of Yorkshire and Derbyshire raises the average for the United Kingdom to 19s. 7d.

TABLE 37. *Combination of averages estimated separately for South Lancashire and Cheshire, North and North-East Lancashire and Scotland, with resulting estimated average weekly wages per head of all employed as cotton factory operatives in the United Kingdom, 1833-1906.*

Years.	South Lancashire and Cheshire.		North and North-East Lancashire.		Lancashire and Cheshire.		Scotland.		United Kingdom.	
	Average wage per head.	Relative number employed.	Average wage per head.	Relative number employed.	Average wage per head.	Relative number employed.	Average wage per head.	Relative number employed.	Average wage per head.	Index number. (1900 = 100.)
1833	d.	14	d.	10	d.	24	d.	4	d.	52
1836	126	15	106	12	117½	27	96	4	114	53½
1839-41	129	17	108	15	120	32	(100)	4	117	51
1845	125	18	104	17	115	35	88	4	112	54½
1849-50	134	20	108	20	121½	40	102	4	119	50½
1855	124	21	105	23	114½	44	89	4	110	54½
1860	133	23	111	26	121½	49	103	4	120	54½
1863-64	146	24	138	28	142	52	108	4	139	63½
1866	143	25	135	32	139	54	103	4	136	62
1871	162	26	159	34	160½	58	117	4	157	71½
1874	175	27	176	36	175½	61	130	4	173	79
1877	189	28	185	38	187	64	146	4	184	84½
1880	197	29	194	39	195	67	(147)	4	192	88
1883	186	30	176	41	181	69	(154)	4	178	81½
1886	195	31	183	—	188	72	142	4	186	85
1891	189	—	181	—	184	76	147	4	182	83½
1896	—	—	—	—	206	80	168	4	204	93½
1900	—	—	—	—	210	84	(168)	4	208	95
1906	—	—	—	—	221	88	(172)	4	219	100
					237		177	4	235	107½

To get the intermediate wages and weights from 1833 to 1886, I have taken the variations indicated by the mean index numbers for Oldham, Bolton, and Manchester to represent South Lancashire and Cheshire, of Preston and Blackburn (slightly adjusted to allow for the more rapid rise at Clitheroe in the "seventies") for North and North-East Lancashire, and have assumed that the relative numbers employed have gradually changed from the proportions indicated in 1833 to those indicated by the Wage Census of 1886. From 1886 to 1906 I have taken the wage indicated by the index numbers for the whole of Lancashire and Cheshire and Scotland respectively, and have ignored the distinction between the North and South Lancashire districts, as it ceases to be of any use. The combination of the whole of these figures is shown in Table 37.

Previous to 1833 our only statement other than for the Manchester district is that at Glasgow wages were practically unchanged for many years. The Manchester district figures do not show much change (between 1806 and 1833 a fall of 6 per cent.), and such changes as they do show are gradual. If we assume that the fluctuations in wages at the few mills represented in our Manchester district figures are typical of Lancashire and Cheshire (a fairly safe assumption for these early years when Manchester employed so large a proportion of the total operatives), and that in Scotland, representing roughly $\frac{1}{4}$ th of the trade (perhaps more in 1806 and less in 1833), wages were unchanged at 8s. per week, we get the following for the period 1806-1833:—

TABLE 38.
(In pence per week.)

	Weights.	1806.	1810-16.	1817.	1818-20.	1821-22.	1823-26.	1832-33.
Lancashire and Cheshire.....	6	125	131	129	128	127	121	117
Scotland.....	1	96	96	96	96	96	96	96
United Kingdom.....	7	121	126	125	124	123	118	114
Index number. (1900 = 100)	—	55 $\frac{1}{2}$	57 $\frac{1}{2}$	57	56 $\frac{1}{2}$	56	54	52

The accuracy of these figures turns mainly on the correctness of the figure for 1833. We may assume that in 1886 and 1906 the Wage Census Returns were typical, and that in 1833 the Glasgow and South Lancashire and Cheshire figures were also typical. Any error is introduced by the assumption made regarding the Rest of Lancashire. Here we may possibly be 6*d.* per week wrong. If too high by 6*d.* the resulting average for England and Wales is 115 pence instead of the 117 pence shown in Table 38, and for the

United Kingdom 112 pence instead of the 114 there shown. If, on the other hand, the average is understated by 6*d.* the results shown would have to be raised by 2½*d.* for England and Wales and 2*d.* for the United Kingdom. If, as is almost inconceivable, the average for South Lancashire in 1833, namely, 10*s.* 5*d.*, should be correct also for the whole Lancashire and Cheshire area, the United Kingdom average of 9*s.* 6*d.* is too low by 7*d.* On the whole, therefore, we seem quite justified in assuming that our result for 1833 is sound within $\pm 6d.$ per week or approximately ± 5 per cent.

In the earlier years the error may be larger, but not much, and in the intervening years between 1833 and 1886 the later we get the more accurate our figures become, because the margin between the wages of the Northern and Southern districts becomes less, and the relative numbers employed in Lancashire increase. Further investigation may at some later date result in such additional material as will lead to a modification of these figures, but for the present we are tolerably safe in saying that the average wages of cotton factory operatives in the United Kingdom have advanced by more than 100 per cent. between 1832–1850 and 1906; that between 1810 and 1832 a fall of about 10 per cent. took place; that from the lowest point, which was reached in the great trade depression of 1847–49, to the *maximum* of the “seventies” the advance was about 75 per cent.; that a series of reductions reduced the *maximum* earnings of the “seventies” by about 10 per cent., and that by 1906 the average was not only higher than was ever reached before, but was about 20 per cent. higher than the highest point reached in the “seventies” and about 35 per cent. higher than the lowest point of the previous 30 years (*i.e.*, 1879).

Up to this point we have been considering factory operatives only, but in the early days of the industry the hand-loom weavers working in their own homes were more numerous than the factory workers, and it is necessary to devise some means of combining the information relating to these two groups.

The estimates for hand-loom weavers' wages will be found in Section V dealing with these operatives (*Journal*, April, 1900, p. 433), and they are also given in Table 41 below.

So far we have only arrived at estimates for factory operatives for certain years, generally at intervals of three or five years. These we may call our “pivot” points. Considerable materials relating to intermediate years are to be found in the section dealing with changes in list prices,³ and in those giving the detailed information for the Manchester, Oldham, Bolton, and Preston and Blackburn

³ Section I, *Journal*, January, 1910.

districts. By their aid we can compute intermediate numbers for practically every year since 1839. These numbers form our final estimate of the course of wages of cotton operatives employed in factories from 1806 to 1909 and are given later in Table 41, where we shall consider them in conjunction with the numbers employed.

Estimates of numbers employed.

We have now to combine the index-numbers of factory operatives' wages with those of the home-workers to arrive at final numbers representing the whole trade. In doing this we are limited by the fact that we know nothing regarding the course of wages of the cottage spinners, winders, and warpers dependent on the hand-loom weavers; nor can we do more than conjecture as to their numbers. It must be clearly understood, therefore, that, in what follows, this limitation is involved, and that our final results only refer to the factory operatives *plus* the hand-loom weavers.

For this purpose it is necessary to estimate the numbers employed in each branch at various dates between 1806 and the time when the hand-loom weavers had so dwindled away as to be insignificant in proportion to the growing number of factory employees. Unfortunately our material for this is sadly deficient, and we are able at the best only roughly to approximate. Our main authorities are Ellison,⁴ Baines,⁵ and the factory inspectors,⁶ and the whole matter was reviewed at some length by Porter.⁷ Table 39 shows the estimates of these authorities.

With the exception that Baines's figures for 1833 seem too large for the numbers of factory operatives, and that his estimate of the number of hand-loom weavers is the *maximum*, these estimates are quite consistent with each other. They are not, however, quite independent, Ellison relying on Baines and Baines quoting Kennedy with approval for the earlier years, and disagreeing with him as to the power looms in 1829.

Ellison's estimate for 1787 is apparently based on a statement, really for 1788, appearing in the *Manchester Mercury*, April 28, 1788, and probably elsewhere, that 143 mills were erected or in course of erection, two-thirds of which had been erected in 3 years, and that besides there were 20,500 spindles in existence. The estimate appears too high, however, as few factories at that date had so many as 100 employees,⁸ and therefore there would not

⁴ *The Cotton Trade of Great Britain*, 1886.

⁵ *History of the Cotton Manufacture*, 1835.

⁶ Returns of numbers employed in factories, 1835

⁷ *Progress of the Nation*, 1847, Chap. II.

⁸ Chapman, *The Lancashire Cotton Industry*, p. 58.

TABLE 39. — *Estimates of the numbers employed in various branches of the cotton industry.*

Year.	Authority.	Factory spinning.	Power-loom weaving.		All factory operatives.	Hand-loom weavers.
			Operatives.	Looms.		
1787.....	Ellison	60,000	—	—	60,000	—
1813.....	Baines	—	—	2,400	—	—
1815.....	Ellison	100,000	7,000	—	107,000	200,000
1817.....	Kennedy*	110,700	—	—	—	—
1819-21	Ellison	110,000	10,000	—	—	240,000
1820.....	Kennedy*	—	—	14,150	—	240,000
1823.....	Baines	—	—	Large additions	—	—
1824-5.....	"	—	—	Larger additions	—	—
1826-31	"	—	—	Few additions	—	—
1829.....	Kennedy*	—	—	55,500	—	—
1829-31	Ellison	140,000	50,000	—	190,000	225,000
1832.....	Stanway†	133,000	75,000	—	205,000	—
1832-3-4	Baines	—	—	Enormous increase	—	—
1833.....	"	—	—	100,000	237,000	250,000
1833.....	Porter, quoting Witnesses to 1833 Commission	—	—	—	—	{ Not less than in 1820, 200,000—250,000
1835.....	Factory Inspectors	—	—	110,000	220,000	—
1839.....	"	—	—	—	259,000	—
1844-6.....	Ellison	190,000	150,000	—	340,000	60,000
1859-61	"	248,000	203,000	—	451,000	5,000—10,000

* Quoted by Porter and Baines, but I have not found the originals.

† Commission on Employment of Children in Factories of 1833. Quoted by Porter.

be, at most, 14,500 operatives employed in them. The addition of 20,000 spinners on hand jennies of 80 spindles each, of which Ellison speaks, may bring the numbers up to his total, but it seems excessive.

The point is not very important, however, as our wages records do not go back so far.

We have no knowledge of the number of hand-loom weavers, other than a statement by Schulze-Gävernitz on the authority of a Committee on Petitions from several Cotton Manufacturers, 1808, that there were then 200,000 (I have not found the original), Kennedy's estimate of 240,000 in 1820, and the general consensus of opinion that they had not diminished by 1833, when they were variously estimated at 200,000 and 250,000. Ellison expressly takes the mean of these numbers for 1829-31 and estimates them at 60,000 in 1844-6 and 5 to 10 thousand in 1859-61. Assuming that they remained unchanged from 1820 to 1831, and that they gradually dwindled away from year to year after until they practically disappear about 1860, we still have to estimate their numbers before 1820.

At that time the power-loom was just beginning to make its influence felt; before that time practically the whole of the vastly increased supply of yarn had to be woven by the hand-loom weavers. As the output per operative employed in spinning increased year by year, the hand-loom weavers would bear no definite proportion to the spinning operatives, and this fact, coupled with the decline of the hand-spinners as the factory operatives increased, makes it impossible for us to assume any connection between the numbers of spinners and the numbers of the weavers using their yarn output. It is absolutely certain, however, that they increased very materially. No improvements of sufficient importance to materially affect the consumption of yarn per loom were made in the hand-loom. Yet the imports of raw cotton averaged in millions of lbs. per annum:—

1781-84.....	7½	1800-1804.....	57	1815-1819.....	129
1785-89.....	23	1805-1809.....	66	1820-1824.....	154
1790-94.....	30	1810-1814.....	80	1825-1829.....	227
1795-99.....	30				

Up to 1820 this enormous increase must have required more looms to use it; after that date the power-loom may have increased sufficiently to absorb the extra supplies of yarn. If we estimate that increase to have been 4,000 per annum, we get 108,000 in 1787, or not quite twice as many as there were employed in spinning mills. In 1810 we get the 200,000 quoted by Schulze-Gävernitz for 1808. In 1820 we have something over twice as

many hand-loom weavers as spinning employees, and 14,500 power-looms, equal probably to 50,000 hand-loom weavers,⁹ in addition. This, in all, is practically 290,000 hand-loom units to 110,000 power-spinning units. These numbers are therefore consistent with a large increase in the number of power-spinners, an enhanced output per spinning operative and a vastly increased consumption of raw material.

Combining the whole of these estimates, carrying on our numbers of factory operatives by means of the Factory Inspectors' Returns, and assuming all increases or decreases to have been uniform and gradual in between years, but making allowance for the inflated growths of 1823-5 and 1832-4, we arrive at the following "weights" for combining the wages of hand-loom weavers to factory operatives.

TABLE 40.—*Estimates of numbers employed in various branches of the cotton trade, 1787-1862.*
(000's omitted.)

Years.	In factories.			Hand-loom weavers.
	Spinning.	Weaving.	Total.	
1788.....	60	—	60	108
1801.....	83	—	83	164
1806.....	90	few	90	184
1813.....	104	3	107	212
1817.....	111	10	121	228
1820.....	115	11	126	240
1823.....	120	15	135	240
1824.....	122	45	167	240
1825.....	124	49	173	240
1831.....	131	56	187	240
1832.....	132	64	196	227
1833.....	133	75	208	213
1835.....	—	—	220	188
1839.....	—	—	259	135
1847.....	—	—	277	53
1850.....	—	—	331	40
1856.....	—	—	379	23
1862.....	—	—	452	3

In criticising these numbers it should be borne in mind that they are not intended so much for definite estimates of the numbers employed in the cotton industry as for proportions between factory

⁹ Baines says that a hand-loom weaver would weave two pieces of shirting a week; that in 1823 a steam-loom weaver on two looms would weave seven similar pieces; in 1826, on four looms with a tenter, 12 to 15 similar pieces; and in 1833, on four looms with a tenter, 18 to 20 similar pieces. A power loom was, therefore, equal to three and a half hand-looms in 1823-26, and four and a half in 1833.

workers and hand-loom weavers. No account is taken, for instance, of the numbers employed at hand spinning in the early years, or of the winders and warpers for the hand-loom, about whom we know very little. Dyeing and printing is not included, as this should be treated as a separate industry.

We have now arrived at the outline of our estimate of the course of wages of all cotton operatives, and it only remains to fill in the details. This is done in Table 41, where are shown the variations in wages of both factory operatives and hand-loom weavers from 1806 to 1862, and the estimated changes in the final averages of all combined, when allowance is made for the annually changing proportions of factory and non-factory workers. Certain figures are given in italics, indicating that these rest on less sufficient evidence than the rest of our numbers.

When the results shown in Columns 7 and 8 were calculated, they seemed so extraordinary that I felt inclined to reject them altogether. It certainly needs very sound evidence to substantiate a conclusion which shows that the wages of all persons employed in the industry were as high in 1806 as in 1890,¹⁰ that a reduction of over 50 per cent. took place in so short a space as 25 years, and that in the space of 75 years (1831-1906), an advance of 160 per cent. took place. We need therefore to consider the possible sources of error at the weakest places. These appear to be 1806, and about 1831, namely, the highest and lowest points. Of these, we may easily satisfy ourselves about 1831. Our figures show very little variation between 1830 and 1833, and in the latter year we have abundance of evidence. Our table shows an average wage of 9s. 6d. for 208,000 factory operatives in 1833, and of this we are only in doubt respecting a small part, the main basis of the figures being in fact a very wide census. The 208,000 taken as the number employed in factories may have been more or less, but not by many either way. Neither, as we have seen, is the average wage open to much doubt. We have, indeed, found that at the utmost it cannot be more than 7d. wrong, and is probably within 2d. For the hand-loom weavers we have an average of 6s. for 240,000 in 1831, and 213,000 in 1833. The wage is attested by scores of witnesses to the Committee of 1835 and Commission of 1838-40;

¹⁰ This is not a strictly accurate description of the change, as of course the winders for the hand-loom are not included; neither are the cottage spinners. Their inclusion would reduce the average, as they certainly earned much less than the weavers. As we know practically nothing about them, I have been forced to ignore them. It may be noticed, however, that if there was one winder in 1806 for every six hand-loom weavers, and she earned 5s. a week, the average wage of factory operatives, hand-loom weavers and winders combined, becomes 15s. 6d. instead of the 16s. 8d. shown in Col. 7. This margin of 1s. 2d. becomes less every year after

TABLE 41.—*Changes in average wages and numbers employed of cotton operatives employed in factories and as hand-loom weavers from 1806 to 1862, and in the average wages of cotton factory operatives from 1863 to 1909, with the final average for all these workpeople when allowance is made for the changing numbers employed.*

Years.	Operatives in factories.			Hand-loom weavers.		All workpeople.		
	1. Number em- ployed.	2. Weekly wage.	3. Col. 2 as per- centage of 1900.	4. Number em- ployed.	5. Weekly wage.	6. Number em- ployed.	7. Weekly wage.	8. Col. 7 as per- centage of 1900.
	000's.	d.		000's.	d.	000's.	d.	
1806.....	90	121	55½	184	240	274	200	91½
1807.....	93	122	—	188	207	281	178	81½
1808.....	95	123	—	192	159	287	147	67
1809.....	97	124	—	196	168	293	153	70
1810.....	100	126	57½	200	171	300	156	71½
1811.....	102	126	57½	204	147	306	140	64
1812.....	105	126	57½	208	168	313	154	70½
1813.....	107	126	57½	212	180	319	162	74
1814.....	110	126	57½	216	222	326	189	86½
1815.....	114	126	57½	220	162	334	150	68½
1816.....	117	126	57½	224	123	341	124	56½
1817.....	121	125	57	228	105	349	112	51
1818.....	123	124	56½	232	99	354	108	49½
1819.....	125	124	56½	236	99	361	108	49½
1820.....	126	124	56½	240	99	366	108	49½
1821.....	129	123	56	240	99	369	107	49
1822.....	132	123	56	240	99	372	107	49
1823.....	135	118	54	240	99	375	106	48½
1824.....	167	118	54	240	99	407	107	49
1825.....	173	118	54	240	99	413	107	49
1826.....	175	118	54	240	93	415	103	47
1827.....	177	118	—	240	90	417	102	46½
1828.....	180	117	—	240	87	420	100	45½
1829.....	182	116	—	240	87	422	99	45½
1830.....	185	115	—	240	75	425	92	42
1831.....	187	114	—	240	72	427	90	41
1832.....	196	114	52	227	72	423	91	41½
1833.....	208	114	52	213	72	421	93	42½
1834.....	215	115	—	200	84	415	100	45½
1835.....	220	116	—	188	75	408	96	43½
1836.....	230	117	53½	174	75	404	98	44½
1837.....	240	117	—	160	75	400	99	45½
1838.....	250	116	—	147	75	397	100	45½
1839.....	259	112	51	135	75	394	99	45½
1840.....	262	112	51	123	75	385	100	45½
1841.....	264	113	51½	110	75	374	102	46½
1842.....	267	113	51½	97	75	364	103	47
1843.....	269	110	50½	85	75	354	102	46½
1844.....	271	113	51½	72	75	343	105	48
1845.....	273	119	54½	60	75	333	111	50½
1846.....	275	119	54½	57	75	332	111	50½
1847.....	277	110	—	53	75	330	104	47½
1848.....	295	110	—	50	75	345	104	47½
1849.....	313	110	50½	47	75	350	105	48

TABLE 41 *contd.*—Changes in average wages and numbers employed of cotton operatives, &c.

Years.	Operatives in factories.			Hand-loom weavers.		All workpeople.		
	1. Number em- ployed.	2. Weekly wage.	3. Col. 2 as per- centage of 1900.	4. Number em- ployed.	5. Weekly wage.	6. Number em- ployed.	7. Weekly wage.	8. Col. 7 as per- centage of 1900.
	000's.	d.		000's.	d.	000's.	d.	
1850.....	331	110	50 $\frac{1}{3}$	43	75	374	106	48 $\frac{1}{3}$
1851.....	339	112	51	40	75	379	108	49 $\frac{1}{3}$
1852.....	347	114	52	37	75	384	110	50 $\frac{1}{3}$
1853.....	355	120	54 $\frac{2}{3}$	33	75	388	116	53
1854.....	363	118	54	30	75	393	115	52 $\frac{2}{3}$
1855.....	371	120	54 $\frac{2}{3}$	27	75	398	117	53 $\frac{1}{3}$
1856.....	379	126	57 $\frac{1}{3}$	23	75	402	123	56 $\frac{1}{3}$
1857.....	391	127	58	20	75	418	124	56 $\frac{2}{3}$
1858.....	403	127	58 $\frac{1}{3}$	17	75	420	125	57
1859.....	415	131	60	13	75	428	129	59
1860.....	427	139	63 $\frac{2}{3}$	10	75	437	138	63
1861.....	439	139	63 $\frac{2}{3}$	7	75	446	138	63
1862.....	452	137	62 $\frac{1}{2}$	3	75	455	137	62 $\frac{2}{3}$

All workpeople.

Year.	Number.	Weekly wage.	Per- centage of 1900.	Year.	Number.	Weekly wage.	Per- centage of 1900.
	000's.	d.			000's.	d.	
1863.....	—	136	62	1885.....	504	184	84
1864.....	—	136	62	1886.....	—	182	83 $\frac{1}{3}$
1865.....	—	144	66	1887.....	—	185	84 $\frac{2}{3}$
1866.....	—	157	71 $\frac{2}{3}$	1888.....	—	192	87 $\frac{2}{3}$
1867.....	—	158	72 $\frac{1}{3}$	1889.....	—	194	88 $\frac{2}{3}$
1868.....	—	162	74	1890.....	529	197	90 $\frac{1}{3}$
1869.....	—	159	72 $\frac{2}{3}$	1891.....	—	204	93 $\frac{1}{3}$
1870.....	450	165	75 $\frac{1}{2}$	1892.....	—	207	94 $\frac{2}{3}$
1871.....	—	173	79	1893.....	—	206	94
1872.....	—	178	81 $\frac{1}{2}$	1894.....	—	206	94
1873.....	—	181	83	1895.....	539	206	94 $\frac{1}{3}$
1874.....	430	184	84 $\frac{1}{3}$	1896.....	—	208	95
1875.....	—	184	84 $\frac{1}{3}$	1897.....	—	209	95 $\frac{2}{3}$
1876.....	—	187	85 $\frac{2}{3}$	1898.....	—	211	96 $\frac{1}{3}$
1877.....	—	192	88	1899.....	—	214	97 $\frac{2}{3}$
1878.....	433	179	82	1900.....	—	219	100
1879.....	—	172	78 $\frac{1}{3}$	1901.....	523	220	100 $\frac{2}{3}$
1880.....	—	178	81 $\frac{1}{3}$	1902.....	—	219	100
1881.....	—	183	83 $\frac{1}{3}$	1903.....	—	218	99 $\frac{1}{3}$
1882.....	—	184	84	1904.....	523	220	100 $\frac{2}{3}$
1883.....	—	186	85	1905.....	—	226	103 $\frac{1}{3}$
1884.....	—	187	85 $\frac{1}{3}$	1906.....	—	235	107 $\frac{1}{3}$

Note.—The percentages of 1900 are given to the nearest one-third, not as a pretence to accuracy, but for convenience in re-converting them to terms of any other year at any time.

while the number is between the 200,000 and 250,000 estimated by contemporary witnesses. Assuming that the average wage of both factory operatives and hand-loom weavers may be wrong by 6*d.*, and taking the number of hand-loom weavers at 200,000 to 250,000, their wages at either 5*s.* 6*d.* or 6*s.* 6*d.*, and the number of factory operatives at 185,000 to 210,000, and their wages at 9*s.* to 10*s.*, the result which we have arrived at, namely, 90 pence in 1831, 91 pence in 1832, and 93 pence in 1833, is well within the limits of 85 to 99 pence which these variations yield.

In 1806 the case is different. Here we have assumed rather more, and cannot pretend that our result is so accurate. Our wages for factory operatives depend on an assumption for one-seventh; our numbers are entirely assumed; our wages for hand-loom weavers are not based on so much evidence; they are further open to the suspicion that in making retrospective statements the most favourable aspects would be the most likely to be brought out; and our numbers are also little better than conjecture. The question is whether the result for 1806 is too high. In the first place our number employed in factories, while it agrees with the known facts, may be, say, within 10,000. The average wage, for factory operatives, may be 1*d.* higher if the course of wages at Manchester indicates the course at Glasgow, and wages there, in 1806, were 8*s.* 6*d.* per week instead of 8*s.*, and perhaps 3*d.* higher if the North and North-East Lancashire district wage as estimated for 1833 is too low. It is possible, therefore, that our 1806 wage for factory operatives is too low by 4*d.*, but scarcely probable that it is too high. The numbers of hand-loom weavers, estimated at 184,000, can scarcely be more than 6,000 too few, or we get too little increase between 1806 and the time when the power loom came in in sufficient numbers to appreciably affect the consumption of yarn, the supply of which increased annually. It may, however, be too high, possibly by 20,000. Their wages, again, may be wide of the mark, but in view of the careful summary of the Committee of 1835, quoted in Section IV (*Journal*, April, 1910, p. 434), we are quite justified in believing that they cannot have been below 18*s.* On the other hand, they may have been higher. At Bolton we have as the earnings in that year, for various work, 22*s.*, 21*s.*, and 21*s.*, at Wigton 22*s.*, at Glasgow 17*s.* 8*d.* and 32*s.* 6*d.* Wages had fallen by 1810, yet even in that year we have 16*s.* 3*d.*, 16*s.* 10½*d.*, 14*s.*, 16*s.* 5½*d.*, 17*s.* 2*d.*, and 21*s.* as wages on various goods at Manchester, and 17*s.* to 24*s.* 6*d.*, and 13*s.* 6*d.* to 17*s.* 2*d.* at Glasgow. Our 20*s.* in 1806 might therefore even be as high as 24*s.* Hence, our range in that year includes the variations between—

80,000 to 100,000 factory operatives at 9*s.* 6*d.* to 10*s.* 6*d.*

165,000 to 190,000 hand-loom weavers at 18*s.* to 24*s.*

namely, from 14s. 9d. to 20s. compared with the 16s. 8d. which we have estimated. In 1806, therefore, our final average weekly wage may be 2s. too high or 3s. 8d. too low, and our index number, compared with 1900, may be 81 or 110 instead of 91. In any case the result substantiates the conclusion that very high wages were obtained in the very early years of the century, and that a great and rapid fall took place for 25 years, and that the high average of 1806 was not again attained until the "seventies," and probably not until the "nineties."

In each year after 1806 our error becomes less until 1816, when it is at its *minimum*: it increases after to 1831, when it reaches a second *maximum*; and then decreases as the hand-loom workers fall out, until in the "sixties" it comes within negligible limits.

The course of wages of each section and of all combined is illustrated by the diagram.

Assuming that our result is sufficiently correct for all practical purposes, and summarising it in periods as follows:—

		Factory operatives.	Hand-loom weavers.	All workpeople.
<i>Maximum</i>	1806—1809	122	193	170
Falling	1810—1819	126	148	140
Falling	1820—1829	119	95	105
Falling	1830—1839	115	75	96
<i>Minimum</i>	1830—1833	—	—	92
Little change	1840—1849	114	75	106
Factory <i>minimum</i>	1847—1850	110	75	105
Rising	1850—1859	121	75	118
Rising	1860—1869	147	—	147
Rise and fall	1870—1879	180	—	180
<i>Maximum</i>	1874—1877	187	—	187
<i>Minimum</i>	1878—1881	176	—	176
Recovery	1880—1889	185	—	185
Slowly rising	1890—1899	207	—	207
Quick rise.....	1900—1906	222	—	222

we find that wages have almost steadily advanced for over seventy years and that they now are at least double what they were in the middle of the nineteenth century.

How various classes of operatives have shared this advance.

There are so many different occupations in the cotton industry that it cannot be expected that all will have shared alike in this

advance in wages. The changes in different occupations are interesting in themselves; they also help to indicate where the factors making for improvement have been most operative.

We cannot, however, trace the changes in the occupations as accurately as we can trace the changes in the industry as a whole. In the larger calculation, the errors have room to balance one another. For each occupation taken separately, the material is often lacking in completeness. Nevertheless we can get fairly close so far as the Lancashire and Cheshire area is concerned. In Table 42 are given the estimated average earnings for such types of operatives as the most reliable and complete information can be obtained for. No pretence is made to close accuracy: the results are stated to the nearest 3*d.* per week, except in the Census years; and only intermediate years are taken. We cannot pretend to take this back earlier than 1833.

TABLE 42.—*Estimated average weekly earnings of various classes of cotton operatives in Lancashire and Cheshire, 1833–1906.*

	1833.	1840.	1850.	1860.	1871.	1874.
Blow, &c., room women	7/-	7/-	7/6	8/-	12/-	12/-
Strippers and grinders	14/6	13/-	12/9	14/9	21/-	23/-
Draw frame tenters.....	7/6	7/6	7/-	8/-	12/9	14/6
Slubber " "	7/6	8/-	8/6	9/-	14/9	15/6
Rover " "	8/-	8/-	8/6	10/6	15/6	16/-
Throstle and ring spinners....	7/9	8/-	7/6	9/-	12/-	13/-
Self-actor spinners	25/9	22/6	21/9	24/3	30/-	33/-
" big piecers	9/-	10/-	8/9	10/-	12/-	14/-
" little piecers	3/6	5/-	5/6	6/6	7/-	8/6
Winders	9/6	9/-	8/6	10/-	13/-	13/9
Reelers	10/-	9/-	9/-	9/6	13/-	13/-
Warpers	11/-	9/-	11/-	11/6	14/-	15/-
Weavers	11/-	10/6	11/-	12/6	14/-	15/-
Dressers and sizers	27/9	26/-	25/-	25/-	30/-	37/-
Weavers' helpers.....	5/-	5/-	5/-	5/-	5/-	5/3

	1877.	1880.	1886.	1891.	1900.	1906.
Blow, &c., room women	14/3	13/-	11/10	13/-	13/9	14/3
Strippers and grinders	22/-	21/6	20/4	26/6	28/6	29/5
Draw frame tenters.....	16/-	14/6	14/9	18/6	19/6	20/-
Slubber " "	17/-	15/-	15/4	18/-	19/-	19/6
Rover " "	17/-	15/-	15/4	18/-	19/-	19/3
Throstle and ring spinners....	13/6	12/-	12/6	14/-	15/-	15/7
Self-actor spinners	34/-	31/-	31/3	36/-	39/-	41/5
" big piecers	14/-	14/-	14/1	15/3	16/9	17/10
" little piecers	8/6	9/-	9/9	10/6	11/3	12/-
Winders	14/-	13/-	13/-	14/-	14/6	15/3
Reelers	13/-	13/6	13/-	13/-	13/6	13/10
Warpers	17/-	16/-	18/2	18/9	20/-	21/1
Weavers	17/-	16/-	17/1	17/11	19/-	20/6
Dressers and sizers	40/-	35/-	35/2	36/-	37/-	40/-
Weavers' helpers.....	5/6	5/3	5/3	5/9	6/-	6/3

All classes will be seen to have shared in the advance, but the weavers' helpers have shared least. Their compensation is that they do not remain helpers very long, but become weavers themselves. Since 1850 the frame-tenters' wages have increased by well over 100 per cent. (drawing-frame tenders' wages have increased by nearly 200 per cent.), and so have those of strippers and grinders, piecers, and ring spinners. Reelers have only risen by about 50 per cent., but winders, warpers and weavers have increased by 80 to 90 per cent.

Influences affecting average wages.

There are four chief causes of change in the average wage in an ordinary week of all employed, and it is interesting and instructive to examine the growth of wages in the cotton industry, and try and separate these influences. The four causes are :—

- (a) Advances or reductions in piece prices or time-work rates ;
- (b) Changes in hours of labour :
- (c) Changes in the proportions of skilled and unskilled, the distribution of occupations, or the relative numbers of men, women, boys, and girls ; and
- (d) Changes in the efficiency of operative or machine.

We cannot expect to state exactly what proportions of the change in the average over a particular period are due to any of these causes, but we can make some close approximations.

In Section I¹¹ will be found an account of the changes in the levels of piece prices under certain well-known "lists" which now practically govern the trade, and of the changes in time rates for certain classes of operatives at two mills. It is almost impossible to combine these records, and say that wage rates are definitely 5, 10, or 15 per cent. above or below what they were in 1860 or 1870. The levels of list prices in 1860 and 1906 were :—

TABLE 43.

	1860.	1906.
Weaving list	105	100
Oldham spinning	(90 ?)	105
„ male card-room	90 ?	120 ?
Preston spinning.....	107½	112½
Bolton	105	105
„ card-room	105	110
„ male card-room	105	125
Ashton spinning	100	110

¹¹ *Journal of the Royal Statistical Society*, January, Table I.

The three query marks indicate that these are the probable levels, but that the records are incomplete.

The indications are that, taking into account the relative numbers employed in the spinning and weaving branches, and the various adjustments of prices to new conditions, payments for extras previously not paid for, &c., the average rate of payment in 1906 was about 5 or $7\frac{1}{2}$ per cent. above that of 1860. This advance does not seem very great when we remember that the average wage of all employed has advanced by 69 per cent. We shall be fairly within the mark if we estimate it at $7\frac{1}{2}$ per cent., or 10d. per head.

The effects of legal reductions of hours on wages.

The question of the effects of factory legislation on the cotton industry has already been discussed by me in the Society's *Journal*,¹² and it is not my present purpose to go over the ground again. In making investigations for the present paper, however, I have acquired some further information, and it will not be out of place if it is briefly considered here. We need only refer to the effect of reductions of hours on wages, and can say little about that of 1847, except that our index-numbers show the average wage for factory operatives to have been:—

	<i>d.</i>		<i>d.</i>
1844	113	1849	112
1845	119	1850	112
1846	119	1851	113

substantiating the conclusions arrived at in 1902 that the "Ten Hours Act" was accompanied by a reduction of wages, but not by any means *pro rata* with the reduced hours (69 to 60). In a large mill in the North and North-East Lancashire district, time workers were reduced *pro rata* with the reduced hours, but piece workers generally made up their former earnings without any advance in piece rates, as soon as trade, which was very depressed in 1847 and 1848, revived.

In 1875 the hours were reduced from 60 to $56\frac{1}{2}$ per week. Generally speaking, the time workers had their former wages paid for the shorter hours.¹³ Our index-numbers for this period indicate

¹² "Factory Legislation Considered, &c.," by George H. Wood, *Journal of the Royal Statistical Society*, June, 1902.

¹³ *E.g.*, the Blackburn employers resolved to make a *pro rata* reduction for time workers, but failed; and the Oldham employers resolved to pay the former rates to all datal hands. The piecers generally succeeded in obtaining the 60 hours' rate for $56\frac{1}{2}$ hours. See Section II, Oldham and District, *Journal*, February, 1909, p. 158.

the following average earnings per head in pence, during the 3 years before and after the change in hours:—

1872.....	178	1874.....	184	1876.....	187
1873.....	181	1875.....	184	1877.....	192

It will be seen that as wages were rising throughout the period of 6 years, the reduction of hours arrested the advance for 1 year.

The manager of a large spinning mill informs me that while they made no change in weekly rates for dotal operatives, and no change in piece rates, their average earnings fell 7 per cent. between the period preceding the reduction of hours on January 1, 1875, and the middle of the year. The previous hours had been 59. Here the reduction in hours brought a definite decrease in earnings. By 1876, however, the average was higher than ever before, and again no changes in rates had taken place.

In a large weaving establishment which we are unable to identify, but for which we have full particulars from an "average" book, the following were the average earnings for four full weeks in November–December, 1874, and four full weeks January–February, 1875:—

TABLE 44.

	1874. Nov.–Dec.	1875. Jan.–Feb.	Percentage change.	1875. Sept.–Oct.
Winders	12/3	12/0·8	—1·4	12/4
Warpers	17/1	16/5·4	—3·6	16/10
Dressers	34/3·7	32/8·25	—4·7	33/2½
Twisters-in	14/9·2	14/3	—3·4	15/—
Drawers-in	18/9·3	17/9·9	—5·0	17/9½
Weavers, per loom	6/1·18	5/9·01	—5·9	5/8·44

Here the reduction of hours would presumably have been, as was general in the weaving districts, from 60 to 56½, *i.e.*, 5·83 per cent.

All these operatives are piece workers. In the case of the weavers the reduction in earnings was almost exactly equal to the reduction in hours. In the other cases it was less, until in the case of the winders it was about one-fourth of the reduction in hours. As would perhaps be expected, the least reduction came where there was least machine-regularity and most could be gained by personal application. With the weaver the loom, being quite constant in its running, would probably have to be speeded before the effect of the reduction of hours could be regained. With the others there is a margin of personal activity which increases through the processes, and is greatest with the twisters-in and

winders. In each case, however, the reduction of hours brought a reduction of earnings, and in each case the reduction was regained before two years had passed.

This is quite confirmatory of the conclusions arrived at in my earlier paper, namely, that the limitation of the hours of labour, both in 1847 and in 1875, probably caused an immediate, but not *pro rata*, reduction in earnings, that the reduction so caused was made up within a very short period, and that the limitation did not prevent wages from soon attaining a distinctly higher level than had been attained under similar conditions of prosperity previous to the reduction of hours. We cannot say that an advance in earnings followed because of the reduction of hours, but we have as yet failed to find a case where reduction of hours has not been followed in a very few years by higher earnings for the less hours than were formerly obtained in the longer working week.

The Act of 1901, which again reduced the hours, this time from $56\frac{1}{2}$ to $55\frac{1}{2}$, apparently failed to have any perceptible effect on earnings. As one manager put it to me, "We had a whip-up and were more stringent as to the cleaning time." This probably happened in most cases. The falling off in trade which came in 1902, though not great, obscures the question too much for any fine measurement of the effect of reducing the working week by less than 2 per cent., and we should require an investigation into a number of cases with full knowledge as to the state of trade in each mill before we could be sure of any conclusion on the matter.

We thus arrive at the negative conclusion that reductions in hours of labour have not prevented wages from rising. We may, therefore, ignore the question which is naturally raised in considering the causes of the advance, namely, "How much higher would wages have been if the old hours had been continued?" We have no evidence that they would have been any higher. The operatives have soon earned as much in the short week as in the previous long one, because they have drawn on their "reserves of personal efficiency" and the organisation of the work has been improved and the machines speeded.

Increment due to changes in "personnel."

Taking next the changes in the *personnel* it will be convenient to trace these at different periods. From the Factory Inspectors' returns we find the proportionate numbers of children, young persons, and adults to have been :—

TABLE 45.

	1835.	1850.	1862.	1868.	1874.	1878.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Children, —13	13·1	4·5	8·8	10·3	13·9	12·8
Male, 13—18	12·4	11·2	9·1	8·5	8·3	7·2
Male, +18	26·4	28·8	26·4	26·1	24·1	25·1
Female, +13	48·1	55·6	55·7	55·1	53·7	54·9

	1885.	1890.	1895.	1901.	1904.	1907.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Children, —13	9·9	9·1	5·8	4·0	3·4	3·2
Male, 13—18	8·0	8·2	7·8	7·1	7·1	7·9
Male, +18	26·1	26·8	27·6	28·1	28·9	28·3
Female, +13	56·0	55·9	58·8	60·8	60·6	60·6

From this we see that some extraordinary changes have taken place. The continuous diminution in the employment of children and lads and the successively increasing employment of women and girls without reducing the proportion of men, but indeed tending to increase it, would of itself raise the average wage of all considered together.

The division of ages adopted in the Wage Census is not quite the same as that of the Factory Inspectors' returns, the Census age for adult males being 20 years and the Factory Inspectors' only those of 18 years and up. To balance matters I have taken all the big piecers and male 4-loom weavers in the Wage Census from the "boys" and included them with the "men." This gives the following:—

TABLE 46.

	Factory Inspectors' Returns.			Wage Census, 1906.	
	1835. Per cent.	1862. Per cent.	1907. Per cent.	Wage.	Per cent.
Men	26·4	26·4	28·3	28/9	30·2
Lads and boys	12·4	9·1	7·9	11/7	8·7
„ half-timers	6·9	4·9	1·5	3/6	1·5
Women	30·8	(39·0)	45·7	18/8	44·5
Girls	17·3	(16·7)	14·9	11/-	13·5
„ half-timers	6·2	3·9	1·7	3/-	1·6
Average wage in 1906 if employed in the proportions stated	<div> <div>17/2</div> <div>18/-</div> <div>19/6</div> </div>			—	19/7

The proportions for women and girls in 1862 have been interpolated on the basis of a nearly uniform rate of change between 1847

and 1907. The actual numbers are not given by the Factory Inspectors. The Wage Census average in 1906 comes out a trifle too high, as slightly too large a proportion of men were returned. If the proportions of men, women, lads, girls, and half-timers had been returned as the 1907 Factory Inspectors' return shows to have been employed in that year, the average wage would have been 19s. 6d. If, however, the proportions had been the same as those of the Factory Inspectors' returns of 1835, the average wage would only have been 17s. 2d., and if the proportions had been as in 1862, the average would have been 18s. Thus we find an advance of 2s. 4d. in 61 years, due to changes in the *personnel*. Most of this is obviously caused by the reduction of the half-timers.

Even between 1886 and 1906 the advance due to the reduction of half-timers is quite marked. If we take the average wage of full-timers only according to the numbers returned at each Wage Census, the advance is from 16s. 4d. to 20s. 2d., or by 24 per cent.; and if we take the 1886 numbers and apply them to the 1906 wages, we get 19s. 11d. as the average wage, and 22 per cent. as the advance. In 20 years, therefore, the average of full-timers has advanced by alterations in the proportionate numbers employed by about 3d. per week, or 2 per cent. This is almost negligible. Including the half-timers, we get the following details:—

TABLE 47.

	1886.		1906.		Advance 1886—1906
	Per cent.	Wage.	Per cent.	Wage.	
Men*	26·3	23/7	30·9	28/10	+ 5/3
Lads and boys, full-timers	9·1	9/11	9·4	12/-	+ 2/1
„ half-timers	3·8	2/11	1·6	3/6	+ 7d.
Women	44·4	15/3	43·0	18/8	+ 3/5
Girls	11·2	8/9	13·4	11/-	+ 2/3
„ half-timers	5·2	2/8	1·7	3/-	+ 4d.
	100·0	15/2	100·0	19/7	+ 4/5
Average with 1886 numbers and 1906 wages	} —	—	—	18/6	+ 3/4

* Including lads and boys, big piecers, but not lads and boys, four-loom weavers.

Between 1886 and 1906, therefore, the reduction in the proportion of half-timers has caused an advance in average wages per head of 10d. per week, and the changes in the proportion of men, women, lads, and girls full-timers 3d. per week.

It is interesting to trace the effects of the changing proportions

of full-timers over a longer period. The Factory Inspectors' Returns do not show the women over 18 years and girls under that age separately, as a rule, and we are confined to certain periods. Taking the returns for 1835, 1839, 1847, and 1907, and interpolating as above for women and girls in 1862, we get the following (still classifying lads and boys, big-piecers, and four-loom weavers as "men," to bring the Wage Census nearer into harmony with the Factory Inspectors' classification) :—

TABLE 48.—*Full time workers only.*

	Factory Inspectors' Returns.					1906. Wage Census.	
	1835. Per cent.	1839. Per cent.	1847. Per cent.	1862. Per cent.	1907. Per cent.	Per cent.	Wages.
Lads and boys	14·3	16·7	12·6	10·0	8·2	9·9	11/7
Men	30·4	26·1	28·7	28·9	29·2	31·2	28/9
Girls	19·9	23·0	19·3	(19·3)	15·3	13·9	11/-
Women	35·4	34·2	39·4	(42·8)	47·3	45·9	18/8
Wage in 1906 at above propor- tions	19/2	18/4	19/2	19/5	19/10	20/2	—

The Wage Census has, as we have seen, too many adults and not enough boys and girls.

The advance in average earnings of full-timers due to the decreasing employment of boys and girls is 1s. 6d. since 1839, and 8d. since 1835, a change in four years due to the reductions of half-timers and children under 13 years of age which took place in these four years. From 1862 to 1907 the advance from this cause is only 5d.

We thus find that between 1860 and 1906 the average had advanced by 1s. 6d. through the changed proportions of children, young persons, and adults, and that of this advance 5d. is due to changes between young persons and adults, and 1s. 1d. is due to the lessened proportion of children (half-timers).

We can do but very little with the effects of changes in the various occupations owing to want of definite material. The changes from 1886 to 1906, as shown by the Wage Censuses, are illustrated for Lancashire and Cheshire in the table given in the Appendix.

Increment due to improved machinery and greater personal efficiency.

Here we are on more difficult ground. We cannot separate the improvement in the machine from the improvement in the work man. But, after deducting the advances due to definite increases in

wage-rates and to the changes in *personnel*, the residuum of increase is due to the combination of improved machine and greater personal efficiency.

Neither can we trace this movement back very far. We do not know the relative levels of wage-rates before the adoption of the various Standard lists. It is, however, sufficient for all practical purposes to go back to 1860. Between that date and 1906, the average wage of all employed has advanced from 11s. 7d. to 19s. 7d., or by 69 per cent. Of this advance, about 7 per cent. (or 10d.) is due to increased rates of pay, and about 13 per cent. (or 1s. 6d.) is due to the employment of relatively more adults and less children. The remaining 49 per cent. (or 5s. 8d.) is due, therefore, to increased efficiency of operative and machine.

How improved efficiency has been brought about.

It will not be found unprofitable to consider this increase of efficiency as we find it in the various departments of the mill.

Commencing in the cardroom, we find the grinder of to-day practically a skilled operative. On the average he has 14 cards to take care of. The cards are entirely different from those of half-a-century ago; but in a mill where to-day two grinders do the whole of the work, forty to fifty years ago, under the old carding system, about eight or 10 strippers and grinders would have been employed. Here both operative and machine have improved considerably.

In the frames (drawing, slubbing, intermediate, and roving) a large development has taken place, although it is difficult to give exact details. Payment by piece rates has now almost superseded payment by time rates, and the rates are so fixed that an increase in the number of spindles in the frame brings an increased remuneration to the operative, but a less price for producing a given quantity of "drawings" or "rovings." The basis of the Oldham list of 1890 and the Universal list of 1907 is given in Section II (*Journal*, February, 1910, pp. 155-156). There are lists in other districts, and the Blackburn "Lists of Prices for Slubbing, Intermediate, and Roving frames, January 6th, 1873, illustrates the advance which has taken place and the method of payment. In slubbing, the standard length is 70 spindles; for every additional five spindles 4 per cent. is to be added, and for every five less spindles 2 per cent. is to be deducted. For the intermediates the standard length is 90 spindles; for every additional five spindles 3 per cent. is to be added, and for every five less spindles $1\frac{1}{2}$ per cent. is to be deducted. In roving the standard

length is 125 spindles; for every five additional spindles 7 per cent. is to be added, and for every five less spindles 1 per cent. is to be deducted. The corresponding lengths of frame under the Oldham and Universal lists are: slubbers, 84 spindles; intermediates, 124 spindles; and rovers, 164 spindles.

Thus, under the Blackburn list, if a slubber with 70 spindles is supposed to earn 16s. 8d., with 75 spindles she would earn 17s. 4d., and with 65 spindles 16s. 4d., and so on.

With such an arrangement there is every inducement to the employer when putting in new machinery to have more spindles to a frame. His labour cost of production decreases, and the operatives earn higher wages. Further, there is always an incentive to greater speed. More work is done by each unit of machine, and the proportion of standing charges, overlooking, &c., is decreased. This inducement has been sufficient to cause a great development in average spindleage. Contemporary writers say very little about the sizes of frames, and I have not been able to trace the growth until recent years. The old "stretcher," which in 1797 did the work of the slubbing and roving frames, had 90 spindles.¹⁴ The differentiation between slubbing and roving brought shorter slubbing frames and longer roving frames, and the added intermediate frame was, as its name indicates, midway between the two. An old-established spinning and manufacturing firm in Lancashire have given me the following particulars of frames which they have put in at various times:—

		Spindles.
Slubbing frames.....	{	1878 76—90
		1906 96
		1863 92
Intermediates	{	1883 96—120
		1906 108—126
		1863 120
Roving frames	{	1890 150
		1906 150—180

At another place the average spindleage of all frames then running, old and new, were:—

	1885.	1906.
	Spindles.	Spindles.
Slubbers	70	89
Intermediates.....	92	102
Rovers.....	109	146

Even if the present usual length of frame is adhered to, the average length will increase for some years, owing to the old short

¹⁴ See part I, *Journal*, January, 1910, p. 57. Notes to Table 3.

ones being taken out when finished with and those of the present normal length being substituted. It is not certain, however, that the maximum length has yet been reached.

An even greater development has probably taken place in the mule. Hargreaves' jenny, 1764, originally had 8 spindles, soon increased to 20 or 30. Crompton's mule invented in 1774 and completed in 1779, combined Hargreaves' jenny and Arkwright's frame of 1769, and started with about 30 spindles. In 1787, "mule jennies" contained about 90 spindles and "hand jennies" about 80 spindles. The mule was rapidly improved after this, and large numbers of spindles were added. In 1788 we find McConnell making mules of 120 and 144 spindles; by 1795 180 is "as few as any we have made this year," and "what was thought best two years ago is now thought too small, as 216 [spindles] now run as light as 144 used to." In 1796 we first hear of two mules being paired, with the gearing in the middle. In 1799 we find mention of 264 spindles in April and 300 in July. This length is, however, probably quite extraordinary as by 1819 the usual length was under 348 spindles.

In 1825 Roberts invented the self-acting mule and by 1830 had very materially improved it. Between 1830 and 1834 we are told by Ure that these mules were put in in 60 mills, containing between 300,000 and 400,000 spindles. The hand mule, however, remained a long time; the self-actor being adopted first for coarse counts and gradually applied to finer counts as improvements were made. It superseded the hand mule very largely in Preston during the strike of 1853, in Oldham between 1866 and 1874, and in Bolton between 1878 and 1886. It is possible that one or two are actually working to-day. There were about a dozen in Bolton four years ago.

The adoption of self-acting, very often by an alteration of the hand-mule, did away with one piecer. This of itself would tend to raise the average earnings per head and increase the average number of spindles per operative.

In 1833 the hand-mule usually had 300 to 400 spindles, and the self-actors 360 to 480. In the "seventies" the average might be put at from 720 to 960; to-day 1,080 is a usual size. The largest known to me are 1,572 spindles, and these (or their predecessors filling the same space) have, singularly enough, been built for over 50 years. Speeds have increased very considerably. In 1830 Ure speaks of 3,800 to 5,000 revolutions of the spindles per minute. To-day the speed is from 8,000 to 9,000. In 1876, when the Oldham spinning list was adopted, the standard number of draws, that is journeys in and out of the carriage which contains

the spindles, was three in 50 seconds, to-day it is three in 42 seconds.

Turning to weaving, we find that an equally wonderful development of efficiency has taken place. The power loom was invented in 1785 and patented in 1787. For many years it came into use but slowly. Gradually improvements were made, and by 1813 it had assumed a form which has been little altered since. From that time to 1830 an enormous number were erected. In 1833 it was still defective, so defective, indeed, that between then and 1882 the improvements made trebled its productive power. The chief of these improvements was the self-acting "temple" or "templet," a rotating contrivance for keeping the woven cloth automatically stretched across the loom, and thereby obviating the necessity of stopping the loom as every few inches were woven to shift the stationary temple, which consisted of a stick with pins in the ends. This moved on as the cloth was wound on the beam; the automatic temple was a part of the loom, and the cloth passed through it. This invention is said to have made possible the minding of an additional loom per weaver. It is not clear who first invented the automatic temple, but Messrs. Kenworthy and Bullough, of Blackburn, are credited with having produced a loom which "with its self-acting temple, stop, and taking-up motion, reduced the labour of the weaver by nearly one-half."

Apart from changes in piece prices there are two important ways in which weavers' wages may have risen, viz., by increased speed of the loom and by an increased number of looms tended. The speed of the loom, as indicated by the number of picks woven per minute (*i.e.*, the number of times the shuttle passes from one side to another) has increased very greatly. Lord Shaftesbury, speaking in the House of Commons in 1844, stated that the average speed had advanced between 1819 and 1842 from 60 to 140 picks per minute. Ellison quotes, with approval, an estimate by Messrs. Bridges and Holmes in 1873 that the speed in 1833 was 90 to 112 picks per minute, and puts them in 1882 as 170 to 200 picks. The following account was given me by an old weaving overlooker. In 1850, 130 picks, gradually increasing to 160 by the time of the famine, increased sharply after the famine until the "boom" of the "seventies," and then more slowly to 195 in 1882. Another well qualified informant told me that his looms had run at 165 picks in 1864, and 202 in 1906, but that new looms put in since then are running at 212 picks. At a third mill the average in 1875 was 180, and in 1908, 195. Messrs. Bridges and Holmes, in 1873, put the average at 175 or 180 picks. In some parts of Lancashire the speed to-day reaches 240 picks, in weaving coloured

goods, but the looms are somewhat narrower than usual for plain goods. On the whole, the course has probably been: 1833, about 100 picks; 1850, 130 (or more); 1865, 165; 1873, 175; 1885, 180; 1906, 200.

At first nearly all the power loom weavers were women, assisted by children. In 1819, Kennedy, in his "Rise and Progress of the Cotton Trade,"¹⁵ said "it is found that one person cannot attend more than 2 looms." Professor S. J. Chapman says that "for a long time a single operative could not manage more than 1 or 2 looms."¹⁶ Yet we hear of weavers with three or four looms quite early. These almost invariably had a "tenter" or assistant, and I do not think they were very common until the "forties," when the chief improvements in the loom had been made. I repeat the summary made, given in the section on winding, reeling, warping, and weaving for the Manchester district,¹⁷ which further study of the question has confirmed: "From the introduction of the power loom the average weaver had 1 or 2 looms, rising to $2\frac{1}{2}$ by about 1850, increasing slowly to $2\frac{2}{3}$ by 1860, and more rapidly after the cotton famine to $2\frac{4}{5}$ by 1870, and more slowly to $3\frac{1}{5}$ by 1877. By 1886 the average had advanced to 3.3 and by 1906 to 3.44." This, it must be remembered, is the average *per weaver*. The old three- and four-loom weavers had tenters whom they paid out of their gross earnings. Gradually the three-loom weavers did without tenters; then some four-loom weavers, mainly men, followed; to-day quite a large number of four-loom weavers are without tenters, but a six-loom weaver invariably has one. Working without a tenter, of course, usually augments the weaver's net earnings, though not to the full extent of the tenter's wages.

In assisting to bring about this increased efficiency of operative and machine, the Cotton Industry has, in my judgment, been admirably aided by its efficient organisation of employers and operatives, its universal adoption of the principles of Collective Bargaining, its Standard Piece Lists, and its high proportion of piece work. 65.7 per cent. of the cotton operatives work at piece rates, and a further considerable proportion are employed at time rates by piece workers (piecers, reachers-in, weavers' tenters, &c.). These are, for all practical purposes, piece workers. The operatives, therefore, have every inducement to keep pace with faster and better machinery if their price lists are so arranged as to give them the advantage of greater output.

¹⁵ Quoted by Chapman, *The Lancashire Cotton Industry*, 1904, p. 31. I have not traced the original.

¹⁶ Chapman, p. 46.

¹⁷ *Journal*, February, 1910, p. 137.

We have already seen that in frame tenting this is ensured by the addition of a proportionate standard, or rather expected, wage for each additional unit of spindleage. This device is typical of the industry. Its classic example is that of the Oldham Spinning List (1876). I give the main features of this list, which shows how this principle works.

Extract from the Oldham Spinning List, operatives' edition.

No. of dozen spindles.	Total earnings should draw from office	Spinner's wages.	Piecers' wages.
	£ s. d.	s. d.	s. d.
50	2 2 4	27 10	14 6
60	2 9 6	29 6	20 0
70	2 17 2	31 2	26 0
80	2 19 10	32 10	27 0
90	3 3 6	34 6	29 0
100	3 9 2	36 2	33 0
110	3 14 4	37 10	36 6

The wage which should be earned in a week of $56\frac{1}{2}$ hours, allowing for the various necessary stoppages, is stated in the first column. The piece prices are calculated by ascertaining how many hanks of yarn the mules will spin in a week, and dividing it into the amount given in Column 2. The more spindles in the mule, the lower the price, but the higher the average earnings. The inducements to the employer to put in the longest mules for which his mill and work are suited and to the operative to prefer long mules to short ones are obvious. The inducement to keep the machinery in good order is also obvious, when it is understood that the wage must be earned equally on mules 25 years old and on those only just put in. If the old machines will not yield the standard wage at the prices calculated when they are put in, the prices must be advanced. The earnings must not suffer. In other words, the backward employer is penalised for his relative inefficiency.¹⁸ The penalty is often twofold. If he prefers to work with small machines, he pays a higher price per unit of work than does his competitor whose mill is equipped with the large machines. If he does not renew his machinery and enable the output to be maintained he again has to pay a higher price than his competitor whose machines are the newest and best of their size. We hear a great deal occasionally of Trade Union objections to new and improved processes and higher speeds, but the cotton industry has built up its magnificent efficiency largely because its operatives

¹⁸ Compare S. and B. Webb. *Industrial Democracy*, p. 413 of the one-volume edition.

take the opposite view, and not only welcome improvements but penalise all who will not make them. There are many practical difficulties in the way of adopting the cotton trade principles in all industries, but they are slowly gaining a footing in the woollen industry, where the adoption of a "fast" loom for a "slow" one brings a lower piece price, a greater output per unit of time, and a higher earning at the week end. The spinning branches of all textile trades are so much akin to the cotton trade (all spinning is either done on the "mule" or the "frame") that the adoption of piece work with standard lists based on the principle of a lower price but higher wage as the size of the machine increases should be easy of arrangement, and would benefit employer and employed alike.

It is worthy of notice that in the weaving branch of the cotton trade this principle is not in vogue. The price fixed by the Uniform Weaving List applies to all looms of whatever speed, and to weavers with two, three, four, or six looms each. In such circumstances it would be advantageous to the employer to give a weaver as few looms as possible, and to the operative to tend as many as he or she can get. A two-loom weaver earns an average of 6s. 6d. per loom per week, and a three-loom weaver 5s. 11³d. per loom per week, each without an assistant. The four-loom weavers in the Wage Census earn 6s. per loom per week, but many have tenters. Perhaps the average without a tenter will be 5s. 10d.

Subject to the supply of weavers, an employer probably does endeavour to keep the average number of looms per weaver down, and therefore keep his production up. His test is the average per loom all over the shed, and this he always wants to see increasing. Every increase means more work done with the same standing charges. On the other hand, his operatives must earn a sufficient wage to keep them from entering the spinning branches of the trade. Usually each operative has to prove his or her worth on two looms, then three looms, and only the best are promoted to four looms. The inducement to "speed up," however, is still operative. The "tackler," paid on the weavers' earnings, is induced to keep production to the maximum; the employer is induced to "speed up" the looms, and when renewing to put in the fastest his work will stand, by the increased output relative to standing charges.

Although, if a weaver only had one loom, he or she would be paid at the same price as the weaver with four looms, the "standard" weaver is really the three-loom weaver, and the gross average earnings per loom of the four-loom weaver is probably the same as that of the "three-loomer," only part of it going to the tenter. Tenters' wages have usually been very nearly equal to the earnings of one loom, and the higher wages which "doffers" and other assistants earn in the other departments make recruiting of tenters difficult.

Many employers in theory refuse to allow their weavers to take four looms without a tenter; few, in practice, are able to carry this out.

One very interesting feature of the cotton trade is the regularity of the output, despite the great variation in the ability of the operatives. Taking some consecutive weeks at random from an old "average" book relating to a mill which we cannot identify, the average earnings per pair of looms in 1880 were:—11s. 10½d., 12s. 2¼d., 12s., 11s. 10½d., 11s. 9½d., 11s. 8¾d., 11s. 9½d., 12s. 0¼d., 12s., 11s. 11d., 12s. 0½d., 11s. 10½d., 11s. 11¾d. I have even seen them more regular, and not varying by more than 1d. per pair between the highest and lowest of twelve weeks.

A spinning mill not making a wide range of counts will have nearly as regular an output. The following is not an unfair example:—

Total earnings of all employed at a spinning mill in consecutive weeks.

£	s.	d.	£	s.	d.	£	s.	d.
72	13	3	73	1	7	73	11	0
72	18	3	73	11	0	73	1	2

To vary only 18s. on 73l. in six consecutive weeks, or less than 1¼ per cent., is a regularity of which not many industries can boast.

Comparison of cotton with other industries.

It will not be unprofitable to compare the results we have arrived at for the cotton industry with those which are moderately well established for other industries. An examination of the course of wages in various large industries as indicated by the index numbers given in Table 49 reveals the fact that the advance in the wages of cotton factory operatives is only exceeded by that of the Scottish agricultural labourer. From 1850 no industry shows so great a proportionate advance.

I do not think that this excess of advance in the cotton industry is accidental. The outstanding features of the industry are, its extensive collective bargaining, its high proportion of piece work, and its encouragement of higher efficiency both in operative and machine. Operating over at least half a century, these influences have helped to change the cotton industry from an ill-paid, if not badly sweated, industry to a well paid and almost entirely non-parasitic one. A simple and much-needed re-organisation of "piecing" would, indeed, almost rid the industry of "blind alley" occupations. The comparison with the wool and worsted industries, as illustrated by Huddersfield, Leeds, and Bradford, is especially instructive. The progress is fairly continuous at Huddersfield; it is almost arrested at Bradford and Leeds. Trade Unionism is strong

TABLE 49.—*Showing the changes in average wages in various industries, 1800—1906.*
(1900 = 100.)

	1800.	1810.	1820.	1831.	1840.	1850.	1860.	1870-71.	1880.	1886.	1891.	1900.	1906.
Cotton, including hand-loom weavers	—	71	49	41	47	49	63	—	—	—	—	(100)	—
Cotton, excluding hand-loom weavers	—	58	57	52	51	51	64	76	81	83	93	100	107
Wool, Huddersfield	—	110	—	57	53	67	82	90	103	92	94	100	109
" Leeds	85	—	—	(75-80)	—	—	95	100	110	100	—	—	100
Worsted, Bradford	—	—	101	101	86	72	82	104	97	96	96	100	106
Jute	—	—	—	—	—	—	61	76	82	74	96	100	105
Engineering	51	64	65	64	69	67	73	77	82	84	93	100	102
Shipbuilding	47	—	56	60	62	64	68	75	83	83	95	100	99
Building	40	57	57	53	57	58	68	76	87	87	90	100	100
Compositors	72	86	76	76	81	81	81	83	94	94	98	100	102
Coal hewers	—	—	—	—	—	62	71	74	67	67	93	100	90
Puddlers	—	—	—	—	—	66	66	78	81	64	72	100	78
Gas	—	—	—	—	—	67	70	80	87	87	96	100	102
Furniture	—	—	—	—	—	66	71	81	92	91	94	100	100
Agriculture, England and Wales	73	93	84	68	72	64	76	84	92	90	93	100	101
Agriculture, Scotland	34	48	38	32	44	50	60	71	85	87	91	100	103

enough at Huddersfield to make Collective Bargains with the Employers' Associations ; there are some recognised Standard Piece Price Lists in operation and, though not to so great a degree as in the cotton industry, *maximum* efficiency is striven for and, in a way, the least efficient employer is penalised. The proportion of piece workers is 54·9 as compared with 65·7 in the cotton industry. In the other districts cited collective bargaining is in its infancy ; there are no Standard Piece Price Lists, and the low proportion of 28·1 per cent. of piece workers is found at Bradford, and of 33·8 per cent. at Leeds. I do not suggest that a high proportion of piece workers and high and rising wages always accompany each other, but in those occupations where, as in combing, spinning, winding, warping, and weaving, there are routine processes similar in each mill or factory, a high proportion of piece work done under standard conditions is the safest guide to progress.

Summary and conclusion.

We have seen that the device of the index number enables us to arrive at substantial conclusions, in spite of the apparent inconsistencies and contradictions in the raw material of our inquiry. In the early days of the cotton industry an enormous range of earnings prevailed, and the industry was greatly dependent on child-labour. Continuous adaptation to new methods, extensive collective bargaining, an ever-widening area of standardised conditions, and a conscious adoption of the principles of mutual inducements to both employer and operative to increase the efficiency of person and machine, and of penalising the backward, inefficient employer by relatively increased costs of production, have brought about an increase of wages unequalled over sixty years in any other industry. We have been able, in some instances, to analyse the advance due to the decreased employment of children, the advance of piece prices paid, and the increase in personal and mechanical efficiency, and have found that, even if the old proportion of child-labour had still prevailed, and the piece prices of 1860 had remained unimproved upon, a very considerable advance in average earnings would have accrued. With all this the hours of labour have been reduced considerably.

We have not seen any evidence that these progressive forces have ceased to be operative, or that there is any need to be apprehensive of a decline. The progress in the cotton trade is a marvellous example of the results of close and persistent organisation, which should be copied by many other industries, if they would maintain and increase their efficiency.

ERRATUM.—Part XV, Section I, Table 4. Throstle and ring spinners, 1839. For 7/- read 8/-.

2 x 2

APPENDIX.

Table showing the percentage employed and average wages of various classes of cotton operatives in LANCASHIRE and CHESHIRE in 1886 and 1906.

Occupation.	1886.				1906.		
	Time or piece.	Number.	Per cent.	Average wage.	Number.	Per cent.	Average wage.
MEN.							
Foremen:—							
Preparing	T	746	0·6	32/2	754	0·4	39/0
„	P	16	—	28/10	34	—	43/9
„	T & P	762	0·6	32/1	788	0·4	39/2
Spinning	T	611	0·5	32/1	581	0·3	41/11
„	P	6	—	24/3	39	—	45/0
„	T & P	617	0·5	32/0	620	0·3	42/11
Weaving	T	167	0·1	31/9	625	0·3	38/7
„	P	1,151	0·9	36/9	2,303	1·3	43/9
„	T & P	1,318	1·0	36/1	2,928	1·6	42/8
Others	T	180	0·1	37/5	692	0·4	34/5
„	P	6	—	22/1	28	—	37/4
„	T & P	186	0·1	36/11	720	0·4	34/6
Mixers	T	558	0·4	17/2	582	0·3	21/7
Scutchers	T	744	0·6	18/9	760	0·4	25/9
„	P	16	—	29/4	—	—	—
„	T & P	760	0·6	18/10	760 +	0·4	—
Grinders	T	1,942	1·5	20/4	1,557	0·8	29/5
„	P	41	—	20/4	—	—	—
„	T & P	1,983	1·5	20/4	1,557 +	0·8	—
Spinners—							
Counts below 40's	P	—	—	—	4,798	2·5	38/10
„ 40's to 80's ...	P	—	—	—	3,943	2·1	43/0
„ above 80's	P	—	—	—	1,269	0·7	46/0
All counts.....	P	6,951	5·3	31/3	10,010	5·3	41/5

Note re Percentages.—The percentages in this table are calculated to the nearest decimal place, and slight discrepancies occur owing to “throwing up” the excess of ‘05 to the nearest ‘1.

Table showing percentage employed and average wages.

Occupation.	1886.				1906.		
	Time or piece.	Number.	Per cent.	Average wage.	Number.	Per cent.	Average wage.
MEN—contd.							
Big piecers (M and B)	T	5,690	4·3	14/1	8,851	4·7	17/9
„ „	P	212	0·2	14/10	164	0·1	19/10
„ „	T & P	5,902	4·5	14/1	9,015	4·8	17/10
Twiners... ..	P	101	—	33/8	125	0·1	42/1
Ball warpers.....	T	—	—	—	33	—	30/7
„	P	25	—	38/0	216	0·1	42/0
„	T & P	25	—	38/0	249	0·1	40/6
Sizers, &c.....	T	332	0·3	32/10	426	0·2	43/0
„	P	265	0·2	38/2	131	0·1	46/2
„	T & P	597	0·5	35/2	557	0·3	43/9
Warp dressers	P	—	—	—	675	0·4	37/1
Twisters-in	T	14	—	21/0	33	—	25/4
„	P	851	0·6	20/3	1,166	0·6	25/7
„	T & P	865	0·6	20/3	1,199	0·6	25/7
Drawers-in	T	9	—	23/6	—	—	—
„	P	366	0·3	24/10	300	0·2	30/9
„	T & P	375	0·3	24/10	300 +	0·2	—
Weavers, 2 looms	P	239	0·2	15/11	661	0·4	21/8
„ 3 „	P	1,284	1·0	16/6	1,433	0·8	19/6
„ 4 „	P	6,257	4·7	20/10	11,367	6·1	25/1
„ 6 „	P	767	0·6	26/7	1,825	1·0	32/11
„ All*	P	8,577	6·5	20/7	15,286	8·1	25/4
Fustian weavers, 2 looms	P	12	—	12/0	—	—	—
„ „ 3 „	P	73	—	16/6	—	—	—
„ „ 4 „	P	206	0·2	19/10	69	—	21/8
„ All.....	P	291	0·2	18/8	69 +	—	21/8
Warehousemen	T	1,404	1·1	22/4	2,585	1·4	24/1
„	P	182	0·1	21/2	889	0·5	28/11
„	T & P	1,586	1·2	22/2	3,474	1·9	25/4
Mechanics.....	T	669	0·5	31/2	607	0·3	34/1

* Including a few on 1 and 5 looms respectively in 1886.

Table showing percentage employed and average wages.

Occupation.	1886.				1906.		
	Time or piece.	Number.	Per cent.	Average wage.	Number.	Per cent.	Average wage.
MEN—contd.							
Enginemmen	T	909	0·7	25/3	1,260	0·7	31/3
„	P	—	—	—	23	—	35/8
„	T & P	909	0·7	25/3	1,283	0·7	31/4
Labourers	T	208	0·1	18/7	1,369	0·7	20/2
Other men	T	2,619	2·0	20/1	2,917	1·6	23/2
„	P	347	0·3	28/7	590	0·3	29/1
„	T & P	2,966	2·3	21/1	3,507	1·9	24/2
TOTAL MEN	T & P	36,206	27·5	23/3	56,180	30·0	27/3
LADS AND BOYS.							
Little piecers	T	4,226	3·2	9/9	8,211	4·4	12/0
„ „	P	—	—	—	72	—	11/7
„ „	T & P	4,226	3·2	9/9	8,283	4·4	12/0
Weavers, 2 looms.....	P	1,471	1·1	10/9	1,685	0·9	12/5
„ 3 „	P	689	0·5	15/2	1,310	0·7	17/11
„ 4 „	P	41	—	19/3	668	0·4	24/1
„ All	P	2,201	1·7	12/3	3,663	1·9	16/6
Other lads and boys ...	T	4,416	3·3	8/4	5,387	2·9	9/4
„ „	P	233	0·2	11/4	196	0·1	13/8
„ „	T & P	4,649	3·5	8/6	5,583	3·0	9/6
Half-timers	T	5,169	3·9	3/0	3,006	1·6	3/7
TOTAL LADS AND BOYS	T & P	16,245	12·3	7/7	20,535	10·9	10/11
WOMEN.							
Draw-frame tenters.....	T	547	0·4	12/11	379	0·2	16/9
„ „	P	1,847	1·4	15/4	2,294	1·3	20/7
„ „	T & P	2,394	1·8	14/9	2,673	1·4	20/0
Slubbing „	T	—	—	—	116	0·1	16/2
„ „	P	—	—	—	1,706	0·9	19/11
„ „	T & P	—	—	—	1,822	1·0	19/8
Intermediate „	T	—	—	—	88	0·0	15/1
„ „	P	—	—	—	2,113	1·1	19/5
„ „	T & P	—	—	—	2,201	1·2	19/4

Table showing percentage employed and average wages.

Occupation.	1886.				1906.		
	Time or piece.	Number.	Per cent.	Average wage.	Number.	Per cent.	Average wage.
WOMEN—contd.							
Roving	T	—	—	—	123	0·1	18/9
„ „	P	—	—	—	6,294	3·4	19/3
„ „	T & P	—	—	—	6,417	3·4	19/3
Frame tenters unclassified	P	—	—	—	526	0·3	21/5
Slubbing, intermediate, roving, and unclassified tenters	T	733	0·5	14/5	327	0·2	16/10
„ „	P	7,658	5·8	15/5	10,639	5·7	19/5
„ „	T & P	8,301	6·3	15/4	10,966	5·9	19/5
Ring spinners	T	1,669	1·3	12/0	3,130	1·7	15/2
„	P	488	0·3	14/0	871	0·5	16/11
„	T & P	2,157	1·6	12/6	4,001	2·1	15/7
Reelers and winders	T	390	0·3	13/2	333	0·3	13/6
„ „	P	10,139	7·7	13/0	13,063	7·0	15/2
„ „	T & P	10,529	8·0	13/0	13,406	7·1	15/2
Doublers	T	441	0·3	12/0	590	0·3	13/10
„	P	218	0·2	11/7	169	0·1	14/9
„	T & P	659	0·5	11/10	759	0·4	14/0
Beam warpers	T	42	—	15/4	314	0·2	18/0
„	P	1,241	0·9	18/3	1,545	0·8	21/8
„	T & P	1,283	1·0	18/2	1,859	1·0	21/1
Weavers, 1 loom	P	152	0·1	12/6	—	—	—
„ 2 „	P	3,953	3·0	11/8	3,050	1·6	13/11
„ 3 „	P	10,142	17·7	16/1	15,213	8·1	17/9
„ 4 „	P	13,546	10·3	19/11	24,803	13·2	23/6
„ 6 „	P	196	0·2	26/3	168	0·1	30/7
„ All	P	27,989	21·3	17/4	43,234	23·1	20/10
Fustian weavers, 2 looms	P	298	0·3	11/6	127	0·1	12/11
„ „ 3 „	P	1,123	0·8	17/1	637	0·3	18/4
„ „ 4 „	P	528	0·4	18/10	211	0·1	20/10
„ „ All ...	P	1,949	1·5	16/8	975	0·5	18/2

Table showing percentage employed and average wages.

Occupation.	1886.				1906.		
	Time or piece.	Number.	Per cent.	Average wage.	Number.	Per cent.	Average wage.
WOMEN—contd.							
Other women	P	1,446	1·1	11/11	2,597	1·4	13/4
“ “	P	1,102	0·8	13/8	1,522	0·8	16/5
“ “	T & P	2,548	1·9	12/8	4,119	2·2	14/6
ALL WOMEN	T & P	57,809	44·0	15/9	81,992	43·8	19/0
GIRLS.							
Reelers and winders ...	T & P	1,010	0·8	9/4	2,164	1·1	11/0
Weavers, 1 loom	P	46	—	5/4	—	—	—
“ 2 “	P	4,024	3·1	10/5	6,066	3·2	11/9
“ 3 “	P	1,043	0·8	15/8	3,163	1·7	17/4
“ 4 “	P	42	—	19/4	722	0·4	22/2
“ All	P	5,155	3·9	11/6	9,951	5·3	14/3
Fustian weavers, 2 looms	P	—	—	—	84	—	12/1
“ “ 3 “	P	—	—	—	90	—	17/10
“ “ All ...	P	34	—	8/1	174	0·1	15/1
Other girls, full time ...	T	6,921	5·3	7/1	11,795	6·3	8/5
“ “	P	867	0·6	8/6	1,305	0·7	10/5
“ “	T & P	7,788	5·9	7/3	13,100	7·0	8/7
Half-timers	T*	7,333	5·6	2/7	3,222	1·7	3/0
ALL GIRLS	T & P	21,320	16·2	6/10	28,611	15·3	10/2
ALL EMPLOYED ...	T & P	131,580	100·0	15/4	187,318	100·0	19/7

* A very few worked by piece-work in 1906.

This table has not been included in the main body of the paper because, owing to the unfortunate method of the Board of Trade in making the groups of “other” men, women, lads and boys, and girls so large. For example, as we do not know how many of the 4,649 “other lads and boys” are piecers, weavers’ assistants, ring doffers, reachers-in, &c., we cannot definitely tell what departments have grown most proportionately between 1886 and 1906.

The changes in the relative proportions of men, &c., have been :—

	1886.	1906.
Men.....	27.5	30.0
Lads and boys, full time	8.4	9.3
„ half time	3.9	1.6
Women.....	44.0	43.8
Girls, full time	10.6	13.6
„ half time	5.6	1.7
	100.0	100.0

These changes are not very significant, except for the reduction of half-timers, who have been partly replaced by full-time boys and girls. The growth of men relatively to women may also be significant, as it is mainly to be found in weaving.

Foremen have increased from 2.2 per cent. to 2.7 per cent., but the men in mixing, scutching, and cardrooms have declined from 2.5 per cent. to 1.5 per cent.

The figures for spinning are interesting, thus:—

	1886.	1906.
Men spinners	5.3	5.3
„ piecers	4.5	4.8
Lads and boys, piecers	3.2	4.4
Total recorded in male spinning	13.0	14.5
Assume, half of half-time lads and boys as piecers	2.8	0.8
Total estimated male spinning	15.8	15.3
Ring spinning, women	1.6	2.1
Total recorded in spinning	17.4	17.4

A slight re-arrangement of proportions has left the total percentage shown in spinning unchanged. The inclusion of ring-frame doffers (girls and boys) would probably add a little to the 1906 percentage.

Frame-tenters (*women*) have increased from 8.1 per cent. to 13.2 per cent., indicating that the improvements in machinery have been greater in spinning and the earlier preparation than the frames and looms.

Weavers have also increased in proportion.

In 1886 and 1906 these were distributed thus:—

	1886.	1906.
	Per cent.	Per cent.
Weavers, men	6·7	8·1
„ lads and boys	1·7	1·9
„ women.....	22·8	23·6
„ girls.....	3·9	5·4
	35·1	39·0

All have increased, but the increase in men weavers is significant of the high average earnings of four- and six-loom weavers.

The other groups do not call for any remark.

DISCUSSION *on* MR. WOOD'S PAPER.

THE PRESIDENT said the Paper, like all Mr. Wood's work, contained a great deal of valuable information ; and, as usual in wage-statistics, a considerable portion of his labour had to be spent in filling up gaps by inference, owing to the lack of definite information. Fortunately, there were present gentlemen who were perfectly competent to deal with that aspect of the matter ; and he asked Mr. Bowley, who was a master of statistical hypothesis, to move the vote of thanks.

MR. A. L. BOWLEY, in moving a vote of thanks, said the actual Paper gave but little indication of the amount of work which had been done to produce the results. It was now eleven years since Mr. Wood put into his hands his draft estimate of the changes of wages in Manchester, and he had already carried the matter very much farther than any previous investigator had been able to take it ; and, so far as he knew, that subject had never been absent from his mind since that time. This Paper followed nearly 100 pages of tabulated matter in the last four issues of the *Journal*, from a study of which it would be apparent that a great amount of detail was necessary for compiling the wages of such an industry, even when it was as concentrated as the cotton industry was. Inspection of the details of those preliminary sections would show what an immense amount of technical and local knowledge was needed to piece together the information obtained from different districts, and to trace the course of wages in different occupations. On first taking up the question of the statistics of wages in the cotton trade, one's impression was one of simple chaos ; the various lists gave no guide as to hours ; the rates varied from place to place, and the minute grades of occupation also varied from place to place. The quotations obtained from almost any one of the large numbers of

authorities who dealt with this subject were often badly localised, vague in extent, and difficult to fit in with any reasoned scheme. The main work of the Paper, apart from the mechanical tabulation, had been to fit together all those scattered estimates, to find out the presence of apparent inconsistencies, to discover the truth among those various inquiries, and to reject all figures which could not be properly supported. All that required a very considerable knowledge of the trade and of the district. It had been his privilege to be with Mr. Wood in Lancashire, and to see the actual way in which he had obtained first-hand information. There was behind it a large amount of knowledge based on weavers' averages and on the records of mills where particulars were kept. The mere accumulation of figures and their tabulation was a great piece of work, but not always praiseworthy; sometimes it was a hindrance to carrying on a real statistical investigation; and, therefore, he would call attention especially to the way in which the author considered the possibilities of error, tested them in case after case, and traced the effect of the possible errors through to their result. Having had some experience of dealing with this kind of weighted averages, he was astonished to find how very little difference those errors in detail had in the final page, which gave the index number. Again, in dealing with cotton and other wages, it was not enough to perceive and record all the changes: one had also to find out, if possible, the causes and nature of the circumstances in order to know whether a change was genuine. Mr. Wood had been singularly successful in finding out why and when wages changed, and particularly in analysing the effect of the different events which might have been expected to cause those changes. When one put together the kind of detail on which the Paper was based, and began to piece it together and find the averages, it became evident that the figures were not mere chance, random manifestations, but were closely related together, and the final average grew under one's eye; the whole structure attained a kind of organic life, and it became absolutely certain that the true result was very near the one which was being evolved. After that stage was once reached, where new information or small uncertainties began to have very little effect on the final line shown, then certainty began to take the place of assumption. It was quite evident, from even a casual reading of the Paper, that that phenomenon had been present among these statistics; and, therefore, the result might be depended on with very much more confidence than those who had not worked in this kind of material would believe. They were not altogether dependent, however, on such a phenomenon. There were very important inquiries and returns of 1833, 1886, and 1906, which made it possible to contrast at these widely different dates the net result of all those changes. He had looked as far as he could into the means by which that could be done; and he did not find any flaw in the method. He was afraid they would have to take a very great deal of the work for granted; but he had looked carefully into some of the weighted averages, assigning the various proportions to different centres, and he had no criticism of any kind to make on

the method or the result. Quite recently he had occasion to examine closely cotton wages during the last twenty years, and he had made an index number from 1880 to 1906. In so doing, he had had to reject some part of the work which he did for a Paper in 1895, dealing with wages ; and he found that the figures in his earlier Papers from 1860 to 1883, pieced together with the new results from 1880 to 1906, agreed with remarkable closeness with Mr. Wood's figures. He mentioned that to lend as much support as he could to the line of statistics since 1861. If his estimate had differed from them, however, he should have withdrawn it in favour of Mr. Wood's, but as it was he was glad to think the rather rapid selection he made fifteen years ago had been supported by this new series of numbers. One of the great difficulties in the Paper was the combination of the cotton industry before it was a full factory industry with the cotton industry as it was known to-day. He was glad Mr. Wood had proceeded with so much caution on this point, because it was evident that certainty could not be arrived at. He was surprised he could get so much support for his estimates as he had incidentally obtained ; he could not obtain accuracy (which, in fact, was hardly conceivable), for it was comparing two unlike things together. The operatives in 1806 were handling cotton, and the factory workers to-day were handling cotton ; but at that point the resemblance ceased. It was very interesting to see how the figures ran together, but their combination was not of very great importance ; and, therefore, he did not regret so much as he otherwise would have done the uncertainty that arose from the welding together of the two classes of figures. He would be glad, however, if the foot-note as to winders, &c., in 1800 were brought more into the forefront before the Paper was published, to show that it was an important qualification of the main table. At present, it was not unlikely that the main table would be quoted as referring to handloom workers and factory weavers, leaving out all other operatives. That would modify the general impression given by the Paper in the right direction, and was worth more than a foot-note. He was rather sorry that the author had not brought the question of half-timers more to the front, for they must not lose sight of the fact that a large percentage of cotton operatives, especially in the latter part of the last century, were only working half-time, and could hardly be counted as full persons in a divisor which gave the average. That was dealt with, but not exactly in the place he should have expected to see it. A glance at the results of the Paper, as compared with the changes in piece lists, showed that the changes in piece lists had no definite relation to changes in earnings. A rise in piece lists might be connected with a fall in earnings. The same was true, although it did not operate so much in the cotton trade, in regard to changes in time rates. Changes in standard time rates and piece rates did not enable one to place the change in average earnings. It was necessary to take the industry as a whole, and to watch for all the causes besides nominal changes in rates before one could make any statement which could be depended on in regard to changes in earnings. With regard to the

last table, it was true that the cotton trade had increased in earnings more rapidly than any other trade ; and it was interesting to notice the line of cotton wages beside that of the building trade wages, as they knew that the two trades were very different in their history ; building was still done much as it was done 100 years ago—what few changes there had been had been recent. But cotton was a different industry absolutely. In the one case we had mainly time rates, and in the other mainly piece rates. If one drew the two lines together and compared them, it would be found that the resemblance was remarkably close, both as a whole and in detail. The Paper was an extraordinarily valuable one, and it carried forward the method of dealing with wage statistics yet another stage.

Mr. A. W. FLUX, in seconding the vote of thanks, said he regretted he had not had an opportunity of studying the Paper previously, so that he could hardly speak with any certainty about some points which had been raised. Mr. Bowley had already called attention to the obvious fact that the preparation of a Paper of this character involved an enormous amount of detailed labour. He was struck by the extent to which the estimates by various authorities cited in the Paper did in an extremely remarkable way confirm one another. If one could have had the opportunity of seeing those estimates grow under one's eye, in the way to which Mr. Bowley had referred, he had very little doubt that the sense of conviction that they represented as nearly as possible the fact would have been far more marked than it could be on first hearing the Paper read. He was tempted to ask a question which was suggested by the instructive diagram accompanying the Paper. At the beginning and at the end of the nineteenth century it appeared that the general average of wages of all operatives in the cotton industry had substantially the same level, which was a very remarkable fact. The proportion of children in the industry was substantially higher at the earlier date, and that would lead to the conclusion that the figures presented failed to represent fully the high level of adult wages at the beginning of the nineteenth century. Had any adjustment of the figures been made to allow for the changed proportion of children ? It might be that the answer was in the part of the Paper which the author had not been able to read, but it did not appear to be in the part actually read. Another point was one on which the Chairman remarked—the use of hypothesis. On p. 588 they were told that, if what happened on the average in certain Lancashire centres happened also at Preston, Blackburn, and Clitheroe, the average for those places would be rather less in 1840-42 than in 1833. Did that mean that the figures in the preceding table, representing Preston and Blackburn in 1842, were interpolated on the basis of figures from elsewhere ?

Mr. WOOD said Mr. Flux had misunderstood him. The figures for 1840 and 1841 for Preston and Blackburn were correct ; and the details were given in previous issues of the *Journal*. They did not

know exactly what happened in 1833 in Preston, and no figure was given. He had to assume that something happened; and he assumed that what happened at Clitheroe, where they had information, happened also at Blackburn and Preston.

Mr. FLUX said he was glad to have elicited that explanation, which removed the doubt which arose in his mind from not having had an opportunity of bringing the four valuable articles in the *Journal* and this Paper together. On p. 608 reference was made to the reduction of hours and the effect of that on wages; and the suggestion was that after the hours were reduced there was a speeding-up of machinery. He did not wish to say anything very definite one way or the other, but it might be asked whether perhaps the reduction of hours was not itself the necessary consequence of speeding-up, with its resultant strain on the workers. How far that might modify some of the general conclusions, he was not prepared to say. There was another point. While he was personally in sympathy with the author as to the conclusion he drew, namely, that organisation had tended to raise wages in the cotton industry, still, looking at the matter as a critic, it occurred to him that the author was finding in the figures to some extent what he desired to find. One might be permitted to suggest that there was another point of view, and that a leisurely study of the figures might possibly fail to show that they bore out absolutely the suggestions which were put forward. It was very difficult to summarise a Paper of that length apart from the detailed evidence; and it was therefore necessary to defer definite judgment pending a detailed study of that evidence. He had great pleasure in seconding the vote of thanks.

Miss B. L. HUTCHINS asked whether Mr. Wood had come across any evidence as to the effect of speeding-up on the energy and health of the operatives. A great deal of attention had been given to that in a recent book from America. She thought it ought to be remembered that increased efficiency of machinery might tend to economic or technical progress, and yet involve a decrease in social efficiency if the nervous strain were too great.

Mr. S. ROSENBAUM asked if there were anywhere in the Paper a statement showing what was the average wages of adult workers only, distinguishing also males and females, at different times in the century; and, if not, whether such information was available. He thought that had a very important bearing on the question under discussion.

Mr. G. UDNY YULE said he greatly appreciated the immense amount of labour which had gone to the collection of the data for the Paper.

The PRESIDENT said the question was one on which so much special knowledge was required that he could only deal, as an

outsider, with one or two points which had struck him during the reading of the Paper. The speeding-up of machinery, for instance, was conducive, no doubt, to the greater efficiency and to the higher wages of the operative; but did it not tend to curtail the effective period of the worker's life? Some fourteen or fifteen years ago he had read a report in which the speed at which factory machinery was run in the United States (which was not so high as that mentioned in the Paper) was alleged to result in the incapacity of the worker for that class of work after the age of 40 or 45. He remembered Mr. John Burns saying that at the pay-desk of an American factory he had seen "not a grey hair on the head, nor a smile on the face." That could hardly be called an advantage, especially if in middle life the earning power fell off seriously. Another point to which he would refer, again with some diffidence, was the comparability of the rate of wages at different periods, when the coinage was known to have had very different purchasing power; as, for instance, in 1806 and 1816, and again shortly after 1851. That seemed to him a factor which might well be correlated with the other interesting facts brought together in the Paper. The author, again, had abstained, perhaps wisely, from correlating the four main influences upon wages which he mentioned. It might not be possible so to treat them, but it appeared to him that the successive positions of the cotton wage-earnings could not be definitely appraised unless such factors received their respective values in the estimate.

Mr. WOOD, in reply, said that in regard to the President's question he might observe that it was no part of his work at present to attempt to turn the nominal or money wages into terms of real wages; but for every year since 1850 to 1903 that had been already done by him in the *Journal* last year, and it had been attempted once or twice before. His first attempt at doing it was at the British Association in 1899. The two things had to be done separately; one had to state the course of prices and of wages quite independently. They were two different problems altogether. Mr. Bowley had offered no criticism which required a reply, except that he had not dealt with half-timers exactly as he (Mr. Bowley) had wished. Mr. Bowley was thinking of two half-timers being worth one full-timer, and suggesting that he might possibly have made that estimation. He had eliminated the half-timer altogether for certain purposes; and he did not agree with Mr. Bowley's view of the function of a half-timer at all. He had had reason to criticise the suggestion, which he had known put forward, that two half-timers were worth one full-timer. As a matter of fact, they were much more frequently accustomed to find a half-timer working, *e.g.*, as a weaver's tenter, and the weaver doing without the tenter altogether during that part of the day in which the tenter was at school. The half-timer was an individual, and not half an individual only. Mr. Flux had raised a point which was absolutely explained in the Paper; and the explanation itself became self-evident when the Paper was read closely. Beginning in the year 1833, every

child in the industry was counted in, because a complete census had been taken in that year. He had to estimate, between 1806 and 1833, that there were practically no changes in the relative numbers of men, women, and children employed; they did not know which way the change went.

Mr. FLUX asked if the conclusions held up that the relative wages of adults in 1806 and 1906 would represent even less progress than was shown.

Mr. WOOD said that question rather assumed the mixing of the hand-loom weaver with the factory operative. The wages of the factory operative had been already given in previous sections of the *Journal*; and, looking at the diagram, it would be seen that the dotted line (representing factory workers) was by no means as high in 1806 as in 1890. The high wages were the wages of hand-loom weavers; the low wages were the wages of factory operatives, who were much in the minority. The high resultant average wages of all employed were due to the fact that the hand-loom weavers were earning about 1*l.* a week, while the factory operatives were earning about 10*s.*, and that there were so many more hand-loom weavers than factory operatives. It would be correct to say that all adults in the cotton industry in 1806 earned more wages on the average than all the adults in 1890; but that was because the cotton industry outside the factory branches was largely dependent on adults. With regard to the question of the effect of hours on efficiency, right through the plea of the advocates of the legal curtailment of hours had been that the strain of the machine was so great that the reduction of hours had been necessary for the sake of the women and children. It was said that "the men hid themselves behind the women's petticoats" in asking for the Ten Hours' Act and subsequent reductions; but he did not know if that was always substantiated. He might say that his conclusion was based on unique experience. The details given him as to speeds, length of spindles, &c., were actually taken out from old records, some of which were mouldy and were found in safes and in lofts; one of the most valuable records he had found in an old stable. He had seen much more evidence, and evidence which he could not use here, because it did not belong to him, but which would support his conclusion, namely, that immediately hours were reduced it was found possible to speed up the different machines and get closer attention from the operatives; but beyond that, when new machines were put in, again further improvement was made, and it was able to run at a still faster rate. The speeding-up of the machinery in the cotton trade had been gradual and automatic; it probably advanced 1 per cent. per annum cumulatively from 1833. Schulze-Gävernitz had rightly said that a hand-loom weaver had worked 70 to 80 hours a week, but that it would be impossible to let a modern four-loom weaver work such hours. His impression was that the old weavers could not have been trained to work the present machinery at all. It was a new race of operatives and a new set of machines. In answer

to Miss Hutchins, he did not think there had been any effect on the operative; the thing had been too gradual to affect the health of the operative. His personal opinion, though he must say he had not very much evidence on that point, was that the improvement in the machine, as well as in the operative, had not had any effect on the health of the operative. With regard to the organisation, he must say the evidence as to the value of it in the cotton trade was overwhelming. One could not have without organisation that particular type of standard piece price list which induced the employer to put in newer and better machinery, and induced the operative to work that machinery. He spoke with some considerable knowledge on this point. The value to Lancashire of organisation had been so great that he remembered Mr. Macara saying to him two or three years ago that if the people of Lancashire knew and valued Mr. James Maudesley as he did, they would put up a statue to his memory. The employers in Lancashire had no doubt as to the value of organisation on both sides and of collective bargaining. Mr. Rosenbaum would find in Table 42 the evidence he wished as to the changes in wages of adults; and in Table 48 his estimate as to the changes in wages, not of adults, but of full-timers. He did not think it was possible entirely to separate the adults.

The following candidates were elected Fellows of the Society:—

J. Ellis Barker.

Ernest D. T. E. Breul.

Walter Peacock.