

The Physical Volume of Production
in the U.S.A.

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THE PHYSICAL VOLUME OF PRODUCTION
IN THE UNITED STATES

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THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES

G. F. WARREN AND F. A. PEARSON¹

The general level of commodity prices is the result of four forces: the supply of and the demand for commodities, and the supply of and the demand for gold. When four unknowns are involved, it is difficult to evaluate each of them without ample statistical evidence. Two of these forces can be readily measured—the supply of gold, and the production of all commodities. This publication gives the production of various commodities and of all commodities. Such information is necessary in order to determine what part of the present depression, if any, is due to high production or to unbalanced production. Index numbers of production are useful for many other purposes.

FOOD AND FEED CROPS

The index numbers for production of food and feed crops were made by adding together bushels of wheat, bushels of potatoes, bushels of corn, quarts of strawberries, and 27 other crops all combined according to their importance. The purpose of the index was to include only basic commodities. Livestock was not included. This is all produced from crops except the part which is grown on pasture.

The index numbers of crop production are based on reports of the United States Department of Agriculture and the Bureau of the Census.

The production of food and feed crops in the United States increased from 10 in 1839 to 90 in 1914 (table 1 and figure 1). During this period the annual rate of increase was 3.02 per cent per annum (table 1). In popular opinion, the rapid increase in recent years has been the cause of the agricultural depression. As a matter of fact, the rate of increase from 1915 to 1929 was only 0.60 per cent per annum. If correction is made for the reduction in the number of horses and mules, this rate was 1.17 per cent.²

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² The method of correction for horses and mules is given on page 53.

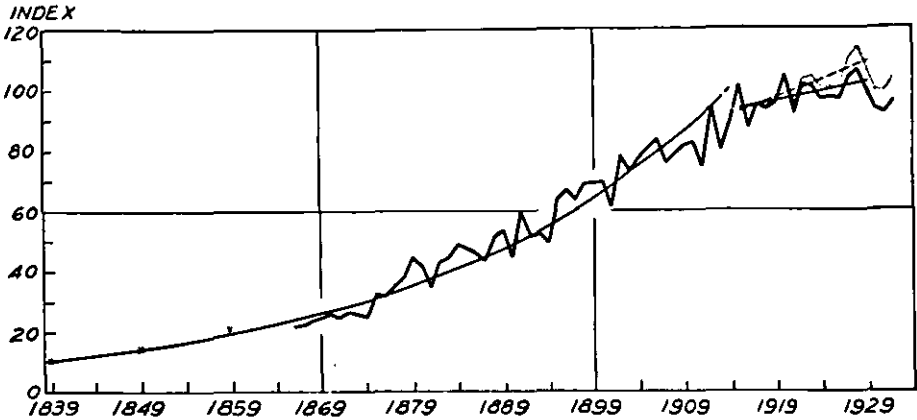


FIGURE 1. INDEX NUMBERS OF THE PHYSICAL VOLUME OF FOOD AND FEED CROPS PRODUCED IN THE UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914, production increased at the rate of 3.02 per cent per annum; from 1915 to 1929, it increased only 0.60 per cent per annum. The upper curve beginning with 1915 shows production corrected for the reduced number of horses and mules

From 1839 to 1914, the production of food and feed crops per capita increased at the rate of 0.74 per cent per annum (table 2 and figure 2). This rate of increase was declining slightly before the World War. From 1915 to 1929, production per capita decreased 0.85 per cent per annum (table 2). When correction was made for the reduction in the number of horses and mules, the decrease was 0.29 per cent.

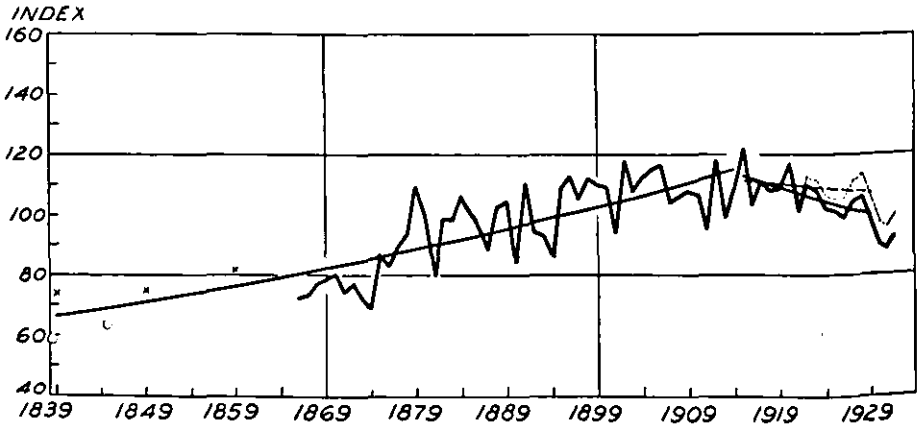


FIGURE 2. INDEX NUMBERS OF THE PRODUCTION OF FOOD AND FEED CROPS PER CAPITA IN THE UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1900, the production of food and feed crops per capita increased 0.86 per cent per annum; from 1901 to 1914, it decreased 0.20 per cent per annum; and from 1915 to 1929, it decreased 0.29 per cent per annum when adjusted for the changes in the number of horses and mules

TABLE 1. INDEX NUMBERS OF PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES, 1839 TO 1932*
(1926-30=100)

Year	Population	Food and feed crops	Total crop production	Forest products	Electric current	Water power other than electric	Coal	Other fuel	Fuel and power	Other minerals	Secondary metals	Other minerals and secondary metals	All minerals and power	Total basic production, constant group weights	Total basic production, constant group weights, weighted by value plus value of manufacture	Total basic production, variable group weights	Total basic production, variable group weights, weighted by value plus value of manufacture
1839	13.94	10.33	10.61	4.18	—	—	0.52	—	0.51	0.51	—	0.35	0.45	5.06	4.99	4.29	3.69
1840	14.27	—	—	5.16	—	—	0.50	—	0.53	0.52	—	0.36	0.46	—	—	—	—
1841	14.77	—	—	6.15	—	—	0.61	—	0.58	0.51	—	0.35	0.49	—	—	—	—
1842	15.28	—	—	7.13	—	—	0.71	—	0.64	0.50	—	0.34	0.52	—	—	—	—
1843	15.86	—	—	8.12	—	—	0.81	—	0.70	0.68	—	0.46	0.60	—	—	—	—
1844	16.36	—	—	9.11	—	—	1.04	—	0.80	0.85	—	0.58	0.71	—	—	—	—
1845	16.86	—	—	10.09	—	—	1.20	—	0.91	1.05	—	0.72	0.83	—	—	—	—
1846	17.36	—	—	11.08	—	—	1.38	—	0.96	1.20	—	0.83	0.91	—	—	—	—
1847	17.86	—	—	12.06	—	—	1.59	—	1.06	1.25	—	0.86	0.98	—	—	—	—
1848	18.36	—	—	13.05	—	—	1.72	—	1.12	1.24	—	0.86	1.02	—	—	—	—
1849	18.86	14.09	14.07	14.04	—	24	1.86	—	1.19	1.07	—	0.74	1.01	8.63	7.46	6.73	5.93
1850	19.45	—	—	14.72	—	—	1.98	—	1.25	0.97	—	0.67	1.02	—	—	—	—
1851	20.12	—	—	15.41	—	—	2.54	—	1.47	0.92	—	0.63	1.14	—	—	—	—
1852	20.78	—	—	16.09	—	—	2.85	—	1.60	0.87	—	0.60	1.21	—	—	—	—
1853	21.45	—	—	16.78	—	—	3.01	—	1.68	1.00	—	0.69	1.29	—	—	—	—
1854	22.20	—	—	17.47	—	—	3.45	—	1.86	1.10	—	0.76	1.42	—	—	—	—
1855	22.87	—	—	18.15	—	—	3.76	—	1.99	1.16	—	0.80	1.52	—	—	—	—
1856	23.54	—	—	18.84	—	—	3.94	—	2.07	1.29	—	0.89	1.61	—	—	—	—
1857	24.21	—	—	19.53	—	—	3.83	—	2.05	1.21	—	0.84	1.57	—	—	—	—
1858	24.96	—	—	20.21	—	—	3.98	—	2.12	1.15	—	0.80	1.60	—	—	—	—
1859	25.63	20.84	22.92	20.90	—	33	4.49	0.00	2.33	1.33	—	0.92	1.77	13.98	11.94	11.30	9.67
1860	26.29	—	—	22.13	—	—	3.99	0.04	2.19	1.42	—	0.99	1.71	—	—	—	—
1861	26.88	—	—	23.36	—	—	4.66	0.17	2.50	1.29	—	0.90	1.87	—	—	—	—
1862	27.46	—	—	24.59	—	—	4.77	0.24	2.60	1.48	—	1.03	1.98	—	—	—	—
1863	28.05	—	—	25.82	—	—	5.81	0.21	2.98	1.74	—	1.21	2.28	—	—	—	—
1864	28.63	—	—	27.05	—	—	6.29	0.17	3.15	2.00	—	1.39	2.46	—	—	—	—
1865	29.30	—	—	28.28	—	—	6.17	0.20	3.15	1.70	—	1.25	2.40	—	—	—	—
1866	29.88	21.71	20.55	29.51	—	—	7.82	0.28	3.80	2.23	—	1.56	2.91	13.79	12.06	10.91	9.56
1867	30.47	22.38	21.48	30.74	—	—	8.12	0.27	3.92	2.47	—	1.72	3.05	14.41	12.63	11.38	10.10
1868	31.05	23.95	22.84	31.97	—	—	8.66	0.29	4.14	2.63	—	1.84	3.23	15.27	13.37	12.02	10.67
1869	31.64	24.81	23.63	33.21	—	43	8.69	0.33	4.19	2.99	—	2.09	3.36	15.81	13.90	12.49	11.18

* Figures in italics are preliminary. The preliminary estimates for 1932 are based on the October, 1932, crop report and the production of other products for the six months January to June, 1932, inclusive.

THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES

TABLE 1 (concluded)

Year	Population	Food and feed crops	Total crop production	Forest products	Electric current	Water power other than electric	Coal	Other fuel	Fuel and power	Other minerals	Secondary metals	Other minerals and secondary metals	All minerals and power	Total basic production, constant group weights	Total basic production, constant group weights, weighted by value plus value of manufacture	Total basic production, variable group weights	Total basic production, variable group weights, weighted by value plus value of manufacture
1870.....	32.30	25.96	25.65	34.18	—	—	8.37	0.42	4.13	3.07	—	2.15	3.34	16.01	14.84	13.40	11.95
1871.....	33.22	24.66	23.46	35.99	—	—	11.13	0.41	5.12	3.33	—	2.33	4.02	16.18	14.26	12.82	11.49
1872.....	34.22	26.47	26.40	37.39	—	—	12.96	0.50	5.82	4.40	—	3.15	4.77	18.11	16.00	14.57	13.22
1873.....	35.14	25.52	25.46	38.78	—	—	14.30	0.78	6.44	4.87	—	3.42	5.25	17.91	15.90	14.37	13.17
1874.....	36.14	25.07	24.87	40.18	—	—	13.27	0.86	6.12	4.87	—	3.42	5.05	17.61	15.72	13.97	12.90
1875.....	37.15	32.27	32.40	41.57	—	—	12.67	0.69	5.84	4.39	—	3.09	4.75	21.49	18.84	17.08	15.34
1876.....	38.06	31.76	31.36	42.97	—	—	12.87	0.72	5.93	4.48	—	3.15	4.84	21.07	18.55	16.83	15.19
1877.....	39.07	34.99	34.16	44.36	—	—	14.57	1.08	6.70	4.93	—	3.48	5.43	22.86	20.06	18.41	16.55
1878.....	39.98	37.44	36.85	45.75	—	—	13.24	1.22	6.30	5.44	—	3.84	5.33	24.30	21.38	19.68	17.72
1879.....	40.98	44.69	43.24	47.15	—	48	16.71	1.57	7.71	5.91	—	4.18	6.31	28.12	24.48	23.03	20.53
1880.....	41.99	42.02	41.79	49.55	—	—	16.77	2.08	7.97	7.27	—	5.15	6.85	27.75	24.46	22.70	20.67
1881.....	42.99	34.56	34.77	51.95	—	—	19.55	2.19	9.02	8.01	—	5.69	7.71	24.62	22.04	20.25	18.92
1882.....	44.07	43.41	43.66	54.35	0	—	22.75	2.41	10.28	9.09	—	6.47	8.77	29.83	26.42	24.96	23.06
1883.....	45.16	44.48	43.26	56.75	0.04	—	25.26	1.87	10.96	9.45	—	6.74	9.29	29.99	26.63	25.07	23.27
1884.....	46.24	49.09	47.29	59.16	0.09	—	25.55	1.96	11.12	9.16	—	6.55	9.31	32.25	28.46	27.26	25.03
1885.....	47.33	47.94	47.19	61.56	0.13	—	24.58	1.89	10.76	9.32	—	6.67	9.15	32.28	28.61	27.21	25.05
1886.....	48.33	46.15	45.52	63.96	0.17	—	25.09	2.56	11.26	11.20	—	8.05	9.09	31.92	28.67	26.06	23.39
1887.....	49.42	43.90	43.83	66.36	0.21	—	28.18	2.77	12.48	12.72	—	9.15	11.16	31.70	28.73	27.18	26.02
1888.....	50.50	51.87	50.80	68.77	0.24	—	31.73	2.95	13.84	13.39	—	9.66	12.19	35.89	32.21	30.69	28.92
1889.....	51.59	53.86	52.45	71.17	0.28	54	30.45	3.49	13.64	14.98	—	10.83	12.53	37.04	33.60	31.69	30.19
1890.....	52.67	44.49	46.14	73.40	0.31	—	32.96	4.29	14.90	17.30	—	12.53	13.96	34.51	31.82	30.09	29.49
1891.....	53.76	59.41	58.94	75.63	0.34	—	35.47	4.91	16.08	17.04	—	12.37	14.01	41.57	37.47	36.18	34.27
1892.....	54.84	51.85	50.37	77.87	0.37	—	37.39	4.63	16.65	18.88	—	13.77	15.51	37.64	34.04	32.85	32.01
1893.....	55.93	52.23	51.42	80.10	0.49	—	38.16	4.48	16.89	16.06	—	11.76	14.86	38.06	34.55	32.84	31.14
1894.....	57.01	49.20	50.54	82.34	0.61	—	36.05	4.59	16.21	15.40	—	11.33	14.28	37.51	34.11	32.90	31.21
1895.....	58.10	63.39	60.42	84.57	0.73	—	40.61	4.88	17.99	19.29	—	14.25	16.51	43.71	39.75	38.78	36.90
1896.....	59.18	66.99	64.47	86.80	0.86	—	39.54	5.58	17.94	19.28	—	14.30	16.50	45.95	41.64	40.82	38.59
1897.....	60.27	63.43	64.15	89.03	0.98	—	40.25	5.67	18.26	21.15	—	15.75	17.27	46.25	42.26	41.27	39.40
1898.....	61.35	69.15	69.37	91.27	1.29	—	43.16	5.42	19.25	24.27	—	18.10	18.82	49.75	45.66	44.20	42.51
1899.....	62.44	69.20	69.05	93.50	1.59	58	49.48	5.96	21.80	27.34	—	20.54	21.30	50.70	46.91	40.20	44.86
1900.....	63.52	69.61	69.04	97.88	2.02	—	50.93	6.82	22.82	28.60	—	21.57	22.33	51.47	47.78	47.03	45.96
1901.....	64.86	61.38	61.65	102.21	2.45	—	56.63	7.67	25.35	31.32	—	23.72	24.71	48.91	46.14	44.57	44.07
1902.....	66.28	78.19	76.66	106.56	3.07	—	51.36	9.65	24.49	34.92	—	26.56	25.31	57.22	53.73	52.55	52.45
1903.....	67.61	73.15	71.74	110.91	3.61	—	67.11	11.17	30.92	35.95	—	27.45	29.55	56.72	53.18	53.29	53.19
1904.....	68.95	77.68	78.43	115.26	4.35	—	66.03	12.93	31.48	36.25	—	27.80	30.03	60.67	56.54	57.20	55.99

THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES

1905.....	70.28	81.07	78.57	116.66	5.02	—	72.72	14.84	34.87	45.92	—	35.50	35.12	62.96	60.00	60.47	60.85
1906.....	71.62	83.78	83.41	123.67	6.06	—	74.09	15.02	35.68	50.72	—	39.37	37.14	66.76	64.13	63.87	64.56
1907.....	73.04	76.03	75.01	123.83	7.18	—	86.66	18.38	41.88	51.57	—	40.20	41.22	64.12	61.73	61.90	62.72
1908.....	74.37	79.14	79.60	112.90	8.33	—	77.31	19.30	39.19	40.30	—	31.54	36.17	63.68	59.23	60.91	59.01
1909.....	75.71	81.85	81.45	120.18	9.68	75	82.89	20.69	42.08	56.08	16.53	43.63	42.69	67.83	65.43	65.86	66.63
1910.....	77.05	82.58	81.85	120.07	11.02	—	89.24	23.14	45.63	59.60	18.77	46.74	46.10	69.45	67.22	67.45	68.44
1911.....	78.21	74.76	78.63	116.49	12.43	—	90.03	24.07	46.64	55.93	20.78	44.86	45.94	67.48	65.00	65.07	65.50
1912.....	79.38	93.67	92.68	121.81	14.17	—	93.71	24.92	48.66	65.92	26.77	53.59	50.60	77.05	74.82	75.80	76.25
1913.....	80.55	80.14	81.81	119.32	16.41	—	100.25	27.25	52.43	68.67	26.80	55.48	53.63	72.52	71.25	71.30	72.18
1914.....	81.72	89.71	91.77	110.32	19.23	—	92.47	28.83	50.87	59.94	24.59	48.80	50.05	75.60	72.04	74.36	72.11
1915.....	82.89	101.11	96.79	104.36	22.66	—	94.52	30.62	53.02	70.44	36.34	59.70	55.66	80.16	77.98	79.49	78.41
1916.....	84.14	87.18	85.65	110.10	26.94	—	102.18	33.94	58.00	88.36	61.13	79.78	66.61	79.31	81.84	78.78	82.76
1917.....	85.31	94.92	92.17	100.04	31.15	—	113.46	37.71	64.46	87.36	63.88	79.97	70.59	83.70	84.68	83.42	85.53
1918.....	86.48	93.86	92.41	89.36	35.27	—	116.84	38.66	66.85	94.62	59.99	76.86	70.81	83.22	83.09	83.21	83.98
1919.....	87.65	95.30	93.38	95.79	39.80	79	97.31	41.06	61.76	70.14	53.31	64.84	62.98	80.88	78.90	80.81	79.37
1920.....	88.90	103.26	101.84	97.85	48.40	—	111.96	46.97	71.22	79.12	56.38	71.96	71.51	88.95	86.48	88.72	86.55
1921.....	90.32	91.77	86.09	80.52	45.28	—	91.40	47.81	63.73	48.59	39.66	44.40	56.09	73.23	67.31	73.00	66.83
1922.....	91.74	101.36	96.11	97.81	53.35	—	78.55	56.09	64.30	67.19	63.25	65.95	64.95	83.25	80.85	83.11	80.35
1923.....	93.07	101.06	96.83	112.96	62.62	90	112.83	74.41	86.31	93.44	76.11	87.98	86.97	93.78	93.48	93.41	92.51
1924.....	94.49	96.82	95.43	109.17	66.64	—	99.70	75.21	82.75	86.19	74.31	82.45	82.63	90.99	90.08	91.28	90.09
1925.....	95.83	97.12	98.69	113.25	74.90	—	94.65	80.59	84.86	95.76	83.20	91.80	87.61	95.02	95.51	95.01	95.67
1926.....	97.25	96.72	99.89	110.62	84.70	—	110.52	83.78	93.78	101.00	94.42	98.93	95.81	98.89	99.60	99.35	100.25
1927.....	98.58	103.69	100.90	104.00	91.47	—	101.36	96.98	97.56	98.54	96.14	87.79	97.65	99.75	99.56	99.65	99.86
1928.....	100.00	106.31	104.85	102.79	101.56	100	97.21	99.36	99.02	102.50	104.79	103.22	100.68	102.98	103.32	103.09	103.87
1929.....	101.42	99.85	100.14	103.89	111.96	—	101.28	114.06	108.85	109.98	116.39	112.00	110.10	104.63	105.96	103.66	105.52
1930.....	102.75	93.41	94.21	78.78	110.31	—	89.63	105.82	100.81	87.98	88.26	88.07	95.78	93.86	91.56	93.14	91.42
1931.....	103.60	82.30	85.98	50.01	106.13	—	74.37	96.35	90.60	60.26	68.10	62.73	79.68	80.12	79.28	85.27	79.48
1932.....	104.17	98.31	92.90	50.94	96.28	—	68.80	87.80	78.09	34.20	—	37.37	62.36	70.16	65.56	75.66	64.10
Rate of change†																	
1839-1914	2.28	3.02	3.03	—	—	—	6.22	—	5.96	7.20	—	7.02	6.43	3.57	3.78	4.03	4.31
1839-1907	—	—	—	4.14	—	—	—	—	—	—	—	—	—	—	—	—	—
1839-1920	—	—	—	—	—	—	—	—	—	—	—	—	—	3.46	—	3.93	—
1839-1930	—	—	—	—	—	—	—	—	—	—	—	—	—	3.22	—	3.66	—
1849-1909	—	—	—	—	—	1.60	—	—	—	—	—	—	—	—	—	—	—
1866-1914	—	—	—	—	—	—	—	10.02	—	—	—	—	—	—	—	—	—
1880-1896	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.55	—
1882-1914	—	—	—	—	18.36	—	—	—	—	—	—	—	—	—	—	—	—
1897-1913	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.60	—
1915-1919	—	-0.36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1919-1923	—	—	—	—	—	—	2.63	—	—	—	—	—	—	—	—	—	—
1920-1929	—	1.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1915-1929	1.46	0.60	0.85	0.60	11.67	—	-0.25	10.07	4.84	2.58	6.56	3.62	4.31	2.08	2.19	2.11	2.13
1915-1929	—	1.17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1915-1930	1.46	—	0.66	—	—	—	—	—	—	—	—	—	—	1.84	—	1.85	—
1915-1930	—	—	1.13	—	—	—	—	—	—	—	—	—	—	—	—	—	—

† The rates of change are based on the equation $y = ar^x$.

TABLE 2. INDEX NUMBERS OF PHYSICAL VOLUME OF PRODUCTION PER CAPITA IN THE UNITED STATES, 1839 TO 1932*
(1926-30 = 100)

Year	Food and feed crops	Total crop production	Forest products	Electric current	Water power other than electric	Coal	Other fuel	Fuel and power	Other minerals	Secondary metals	Other minerals and secondary metals	All minerals and power	Total basic production, constant group weights	Total basic production, constant group weights, weighted by value plus value of manufacture	Total basic production, variable group weights	Total basic production, variable group weights, weighted by value plus value of manufacture
1839	74.10	76.11	29.99	—	—	3.73	—	3.66	3.66	—	2.51	3.23	42.75	35.80	30.77	26.47
1840	—	—	36.16	—	—	3.50	—	3.71	3.64	—	2.52	3.22	—	—	—	—
1841	—	—	41.64	—	—	4.13	—	3.93	3.45	—	2.37	3.32	—	—	—	—
1842	—	—	46.66	—	—	4.65	—	4.19	3.27	—	2.23	3.40	—	—	—	—
1843	—	—	51.20	—	—	5.11	—	4.41	4.29	—	2.90	3.78	—	—	—	—
1844	—	—	55.68	—	—	6.36	—	4.89	5.20	—	3.55	4.34	—	—	—	—
1845	—	—	59.85	—	—	7.65	—	5.40	6.23	—	4.27	4.92	—	—	—	—
1846	—	—	63.82	—	—	7.95	—	5.53	6.91	—	4.78	5.24	—	—	—	—
1847	—	—	67.53	—	—	8.90	—	5.94	7.00	—	4.82	5.49	—	—	—	—
1848	—	—	71.08	—	—	9.37	—	6.10	6.75	—	4.68	5.56	—	—	—	—
1849	74.71	74.60	74.44	—	127.25	9.86	—	6.31	5.67	—	3.92	5.36	45.76	39.55	35.68	31.44
1850	—	—	75.68	—	—	10.18	—	6.43	4.99	—	3.44	5.21	—	—	—	—
1851	—	—	76.59	—	—	12.62	—	7.31	4.57	—	3.13	5.67	—	—	—	—
1852	—	—	77.43	—	—	13.72	—	7.70	4.19	—	2.89	5.82	—	—	—	—
1853	—	—	78.23	—	—	14.03	—	7.83	4.66	—	3.22	6.01	—	—	—	—
1854	—	—	78.69	—	—	15.54	—	8.38	4.95	—	3.42	6.40	—	—	—	—
1855	—	—	79.36	—	—	16.44	—	8.70	5.07	—	3.50	6.65	—	—	—	—
1856	—	—	80.03	—	—	16.74	—	8.79	5.48	—	3.78	6.84	—	—	—	—
1857	—	—	80.67	—	—	15.82	—	8.47	5.00	—	3.47	6.48	—	—	—	—
1858	—	—	80.97	—	—	15.95	—	8.49	4.61	—	3.21	6.41	—	—	—	—
1859	81.31	89.43	81.55	—	128.76	17.52	0.00	9.09	5.19	—	3.59	6.91	54.55	46.59	44.09	37.73
1860	—	—	84.18	—	—	15.18	0.15	8.33	5.40	—	3.77	6.50	—	—	—	—
1861	—	—	86.90	—	—	17.34	0.63	9.30	4.80	—	3.35	6.96	—	—	—	—
1862	—	—	89.55	—	—	17.37	0.87	9.47	5.39	—	3.75	7.21	—	—	—	—
1863	—	—	92.05	—	—	20.71	0.75	10.62	6.20	—	4.31	8.13	—	—	—	—
1864	—	—	94.48	—	—	21.97	0.59	11.00	6.99	—	4.86	8.59	—	—	—	—
1865	—	—	96.52	—	—	21.06	0.68	10.75	6.11	—	4.27	8.19	—	—	—	—
1866	72.66	68.78	98.76	—	—	26.17	0.94	12.72	7.46	—	5.22	9.74	46.15	40.36	36.18	31.99
1867	73.45	70.50	100.89	—	—	26.65	0.89	12.87	8.11	—	5.64	10.01	47.29	41.45	37.35	33.15
1868	77.13	73.56	102.96	—	—	27.89	0.95	13.33	8.47	—	5.93	10.40	49.18	43.06	38.71	34.36
1869	78.41	74.68	104.96	—	135.90	27.47	1.04	13.24	9.45	—	6.61	10.62	49.97	43.93	39.48	35.34
1870	80.37	79.41	105.82	—	—	25.91	1.30	12.79	9.50	—	6.66	10.34	52.35	45.94	41.49	37.00
1871	74.23	70.62	108.34	—	—	33.50	1.23	15.41	10.02	—	7.01	12.10	48.71	42.93	38.59	34.59
1872	77.35	77.15	109.26	—	—	37.87	1.46	17.01	12.12	—	9.21	13.94	52.92	46.76	42.58	38.63
1873	72.62	72.45	110.36	—	—	46.69	2.22	18.23	13.86	—	9.73	14.94	50.97	45.25	40.89	37.48
1874	69.37	68.82	111.18	—	—	36.72	2.38	16.93	13.29	—	9.46	13.97	48.73	43.50	38.66	35.69

G. F. WARREN AND F. A. PEARSON

1875.	86.86	87.21	111.90	—	—	34.10	1.86	15.72	11.82	—	8.32	12.79	57.85	50.71	45.98	41.29
1876.	83.45	82.40	112.90	—	—	33.82	1.89	15.58	11.77	—	8.28	12.72	55.30	48.74	44.22	39.91
1877.	89.56	87.43	115.54	—	—	37.29	2.71	17.15	12.62	—	8.91	13.90	58.51	51.34	47.12	42.36
1878.	93.65	92.17	114.43	—	—	33.12	3.05	15.76	13.61	—	9.60	13.33	60.78	53.48	49.22	44.32
1879.	109.05	105.51	115.06	—	117.13	40.78	3.83	18.81	14.42	—	10.20	15.40	68.62	59.74	56.20	50.10
1880.	100.07	99.52	118.00	—	—	39.94	4.95	18.98	17.31	—	12.26	16.31	66.09	68.25	54.06	49.23
1881.	80.39	80.88	120.84	—	—	45.48	5.09	20.98	18.63	—	13.24	17.93	57.27	51.27	47.10	44.01
1882.	98.50	99.07	123.33	0.00	—	51.62	5.47	23.33	20.63	—	14.68	19.90	67.69	59.85	56.64	52.33
1883.	98.49	95.79	125.66	0.09	—	55.93	4.14	24.27	20.93	—	14.92	20.57	66.41	58.97	55.51	51.53
1884.	106.16	102.27	127.94	0.19	—	55.26	4.24	24.05	19.81	—	14.17	20.13	69.74	61.55	58.95	54.13
1885.	101.29	99.70	130.07	0.27	—	51.93	3.99	22.73	19.69	—	14.09	19.33	68.20	60.45	57.49	52.93
1886.	95.49	94.19	132.34	0.35	—	51.91	5.30	23.30	23.17	—	16.66	20.67	66.05	59.32	55.78	52.53
1887.	88.83	88.69	134.28	0.42	—	57.02	5.61	25.25	25.74	—	18.51	22.58	64.14	58.13	55.00	52.65
1888.	102.71	100.59	136.18	0.48	—	62.83	5.84	27.41	26.51	—	19.13	24.14	71.07	63.78	60.77	67.27
1889.	104.40	101.67	137.95	0.54	104.67	59.02	6.76	26.44	29.04	—	20.99	24.29	71.80	64.94	61.43	68.52
1890.	84.47	87.60	139.36	0.59	—	62.58	8.15	28.29	32.85	—	23.79	26.50	65.52	60.41	57.13	55.99
1891.	110.51	109.64	140.68	0.63	—	65.98	9.13	29.91	31.70	—	23.01	27.18	77.33	69.70	67.30	63.75
1892.	94.55	91.85	141.99	0.67	—	68.18	8.44	30.36	34.43	—	25.11	28.28	68.64	63.17	59.90	58.37
1893.	93.38	91.94	143.21	0.88	—	68.23	8.01	30.20	28.71	—	21.03	26.57	68.05	61.77	58.72	55.68
1894.	86.30	88.65	144.43	1.07	—	63.23	8.05	28.43	27.01	—	19.87	25.05	65.80	59.83	57.71	54.74
1895.	109.10	103.99	145.56	1.26	—	69.90	8.40	30.96	33.20	—	24.53	28.42	75.23	68.42	66.75	63.51
1896.	113.20	108.94	146.67	1.45	—	66.81	9.43	30.31	32.58	—	24.16	27.88	77.64	70.36	68.08	65.21
1897.	105.24	106.44	147.72	1.63	—	66.78	9.41	30.30	35.09	—	26.13	28.65	76.74	70.12	68.48	65.37
1898.	112.71	113.07	148.77	2.10	—	70.35	8.83	31.38	39.56	—	29.60	30.68	81.09	74.43	72.05	69.29
1899.	110.83	110.59	149.74	2.55	89.69	79.24	9.55	34.91	43.79	—	32.90	34.11	81.29	75.13	73.99	71.84
1900.	109.59	108.69	154.09	3.18	—	80.18	10.74	35.93	46.03	—	33.96	35.15	81.03	75.22	74.04	72.36
1901.	94.63	95.05	157.59	3.78	—	87.31	11.83	39.08	48.29	—	30.57	38.10	75.41	71.14	68.72	68.87
1902.	117.97	115.66	160.77	4.63	—	77.49	14.56	36.95	52.69	—	40.07	38.19	86.33	81.07	79.28	79.13
1903.	108.19	106.11	164.04	5.34	—	99.20	16.52	45.73	53.17	—	40.60	43.71	83.89	78.66	78.82	78.67
1904.	112.66	113.75	167.16	6.31	—	95.77	18.75	45.66	52.57	—	40.32	43.55	87.99	82.00	82.96	81.20
1905.	115.35	111.80	165.99	7.14	—	103.47	21.12	49.62	65.34	—	50.51	49.97	89.58	85.37	86.04	80.58
1906.	116.98	116.46	172.68	8.46	—	103.45	20.97	49.82	70.82	—	54.97	51.86	93.21	89.54	89.18	90.14
1907.	104.09	102.70	169.54	9.83	—	118.65	25.16	57.34	70.61	—	55.04	56.43	87.79	84.52	84.75	85.87
1908.	106.41	107.03	151.81	11.20	—	103.95	25.95	52.70	54.19	—	42.41	48.64	85.93	79.64	81.90	79.35
1909.	108.11	107.58	158.74	12.79	99.06	109.48	27.33	55.58	74.07	21.83	57.63	56.39	89.59	86.42	86.99	88.01
1910.	107.18	106.23	155.83	14.30	—	115.82	30.03	59.29	77.35	24.36	60.06	59.83	90.14	87.24	87.54	88.83
1911.	95.59	100.54	148.95	15.89	—	115.11	30.78	59.03	71.51	26.57	57.36	58.74	86.28	83.11	83.20	83.75
1912.	118.00	116.75	153.45	17.85	—	118.05	31.39	61.30	83.04	33.72	67.51	63.74	97.06	94.20	95.49	96.06
1913.	99.49	101.56	148.13	20.37	—	124.46	33.83	65.09	85.25	33.27	68.88	66.58	90.03	88.45	88.52	89.61
1914.	109.78	112.30	135.00	23.53	—	113.15	35.28	62.25	73.35	30.09	69.72	61.25	92.51	88.15	90.99	88.24
1915.	121.98	116.77	125.90	27.34	—	114.03	36.94	63.96	84.98	43.84	72.02	67.14	96.71	94.08	95.90	94.00
1916.	103.61	101.79	130.85	32.02	—	121.44	40.34	68.93	105.02	72.65	84.82	70.17	94.26	97.27	93.63	98.36
1917.	111.26	108.04	117.27	36.51	—	133.00	44.20	75.56	102.40	74.88	93.74	82.75	98.11	99.26	97.78	100.26
1918.	108.53	106.86	103.33	40.78	—	135.11	44.70	77.30	97.85	69.37	88.88	81.88	96.23	96.08	96.22	97.11
1919.	108.73	106.54	109.29	45.41	90.13	111.02	46.85	70.46	80.02	60.82	73.98	71.85	92.28	90.02	92.20	90.55
1920.	116.15	114.56	110.07	54.44	—	125.94	52.83	80.11	89.00	63.42	80.94	80.44	100.06	97.28	99.80	97.36
1921.	101.61	95.32	89.15	50.13	—	101.20	52.93	70.56	61.58	43.91	49.16	62.10	81.08	74.52	80.82	73.99
1922.	110.49	104.76	106.62	58.15	—	85.62	61.14	70.09	73.24	68.94	71.89	70.80	90.75	88.24	90.59	87.58
1923.	108.58	104.04	121.37	67.28	96.70	121.23	79.95	92.74	100.40	81.78	84.53	93.45	100.76	100.44	100.37	99.40
1924.	102.47	100.99	115.54	70.53	—	105.61	79.60	87.58	91.22	78.64	87.26	87.45	96.30	95.33	96.60	95.34

* Figures in italics are preliminary.

TABLE 2 (concluded)

Year	Food and feed crops	Total crop production	Forest products	Electric current	Water power other than electric	Coal	Other fuel	Fuel and power	Other minerals	Secondary metals	Other minerals and secondary metals	All minerals and power	Total basic production, constant group weights	Total basic production, constant group weights, weighted by value plus value of manufacture	Total basic production, variable group weights	Total basic production, variable group weights, weighted by value plus value of manufacture
1925.....	101.35	102.98	118.18	78.16	—	98.77	84.10	88.55	99.93	86.82	95.79	91.42	99.15	99.67	99.14	99.83
1926.....	99.46	102.71	113.75	87.10	—	113.65	86.15	96.43	103.86	97.09	101.73	98.52	101.69	102.42	102.16	103.08
1927.....	105.18	102.35	105.50	92.79	—	102.82	98.38	98.97	99.96	97.52	99.20	99.06	101.19	100.99	101.09	101.30
1928.....	106.31	104.85	102.79	101.56	100.00	97.21	99.36	99.02	102.50	104.79	103.22	100.68	102.98	103.32	103.09	103.87
1929.....	98.45	98.74	102.44	110.39	—	99.86	112.46	107.33	108.44	114.76	110.43	108.56	103.07	104.48	102.21	104.64
1930.....	90.91	91.69	76.67	107.36	—	87.23	102.99	98.11	85.63	85.90	85.71	93.22	91.35	89.11	90.65	88.97
1931.....	89.10	89.63	48.28	102.45	—	71.79	83.01	87.58	68.17	65.74	60.68	76.76	83.14	76.53	88.31	76.67
1932.....	92.46	89.18	29.70	92.41	—	64.53	84.28	75.54	32.83	—	35.87	69.89	73.10	62.93	70.68	61.63
Rate of change																
1839-1914.....	0.74	0.75	—	—	—	3.86	—	—	—	—	—	4.08	—	—	1.73	—
1839-1900.....	0.86	—	—	—	—	—	—	—	—	—	—	—	—	—	1.97	—
1866-1914.....	—	—	—	—	—	—	7.70	—	—	—	—	—	—	—	1.35	—
1880-1896.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.69	—
1897-1913.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1901-1914.....	-0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1915-1919.....	-1.82	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1920-1929.....	-1.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1915-1929.....	-0.85	-0.60	-0.85	—	—	-1.69	8.49	—	—	—	—	2.80	—	—	0.64	—
1915-1929.....	-0.29	-0.13	—	—	—	—	—	—	—	—	—	—	—	—	—	—

← Rate of change when adjustment is made for horses and mules.

TOTAL CROP PRODUCTION

The production of cotton and tobacco followed other crop production closely, so that the total crop production increased at about the same rate as did the production of food and feed crops. But there was a very large cotton crop in 1859, and there were small cotton crops for some years as a result of the Civil War.

The index numbers of crop production from 1839 to 1932 are shown in table 1 and in figure 3. Crop production increased at a uniform

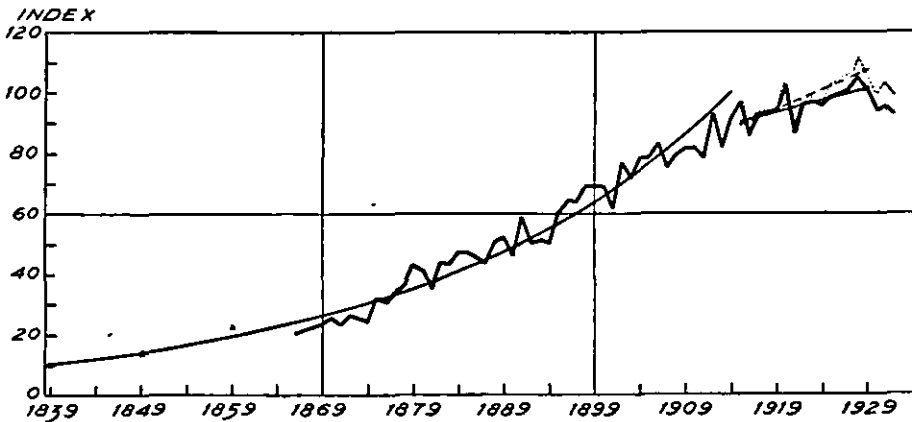


FIGURE 3. INDEX NUMBERS OF THE PHYSICAL VOLUME OF TOTAL CROP PRODUCTION IN THE UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914, crop production increased at the rate of 3.03 per cent per annum; from 1915 to 1929, the rate was 0.85 per cent per annum. If correction is made for the decrease in the number of horses and mules, the latter rate would be 1.33 per cent per annum

rate until about 1906. Since that time the rate of increase has declined. The average rate of increase for the 76 years ending with 1914 was at the compound rate of 3.03 per cent per annum (table 1). From 1915 to 1929, the average rate of increase was 0.85 per cent per annum.

The substitution of automobiles, trucks, and tractors, for horsepower, reduces the demand for crops, so that the effective increase in crop production is greater than the figures indicate. The reduction in the number of horses and mules, and the estimated crop acreage that is released, are shown in table 11 (page 54). For 1929, this released acreage is estimated at 6 per cent of the total crop acreage. The physical volume of production with this released acreage added, also is shown in figure 3. On this basis, the crop production from 1915 to 1929 increased 1.33 per cent per annum (table 1).

From 1839 to 1914, the production of all crops per capita increased at the compound rate of 0.75 per cent per annum (table 2 and figure 4).

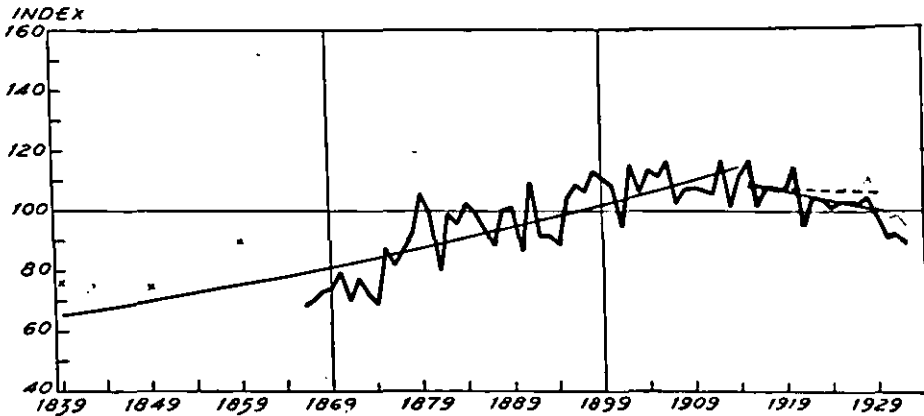


FIGURE 4. INDEX NUMBERS OF THE PHYSICAL VOLUME OF TOTAL CROP PRODUCTION PER CAPITA IN THE UNITED STATES, 1839 TO 1932

(1926-30 = 100)

From 1839 to 1914, production of all crops per capita increased at the rate of 0.75 per cent per annum; from 1915 to 1929 it declined

It is difficult to see how any one can attribute the agricultural depression to over-production, when production per capita is for the first time in history declining. If this decline continues, it appears that there ultimately will be another period of high costs of living.

FOREST PRODUCTS

From 1839 to 1907, the board feet of lumber cut increased nearly 30 times. Since then, lumber production has declined. Fifty years ago, relatively little pulpwood was produced. Pulpwood is now of considerable importance.

From 1839 to 1907, the physical volume of production of lumber and pulpwood increased at the rate of 4.14 per cent per annum (table 1 and figure 5). The production in 1932 was the lowest that has occurred since 1867. The production of lumber and pulpwood increased faster than did crop production for a time, but in the last twenty years it has declined.

From 1839 to 1907, the production of forest products per capita increased at a decreasing rate (table 2 and figure 6). Since 1907 there has been a steady decline in the production of forest products per capita, with a slight increase from 1922 to 1926.

The production of lumber per capita in 1931 was approximately the same as in 1842.

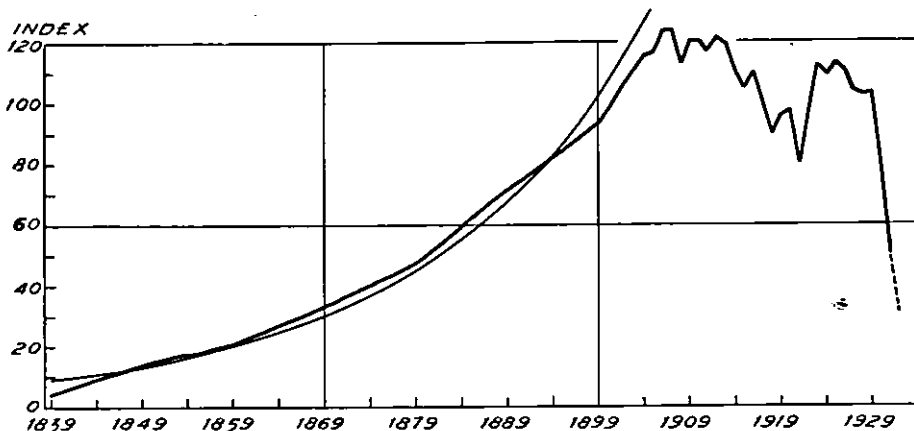


FIGURE 5. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF FOREST PRODUCTS OF THE UNITED STATES, 1839 TO 1932

(1926-30 = 100)

The production of lumber and pulpwood increased rapidly until 1907, and since then has declined. From 1839 to 1907 it increased at the rate of 4.14 per cent per annum. In 1931 it was lower than at any other time since 1880

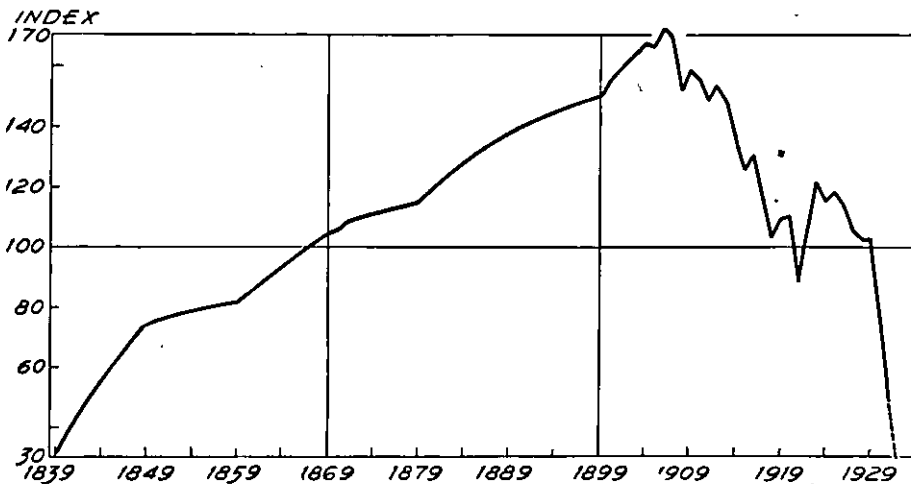


FIGURE 6. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF FOREST PRODUCTS PER CAPITA IN THE UNITED STATES, 1839 TO 1932

(1926-30 = 100)

The production of forest products per capita reached a peak in 1906. Since that time it has declined very rapidly. From 1915 to 1929 it declined at the rate of 0.85 per cent per annum

ELECTRIC CURRENT

Comparatively little electricity was produced before 1900 (table 1 and figure 7). The industry has grown with great rapidity. From 1882 to 1914 the annual rate of increase was 18.36 per cent. From 1915 to 1929 the rate of increase was 11.67 per cent.

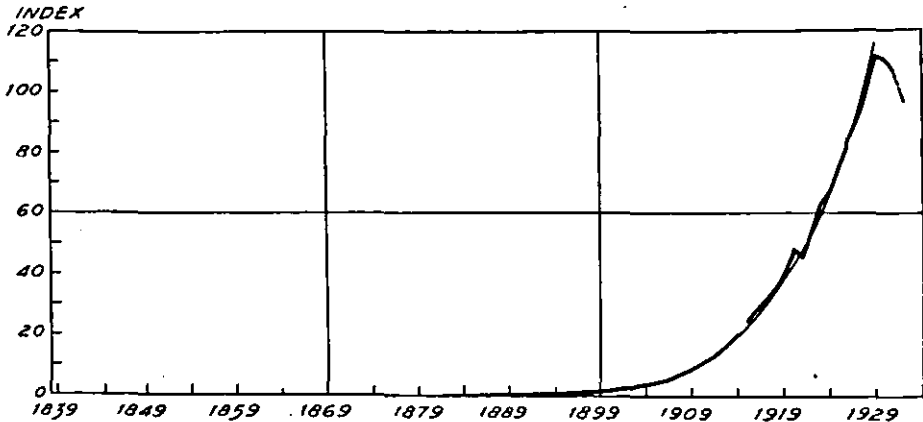


FIGURE 7. INDEX NUMBERS OF THE PHYSICAL VOLUME OF ELECTRIC CURRENT GENERATED IN THE UNITED STATES, 1882 TO 1932
(1926-30 = 100)

From 1882 to 1914 the production of electric current increased 18.36 per cent per annum; from 1915 to 1929 the rate of increase was 11.67 per cent per annum

WATER POWER

Daugherty³ reports the horsepower from water wheels other than those generating electricity to have been 662,000 in 1849. It increased at a uniform rate, and was 2,528,000 in 1923. From 1849 to 1909 the horsepower increased at the compound rate of 1.69 per cent per annum (figure 8).

COAL

Production of bituminous and anthracite coal increased rapidly until 1918, which was the peak year (figure 9). From 1839 to 1914, coal production increased 6.22 per cent per annum. From 1915 to 1929 it decreased at the compound rate of 0.25 per cent per annum.

The production per capita increased steadily from 1839 to 1918, and since that time it has declined very rapidly (figure 10). During the prosperity of 1929, production per capita was less than during the depression of 1921 and was approximately the same as in 1903.

³ Daugherty, C. R., Horton, A. H., and Davenport, R. W. Power capacity and production in the United States. U. S. Geol. Survey. Water-supply paper no. 870, p. 48, 50. 1928.

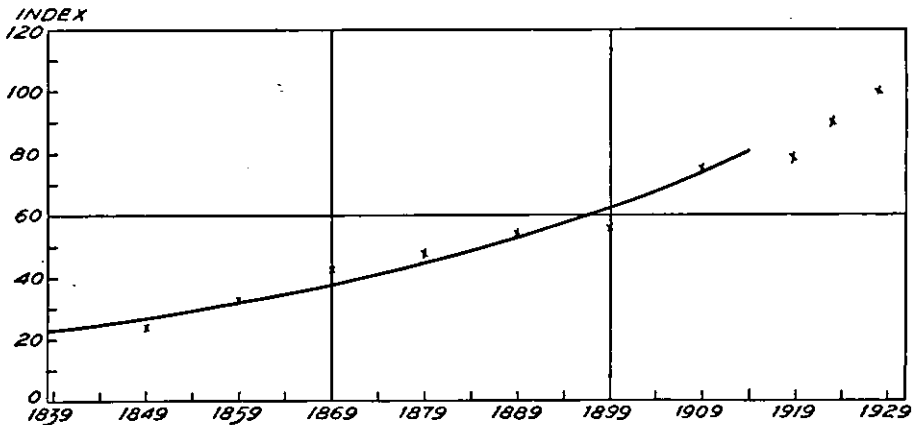


FIGURE 8. INDEX NUMBERS OF THE HORSEPOWER OF WATER WHEELS IN THE UNITED STATES, 1849 TO 1928
(1926-30 = 100)

From 1849 to 1909 the horsepower of water wheels increased at the rate of 1.69 per cent per annum; from 1919 to 1928 the rate of increase was 2.63 per cent per annum

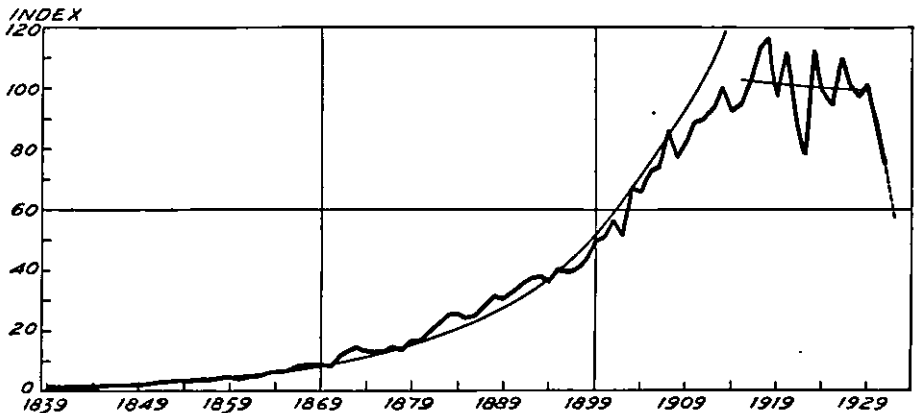


FIGURE 9. INDEX NUMBERS OF THE PHYSICAL VOLUME OF COAL PRODUCED IN THE UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914 the production of coal increased at the rate of 6.22 per cent per annum; from 1915 to 1929 it declined at the rate of 0.25 per cent per annum. Other sources of power have displaced coal

During the depression of 1931, production per capita was about the same as in 1898.

Coal is used more efficiently than it was formerly, so that the power units available have increased faster than has coal production.

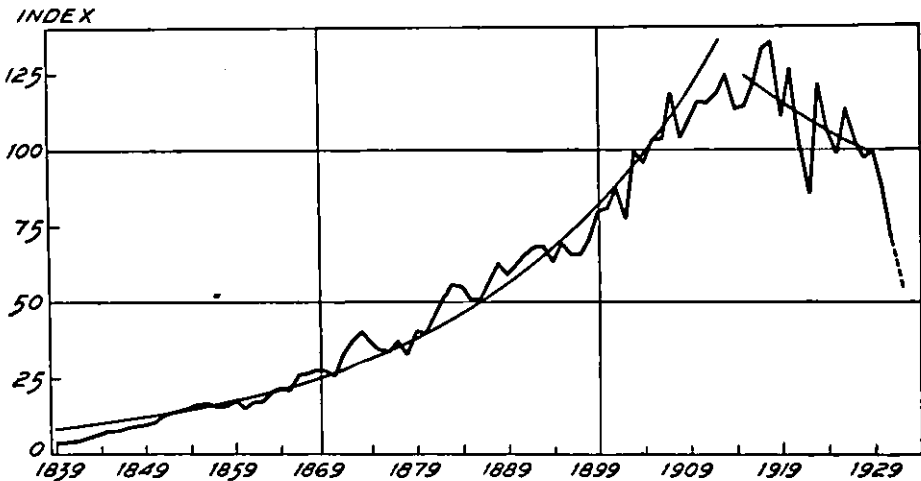


FIGURE 10. INDEX NUMBERS OF THE PHYSICAL VOLUME OF COAL PRODUCED PER CAPITA IN THE UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914 the production of coal per capita increased at the rate of 3.86 per cent per annum; from 1915 to 1929 it declined 1.69 per cent per annum

OTHER FUEL

Other fuel than coal consists mostly of petroleum and natural gas. Practically no petroleum was produced before the Civil War. Production had a steady growth from 1880 until the introduction of automobiles, and has had a very rapid growth since that time (figures 11 and 12).

From 1866 to 1914 the production of other fuel than coal increased 10.02 per cent per annum; and from 1915 to 1929 it increased 10.07 per cent per annum.

From 1866 to 1914 the production per capita increased 7.70 per cent per annum; and from 1915 to 1929 it increased 8.49 per cent per annum.

OTHER MINERALS AND SECONDARY METALS

Pig-iron production has increased from one-fourth of a million long tons in 1839 to more than 40 millions in 1929. Most other minerals have increased with great rapidity. The striking effect of the severe depression is shown in the production for 1931. In 1921 the production of pig iron and copper was less than one-half of the production of the preceding year.

Large amounts of iron, copper, brass, lead, and other products, are collected as waste metals and reworked. These serve the same purpose

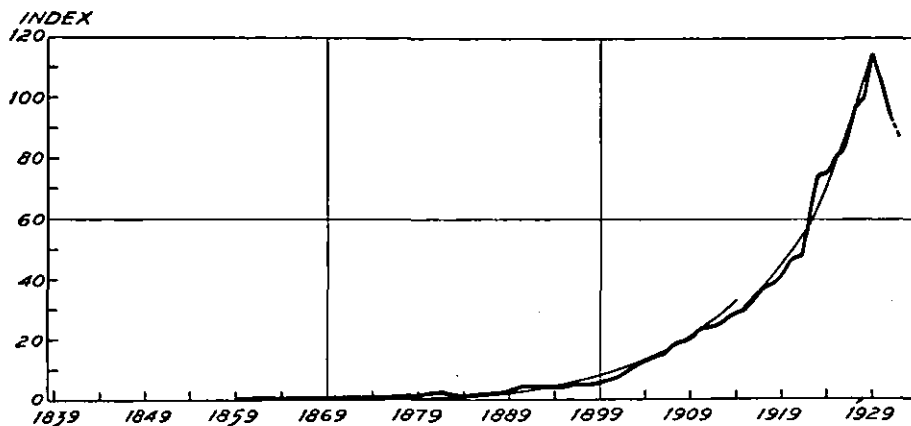


FIGURE 11. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF PETROLEUM, NATURAL GAS, AND NATURAL-GAS GASOLINE IN THE UNITED STATES, 1859 TO 1932
(1926-30 = 100)

From 1866 to 1914, production of other fuel than coal increased 10.02 per cent per annum; from 1915 to 1929 the rate of increase was 10.07 per cent per annum

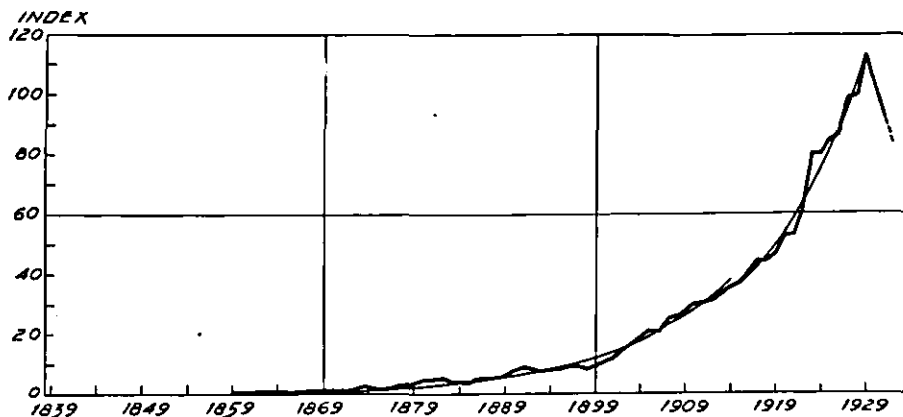


FIGURE 12. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION PER CAPITA OF PETROLEUM, NATURAL GAS, AND NATURAL-GAS GASOLINE IN THE UNITED STATES, 1859 TO 1932
(1926-30 = 100)

From 1866 to 1914, production of other fuel than coal increased 7.70 per cent per annum; from 1915 to 1929 the rate of increase was 8.49 per cent per annum

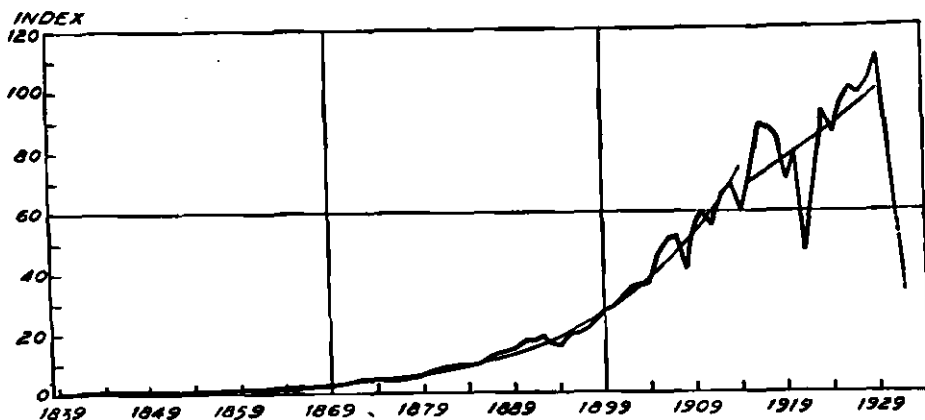


FIGURE 13. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF OTHER MINERALS IN THE UNITED STATES, 1839 TO 1932

(1926-30 = 100)

From 1839 to 1914 the production of other minerals increased 7.20 per cent per annum; from 1915 to 1929 it increased 2.58 per cent per annum

as does new production, and are therefore included in the physical volume of production. The proportion which these represent of the total metals increases rapidly (figure 14).

From 1839 to 1914, the index of other minerals and secondary metals increased at the compound rate of 7.02 per cent per annum (table 1 and figure 15). From 1915 to 1929 it increased only 3.62 per cent per annum.

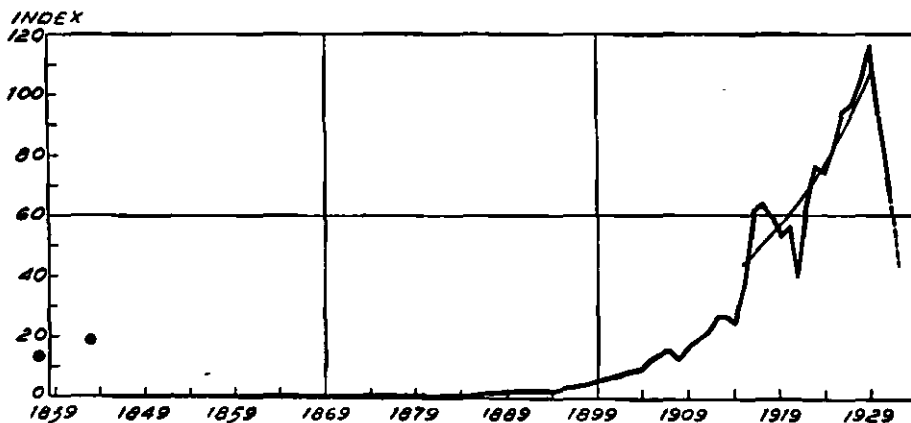


FIGURE 14. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF SECONDARY METALS IN THE UNITED STATES, 1839 TO 1932

(1926-30 = 100)

From 1915 to 1929, production increased 6.56 per cent per annum

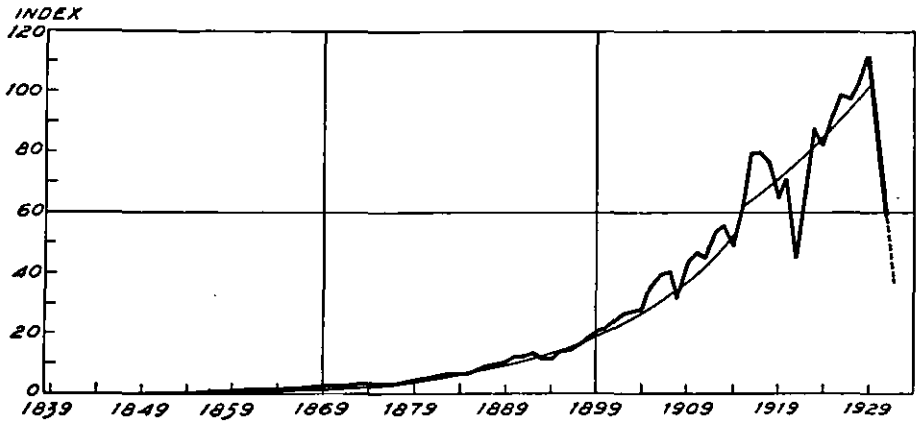


FIGURE 15. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF OTHER MINERALS AND SECONDARY METALS IN THE UNITED STATES, 1839 TO 1932 (1926-30 = 100)

From 1839 to 1914, production increased 7.02 per cent per annum; from 1915 to 1929 it increased 3.62 per cent per annum. Production of these materials fluctuates violently

MINERALS, METALS, FUEL, AND POWER

This index number includes coal, petroleum, natural gas, nearly all other minerals, scrap iron and other secondary metals, and power.

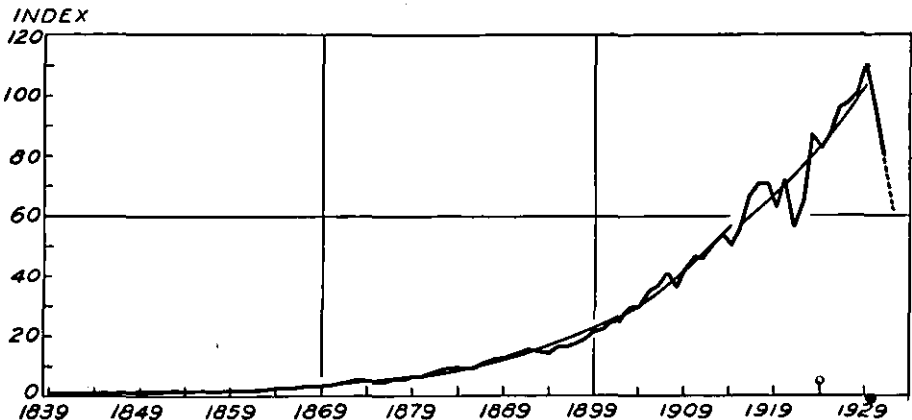


FIGURE 16. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION OF ALL MINERALS AND POWER IN THE UNITED STATES, 1839 TO 1932 (1926-30 = 100)

From 1839 to 1914 the production of all minerals and power increased at the rate of 6.43 per cent per annum; from 1915 to 1929 the average rate of increase was 4.31 per cent per annum

From 1839 to 1914, production increased 6.43 per cent per annum (table 1 and figure 16). From 1915 to 1929 it increased only 4.31 per cent per annum. Production was a little high in 1910, but was low in 1921 and in 1931. The production per capita from 1839 to 1914 increased 4.08 per cent per annum, but the increase was only 2.80 per cent from 1915 to 1929 (table 2 and figure 17).

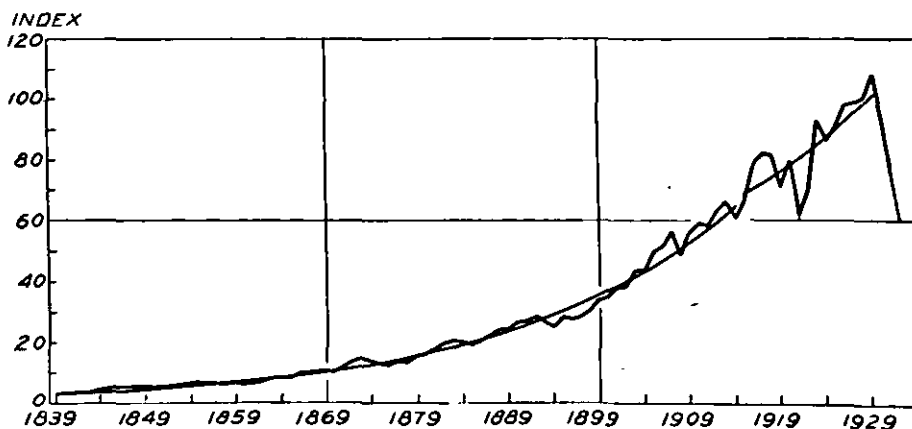


FIGURE 17. INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION PER CAPITA OF ALL MINERALS AND POWER, IN THE UNITED STATES, 1839 TO 1932 (1926-30=100)

From 1839 to 1914 the production per capita of all minerals and power increased at the rate of 4.08 per cent per annum; from 1915 to 1929 the average rate of increase was 2.80 per cent per annum

TOTAL PHYSICAL VOLUME OF PRODUCTION

When crops, forest products, fuel, and power, and other minerals and secondary metals, were all combined using variable group weights in accordance with their importance from time to time, the total basic production increased 4.03 per cent per annum from 1839 to 1914 (table 1 and figure 18). From 1915 to 1929, production increased only 2.11 per cent per annum.

Before the World War, the total basic production per capita increased 1.73 per cent per annum, but from 1915 to 1929 it increased only 0.64 per cent per annum (table 1 and figure 19).

Data before the Civil War are limited, but apparently this war also reduced the output per capita for a time. At that time there were very large undeveloped natural resources per capita.

WORLD PHYSICAL VOLUME OF PRODUCTION

The world physical volume of production, as calculated by Carl Snyder, of the Federal Reserve Bank of New York, is shown in table 3

THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES 21

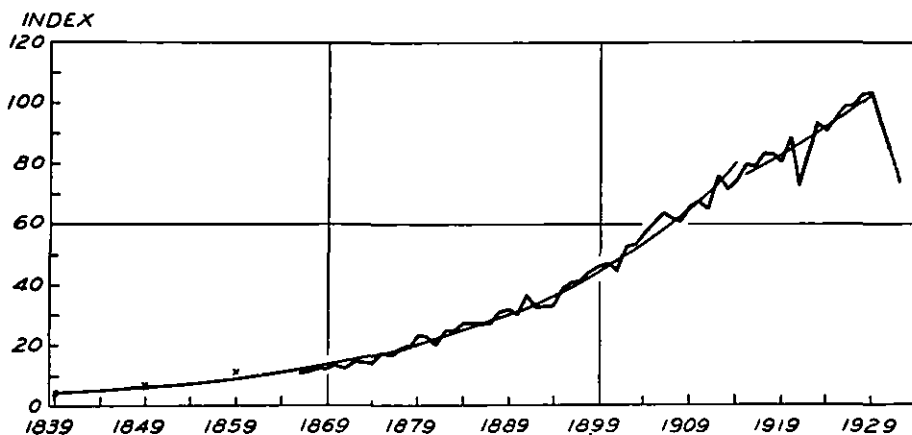


FIGURE 18. INDEX NUMBERS OF THE PHYSICAL VOLUME OF TOTAL BASIC PRODUCTION IN THE UNITED STATES, VARIABLE GROUP WEIGHTS, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914 the total volume of basic production increased at the rate of 4.03 per cent per annum; from 1915 to 1929 it increased only 2.11 per cent per annum

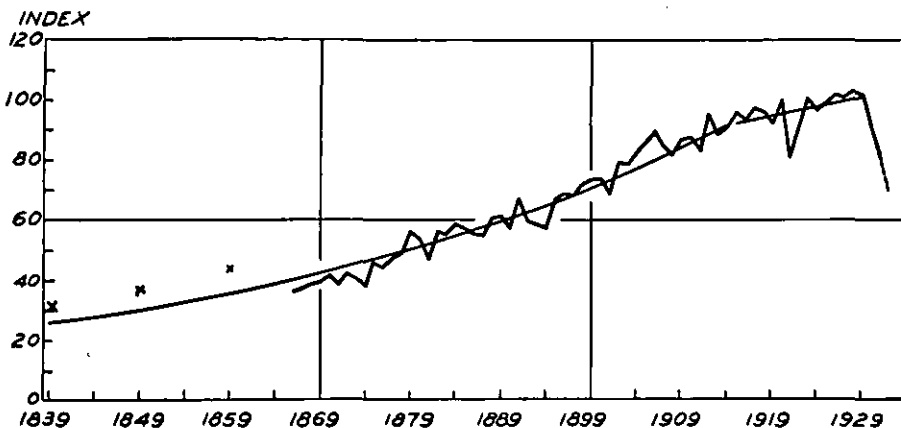


FIGURE 19. INDEX NUMBERS OF THE PHYSICAL VOLUME OF TOTAL BASIC PRODUCTION PER CAPITA IN THE UNITED STATES, VARIABLE GROUP WEIGHTS, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914 the total basic production per capita increased at the rate of 1.73 per cent per annum; from 1915 to 1929 the rate was only 0.64 per cent per annum

and figure 20. From 1865 to 1914, production increased at the rate of 3.15 per cent per annum. It was materially reduced by the World War and by the panic of 1920. It was gradually increasing until the panic of 1929.

The comparative growth of world population and of world production can be approximately measured by determining production per capita in all countries exclusive of Africa and Asia (table 3 and figure 21). This indicates that from 1865 to 1914 the production per capita

TABLE 3. INDEX NUMBERS OF WORLD PRODUCTION, 1840 TO 1931*
(1910-14 = 100)

Year	World physical volume of production†	Physical volume of production per capita‡	Year	World physical volume of production†	Physical volume of production per capita‡	Year	World physical volume of production†	Physical volume of production per capita‡	Year	World physical volume of production†	Physical volume of production per capita‡
1840	<i>11</i>	<i>24</i>	1863	<i>22</i>	<i>39</i>	1886	<i>46</i>	<i>63</i>	1909	<i>93</i>	<i>97</i>
1841	<i>11</i>	<i>23</i>	1864	<i>23</i>	<i>40</i>	1887	<i>46</i>	<i>63</i>	1910	<i>95</i>	<i>98</i>
1842	<i>12</i>	<i>22</i>	1865	<i>23</i>	<i>40</i>	1888	<i>50</i>	<i>67</i>	1911	<i>96</i>	<i>97</i>
1843	<i>12</i>	<i>26</i>	1866	<i>24</i>	<i>42</i>	1889	<i>52</i>	<i>69</i>	1912	<i>103</i>	<i>105</i>
1844	<i>12</i>	<i>26</i>	1867	<i>24</i>	<i>42</i>	1890	<i>50</i>	<i>65</i>	1913	<i>100</i>	<i>105</i>
1845	<i>13</i>	<i>28</i>	1868	<i>25</i>	<i>42</i>	1891	<i>56</i>	<i>72</i>	1914	<i>98</i>	<i>95</i>
1846	<i>13</i>	<i>28</i>	1869	<i>25</i>	<i>41</i>	1892	<i>53</i>	<i>68</i>	1915	<i>100</i>	<i>96</i>
1847	<i>14</i>	<i>29</i>	1870	<i>29</i>	<i>48</i>	1893	<i>54</i>	<i>69</i>	1916	<i>96</i>	<i>92</i>
1848	<i>14</i>	<i>29</i>	1871	<i>28</i>	<i>46</i>	1894	<i>54</i>	<i>68</i>	1917	<i>97</i>	<i>92</i>
1849	<i>15</i>	<i>31</i>	1872	<i>31</i>	<i>50</i>	1895	<i>61</i>	<i>76</i>	1918	<i>90</i>	<i>91</i>
1850	<i>15</i>	<i>30</i>	1873	<i>31</i>	<i>50</i>	1896	<i>64</i>	<i>78</i>	1919	<i>93</i>	<i>87</i>
1851	<i>15</i>	<i>29</i>	1874	<i>30</i>	<i>48</i>	1897	<i>63</i>	<i>76</i>	1920	<i>105</i>	<i>97</i>
1852	<i>16</i>	<i>31</i>	1875	<i>33</i>	<i>53</i>	1898	<i>69</i>	<i>82</i>	1921	<i>93</i>	<i>87</i>
1853	<i>16</i>	<i>31</i>	1876	<i>33</i>	<i>53</i>	1899	<i>68</i>	<i>81</i>	1922	<i>107</i>	<i>101</i>
1854	<i>17</i>	<i>33</i>	1877	<i>35</i>	<i>55</i>	1900	<i>72</i>	<i>85</i>	1923	<i>114</i>	<i>108</i>
1855	<i>17</i>	<i>33</i>	1878	<i>36</i>	<i>56</i>	1901	<i>72</i>	<i>84</i>	1924	<i>115</i>	<i>110</i>
1856	<i>18</i>	<i>34</i>	1879	<i>37</i>	<i>57</i>	1902	<i>77</i>	<i>89</i>	1925	<i>126</i>	<i>119</i>
1857	<i>19</i>	<i>35</i>	1880	<i>41</i>	<i>63</i>	1903	<i>78</i>	<i>90</i>	1926	<i>123</i>	<i>112</i>
1858	<i>19</i>	<i>35</i>	1881	<i>38</i>	<i>58</i>	1904	<i>77</i>	<i>88</i>	1927	<i>130</i>	<i>115</i>
1859	<i>20</i>	<i>36</i>	1882	<i>44</i>	<i>66</i>	1905	<i>84</i>	<i>94</i>	1928	<i>137</i>	<i>116</i>
1860	<i>20</i>	<i>36</i>	1883	<i>43</i>	<i>62</i>	1906	<i>90</i>	<i>98</i>	1929	<i>140</i>	<i>113</i>
1861	<i>21</i>	<i>38</i>	1884	<i>46</i>	<i>66</i>	1907	<i>87</i>	<i>94</i>	1930	<i>134</i>	<i>106</i>
1862	<i>22</i>	<i>39</i>	1885	<i>46</i>	<i>64</i>	1908	<i>87</i>	<i>92</i>	1931	<i>124</i>	<i>95</i>

* Figures in italics are estimates.

† The index numbers of world physical volume of production from 1865 to 1931 were prepared by Carl Snyder and furnished through the courtesy of the Federal Reserve Bank of New York.

The index was originally calculated on a 1923-25 base. To convert to the 1910-14 base, multiply by 0.002979.

The equation of total production from 1865 to 1914 was $y = 23.830 (1.0315)^x$; from 1880 to 1890, $y = 20.031 (1.0265)^x$; and from 1897 to 1913, $y = 24.663 (1.0307)^x$.

An index number of world physical volume of production of cotton, coal, and pig iron was calculated for 1840, 1850, and 1860. These index numbers were 12, 14, and 24. For the same years the Snyder curve projected backward gave index numbers of 11, 15, and 20. An index number for the same years was calculated including steam and sailing vessels, miles of railroad, cotton, coal, and pig iron. The index numbers of ten-year periods from 1840 to 1890 were 11, 15, 23, 28, 39, and 53, and the Snyder index for the same years was 11, 15, 20, 29, 41, and 50. These index numbers agreed very closely with the projected Snyder index.

These index numbers from 1840 to 1865 are the Snyder curve, $y = 23.830 (1.0315)^x$, projected. These are, of course, only approximations and do not show variations from year to year.

‡ Production per capita is based on the population for Europe, America, and Australia, as reported by Willecox, W. F. (International migrations. Publications of the National Bureau of Economic Research, Inc., Report 18, vol. 2, appendix 1, pages 641-644. 1931).

The equation of production per capita from 1865 to 1914 was $y = 25.983 (1.0101)^x$; from 1880 to 1896, $y = 30.833 (1.0122)^x$; and from 1897 to 1913, $y = 20.462 (1.0173)^x$.

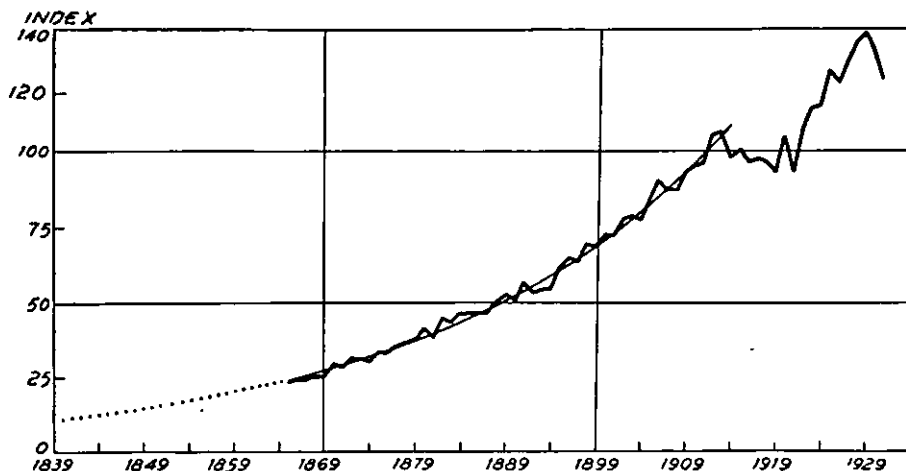


FIGURE 20. SNYDER'S INDEX NUMBERS OF WORLD PHYSICAL VOLUME OF PRODUCTION, 1840 TO 1931
(1910-14 = 100)

From 1865 to 1914 the world physical volume of production normally increased 3.15 per cent per annum. It was materially reduced by the World War and by the panics of 1920 and 1929

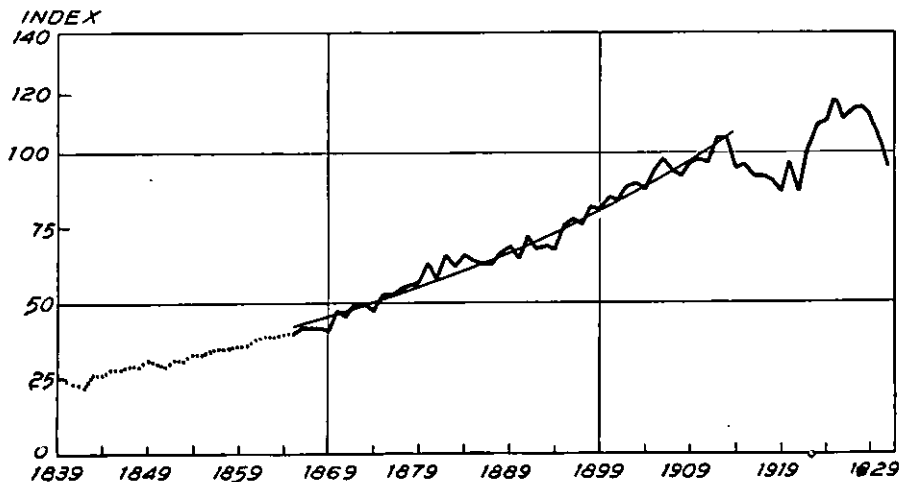


FIGURE 21. WORLD PHYSICAL VOLUME OF PRODUCTION PER CAPITA, 1840 TO 1931
(1910-14 = 100)

From 1865 to 1914 the world physical volume of production per capita increased 1.91 per cent per annum. For many years before the World War, production per capita proceeded with great regularity. During the war period it was strikingly decreased. This is contrary to the popular opinion

increased 1.91 per cent per annum. This rate of increase is about the same as for the United States (1.97). Production per capita is of course far higher in the United States than in other countries. Apparently the world has been able to increase its lower production at about the same rate that the United States has increased its higher production.

The production per capita was very low during the war period, was low in 1921, and was again very low for 1930-31. In no year since the outbreak of the war has production per capita been as high as would be expected from the pre-war trends.

CAUSES OF LOW PRODUCTION PER CAPITA

The low production per capita during the World War is easily explained by the fact that such a large proportion of the able-bodied men were in the army. All of the production of copper, lead, iron, food, and the like which these men used, is, of course, included, regardless of the purpose for which these commodities were employed.

Another factor preventing a normal increase in production is the breakdown in world trade. Each country of the world is attempting to become self-sufficient. It is seeking actively for foreign markets in which to sell, and is attempting to stop buying from other countries. This is done by tariffs, prohibition of imports, limitation of imports, and milling restrictions. France has set the amount of wheat that it will accept from other countries. Many foreign countries allow only a certain percentage of foreign wheat to be milled. These restrictions tend to keep production in areas where production is inefficient.

An even more important factor in preventing the normal development of production is the decline in prices. A price decline throws producers' prices out of line with consumers' prices. Since laborers and farmers are producers, the values of their products are thrown out of line with the prices of the products which they must buy. This makes it impossible to buy the normal amount of produce, and results in unemployment. Since 1920 the United States has had two of the worst periods of unemployment ever known, and England has had continuous unemployment. These results of the war are checking the rate of improvement in the physical well-being of the world.

• FALSE MEASURES OF INCREASES IN EFFICIENCY

Division of labor leads to erroneous conclusions as to increases in efficiency, because only a part of the process is visible. A farmer with a tractor, tractor equipment, a combine, and a truck, is able to grow and harvest much more wheat than was formerly grown per farmer. The increase in efficiency is far less than is assumed, because there

has been a change in the residence of those whose time is required to produce the wheat. Many invisible persons are involved in the production of machinery and fuel that the farmer uses.

Statements are commonly made of the spectacular increase in the output of shoes per worker in the shoe factory. These are misleading. The labor on a pair of shoes includes a part of the time of the persons growing cattle and handling and marketing and skinning them, labor involved in the handling, shipping, and tanning of hides, and labor involved in the handling and shipping of leather. Some workers must make the machinery used in these industries, others must make the buildings and the building materials involved in this endless process. Still others must finance the business. Back of these, there is the mining of coal, the building of railroads and of electrical lines and electrical equipment, and the production of cotton and tanning materials. To complete the process, the shoes must be shipped and sold at retail. This involves the time of more bank clerks, railroad employees, traveling salesmen, retail salesmen, delivery boys, store builders, and paper-box manufacturers, and further fuel and light. It is not probable that any sudden decrease in the time required has occurred in the complete process. We have no indication of any sudden increase in total production of all commodities per capita. There are sudden decreases, such as occurred in 1921 and 1931 when millions of workers were unemployed.

Much attention has been called to the surplus capacities of manufacturing plants. A country needs a large surplus. The demand for automobiles varies. We need plants enough so that these demands can be met. Automobiles cannot be made two years ahead of time, and stored.

In a progressive world there will always be plants that are improperly located or that are becoming obsolete. These may be able to operate when demand is at the peak. A constant succession of them must go out of business and be replaced by new and up-to-date plants.

The railroads need box cars enough to meet the peaks of demand.

There must be a large surplus in the milk supply for our cities. The demand varies on different days of the week. It is affected by weather. The production per cow also is affected by weather. There must be enough cows to supply the demands of the highest day, even though this may be an unfavorable day for cows. In addition, there must be a factor of safety. A so-called surplus of milk is absolutely necessary.

Progress requires that old factories be replaced by new ones. It requires also that some farms, and occasionally some farm communities, replace others. There is a constant adjustment within the farm community. A farm that may not be a good business unit may be com-

bined with another farm. The intensive development of the best land often requires that the poorest land be thrown out of use.

The decline in prices is not due to any abnormal production or to any abnormal change in producing capacity. There need be no fear that Americans will starve because they are able to produce so much. The trouble arises not from the ability to produce more than one can consume, but from a collapse in the exchange system. One cannot obtain the things that he needs by producing the things that he is in the habit of producing. He would gladly work directly to produce the things that he needs, if this were possible.

Wholesale prices of all commodities have declined from an index of 141 in August, 1929, to 93 in June, 1932. There is no possible explanation of this decline on the basis of over-production. There is a monetary explanation.

Instead of finding ways of further curtailing production, the world needs to find ways of increasing production by finding ways whereby the populations that desire to work may be employed producing things to sell in exchange for things that they desire to buy. Innumerable schemes have been proposed to reduce the output per worker in order to provide prosperity. All such schemes are based on the fantastic idea that in order to consume more we must produce less. So long as there are millions of homes without electric lights, toilets, and running water, and millions of people failing to consume desirable foods because of the costs, we need have no fear of starving to death because of plenty. Men may starve in the midst of plenty, but not because of plenty. The error is made in assuming that a low price must be due to the supply of or the demand for the commodity, and the failure to recognize the other side of the price equation—that is, the supply of and the demand for money.

PRODUCTION OF INDIVIDUAL PRODUCTS

For 94 years the production of wheat has followed very closely the production of all crops (figure 22). There were three periods of high production about twenty years apart, but there is no indication that wheat production is making any permanent change relative to the average for all crops.⁴

Wheat production per capita has followed very closely the production of all crops per capita (figure 23). There has been a gradual decline which began before the World War.

The acres of wheat harvested per capita show a tendency for a 20-year cycle, with a large acreage in 1880, 1900, and 1920. The very

⁴The average for all crops includes wheat with a weight of nearly 11 per cent (table 10, page 52). If wheat were compared with crops other than wheat, no difference in conclusions would be reached.

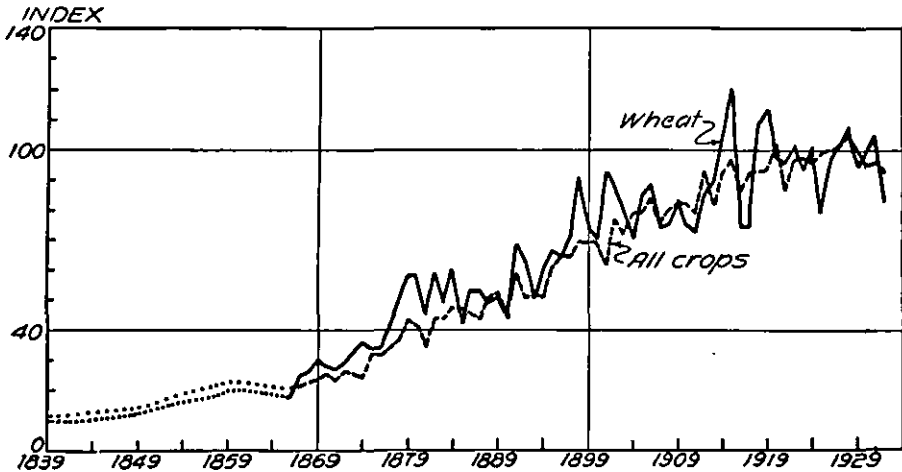


FIGURE 22. UNITED STATES WHEAT PRODUCTION COMPARED WITH THE PRODUCTION OF ALL CROPS, 1839 TO 1932
(1926-30 = 100)

Wheat production has followed all crops very closely, except for three periods of high production and for variations due to weather conditions

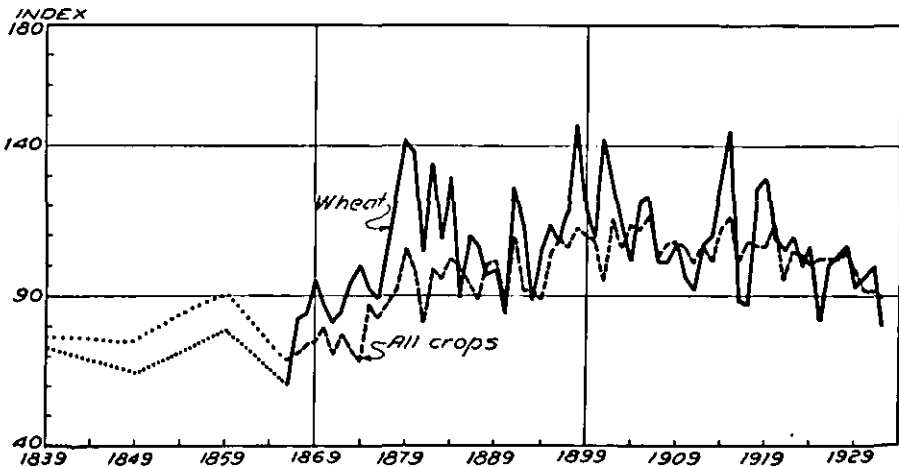


FIGURE 23. UNITED STATES PRODUCTION OF WHEAT PER CAPITA COMPARED WITH THE PRODUCTION OF ALL CROPS PER CAPITA, 1839 TO 1932
(1926-30 = 100)

The production of wheat per capita follows very closely the production of all crops per capita. Since 1900 there has been a gradual decline in the production per capita

low acreage in 1917 and the irregularities in some other years were due to a large amount of winterkilling. The acreage of wheat in New York is steadily declining in very regular 20-year cycles. (Figures 24 and 25.)

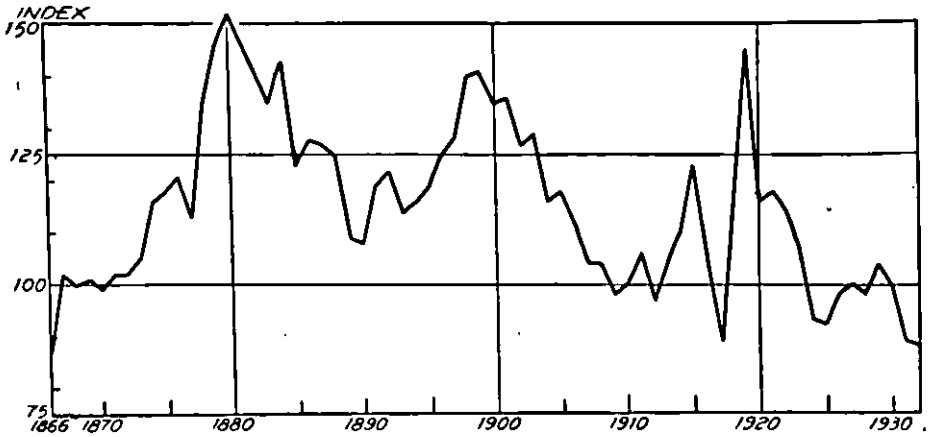


FIGURE 24. INDEX NUMBERS OF THE ACREAGE OF WHEAT HARVESTED PER CAPITA IN THE UNITED STATES, 1866 TO 1932

(1926-30 = 100)

There were three periods of high acreage per capita, about twenty years apart. The low acreage in 1917 was due to abandonment of winter wheat because of winter injury

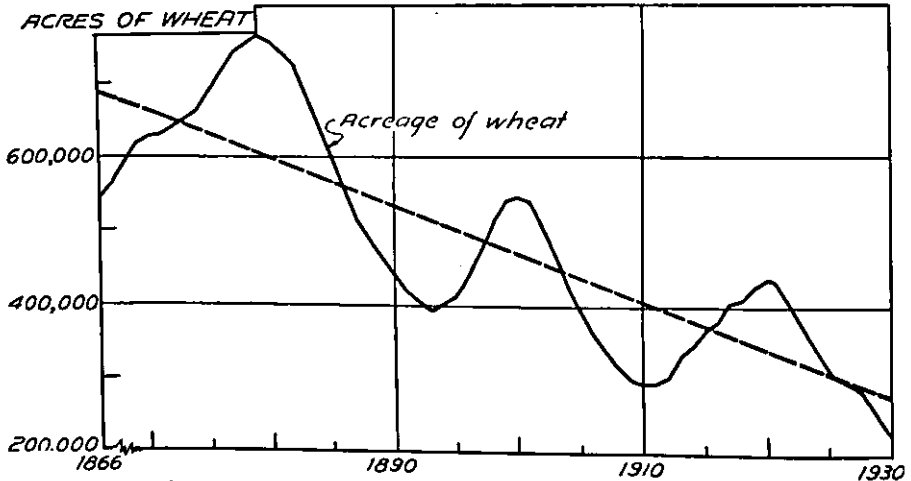


FIGURE 25. CYCLES IN WHEAT ACREAGES IN NEW YORK, 1866 TO 1930*

Cycles of high acreages occurred at intervals of about twenty years

Before 1900, the world production of all crops was increasing faster than was the world production of wheat. Since 1900, the production of wheat and that of all crops have followed about the same course (figures 26 and 27).

*Mereness, E. H., Effect of changes in the price on the acreage and production of wheat in New York (Farm economics, no. 75, p. 1738, May 1932.)

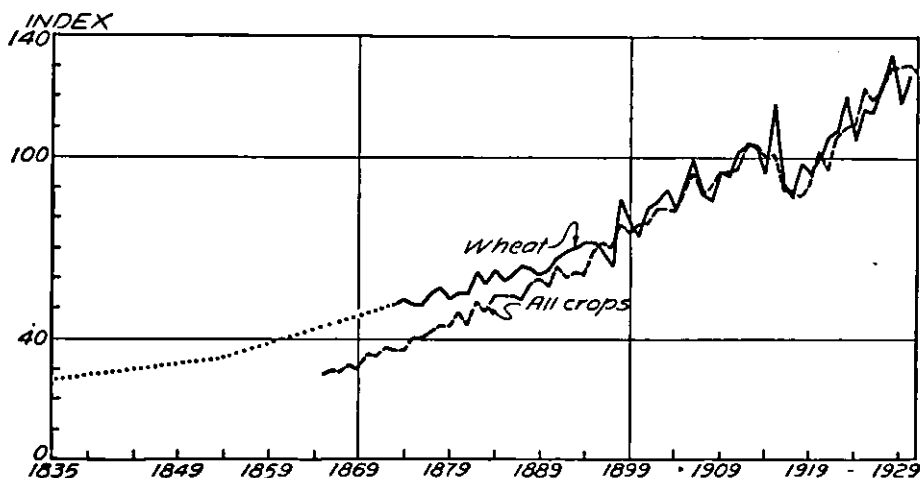


FIGURE 26. WORLD PRODUCTION OF WHEAT COMPARED WITH THE PRODUCTION OF ALL CROPS, 1835 TO 1931
(1910-14 = 100)

Since 1900, wheat production and the production of all crops have followed the same general course

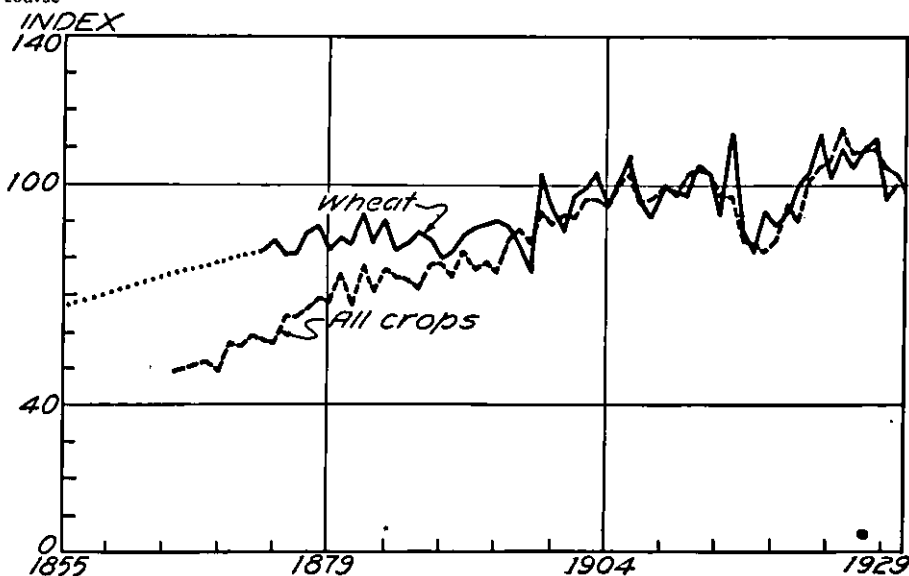


FIGURE 27. WORLD PRODUCTION OF WHEAT PER CAPITA COMPARED WITH THE PRODUCTION OF ALL CROPS PER CAPITA, 1855 TO 1931
(1910-14 = 100)

There is a very striking agreement between the production of wheat and the production of all crops. The world production of wheat in recent years has not been excessive as compared with the production of other products or as compared with the long-time trend

Corn production in the United States has followed very closely the production of all crops, except for low corn production in recent years (figures 28 and 29). The production of corn for the world, as compared with the production of all crops, is about the same as the United States production.

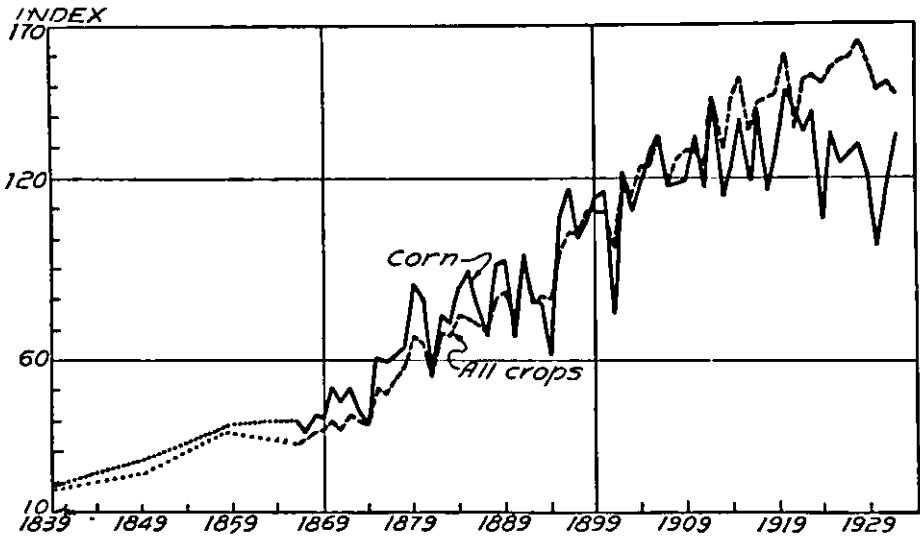


FIGURE 28. UNITED STATES PRODUCTION OF CORN COMPARED WITH THE PRODUCTION OF ALL CROPS, 1839 TO 1932
(1880-1914 = 100)

Up to about 1910, the production of corn increased at about the same rate as did the production of all crops. Since then, corn production has declined in spite of the increase in the production of all crops

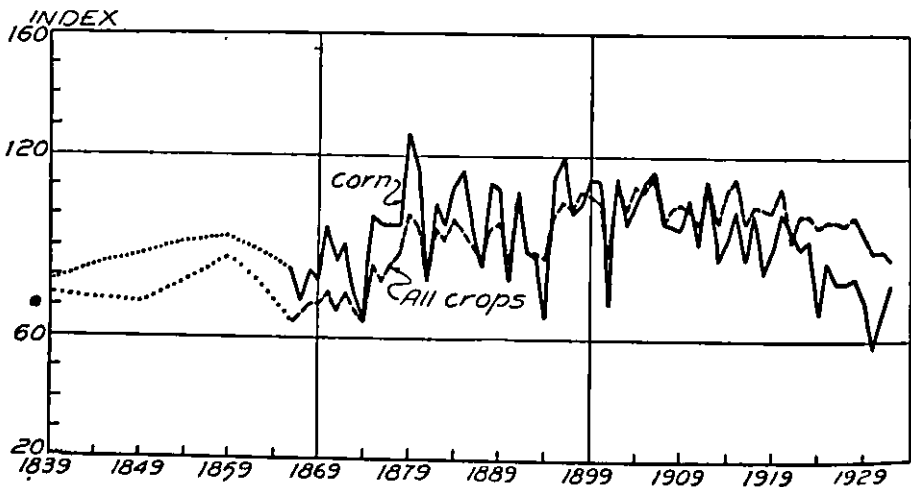


FIGURE 29. UNITED STATES PRODUCTION OF CORN PER CAPITA COMPARED WITH THE PRODUCTION OF ALL CROPS PER CAPITA, 1839 TO 1932
(1880-1914 = 100)

From 1869 to 1910, the production of corn per capita followed very closely the production of all crops. In recent years there has been a striking decline in the production of corn per capita

Cotton production in the United States has followed the average for all crops fairly closely, but year-to-year fluctuations are violent, particularly since the advent of the boll weevil (figures 30 and 31). The

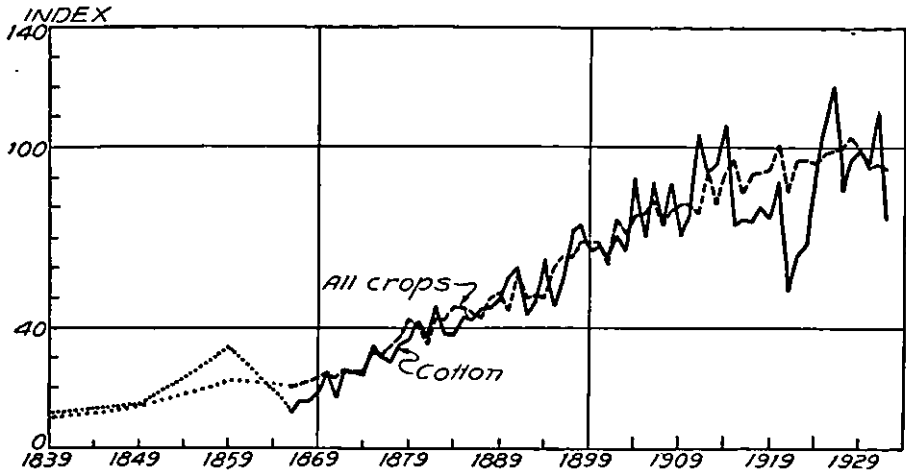


FIGURE 30. UNITED STATES PRODUCTION OF COTTON COMPARED WITH THE PRODUCTION OF ALL CROPS, 1839 TO 1932
(1926-30 = 100)

The production of cotton has followed very closely the production of all crops. From 1915 to 1923 there was a succession of comparatively short crops

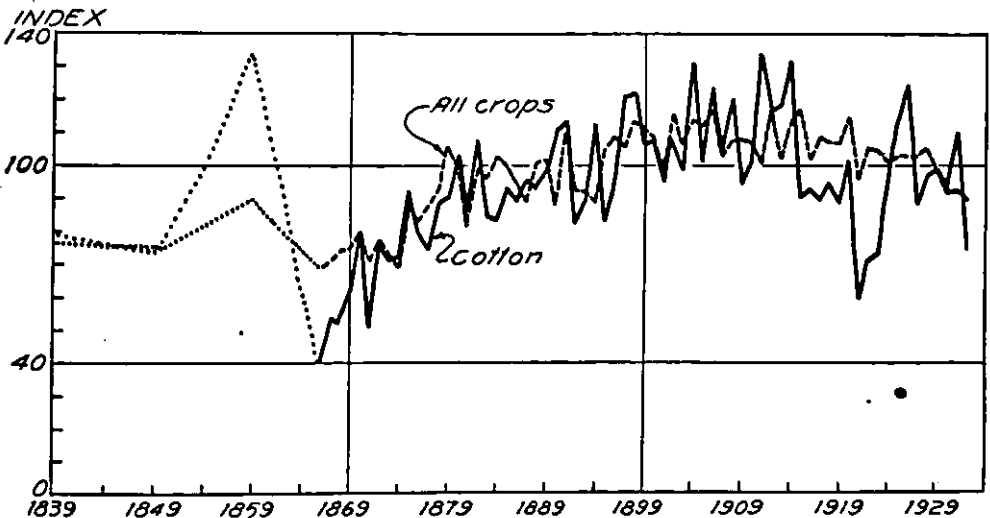


FIGURE 31. UNITED STATES PRODUCTION OF COTTON PER CAPITA COMPARED WITH THE PRODUCTION OF ALL CROPS PER CAPITA, 1839 TO 1932
(1926-30 = 100)

The production of cotton per capita follows very closely the production of all crops per capita

world relationships of cotton production to the production of all crops are similar to the relationships in the United States (figures 32 and 33).

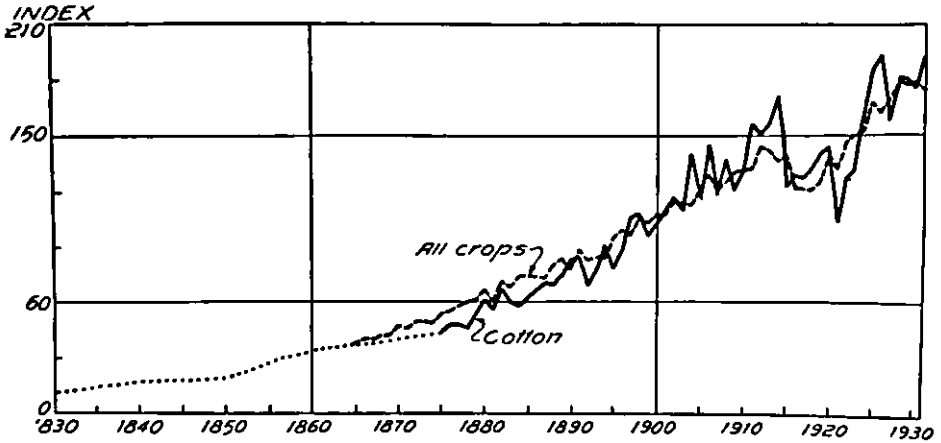


FIGURE 32. WORLD PRODUCTION OF COTTON COMPARED WITH THE WORLD PRODUCTION OF ALL CROPS, 1830 TO 1931
(1880-1914 = 100)

The world production of cotton has followed with remarkable similarity the world production of all crops

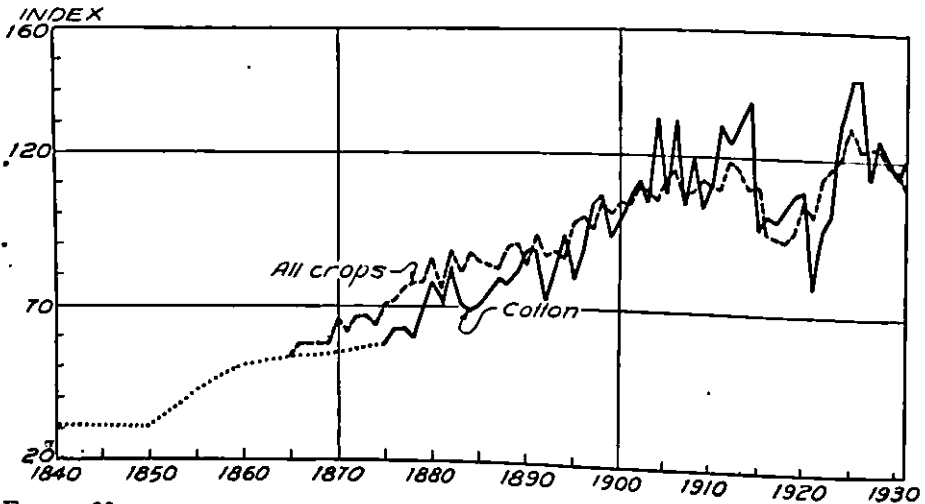


FIGURE 33. WORLD PRODUCTION OF COTTON PER CAPITA COMPARED WITH THE WORLD PRODUCTION OF ALL CROPS PER CAPITA, 1840 TO 1931
(1880-1914 = 100)

The world production of cotton per capita follows the general course of the world production of all crops per capita

There seems to be no indication of any decided "unbalanced production" as between the major crops. There are temporary maladjustments due to weather and to business panics.

PRODUCTION AND PRICES

The production of wheat is not closely associated with prices (figure 34). Production per capita has been relatively stable for 35 years, but prices rose from 1895 to 1920 and have declined since that time. The purchasing power of wheat as compared with that of all commodities shows a much closer relationship to wheat production (figure 35). Both have been fairly stable, and generally a production above normal has been accompanied by a purchasing power below normal.

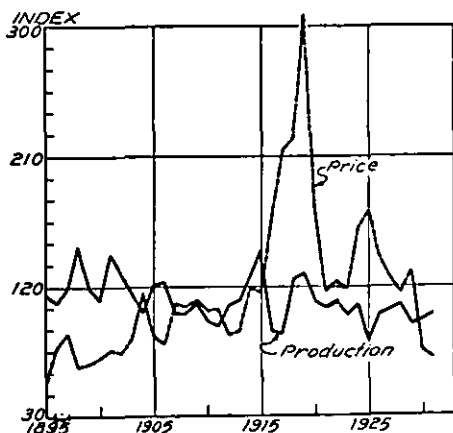


FIGURE 34. INDEX NUMBERS OF THE UNITED STATES PRODUCTION OF WHEAT PER CAPITA AND THE DECEMBER CHICAGO PRICE OF WHEAT, 1895 TO 1931

The production of wheat does not explain the violent price changes

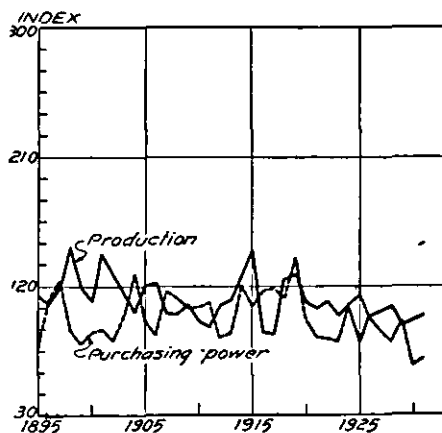


FIGURE 35. INDEX NUMBERS OF THE UNITED STATES PRODUCTION OF WHEAT PER CAPITA AND THE PURCHASING POWER OF THE DECEMBER CHICAGO PRICE OF WHEAT, 1895 TO 1931

While the production of wheat shows little relationship to prices, it shows considerable relationship to the purchasing power of prices

The production per capita of all basic commodities in the United States (table 2, page 8) was compared with the average for the previous five years, in order to determine whether production was high or low for the time. Variations in production prepared in this way were compared with prices of all commodities (figure 36).

The most striking occasions of relationship are the exact opposite of what is popularly supposed. In 1901, 1908, and 1921, and since

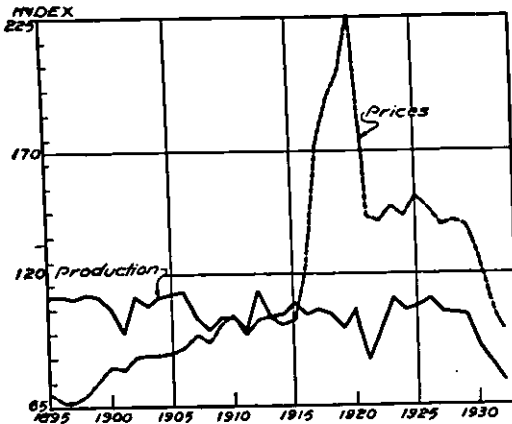


FIGURE 36. PRODUCTION OF BASIC COMMODITIES PER CAPITA IN PER CENT OF THE PREVIOUS FIVE YEARS, AND WHOLESALE PRICES OF ALL COMMODITIES, 1895 TO 1932

Prices cannot be explained by variations in production. They can be explained by variations in the supply of and demand for gold

1929, price declines resulted in low production, so that low prices were accompanied by low production.

Prices rose steadily from 1896 to 1914, and spectacularly from 1914 to 1920. They then declined precipitously, were moderately stable for a few years, and then again declined precipitously. An examination of the curve of production gives no indication whatever of any such price probabilities.

It is evident that the explanation of the general commodity price level cannot be found in the production of commodities. An explanation can be found in the world supply of and demand for gold.

THE PHYSICAL VOLUME OF BUILDING IN THE UNITED STATES

The physical volume of building in the United States, including residential and non-residential building, is shown in table 4 (page 36) and in figure 37. The index numbers are based on the values of building permits, which were adjusted for seasonal variation. Adjustment was made also to eliminate changes in construction costs. The index numbers were expressed in terms of a six-months moving average, entered on the sixth month so as to reflect the relative amounts of construction in progress.

From 1899 to 1914 the volume of building construction increased at the average rate of 3.40 per cent per annum.⁵ During the war, construction was very low and there was a serious shortage.

From 1922 to 1925 there was a rapid expansion in the volume of construction. Construction declined a little from 1927 to 1929, and collapsed in 1930-32. In 1932 it was below the level prevailing in 1900.

The volume of building permits per capita doubled from 1900 to 1905-06 (table 5 and figure 38). Construction was disturbed by the panic of 1907, but was high in 1908-10. There was a steady decline in construction per capita from 1911 to 1916. It then collapsed to an unprecedentedly low level.

⁵ $y = 1.8676x + 55.00$.

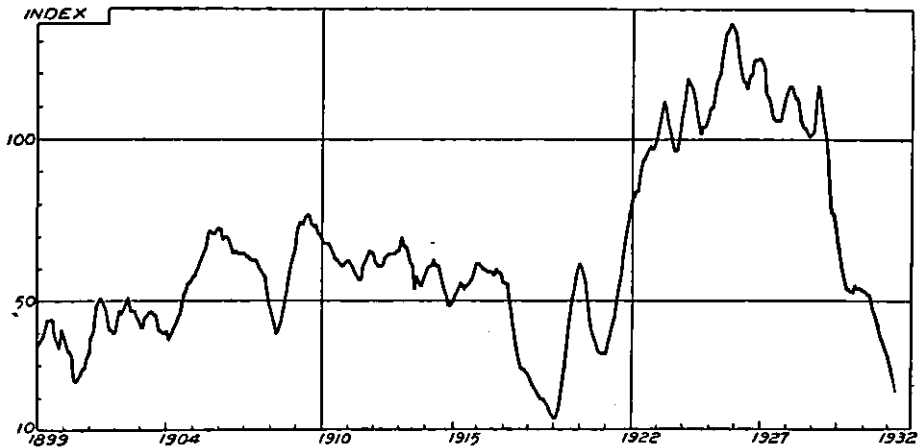


FIGURE 37. MONTHLY VOLUME OF BUILDING CONSTRUCTION IN THE UNITED STATES, 1899 TO 1932
(1926-30 = 100)

Before the World War, building construction was increasing at the average rate of 3.40 per cent per annum. A peak of construction occurred about 1925

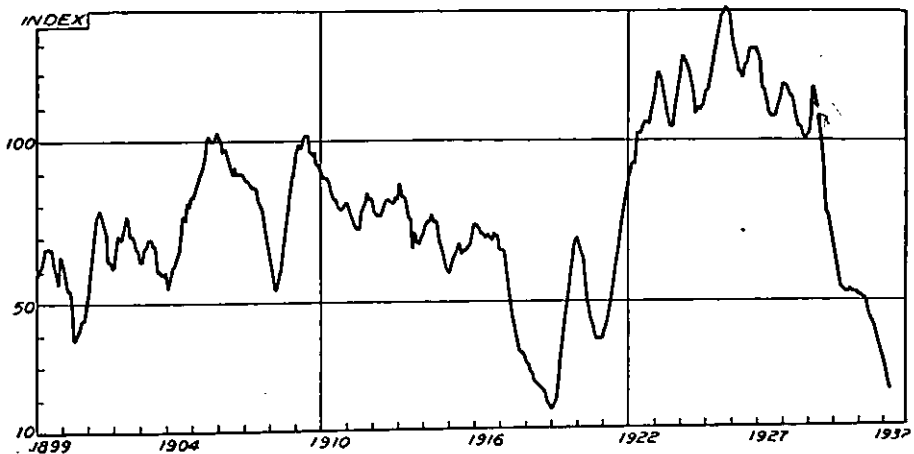


FIGURE 38. MONTHLY VOLUME OF BUILDING CONSTRUCTION PER CAPITA IN THE UNITED STATES, 1899 TO 1932
(1926-30 = 100)

The war caused a great deficit in building. This deficit and cheap food resulted in a construction boom

TABLE 4. INDEX NUMBERS OF THE VOLUME OF BUILDING PERMITS IN SELECTED CITIES IN THE UNITED STATES, 1899 TO 1932*

(1926-30 = 100)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1899....	36	37	38	40	42	42	42	42	39	37	35	41	39
1900....	39	37	34	34	32	25	25	26	27	29	29	32	31
1901....	34	39	41	48	50	51	50	48	47	41	41	40	44
1902....	41	45	47	46	47	49	51	47	47	47	45	44	46
1903....	42	42	45	46	47	47	46	46	41	41	40	40	44
1904....	41	38	40	42	43	45	46	50	53	53	56	56	47
1905....	58	58	60	62	63	65	67	71	72	71	71	72	66
1906....	73	72	69	70	70	68	66	65	66	65	65	65	68
1907....	65	64	64	63	63	63	62	60	59	58	55	51	61
1908....	48	45	43	40	42	44	48	51	55	59	63	65	50
1909....	68	73	75	74	76	77	77	74	73	74	71	71	74
1910....	69	68	68	68	67	65	63	63	62	61	61	62	65
1911....	63	62	61	59	58	57	57	61	63	64	66	65	61
1912....	65	62	61	61	61	63	64	65	65	65	66	66	64
1913....	66	70	67	67	65	62	61	54	58	56	55	57	62
1914....	58	60	61	61	63	61	61	59	56	54	52	49	58
1915....	49	50	52	53	55	56	54	55	55	56	57	60	54
1916....	62	62	61	60	60	59	60	59	58	60	59	59	60
1917....	56	56	56	51	47	42	37	34	31	29	29	28	41
1918....	27	26	24	23	22	21	20	20	19	18	16	15	21
1919....	14	15	17	21	26	32	38	44	48	52	57	60	35
1920....	62	60	58	56	50	44	40	38	36	34	34	34	46
1921....	34	37	39	42	45	49	54	57	62	68	72	75	53
1922....	80	82	85	85	80	94	94	96	97	98	97	99	91
1923....	102	105	110	112	110	100	103	100	97	97	101	106	104
1924....	109	114	119	117	116	114	110	106	102	104	104	105	110
1925....	107	110	110	115	118	120	125	129	133	134	136	135	123
1926....	133	128	124	121	118	118	116	120	120	125	125	125	123
1927....	125	124	122	114	113	110	107	106	106	106	108	110	113
1928....	113	116	117	115	113	113	111	106	104	104	103	101	110
1929....	102	103	107	117	114	109	105	99	91	78	77	74	98
1930....	70	66	61	57	54	54	53	53	55	54	54	54	57
1931....	53	53	52	52	50	47	45	44	41	38	36	34	45
1932....	32	29	25	22	19	17	16	14	14	.....	.....	.....	.....

*A reliable research agency, which prefers not to be quoted, studied the records of various cities and obtained the daily average values of building permits. These were adjusted for changes in construction costs, corrected for seasonal variation, and expressed in terms of a six-months moving average entered on the sixth month so as to reflect the relative amounts of construction in progress. For the five years 1926 to 1930, the index numbers on the 1899 base averaged 254.035. They were converted to the 1926-30 base by multiplying by 0.393647.

THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES 37

TABLE 5. INDEX NUMBERS OF BUILDING PERMITS PER CAPITA IN SELECTED CITIES, 1899 to 1932 (1926-30 = 100)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1899....	58	60	61	64	67	67	67	67	62	59	56	65	63
1900....	62	59	54	54	50	39	39	41	42	45	45	50	48
1901....	53	61	64	74	77	79	77	74	72	63	63	61	68
1902....	62	68	71	70	71	74	77	71	71	70	67	66	70
1903....	63	63	67	68	70	70	68	68	60	60	59	59	65
1904....	60	55	58	61	62	65	67	72	77	78	81	80	68
1905....	83	83	86	88	90	92	95	101	102	100	100	101	93
1906....	103	101	97	98	98	95	92	90	92	90	90	90	95
1907....	90	88	88	87	86	86	85	82	80	79	75	69	83
1908....	65	61	58	54	57	59	64	68	74	79	84	87	68
1909....	90	97	99	98	101	102	102	97	96	97	93	93	97
1910....	90	89	89	89	87	84	82	82	80	79	79	80	84
1911....	81	80	78	76	74	73	73	78	80	81	84	82	78
1912....	82	78	77	77	77	79	81	82	82	81	81	83	80
1913....	82	87	83	83	81	77	76	67	72	69	68	70	76
1914....	71	74	75	75	77	75	75	72	68	66	63	60	71
1915....	59	61	63	64	66	68	65	66	66	67	68	72	65
1916....	74	74	73	71	71	70	71	70	69	71	70	70	71
1917....	66	66	66	60	55	49	43	40	36	34	34	33	49
1918....	31	30	28	27	25	24	23	23	22	21	18	17	24
1919....	16	17	19	24	30	37	43	50	55	59	65	68	40
1920....	70	68	65	63	56	49	45	43	40	38	38	38	51
1921....	38	41	43	47	50	54	60	63	68	75	79	82	58
1922....	88	90	93	93	97	102	102	104	105	106	105	107	99
1923....	110	113	119	121	118	114	111	107	104	104	108	113	112
1924....	116	121	126	124	123	121	116	112	108	110	109	110	116
1925....	112	115	115	120	123	125	130	134	138	139	141	140	128
1926....	138	132	128	125	121	121	119	123	123	128	128	128	126
1927....	128	126	124	116	115	112	108	107	107	107	109	111	114
1928....	114	117	117	115	113	113	111	106	104	104	102	100	110
1929....	101	102	106	116	113	107	103	97	89	77	76	72	97
1930....	68	65	60	56	53	53	52	52	53	52	52	52	56
1931....	51	51	50	50	48	45	43	42	40	37	35	33	44
1932....	31	28	24	21	18	16	14	13	13	....	....	....	....

With the close of the war and the return of soldiers and high wages, construction began to increase in 1919-20 but was curtailed by the panic of 1920. In 1925-26, construction per capita was double that of 1920.

POPULATION

From 1839 to 1914, the population of continental United States increased at the compound rate of 2.28 per cent per annum (figure 39). The rate declined to 1.46 per cent during the 15-year period 1915 to 1929.

From 1840 to 1914, the population of Europe, America, and Australia increased at the compound rate of 1.11 per cent per annum (figure 40).

DATA USED IN CALCULATING INDEX NUMBERS OF PRODUCTION

CROP PRODUCTION

The production of various crops in the United States for census years is shown in table 6 (page 40). Since 1866, the yields reported by the Yearbooks of Agriculture and other publications of the United States Department of Agriculture were used in preparing the index numbers, because some irregularities would have resulted from shifting from census data to Department of Agriculture data.

The production of corn, wheat, oats, hay, tobacco, and cotton, have all increased about 7 to 10 times in the past ninety years. Hemp and flax fiber have practically disappeared. Rye and buckwheat have declined in relative importance. Barley and vegetables have increased in importance, and a few new crops, such as peanuts, citrus fruits, sorghum for grains, and soybeans, have come in. But the major-crop production is very stable.

LUMBER, FUEL, AND POWER

The production of lumber, fuel, and power, is shown in table 7 (page 43). Lumber production increased from 1,604,000,000 feet board measure in 1839 to 46,000,000,000 feet in 1907. Since then it has been decreasing. Practically no pulpwood was produced prior to 1869. During the five-year period 1926 to 1930, lumber represented 92.53 per cent of the forest products, and pulpwood represented 7.47 per cent.

Anthracite coal increased from 1,010,000 tons in 1839 to 99,600,000 tons in 1917. Since then it has declined. Bituminous-coal production has increased one thousand times.

Practically no petroleum was produced before 1859.

The production of natural gas and of natural-gas gasoline is increasing very rapidly.

The production of electric current increased from 175,000,000 kilowatt hours in 1887 to 74,686,000,000 kilowatt hours in 1927.

The increase in the horsepower of water wheels other than electric has been fairly uniform.

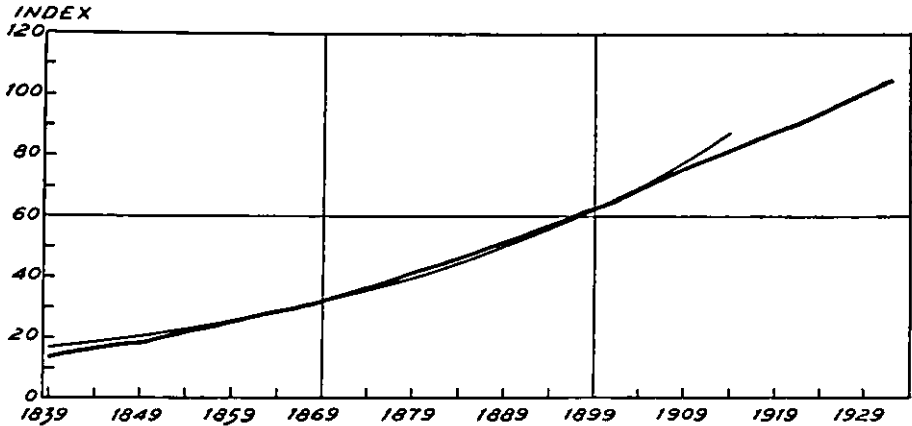


FIGURE 39. INDEX NUMBERS OF THE POPULATION OF CONTINENTAL UNITED STATES, 1839 TO 1932
(1926-30 = 100)

From 1839 to 1914 the population of continental United States increased 2.28 per cent per annum; from 1915 to 1929 the rate was 1.46 per cent per annum

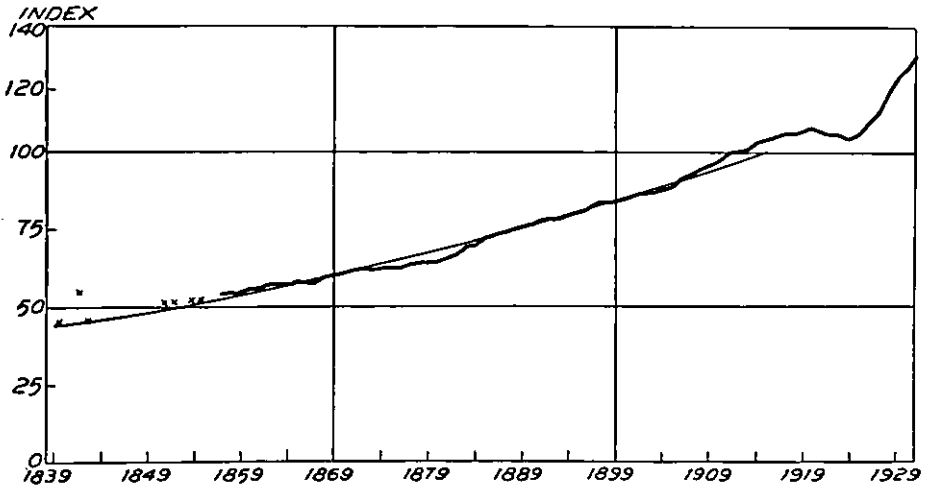


FIGURE 40. INDEX NUMBERS OF WORLD POPULATION EXCLUDING ASIA AND AFRICA, 1840 TO 1931
(1910-14 = 100)

From 1840 to 1914 the world population excluding Asia and Africa increased at the rate of 1.11 per cent per annum; from 1916 to 1927 the rate was 0.35 per cent per annum

TABLE 6. PRODUCTION OF CROPS IN THE UNITED STATES, 1839 TO 1929*

Product	Unit of measure	1839	1849	1859	1869	1879	1889	1899	1909	1919	1929
Corn	000,000 bu.	377.5	592.1	838.8	760.9	1,755	2,122	2,666	2,532	2,346	2,614
All wheat	000,000 bu.	84.82	100.5	173.1	287.7	459.5	468.4	658.5	683.4	945.4	809.2
Oats	000,000 bu.	123.1	146.6	172.6	282.1	407.9	809.3	943.4	1,007	1,055	1,228
Barley	000,000 bu.	4.162	5.167	15.83	29.76	44.00	78.33	119.6	173.3	122.0	302.9
Rye	000,000 bu.	18.65	14.19	21.10	16.92	19.83	28.42	25.57	29.52	75.99	41.91
Buckwheat	000,000 bu.	7.292	8.957	17.572	9.822	11.82	12.11	11.23	14.85	12.09	11.47
Flaxseed	000,000 bu.		0.562	0.567	1.730	7.171	10.25	19.98	19.51	6.65	17.05
Rough rice	000,000 bu.	2.908	7.745	6.733	2.649	3.962	4.626	9.003	21.84	35.33	40.46
Grain sorghums	000,000 bu.						0	5.169	17.60	72.09	49.11
All hay	000,000 short tons.	10.25	13.84	19.08	27.32	35.15	66.83	71.11	87.22	90.36	113.7
Clover and alfalfa seed	000 bu.		469	956	640	1,923	2,753	1,349	1,239	2,044	4,184
Soybeans	000,000 bu.								0.017	1.085	11.43
Peanuts gathered	000,000 pounds			0		3.075	78.94	263.2	427.1	603.9	804.9
Beans, dry edible	000,000 bu.		1.028	2.046	2.067	3.075	3.164	5.064	11.251	14.08	20.71
Potatoes	000,000 bu.	68.47	65.80	111.1	143.3	169.5	217.5	273.3	389.2	290.4	359.0
Sweet potatoes	000,000 bu.	39.82	38.27	42.10	21.71	33.38	43.95	42.52	59.23	78.00	84.52
Sugar beets	000 short tons.				0.448	1.344	2.47	81.7	612	726	1,018
Sugar cane	000 short tons.	60.4	148.5	138.6	52.2	107.3	150.6	161.3	332	122	200
Apples	000,000 bu.	7.3	7.7	20.0	47.3	50.9	143.1	175.4	145.4	130.6	126.5
Peaches	000,000 bu.						36.37	15.43	35.47	50.69	42.83
Grapes	000 short tons.	125	221	1,627	3,088		572.1	650.5	1,133	1,258	1,942
Oranges	000,000 boxes					0	4.392	0.168	19.49	27.83	53.73
Lemons	000,000 boxes						0	0.877	2.770	6.585	5.900
Grapefruit	000,000 boxes						0	0.031	1.189	3.656	10.718
Cabbage	000 tons						395	767.6	644.2	613.8	1,102
Lettuce	000,000 crates							0.69	1.448	4.316	20.18
Onions	000,000 bu.							10.87	10.79	14.65	25.47
Strawberries	000,000 quarts	2.6	5.3	16.2	20.7	21.8		157.9	158.8	176.9	330.9
Tomatoes	000,000 pounds							212	1,859	1,930	2,872
Cantaloupes	000,000 crates							3.65	8.22	7.09	10.19
Peas, green	000 tons						72.6	59.34	91.10	124.7	300
Tobacco	000,000 pounds	219.2	199.8	434.2	262.7	472.7	489.3	868.1	1,056	1,373	1,525
Cotton	000,000 pounds	790.5	987.6	2,397	1,325	2,607	3,564	4,717	5,090	5,459	7,088

* (See pages 41-42 for footnote to table.)

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(Footnote to table 6)

* The figures in italics are estimates, explained below.

The data in this table are those reported by the United States Census, with the following exceptions: 1929, corn, all wheat, oats, barley, rye, buckwheat, flaxseed, rough rice, all hay, clover and alfalfa seed, soybeans, dry edible beans, potatoes, sweet potatoes, sugar beets, sugar cane, lemons, grapefruit, cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, green peas, tobacco, and cotton; 1919, sugar beets, sugar cane, cabbage, lettuce, onions, tomatoes, cantaloupes, and green peas; 1909, 1899, 1889, 1879, and 1869, sugar beets.

All rice estimates were converted to bushels of rough rice.

From 1839 to 1879, the United States Census and the United States Department of Agriculture reports are for all hay.

From 1879 to 1909, the quantities of hay estimated by the United States Department of Agriculture are for tame hay only. In this table, the census reports for all hay are used, and it is assumed that the yields of all hay between census periods varied in proportion to the yields of tame hay. After 1909, the total production of all hay as reported by the United States Department of Agriculture was used. In this way a consistent series for hay production is possible.

Clover and alfalfa seed include red and alsike clover, sweet clover, and alfalfa.

Soybeans include only those gathered.

Peanuts include those gathered. Few peanuts were produced before 1860. They spread from a small area in Virginia after the Civil War. (Twelfth Census of the United States, 1900, Vol. VI, Agriculture, Part II, p. 514. 1902.)

From 1849 to 1879, cowpeas, peas, and beans are all reported as pulse. The beans and the peas were separated from the total on the basis of the region in which they were grown, and the percentage of beans was assumed to be the same as in 1879.

The Census of 1839 reported all potatoes combined. The percentage of sweet potatoes was assumed to be the same as in 1849.

In 1899, the total of orchard fruits was 2,418 in the agricultural index. At this time the value of orchard fruits was \$83,751,840. The total value of orchard fruits, deflated by the December index of prices of farm foods, was used for earlier years.

The estimated grape production given for 1889 is the sum of table grapes, wine grapes, and dried raisins (Eleventh Census of the United States, 1890, p. 602). In 1889 there were 572,139 tons of grapes and 24,306,905 gallons of wine produced. For earlier years, the quantity of wine furnished the only available data. The ratio in 1889 was assumed to hold for the earlier years.

An index number based on the production of cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas, was made. Previous to 1899, the deflated values of all vegetables were used, similarly to the method for orchard products.

Cotton production is reported in pounds or bales. The Bureau of Crop Estimates reports are in bales but the weight of a bale varies. The weights of a bale of cotton are given below. The census weights were used to obtain the number of pounds.

NUMBER OF POUNDS OF COTTON PER BALE

	Watkins "net weight"	United States Census	United States Department of Agriculture	
			Net weight	Gross weight
	(Pounds)	(Pounds)	(Pounds)	(Pounds)
1790.....	.....	225	.....	.....
1800.....	225	225	.....	.....
1810.....	250	250	.....	.....
1820.....	264	264	.....	.....
1833.....	350	339	.....	.....
1839.....	384	385	.....	.....
1849.....	436	400	.....	.....
1859.....	447	445	.....	.....
1869.....	444	440	.....	.....
1879.....	447	453	.....	.....
1889.....	477	477	.....	.....
1899.....	.....	495	.....	.....
1900-1930.....	.....	.....	478	500

(Footnote concluded on page 42)

(Footnote to table 6, concluded)

(Watkins, J. L. Production and price of cotton for one hundred years. U. S. Agr. Dept., Statistics Div. Misc. ser. no. 9, p. 4-13. 1895.)

(Twelfth Census of the United States, 1900, Vol. VI, Agriculture, Part II, p. 405. 1902.)

(Yearbook of Agriculture, 1930, U. S. Agr. Dept., p. 679. 1930.)

The estimates of production of wheat, corn, oats, barley, rye, buckwheat, rice, cotton, tobacco, hay, and potatoes, were made for the years 1842 to 1845 inclusive, and 1847, 1848, and 1850, by the Commissioner of Patents, and reported in the following Annual Reports by the Commissioner of Patents: for 1842, 27th Congress, 3d Session, House of Representatives Document 109, p. 4-5, February 1, 1843; for 1843, 28th Congress, 1st Session, House Document 177, p. 12-13, February 10, 1844; for 1844, 28th Congress, 2d Session, House Document 78, p. 11-12, January 30, 1845; for 1845, 29th Congress, 1st Session, House Document 140, p. 90-91, February 24, 1846; for 1847, 30th Congress, 1st Session, House Document 54, p. 558-560, March 3, 1848; for 1848, 30th Congress, 2d Session, House Document 59, p. 719-720, February 28, 1849; for 1850, 32d Congress, 1st Session, House Document 118, p. 408-511, 1852.

From 1830 to 1870 inclusive, the values of market-garden products and of orchard products are given in millions of dollars.

The Yearbook of Agriculture for 1931 reports the production of corn on page 615; wheat, pages 582-583; oats, page 628; barley, page 639; rye, page 606; buckwheat, page 666; flaxseed, page 650; rice, page 660; grain sorghums, page 668; all hay, page 809; clover and alfalfa seed — summation of clover (red and alsike), sweet clover, and alfalfa, page 820; soybeans, page 799; peanuts, page 815; beans, dry edible, page 796; potatoes, page 768; sweet potatoes, page 781; sugar beets, pages 689, 691; sugar cane, page 601; apples, page 713; peaches, page 735; grapes, page 731; oranges, page 725; lemons and grapefruit, page 744; cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas, page 700; tobacco, page 700; cotton, pages 672-673.

The Yearbook of Agriculture for 1930 was used for years not reported in later yearbooks: for the production of soybeans, page 796; peanuts, page 813; cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas, page 787.

The Yearbook of Agriculture for 1928 was used for years not reported in later yearbooks: for the production of soybeans, page 831; cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas, page 825.

The Yearbook of Agriculture for 1927 reports the production of corn on pages 774-775; oats, pages 788-789; barley, page 799; rye, pages 764-765; buckwheat, pages 825-826; rice, page 819; grain sorghums, page 828; potatoes, page 881; sweet potatoes, page 896; peaches, page 853; grapes, page 847; oranges, page 841; cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas, page 903; tobacco, pages 969-970.

The Yearbook of Agriculture for 1926 reports the production of cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas on page 956.

The Yearbook of Agriculture for 1925 reports the production of cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas on page 942.

The Yearbook of Agriculture for 1923 was used for years not reported in later yearbooks: for the production of soybeans, page 742; sugar beets, page 845; sugar cane, pages 157, 845; oranges, page 730.

The Yearbook of Agriculture for 1922 reports the production of cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas on page 761.

The Yearbook of Agriculture for 1920 reports the production of cabbage, lettuce, onions, strawberries, tomatoes, cantaloupes, and green peas on page 670.

The Thirteenth Census of the United States, 1910, Vol. V, Agriculture, 1914, reports grain sorghums on page 532.

The Twelfth Census of the United States, 1900, Vol. VI, Part II, Agriculture, 1902, reports the production of sugar cane on page 473 and that of cotton on page 405.

The Report of the Statistics of Agriculture in the United States at the Eleventh Census, 1890, Vol. V, reports the production of corn on page 11; wheat, page 14; oats, page 17; barley, page 20; rye, page 23; buckwheat, page 26; flaxseed, page 88; seeds, page 421; peanuts, page 82; dry beans, page 91; cane sugar, page 89; peaches, page 499; grapes and wine, page 602; value of market garden, page 91.

The Statistics of Agriculture, Tenth Census of the United States, 1880, Vol. III, reports the production of seeds on pages 8, 18, 23, and that of potatoes on pages 18, 23.

The Statistics of the Wealth and Industry of the United States, Ninth Census, 1870, Vol. III, 1872, reports the production of seeds on page 84.

The Seventh Census of the United States, 1850, reports the production of tobacco on page LXXXIV and the value of market gardens on pages LXXXIII, LXXXV.

TABLE 7. PRODUCTION OF LUMBER, FUEL, AND POWER IN THE UNITED STATES, 1839 TO 1931*

Year	Forest products		Coal		Other fuel			Power	
	Lumber (000,000 feet board measure)	Pulpwood (000 cords)	Anthracite (000,000 short tons)	Bituminous (000,000 short tons)	Petroleum (000,000 barrels)	Natural gas (000,000,000 cubic feet)	Natural-gas gasoline (000,000 gallons)	Electric current generated by central power stations (000,000 kilowatt hours)	Water wheels other than electric (000 horse- power)
1926-1930..	35,554	5,549.2	76.60	517.8	895.42	1,644.6	1,845.0	81,654	.....
1839.....	1,604	.....	1.01	0.55	.....	.....	.....	.....	.....
1840.....	.....	.....	0.97	1.10	.....	.....	.....	.....	.....
1841.....	.....	.....	1.18	1.11	.....	.....	.....	.....	.....
1842.....	.....	.....	1.37	1.24	.....	.....	.....	.....	.....
1843.....	.....	.....	1.56	1.50	.....	.....	.....	.....	.....
1844.....	.....	.....	2.01	1.67	.....	.....	.....	.....	.....
1845.....	.....	.....	2.48	1.83	.....	.....	.....	.....	.....
1846.....	.....	.....	2.89	1.98	.....	.....	.....	.....	.....
1847.....	.....	.....	3.55	1.74	.....	.....	.....	.....	.....
1848.....	.....	.....	3.81	1.97	.....	.....	.....	.....	.....
1849.....	5,392	.....	4.00	2.45	.....	.....	.....	.....	662

* The data were obtained from the following sources:

Forest products: Federal Reserve Bulletin, vol. 17, no. 9, p. 542, September, 1931. American forests and forest products, Forest Service, U. S. Dept. Agr., Statistical bul. no. 21, p. 21, 62-65, 112, 266, October, 1927.

Lumber cut of the United States: Forest Service, U. S. Dept. Agr., Professional papers, Bul. 1119, p. 25, 30, April 25, 1923. The amount and value of lumber per thousand board feet, and the consumed amount and value of native wood, from 1925 to 1930 were furnished by R. E. Marsh, of the Division of Forest Economics, Forest Service, U. S. Dept. Agr., and LeVerne Beales, of the Bureau of the Census, U. S. Dept. Commerce. Information was furnished also by the following men: C. Stowell Smith, National Lumber Manufacturers Association, Transportation Building, Washington, D. C.; E. A. Goldenweiser, Director of Research and Statistics, Federal Reserve Board; Ripley Bowman, Secretary of the Timber Conservation Board, U. S. Dept. Commerce; Charles W. Boyce, Secretary of the American Paper and Pulp Association, New York City.

Coal: Statistical abstract of the United States, 1930, U. S. Dept. Commerce, p. 770, 1930. Mineral resources of the United States: 1930, Part I, Summary pages A35; 1918, Part II, p. 710.

Other fuels: Mineral resources of the United States: 1930, Part I, Summary pages A70, A47, and A49; 1920, Part II, p. 433, 322, 303; 1927, Part II, p. 205, 1930; 1928, Part II, p. 166, 1929; 1925, Part II, p. 199, 1928; 1918, Part II, p. 993, 1921; 1917, Part II, p. 1055, 1921; 1913, Part I, p. cxlvi, 1914.

Electricity: Central electric light and power stations, 1927. Census of electrical industries, Bureau of the Census, U. S. Dept. Commerce, p. 24, 1930. Wittig, G. F., Central station revenue passes two-billion-dollar mark (Electrical world, vol. 95, no. 1, p. 24, January 4, 1930). Wittig, G. F., Light and power gains (Electrical world, vol. 97, no. 1, p. 26-28, January 3, 1931). G. F. Wittig furnished estimates of the energy output for 1882, 1887, 1892, and 1897. Information was furnished also by W. M. Carpenter, Economist, National Electric Light Association, New York City.

Water wheels: Daugherty, C. R., Horton, A. H., and Davenport, R. W. Power capacity and production in the United States. U. S. Geol. Survey, Water-supply paper no. 579, p. 48, 50, 1928.

Natural gas: Prior to 1906, the quantity of natural gas was estimated from the total value.

TABLE 7 (concluded)

Year	Forest products		Coal		Other fuel			Power	
	Lumber (000,000 feet board measure)	Pulpwood (000 cords)	Anthracite (000,000 short tons)	Bituminous (000,000 short tons)	Petroleum (000,000 barrels)	Natural gas (000,000,000 cubic feet)	Natural-gas gasoline (000,000 gallons)	Electric current generated by central power stations (000,000 kilowatt hours)	Water wheels other than electric (000 horse- power)
1850			4.14	2.88					
1851			5.48	3.25					
1852			6.15	3.66					
1853			6.40	4.17					
1854			7.39	4.58					
1855			8.14	4.78					
1856			8.53	5.01					
1857			8.19	5.15					
1858			8.43	5.55					
1859	8,029		9.62	6.01	0.002				930
1860			8.12	6.49	0.500				
1861			9.80	6.69	2.11				
1862			9.70	7.79	3.06				
1863			11.8	9.53	2.61				
1864			12.5	11.07	2.12				
1865			11.9	11.90	2.50				
1866			15.7	13.35	3.60				
1867			16.0	14.72	3.35				
1868			17.0	15.86	3.65				
1869	12,756	2.2	17.1	15.82	4.22				1,205
1870			15.7	17.37	5.26				
1871			19.3	27.54	5.21				
1872			24.2	27.22	6.29				
1873			26.2	31.45	9.89				
1874			24.8	27.79	10.93				
1875			22.5	29.86	8.79				
1876			22.8	30.49	9.13				
1877			25.7	34.84	13.4				
1878			21.7	36.25	15.4				
1879	18,091	41	30.2	37.90	19.0				1,353
1880			28.6	42.83	26.3				
1881			31.9	53.96	27.7				
1882			35.1	68.43	30.4				
1883			38.5	77.25	23.5				
1884			37.2	83.00	24.2				

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1885			38.3	72.82	21.9				
1886			39.0	74.64	28.1				
1887			42.1	88.56	28.3				
1888			46.6	102.0	27.0			175	
1889	27,039	583	45.5	95.7	35.2				1,522
1890			46.5	111.3	45.8				
1891			50.7	117.9	54.3				
1892			52.5	126.9	50.5			300	
1893			54.0	128.4	48.4				
1894			51.9	118.8	49.3				
1895			58.0	135.1	52.9				
1896			54.3	137.6	61.0				
1897			52.6	147.6	60.5			800	
1898			53.4	166.6	55.4				
1899	35,084	1,617	60.4	193.3	57.1				1,575
1900			57.4	212.3	63.6				
1901			67.5	225.8	69.4				
1902			41.4	260.2	88.8			2,507	
1903			74.6	282.7	100.5				
1904	43,000	2,477	73.2	278.7	117.1				
1905	43,500	2,546	77.7	315.1	134.7				
1906	46,000	2,922	71.3	343	126.5	380			
1907	46,000	3,037	85.6	395	166.1	407		5,862	
1908	42,000	2,652	83.3	333	178.5	402			
1909	44,510	3,208	81.1	380	183.2	481			2,102
1910	44,500	3,147	84.5	417	209.6	509			
1911	43,000	3,390	90.5	406	220.4	513			
1912	45,000		84.4	450	222.9	562	7.4		
1913	44,000		91.5	478	248.4	582	12.1	11,569	
1914	40,500	3,641	90.8	423	265.8	592	24.1		
1915	38,000		89.0	443	281.1	629	42.7		
1916	40,000	4,445	87.6	503	300.8	629	65		
1917	38,000	4,708	99.6	552	330.3	753	103		
1918	32,000	4,506	98.8	579	335.3	795	218	25,438	
1919	34,500	4,445	88.1	466	378.4	721	283		
1920	35,000	5,014	89.6	569	442.9	708	352		2,220
1921	29,000	3,740	90.5	416	472.2	662	385	39,519	
1922	35,250	4,499	54.7	422	557.5	763	450	36,971	
1923	41,000	4,637	93.3	565	732.4	1,007	508	43,560	
1924	39,500	4,720	87.9	484	713.9	1,142	816	51,133	2,528
1925	41,000	4,849	61.8	520	763.7	1,189	934	54,413	
1926	39,750	5,309	84.4	573	770.9	1,313	1,127	61,159	
1927	37,250	5,232	80.1	518	901.1	1,445	1,363	69,158	
1928	36,750	5,295	75.3	501	901.5	1,568	1,641	74,686	
1929	36,900	5,825	73.8	535	1,007.3	1,918	1,814	82,927	
1930	36,100	6,085	69.4	468	898.0	1,943	2,234	91,421	
1931	18,600	5,440	59.5	378	851.1	1,637	2,210	90,076	
							1,832	86,663	

PRIMARY METALS

The primary metals include seven products: pig iron including ferro-alloys, copper, lead, zinc, aluminum, gold, and silver (table 8).

Pig-iron production increased from 290,000 tons in 1840 to 42,600,000 tons in 1929.

Copper production increased from 1,120,000 pounds in 1848 to 1,826,000,000 pounds eighty years later, in 1928.

In the same period, lead production increased about 25 times.

Gold production increased very rapidly in the late forties and early fifties. This was not used in the index.

From 1839 to 1860, silver production was stable at a very low level. Since that time, production has increased very rapidly.

NON-METALS

The non-metals include cement, sand and gravel, gypsum, lime, sulfur, and salt (table 8).

Since 1880, cement production has increased about 80 times.

Data for production of sand and gravel are available since 1902. The amount used has expanded at an unusually rapid rate.

The production of salt has increased at a rather uniform rate. In every two decades, production has somewhat more than doubled.

SECONDARY METALS

A large amount of iron, copper, brass, lead, and other products is collected and reworked. These serve the same purpose as does new production, and are therefore included in the physical volume of production. The proportion which these represent of the total metals increases rapidly. In preparing the index the scrap iron has been assumed to increase in proportion to other secondary metals (table 9, page 51).

TABLE 8. PRODUCTION OF MINERALS OTHER THAN FUEL IN THE UNITED STATES, 1839 TO 1931*

Year	Primary metals							Non-metals					
	Pig iron, including ferro-alloys (000,000 long tons)	Copper (000,000 pounds)	Lead (000 short tons)	Zinc (000 short tons)	Aluminum (000,000 pounds)	Gold (000 fine ounces)	Silver (000,000 fine ounces)	Cement (000,000 barrels)	Sand and gravel (000,000 short tons)	Gypsum (000 short tons)	Lime (000 short tons)	Sulfur (000 long tons)	Salt (000 short tons)
1926-1930.	37.72	1,729.4	644.2	576.4	193.8	2,251.8	58.72	171.26	200.46	4,914.2	4,217.4	2,181.0	7,922.8
1839.....	.....	.....	17.5	.....	.....	23	0.02	.....	.....	.....	.....	.....	173
1840.....	0.29	.....	17.0	.....	.....	24	0.02	.....	.....	.....	.....	.....	183
1841.....	.....	.....	20.5	.....	.....	30	0.02	.....	.....	.....	.....	.....	181
1842.....	0.22	.....	24.0	.....	.....	43	0.02	.....	.....	.....	.....	.....	167
1843.....	.....	.....	25.0	.....	.....	58	0.02	.....	.....	.....	.....	.....	196
1844.....	.....	.....	26.0	.....	.....	55	0.02	.....	.....	.....	.....	.....	214
1845.....	.....	0.22	30.0	.....	.....	49	0.04	.....	.....	.....	.....	.....	228
1846.....	0.77	0.34	28.0	.....	.....	55	0.04	.....	.....	.....	.....	.....	250
1847.....	0.80	0.67	28.0	.....	.....	43	0.04	.....	.....	.....	.....	.....	232
1848.....	0.80	1.12	25.0	.....	.....	484	0.04	.....	.....	.....	.....	.....	263
1849.....	0.65	1.57	23.5	.....	.....	1,935	0.04	.....	.....	.....	.....	.....	273
1850.....	0.56	1.46	22.0	.....	.....	2,419	0.04	.....	.....	.....	.....	.....	279
1851.....	.....	2.02	18.5	.....	.....	2,661	0.04	.....	.....	.....	.....	.....	260
1852.....	0.50	2.46	15.7	.....	.....	2,903	0.04	.....	.....	.....	.....	.....	283
1853.....	.....	4.48	16.8	.....	.....	3,144	0.04	.....	.....	.....	.....	.....	308
1854.....	0.66	5.04	16.5	.....	.....	2,903	0.04	.....	.....	.....	.....	.....	319
1855.....	0.70	6.72	15.8	.....	.....	2,661	0.04	.....	.....	.....	.....	.....	261
1856.....	0.79	8.96	16.0	.....	.....	2,661	0.04	.....	.....	.....	.....	.....	291
1857.....	0.71	10.8	15.8	.....	.....	2,661	0.04	.....	.....	.....	.....	.....	232
1858.....	0.63	12.3	15.3	.....	.....	2,419	0.04	.....	.....	.....	.....	.....	364
1859.....	0.76	14.1	16.4	.....	.....	2,419	0.08	.....	.....	.....	.....	.....	366
1860.....	0.82	16.1	15.6	.....	.....	2,225	0.12	.....	.....	.....	.....	.....	296
1861.....	0.65	16.8	14.1	.....	.....	2,080	1.55	.....	.....	.....	.....	.....	386
1862.....	0.70	21.2	14.2	.....	.....	1,896	3.48	.....	.....	.....	.....	.....	481
1863.....	0.85	19.0	14.8	.....	.....	1,935	6.57	.....	.....	.....	.....	.....	474
1864.....	1.01	17.9	15.3	.....	.....	2,230	8.51	.....	.....	.....	.....	.....	467
1865.....	0.83	19.0	14.7	.....	.....	2,575	8.70	.....	.....	.....	.....	.....	388
1866.....	1.21	19.9	16.1	.....	.....	2,588	7.73	.....	.....	.....	.....	.....	409
1867.....	1.31	22.4	15.2	.....	.....	2,502	10.44	.....	.....	.....	.....	.....	433
1868.....	1.43	26.0	16.4	.....	.....	2,322	9.28	.....	.....	.....	.....	.....	480
1869.....	1.71	28.0	17.5	.....	.....	2,395	9.28	.....	.....	.....	.....	.....	493
1870.....	1.67	28.2	17.8	.....	.....	2,419	12.4	.....	.....	.....	.....	.....	607
1871.....	1.71	29.1	20.0	.....	.....	2,104	17.8	.....	.....	.....	.....	.....	610
1872.....	1.55	28.0	25.7	.....	.....	1,742	22.2	.....	.....	.....	.....	.....	490
1873.....	2.56	34.7	41.9	7.34	.....	1,742	27.7	.....	.....	.....	.....	.....	488
1874.....	2.40	39.2	51.2	.....	.....	1,620	28.9	.....	.....	.....	.....	.....	469

* (See page 50 for footnote to table.)

TABLE 8 (concluded)

Year	Primary metals							Non-metals					
	Pig iron, including ferro-alloys (000,000 long tons)	Copper (000,000 pounds)	Lead (000 short tons)	Zinc (000 short tons)	Aluminum (000,000 pounds)	Gold (000 fine ounces)	Silver (000,000 fine ounces)	Cement (000,000 barrels)	Sand and gravel (000,000 short tons)	Gypsum (000 short tons)	Lime (000 short tons)	Sulfur (000 long tons)	Salt (000 short tons)
1875	2.02	40.3	58.6	15.8	.....	1,619	24.5	.....	.....	.....	.....	.....	581
1876	1.87	42.6	62.9	.....	.....	1,932	30.0	.....	.....	.....	.....	.....	567
1877	2.07	47.0	80.4	.....	.....	2,269	30.8	.....	.....	.....	.....	.....	671
1878	2.30	48.2	89.1	.....	.....	2,477	35.0	.....	.....	.....	.....	.....	744
1879	2.74	51.5	90.8	.....	.....	1,882	31.6	.....	.....	.....	.....	.....	835
1880	3.84	60.5	95.7	23.2	.....	1,742	30.3	2.1	90.0	.....	0.54	.....	835
1881	4.14	71.7	114	.....	.....	1,679	33.3	2.5	85.0	.....	0.54	.....	868
1882	4.62	90.6	130	33.8	.....	1,572	36.2	3.3	100.0	.....	0.54	.....	898
1883	4.60	116	140	36.9	.....	1,451	35.7	4.2	90.0	.....	0.89	.....	867
1884	4.10	145	136	38.5	.....	1,490	37.8	4.0	90.0	.....	0.45	.....	912
1885	4.04	166	126	40.7	0.0003	1,538	39.9	4.2	90.4	.....	0.64	.....	985
1886	5.68	158	127	42.6	0.003	1,687	39.5	4.5	95.3	.....	2.23	1,079	.....
1887	6.42	181	142	50.3	0.018	1,603	41.3	6.9	95.0	.....	2.68	1,096	.....
1888	6.49	226	147	55.9	0.019	1,604	45.8	6.5	110	.....	.....	1,128	.....
1889	7.60	227	152	58.9	0.047	1,595	50.0	6.8	268	.....	0.40	1,121	.....
1890	9.20	260	140	63.7	0.061	1,589	54.5	7.8	183	.....	.....	1,243	.....
1891	8.28	284	175	80.9	0.15	1,605	58.3	8.2	208	.....	1.07	1,399	.....
1892	9.16	345	168	87.3	0.26	1,597	63.5	8.8	256	.....	2.40	1,638	.....
1893	7.12	329	159	78.8	0.33	1,739	60.0	8.0	254	.....	1.07	1,666	.....
1894	6.66	354	154	75.3	0.55	1,911	49.5	8.4	239	.....	0.45	1,816	.....
1895	9.45	391	160	89.7	0.92	2,255	55.7	8.7	266	.....	1.61	1,914	.....
1896	8.62	460	180	81.5	1.30	2,568	58.8	9.5	224	.....	4.70	1,939	.....
1897	9.65	494	198	100	4.00	2,775	53.9	11.0	289	.....	2.03	2,236	.....
1898	11.8	527	202	115	5.20	3,118	54.4	12.3	292	.....	1.07	2,466	.....
1899	13.6	569	202	129	6.50	3,437	54.8	15.9	486	.....	4.31	2,759	.....
1900	13.8	606	261	124	7.15	3,830	57.6	17.2	594	.....	3.15	2,922	.....
1901	15.9	602	259	141	7.15	3,806	55.2	20.1	634	.....	6.87	2,879	.....
1902	17.8	660	267	157	7.30	3,870	55.5	25.8	816	1.85	8.00	3,339	.....
1903	18.0	695	281	159	7.50	3,560	54.3	29.9	1,042	2.11	25.00	2,656	.....
1904	16.5	813	298	187	8.60	3,892	57.7	31.7	941	10.7	85.00	3,084	.....
1905	23.0	889	309	204	11.3	4,266	56.1	40.1	23.2	1,043	2,084	220.0	3,635
1906	25.3	918	336	200	14.9	4,565	56.5	51.0	32.9	1,541	3,198	295.1	3,944
1907	25.8	869	352	224	17.2	4,375	56.5	52.2	41.9	1,752	3,093	188.9	4,159
1908	15.9	943	312	191	11.2	4,574	52.4	52.9	37.2	1,722	2,767	364.4	4,035
1909	25.8	1,093	353	230	34.2	4,822	54.7	66.7	59.6	2,253	3,485	274.0	4,215
1910	27.3	1,090	375	253	47.7	4,657	57.1	77.8	69.4	2,379	3,506	247.1	4,243
1911	23.6	1,097	392	272	46.1	4,687	60.4	79.5	66.8	2,324	3,393	205.1	4,366
1912	29.7	1,243	393	324	65.0	4,521	63.8	83.4	68.4	2,501	3,529	787.7	4,645
1913	31.0	1,224	412	337	72.4	4,300	64.8	92.9	79.6	2,600	3,595	491.1	4,810
1914	23.3	1,150	813	343	79.1	4,573	72.4	89.1	79.3	2,476	3,381	417.7	4,873

1915.....	29.9	1,388	507	458	100	4,888	74.9	86.7	78.6	2,448	3,023	520.6	5,352
1916.....	39.4	1,928	552	564	.....	4,479	74.4	92.4	89.1	2,758	4,073	649.7	6,363
1917.....	38.6	1,896	548	585	.....	4,051	71.7	93.5	76.4	2,696	3,786	1,134	6,978
1918.....	39.1	1,909	540	492	.....	3,321	67.8	71.5	61.8	2,057	3,206	1,354	7,239
1919.....	31.0	1,286	424	452	.....	2,919	56.7	81.3	70.6	2,420	3,330	1,191	6,883
1920.....	36.9	1,209	477	450	138	2,476	55.4	100.8	82.0	3,129	3,570	1,255	6,840
1921.....	16.7	506	398	198	55	2,422	53.1	99.4	79.8	2,891	2,532	1,879	4,981
1922.....	27.2	950	469	353	74	2,363	56.2	115.7	94.9	3,780	3,640	1,831	6,793
1923.....	40.4	1,435	544	508	129	2,503	73.3	138.7	139.9	4,753	4,076	2,036	7,131
1924.....	31.4	1,634	566	516	150	2,529	65.4	150.8	156.2	5,043	4,072	1,221	6,803
1925.....	36.7	1,675	655	556	140	2,412	66.2	163.4	172.0	5,078	4,581	1,409	7,398
1926.....	39.4	1,740	681	612	145	2,335	62.7	166.6	183.1	5,035	4,560	1,890	7,372
1927.....	36.6	1,684	668	577	160	2,197	60.4	175.3	197.5	5,347	4,415	2,112	7,569
1928.....	38.2	1,826	626	592	210	2,233	58.5	178.5	209.1	5,102	4,458	1,982	8,075
1929.....	42.6	2,003	672	612	225	2,208	61.3	172.9	222.6	5,016	4,270	2,362	8,544
1930.....	31.8	1,394	574	489	229	2,286	50.7	163.0	197.0	3,471	3,388	2,569	8,054
1931.....	18.4	1,043	390	292	178	2,396	30.9	126.7	155.0	2,559	2,710	2,130	7,358

(Footnote to table 8)

*The figures in italics are estimates.

The data were obtained from the following sources:

Pig iron, including ferro-alloys: Mineral resources of the United States, 1917, Part I, p. 593, 1921; 1930, Part I, p. 88. Statistical abstract of the United States, 1930, U. S. Dept. Commerce, no. 52, p. 755-756, 1930.

Copper: Mineral resources of the United States, 1929, Part I, page 535; 1930, Part I, page A40.

Lead: Smith, L. A., Summarized data of lead production (U. S. Bur. Mines, Economic paper no. 5, p. 13-14, 1929). Mineral resources of the United States, 1929, Part I, p. 233; 1930, Part I, p. A57.

Zinc: Mineral resources of the United States, 1917, Part I, p. 856, 1921; 1929, Part I, p. 677; 1930, Part I, p. A90. Statistical abstract of the United States, 1930, no. 52, p. 767, 1930.

Aluminum: Mineral resources of the United States, 1915, Part I, pages 33A, 52A, 1917; 1929, Part I, p. 493; 1930, Part I, p. A24. From 1904 to 1915 inclusive, the pounds of aluminum used are assumed to represent the production.

Gold: Ridgeway, R. H., Summarized data of gold production (U. S. Bur. Mines, Economic paper no. 6, p. 14, 1929). Statistical abstract of the United States, 1930, no. 52, p. 768, 1930. Mineral resources of the United States, 1929, Part I, p. 885; 1930, Part I, p. A50.

Silver: Merrill, C. W., Summarized data of silver production (U. S. Bur. Mines, Economic paper no. 8, p. 18, 1930). Mineral resources of the United States, 1929, Part I, p. 885; 1930, Part I, p. A50.

Cement: Mineral resources of the United States, 1915, Part II, p. 192, 1917; 1929, Part II, p. 303; 1930, Part I, page A28. Statistical abstract of the United States, 1930, no. 52, 785, 1930. Cement includes the production of Portland cement and the shipments of natural, masonry, and puzzolan cement.

Sand and gravel: Mineral resources of the United States, 1911, Part II, p. 587, 1912; 1915, Part I, p. 48A-50A, 1917; 1919, Part II, p. 151, 1922; 1925, Part II, p. 281, 1928; 1929, Part II, p. 282, 1929; 1927, Part II, p. 162, 1930; 1929, Part II, p. 360; 1930, Part I, page A77.

Gypsum: Mineral resources of the United States, 1915, Part I, p. 31A-45A, 1917; 1918, Part II, p. 283, 1921; 1924, Part II, p. 232, 1927; 1925, Part II, p. 166, 1928; 1929, Part II, p. 142, 1929; 1927, Part II, p. 114, 1930; 1930, Part II, p. 88.

Lime: Mineral resources of the United States, 1915, Part I, p. 31A-50A, 1917; 1924, Part II, p. 193, 1927; 1925, Part II, p. 136, 1928; 1929, Part II, p. 183, 1929; 1927, Part II, p. 140, 1930; 1929, Part II, p. 268; 1930, Part I, p. A59.

Sulfur: Mineral resources of the United States, 1915, Part I, p. 31A-40A, 1917; 1925, Part II, p. 387, 1928; 1929, Part II, p. 296, 1929; 1930, Part II, p. 119. The data from 1901 to 1903 were furnished by O. E. Kiessling, of the United States Bureau of Mines.

Salt: Mineral resources of the United States, 1924, Part II, p. 141, 1927; 1925, Part II, p. 93, 1928; 1926, Part II, p. 71, 1929; 1927, Part II, p. 99, 1930; 1930, Part II, p. 73. Prior to 1879, the data on salt production between the census years are estimates based on the annual production of Michigan (1860-1879), Onondaga district, New York (1839-1879), and Kanawha County, West Virginia (1839-1857, 1864-1870, 1875-1879). These areas reported from two-thirds to three-fourths of the total production.

COMPARISON OF THE PRODUCTION OF SALT FOR THE UNITED STATES AND IMPORTANT PRODUCING AREAS
IN MICHIGAN, NEW YORK, AND WEST VIRGINIA

Year	Michigan, Onondaga district, New York, and Kanawha County, West Virginia	United States	Per cent produced in Michigan, Onondaga district, New York, and Kanawha County, West Virginia
1839.....	(Barrels) 891,587**	(Barrels) 1,235,835	72
1849.....	1,607,012**	1,052,768	82
1859.....	1,634,160**	2,543,440	64
1869.....	2,658,221	3,821,221	75
1879.....	4,249,388	5,901,060	71

** (Excluding the Michigan area, for which no records are available before 1860. In 1860, Michigan produced only 4000 barrels of salt. Sources of data are as follows: Compendium of the enumeration of the inhabitants and statistics of the United States, Sixth Census of the United States, p. 358, 1841. Statistics of wealth and industry of the United States, p. 622, 1872. Report on the manufactures of the United States, Tenth Census, vol. 2, p. 1016, 1883. Mineral resources of the United States, 1843-84, p. 840, 1885; 1887, p. 615, 1888; 1894, Part IV, p. 654, 1895; 1896, Part V, p. 1301, 1897; 1897, Part VI continued, p. 592, 1898; 1898, Part VI continued, p. 674, 1899; 1914, Part II, p. 293, 1916; 1918, Part II, p. 266, 1917; 1918, Part II, p. 117, 1921.)

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TABLE 9. PRODUCTION OF SECONDARY METALS*

Year	Copper, including that in alloys other than brass (000 short tons)	Brass scrap remelted (000 short tons)	Lead as metal (000 short tons)	Lead in alloys (000 short tons)	Zinc as metal (000 short tons)	Zinc in alloys other than brass (000 short tons)	Aluminum as metal (000 short tons)	Aluminum in alloys (000 short tons)
1926-1930.....	329.42	272.3	129.9	155.84	62.96	11.52	22.72	22.34
1907.....	.....	.....	10.2	15.5	18.8	1.42	.....	.....
1908.....	.....	.....	7.9	10.5	17.0	0.67	.....	.....
1909.....	50.8	54.7	18.4	23.3	33.0	1.2	.....	.....
1910.....	51.0	62.0	29.5	25.9	41.2	2.7	.....	.....
1911.....	50.8	80.4	27.4	26.9	40.5	3.2	.....	.....
1912.....	66.4	101.5	30.3	36.9	52.3	3.9	.....	.....
1913.....	67.0	99.3	33.1	39.7	50.0	3.7	2.2	2.5
1914.....	58.6	99.0	29.3	31.7	43.0	3.9	2.8	1.7
1915.....	99.9	137.5	36.4	42.5	52.9	5.3	5.7	2.8
1916.....	140.0	300.0	56.7	39.6	50.7	2.6	12.9	6.4
1917.....	159.4	320.0	45.1	48.4	31.4	4.8	6.7	9.4
1918.....	122.5	328.8	41.1	56.0	27.1	11.1	6.1	9.0
1919.....	112.4	249.7	55.7	66.4	39.9	6.1	6.0	12.7
1920.....	130.6	259.8	56.4	68.3	42.9	7.7	5.0	10.5
1921.....	113.4	148.5	46.4	57.4	33.8	5.8	3.7	5.3
1922.....	144.1	274.0	75.5	84.1	69.3	10.3	7.2	9.1
1923.....	193.2	311.0	96.4	98.1	65.2	8.6	6.8	14.5
1924.....	196.5	274.0	90.4	114.1	58.9	10.5	10.4	16.7
1925.....	250.6	242.3	112.4	114.5	61.4	13.3	17.7	26.3
1926.....	281.7	283.0	125.0	152.3	64.6	13.4	20.5	23.7
1927.....	290.0	286.0	119.0	157.0	64.8	12.4	23.0	23.2
1928.....	325.0	302.0	138.0	170.6	70.7	12.5	24.5	23.3
1929.....	417.6	298.5	138.5	172.5	65.4	11.6	25.9	22.6
1930.....	332.8	192.0	129.0	126.8	49.3	7.7	19.7	18.9
1931.....	261.0	122.8	128.8	105.9	34.8	7.4	15.2	15.1

* Mineral resources of the United States, 1909, Part I, p. 174, 1911; 1912, Part I, p. 343-381, 1913; 1927, Part I, p. 383 384, 1930; 1929, Part I, p. 190; 1930, Part I, p. A58, A91.

METHODS OF CALCULATING INDEX NUMBERS OF THE PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES

CROP PRODUCTION

In order to make an index number of agricultural production, crops were combined in proportion to their relative importance in the period 1926 to 1930. This weighting made 1.38 bushels of corn, 6.4 pounds of cotton, 1 bushel of potatoes, and 0.6 crate of lettuce, each equivalent to 1 bushel of wheat. This gives the index numbers of agricultural production (table 1, page 5). When the agricultural production of the United States from 1926 to 1930 is taken as 100, the production in 1839 is 10.61.

Since all the major crops—corn, oats, wheat, hay, cotton, and tobacco—have increased at approximately the same rate, the index number is not greatly changed by changing weights. The weights given to the different crops are shown in table 10.

TABLE 10. PRODUCTION AND VALUE OF CROP PRODUCTION IN THE UNITED STATES, 1926-1930

Product	Unit of measure	Average production, 1926-30	Average value, 1926-30	Per cent of total value
Corn.....	000,000 bu.	2,593.8	\$1,854	23.18
Wheat.....	000,000 bu.	856.98	845	10.57
Oats.....	000,000 bu.	1,299.8	521	6.51
Barley.....	000,000 bu.	287.42	156	1.95
Rye.....	000,000 bu.	46.884	36	0.45
Buckwheat.....	000,000 bu.	12.407	11	0.14
Flaxseed.....	000,000 bu.	21.17	41	0.51
Rough rice.....	000,000 bu.	42.50	40	0.50
Grain sorghums.....	000,000 bu.	83.602	52	0.65
Hay.....	000,000 short tons	106.756	1,268	15.85
Clover and alfalfa seed.....	000 bu.	3,250.0	33	0.41
Soybeans.....	000,000 bu.	9,352.4	17	0.21
Peanuts.....	000,000 pounds	804.22	32	0.40
Beans.....	000,000 bu.	18.88	61	0.76
Potatoes, white.....	000,000 bu.	388.54	387	4.84
Sweet potatoes.....	000,000 bu.	82.028	74	0.93
Sugar beets.....	000 short tons	1,050.8	56	0.70
Sugar cane.....	000 short tons	131.6	8	0.10
Apples.....	000,000 bu.	172.7	175	2.19
Peaches.....	000,000 bu.	56.556	57	0.71
Grapes.....	000 short tons	2,436.4	56	0.70
Oranges.....	000,000 boxes	41.312	115	1.44
Lemons.....	000,000 boxes	6,900.4	22	0.28
Grapefruit.....	000,000 boxes	10,955.4	25	0.31
Cabbage.....	000 tons	1,077.8	20	0.25
Lettuce.....	000,000 crates	18,978	30	0.38
Onions.....	000,000 bu.	23,482	18	0.22
Strawberries.....	000,000 quarts	297.88	45	0.56
Tomatoes.....	000,000 pounds	3,372.4	47	0.59
Cantaloupes.....	000,000 crates	15,428	20	0.25
Peas, green.....	000 tons	284.8	21	0.26
Tobacco.....	000,000 pounds	1,384.0	254	3.18
Cotton.....	000,000 pounds	7,120.2	1,089	13.62
All other.....	000,000 pounds	.....	512	6.40
			\$7,998	100.00

An index was prepared also showing the production of food and feed crops (column 3, table 1). The two index numbers are almost alike.

Livestock production is not included. All livestock is produced from crops, except the part that is produced from pasture.

In the index number that is weighted by the value added by manufacture, the values added to livestock and its products by manufacturing processes are included. In this index number it would be desirable to have the value of livestock, since it goes to market, above the value of the crops consumed, but such figures are not available. The addition is not a large sum.

The production of food and feed crops follows approximately the same relationship as does the production of all crops. For the 76 years previous to the World War, the rate of increase was 3.02 per cent per annum. From 1915 to 1929, the rate of increase was 0.60

per cent per annum; or, if correction is made for the reduced number of horses and mules, it was 1.17 per cent per annum.

ADJUSTMENT FOR HORSES AND MULES

The substitution of automobiles, trucks, and tractors, for horses and mules, has reduced the demand for farm products. Gasoline has been substituted for horse feed. It is estimated that 23,000,000 additional acres would have been required in 1930 to raise horse feed if there had been as many horses and mules as there were in 1915. This is 6 per cent of the total crop acres, or 7 per cent of the acres of food and feed crops. The crop acreage would have to be decreased 6 per cent to be comparable with 1915 and previous years. Index numbers of crop production were increased 6 per cent to get the adjustment for horses and mules.

RELATIVE PRODUCTION OF VARIOUS CROPS

The comparative production of each crop multiplied by its weight is shown in table 12. The weight as shown in table 10 was multiplied by the index number of production. To simplify the operation, the work was done as follows: The corn crop for the five years 1926 to 1930 was 2,593,800,000 bushels. Since this was 100 per cent, and a weight of 23.18 per cent was desired, 112,000,000 bushels would represent 1 per cent; or, the bushels multiplied by 0.008937 gives the index times weight as shown in table 12.

Wheat, oats, rice, hay, and cotton represented about the same percentage of the index of crop production in 1839 as in 1929. Corn represented somewhat more of the index in the earlier year. While many minor new crops have been added, the more important crops have expanded at approximately the same rate.

FOREST PRODUCTS

The index number of forest products is based on the board feet of lumber cut and the cords of pulpwood. For the five-year period 1926 to 1930, lumber represented 92.5 per cent of the total, and pulpwood 7.5 per cent (table 13, page 56).

TABLE 11. ADJUSTMENT FOR HORSES AND MULES, 1915 TO 1932

Year	Number of horses and mules			Crop acres released (000,000 omitted)	Per cent that released crop acreage was of		Adjustment factor for		Index numbers of crop production adjusted for reduction in the number of horses and mules ¹	
	On farms* (000 omitted)	In cities (000 omitted)	Total (000 omitted)		Total crop acreage (365,000,000 in 1929)†	Total crop acreage less cotton, flax-seed, tobacco, and hops (314,000,000 in 1929)†	Total crop production	Food- and feed-crop production	Total crop production (1926-30 = 100)	Food- and feed-crop production (1926-30 = 100)
1910.....	24,043	3,453†	27,496	.....	.....	.....	.....	.....	.....	.....
1911-18....	.....	.....	28,000†	.....	.....	.....	.....	.....	.....	.....
1915.....	25,674	.....	.....	0	0	0	100.0	100.0	96.79	101.11
1916.....	25,752	.....	.....	0	0	0	100.0	100.0	85.65	87.18
1917.....	25,933	.....	.....	1	0.3	0.3	100.3	100.3	92.45	95.29
1918.....	26,428	.....	.....	1	0.3	0.3	100.3	100.3	92.69	94.14
1919.....	26,436	.....	.....	1	0.3	0.3	100.3	100.3	93.66	95.59
1920.....	25,323	2,084†	27,407	2	0.5	0.6	100.5	100.6	102.35	103.88
1921.....	24,720	1,946	26,666	4	1.1	1.3	101.0	101.0	86.95	92.69
1922.....	24,292	1,809	26,011	6	1.6	1.9	102.0	102.0	98.03	103.39
1923.....	23,645	1,671	25,316	8	2.2	3.0	102.0	103.0	98.77	104.09
1924.....	22,952	1,534	24,486	11	3.0	4.0	103.0	104.0	98.29	100.69
1925.....	22,195	1,396‡	23,591	13	4.0	4.0	104.0	104.0	102.64	101.00
1926.....	21,570	1,304	22,874	18‡	5.0	6.0	105.0	106.0	104.82	102.52
1927.....	20,785	1,218	22,003	18	5.0	6.0	105.0	106.0	105.95	109.91
1928.....	19,999	1,138	21,137	21	6.0	7.0	106.0	107.0	111.14	113.75
1929.....	19,286	1,000	20,000	22‡	6.0	7.0	106.0	107.0	106.15	106.84
1930.....	18,643	.....	.....	23	6.0	7.0	106.0	107.0	99.80	99.95
1931.....	17,934	.....	.....	24	7.0	8.0	107.0	108.0	102.54	99.51
1932.....	17,761	.....	.....	25	7.0	8.0	107.0	108.0	.....	.....

* Yearbook of Agriculture, 1931, U. S. Dept. Agr., p. 859, 1931.

† Warren, G. F., and Pearson, F. A. Effects of the gasoline engine. Farm econ., no. 31, p. 385, February 6, 1926.

‡ The number of horses and mules in 19 cities in 1925 was 67 per cent of the number in 1920. (Thurston, M. F., Changes in the number of horses and mules in cities. Farm econ., no. 42, p. 630, February, 1927.)

§ Cavert, W. L. The horse situation. Farm econ., no. 61, p. 1175, October, 1929.

¶ Yearbook of Agriculture, 1931, U. S. Dept. Agr., p. 974, 1931.

‡ The unadjusted index numbers as given in table 1 were multiplied by the adjustment factor.

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TABLE 12. INDEX NUMBERS OF TOTAL CROP PRODUCTION IN THE UNITED STATES*
(1926-30 = 100)

Crop	1839	1849	1859	1869	1879	1889	1899	1909	1919	1929
Corn	3.374	5.292	7.496	7.814	16.292	17.865	21.940	22.986	25.122	23.361
Wheat	1.046	1.240	2.135	3.208	6.166	5.358	7.846	8.639	11.939	9.981
Oats	0.616	0.734	0.864	1.444	2.257	4.014	4.635	5.349	6.929	6.150
Barley	0.028	0.035	0.107	0.194	0.331	0.531	0.791	1.275	1.001	2.055
Rye	0.179	0.136	0.203	0.216	0.242	0.272	0.291	0.340	0.724	0.402
Buckwheat	0.082	0.101	0.198	0.197	0.198	0.137	0.147	0.203	0.162	0.129
Flaxseed		0.014	0.014	0.042	0.173	0.247	0.481	0.475	0.173	0.411
Rough rice	0.034	0.001	0.079	0.031	0.047	0.054	0.106	0.242	0.494	0.476
Grain sorghums							0.040	0.137	0.823	0.494
Hay	1.522	2.055	2.833	3.923	5.918	8.475	11.269	13.773	15.649	16.881
Clover and alfalfa seed	0.029	0.059	0.120	0.081	0.242	0.347	0.170	0.162	0.258	0.527
Soybeans								0.001	0.046	0.257
Peanuts			0	0.013	0.026	0.039	0.131	0.212	0.389	0.462
Beans		0.041	0.082	0.083	0.124	0.127	0.204	0.453	0.539	0.834
Potatoes	0.853	0.820	1.384	1.668	2.262	2.506	3.243	4.016	4.022	4.472
Sweet potatoes	0.451	0.434	0.477	0.246	0.378	0.498	0.472	0.655	1.101	0.958
Sugar beets				0	0.001	0.002	0.054	0.312	0.484	0.678
Sugar cane	0.046	0.113	0.105	0.033	0.068	0.115	0.122	0.293	0.093	0.152
Apples	0.203	0.245	0.495	0.701	1.227	2.272	2.055	1.853	1.802	1.811
Peaches							0.194	0.605	0.668	0.575
Grapes	0.001	0.001	0.011	0.021	0.093	0.164	0.187	0.331	0.448	0.602
Oranges							0.153	0.215	0.681	0.796
Lemons							0.036	0.112	0.142	0.239
Grapefruit							0.001	0.034	0.172	0.303
Cabbage						0.092	0.134	0.154	0.175	0.255
Lettuce							0.010	0.029	0.105	0.398
Onions						0.204	0.780	0.106	0.172	0.244
Strawberries	0.038	0.087	0.207	0.179	0.320		0.224	0.304	0.363	0.619
Tomatoes						0.037	0.241	0.345	0.617	0.660
Cantaloupes						0.062	0.100	0.118	0.204	0.275
Pears, green						0.067	0.041	0.086	0.142	0.276
All other	0.096	0.221	0.527	0.456	0.816	1.175	2.115	2.917	4.534	6.956
Total food and feed crops	8.598	11.719	17.337	20.640	37.181	44.813	57.573	68.098	79.288	83.073
Tobacco	0.504	0.459	0.998	0.629	1.164	1.052	1.844	2.424	3.367	3.504
Cotton	1.512	1.889	4.585	2.356	4.892	6.583	9.628	10.923	10.727	13.559
Total cotton and tobacco	2.016	2.348	5.583	2.985	6.056	7.635	11.472	13.347	14.094	17.063
Total	10.614	14.067	22.920	23.625	43.237	52.448	69.045	81.445	93.382	100.136

*A few minor products, such as flax and hemp, which are not food and feed crops, are included in this group. After 1866, Department of Agriculture figures were used rather than the census figures given in table 6.

TABLE 13. PRODUCTION AND VALUE OF LUMBER, ELECTRICITY, AND MINERALS IN THE UNITED STATES, 1926 TO 1930

	Unit	Average production, 1926-30	Average value, 1926-30 (000,000 omitted)	Per cent of total value
Forest products:				
Lumber.....	000,000 ft. b.m.....	35,554	\$ 920	92.53
Pulpwood.....	000 cords.....	5,549.2	75	7.47
Total forest products.....			1,004	100.00
Coal:				
Anthracite.....	000,000 short tons.....	78.80	406	29.25
Bituminous.....	000,000 short tons.....	517.8	982	70.75
Total coal.....			1,388	100.00
Other fuel:				
Petroleum.....	000,000 barrels.....	895.42	1,200	70.71
Natural gas.....	000,000,000 cu. ft.....	1,644.6	361	21.27
Natural-gas gasoline.....	000,000 gallons.....	1,845.0	136	8.02
Total other fuel.....			1,697	100.00
Power:				
Electricity from water power*.....	000,000 kilowatt hours.....	30,294	714	89.38
Water power other than electric†.....	000 horsepower.....	2,528	85	10.64
Total power.....			799	100.00
Other minerals:				
Cement.....	000,000 barrels.....	171.26	268	15.40
Sand and gravel.....	000,000 short tons.....	200.46	119	6.84
Gypsum.....	000 short tons.....	4,914.2	36	2.07
Lime.....	000 short tons.....	4,217.4	35	2.01
Sulfur.....	000 long tons.....	2,181.0	39	2.24
Salt.....	000 short tons.....	7,922.8	26	1.49
Pig iron, including ferro-alloys.....	000,000 long tons.....	37.72	732	42.07
Copper.....	000,000 pounds.....	1,729.4	252	14.48
Lead.....	000 short tons.....	644.2	82	4.71
Zinc.....	000 short tons.....	576.4	73	4.20
Aluminum.....	000,000 pounds.....	193.8	46	2.65
Silver.....	000,000 fine ounces.....	58.72	32	1.84
Total other minerals.....			1,740	100.00
Secondary metals:				
Copper, including that in alloys other than brass.....	000 short tons.....	329.42	97	42.73
Brass scrap remelted.....	000 short tons.....	272.3	63	27.75
Lead as metal.....	000 short tons.....	129.9	18	7.05
Lead in alloys.....	000 short tons.....	155.84	20	8.81
Zinc as metal.....	000 short tons.....	62.96	8	3.52
Zinc in alloys other than brass.....	000 short tons.....	11.52	1	0.44
Aluminum as metal.....	000 short tons.....	22.72	11	4.85
Aluminum in alloys.....	000 short tons.....	22.34	11	4.85
Total secondary metals.....			227	100.00
Total.....			\$6,855	.....

* For the four years 1927 to 1930, 37.1 per cent of the total electricity generated was from water power. Assuming this ratio held for the five years 1926 to 1930, the electricity generated from water power was 30,293,634,000 kilowatt hours (81,654,000,000 × 0.371 = 30,293,634,000).

† In 1923, the total capacity of water wheels used for purposes other than generating electric current was 2,528,000 horsepower. If these water wheels were one-third as efficient as those used for generating electric power, the estimated value would be \$85,000,000.

FUEL AND POWER

Power from water wheels increased by about four times from 1849 to 1923 (table 7, page 43).

The increase in electric current is shown in table 7. In computing the fuel and power index, 37.1 per cent was assumed to be from water power.⁶ This was the proportion from 1927 to 1930. Perhaps a different proportion came from water power in the earlier years, but the total was then so small as not to disturb the index seriously.

The methods of constructing the index numbers of coal and other fuel are shown in table 14. All of these groups were combined to make an index of fuel and power. The weightings were in accordance with the relative importance in the period 1926 to 1930. Electricity from water power was 18.38 per cent, other water power was 2.19 per cent, coal was 35.74 per cent, and petroleum, natural gas, and natural-gas gasoline were 43.69 per cent.

TABLE 14. WEIGHTS FOR FUEL AND POWER INDEX

	1926-30 value (000,000 omitted)	Per cent
Coal.....	\$1,388	35.74
Other fuel.....	1,697	43.69
Electric power from water.....	714	18.38
Water wheels not electric.....	85	2.19
Total.....	\$3,884	100.00

OTHER MINERALS

The index numbers of mineral production other than fuels are shown in table 1—one for primary materials, and one for secondary, or waste, materials. The weightings for the other materials and metal groups are shown in table 13. These were combined to make the metal-and-secondary-metal index by using the following weights: other minerals, 68.5 per cent; secondary metals, 31.5 per cent.⁷

⁶ For the four years 1927 to 1930, the total electricity generated was 339,110,000,000 kilowatt hours, of which 125,810,000,000 was generated by water power; this represents 37.1 per cent of the total (Wittig, G. F., Light and power gains, Electrical world, vol. 97, no. 1, p. 26, 28, January 3, 1931). According to the United States Census, water power represented 23.8 per cent of the horsepower capacity of prime movers in 1902, 32.0 per cent in 1907, 32.8 per cent in 1912, 33.8 per cent in 1917, and 29.0 per cent in 1922 (Central electric light and power stations and street and electric railways, 1912, U. S. Census Bur., p. 20, 1915, and Central electric light and power stations, 1922, Census of electrical industries, U. S. Census Bur., p. 14, 1925).

⁷ From 1926 to 1930, the value of other minerals was estimated at \$1,740,000,000 and of secondary metals at \$800,000,000. The Institute of Iron and Steel Scrap estimates that the business of its members amounts to more than 30,000,000 tons of iron and steel scrap and aggregates half a billion dollars (Mineral resources of the United States, 1928, U. S. Dept. Commerce, 71st Congress, 2d Session, House Document no. 510, p. 148, 1931).

⁸ The Bureau of Mines estimated value of all secondary metals is more than one billion dollars (Mineral resources of the United States; 1924, Part I, p. 110, 1927; 1926, Part I, p. 277, 1929; 1927, Part I, p. 373, 1930; 1928, Part I, p. 145, 1931).

In making the index, it was assumed that scrap iron varied in proportion to the production of other secondary metals.

Going backward in time, the production of secondary metals became a steadily smaller and smaller percentage of that of other minerals. In constructing the index number, this more rapid rate of decline was assumed to have continued at the same rate for the years before data were available.⁸

A combined index is shown in table 1 and figure 15. From 1839 to 1914, mineral production increased 7.02 per cent per annum. From 1915 to 1929, the rate of increase was 3.62 per cent per annum.

ALL MINERALS AND WATER POWER

From 1926 to 1930, the fuel and water power were worth \$3,884,000,000, and other minerals and secondary metals were worth \$2,540,000,000. In making the combined index, the relative weights used were 60.4 and 39.6 per cent.

TOTAL BASIC PRODUCTION, CONSTANT GROUP WEIGHTS

Four final index numbers of production were prepared. The first one combines the different groups in proportion to their total values for the five years 1926 to 1930 (table 15). The value of crops represented 51.9 per cent of the total. Fuel and power were second, representing one-fourth of the total.

TABLE 15. GROUP WEIGHTINGS FOR INDEX NUMBERS OF TOTAL BASIC PRODUCTION WITH CONSTANT GROUP WEIGHTS

Groups	Value 1926-30 (000,000 omitted)	Weight
Crops.....	\$7,998	51.85
Forest products.....	1,004	6.51
Fuel and power.....	3,884	25.18
Other minerals and secondary metals.....	2,540	16.46
Total.....	\$15,426	100.00

TOTAL BASIC PRODUCTION, VARIABLE GROUP WEIGHTS

Constant group weights consider the relative importance of a bushel of wheat and a ton of pig iron to be the same throughout the period. No great error is involved when this method is applied to the agricul-

⁸ From the five-year period 1926-1930 to 1909, the secondary-metal index declined from 100 to 16.534. Other minerals declined from 100 to 58.983. Assuming the continuance of this more rapid decline, the secondary-metal index in 1839 was 0.002; in 1859, 0.037; in 1879, 0.425; and in 1899, 3.741.

tural group, but a given quantity of agricultural production was less important as compared with industrial production in the earlier years. By varying the group weights, an index number was prepared which combined the different groups in accordance with their importance in different periods.

In preparing this index, the index numbers of the physical volume of production for the farm-products group were multiplied by the weight for the farm-products group, as in the index with constant group weights. These were again multiplied by the ten-year moving-averages of the index numbers of wholesale prices of farm products, which were converted to the 1926-30 base. The lumber index times its weight was multiplied by the ten-year moving average of the index of lumber prices. The fuel-and-power index times its weight was multiplied by the index numbers of the wholesale prices of fuel and power. The other-minerals-and-secondary-metals index times its weight was multiplied by the ten-year moving average of the index numbers of wholesale prices of metals. The sum of all these for each year was divided by the ten-year moving average of the index numbers of wholesale prices of all commodities. The divisor should have the weighted average of these four groups, but this agrees very closely with the all-commodity index.

TOTAL BASIC PRODUCTION WITH CONSTANT GROUP WEIGHTS PLUS VALUE ADDED BY MANUFACTURE

A given value in production of metals sustains a higher value in manufacturing process than is the case with most agricultural products except cotton and wool. If the "value added by manufacture" is added to the production of basic raw materials, agriculture represents about 42 per cent of the total, forest products 8 per cent, fuel and power 13 per cent, and other minerals and secondary metals 37 per cent (table 16).

TABLE 16. RELATIVE IMPORTANCE OF THE DIFFERENT GROUPS OF COMMODITIES*

Group	Value 1926-30 (000,000 omitted)	Per cent of total	Value added by manufacture (000 000 omitted)	Total basic value and value added by manufacture† (000,000 omitted)	Per cent of total
Crops.....	\$7,998	52	\$ 7,787	\$15,785	42
Forest products.....	1,004	7	1,961	2,965	8
Fuel and power.....	3,884	25	791	4,675	13
Other minerals and secondary metals...	2,540	16	11,488	14,028	37
Total.....	\$15,426	100	\$22,027	\$37,453	100

* In making the computations, two decimals were carried.

† Day, Edmund E., and Thomas, Woodlief. The growth of manufactures, 1899 to 1923. U. S. Census Bur. Census monograph 8, p. 141-146. 1928

TOTAL BASIC PRODUCTION WITH VARIABLE GROUP WEIGHTS PLUS VALUE
ADDED BY MANUFACTURE

This index was computed in the same manner as was the basic index with variable group weights, except that the group weights for the index numbers of basic production plus value added by manufacture were used.

COMPARISON OF THE FOUR INDEX NUMBERS

From 1839 to 1914, the index number of total basic production with constant group weights increased at the compound rate of 3.57 per cent per annum (figure 41). When the value added by manufacture is included, the rate was 3.78 per cent per annum (figure 42). Basic production with variable group weights increased 4.03 per cent per annum. Basic production with value added by manufacture, with variable group weights, increased 4.31 per cent per annum (figure 43).

The index number with variable group weights increasing at the rate of 4.03 per cent per annum, is believed to be the best index for most purposes. The rate 3.57 is certainly too low to give a correct picture of the progress of production. The rate 4.31 is the maximum that could be defended.

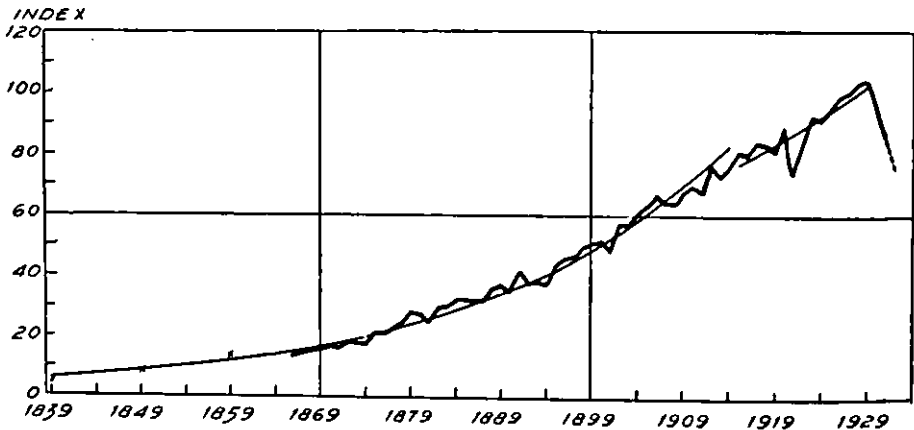


FIGURE 41. INDEX NUMBERS OF PHYSICAL VOLUME OF BASIC PRODUCTION IN THE UNITED STATES, 1839 TO 1932, CONSTANT GROUP WEIGHTS

(1926-30 = 100)

From 1839 to 1914, production increased at the rate of 3.57 per cent per annum; from 1915 to 1929 the rate of increase was 2.08 per cent per annum

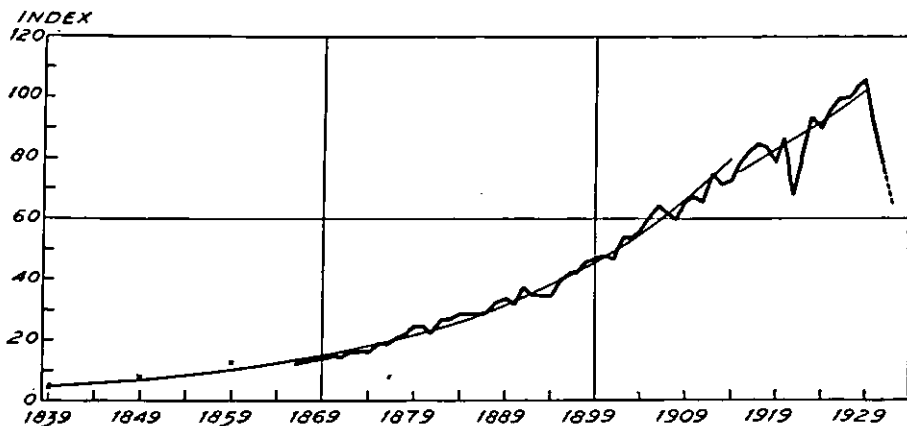


FIGURE 42. INDEX NUMBERS OF PHYSICAL VOLUME OF BASIC PRODUCTION IN THE UNITED STATES, 1839 TO 1932, CONSTANT GROUP WEIGHTS, WEIGHTED BY VALUE PLUS VALUE ADDED BY MANUFACTURE

(1926-30 = 100)

From 1839 to 1914, production increased at the rate of 3.78 per cent per annum; from 1915 to 1929 the rate of increase was 2.19 per cent per annum

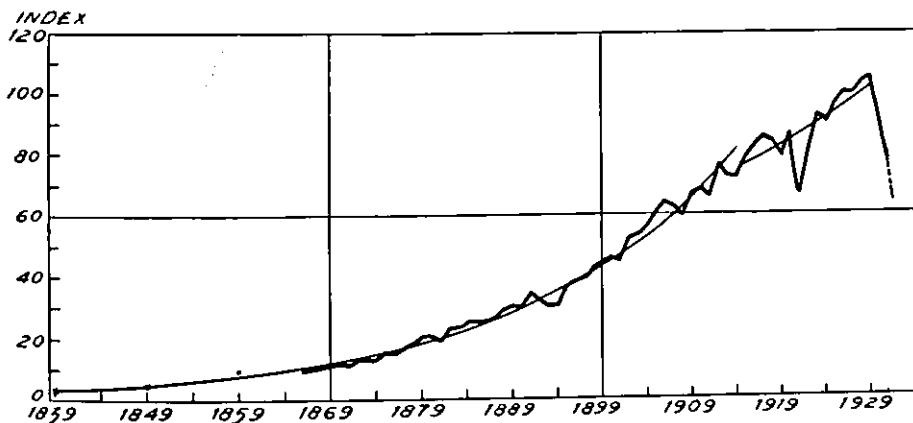


FIGURE 43. INDEX NUMBERS OF BASIC PRODUCTION IN THE UNITED STATES, 1839 TO 1932, VARIABLE GROUP WEIGHTS, WEIGHTED BY VALUE PLUS VALUE ADDED BY MANUFACTURE

(1926-30 = 100)

From 1839 to 1914, production increased at the rate of 4.31 per cent per annum; from 1915 to 1929 the rate of increase was 2.13 per cent per annum

The amount which each group contributes to the final index by each method of weighting is shown in tables 17, 18, 19, and 20. It should be noted that, in the index numbers with variable group weights, a given quantity of farm crops or of forest products in 1839 has less value than the same quantity has at the present time. A given quantity of fuel or of minerals in 1839 has greater value than at present. Therefore, tables 19 and 20 should not be used to show comparative productions within any group.

TABLE 17. INDEX OF PHYSICAL VOLUME OF PRODUCTION, CONSTANT GROUP WEIGHTS
(1926-30 = 100)

	1839	1840	1859	1869	1879	1889	1899	1909	1919	1929
Crops.....	5.50	7.30	11.88	12.25	22.42	27.19	35.80	42.23	48.42	51.92
Forest products....	0.27	0.91	1.36	2.16	3.07	4.63	6.00	7.82	9.24	9.76
Fuel and power....	0.13	0.30	0.59	1.06	1.94	3.44	5.49	10.60	15.55	27.41
Other minerals and secondary metals.	0.06	0.12	0.15	0.34	0.69	1.78	3.38	7.18	10.67	18.44
Total.....	5.96	8.63	13.98	15.81	28.12	37.04	50.76	67.83	80.88	104.53

TABLE 18. INDEX OF PHYSICAL VOLUME OF PRODUCTION, CONSTANT GROUP WEIGHTS,
WEIGHTED BY VALUE PLUS VALUE ADDED BY MANUFACTURE
(1926-30 = 100)

	1839	1840	1859	1869	1879	1889	1899	1909	1919	1929
Crops.....	4.46	5.91	9.63	9.92	18.16	22.03	29.00	34.21	39.22	42.06
Forest products....	0.33	1.12	1.67	2.66	3.77	5.09	7.48	9.61	7.66	8.31
Fuel and power....	0.07	0.16	0.30	0.55	1.00	1.77	2.83	5.47	8.03	14.15
Other minerals and secondary metals.	0.13	0.27	0.34	0.77	1.55	4.01	7.60	16.14	23.09	41.44
Total.....	4.99	7.46	11.04	13.90	24.48	33.50	46.91	65.43	78.00	105.96

TABLE 19. INDEX OF PHYSICAL VOLUME OF PRODUCTION, VARIABLE GROUP WEIGHTS
(1926-30 = 100)

	1839	1840	1859	1869	1879	1889	1899	1909	1919	1929
Crops.....	3.93	5.79	9.98	9.96	18.73	23.44	31.96	41.00	47.99	50.86
Forest products....	0.09	0.38	0.54	0.93	1.51	2.87	4.13	6.12	5.53	6.76
Fuel and power....	0.12	0.28	0.48	0.95	1.60	2.55	5.10	9.37	15.96	27.41
Other minerals and secondary metals.	0.15	0.28	0.30	0.65	1.19	2.83	5.01	9.37	11.33	18.03
Total.....	4.29	6.73	11.30	12.40	23.03	31.69	46.20	65.86	80.81	103.66

TABLE 20. INDEX OF PHYSICAL VOLUME OF PRODUCTION, VARIABLE GROUP WEIGHTS, WEIGHTED BY VALUE PLUS VALUE ADDED BY MANUFACTURE (1926-30 = 100)

	1830	1840	1850	1860	1870	1889	1899	1909	1919	1929
Crops.....	3.19	4.69	8.08	8.07	15.18	18.99	25.89	33.22	38.88	41.20
Forest products....	0.11	0.47	0.66	1.14	1.86	3.53	5.08	7.52	6.79	8.31
Fuel and power....	0.06	0.14	0.25	0.49	0.82	1.31	2.63	4.84	8.24	14.15
Other minerals and secondary metals.	0.33	0.63	0.68	1.48	2.67	6.36	11.26	21.05	25.46	41.86
Total.....	3.60	5.93	9.67	11.18	20.53	30.19	44.86	66.63	79.37	105.52

SNYDER'S MEASURES OF BASIC PRODUCTION

The quantity of output for the product in a given year is weighted by its 1923-25 average price per unit in the United States. The resulting totals are the comparative physical output of basic production (table 21, page 64).

The Snyder index of world physical volume of production begins with 10 commodities from 1865 to 1874. The number gradually increases until 1900, when there are 30 series included. The values were estimated at 1923-25 average prices. From 1865 to 1930, the following commodities were included: wheat, corn, cotton, wool, sugar, coal, pig iron, copper, zinc, and tin; from 1875 to 1930, steel, silver, petroleum, rubber, and coffee, were added; from 1883 to 1930, silk; from 1884 to 1930, lead; from 1890 to 1930, nickel and jute; from 1894 to 1930, aluminum; and from 1900 to 1930, oats, barley, rye, potatoes, tea, hops, tobacco, flaxseed, artificial silk, and sulfur.

The output for the United States includes the same products in so far as they are produced in the United States.

The measures of basic production in the United States are practically the same as the index prepared by the writers with constant group weights (table 1, page 5).

PERSONS' INDEX OF PHYSICAL PRODUCTION

Persons has presented an index of total production for the period 1860 to 1930, based on crops, minerals, and manufactures. The index is weighted in the following manner: crops, 36 per cent; minerals, 8 per cent; manufactures, 56 per cent.⁹ The base period is 1909 to 1913. Constant weights based on the values of crops and minerals and the value added by manufacture in 1909 were used throughout. This index number is between the two index numbers which include value added by manufacture as prepared by the writers. (Table 22, page 65.)

⁹ Persons, W. M. Forecasting business cycles, p. 174. 1931.

TABLE 21. SNYDER'S MEASURES OF PHYSICAL VOLUME OF BASIC PRODUCTION

Year	Products of the soil			Other products			Basic commodities		
	United States	Other countries*	World*	United States	Other countries*	World*	United States	Other countries*	World*
1926-1930	7,596	21,800	29,396	6,862	7,879	14,741	14,458	29,679	44,137
1910-1914	6,974	16,503	23,478	4,268	5,817	10,085	11,242	22,321	33,563
1880-1914	5,212	11,945	17,157	2,037	3,450	5,487	7,249	15,395	22,644
1865	1,473	5,081	6,554	135	1,004	1,139	1,608	6,085	7,693
1866	1,657	5,178	6,835	170	1,033	1,203	1,827	6,211	8,038
1867	1,696	5,103	6,799	181	1,069	1,250	1,877	6,172	8,049
1868	1,850	5,384	7,234	195	1,088	1,283	2,045	6,472	8,517
1869	1,805	5,328	7,133	203	1,150	1,353	2,008	6,478	8,486
1870	2,386	5,813	8,199	202	1,172	1,374	2,588	6,985	9,573
1871	2,069	5,880	7,949	207	1,247	1,514	2,336	7,127	9,463
1872	2,378	6,219	8,597	317	1,342	1,659	2,695	7,561	10,256
1873	2,264	6,255	8,519	342	1,407	1,749	2,606	7,662	10,268
1874	2,149	6,260	8,415	316	1,371	1,687	2,465	7,637	10,102
1875	2,793	6,546	9,339	300	1,443	1,743	3,093	7,989	11,082
1876	2,719	6,700	9,425	311	1,456	1,767	3,030	8,162	11,192
1877	2,972	6,987	9,959	352	1,480	1,832	3,324	8,467	11,791
1878	3,170	7,079	10,249	361	1,505	1,866	3,531	8,584	12,115
1879	3,593	6,839	10,432	423	1,518	1,941	4,016	8,357	12,373
1880	3,985	7,510	11,495	483	1,716	2,199	4,468	9,226	13,694
1881	2,963	7,286	10,249	500	1,843	2,409	3,529	9,129	12,658
1882	3,947	8,211	12,158	659	1,945	2,604	4,606	10,156	14,762
1883	3,533	8,075	11,608	680	2,036	2,732	4,229	10,111	14,340
1884	3,901	8,749	12,710	705	1,993	2,698	4,666	10,742	15,408
1885	4,004	8,697	12,701	677	1,989	2,666	4,681	10,686	15,367
1886	3,871	8,860	12,731	763	1,997	2,760	4,634	10,857	15,491
1887	3,723	8,722	12,445	881	2,099	2,980	4,604	10,821	15,425
1888	4,253	9,452	13,705	942	2,294	3,206	5,195	11,716	16,911
1889	4,386	9,774	14,160	973	2,366	3,339	5,359	12,140	17,499
1890	3,863	9,426	13,289	1,126	2,443	3,569	4,989	11,869	16,858
1891	4,954	10,161	15,115	1,159	2,499	3,658	6,113	12,660	18,773
1892	4,134	9,882	14,010	1,263	2,405	3,758	5,397	12,377	17,774
1893	4,103	10,378	14,481	1,184	2,443	3,627	5,287	12,821	18,108
1894	4,199	10,123	14,322	1,143	2,658	3,801	5,342	12,781	18,123
1895	4,993	11,320	16,313	1,369	2,741	4,110	6,362	14,061	20,423
1896	5,385	11,625	17,010	1,342	2,983	4,325	6,727	14,608	21,335
1897	5,540	11,010	16,550	1,474	3,157	4,631	7,014	14,167	21,181
1898	5,910	12,321	18,231	1,663	3,305	4,968	7,573	15,620	23,199
1899	5,626	12,047	17,673	1,905	3,482	5,386	7,431	15,529	22,959
1900	5,651	12,737	18,388	1,977	3,654	5,631	7,028	16,301	24,019
1901	4,914	13,490	18,404	2,245	3,635	5,890	7,159	17,125	24,284
1902	6,199	13,358	19,557	2,416	3,780	6,196	8,015	17,138	25,753
1903	5,697	13,705	19,392	2,637	4,020	6,657	8,234	17,815	26,049
1904	6,203	13,003	19,206	2,601	4,110	6,711	8,894	17,113	26,007
1905	6,298	14,520	20,818	3,183	4,320	7,503	9,481	18,840	28,321
1906	6,884	15,310	22,194	3,443	4,636	8,079	10,327	19,946	30,273
1907	5,959	14,698	20,657	3,701	4,904	8,605	9,720	19,602	29,322
1908	6,290	14,946	21,236	2,959	5,045	8,004	9,249	19,691	29,240
1909	6,234	16,082	22,296	3,765	5,108	8,873	9,999	21,170	31,169
1910	6,630	16,681	22,311	4,076	5,377	9,452	10,705	21,058	31,763
1911	6,621	16,958	22,579	3,914	5,835	9,749	10,535	21,793	32,328
1912	7,490	17,240	24,730	4,524	5,971	10,495	12,014	23,211	35,225
1913	6,701	17,083	24,384	4,730	6,403	11,133	11,431	24,086	36,517
1914	7,429	16,955	23,384	4,097	5,500	9,597	11,520	21,455	32,081
1915	7,408	16,205	23,703	4,721	5,102	9,823	12,189	21,397	35,886
1916	6,341	14,468	20,807	5,696	5,007	11,303	12,037	20,073	32,110
1917	7,115	13,721	20,830	6,054	5,735	11,789	13,169	19,456	32,625
1918	7,134	13,382	20,518	6,152	5,403	11,015	13,280	18,845	32,131
1919	7,027	14,363	21,390	5,047	4,741	9,788	12,074	19,104	31,178
1920	7,793	16,068	23,861	5,947	5,442	11,389	13,740	21,510	36,250
1921	6,586	15,841	22,427	3,982	4,950	8,932	10,508	20,701	31,359
1922	6,955	18,142	25,097	4,958	5,022	10,880	11,913	24,064	36,977
1923	7,116	18,626	25,742	6,089	5,931	12,620	13,805	24,657	38,362
1924	7,062	18,987	26,070	5,904	6,712	12,616	12,906	25,699	38,695
1925	7,639	21,178	28,817	6,450	6,088	13,438	14,089	28,166	42,255
1926	7,774	20,093	27,867	6,941	6,608	13,540	14,715	26,701	41,410
1927	7,418	21,360	28,768	6,710	8,034	14,750	14,134	29,384	43,518
1928	8,031	22,601	30,632	6,953	8,238	15,101	14,984	30,839	45,823
1929	7,401	23,090	30,551	7,674	8,805	16,439	16,035	31,055	46,990
1930	7,054	23,622	30,676	6,154	8,090	14,244	13,208	31,712	44,920
1931	7,867	22,195	30,062	4,698	6,912	11,010	12,555	29,107	41,662

* Russian production excluded.

TABLE 22. PERSONS' INDEX NUMBERS OF PHYSICAL PRODUCTION IN THE UNITED STATES, 1860 TO 1930*

Year	Production of crops	Production of minerals	Production of manufactures	Total production	Year	Production of crops	Production of minerals	Production of manufactures	Total production
1860		2.4			1896	75.7	36.2	47.2	56.5
1861		2.9			1897	76.7	38.7	53.0	60.3
1862	19.5	3.1			1898	83.4	43.0	57.3	65.5
1863	15.4	3.5	7.5	10.0	1899	80.4	48.5	60.4	66.7
1864	16.4	3.8	8.7	11.1	1900	80.9	51.3	61.0	67.4
1865	22.3	4.0	8.5	13.1	1901	71.8	55.6	67.0	68.1
1866	24.4	4.7	11.4	15.6	1902	91.4	59.5	73.7	70.0
1867	26.5	4.8	11.8	16.5	1903	84.4	65.5	74.0	77.5
1868	27.9	5.1	11.5	17.5	1904	93.3	66.1	73.7	80.2
1869	29.3	5.3	14.0	18.9	1905	94.5	78.4	86.4	88.7
1870	32.1	5.5	13.7	19.7	1906	100.5	80.0	91.8	94.1
1871	28.6	6.7	14.9	19.2	1907	90.4	90.2	91.2	90.8
1872	31.8	7.5	18.3	22.3	1908	95.5	74.8	76.1	83.0
1873	31.8	8.7	17.9	22.2	1909	96.4	89.1	93.6	94.3
1874	30.0	8.4	17.5	21.3	1910	96.1	98.1	96.0	97.4
1875	38.4	8.4	16.9	24.0	1911	93.9	97.2	92.4	93.3
1876	38.0	8.3	16.9	23.0	1912	111.7	104.1	106.9	108.3
1877	41.5	9.8	19.1	26.4	1913	99.0	111.7	111.1	106.7
1878	45.0	10.1	20.0	28.2	1914	111.5	105.8	102.1	105.8
1879	47.1	11.5	21.7	30.1	1915	117.4	112.9	114.1	115.2
1880	51.0	13.1	27.0	34.5	1916	192.7	126.7	130.0	123.3
1881	41.5	15.1	27.4	31.4	1917	109.1	135.7	137.1	126.8
1882	53.3	17.4	30.9	37.9	1918	110.0	136.2	134.8	125.9
1883	52.5	19.2	30.6	37.5	1919	112.0	120.0	131.7	123.6
1884	56.7	18.4	30.8	39.1	1920	122.3	137.3	139.7	133.1
1885	57.1	17.8	29.7	38.6	1921	101.1	109.0	108.1	105.7
1886	54.9	20.4	35.2	41.0	1922	112.2	118.8	143.1	130.0
1887	53.3	22.8	36.6	41.5	1923	113.0	163.2	160.8	148.7
1888	60.8	24.8	37.3	44.8	1924	110.9	151.2	156.4	139.6
1889	63.7	26.2	41.5	48.2	1925	114.2	156.0	175.1	161.7
1890	55.8	30.2	44.3	47.2	1926	116.2	169.5	178.7	155.5
1891	70.4	31.0	48.4	55.0	1927	115.5	168.3	173.9	152.5
1892	60.3	33.3	48.6	51.6	1928	121.0	167.0	181.5	158.7
1893	61.4	30.8	43.0	48.7	1929	114.4	179.0	182.9	163.6
1894	60.5	29.7	42.2	47.8	1930	106.2	154.7	153.3	136.4
1895	70.3	35.8	51.4	57.1					

* Persons, W. M. Forecasting business cycles, p. 170. 1931.

APPENDIX

TABLE 23. EQUATIONS OF RATES OF CHANGE*

Period	Equation, $y = ar^x$	Period	Equation, $y = ar^x$
United States:		United States (continued):	
Population:		Variable group weights:	
1839-1914.....	$y = 16.14 (1.023)^x$	1839-1914.....	$y = 4.14 (1.040)^x$
1915-1929.....	$y = 27.52 (1.015)^x$	1839-1920.....	$y = 4.30 (1.039)^x$
1915-1930.....	$y = 27.62 (1.015)^x$	1839-1930.....	$y = 4.80 (1.037)^x$
Production:		1880-1896.....	$y = 5.33 (1.035)^x$
Food and feed crops:		1897-1913.....	$y = 5.50 (1.036)^x$
1839-1914.....	$y = 10.80 (1.030)^x$	1915-1920.....	$y = 15.60 (1.021)^x$
1915-1929.....	$y = 59.34 (1.006)^x$	1915-1930.....	$y = 19.21 (1.019)^x$
Food and feed crops, adjusted for horses and mules:		Variable group weights plus value added by manufacture:	
1915-1919.....	$y = 124.73 (0.996)^x$	1839-1914.....	$y = 3.43 (1.043)^x$
1915-1929.....	$y = 38.26 (1.012)^x$	1915-1929.....	$y = 15.38 (1.021)^x$
1920-1929.....	$y = 37.78 (1.012)^x$	Production per capita:	
Total crops:		Food and feed crops per capita:	
1839-1914.....	$y = 10.63 (1.030)^x$	1839-1900.....	$y = 63.44 (1.009)^x$
1915-1929.....	$y = 47.53 (1.009)^x$	1839-1914.....	$y = 66.31 (1.007)^x$
1915-1930.....	$y = 55.37 (1.007)^x$	1901-1914.....	$y = 123.46 (0.998)^x$
Total crops, adjusted for horses and mules:		1915-1919.....	$y = 464.27 (0.982)^x$
1915-1929.....	$y = 32.73 (1.013)^x$	1915-1920.....	$y = 217.09 (0.991)^x$
1915-1930.....	$y = 38.33 (1.011)^x$	1920-1929.....	$y = 258.14 (0.990)^x$
Forest products:		Food and feed crops per capita, adjusted for horses and mules:	
1839-1907.....	$y = 8.95 (1.041)^x$	1915-1929.....	$y = 139.06 (0.997)^x$
1915-1929.....	$y = 62.15 (1.006)^x$	Total crops per capita:	
Electric current:		1839-1914.....	$y = 65.29 (1.008)^x$
1882-1914.....	$y = 0.0001 (1.184)^x$	1915-1929.....	$y = 172.76 (0.994)^x$
1915-1929.....	$y = 0.01 (1.117)^x$	Total crops per capita, adjusted for horses and mules:	
Water power other than electric:		1915-1929.....	$y = 118.01 (0.999)^x$
1849-1909.....	$y = 22.96 (1.017)^x$	Forest products per capita:	
1919-1928.....	$y = 9.99 (1.026)^x$	1915-1929.....	$y = 225.81 (0.991)^x$
Coal:		Coal per capita:	
1839-1914.....	$y = 1.37 (1.062)^x$	1839-1914.....	$y = 8.42 (1.039)^x$
1915-1929.....	$y = 124.63 (0.997)^x$	1915-1929.....	$y = 452.93 (0.983)^x$
Other fuel:		Other fuel per capita:	
1866-1914.....	$y = 0.03 (1.100)^x$	1860-1914.....	$y = 0.15 (1.077)^x$
1915-1929.....	$y = 0.02 (1.101)^x$	1915-1929.....	$y = 0.07 (1.085)^x$
Fuel and power:		All minerals, fuel, and power, per capita:	
1839-1914.....	$y = 0.74 (1.060)^x$	1839-1914.....	$y = 3.25 (1.041)^x$
1915-1929.....	$y = 1.49 (1.048)^x$	1915-1929.....	$y = 8.40 (1.028)^x$
Other minerals:		Total basic production, variable group weights:	
1839-1914.....	$y = 0.41 (1.072)^x$	1839-1914.....	$y = 25.43 (1.017)^x$
1915-1929.....	$y = 10.14 (1.026)^x$	1866-1914.....	$y = 22.31 (1.020)^x$
Secondary metals:		1880-1896.....	$y = 30.32 (1.014)^x$
1915-1929.....	$y = 0.35 (1.066)^x$	1897-1913.....	$y = 26.83 (1.017)^x$
Other minerals and secondary metals:		1915-1929.....	$y = 56.68 (1.006)^x$
1839-1914.....	$y = 0.32 (1.070)^x$	World:	
1915-1929.....	$y = 4.13 (1.036)^x$	Population:	
All minerals, fuel, and power:		1840-1914.....	$y = 43.35 (1.011)^x$
1839-1914.....	$y = 0.53 (1.064)^x$	1916-1927.....	$y = 80.40 (1.004)^x$
1915-1929.....	$y = 2.33 (1.043)^x$	Total basic production:	
Total basic production, constant group weights:		1865-1914.....	$y = 23.83 (1.032)^x$
1839-1914.....	$y = 5.96 (1.036)^x$	1880-1896.....	$y = 20.93 (1.027)^x$
1839-1920.....	$y = 6.21 (1.035)^x$	1897-1913.....	$y = 24.66 (1.031)^x$
1839-1930.....	$y = 6.85 (1.032)^x$	Production per capita, total basic:	
1915-1929.....	$y = 16.06 (1.021)^x$	1865-1914.....	$y = 25.98 (1.019)^x$
1915-1930.....	$y = 19.49 (1.018)^x$	1880-1896.....	$y = 36.85 (1.012)^x$
Constant group weights plus value added by manufacture:		1897-1913.....	$y = 29.46 (1.017)^x$
1839-1914.....	$y = 4.80 (1.038)^x$		
1915-1929.....	$y = 14.58 (1.022)^x$		

* The equations are based on the index numbers of physical volume of production (1926-30 = 100, tables 1 and 2, pages 5 and 8), except for index numbers of world population and world production (1910-14 = 100, table 3, page 22).

BIBLIOGRAPHY

- [ANONYMOUS] Indexes of trade and production. Federal Reserve bul. 8: 292-296. 1922.
- Revised indexes of industrial activity. Federal Reserve bul. 10: 183-188. 1924 a.
- Index numbers of agricultural exports. U. S. Agr. Dept. Foreign crops and markets 9: 236-237. 1924 b.
- Index numbers of mass crop production. U. S. Agr. Dept. Crops and markets 1, Suppl. 12: 399. 1924 c.
- Memorandum on production and trade. League of Nations, Economic and Financial Section, 1929, II.53. 1926.
- Memorandum on production and trade, 1913 and 1923-1926. League of Nations, Economic and Financial Section, 1928, II.3. 1928.
- Memorandum on production and trade, 1913 and 1923-1927. League of Nations, Economic and Financial Section, 1929, II.13. 1929 a.
- Recent economic changes in the United States. Nat. Bur. Econ. Research. Pubs. 13²: 454, 635. 1929 b.
- Der Hausratindex des Instituts für Wirtschaftbeobachtung. Markt der Fertigware 1: 42-53, 107-123, 254-284. 1929 c.
- [Same.] Markt der Fertigware 2: 10-17. 1930 a.
- Memorandum on production and trade, 1923 to 1928-1929. League of Nations, Economic and Financial Section, 1930, II.8. 1930 b.
- Wskozniki produkeji przemyslowej w latach, 1922-1924. Konjunktura Gospodareza 4: 112-117. 1931 a.
- Twelve years of the economic statistics of Canada. Dominion Statistics Bur. Mo. rev. Canad. business statistics, Suppl., November, 1931, p. 18-19. 1931 b.
- Memorandum on production and trade, 1925 to 1929-1930. League of Nations, Economic and Financial Section, 1931, II.A.19. 1931 c.

- Review of world trade 1930. League of Nations, Economic and Financial Section, 1931, II. A. 28/I. 1931 d.
- Industrielle Produktion. Vierteljahrshefte zur Konjunkturforschung 6³: 35-37. 1931 e.
- Review of world production, 1925-1931. League of Nations, Economic and Financial Section, 1932, II.A.13. 1932.
- ARNOLD, JOHN R. The trend of consumption in the United States: Index for consumer goods. *Annalist* 32: 472-473. 1928.
- BACCI, RICCARDO. Sulla costruzione di barometri economici in Italia. *Annali di economia* 4: 279-307. 1928.
- BENHAM, FREDERIC C. The prosperity of Australia; an economic analysis, p. 1-276. 1928.
- BURNS, ARTHUR F. The measurement of the physical volume of production. *Quart. journ. econ.* 44: 242-262. 1930.
- CRACCO, F. Un indice de la production industrielle Belge de 1897 à 1930. *Inst. Sci. Econ. Bul.* 2(4): 367-412. 1931.
- DAY, EDMUND E. An index of the physical volume of production. *Rev. econ. statis.* 2: 246-259, 287-289. 1920.
- The measurement of variations in the national real income. *Amer. Statis. Assn. Quart. pub.* 17: 552-559. 1920-21.
- An index of the physical volume of production. *Rev. econ. statis.* 3: 19-22. 1921.
- The volume of production of basic materials in the United States, 1909-21. *Rev. econ. statis.* 4: 215-230. 1922.
- The physical volume of production in the United States for 1922. *Rev. econ. statis.* 5: 196-211. 1923.
- The physical volume of production in the United States for 1923. *Rev. econ. statis.* 6: 193-204. 1924.
- DAY, EDMUND E., AND PERSONS, WARREN M. An index of the physical volume of production. *Rev. econ. statis.* 2: 309-337. 1920.
- DAY, EDMUND E., AND THOMAS, WOODLIEF. The growth of manufactures, 1899 to 1923. U. S. Census Bur. Census monograph 8: 1-205. 1928.

- DESSIRIER, JEAN. Indices comparés de la production industrielle et de la production agricole en divers pays de 1870 à 1928. *Bul. statis. gén. France* 18: 65-111. 1928.
- La production industrielle. *Rev. écon. polit.* 43: 591-604. 1929.
- ELLSWORTH, D. W. Revision of the index of business activity. *Annalist* 33: 388, 396. 1929.
- ELSAS, MORITZ. Wohlstandsindex und sozialer Wohlstand. *Archiv Sozialwissenschaft und Sozialpolitik* 60: 86-102. 1928.
- FISHER, I. The purchasing power of money, p. 1-505. (Reference on p. 478.) 1920.
- HO, F. L. Index numbers of quantities of imports and exports and of the barter terms of trade in China, 1867-1928. *Chinese econ. journ.* 7: 1013-1041. 1930.
- JOY, ARYNESS. Index of production of manufactures derived from census data, 1927. *Amer. Statis. Assn. Journ.* 25: 453-459. 1930.
- KEMMERER, EDWIN WALTER. Money and credit instruments in their relation to general prices. *Cornell studies in history and political science* 1: 1-160. 1909.
- Inflation. *Amer. econ. rev.* 8: 247-269. 1918.
- High prices and deflation, p. 1-86. 1920.
- KING, W. I. Is production keeping pace with population? *Bankers Statis. Corp. Special service* 2¹²: —. August 24, 1920.
- KUZNETS, SIMON. Retardation of industrial growth. *Journ. econ. and business history* 1(1928-29): 534-560. 1929.
- LEONARD, WILLIAM E. An index of changes in extractive industries. *Amer. Statis. Assn. Pubs.* 13(1912-13): 539-550. 1914.
- LIND, ERWIN. Die Statistik der Umsatzsteuerveranlagung als Erkenntnisquelle für die Berechnung eines "Index des Massenverbauchs." *Jahrb. Nationalökonomie und Statistik* 130: 896-900. 1929.
- MCLEOD, A. S. The index of manufactures, 1875-1899 and 1863-1874. *In Forecasting business cycles*, by W. M. Persons, p. 174. 1931.
- MAIWALD, K. Pokus o provisorní sestavení indexu průmyslové výroby. *C. SR Stat. Obzor.* 12(9-10): 602-639. 1931.

- MARTIN, J. W. The current economic progress of Kentucky. *Kentucky prog. mag.* 3: 11, 43-44. 1930.
- MATTHEWS, ADA M. The physical volume of production in the United States for 1924. *Rev. econ. statis.* 7: 208-216. 1925.
- MAXWELL, W. FLOYD. The physical volume of production in the United States for 1925. *Rev. econ. statis.* 8: 144-152. 1926.
- The physical volume of production in the United States for 1926. *Rev. econ. statis.* 9: 142-150. 1927.
- The revised index of the volume of manufacture. *Rev. econ. statis.* 11: 68-109. 1929 a.
- The revised index of the volume of mining. *Rev. econ. statis.* 11: 128-148. 1929 b.
- MICHELL, H. An index of the physical volume of production in Canada. *Rev. econ. statis.* 9: 69-73. 1927.
- An index of physical volume of production in Canada. *Amer. Statis. Assn. Journ.* 24(n. s. 165A, Proc.): 167-170. 1929.
- MITCHELL, WESLEY C. History of prices during the war. War Industries Board. *Price bul.* 1: 1-95. (Reference on p. 45.) 1919.
- MYERS, MARGARET G. Monthly production of pig iron, 1884 to 1903. *Amer. Statis. Assn. Journ.* 18: 247-249. 1922-23.
- PENHOUSE, E. F. Food supplies and raw materials of Japan. 1930.
- PERRY, F. GARDINER, AND SILVERMAN, A. G. A new index of the physical volume of Canadian business. *Amer. Statis. Assn. Journ.* 24: 127-143. 1929.
- PERSONS, WARREN M. Construction of a business barometer based upon annual data. *Amer. econ. rev.* 6: 739-769. 1916.
- An index of trade for the United States. *Rev. econ. statis.* 5: 71-78. 1923.
- Statistical and chronological records, 1875-1930. *Barron's financial weekly* 10⁵²: 3, 7. 1930.
- [Same.] *Barron's financial weekly* 11²: 12-13. 1931 a.
- [Same.] *Barron's financial weekly* 11³: 8-9. 1931 b.

- Forecasting business cycles, p. 86, 170, 180, 182, 188. 1931 c.
- PERSONS, WARREN M., AND FRICKEY, EDWIN. Production, prices, and aggregate values of crops. *Rev. econ. statis.* 3:34-36. 1921.
- PERSONS, WARREN M., AND MATTHEWS, ADA M. The production of electricity as an index of the physical volume of business. *Rev. econ. statis.* 10:196-201. 1928.
- ROKELING, G. D. A British index of national prosperity. *Economist* 107, Suppl., Oct. 6, 1928:1-8. 1928.
- RORTY, M. C. The statistical control of business activities. *Harvard business rev.* 1:154-166. 1922-23.
- ROWE, J. W. F. The physical volume of production. London and Cambridge Econ. Service. Special memorandum no. 8:1-32. 1924.
- An index of the physical volume of production. *Econ. journ.* 37:173-187. 1927.
- SERING, MAX, SCHINDLER, A., AND LEROH, RUD. Internationale Preisbewegung und Lage der Landwirtschaft in den aussertropischen Ländern, p. 22. 1929.
- SNYDER, CARL. A new index of the volume of trade. *Amer. Statis. Assn. Journ.* 18:949-963. 1922-23.
- A new clearings index of business activity for fifty years. *Amer. Statis. Assn. Journ.* 19:329-335. 1924.
- The revised index of the volume of trade. *Amer. Statis. Assn. Journ.* 20:397-404. 1925.
- The index of volume of trade: Second revision. *Amer. Statis. Assn. Journ.* 23:154-163. 1928.
- New measures of the relations of credit and trade. *Acad. Polit. Sci. Proc.* 13⁴:16-34. 1930.
- Overproduction and business cycles. *Acad. Polit. Sci. Proc.* 14³:5-31. 1931.
- SNYDER, CARL, AND PISER, LEROY M. The index of the volume of trade: Third revision. *Amer. Statis. Assn. Journ.* 26:436-442. 1931.

- STEWART, WALTER W. An index number of production. *Amer. econ. rev.* 11:57-70. 1921.
- THOMAS, WOODLIEF. British production indexes. *Amer. Statis. Assn. Journ.* 20:413-416. 1925.
- Construction of an index number of production. *Amer. Statis. Assn. Journ.* 22:315-330. 1927.
- TOLLES, N. A., AND DOUGLAS, P. H. A measurement of British industrial production. *Journ. political econ.* 38:1-28. 1928.
- VALK, WILLEM L. The importance of an index of specific relative growth of industries. *Amer. Statis. Assn. Journ.* 25:82-83. 1930.
- VANDERBLUE, HOMER B., AND CRUM, WILLIAM L. The relation of a public utility to the business cycle. *Harvard business rev.* 2:409-420. 1923-24.
- [Same.] *Harvard business rev.* 3:8-19. 1924-25.
- WAGENFÜHR, ROLF. Die Vergleichbarkeit von Produktions- und Beschäftigungsstatistiken. *Jahrb. Nationalökonomie und Statistik* 134:108-113. 1931.
- WARREN, G. F. Prices of farm products in the United States. U. S. Agr. Dept. Bul. 999:1-72. (Reference on p. 6.) 1921.
- WARREN, G. F., AND PEARSON, F. A. Physical volume of production in the United States. *Farm econ.*, no. 74:1678-1685. 1932.
- Physical volume of production. *In* Prices, chapter 3. (To be published in 1933.)