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Chapter 3

The Output of Individual Products

As was indicated by the trend measures given in the preceding chapter, there has been wide diversity in the development of the different groups and individual products of American agriculture since 1899. Most products have expanded in volume, though at varying rates, but some have actually declined. Limited by two extremes—citrus fruit, with the greatest increase, and hay, with the largest decline—the products have each followed a distinctive pattern of output, changes in which can be detected even from year to year.

In Chapter 2 we tried to summarize the behavior of each group by means of a few simple trend values, comparing the ranks with reference only to two periods, an initial and a final one. Here we shall consider the year-by-year course of each group and of a number of individual products, and at the same time suggest explanations for the diversity of movement so clearly evidenced by Tables 5 and 6.

GRAINS

As a concentrated source of carbohydrates the grains are unsurpassed among foodstuffs. According to our estimates, presented in Chapter 4 below, the grains used for human food alone have supplied, on the average, around 50 percent of the total carbohydrates consumed by the population of the United States during the last two decades, or, in terms of calorific value, somewhat less than one third of the total food supply. They resemble one another not only in regional distribution and methods of cultivation, but also in ultimate destination.

TABLE 5

INDEXES OF OUTPUT FOR SELECTED GROUPS AND PRODUCTS, 1897–1939[a]

1929:100

Year	Combined Index	Grains	Potatoes and Related Products	Hay	Cotton	Tobacco	Sugar Crops	Wool	Meat Animals	Poultry and Eggs	Milk and Milk Products	Fruit, Non-citrus	Fruit, Citrus	Oil Crops	Truck Crops	Tree Nuts
1897	66.0	85.7	55.1	380	70.6	45.9	60.3	69.7	75.9	46.8	51.9	77.7	14.5	42.5	..	..
1898	69.5	99.9	66.9	413	74.4	59.3	59.3	72.9	77.0	47.3	53.9	58.1	9.9	51.3	..	..
1899	69.5	91.8	71.0	370	61.5	56.8	37.2	75.5	82.6	48.8	54.3	82.9	16.6	54.8	..	..
1900	70.1	87.2	69.5	353	66.1	55.6	67.4	82.6	81.0	52.5	54.8	96.4	20.9	50.2	..	..
1901	68.8	90.8	58.2	350	64.1	57.8	78.5	84.4	79.3	52.9	55.7	66.9	20.1	70.0	..	..
1902	71.8	102.9	79.0	380	70.9	62.6	89.2	87.0	76.2	52.6	51.1	100.6	22.6	79.3	..	..
1903	72.5	93.6	75.8	407	66.2	63.7	77.3	77.9	79.9	56.2	58.6	92.7	29.8	71.6	..	..
1904	75.7	87.7	93.0	420	88.5	55.9	99.0	79.4	79.7	57.2	58.8	106.8	32.7	71.0	..	..
1905	75.3	104.5	83.3	427	70.4	61.3	103.7	80.5	82.6	60.0	57.8	66.4	33.7	74.3	..	..
1906	81.7	107.4	92.4	390	88.2	63.5	108.3	81.4	84.8	66.9	60.1	101.1	36.0	83.0	..	..
1907	76.3	89.7	90.6	420	72.4	57.8	119.4	81.4	85.2	69.5	60.9	65.4	36.7	63.9	..	..
1908	78.1	91.5	85.8	447	87.6	54.5	116.9	85.8	85.5	65.9	59.6	76.4	47.2	76.2	..	..
1909	77.4	102.3	104.2	433	67.2	68.8	111.3	91.1	79.0	67.5	62.8	77.0	44.1	70.5	..	..
1910	79.4	96.9	94.9	400	78.7	74.5	119.9	89.9	82.1	72.6	62.9	78.4	54.4	73.7	..	..
1911	81.5	85.4	85.2	327	105.0	61.4	138.9	88.7	83.5	75.8	63.1	98.5	49.5	91.7	..	..
1912	85.6	109.3	105.5	410	92.2	72.9	112.7	81.9	84.2	73.7	65.7	114.3	36.6	98.9	..	..
1913	82.8	91.0	91.1	353	95.5	64.7	130.0	78.9	88.3	73.4	66.8	79.0	62.5	92.4	..	..
1914	89.6	109.5	96.8	357	109.3	67.6	116.0	74.6	91.0	73.8	68.2	122.3	66.4	102.9	..	..
1915	89.9	125.4	94.9	360	76.3	75.5	116.1	71.7	94.4	76.6	69.4	117.4	62.3	80.8	..	..
1916	82.3	86.0	76.9	367	78.8	78.7	134.9	72.5	95.2	74.0	70.4	97.5	70.3	85.5	..	..

[a] Data relate to crop years in the case of crops, calendar years in the case of livestock and livestock products. See Appendix A.

TABLE 5 (concluded)

Year	Combined Index	Grains	Potatoes and Related Products	Hay	Cotton	Tobacco	Sugar Crops	Wool	Meat Animals	Poultry and Eggs	Milk and Milk Products	Fruit, Non-citrus	Fruit, Citrus	Oil Crops	Truck Crops	Tree Nuts
1917	85.9	100.9	110.4	303	77.2	86.5	129.8	70.5	94.5	72.4	73.1	94.9	35.5	84.3	..	..
1918	90.2	109.9	101.4	280	82.0	94.2	136.2	75.6	100.0	74.5	75.7	90.9	68.8	88.9	53.7	..
1919	87.1	114.5	90.2	290	77.3	94.2	107.6	80.2	90.5	78.3	73.4	91.6	74.0	73.1	49.4	96.3
1920	90.0	122.6	101.6	267	89.6	98.5	130.9	74.9	86.8	76.4	76.7	102.8	92.6	79.3	59.9	45.8
1921	81.9	108.1	92.0	227	54.0	65.6	126.4	72.3	89.6	80.4	77.2	66.7	69.3	59.8	50.3	73.8
1922	90.3	107.9	110.2	233	65.7	81.8	98.5	68.3	100.4	85.6	79.6	115.2	90.0	62.8	64.8	56.6
1923	91.9	105.0	103.5	223	68.1	99.0	99.9	68.9	102.7	90.4	81.5	111.4	111.0	68.8	63.3	92.4
1924	94.9	106.1	99.2	203	91.9	81.2	94.7	71.5	95.9	89.6	86.8	104.3	90.9	103.0	74.8	71.6
1925	95.8	100.6	86.8	173	108.8	89.8	96.5	76.2	91.8	91.5	88.8	100.2	103.7	107.9	85.3	97.8
1926	101.3	104.4	93.5	147	121.9	84.1	93.7	81.6	95.9	97.4	92.6	134.1	117.7	113.6	81.5	103.4
1927	98.2	110.8	105.1	147	87.8	79.0	96.5	87.6	98.6	101.2	95.0	95.8	96.9	100.6	85.4	113.1
1928	102.4	116.6	109.1	117	98.1	89.6	94.0	95.9	99.6	98.3	97.0	124.7	154.6	102.8	87.8	103.0
1929	100.0	100.0	100.0	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1930	100.4	90.3	100.6	73	93.9	107.5	115.2	107.2	100.0	103.0	101.8	111.7	162.9	100.8	103.6	92.9
1931	104.0	94.9	109.9	77	114.9	102.1	104.6	114.4	104.2	98.7	104.5	129.0	144.9	110.9	93.9	119.8
1932	100.0	94.3	111.8	80	87.8	66.4	119.1	106.5	105.9	98.0	105.0	102.4	145.1	94.6	91.0	129.3
1933	97.4	66.8	104.1	77	87.4	89.5	136.0	113.0	109.7	97.7	105.1	104.3	136.3	80.6	87.3	108.7
1934	83.5	44.8	112.3	63	65.4	70.6	110.6	111.5	80.2	91.6	102.5	95.9	191.4	76.3	100.4	108.4
1935	92.2	77.7	115.8	77	72.1	84.6	120.2	110.0	86.1	90.8	102.9	122.4	154.9	97.5	106.4	156.8
1936	93.0	59.0	97.3	63	84.4	75.4	128.0	108.6	97.1	97.2	104.8	93.9	171.0	102.2	109.1	98.5
1937	106.3	104.7	119.1	73	128.3	102.0	129.9	110.5	91.7	95.9	105.3	136.3	216.0	138.5	115.9	170.8
1938	105.4	111.5	113.7	80	81.1	89.8	154.0	112.4	100.0	98.7	108.5	107.0	247.4	115.3	118.2	132.1
1939	110.7	107.0	110.6	77	80.1	120.6	143.3	114.9	111.3	104.9	109.1	127.5	237.5	128.8	118.9	156.6

TABLE 6

INDEXES OF OUTPUT FOR SELECTED GROUPS AND PRODUCTS, FIVE-YEAR MOVING AVERAGES, 1899–1937

1897–1901: 100

Year	Combined Index	Grains	Potatoes and Related Products	Hay	Cotton	Tobacco	Sugar Crops	Wool	Meat Animals	Poultry and Eggs	Milk and Milk Products	Fruit, Non-Citrus	Fruit, Citrus	Oil Crops
1899	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1900	101.7	103.7	107.5	100.0	100.1	106.0	109.6	104.5	100.0	102.2	99.8	106.0	109.7	113.6
1901	102.6	102.4	110.3	99.6	97.8	107.6	115.5	105.8	100.8	105.8	101.5	115.1	134.1	121.2
1902	104.4	101.4	117.2	102.3	105.8	107.3	136.0	106.9	100.0	109.3	103.1	121.3	153.6	127.1
1903	105.9	105.3	121.5	106.2	107.0	109.3	148.1	106.2	100.4	112.3	104.3	113.5	169.4	136.1
1904	109.6	108.9	132.1	108.4	114.1	111.4	157.9	105.5	101.8	117.9	105.9	122.4	188.9	140.9
1905	110.9	106.0	135.7	110.5	114.6	109.6	167.8	104.0	104.2	124.7	109.6	113.2	206.0	135.3
1906	112.6	105.6	138.8	112.7	121.0	106.4	180.8	106.1	105.6	128.6	110.0	108.9	227.3	137.0
1907	113.1	108.8	142.4	113.4	114.7	111.1	185.0	109.1	105.4	132.8	111.3	101.2	240.7	136.8
1908	114.3	107.1	146.0	112.0	117.1	115.8	190.2	111.6	105.2	137.8	113.3	104.3	266.3	136.6
1909	114.2	102.3	143.7	108.6	122.1	115.1	200.5	113.5	104.9	141.4	114.4	103.5	282.8	139.8
1910	116.9	106.6	148.4	108.0	127.9	120.5	198.3	113.6	104.7	143.1	116.1	116.4	282.1	152.8
1911	118.3	106.5	150.1	103.0	130.3	124.3	202.6	111.8	105.3	146.1	118.7	117.0	301.0	158.7
1912	121.8	108.0	147.7	98.9	142.8	123.8	204.1	107.5	108.3	148.5	120.7	128.9	328.5	170.8
1913	124.9	114.3	147.7	96.8	142.2	124.1	203.0	102.9	111.5	150.1	123.1	139.1	338.2	173.4
1914	125.1	114.5	145.1	98.9	134.3	130.5	201.7	98.7	114.4	149.5	125.9	138.9	363.2	171.2
1915	125.2	112.6	146.6	93.2	129.9	135.4	207.3	95.7	117.0	148.9	128.7	133.8	362.0	165.8
1916	127.4	116.8	150.0	89.3	125.9	146.1	209.3	94.8	119.9	149.5	132.0	136.9	369.9	164.5

TABLE 6 (concluded)

Year	Combined Index	Grains	Potatoes and Related Products	Hay	Cotton	Tobacco	Sugar Crops	Wool	Meat Animals	Poultry and Eggs	Milk and Milk Products	Fruit, Non-Citrus	Fruit, Citrus	Oil Crops
1917	126.6	117.9	147.7	85.7	116.3	155.7	206.4	96.2	119.8	151.3	133.8	128.8	379.0	153.3
1918	126.7	117.2	149.9	80.7	120.4	164.1	211.4	97.1	117.9	151.1	136.6	125.0	415.6	152.8
1919	126.5	122.1	154.6	73.2	112.9	159.3	208.6	97.0	116.5	153.7	139.0	117.0	414.4	143.3
1920	127.8	123.6	154.6	69.5	109.5	157.7	198.2	96.5	118.1	159.2	141.4	122.3	480.8	135.3
1921	128.3	122.5	155.2	66.4	105.3	159.3	186.3	94.7	118.7	165.4	143.6	127.6	532.6	127.9
1922	130.6	120.6	158.0	61.8	109.8	154.6	182.0	92.5	120.1	170.0	148.6	131.0	553.3	138.8
1923	132.3	115.8	153.4	56.8	115.5	151.5	170.6	92.7	121.3	176.1	153.0	130.4	566.7	149.6
1924	137.9	115.0	153.8	52.5	135.7	158.3	159.8	95.2	122.9	182.9	158.8	147.9	625.2	169.5
1925	140.2	115.7	152.3	47.9	142.2	157.2	159.2	100.1	122.5	189.1	164.5	142.9	633.8	183.6
1926	143.3	118.2	154.0	42.1	151.1	153.9	157.2	107.3	121.6	192.4	170.2	146.3	686.8	196.3
1927	144.7	116.9	154.3	36.6	153.5	160.6	159.0	114.5	122.7	196.6	175.0	145.3	698.4	195.2
1928	146.1	114.6	158.7	31.2	149.0	167.2	165.1	122.6	124.7	201.2	179.9	148.3	770.3	192.6
1929	146.9	112.5	163.8	27.5	147.0	173.7	168.6	131.2	126.9	201.8	184.3	146.9	803.2	191.4
1930	147.4	108.9	165.8	23.9	147.0	169.0	176.2	136.1	128.8	200.4	188.0	148.7	862.3	189.2
1931	145.9	98.0	164.3	21.8	143.8	169.0	190.1	140.5	131.3	200.2	190.9	143.3	839.7	181.0
1932	141.1	85.8	168.2	19.8	133.6	158.3	193.6	143.5	126.3	196.8	191.9	142.3	951.2	172.1
1933	138.7	83.1	172.9	20.0	127.0	149.9	195.2	144.3	122.7	192.0	192.2	145.0	941.5	171.0
1934	135.6	75.2	169.0	19.3	118.0	140.3	203.0	142.7	121.0	191.3	192.2	135.9	973.2	167.7
1935	137.4	77.5	171.1	18.9	130.0	153.2	206.4	143.8	117.3	190.3	192.4	144.6	1,060	184.0
1936	139.8	87.3	174.1	19.1	128.1	153.4	212.4	143.6	114.9	190.7	193.7	145.4	1,195	197.0
1937	147.7	101.0	173.6	19.8	132.5	171.5	223.3	144.5	122.7	196.2	196.1	153.7	1,251	216.5

Their share in farm output fell over four decades from nearly one fifth to about one eighth (Table 2). Together they account for over 60 percent of the country's total crop acreage, but furnish only one out of every ten dollars of gross farm income.

The grains group includes the following crops: wheat, rye, corn, oats, barley, flaxseed, rice and buckwheat.[1] These, in turn, may be divided into food grains and feed grains, although the lines separating the two classes are rather flexible and to some degree arbitrary. By far the largest portion of the feed grains is consumed on the farms where it is grown and thus never enters the "organized" market.[2] At the same time the retention of the various grains for use as feed is influenced by the prevailing market situation. None of the grains is used exclusively for human food or exclusively to feed animals; nevertheless some are used predominantly for the one purpose, some mainly for the other. Wheat, rice and rye are primarily the food grains; corn, oats, barley and, to an

[1] There seems to exist some doubt as to whether it is proper to include flaxseed and buckwheat in the group. In strict scientific usage the term cereal is restricted to members of the grass family whose fruits or seeds are farinaceous (i.e., can be ground into a mealy substance) and suitable for food. The term grains, in turn, properly refers only to the fruits of grasses so defined, but is often used as a synonym for cereal. In commercial usage, moreover, the term grains is broadened to include even such crops as beans, peas, lentils, etc.

Buckwheat, being an herb and not a grass, is therefore not a cereal proper, but its inclusion in the grains group may be justified by its utilization as a substitute for other grains. On the other hand, flaxseed, a cereal neither by plant classification nor by utilization, has often been included with grains because of regional affinity and similarities in its handling and marketing. N. Jasny, *Competition Among Grains* (Food Research Institute, Stanford University, 1940), p. 5, objects to the inclusion of flaxseed with grains, holding that the latter term should properly be confined to cereals. On the other hand, the inclusion of buckwheat, also not a cereal, is accepted by Jasny. It would seem that for our purposes these distinctions should not be given too much consideration. Flaxseed, for instance, we have included both in the grains and in the oil materials group (as already noted, the classification exemplified in Table 5 is intended to be neither exhaustive nor free from duplication), while buckwheat seems to fit into the grains group better than into any other.

[2] This portion, as explained in Chapter 1, is excluded from our indexes of output.

increasing degree, buckwheat, make up the feed group. Flaxseed stands alone as an industrial raw material. The approximate distribution of the gross output of each of the eight crops among seed, feed and net output is shown in Table 7. These figures suggest sharp increases, for the majority of grains, in the relative importance of feed utilization—a trend which reflects the expansion that has occurred in the output of dairy products.

TABLE 7

GRAINS

Percentage Distribution of Gross Output, 1897–1901 and 1935–39[a]

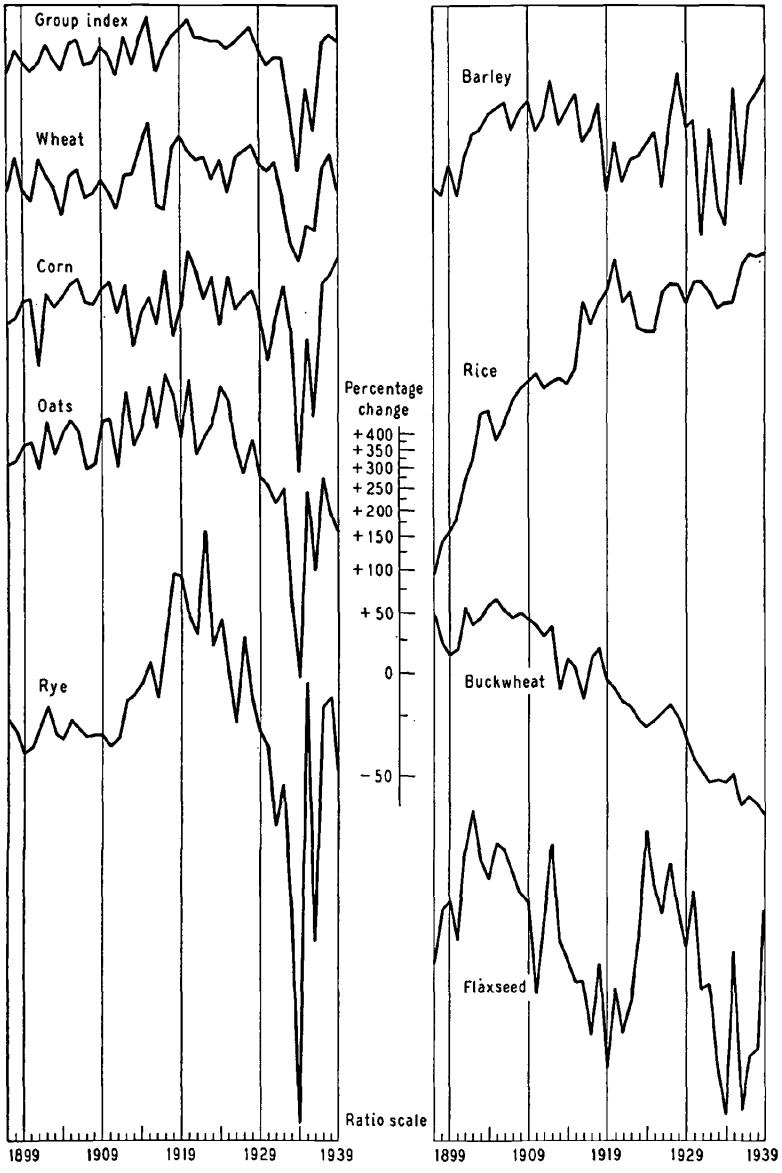
	1897–1901			*1935–39*		
Crop	Seed	Feed	Net Output	Seed	Feed	Net Output
Wheat	11.0	4.5	84.6	11.3	13.2	75.6
Corn	[b]	[b]	20.0	[b]	[b]	22.2
Oats	[b]	[b]	30.0	[b]	[b]	17.1
Rye	15.6	15.0	69.4	21.4	35.1	43.5
Barley	[b]	[b]	50.0	[b]	[b]	37.4
Rice	8.9	3.7	87.4	5.0	1.3	93.7
Buckwheat	6.2	30.0	63.8	5.8	54.3	39.9
Flaxseed	8.0	0	92.0	10.8	0	89.2

[a] Data for 1935–39 are estimates by the Department of Agriculture. Data for 1897–1901 were assembled by the authors from various sources (see Appendix A); in most cases they are only rough approximations.
[b] Not separately available.

Corn is raised in every state of the Union—Iowa, at the top of the scale, has more than 10 million acres in corn crops; Nevada and Rhode Island, at the bottom, have less than 10 thousand each. Nor is there a state in which oats are not raised. Wheat is grown in forty states, barley in thirty-six and rye in thirty-four. Although the grains are widely dispersed, some areas are far more important producers than others. To-

Chart 6

GRAINS: NET OUTPUT



For source and notes see Appendix D

day grain growing is centered in the North Central region:[3] on the average during the past decade this territory has been responsible for 85 percent of all rye production, 80 percent of oats, 70 percent of corn, and 60 percent of wheat. Today Iowa (oats and corn), Kansas (wheat), North Dakota (rye), and Minnesota (barley), are the principal producing states.

Table 8 shows, for grains as a group and for each separate crop, annual average rates of change for the periods before and after the war of 1914–18.[4] These data of course refer not to the whole crop, but to net output only.[5] The combined grain index shows an annual average rate of growth for the period 1897–1914 of 0.6 percent, whereas the post-war period is characterized by an average decline of 2.0 percent per annum. The grains group and hay, to which we shall turn later in this chapter, are the only groups whose rate of growth has not merely slackened but has actually turned into a decline.[6] Yet

[3] Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

[4] For the method used in these comparisons see above, pp. 33-37.

[5] As explained in Chapter 1, our production data should be adjusted to exclude the portion used for seed or fed to livestock without leaving the farm economy, i.e., to include only the part consumed by the farm family or sold to a nonfarm consumer. Provided that this could be done, it would leave us with production series which, in the case of the feed grains, would exclude most of the farm demand for feed. Unfortunately, it is rarely possible to determine even roughly the distribution of total sales from farms according to utilization. Thus, some transactions are undoubtedly farmer-to-farmer sales for feed or seed, and to that degree are included only because we lack the data required to eliminate them. Another portion represents sales to commercial feed and seed dealers and feed processing plants, a third part is sold for eventual human consumption and a fourth for nonfood industrial uses. Our aim is to include in the case of each crop only that portion which is sold "off farms," i.e., leaves agriculture—regardless of the purpose for which it is used thereafter. The technical difficulties involved in arriving at such "net output" series are discussed in the Notes to Table A-1, pp. 353-71. It is clear from the foregoing that our "net values" are identical with what is commonly designated as "gross income." In order to avoid the impression that the entire crop is referred to we have preferred not to use the term "gross."

[6] See Table 4 above: the production of meat animals also showed a negative trend for 1921–38, but of such negligible proportions that it hardly can be considered significant.

during the same period (1921–38) population grew roughly 20 percent, or a little more than 1 percent per annum.[7]

TABLE 8

GRAINS

Average Annual Rates of Change in Net Output, 1897–1914 and 1921–38[a]

Crop	*1897–1914*	*1921–38*
	(Percent)	
Wheat	+0.3	− 1.7
Corn	+0.4	− 2.0
Oats	+1.1	− 5.3
Rye	+1.2	−12.8
Barley	+3.1	+ 1.1
Rice	+6.6	+ 1.9
Buckwheat	−0.6	− 4.2
Flaxseed	−0.9	− 5.3
ALL GRAINS	+0.6	− 2.0

[a] The data in this table are computed in the same manner as, and afford a partial breakdown of material to be found in, Table 4.

For each crop the annual average rates of change for the two periods reveal considerable dispersion, but in each period those for wheat and corn are closest to the central tendency. This is to be expected, in view of the relative importance, in terms of value, of the several crops (Table 9). In all Census years but one (1909) wheat accounted for more than 50 percent of the total net value of the grains crop, and even in 1909 it contributed 50 percent. Corn, second in importance throughout the long period 1899–1937, contributed between 25 and 30 percent. Oats declined from 11 percent in 1899 to 6 percent in 1937, with barley, rice, flaxseed, and

[7] Over our entire period of study the net output of the grains as a whole showed on balance practically no change (Table 6 above). If a direct comparison is made between the average for 1897–1901 and the average for 1935–39, the net output of the group is found to have fallen by 0.3 percent. By contrast, the combined *gross* output of the eight grains expanded 7.2 percent. The difference between the two results reflects the increased use of grain for feed disclosed by Table 7 above.

buckwheat following in the order given. The main influence on the behavior of the group is to be found, therefore, in the production of wheat and corn.

TABLE 9

GRAINS

Percentage Contributions of Individual Crops to Total Net Value of Group[a]

Crop	*1899*	*1909*	*1919*	*1929*	*1937*
Wheat	54.1	50.0	58.2	53.0	56.9
Corn	25.3	29.0	25.2	29.4	27.3
Oats	11.0	11.6	7.3	7.2	6.0
Rye	1.4	1.2	2.8	1.3	1.5
Barley	3.7	4.1	2.0	3.1	4.2
Rice	1.0	1.4	3.4	2.8	2.9
Buckwheat	.6	.5	.3	.3	.2
Flaxseed	2.9	2.1	.8	2.9	1.1
ALL GRAINS	100.0	100.0	100.0	100.0	100.0

[a] Each figure represents the product of net output and average season farm price, expressed as a percentage of the sum of these products for all eight grains. See Table A-2, p. 372.

Wheat is predominantly and typically the food grain. The explanation for its declining trend (see Chart 6) must be sought in shrinking per capita consumption at home, aggravated by a receding demand for American wheat in markets formerly supplied by this country. There is abundant evidence of the influence of both factors.

The decline in per capita consumption of wheat flour is not a phenomenon confined to the years after 1918, even though the slackening in population growth, coupled with the loss of former markets, tends to create that impression. As early as 1926 it was pointed out [8] that per capita flour consumption had dropped over 21 percent between 1904 and 1923; yet these years witnessed no decrease in aggregate production, since population increased at a rate more than suffi-

[8] Holbrook Working, "The Decline in Per Capita Consumption of Flour in the United States," *Wheat Studies*, Vol. II (Food Research Institute, Stanford University, 1926), p. 265.

cient to offset the decline in per capita consumption. Recent data released by the Department of Agriculture indicate that between 1909–14 and 1935–39 per capita wheat flour consumption fell off by 26 percent.[9] This downward trend has been fairly persistent; it has been reversed occasionally, but never for more than one year at a time.

The decline in wheat consumption can be appreciated only as part of the general shift in the pattern of the nation's food supply during the past three or four decades. For this reason it becomes necessary at this point to refer to the general discussion of trends in food consumption contained in Chapter 4, below. The factors listed there go far toward interpreting the statistical picture encountered in this section of our analysis. They suggest, further, that the rate of decline shown for the post-war period is not due primarily to the severe damage wrought by the drought years, though no doubt those years of extreme depression—1930, 1934 and 1936—are a contributory cause. From the consumption trends alone, one might well guess that any recovery to former output levels is unlikely; even the maintenance of wheat production on its present scale seems by no means certain.

The consequences of declining per capita consumption at home have been aggravated by the disappearance of foreign markets and the emergence of powerful competitors abroad. To summarize a development whose roots reach down to the beginning of the century, and which has left in its wake one of the basic problems in agricultural adjustment that this country has had to face, we present Table 10 which shows the annual percentages of net wheat output represented by wheat exports (both grain and flour). If we divide the period at 1925, regarding the years following as the post-war period—and for the history of wheat exports this would be quite justified—we find that exports averaged 15.8 percent of net output for 1926–38, whereas for 1897–1925 exports av-

[9] See Appendix Table B-1.

TABLE 10

WHEAT[a]

Ratio of Exports to Net Output, 1897–1938

Year	*Percent*	*Year*	*Percent*
1897	38.4	1918	37.3
1898	31.8	1919	26.9
1899	33.2	1920	50.3
1900	41.5	1921	40.5
1901	34.0	1922	31.6
1902	33.0	1923	26.0
1903	21.3	1924	36.9
1904	9.6	1925	19.2
1905	16.1	1926	30.7
1906	22.7	1927	27.8
1907	30.7	1928	21.1
1908	20.7	1929	22.5
1909	14.5	1930	20.3
1910	12.7	1931	19.7
1911	16.1	1932	7.5
1912	22.9	1933	9.2
1913	23.2	1934	6.0
1914	42.6	1935	3.5
1915	27.3	1936	4.9
1916	39.8	1937	16.0
1917	26.4	1938	15.9

Source: Exports from U. S. Department of Agriculture, *Agricultural Statistics, 1940,* Table 1; net output from Appendix A. Data are for crop years.

[a] Grain and flour (converted to wheat equivalent).

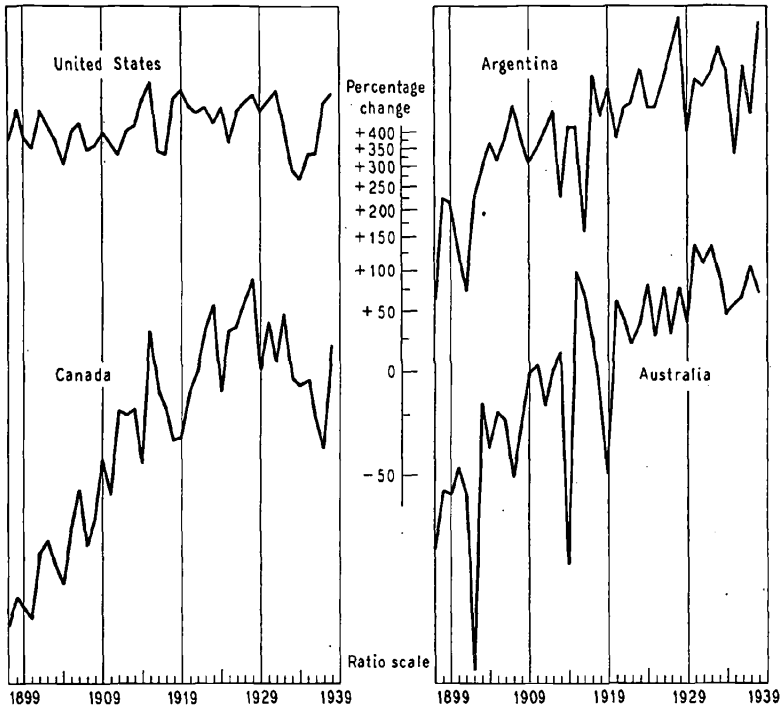
eraged 28.5 percent. Moreover the pre-war years for which amounts exported are low are years of weak yields (1904, 1911), or years immediately following such poor years (1917), or years of bumper crops (1915 and 1919) when the large quantities exported still amounted only to a small fraction of the total. In contrast, the proportion exported since 1925 has been low regardless of the size of the crop.

Increasing self-sufficiency in Europe and expanding production on the part of competing non-European countries have contributed to the shrinkage of wheat exports from the United States. Between 1909–13 and 1934–38 wheat output

in Europe rose almost 20 percent.[10] And Canada, which at the beginning of the century produced only about 56 million bushels a year—or one tenth of United States production—harvested during the 1920's close to 400 million bushels on the average—more than half of United States production—

Chart 7

WHEAT: GROSS OUTPUT IN VARIOUS COUNTRIES



For source and notes see Appendix D

and in each of the years 1928, 1939 and 1940 raised more than 500 million bushels. The story of Australia and Argentina resembles that of Canada on a smaller scale (see Chart 7). As a net result, the contribution of the United States to the

[10] Excluding the U.S.S.R.; M. K. Bennett, "Wheat and War, 1914–18 and Now," *Wheat Studies*, Vol. XVI (Nov. 1939), p. 84.

world's total wheat production [11] dropped from 29 percent at the turn of the century to 23 percent in the mid-1920's, and again to 20 percent by the late 1930's.

The decline in American wheat exports may be attributed primarily to agricultural protection on the continent of Europe, and, so far as the United Kingdom is concerned, to the preferential treatment it has accorded Canada and Australia for political, and Argentina for commercial, reasons. As long as the European farmer continues to be protected from outside competition, and the policy of Great Britain remains inspired by the chimera of Imperial self-sufficiency, it seems idle to expect any substantial or permanent recovery in the export of wheat by this country. And since the scale of wheat exports in the United States from one period to another is powerfully influenced by such matters, it seems probable that the days when one third of the wheat crop was regularly exported are gone forever.

Corn is put to a multitude of uses (see Chart 8) and for this reason the explanation of its declining volume is much more complicated than in the case of wheat. Although it has never been subject to the hazards of the export market and is affected only indirectly by the human consumption factor, it slumped at least as fast as wheat during the years following the first World War (Chart 6). During 1937–39, however, net corn output [12] was the highest ever attained in three successive crop years. In order to understand this development, we must first disentangle and appraise the large number of influences that operate upon the demand for corn. This is not an easy task; indeed the effort to follow corn products down the numerous channels through which they reach the consumer has caused much difficulty to seasoned statisticians. Of the roughly 2.5 billion bushels normally grown in this country,

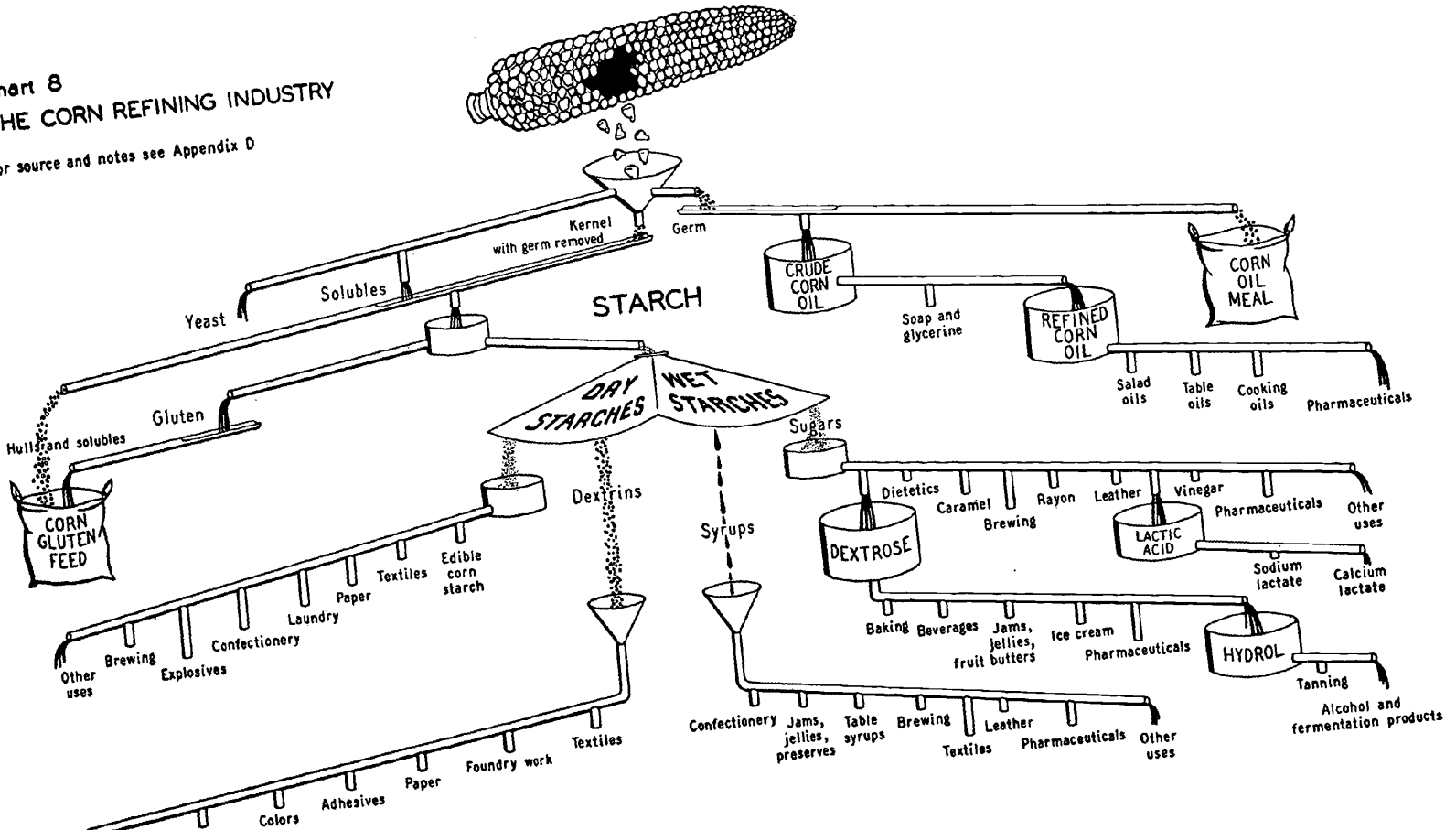
[11] Excluding the U.S.S.R. and China.

[12] We may remind the reader that net output excludes consumption for feed and seed: in the case of corn this is a particularly important reservation.

Chart 8

THE CORN REFINING INDUSTRY

For source and notes see Appendix D



some 10 to 20 percent is harvested for silage or "hogged off." Of the remainder about 1.5 billion bushels are harvested for grain and consumed as feed on the farm where grown. This leaves a balance of around 500 million bushels sold by growers, and it is this amount for which data on disposition are not readily available. From one source it is indicated that "about 9 percent of the domestic crop of 2½ to 3 billion bushels is used for all 'city' purposes, including the production of starch." [13] These 250 to 300 million bushels, then, may be taken to represent at least one half of the amount of corn reported as sold, and to include the basic material for the large variety of products emerging from both the dry- and the wet-milling processes.[14]

In all its commercial uses corn has to compete fiercely with a host of other products, agricultural and otherwise. Starch, for example, is easily obtained from a variety of other sources; so also are sirups, vegetable oils and other corn derivatives. Hence the extent to which corn enters the processing industries depends largely on its relative price. So far the absorption of corn in the wet-milling process has ranged from a low

[13] U. S. Department of Agriculture, *Yearbook of Agriculture, 1940*, p. 620.

[14] The following is based on a survey entitled *Regional Research Laboratories, Department of Agriculture,* Sen. Doc. No. 65, 76th Congress, 1st Session (Washington, 1939), pp. 22-25.

The dry-milling process yields mainly food products derived both from the starchy kernel (endosperm) and from the germ. The former is the source of hominy, grits, corn meals and flours, processed flour, flaked products and prepared cereal foods, while the germ yields corn oil and stock feed. Nonfood uses of dry-milled corn are cold-water paints and pastes, foundry flours, and fillers or sizing products.

The wet-milling process, the more extensive and promising one for nonfood industrial purposes, also yields commercial feed and oil from the germ factor, but the main product is starch, which is the basis of a multitude of derived products, dextrins, gums, sirups, dextrose or corn sugar—not quite so numerous as the derivatives of coal tar, but economically almost as diverse. A variety of manufactured food products is based in turn on these modified starches. Among nonfood uses we find corn entering into laundry starch, textile sizes, explosives, adhesives, colors; the leather and rayon industries also make extensive use of it in their processing phases; distillation and fermentation, finally, provide another outlet in which malt liquor and the conversion of corn into industrial alcohol are easily the most prominent.

of 55 million bushels in 1934–35 to a high of 88 million bushels during the season of 1927–28. The distribution of that portion of the corn crop which is used for manufacturing of one sort or another may be summarized as follows: roughly one half of the processed products goes to food uses, one fourth reaches the farmer in the form of feeds and the remaining fourth is used industrially for purposes other than the manufacture of food.[15]

When to this amount we add the portion sold to other farmers directly or by way of feed dealers without intervention of processors—an amount that must run to at least another 200 million bushels—it becomes abundantly clear that our net output series is a composite, subject to many influences. It is determined on the one hand by the size of the entire crop,[16] and on the other by a variety of industrial demands largely dependent upon the changing position of corn in the price pattern of a large number of agricultural products.

[15] The approximate nature of these estimates is demonstrated by a comparison with other sources. Thus, a recent release (U. S. Bureau of Agricultural Economics, "Consumption of Agricultural Products," Washington, 1941) puts corn consumption as food at roughly 9 billion pounds of shelled corn, i.e., some 160 million bushels of corn. Since this estimate includes nonfood industrial products of the wet-grinding process (according to a written communication from the director of the study, Miss Elna Anderson) and thus would appear to exclude only industrial alcohol, it falls a good deal short of the estimate cited in the text. Another estimate, made by N. L. Gold (*Agricultural Land Requirements and Available Resources,* Pt. III of the Supplementary Report of the Land Planning Committee of the National Resources Board, Washington, 1935, p. 5) indicates that food consumption of corn was about 160-180 million bushels during the 1920's. This estimate presumably excludes all nonfood uses and thus would come closer to the figure of 250 million bushels mentioned at the outset. Finally, we have a third estimate for recent years, according to which 115 million bushels enter the dry-milling industry, 80 million bushels are absorbed in wet-milling, and close to 40 million go into the manufacture of distilled and fermented liquors. See D. W. Malott and B. F. Martin, *The Agricultural Industries* (McGraw-Hill, 1939), pp. 252-53.

[16] Statistics of sales vary directly with the size of the crop, a phenomenon which may not be altogether unconnected with the way in which such estimates are obtained.

Oats appear to have reached peak output during the first World War (Chart 6), possibly as a result of the army's demand for horse feed.[17] From then on, with occasional reversals in trend usually resulting from high yields (as in 1920 and 1924), the net output of oats declined at an accelerating rate until by 1934, after a precipitous decline beginning in 1928, it had fallen to not quite 60 million bushels, or less than one seventh of the wartime high (1917). The computed post-war rate of decline (Table 8) was 5.3 percent, more than twice that of grains as a whole. Though output has expanded since then, the level prevailing prior to 1929 has not again been touched, nor is it likely to be reattained in the future, since the eclipse of oats is no doubt associated with the gradual disappearance of the horse. From the scanty statistics available it is reasonably certain that most farmers' sales of this crop eventually find their way into animal feed, if for no other reason than that oats are the preferred diet for horses. The quantity utilized for human food—largely in the form of breakfast cereals (oatmeal, rolled oats)—and for industrial non-food purposes—oat hulls for furfural, a plastics material —is much less important. Using Gold's estimates [18] one would arrive at total annual oatmeal consumption of between 30 and 40 million bushels, as compared with sales of oats by farmers totaling on the average more than 200 million bushels per annum.[19] Unless the horse should stage a comeback, it is improbable that oats will regain the position it held prior to the first World War, when it contributed some 11 percent to the total net value of grains.

Rye, as its percentage contribution to the net value of grains indicates (between 1 and 2 percent; see Table 9), is of very minor importance. This low percentage was exceeded

[17] Exports of oatmeal also were exceptionally high during the final months of the war, amounting to the equivalent of 20 million bushels of oats.

[18] See footnote 15.

[19] These estimates are confirmed in a U. S. Department of Agriculture release, "The National Food Situation" (Washington, 1941).

only during and immediately after the first World War period (1919 percentage contribution: 2.8), when there occurred a sudden bulge in the curve of output (Chart 6), occasioned both by the relatively high price of rye—exceeding the price of wheat during the spring of 1918—and by the drought conditions which had prevailed in the Dakotas in 1916 and 1917.[20] A peak was reached in 1922, when net output stood at four times its pre-war level. Nor was that level accidental in the sense of the 1927 bulge which was due entirely to a record yield; for in 1922, although that year saw the largest rye yield ever recorded, acreage had expanded to about three times the pre-war level, with exports reaching an all-time high of more than 50 million bushels.[21] From that level rye output declined most precipitously until 1934, exceeding even oats in its rate of fall. In the last four years, however, there has been a return to the level obtaining between 1897 and 1909, so that the average annual rate of decline of nearly 13 percent per annum computed for the period 1921–38 is attributable primarily to the abnormally low output of the middle 1930's.

Barley cultivation is concentrated in the North Central area, and especially in its western part. Minnesota, Wisconsin and the Dakotas alone were responsible, during the period 1929–38, for over half the average crop. California for many years has contributed one tenth of the annual total.

Barley holds a peculiar position among the grains in that

[20] As has been pointed out by B. B. Hibbard, *Effects of the Great War upon Agriculture in the United States and Great Britain* (Oxford University Press, 1919), p. 33, in explaining this phenomenal increase in rye cultivation, "over seven-eighths of the increase in the rye acreage of the country took place in those two states, and as a matter of fact pretty much all of this in North Dakota. The North Dakota farmers were getting desperate. They must raise something. Wheat had been a comparative failure for two years. A winter crop stands the summer drought better than a spring crop. They cannot sow winter wheat, so they are trying rye."

[21] Rye exports were practically zero prior to the World War, but far into the 1920's the temporary elimination of Russia as an exporter enabled the United States to unload upon the European market a great part of its war-swollen rye crop. See "Rye in its Relations to Wheat," *Wheat Studies*, Vol. IV (March 1928), pp. 198-202.

it appears in the human diet almost exclusively in the form of malt, and more particularly as fermented malt liquor. In terms of bushels consumed in the manufacture of alcohol, distilled spirits and fermented malt liquor, it has now outstripped its closest grain competitor, corn; since the repeal of the 18th Amendment, barley has become twice as important as corn in this connection. However, even the large amount utilized for beverages is secondary to the portion fed to livestock, above all to hogs. Only in times of extreme emergency has barley-meal been used as a flour substitute. In 1917–18, approximately 20 million bushels of barley were ground into flour.[22] In normal times not more than a few million bushels are likely to find their way into the human diet as pearl barley, yeast and vinegar, breakfast foods, and malt preparations other than beverages.[23]

Gold's figures [24] indicate that aggregate consumption of barley as malt stood at about 45 million bushels prior to the first World War, and at between 15 and 20 million bushels during the prohibition era. For 1937, barley consumed in the form of malt has been estimated at 61 million bushels,[25] with minor quantities going into barley flour and breakfast foods. During the past 30 years the use of barley as feed on the farms where it is produced has more than doubled, so that by now feed can be said to be the main destination of barley. Though it is true that only certain types of barley can be used for malting purposes, there can be little doubt that prohibition acted as a stimulus in the shift of barley from a malt material to a feed, especially since, as Jasny points out,[26] the dividing line between malting and non-malting barley is determined to a considerable extent by crop conditions.

[22] Raymond Pearl, *The Nation's Food* (W. B. Saunders, Philadelphia, 1920), p. 53.

[23] U. S. Tariff Commission, *Agricultural Staples and the Tariff*, Tariff Information Series No. 20 (Washington, 1920), p. 108.

[24] See footnote 15.

[25] *Regional Research Laboratories*, p. 43.

[26] Jasny, *Competition Among Grains*, p. 106.

Peculiar demand conditions must be held responsible for the fact that barley is one of the two grains (the other is rice) that showed a positive rate of change both before and after the first World War, even though the post-war rate is less than half the pre-war rate, 1.1 percent as against 3.1 percent (Table 8). In this drop is reflected the influence of prohibition, for the net output curve shows the decline to lower levels setting in with the 1919 crop (Chart 6). A temporary upsurge lasted from 1927 to 1930; and in two of these years, 1927 and 1928, exports took up 50 percent and more of the commercial crop. Since 1930 net output has fluctuated widely, but in general has tended upward to regain its average pre-war level which it exceeded for the first time in 1937. It has not declined since then, and in 1939 it came within 2 million bushels of the record net output of 1927.

Rice differs from the other grains in almost every respect. It is the one crop that registered consistent gains throughout the period and did not suffer a relapse after its wartime expansion (Chart 6). Rice growing is confined to Louisiana, Texas, Arkansas, and California. The climate of these states is radically different from that of the North Central region, the principal source of the other grains, so that rice was unaffected by the drought years. Rice is one of the few crops to have experienced a secular rise in yield per acre: where 35 bushels per acre constituted a record yield at the beginning of this century, present yields average close to 50.[27] Between 1897 and 1938 acreage tripled, and average yield per acre doubled. Since the end of the World War usually half the crop has been shipped to United States territories and foreign countries, and although exports to foreign countries fell off heavily during the depression, shipments to Hawaii, Alaska, and Puerto Rico have continued at the same pace. The favored position of the United States in these territories, in which per capita consumption of American rice is 20 to 40

[27] See Table 50, below.

times the per capita consumption in the continental United States, and in which rice imports from other countries are practically barred, has been and continues to be an important factor in the steady development of rice growing in this country.

Buckwheat, grown mainly in the hilly sections of New York, Pennsylvania, and parts of New England, has little economic importance. Its principal advantage is that it will thrive even when it is planted late in the spring, in climate and soil unsuitable for other grains. Scarcely entering commercial channels, except as flour for griddle cakes, its net output—and more recently even its gross output—has declined steadily throughout the past three decades, with its impending eclipse as a commercial crop only temporarily delayed by the first World War. The chief current use of buckwheat is as feed in regions where more desirable crops are not easily grown.

Flaxseed, which is not a cereal or a food, is included among the grains because of its place in crop systems and the similarity in methods of farming.[28] Classification by use would put it clearly into the oil crops group, since in this country practically all flax is planted for its seed and not for its fiber. It is only on a small acreage in Oregon that fiber flax is cultivated, amounting, in terms of value, to less than 0.5 percent of the $40 million worth of linen and fiber annually imported into the United States. It has been estimated that imports could be replaced by the yield from 500,000 acres, allowing for rotation of crops.[29]

Like buckwheat, flax has been a pioneer crop, doing well on newly broken soil and preparing virgin land for cultivation of wheat or other grain during subsequent years. Con-

[28] See above, p. 46n.

[29] *Regional Research Laboratories,* p. 105. The use of flax fiber in the manufacture of cigarette paper, long a potential market for flax, has, with the cessation of imports after the fall of France, become a reality, though so far the approximate volume of utilization can be gauged only by the $5 to $6 million annually paid for imported cigarette paper.

sequently, it is not surprising that output reached its peak around the turn of the century and suffered an almost continuous decline for the following two decades; in 1919 net output amounted to barely more than one sixth of its 1902 level. At that time, there began a resumption of flax growing which, by 1924, in the short span of five years, had carried output up to a level second only to that of 1902. Another steep decline ensued, however, and in 1934 and again in 1936 net output was below even the trough of 1919. Recovery from those levels was well under way in 1939 and 1940.

The explanation of these rather violent changes is to be found partly in the relationship of flax to other grains, and partly in its sensitiveness to the price of other vegetable oils. Flaxseed production is concentrated in a narrow area in Minnesota and North Dakota.[30] To follow in any detail the trend of flaxseed production would therefore involve tracing the interrelationship of the principal grains grown in the spring wheat belt. In this connection it is significant that the doubling of flaxseed production in 1924 followed upon a year of extremely poor yields in both wheat and rye, a year, furthermore, in which the spread between the price of flaxseed and that of wheat had widened in favor of flaxseed. This spread is believed to have an important bearing upon the acreage planted to flax in the succeeding year.[31] While flax competes for land with wheat, corn and oats, the derived product, linseed oil, competes with other oils, both domestic and imported. This country since about 1910 has usually been on an import basis with regard to flaxseed, so that the price is scarcely affected by the size of the domestic flaxseed crop. And as the size of the domestic crop is largely conditioned by the world market price of linseed oil and its relationship to the price of domestic wheat, major fluctuations from year to year are not surprising. Since the first World War, these fac-

[30] More recently Kansas and California have begun to acquire status as flaxseed growing states.

[31] *Flaxseed Prices and the Tariff*, Sen. Doc. No. 62, 76th Congress, 1st Session (Washington, 1939), p. 8.

tors, with rare exceptions, have combined to make the cultivation of flaxseed appear less profitable than that of alternative crops; increasing tariffs on both seed and oil have relieved, but not eliminated, the comparative unprofitability of the crop.

POTATOES AND RELATED CROPS

This group comprises three staple foods which, although vegetables, are not counted as truck crops: potatoes, sweetpotatoes, and dry edible beans. By virtue of their high starch content, they are closer to the grains than to other vegetables. In its year-to-year fluctuations the group is dominated by the behavior of potatoes, but the rapid rise in dry edible beans has increased its relative importance over the whole period. The combined contribution of the three crops to total output rose from 3.3 percent in 1897–1901 to 4.1 percent in 1935–39 (Table 2).

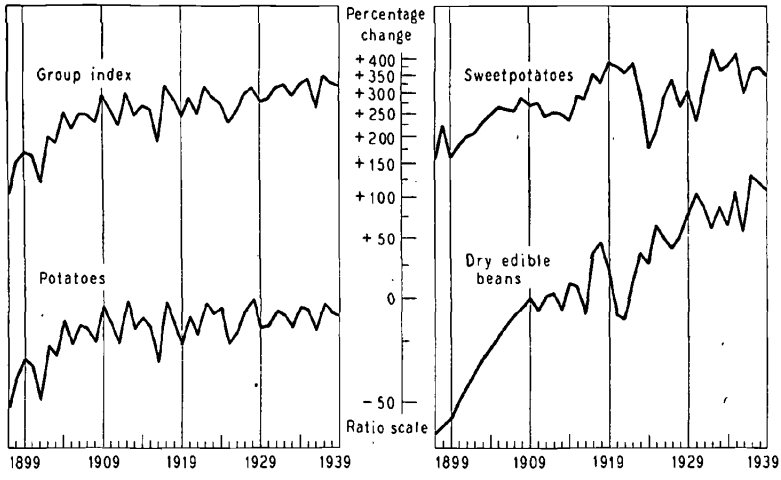
Potatoes, like corn and oats, are raised in every state. Production, however, is not highly concentrated, although it is more so in some areas than in others. Maine, the largest potato state, produced only 10 percent of the total during the past decade. Yet this small percentage supplies almost half the cash income of the Maine farmer. Altogether only 3 million acres —or one in every hundred crop acres on farms—are devoted to potato growing, but the yield per acre is exceedingly high: by weight, between 8 and 9 times that of wheat. Output in bushels is almost half that of wheat. Usually one fifth of the potato crop is retained as food for the farm household, a much larger portion than in the case of either wheat or corn.[32]

[32] Production for use in the farm household is of course included in net output as we compute it. Since in some states potatoes are mainly a cash crop, the percentage retained for food naturally shows a great deal of variation from state to state. Thus, in 1938 only 1 to 3 percent of total production was home-consumed in Maine, Idaho, Colorado, California, while 50 percent or more was retained for food in Indiana, Illinois, Iowa and other states.

Sweetpotatoes, grown on an acreage usually less than one third that devoted to potatoes, are mainly a southern crop, even though they may be found on a few thousand acres in Iowa, Indiana and Illinois. The bulk of the crop originates east of the Mississippi and south of the Mason-Dixon line, with the lower Atlantic states contributing more than one third of the total. To a much larger extent than potatoes,

Chart 9

POTATOES AND RELATED CROPS: NET OUTPUT



For source and notes see Appendix D

sweetpotatoes are grown for home consumption: usually less than one third of the crop is sold.

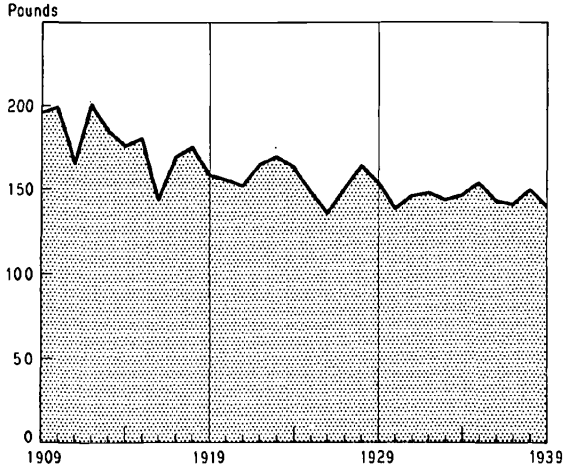
Dry edible beans, predominantly a cash crop, come from three widely separated areas: lower Michigan and western New York; California; and more recently, certain areas in the Mountain states, particularly Colorado and Idaho, along the western border of the Great Plains. Michigan and California together account for over one half of the country's crop.

The combined output of the potato group showed a fairly rapid rise up to about 1909 (Chart 9), after which expansion

slowed down noticeably. The computed annual average rate of growth for the group amounts to 2.8 percent for the pre-war period, but to only 0.9 percent for the post-war period (Table 4 above). This retardation of growth is explained in part by a decided contraction in per capita potato consumption, amounting to some 25 percent since 1909. In fact population growth has just sufficed to keep total consumption

Chart 10

POTATO CONSUMPTION PER CAPITA, 1909 - 39



For source and notes see Appendix D

steady. The rapid rise in the production of beans and the moderate advance in the output of sweetpotatoes suggest that there has been a substitution in their favor.

It is pertinent to remark on the substantial increase in potato yields over the past two decades, a gain which appears to have helped maintain post-war levels of potato output: whereas in every year since 1922 more than 100 bushels per acre have been harvested, in only 9 years during the long period 1866–1921 were there any yields of similar magni-

tude.[33] Expansion in sweetpotatoes and beans, on the other hand, has been due to additional acreage; in fact sweetpotato yields seem to have passed their peak (Table 50 below).

TOBACCO

Tobacco is purely a cash crop, and perhaps its most important characteristic is its unusually high monetary value per acre. Grown in an area amounting to no more than one half of 1 percent of the nation's entire crop acreage, tobacco has in recent years contributed between 2 and 3 percent to gross farm income, and between 3 and 4 percent to cash income. The crop is distinguished also by the marked qualitative variations—there are 28 officially recognized types—that originate in differences of climate, soil, seed and curing processes. Tobacco growing is highly localized and occupies an especially prominent place in the economy of North Carolina, Kentucky and Tennessee. In 1935, for example, its sales supplied the farmers of North Carolina with 40 percent of their gross income, 54 percent of their cash income.[34] The three states together have produced more than 70 percent of all domestic tobacco during the past 10 years. The remainder of the crop is derived from 17 states, most of which raise only small amounts of special varieties. And finally, when we turn to foreign trade, we find tobacco not only the oldest article of export,[35] but also high up in the list of farm products sent to foreign markets at the present time. Although, for reasons set out below, a decreasing fraction of total tobacco production

[33] See Table 50 and Chart 47 below. Fertilizer and certified seed appear to have been the two agents responsible.

[34] U. S. Bureau of Agricultural Economics, *Farm Value, Gross Income and Cash Income from Farm Production, by States and Commodities, 1934–1935* (Washington, 1936).

[35] As early as 1618 the colonies shipped tobacco, in that year only 20,000 pounds, to England. See W. W. Garner, E. G. Moss, H. S. Yohe, F. B. Wilkinson and O. C. Stine, "History and Status of Tobacco Culture," *Yearbook of Agriculture, 1922*, p. 448.

has been entering export channels, this crop has accounted for a growing percentage of aggregate agricultural exports since the War of 1914–18. This development too is treated in greater detail below.

Before attempting to analyze such changes in tobacco output as have occurred over the past few decades, we shall briefly sketch the actual course of output and the measures of change that are yielded by our standard procedures (Chart 11). The opening year of our period finds tobacco output at the end of a series of years during which it had shown practically no change. The next year, 1898, marks the permanent transition to the million-acre level as well as the first 800-pound-per-acre yield since 1875. With the exception of three years—1899, 1900 and 1913—yields above 800 pounds per acre remained the rule until after the War of 1914–18.[36] To some extent this sudden jump from 1897 to 1898 accounts for the high annual average growth rate for the period 1897–1914 of 1.5 percent; for practically no change in output occurs until 1909, when another substantial increment in acreage carries tobacco production to a new level[37] around which it oscillates until 1914. Though the increase in acreage was larger between 1908 and 1909 than between 1897 and 1898 (20 percent as against 15), output expanded relatively less in the more recent period, since it was not accompanied, as it had been in 1898, by a corresponding spurt in yield per acre.

Since the first World War fluctuations in output have been erratic, as may be seen from Chart 11, and the computed annual rate of growth of 0.3 percent has little meaning. Because there was a spectacular rise in the short span of four years (1915–18), our computed rates of growth for the pre- and post-war periods give little hint of the substantial difference between the pre-war and post-war volumes of production. The

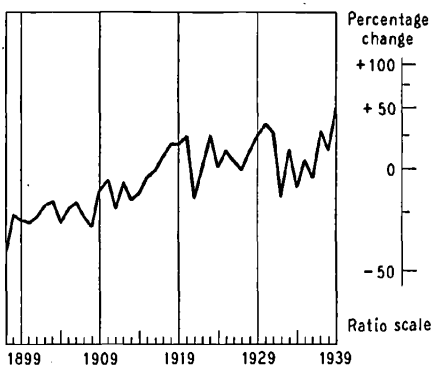
[36] See Table 50 and Chart 47 below.

[37] A glance at the price statistics of the period suggests that the upward movement was not unconnected with the substantial rise in tobacco prices which had preceded it.

high level of output attained in 1918, 1919 and 1920 gave way, in a number of years to follow, to a crop more reminiscent of the average size prevailing between 1909 and 1916, but in other years, notably 1923, 1929–31 and, most recently, 1937 and 1939, the 1920 peak was surpassed. It appears that the wartime expansion in acreage has left a permanent mark on tobacco growing, much as it has on wheat growing and on

Chart 11

TOBACCO: NET OUTPUT



For source and notes see Appendix D

other types of farm enterprise which, in a period of falling prices, have refused to embrace output contraction as a means of economic salvation. Two years of abrupt decline in acreage, 1921 and 1932, were both preceded by a season of plunging prices. Acreage contraction during the 1930's serves to explain why post-war output has not risen to a greater extent than the annual 0.3 percent mentioned above.

Shifts in both domestic demand and foreign trade have had their effect on tobacco raising. Indeed the emergence of the cigarette and the attendant changes in the composition of American tobacco output fall within the period under study. More recent years have witnessed also the slow process by which United States tobacco has been shut off increasingly from its export markets.

Domestic demand, as revealed in per capita consumption data, rose almost without interruption from 1900 to 1913, amounting to an average of 1.8 percent per year as compared to the annual growth rate of 1.5 percent from 1897 to 1914. Per capita consumption began another brief but rapid rise in 1915, and by 1917 it reached the unprecedented (and so far not repeated) level of 7.74 pounds per person. Of this total, one sixth represented consumption of cigarettes, whereas only three years earlier, at the outbreak of the war, cigarettes had accounted for scarcely 10 percent of all tobacco consumed. It is common knowledge that the first World War accelerated the spread of cigarette smoking, which to this day has apparently not reached its culmination (Table 11).

The effect of increased cigarette smoking upon the output of tobacco during the World War becomes clear when we trace the development of tobacco by types. It is then seen that the real upswing occurred in flue-cured tobacco,[38] the type that is grown in the Atlantic states and used predominantly in the manufacture of cigarettes; tobacco for cigars and pipes showed little tendency to expand. Naturally, the growth in output was paralleled (and presumably stimulated) by rising prices for flue-cured tobacco which far outran prices of other types.[39] This tendency was furthered by the development of blends that used less Turkish and more domestic tobacco, particularly when imports of Turkish tobacco were temporarily interrupted during the war.[40] Thus the shift toward cigarette smoking also meant a decline in import requirements and became a boon to the domestic producers of flue-cured tobacco.

Both per capita consumption and exports have been unable

[38] Garner et al., *op. cit.*, p. 412.

[39] *Ibid.*, p. 442.

[40] Malott and Martin, *The Agricultural Industries*, p. 380. Import statistics indicate that imports from San Domingo temporarily took the place of imports from Turkey, but the lapse was considerable and the total volume remained low.

TABLE 11

TOBACCO PRODUCTS

Per Capita Consumption, 1900–39

Pounds

Calendar Years	*Cigars*	*Cigarettes*	*Chewing Tobacco*	*Smoking Tobacco*	*Snuff*	*Total*
1900[a]	1.33	0.14	2.39	1.31	0.20	5.37
1905[a]	1.59	0.15	2.09	1.92	0.25	6.00
1910	1.59	0.34	2.17	2.30	0.34	6.74
1911	1.65	0.40	1.98	2.23	0.31	6.57
1912	1.65	0.49	1.96	2.28	0.33	6.71
1913	1.72	0.60	1.96	2.27	0.34	6.89
1914	1.67	0.62	1.84	2.28	0.31	6.72
1915	1.58	0.67	1.77	2.36	0.33	6.71
1916	1.71	0.93	1.90	2.37	0.34	7.25
1917	1.79	1.29	1.98	2.34	0.34	7.74
1918	1.65	1.39	1.76	2.25	0.36	7.41
1919	1.61	1.59	1.53	2.17	0.34	7.24
1920	1.87	1.56	1.43	1.98	0.34	7.18
1925	1.39	2.07	1.10	2.14	0.33	7.03
1930	1.17	2.73	0.80	1.87	0.33	6.90
1931	1.08	2.58	0.69	1.95	0.32	6.62
1932	0.89	2.32	0.57	1.93	0.29	6.00
1933	0.89	2.53	0.55	1.87	0.29	6.13
1934	0.94	2.87	0.56	1.87	0.29	6.53
1935	0.96	3.01	0.89	1.49	0.28	6.63
1936	1.03	3.40	0.90	1.51	0.29	7.13
1937	1.04	3.55	0.89	1.44	0.28	7.20
1938	0.97	3.54	0.82	1.53	0.29	7.15
1939	0.99	3.71	0.81	1.50	0.29	7.30

Source: U. S. Department of Agriculture, *First Annual Report on Tobacco Statistics,* Statistical Bulletin 58 (Washington, 1937), Table 16; *Annual Report on Tobacco Statistics, 1940,* Table 25. Data for 1939 are preliminary.

[a] Year beginning July.

to maintain the heights they reached during the World War. Consumption quickly receded from its record-breaking performance of 1917 to a low in 1922, yet this low equaled the highest level attained in pre-war years. With the exception of a steep decline during the depression of the 1930's, beginning

TABLE 12

LEAF TOBACCO USED IN MANUFACTURE OF VARIOUS PRODUCTS

Five-year Average	*Cigars*		*Cigarettes*		*Tobacco and Snuff*		*Total*	
	1000 lbs.	Percent	1000 lbs.	Percent	1000 lbs.	Percent	1000 lbs.	Percent
1897–1901	95,941	25.7	14,628	3.9	262,069	70.3	372,638	100.0
1907–1911	141,134	26.4	26,576	5.0	366,896	68.6	534.606	100.0
1917–1921	154,180	23.7	146,272	22.5	349,991	53.8	650,442	100.0
1927–1931	144,292	18.8	325,009	42.5	296,249	38.7	765,550	100.0
1934–1938	119,770	14.5	438,394	53.0	269,247	32.5	827,411	100.0

Source: U. S. Department of Agriculture, *First Annual Report on Tobacco Statistics*, Statistical Bulletin 58 (Washington, 1937), Table 13; U. S. Agricultural Marketing Service, *Annual Report on Tobacco Statistics, 1940* (Washington, 1940), Table 20. Data relate to calendar years, except for cigars and cigarettes in 1897–1901 and 1907–11 where figures are for years beginning July.

in 1930 and not overcome until 1936, per capita consumption has remained stable at just about seven pounds per head of population. Whether the high level of 1939 marks the beginning of another upswing, paralleling the experience of the first World War, it is too early to predict. It seems unlikely, however, that any such striking development as the popularization of the cigarette, or the spread of smoking among women, is to be anticipated in the future. Throughout the period, cigarettes have continued to grow in importance, so that by now more than 50 percent of all leaf tobacco processed is used in the production of cigarettes (Table 12). At the same time per capita use of tobacco in other forms has tended to decline (Table 11).

Exports, which up to 1930 had remained substantially above the pre-war level, have suffered a severe decline since that year; nonetheless, the share of tobacco in total agricultural exports (in terms of value) was much higher in the 1930's than in the preceding decade.[41] In 1935, the percentage of the tobacco crop exported was lower (except for 1931) than at any time since 1917, yet in that same year tobacco's share of aggregate agricultural exports registered a high of over 18 percent—as against 5 to 7 percent in the peak export period 1918–19—so severe had been the decline in exports of other agricultural commodities (Chart 12). In comparison with other farm products, tobacco's hold on the export market has been tenacious, even in the face of import restrictions by European countries, preferential tariffs granted to Empire nations by the United Kingdom, increased domestic growth of flue-cured tobacco in China (formerly one of our most important customers), and the continuous shrinkage in exports of fire-cured tobacco.[42] At the same time exports have

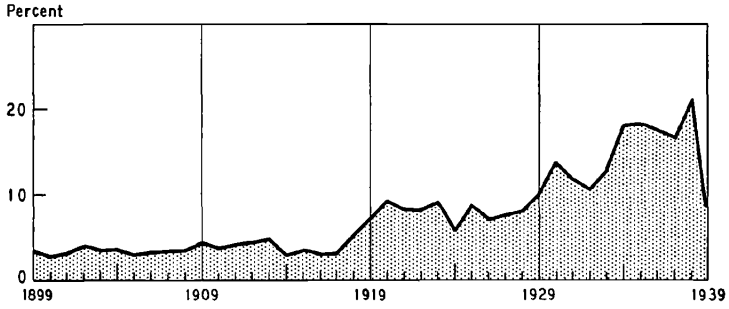
[41] Frederick Strauss, *The Composition of Gross Farm Income since the Civil War,* Bulletin 78 (National Bureau of Economic Research, 1940), Table 7.

[42] B. S. White, Jr., "Our Changing Tobacco Exports," *The Agricultural Situation,* March 1939.

Chart 12

TOBACCO EXPORTS

Ratio to Total Farm Exports

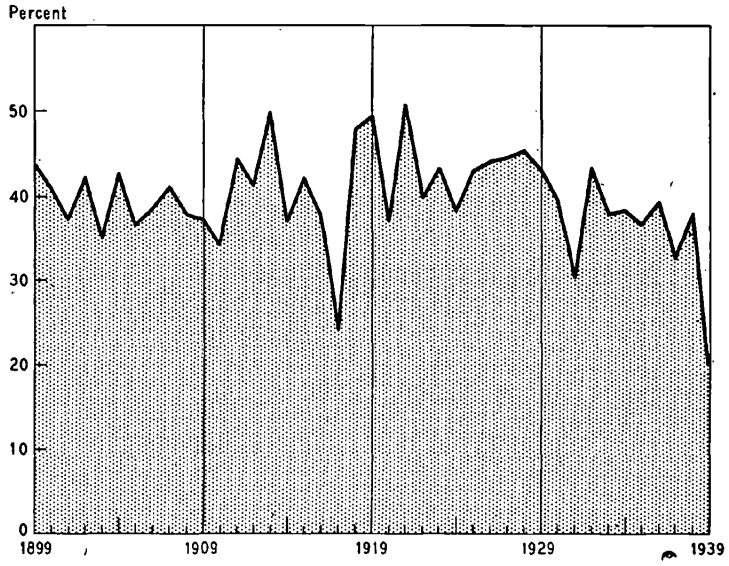


For source and notes see Appendix D

Chart 13

TOBACCO EXPORTS

Ratio to Gross Farm Income from Tobacco



For source and notes see Appendix D

amounted to less than 40 percent of tobacco output in every year since 1932, and are likely to sag still further, temporarily at least, since tobacco has been one of the first victims of the shipping shortage of the current war. The threat of surplus production, ever present since war-born expansion first swept acreage to the 2-million mark, overhangs the industry. Indeed it is believed that the 600,000 tobacco-raising families in the South could "produce readily at least 50 percent more than the world now consumes." [43] It is difficult to imagine changes in smoking habits here or abroad which would result in absorption of such tremendous quantities. To expect a continuation of the rising output trend which began in 1932 therefore seems visionary; even maintenance of the level prevailing during the 1920's may prove an impossible task.

COTTON

Among nonfood products of agricultural origin cotton is easily the most important, measured by any standard. But even when compared with food products, cotton ranks high. One out of every ten farm acres tilled is usually planted to cotton, and the contribution of this crop to farm income, cash or gross, is greater than that of any other single crop.

Its limited tolerance in respect of climatic conditions makes cotton a highly localized product, and one of enormous significance in some states. It has been estimated that "sixty percent of the southern farm families are dependent on cotton for their primary source of income." [44] In Mississippi in 1935, farmers received as much as 70 percent of their cash income, and about half their gross income, from cotton (including cottonseed); in a few other states the ratios are almost as high. Cotton had its greatest expansion in the mid-1920's when over 45 million acres were planted. Texas alone, between

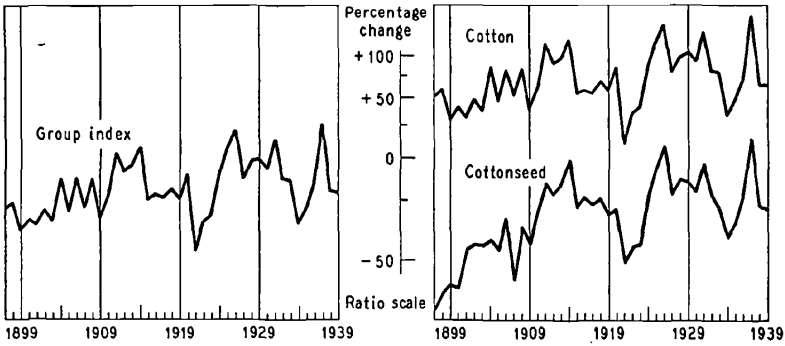
[43] U. S. Department of Agriculture release, "Regional Adjustments to Meet War Impacts" (Washington, 1940), p. 18.

[44] *Ibid.*, p. 16.

1919–20 and 1925–26, put some 5 to 6 million additional acres into cotton and became responsible for about one third of the total acreage. At the same time the importance of the older cotton regions of Georgia and the Carolinas, the Coastal Plains and the Piedmont, steadily declined. More recently the largest reductions in cotton acreage have occurred in precisely those areas to which production had shifted in the 1920's: acreage in the South Central states,[45] for instance, was halved—from 34 to 19 million—between 1930 and 1940.[46]

Chart 14

COTTON: NET OUTPUT



For source and notes see Appendix D

The computed rates of growth for cotton and cottonseed combined are 2.6 percent per annum for the period 1897–1914, 0.9 percent for the period after 1921, but only 0.6 percent for the four decades as a whole (Table 4 above). This anomaly is explained by the severe slump in cotton output between 1914 and 1921 (Chart 14). During this interval cotton production fell from 16 to 8 million bales, cottonseed produc-

[45] Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma and Texas.

[46] In Texas the decline was from 16.1 to 8.5 million acres. See *Agricultural Statistics;* also Bureau of Agricultural Economics release, "Cotton Revisions: Acreage, Yield and Production, Crop Years 1866–1935, by States" (1936). Because of rising yields per acre production has been reduced proportionately less.

tion from 6 to 3 million tons. This period saw the heaviest boll weevil infestation,[47] combined with a decline of cotton exports and a consequent accumulation of large carryovers which further discouraged the cultivation of the crop. The year 1921, characterized by a reduction in yield of over 30 percent due to weevil damage,[48] appears to have marked the turning point in weevil control and the resumption of exports on a pre-war scale: by 1926 output had exceeded that of 1914, the record year of the pre-war era. Since then output has fluctuated about the 10 million-bale level, with a corresponding production of cottonseed, and in 1937, largely because of the highest yield ever registered, the record of 1926 was outstripped.

Cotton's place in agriculture, as gauged by its contribution to total production, declined only slightly between 1899 and 1937. In the former year it contributed 10.8, in the latter, 10.2, percent to agricultural output as a whole (Table 2). Of this contribution, one tenth was derived from cottonseed in 1899, one seventh in 1937. The increased importance of cottonseed as compared with cotton reflects a growth in the fraction of cottonseed absorbed into commercial channels: it will be recalled that we do not count as output cottonseed used as seed, feed or fertilizer.

Just as cotton has until recently retained its relative position in domestic agriculture, it has also maintained its place in the scheme of agricultural exports, but only because other exports have shrunk more than cotton. This is illustrated by Charts 15 and 16 which give the percentage contribution of cotton to total agricultural exports, and the percentage contribution of cotton exports to gross income from cotton. While the first series shows little trend, the second is marked by an abrupt decline early in the World War. With occasional reversals, the proportion of income from cotton repre-

[47] W. C. Holley and L. E. Arnold, *Cotton* (National Research Project, Philadelphia, 1938), p. 92. The boll weevil first appeared in the Southwest in 1892 and by 1920 had affected substantially the whole of the cotton area.

[48] *Ibid.*, p. 93.

sented by exports has continued to fall ever since. The era when two thirds of gross farm income from cotton was regularly derived from exports ended before the first World War.

There are many reasons for this shift in the export situation: [49]

(a) Exports of cotton textiles from the United Kingdom reached a peak in 1911 and have been declining ever since.

Chart 15
COTTON EXPORTS
Ratio to Total
Farm Exports

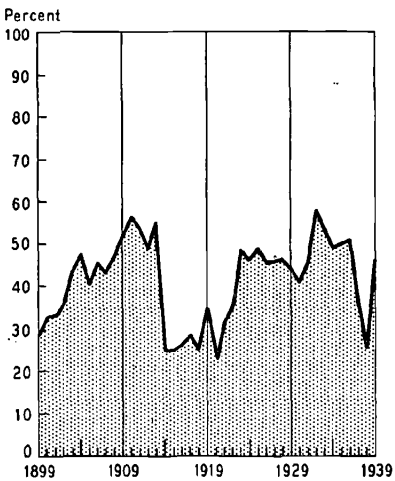
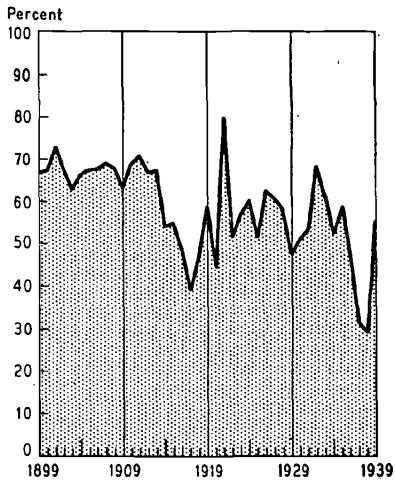


Chart 16
COTTON EXPORTS
Ratio to Gross
Farm Income from Cotton



For source and notes see Appendix D

This decline, in turn, affected the United States more than other cotton exporters since about 80 percent of Great Britain's raw cotton imports before the World War were of American origin. In addition, an increasing portion of Great Britain's cotton imports has been derived from competing areas (e.g. British India, Egypt and the Sudan) so that only

[49] This discussion is based on a Bureau of Agricultural Economics release by M. R. Cooper entitled "Some Effects of the World War on Cotton" (1937); and Malott and Martin, *The Agricultural Industries*, pp. 162-67.

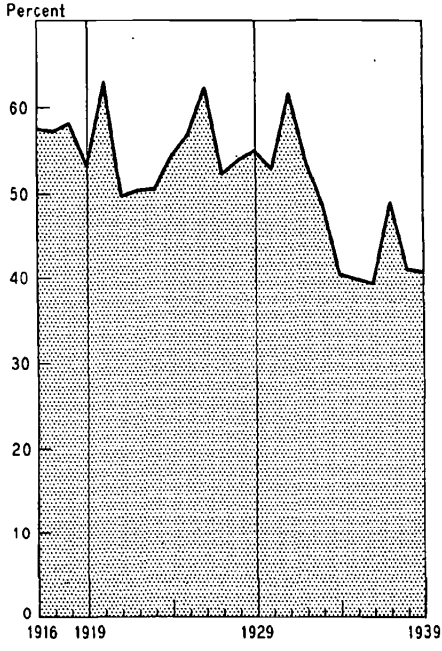
about one half of its imports now comes from the United States.

(b) The countries to which cotton manufacturing has shifted —Japan, China, India and Brazil—use larger proportions of non-American cotton than Great Britain did,[50] mainly be-

Chart 17

COTTON

Ratio of U. S. Output to World Output, 1916-39



For source and notes see Appendix D

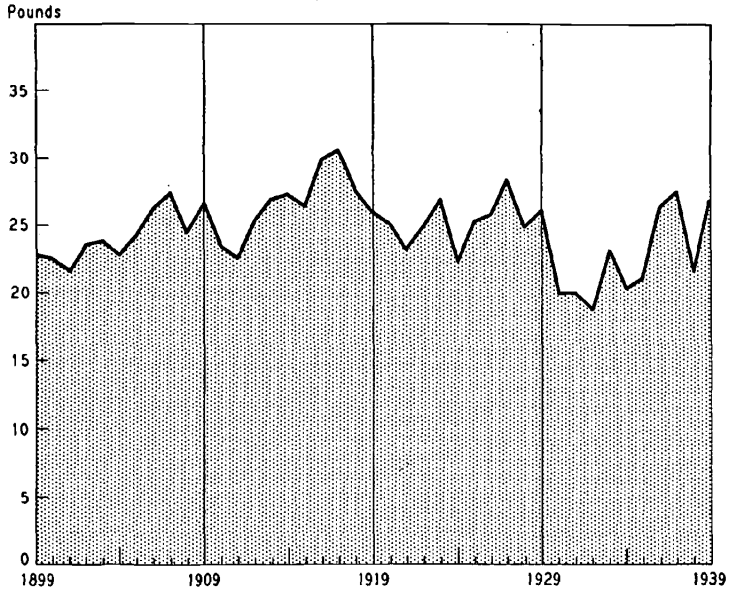
cause of the more favorable location of non-American growers, and also because of the high prices of American cotton which prevailed during the early 1920's. Those high prices

[50] Nonetheless, Japan and China have been using relatively more American cotton than before the World War, and this has been the only offsetting factor among the changes in the foreign trade situation.

furthermore seem to have been instrumental in stimulating foreign production which has grown much faster than United States output (Chart 17).

(c) This country's relative contribution to the raw cotton imports of continental Europe has declined severely, though not so much as in the case of British imports.

Chart 18
COTTON CONSUMPTION PER CAPITA



For source and notes see Appendix D

(d) In recent years competition from other fibers has cut severely into the foreign demand for cotton.

Since cotton has ceased to be predominantly an export commodity, trends in domestic per capita consumption have acquired increased significance, but have failed to compensate for the shrinkage in exports. Indeed, per capita consump-

tion on the domestic market declined, on the average, more than 20 percent between the period of peak consumption during the first World War and the trough of the depression of the 1930's. This drop assumes even larger proportions when we compare the years of highest and lowest consumption, 1917 and 1932 respectively, between which consumption fell almost 40 percent. Despite recovery in recent years, consumption still remains below World War levels (Chart 18).

Competition from rayon, which in 1939 furnished 10 percent by weight of all apparel fibers consumed in the United States—as against less than 4 percent in 1929 and 0.3 percent in 1919—has been a potent factor in curtailing the consumption of cotton. That increased rayon consumption has made greater inroads on cotton than on wool is suggested by the data presented in Chart 19. These show that the share contributed to total fiber consumption by wool shrank very abruptly between the two fiscal years 1897–98 and 1898–99,[51] i.e., almost two full decades before rayon appeared, while the shrinkage in relative cotton consumption proceeded *pari passu* with the growth of rayon. It is possible also that rayon assumed the role that would otherwise have fallen to silk, and so may have been responsible for the failure of silk consumption to increase.

Despite the decline in its importance, cotton continues to occupy the predominant position among textile fibers.[52] However, there is general agreement that in the long run cotton acreage will have to be curtailed still further: cotton growing will have to be replaced by other farm enterprises or by nonfarm employment if a full adjustment is to be effected in the economy of the southern states.

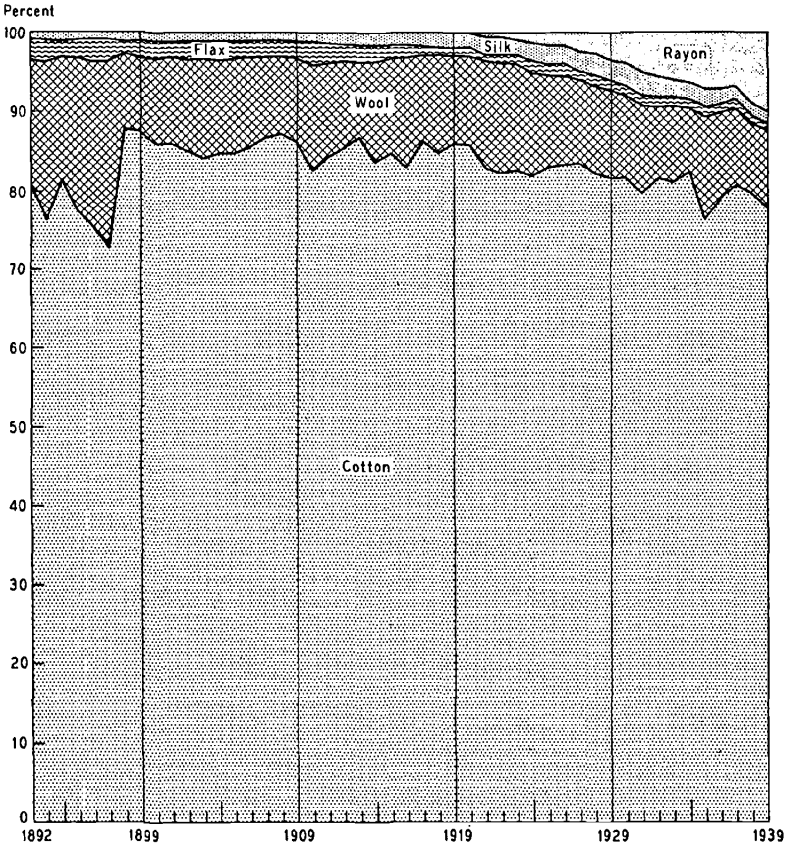
[51] For a further explanation of this break, see p. 88 below.

[52] The consumption of imported cotton in pounds, itself a negligible fraction of all cotton consumed in the United States, still normally exceeds total imports of silk, a fiber we are accustomed to regard as taking pride of place among textile materials of foreign origin.

Chart 19

APPAREL FIBERS

Percentage Distribution of U. S. Consumption, 1892 – 1939



For source and notes see Appendix D

WOOL

Although some wool is shorn [53] in every state, its production is concentrated in the western states, which usually are responsible for half the output. Another 20 percent originates in Texas, the largest single producing state, and the balance is scattered over the rest of the country, with the 17 Atlantic states contributing a negligible amount. The prominence of Texas dates only from the middle 1920's: between 1920 and

TABLE 13

APPAREL FIBERS

Percentage Distribution of Domestic Consumption[a]

Fiber	*1892–99*	*1900–09*	*1910–19*	*1920–29*	*1930–39*
Cotton	80.2	85.8	84.9	83.1	80.0
Wool[b]	16.5	11.0	11.7	11.8	10.0
Silk	.8	1.0	1.4	2.1	2.0
Rayon	..	..	.2	1.7	6.9
Flax	2.5	2.2	1.8	1.3	1.1
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: R. B. Evans and R. F. Monachino, *Trends in the Consumption of Fibers in the United States, 1892–1939* (U. S. Bureau of Agricultural Chemistry and Engineering, New Orleans, 1941), Table 9.

[a] The distributions are in terms of weight. Periods shown relate to fiscal years ended June 30, 1892–1917; calendar years, 1918–39.

[b] Including mohair and camel's hair.

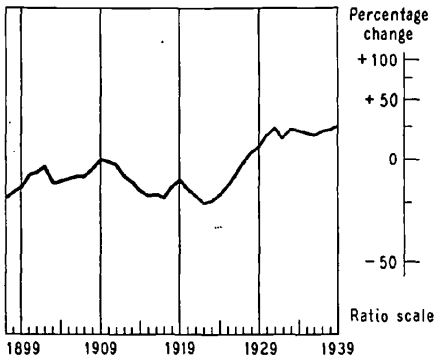
1928 wool production almost doubled, and by 1940 it had doubled once more. Even so, income derived from wool in the last few years has contributed only around 5 percent to the total gross income of Texas farmers.

The behavior of wool output is distinguished by the fact that its growth rate for the post-war period amounts to more

[53] Only shorn wool is considered here, since pulled wool is really a product of the meatpacking industry and its production and value are reflected in the series dealing with sheep and lambs. Mohair is included from 1909 on, but is not accorded separate treatment because it amounts only to a small percentage of wool production.

than five times that of the pre-war years: 0.6 percent for 1897–1914, and 3.3 percent for 1921–38 (Table 4). The war years themselves show no discernible trend, but the prolonged period of shrinkage, beginning in 1909 and not reversed till 1922, results in an average growth rate for the entire period of only 0.9 percent. Increase during the post-war period is confined entirely to an 8-year span, 1923–31,

Chart 20
WOOL: NET OUTPUT



For source and notes see Appendix D

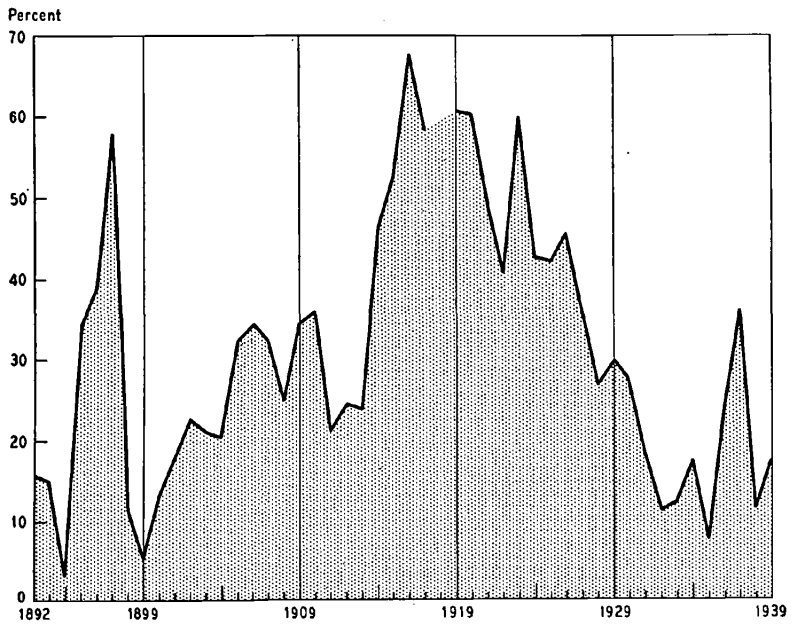
during which output increased by more than 60 percent; since 1931 an almost constant level has prevailed, with deviations from the 1931–39 average measuring not more than 5 percent in either direction for any year.

Comparing the terminal years with a view to assessing the place of wool in total agricultural production, we find that in 1935–39 it contributed only slightly less than in 1897–1901: 1.1 percent and 1.2 percent respectively (Table 2). This observation checks with the computed average growth rate of 0.9 percent which is close to that for agricultural output as a whole. It is interesting also to compare the contribution of wool with that of sheep and lambs as meat animals; here we find that between the two 5-year periods the contribution

Chart 21

APPAREL WOOL

Ratio of Imports to Domestic Consumption, 1892 – 1939

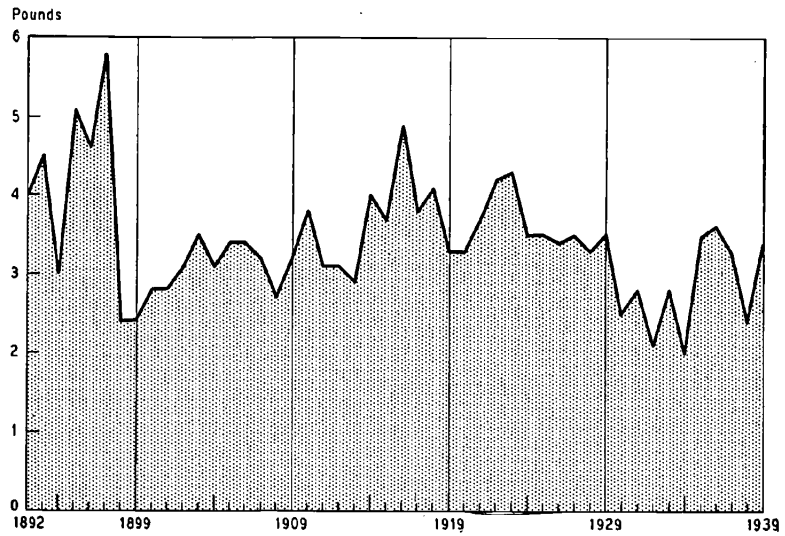


For source and notes see Appendix D

Chart 22

APPAREL WOOL

Per Capita Consumption, 1892 - 1939



For source and notes see Appendix D

represented by the utilization of sheep and lambs for purposes of food advanced in relation to that made by wool shearing, so that by 1935–39 sheep and lambs contributed as meat more than 1½ times as much as they did as wool; in 1897–1901 this lead amounted to only 25 percent.[54]

Confronted with the task of explaining the changes in output, we cannot simply refer to demand for wool as reflected in per capita consumption estimates. For domestic output has been conditioned more by changes in the tariff situation and by ease of import from competing countries—above all Australia and South America—than by domestic demand. Indeed, as Charts 20-22 show, there is a close resemblance in movement of per capita consumption and imports, while domestic output usually runs counter to both these series. Thus the highest demand for apparel wool arose during the war years 1914–18, with a peak of 4.9 pounds per capita in 1916. Yet during these years domestic output stood at lower levels than obtained either before or after, and imports rose sharply from 31.5 percent of all apparel wool made available for consumption in 1910–14 to 61.6 percent in 1915–19.[55] By 1935–39 the import ratio had dropped back to 19.4 percent of total consumption—one third or one fourth of the war-time volume—and domestic output soared to record levels. Indeed, the sustained expansion in domestic output during 1923–31 was paralleled by an equally sustained shrinkage in imports, which by 1932 had virtually ceased. In the same way, the earlier shrinkage in domestic output which began in 1909 had almost coincided with a sharp upturn in imports (after 1911) which culminated in the war years. The influence of the tariff may be traced in two instances, although it is difficult to say just how strong a force the change in duty alone

[54] This comparison is in terms not of weight but of values at constant prices. See pp. 26-27 above.

[55] R. B. Evans and R. F. Monachino, *Trends in the Consumption of Fibers in the United States, 1892–1939* (U. S. Bureau of Agricultural Chemistry and Engineering, New Orleans, 1941), Tables 6 and 18.

exerted in either case. These two instances are the arrival of free wool in 1894 and again in 1913,[56] and the return to the tariff in 1897 and 1921 respectively.

The situation that developed in 1897 perhaps deserves special consideration since that very year marks a transition from a high level of wool consumption, both absolute and relative to other fibers, to a much lower one (Charts 19 and 22, and Table 13). Although during the past decade curtailed wool consumption may have resulted in part from the competition of rayon, this was not true at the turn of the century. What happened was that greatly increased imports during the period of free wool (1894–97), and particularly during the months preceding the reimposition of the tariff in July 1897, led to a high apparent level of consumption; similarly, smaller imports than had prevailed throughout the preceding ten years rendered wool consumption extremely low during the remaining two years of the century. While these happenings account for the sudden break in 1897, they do not explain why wool consumption did not again, save for isolated years, reach the level of the 1890's. Probably the chief causes were increasing competition from cotton, and the emergence of rayon. Indeed, it seems to have been during the era of free wool that farmers in the West, from sheer desperation, began to market sheep and lambs for meat rather than for wool.

As is easily seen from the foregoing summary, the complete story of the wool growing enterprise would require a much more thorough analysis of tariff policies and their effects than the scope of our study allows. But this much is obvious: domestic demand has affected domestic supply only indirectly through the import situation, and periods of high per capita consumption have usually coincided with years of low output.

[56] The 1913 tariff law never received a fair trial, since military exigencies soon counteracted any effects it might have had.

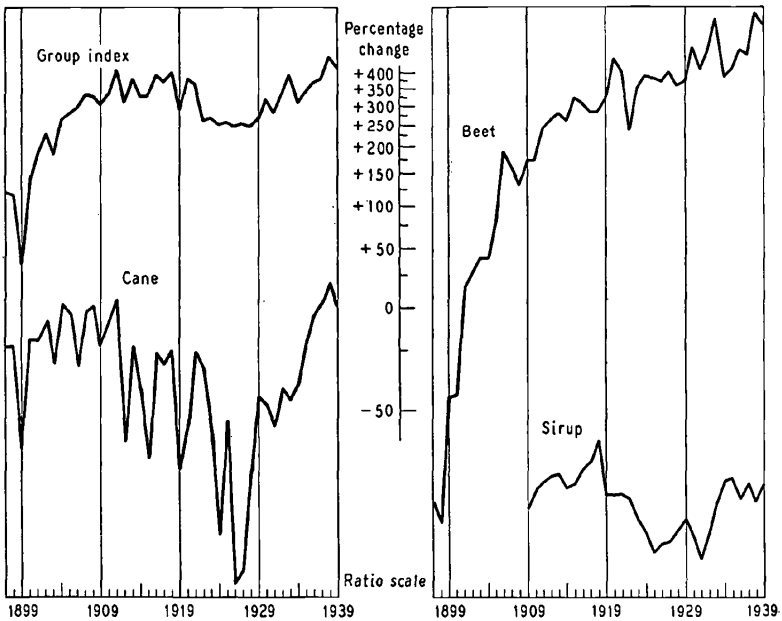
SUGAR CROPS

This group combines the yield of two totally different plants, sugarcane and sugar beet. Since the resulting foodstuffs are identical, the two crops are treated together in this discussion.

Sugar is the most important food item derived principally from areas outside the North American continent.[57] The

Chart 23

SUGAR CROPS: NET OUTPUT



For source and notes see Appendix D

period of our study has witnessed drastic changes in the sources of sugar supply. The trend, observable in Table 14, has been toward independence of foreign sources of cane sugar, and more recently even of areas outside the continental United States. All imports from insular possessions and from

[57] Of food products in the wider sense only coffee looms as large in our import balance.

foreign countries consist of cane sugar, while beet sugar is restricted to the amount obtained from beets grown in the United States.[58]

Sugar was first extracted from home-grown cane in this country in 1791,[59] but the raising of sugar beets lagged almost one hundred years behind, notwithstanding sporadic attempts to introduce beet-sugar manufacture earlier in the nineteenth century.[60] The real rise of sugar-beet growing started with the Tariff Act of 1890 which replaced the tariff by a cash bounty payable directly to growers; various states added bounties of their own. Succeeding tariffs have been high enough to promote the growth of beet sugar as depicted in Chart 23. By 1906 more sugar of domestic origin was derived from beets than from cane, and the positions have not since been reversed.

Louisiana contributes 90 percent of all domestic sugarcane grown for sugar production. The cultivation of beets, though widespread, is concentrated in three areas: between 50 and 60 percent is grown in the Rocky Mountain states and in western Nebraska; a secondary area embraces Ohio and Michigan; and a third is California. Neither the cane nor the beet crop contributes more than 10 percent to gross farm income in any state, but in particular counties the picture may well be different.[61]

Our usual trend measures, which in this case fail to separate the different periods altogether satisfactorily, indicate an annual growth of 5 percent for 1897–1914 and of 2 percent for 1921–38 (Table 4 above). Actually, the period falls rather naturally into two phases of growth (1897 to 1911 and

[58] The amount of beet sugar occasionally imported from European countries is entirely negligible.

[59] P. G. Wright, *Sugar in Relation to the Tariff* (McGraw-Hill, 1924), p. 36.

[60] Only 0.19 percent of sugar consumed was domestic beet sugar in 1890. *Ibid.*, p. 68.

[61] See, for example, L. K. Macy, L. E. Arnold, E. G. McKibben and E. J. Stone, *Sugar Beets* (National Research Project, Philadelphia, 1937), p. 2.

TABLE 14

SUGAR

Percentage Distribution of Domestic Consumption by Sources, 1897–1939

Crop Years	*Continental United States*		*United States Insular Possessions*[a]	*Foreign*[b]
	Cane	Beet		
PERIOD				
1897–1901	11.1	3.2	14.8	70.9[c]
1902–1906	11.3	8.1	18.2	62.3[c]
1907–1911	10.5	14.1	23.9	51.6[c]
1912–1916	5.7	17.5	25.5	51.3[c]
1917–1921	5.1	18.4	23.9	52.6[c]
1922–1926	2.9	16.5	23.0	57.5
1927–1931	2.3	17.1	33.1	47.4
YEAR				
1931	2.8	19.1	43.5	34.5
1932	4.1	22.6	47.8	25.6
1933	3.8	27.0	49.7	19.5
1934	4.2	19.3	36.0	40.5
1935	5.8	19.2	40.8	34.2
1936	6.6	21.2	43.0	29.1
1937	7.5	22.2	43.5	26.8
1938	8.7	27.1	40.7	23.5
1939	7.1	24.8	36.2	31.9

Sources: 1897–1931: U. S. Tariff Commission, *Report to the President on Sugar,* Report No. 73, Second Series (Washington, 1934), p. 159; percentages refer to total market deliveries for consumption.

1931–39: *Statistical Abstract of the United States, 1940,* Tables 701, 703; percentages refer to sugar available for consumption, regardless of stocks at beginning and end of year.

[a] Hawaii, Philippines, Puerto Rico, Virgin Islands (since 1917).

[b] For the past three decades, almost exclusively Cuba; prior to 1903, when Cuba was granted preferential tariff, also Java, Germany, San Domingo and some South American countries (notably Peru) although even then Cuba was usually the largest *single* source abroad. For some years following 1903 imports from countries other than Cuba continued until expanded Cuban production forced the sugar price to a level at which other countries were squeezed out.

[c] Includes a small amount (less than 1 percent) of undetermined origin.

1928 to 1939), one of stagnation (1911 to 1921) and one of depression (1922 to 1928). Total domestic sugar crop production, according to our index, reached a peak in 1911, thanks to the rapid rise of beet cultivation, and for the succeeding decade kept fairly close to that level. At the start, decline in cane output was balanced by the continued growth of sugar-beet production. But once the rate of growth of beet output had begun to slacken in 1921, a succession of low-output years ensued until 1929, when both sugarcane and beets moved upward; thereafter production expanded year after year (except for 1934 when drought affected the crop) to reach an all-time high, more than 50 percent above the 1929 level, in 1938.

The fluctuations of the past 20 years are attributable largely to the changing fortunes of sugarcane cultivation. Although cane production fluctuated but little up to the first World War, it had shrunk to about half its former dimensions by the onset of the immediate post-war depression; and in the mid-1920's it stood at about one sixth its pre-war level. Recovery in the 1930's was equally rapid. These violent fluctuations must be charged primarily to the damage wrought in the Louisiana [62] cane fields by the so-called mosaic disease,[63] which had obtained a firm footing by 1919. Beginning with 1921 this plague caused both per-acre yield and acreage harvested to shrink year after year, while government experts were busy trying to develop disease-resistant strains. In this they succeeded: yields rose after 1926, acreage after 1927. Wider distribution of resistant strains has subsequently helped to bring about yields per acre not recorded since 1909, the year for which the first yield data are available. The extent of both the depression and the ensuing recovery may be gauged by Chart 24.

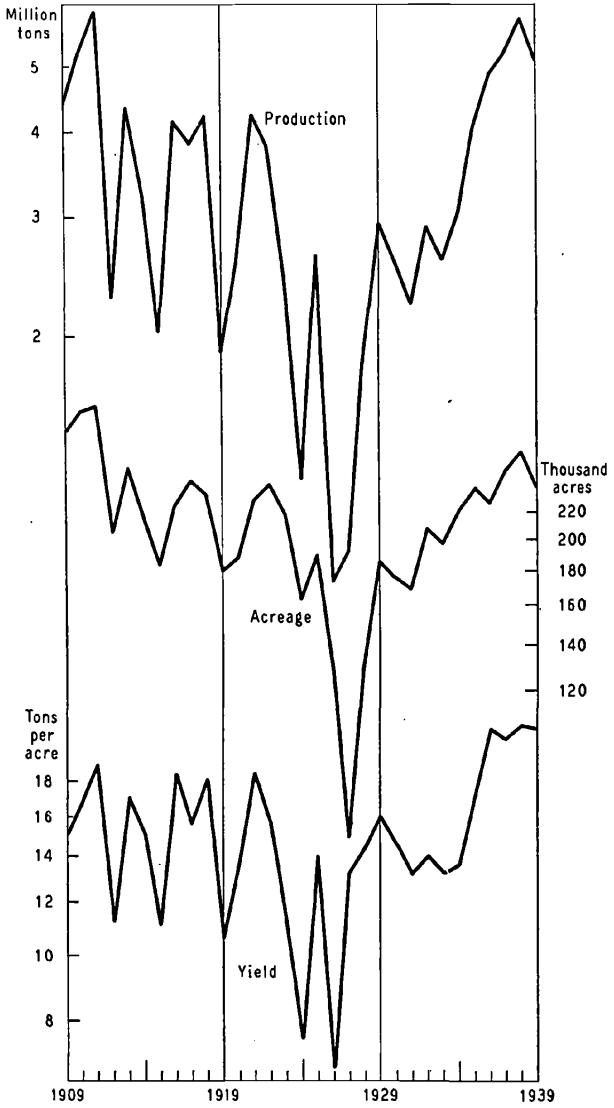
[62] Florida entered sugarcane production only recently and contributes but a small fraction to total sugar output.

[63] U. S. Department of Agriculture, *Technology on the Farm* (Washington, 1940), pp. 141-42.

Chart 24

SUGARCANE FOR SUGAR IN LOUISIANA

Production, Acreage and Yield, 1909 – 39



For source and notes see Appendix D

Although the assumption is a tempting one, it is quite unlikely that the slackening of domestic production in the 1920's was related to the approaching stability of per capita sugar consumption in the United States. The argument against a correlation is supported by the fact that in 1928 output resumed its upward trend in the face of a decline, though a minor one, in per capita consumption. The latter development deserves special mention, since rising per capita sugar consumption has been one of the most striking developments in human nutrition, much to the regret, it must be noted, of the nutritionists.[64] Whether the present stability signifies a genuine saturation of the demand for sugar or reflects the teachings of the experts it is hard to say.

Compared with beet and cane sugar, the other sugars and sweetening agents—maple sugar and sirup, sugarcane sirup, sorgo sirup, etc.—are of slight importance in the scheme of consumption, although in terms of gross income the four products just named have together accounted for a little more than 20 percent of the gross income derived from sugar crops as a whole.

Of the minor sugar products, sugarcane sirup is the most important; it roughly maintains the level it held in 1909, the first year for which we possess reliable data. It is of interest that the ups and downs of cane grown for sugar apply only to a negligible degree to cane grown for sirup. This is probably because the latter is more widely distributed geographically than the former, and thus escaped the plight of sugarcane in Louisiana. More than half the output of cane sirup comes from states which no longer contribute to sugar production (South Carolina, Georgia, Alabama, Mississippi, Arkansas, Texas), and in these states the bulk of the output is consumed in the grower's household, being consequently much less exposed to the vicissitudes of the market.[65]

[64] See pp. 163-64 below.

[65] Sugarcane sirup consumed by farm households is included in our index so far as statistics allow.

The three remaining crops, maple sugar, maple sirup, and sorgo sirup are too unimportant to treat in detail, the two former contributing even in Vermont not more than 2 to 3 percent of gross farm income. Other sugars such as glucose or grape sugar are manufactured products and thus do not come within the scope of this study.

MEAT ANIMALS

This group comprises only cattle, calves, hogs, sheep, and lambs, i.e., the animals which provide the raw material of the meat-packing industry. Horses and mules are excluded, and other livestock products (milk, shorn wool) are treated elsewhere, as is also the poultry enterprise.

Since we are interested in the relationship of production to employment, we have chosen to account not only for the number of animals slaughtered, but also for additions to, or deductions from, herds. Clearly, if we assume that in a given year no animals are sold for slaughter or are slaughtered on farms, but that all young stock are added to existing herds, we still cannot consider the output of such a year as zero. Net output is therefore defined as the number of animals slaughtered—this being the closest approximation to the total number of heads disposed of on farms and ranches either by slaughter or by sale for slaughter [66]—plus or minus the increase or decrease in the number on hand between the beginning and the end of the year.

This procedure raises the awkward problem of assigning a price to the computed change in inventory. To use for this purpose the price received by farmers for animals sold for slaughter is to introduce an artificial element. What we are in fact assuming is that if the addition to herds had been marketed it would have sold at the average annual farm price, or in the opposite case, that the number of animals sold from

[66] Animals reshipped (so-called stockers or feeders) are omitted, since such transfers take place within the enterprise itself.

herds beyond the point of replacement went at the average price realized for all animals. Neither calculation is altogether correct, yet neither can be dispensed with except through a lengthy investigation of the changing age and sex composition of the herds.[67] However, since we are not dealing with income estimates, but require prices merely as statistical weights in estimating production, these prices are thought sufficiently accurate as indicators of the relative importance of the various animals in question.

The omission from our indexes, both for livestock and for output as a whole, of horses and mules also calls for some explanation. This apparent deficiency stems in the main from the impossibility of securing reliable data concerning the movement of horses and mules to nonagricultural areas and occupations. In principle there is a strong case for treating the sale of horses to urban areas, adjusted for changes in inventory, as a form of agricultural production.[68] However, apart from the fact that the methods available for estimating sales of horses off farms are rather unsatisfactory, we face the added difficulty that for many years the number thus disposed of (corrected for the change in number on hand) yields a negative result. The net output of horses may indeed have been negative, but the statistical evidence is very insecure.

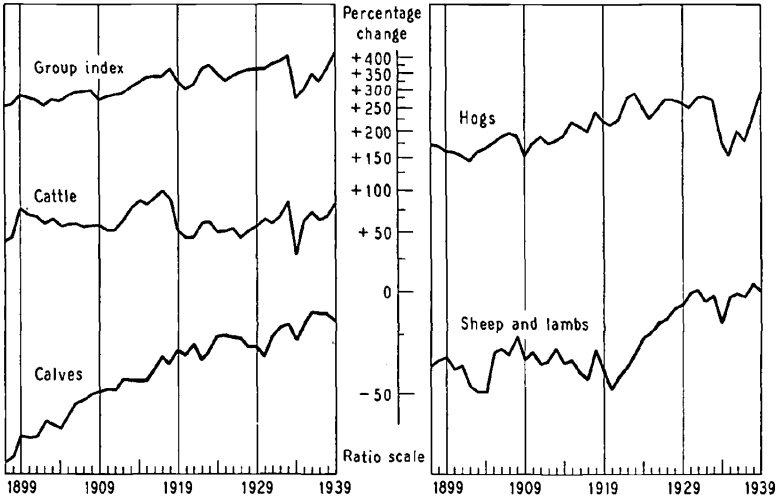
[67] It might be argued that certain types of changes in livestock inventories should be regarded as fluctuations in the volume of capital equipment, and that such changes should not be treated as additions to or deductions from current output. The only type of animal for which this argument has real justification is, of course, the dairy cow. However, since the final destination even of most dairy cows is the slaughterhouse, we may consider changes in the number of dairy cows as a measure of changes in their production, without being guilty of a major inconsistency. As always, our decision was shaped by the availability of data, the amount of work required to follow a more refined method, and the probable difference in the final result.

[68] As in the case of the milk cow, it might seem preferable to regard the farm horse as a form of equipment. If changes in the number of horses were counted as part of production, additions to buildings and permanent improvements might be thought to possess an equal claim to inclusion in the volume of production; in fact so might everything on which farm labor is expended. Such a treatment, even if desirable, is obviously not feasible.

For all these reasons, it was finally decided to omit both horses and mules altogether.

The production of meat animals is by far the most important branch of the farm economy. Around 1899, according to our measurements (Table 2), it accounted for 32.5 percent of all physical output, and in spite of its diminished significance

Chart 25
LIVESTOCK: NET OUTPUT



For source and notes see Appendix D

it still contributed 27.2 percent in 1937. As between the different kinds of animals, hog raising had a slight lead over cattle raising at the beginning of the period under discussion and has since retained it; [69] in fact hog raising itself represents the second largest farm enterprise, being surpassed only by dairy farming. Cattle, hogs and sheep are found throughout the country, but their significance in the farm economy differs widely from state to state, both in absolute number

[69] In terms of gross income, cattle and calves combined have overtaken hogs by a narrow margin since 1937.

raised and in their relation to other enterprises. Thus, in the late 1930's, the 50,000 cattle on the farms of Delaware contributed about 3 percent to the gross farm income of that state, while during the same period Iowa farms derived more than 20 percent of their gross income from their 4.5 million cattle.

Notwithstanding these differences, livestock raising [70] is perhaps the least concentrated type of agricultural activity. In recent years only one state, Iowa, has been responsible for as much as 10 percent of all gross income derived from cattle and calves; two states, Iowa and Illinois, occupy a similar place in hog raising; no state has a lead of equal proportions in sheep and lamb production. The Corn Belt states naturally figure most prominently: about half the cattle and calves slaughtered originate in the twelve North Central states,[71] and the western seven of these have recently accounted for about 70 percent of hog production. Sheep production, on the other hand, is most heavily concentrated in the West.

Livestock production as a whole has increased rather steadily throughout the past four decades with only one serious interruption—the drought year 1934 (Chart 25). The computed rate of growth is 0.6 percent per annum, slightly higher for the pre-war period and practically zero for the post-war period (Table 4 above). Yet we should hesitate to conclude from these data that retardation of growth in the production of meat animals has already set in, for the absence of a positive growth rate for the period 1921–38 is evidently due to the exceptional conditions which affected all four species during 1934–37. It is clear, nevertheless, that meat animal production has not grown as fast as farm output as a whole, which increased at around 1 percent per annum on the aver-

[70] Within this section the term "livestock" is used as a synonym for "meat animals." Throughout the remainder of the book "livestock" includes both meat animals and livestock products.

[71] Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

age. Thus the contribution of meat animals to net physical output fell from 32 percent in 1899 to 27 percent in 1937 (Table 2 above).[72]

Calves, of the four categories, have shown the greatest increase over the period: whereas in 1899 one calf was killed for every 2.8 mature animals, the ratio, by 1939, had increased to 1:1.6. In 1916 the output of calves (in terms of liveweight pounds) for the first time exceeded the output of sheep and lambs. Even at the peak, however, calves contributed less than 10 percent to total meat animal production.

Sheep and lambs come next in order of increase, showing a rise of more than 60 percent over the period 1899–1937. But again the contribution to total livestock output is below 10 percent, so that the course of this output as a whole is influenced only slightly by the expansion of the output of either calves or sheep and lambs.

Cattle and *hogs,* in contrast to the two expanding, but minor series, have changed but little over the 40 years. Hog output in the 5-year period centered on 1937 was just 17 percent above the output of the half decade centered on 1899; and cattle output had risen by barely 8 percent over the same period. These gains are, of course, smaller than the increase in population.

For an explanation of the virtual stagnation of cattle and hog production, we have to consider—as in the case of wheat, sugar and many other items—both the changing diet of the American people and the loss of export markets. The first topic is dealt with in Chapter 4, and will not be treated further here; but the development of foreign trade requires some discussion at this point (see Table 15). Before we can proceed, however, we must distinguish between the export of cattle and beef products, and that of hogs and pork prod-

[72] The decline in the contribution of meat animals is probably understated, inasmuch as truck crops, which appear to have increased greatly in relative importance, are unrepresented in the comparison undertaken in Table 2.

ucts. Though both items are alike in that they began to be major factors in the export situation at the same time, and though the export of both has now declined to negligible proportions, they differ with respect to the time this decline set in and to the events which caused it.

As is well known, the rise in meat exports was closely connected with the spread of refrigeration, which dates from the 1870's. By 1880, this country was exporting (in terms of gross

TABLE 15

BEEF AND PORK

Exports as Percentage of Gross Farm Income from Each, 1894–1937

Period	*Live Cattle and Beef Products*	*Pork and Pork Products*
1894–98	16.4	18.8
1899–1903	15.5	20.9
1904–08	13.7	17.2
1909–13	4.9	13.3
1914–18	7.4	18.8
1919–23	5.0	21.1
1924–28	2.4	12.4
1929–33	1.2	6.9
1934–37	0.5	2.7

Source: Frederick Strauss, *The Composition of Gross Farm Income since the Civil War,* Bulletin 78 (National Bureau of Economic Research, 1940), Table 6. Data are averages for calendar years shown.

farm income) 15 percent of its beef production, including live cattle; thereafter there was a decline resulting from import restrictions imposed by European countries, but once the restrictions were relaxed, in 1887, the proportion exported rose again, and remained close to 15 percent until about 1907. At that time Argentina was rapidly overtaking the United States in the competitive market.[73] Although that country exported

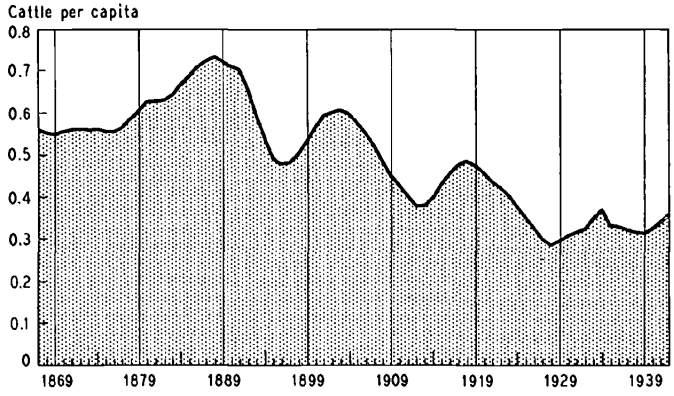
[73] Figures on Argentine exports from L. R. Edminster, *The Cattle Industry and The Tariff* (Macmillan, 1926), p. 150; on United States exports, U. S. Agricultural Marketing Service, *Livestock, Meats and Wool Market Statistics and Related Data, 1940* (Washington, 1941), p. 56.

only 6.6 million pounds of beef [74] in 1896, it shipped abroad an average of 245 million pounds during each year of the period 1901–05, and this average almost doubled during the succeeding five years; in contrast, United States exports of beef were 360 million pounds in 1896, 400 million pounds a year during 1901–05, but only 270 million pounds in

Chart 26

THE CATTLE CYCLE

Number of Beef Cattle on Farms, January 1st, per Head of U. S. Population, 1867 – 1942



For source and notes see Appendix D

1906–10. By 1913 beef exports from the United States had dropped to a mere 40 million pounds, and even this modest level was never regained after the temporary wartime boom had spent itself in 1920–21.

The question as to what factors were responsible for the replacement of American by Argentine exports is a rather complex one, deserving of more than the summary treatment to which we are limited here. The factors involved in the rather sudden change appear to have been the following:

(a) The slowing down in the expansion of this country's total beef cattle inventory. The peak of the cattle cycle 1896–

[74] Excluding live cattle.

1912 occurred in 1903 and, on a per capita basis, fell below the peak reached in 1888 during the preceding cycle (Chart 26). This development, in turn, may be related to the disappearance of the frontier and the inability of beef raising to compete successfully with other farm enterprises, once the advantages inherent in the open range had been lost.[75]

(b) Both aggregate beef production and per capita consumption continued to rise until 1909. If per capita consumption had remained at the 1899–1901 level, exports could easily have been continued at pre-1907 levels; in other words, it was not so much the inadequacy of current production—though sooner or later the encroachment upon inventories was bound to lead to a decline in output—as the increase in domestic per capita consumption that curtailed the amount available for exports.

(c) It is hardly a mere accident that the decline of United States meat exports coincides exactly with the entry of this country's meat packers into the South American market, though it is difficult to assign cause and effect. Certainly the North American packers took a hand in the South American trade, perhaps because it had already been expanding greatly,[76] and it is also true that their movement into Argentina and Uruguay resulted in further and accelerated expan-

[75] This point is made very forcefully by Edminster, *op. cit.*; unfortunately writing in the 1920's, this author drew his conclusions from Department of Agriculture figures which have since been revised in such a way as to weaken his argument. As is evident in Chart 26, per capita inventory of beef cattle reached a peak in 1888 and a low in 1896. During those years nothing happened to beef exports, although population pressure must have been just as strong as during the succeeding cycle. The relative decline in the beef cattle industry would thus seem to have been a necessary condition, but in no way a sufficient one. Other factors, such as rising domestic costs (Chart 27), the profitability of South American exports during and after the Boer War, and the corresponding reaction of the United States meat packers, must be taken into consideration if a satisfactory explanation is to be found.

[76] About 30 times more frozen meat was exported from South America in 1907 than in 1897, and exports of chilled meat, which were nonexistent in 1897, amounted to half as much again as those of frozen meat in 1907; A. D. Melvin, "The South American Meat Industry," *Yearbook of Agriculture, 1913*, p. 353.

sion of frozen, and particularly chilled, meat exports. Though the opening fanfare in the packers' South American drive was not sounded until 1907, when the largest Argentine firm was acquired by the Swift interests,[77] within three years United States packers controlled over 40 percent of total Argentine and Uruguayan beef exports,[78] and in succeeding years increased exports were attributable largely to the widening activities of the American-controlled establishments.[79]

To summarize, there can be little doubt that although beef exports from this country declined severely after 1907, total exports by United States packers, regardless of the origin of shipments, increased, as export operations were shifted from this country to Argentina and Uruguay. It is unlikely that the packers were forced into this situation by dwindling supplies at home, since on a per capita basis herds began to decline as early as 1888, and it was not until 1909 that the previous low of 1896 was reached (Chart 26). Total production, on the other hand, increased up to 1909, by which time the United States packers were firmly entrenched in Latin America (Chart 27). A low in exports was touched in 1913,[80] the year when the tariff on imports into this country was abolished, and for the next two years large amounts of beef, originating chiefly in South America, were imported to relieve a brief shortage resulting from a decline in production.[81] Temporarily reversed during the war, the downward trend has by

[77] Federal Trade Commission, *Report on the Meat-Packing Industry,* Summary and Part I (Washington, 1919), p. 164.

[78] *Ibid.,* p. 167.

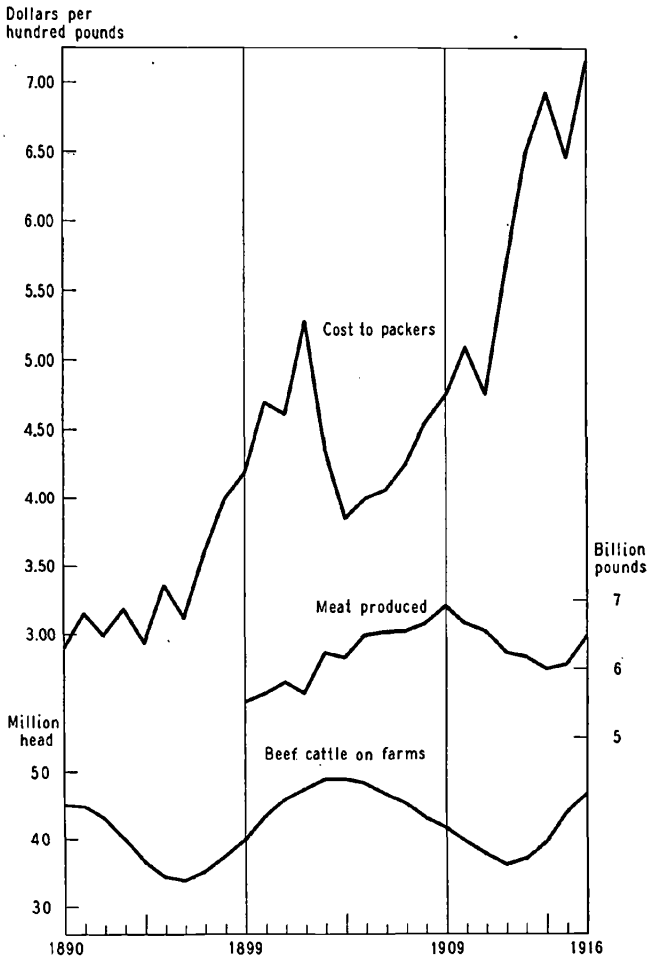
[79] *Ibid.,* p. 166.

[80] Strauss, *The Composition of Gross Farm Income since the Civil War,* Table 6.

[81] From evidence in the Federal Trade Commission reports mentioned above it seems that these imports too were largely under the control of United States packers. It is interesting to note in this connection that the average cost of domestic cattle to United States packers (per pound of live weight) had risen almost uninterruptedly since 1896, and especially sharply between 1911 and 1913 (Chart 27). Comparable costs of imports are not available.

Chart 27

MEAT PRODUCTS: VOLUME AND COST, 1890-1916



For source and notes see Appendix D

now reached a point where beef exports have practically disappeared.

The turning point in beef exports occurred as early as 1907, but pork exports, despite a slight shrinkage during the

years immediately preceding the World War, were rising as late as 1923, in which year they accounted for as much as 19.4 percent of the gross farm income derived from hogs.[82] Then the downward tendency which had been interrupted for about ten years revived with redoubled intensity, so that in the decade 1927–37 there was only one year, 1929, when as much as 10 percent of farm income from hogs was supplied by exports.[83] European competition, rather than the development of South American production, has been in the main responsible for this trend.[84]

Changes in the output of both veal and lamb (including mutton) are little affected by foreign trade. The rise in veal consumption reflects on the one hand a trend toward a lighter and finer type of meat, and on the other a preference on the part of foreign-born elements of the population.[85] Consumption of veal may also have been stimulated by the increased supply of calves for slaughter associated with the expansion of dairying: to some degree milk and calves may be regarded as joint products. The expansion in the output of sheep and lambs is more difficult to trace, since it is intimately connected with wool production and thus must have been influenced by the emergence of Australian and Argentine competition and by changes in the tariff on wool and its price. It appears true in general that the real beginning of expansion was the severe crisis of the 1890's which threatened virtually to wipe out wool growing in this country.[86] As a means of raising cash, the sale of lambs for meat was pushed and, as so often, an emergency measure proved to be the beginning of a trend. Though specific data are lacking, there can be little

[82] Strauss, *op. cit.*, Table 6.

[83] *Ibid.*

[84] Of particular importance appears to have been a preference developed in the English market for Danish-type bacon which cannot easily be shipped from this country.

[85] R. A. Clemen, *The American Livestock and Meat Packing Industry* (Ronald, 1933), p. 268.

[86] M. A. Smith, *The Tariff on Wool* (Macmillan, 1926), pp. 116-17, 120.

doubt that most slaughtered animals classified as "sheep and lambs" around the turn of the century were in fact sheep, and it was only gradually that lamb began to replace mutton.

In conclusion it must be mentioned that the drop shown by the composite index for meat animals as a group for 1934 would be somewhat less severe if we had included the more than 4.5 million cattle and calves which in that year were slaughtered for government account and turned over for the most part to state relief associations. Inclusion of this item would have raised cattle output by about 30 percent and the output of calves by about half as much, so that the livestock index for 1934 would have stood at 91 instead of 80.2.[87] The case of sheep and lambs is analogous to that of cattle, but of little quantitative importance; the same observation applies to hogs, to which we must add that the government purchase of more than 6 million pigs under the emergency control of hog production in 1933 yielded but 100 million pounds of meat which was distributed to needy families.[88] The balance of the slaughter was utilized in the manufacture of tankage, fertilizer, etc.

POULTRY AND EGGS

In absolute numbers chickens far exceed all other farm animals taken together: since 1910 there have never been fewer than 350 million chickens on the country's farms at the beginning of each year; an even larger number are consumed

[87] Whether the item should be included is arguable. On the one hand, we have made it a practice to exclude crops not harvested or donated to charity (e.g., citrus fruit in California); on the other, since our prices of grain, cotton, etc., include loan values, it might have been logical to include the results of government intervention also in this case. It is noteworthy that although slaughter and meat production statistics, as given in *Agricultural Statistics, 1940,* Tables 475 and 498, exclude this item, it is obviously included in a recent recapitulation of total net meat production as released in U. S. Agricultural Marketing Service, *Farm Production and Income from Meat Animals, by States, 1939–1940* (Washington, 1941).

[88] Total pork consumption in 1934 exceeded 9 billion pounds; see Appendix Table B-1.

annually, one third on the farms where produced, and the balance in urban and rural homes. Since they require little in the way of land resources, chickens more than any other farm animal are most often raised by nonfarm families. According to an estimate released in 1930,[89] one chicken is raised off farms for every 20 chickens on farms.

Chicken production is widely scattered. Iowa, the leading state in 1939, contributed a little over 6 percent to total chicken output, Illinois, a bare 5 percent; all other states were responsible for less than 5 percent each. The North Central states together account for about half of total output. Egg production is even more widely dispersed. Some of the New England states have derived as much as 20 percent of their gross farm income from chickens and eggs; Delaware, more than 30 percent. For most states, however, the percentage is less than 10.

Our combined index for eggs and chickens, which after 1929 includes the net output of turkeys as well, gives evidence of remarkably steady growth (Chart 28). The average rate for the four decades is 1.7 percent per annum—a tempo exceeded by two groups only, dairy products and citrus fruit (Table 4).[90] The output of eggs and poultry contracted significantly only during the 5-year span 1931–35, and by 1939 production was above the record levels of 1930. There is some evidence of retardation in the rate of expansion, the annual growth rate being 3.1 percent for the pre-war period, but only 0.6

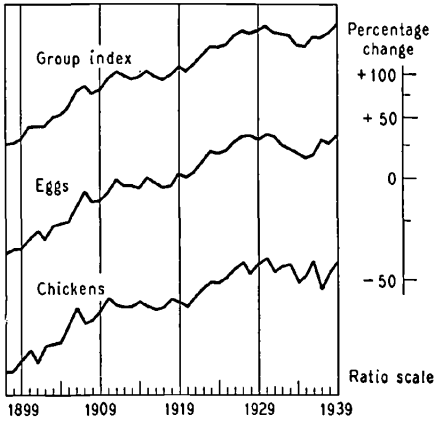
[89] S. A. Jones, "Method and Procedure in Estimating Production, Disposition and Income from Poultry and Eggs," *Farm Value, Gross Income, and Cash Income from Farm Production,* Part II (U. S. Bureau of Agricultural Economics, 1930), p. 26. Chickens raised off farms are not included in our output index.

[90] We may note that in 1937 the indexes for sugar and for oil crops on a 5-year average basis stood at a higher level in relation to 1899 than the corresponding index for eggs and poultry (223 and 216 respectively against 196; see Table 6). However, relapses suffered at various times by oils and by sugars are not paralleled in the case of eggs and poultry, and the computed growth rate for the latter group consequently exceeds the rates for the two former groups.

percent for the post-war years; yet even the latter exceeds the corresponding rate for agricultural output as a whole (0.5 percent—see Table 4 above). For the four decades together, eggs and poultry have in fact grown almost twice as fast as farm output as a whole; their share in net physical output has expanded from 9 to 12 percent (Table 2). Within the group, the share of eggs rose from not quite two thirds to nearly

Chart 28

POULTRY AND EGGS: NET OUTPUT



For source and notes see Appendix D

three quarters. Just about twice as many chickens were produced in 1939 as in 1899; but the output of eggs rose to 2.2 times its former level. This shift has resulted mainly from an increase in the number of eggs per laying chicken.[91]

There remains the question whether the inclusion in our index of other types of poultry would materially affect the results just outlined; this is difficult to settle with confidence, but if we were to base a guess on the scanty data available, we would answer in the negative. The dominant position of chicken eggs and the negligible number of birds other than

[91] See Table 50 below. The increases during the months of November and December of each year have been particularly striking.

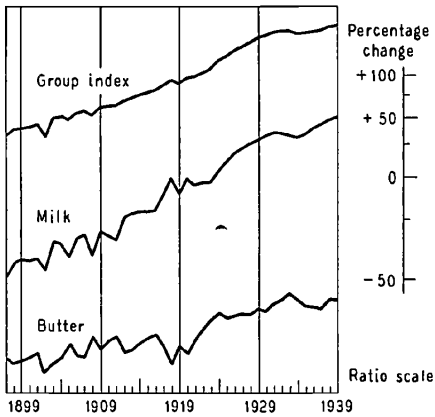
chickens, as evidenced by early Census data,[92] leads us to believe that the coverage provided by chickens and eggs alone is sufficiently high to yield results applicable to poultry as a whole. Even in 1929 and 1937, years for which we possess data on the output of turkeys, the contribution of the latter to the total value of the group did not amount to more than 3.4 and 6.2 percent, respectively.

MILK AND MILK PRODUCTS

As indicated in an earlier section, dairy farming is the largest single farm enterprise: at the turn of the century it contrib-

Chart 29

MILK AND MILK PRODUCTS: NET OUTPUT



For source and notes see Appendix D

uted 15.9 percent to total output, followed closely by hogs (15.8) and by cattle and calves (15.2); in 1935–39 the percentage contribution of milk and milk products had risen to 22.1, while the share of the nearest competitor—hogs—had dropped to 13.1 (Table 2 above). Dairying ranks high even when com-

[92] Jones, *op. cit.*, p. 7. This report served as the basis for the estimates of chickens and eggs in 1899 (see Appendix A), but lack of supplementary material made it impossible to combine into an annual series the data given for other fowl.

pared to the leading branches of manufacturing. The gross income derived from dairying in 1937 ($1,937 million), when compared with the value of products of leading branches of manufacture, ranks just below the fifth largest manufacturing group (motor-vehicle bodies and parts) and above such important industries as electrical machinery, printing and publishing (newspapers and periodicals), or cigarette manufacture.

As in the case of poultry, no state contributes, in terms of gross income, as much as 10 percent of aggregate production; but in terms of weight in pounds, Wisconsin has for many years turned out more than a tenth of the total.[93] Minnesota, New York and Iowa, in 1939, each accounted for more than 5 percent of the total, but the remainder of the milk output was divided between twelve states producing between 2 and 5 percent each, fourteen states with 1 to 2 percent each, and the remaining states with less than 1 percent each. Geographically, dairying is rather widely dispersed. When production data are broken down in accordance with the use to which milk is put, this statement must be qualified. More than 30 percent of all milk skimmed for sale as cream in 1939 originated in Minnesota and Iowa, more than 50 percent in the seven West North Central states.[94] On the other hand, over half the dairy products consumed on the farms where they were produced were accounted for by the sixteen states in the South Atlantic and South Central regions, which figure only negligibly in the production of milk for sale. For the country as a whole about 25 percent of all milk produced is consumed on the farm on which it originates.

The steady expansion during the past four decades of the output of milk and products derived from it distinguishes this group rather sharply from others considered here. While

[93] This discrepancy is due to the fact that most Wisconsin milk goes into manufactured dairy products and thus earns a lower price per unit.

[94] Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

the respective shares of liquid milk and of butter in the group total are subject to rather sharp movements from year to year, the growth in the output of the group as a whole has been remarkably smooth (Chart 29). Over the entire period the average annual rate of growth amounts to as much as 2.1 percent, being exceeded only by that of citrus fruit (Table 4 above). The output of dairy products increased more than twice as rapidly as population, and its contribution to net farm output as a whole rose from 16 percent in 1897–1901 to 22 percent in 1935–39 (Table 2). With the exception of wool, milk is the only product that grew more rapidly in the post-war than in the pre-war period.[95] Its average growth rate during 1897–1914 (1.5 percent) equaled that for farm output as a whole; during 1921–38 the group rose (at 1.8 percent yearly) more than three times as rapidly as total farm output (Table 4 above).

From the available data it appears that expansion from 1909 to 1919 was due mainly to an increase in the number of milk cows.[96] For the succeeding decade, numbers did not increase much; but milk production per cow rose 10 percent from 1924 to 1929 [97] and appears to have expanded even more between 1919 and 1924. Since 1929 growth has been attributable again to increase in the number of cows, with production per cow falling from 1929 to 1934 and returning to the 1929 level in 1940.

In constructing our index for this group, we weighted butter and the various forms of fluid milk by their respective farm prices. Consequently the index reflects not only changes in total milk production (measured in gallons), but also shifts between alternative uses. It shows that dairy products in-

[95] However, we have no data for truck crops in the earlier period; possibly they also may be an exception in this respect.

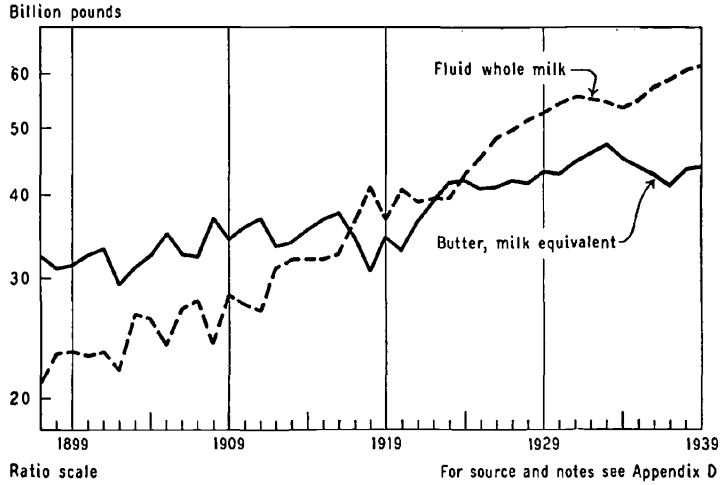
[96] R. G. Bressler, Jr., and J. A. Hopkins, *Trends in Size and Production of the Aggregate Farm Enterprise, 1909–36* (National Research Project, Philadelphia, 1938), Tables A-95 and A-96.

[97] U. S. Agricultural Marketing Service, *Farm Production, Disposition and Income from Milk, 1924–1940, by States* (Washington, 1941), p. 2.

creased 96 percent between 1899 and 1937 (5-year averages) whereas the net output of milk in gallons (i.e., unweighted) rose only 86 percent. The divergence between our index (weighted) and milk output in gallons has been particularly pronounced since the first World War, and it is an indication of the fact that the milk supply has shifted to outlets which have yielded consistently better monetary returns. The de-

Chart 30

MILK AND BUTTER: PRODUCTION



tailed data [98] on milk disposition tell the story: while total butter production increased by less than 40 percent between 1897 and 1939, farmers, over the same period, expanded their sales of fluid whole milk (mainly for consumption in liquid form [99]) roughly threefold. Again, whereas in 1897 more milk

[98] See Appendix A.

[99] Whole milk disposed of in fluid form must not be considered altogether identical with consumption of milk. A sizable proportion of whole fluid milk sales goes into cheese manufacture and a somewhat smaller fraction is turned into evaporated milk, etc. The exact relationship between forms in which milk is sold off farms and in which it is consumed is rather complex and not easily subject to statistical verification; but it appears approximately true that most milk sold as butterfat actually is turned into butter and that little butter is produced from milk sold as whole fluid milk.

left the farms as butter or butterfat than as whole fluid milk, the situation began to be reversed around the end of the World War, and had so changed by 1939 that fluid whole milk sales off farms exceeded farm sales of butter and butterfat by over 40 percent. This shift may be seen in Chart 30.

Another change that has proceeded apace throughout the period and is similarly reflected by the index is the transfer of buttermaking from farm to factory.[100] According to a recent estimate,[101] 1917 was the first year in which more than half the butter produced originated in creameries, and since then factory butter has never relinquished its leadership. Farm butter output reached its peak in the first few years of this century; by now its share of total butter output has shrunk to but little more than 20 percent, and by no means all of this is marketed.[102] It is easily seen that such a shift would tend to depress the index, if we were using unit labor requirements as weights. Though less obviously, weighting by prices of butter and butterfat respectively has the same effect, since the price of farm butter has consistently been above that of an equivalent amount of butterfat.[103]

NONCITRUS FRUIT

Although the climate of most of the states of the Union will support fruit trees, only apples, peaches and cherries are at all widely dispersed. Other kinds of fruit are concentrated on the Pacific Coast, and especially in California. Today California produces 90 percent of all our grapes and apricots, and, with Oregon, over 90 percent of all plums and prunes. California

[100] In contrast to butter, cheesemaking appears to have become predominantly a factory operation by the late 1860's.

[101] E. E. Vial, *Production and Consumption of Manufactured Dairy Products,* Technical Bulletin 722 (U. S. Department of Agriculture, 1940), Appendix Table 5.

[102] Percent of farm butter marketed was about 40 in 1924, 20 in 1939.

[103] To facilitate these comparisons milk, butter and butterfat had to be reduced to comparable milk equivalent units. The technical procedure is described in some detail in Appendix A.

also contributes heavily to peach, pear and cherry production, providing two fifths of the nation's supply of peaches, one third of the pears and more than a tenth of the recorded production of cherries. The main fruit crop for which California does not top the list is apples; the four states—Washington, New York, Virginia and Pennsylvania—yield half the total output of apples, with Washington alone producing a fifth of the entire crop.

The emergence of California and the Pacific Northwest as the leading fruit growing area has probably been the outstanding feature in the recent history of this branch of agriculture. Up to 1900 Washington had produced only one apple crop exceeding 2 million bushels; in 1937 it produced over 30 million bushels. Similarly, pear production in the Pacific Coast states rose threefold between 1919 and 1938, but only about a third in the rest of the country. Production of clingstone peaches in California has increased more than tenfold since 1909, and it now represents 20 to 30 percent of the country's total peach crop.

Our index for noncitrus fruit rests upon data whose adequacy diminishes progressively as they recede beyond 1919. Sometimes output records, sometimes price records, and frequently both, have had to be pieced together in an effort to gauge the development of this important category of agricultural production. While it is believed that long-run tendencies are mirrored in our index with reasonable fidelity, the year-to-year fluctuations are probably much less reliable.[104]

[104] Wherever possible, we have relied on official data; unfortunately, however, revised estimates of fruit production for years prior to 1919 have not yet been released by the Department of Agriculture, so that we had to resort to earlier, unrevised, estimates; those, in turn, were supplemented by estimates made some ten years ago by Dr. O. E. Baker, of the Department of Agriculture, in collaboration with Professor S. W. Shear, of the University of California. Since Professor Shear is an outstanding authority on fruit statistics we did not attempt to improve upon his estimates, but merely tried to reconcile them with such official data for the more recent period as have become available since his estimates were made. The make-up of our series is described in some detail in Appendix A.

Apart from doubts about the validity of our data, short-run fluctuations are of less significance in this group for yet another reason: changes in acreage, i.e., in the number of bearing trees, take place comparatively slowly. Short-run changes in output result from the vagaries of the weather and the incidence of pests and diseases—to which few crops are more susceptible.

Our index includes for a varying number of years, in order of importance, apples, peaches, grapes, strawberries,[105] pears, prunes, apricots, cranberries, plums, figs and olives. It will be remarked that a great many fruits are missing from this list, notably cherries and various types of berries. These omissions are caused entirely by the absence of data [106] and fortunately are of minor consequence; in recent years the total value of the items omitted cannot have amounted to more than 7 or 8 percent of the value of noncitrus fruit as a whole. From the point of view of coverage our index may therefore be accepted as representative, at least from 1909 on; and there is ground for assuming that the representativeness of the index is of a high order even for the first decade.[107]

The noncitrus fruits together (including those omitted from our index) account at present for close to 4 percent of total gross farm income. Forty years ago the four principal fruits—apples, grapes, apricots and prunes—contributed 3.2 percent to agricultural output as defined here (Table 2). If

[105] Strawberries are frequently included among the truck crops, owing to the method of cultivation; in conformity with popular opinion and their place in the pattern of demand we have listed them with the fruits.

[106] Of the twelve states for which cherry production has been recorded, no data are available for seven prior to 1924, and for two prior to 1929. Production of berries, other than cranberries and strawberries, has been unrecorded until very recently.

[107] Among the items missing in the earlier period are peaches and strawberries. For the former we have an output series whose movements conform quite well to those of the index for the group, showing the same direction of change in eight out of twelve years; the lack of a price series for peaches prevented its inclusion. As for strawberries, we know from a comparison of the 1899 and 1909 Censuses that the number of crates of strawberries harvested remained practically unchanged between the two years; so did our index.

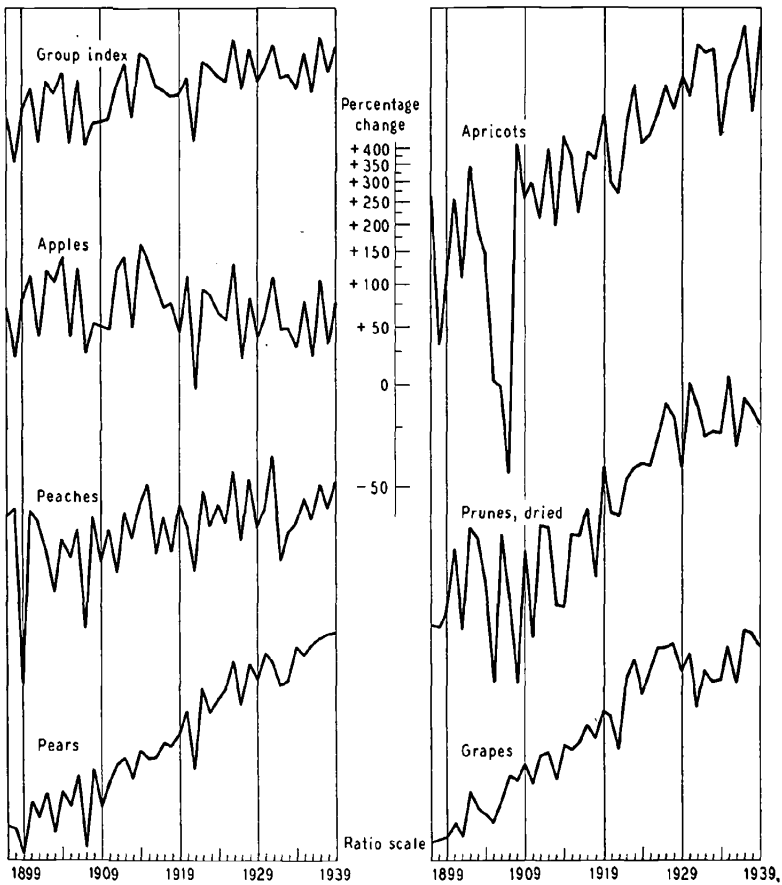
we make due allowance for the fruits not included in the earlier year we may conclude that the place of noncitrus fruit in agriculture has changed very little. The total area devoted to this group (excluding acreage of trees not of bearing age) is just over 4 million acres. Yet in 1939 more than $300 million of gross income was derived from these fruits, compared with slightly more than $400 million from wheat grown on an acreage over thirteen times as large.

As may be seen from Chart 31, year-to-year fluctuations in fruit production are exceedingly violent. This fact deprives our computed growth rates for the two subperiods of much of their significance, but we may notice that over the four decades as a whole the output of the group grew at an annual average rate of 0.9 percent, or slightly less than the corresponding rate for farm output as a whole (Table 4 above).

Apples are the dominant noncitrus fruit crop, accounting for close to 40 percent of the total value of all such crops included in our index in 1937; for this reason most of the changes in the group index can be explained with reference to the apple crop. The big 1921 slump is directly traceable to the very large loss inflicted on the apple crop of that year by frost and freeze. All states except those of the Pacific Northwest (which in that very year reaped a record crop) salvaged only a fraction of their customary harvest, and the southernmost fringe of the apple-producing states—Virginia, West Virginia and North Carolina—lost more than nine tenths of their crop. Regardless of the causes of change in the size of the apple crop, there is no doubt that its fluctuations govern the behavior of the index. And because of the relative decline of the apple crop—as against 2.8 percent in 1897–1901 it contributed only 1.9 percent to total output in 1935–39 (Table 2) —the group index fails to register a more decided increase over the whole period. The expansion in the output of grapes has tended, however, to offset the decline in apple production.

Grapes and *peaches* rank next to apples when the crops are

Chart 31
NONCITRUS FRUIT: NET OUTPUT



For source and notes see Appendix D

arranged by value of output, and of the two, the grape crop has recently outranked peaches. *Grapes,* produced almost exclusively in California—the source of nearly nine tenths of the nation's supply [108]—have maintained a steady rate of increase. By the mid-1920's production had reached a level some

[108] New York, Michigan and Ohio account for the balance.

three to four times higher than that prevailing during the first decade covered by our index. Since most California grapes are of the raisin type, Prohibition had comparatively little effect upon output. Moreover during the "dry" era there was a shift from wine making to use as unfermented juice stock.[109]

Peaches show none of the expansion evidenced by apples during the pre-war period, but otherwise move in a fairly similar fashion, with neither a rising nor a falling trend since the first World War. In both amplitude and frequency of fluctuations peaches are a close rival to apples. Throughout the 42 years there were only seven instances in which a year of growth was not followed by a year of decline or vice versa, and the change was commonly at least 20 percent.

Pears, which usually amount in physical quantity to not more than 10 percent of the apple crop, tripled in output between the opening years of our series and the second half of the 1920's; since then output has risen only very slightly.

Fresh and canned plums and prunes have also risen substantially, though the data become increasingly unreliable as we trace output back to years before 1919. Since that year, however, output has about doubled.

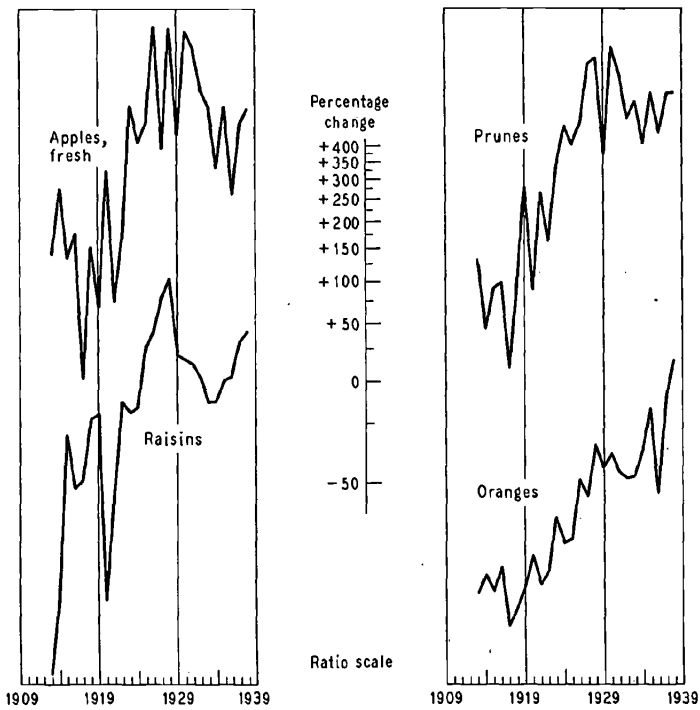
Dried prunes, by far the most important of the plum and prune group, fluctuate widely; yet over the 42-year period output has increased roughly fourfold.

A sizable portion of total fruit output, both citrus and noncitrus, enters foreign trade and has contributed an increasing percentage to total agricultural exports, as is evident from Table 16. Declines in other fields have helped to boost fruit to third place in the list of agricultural exports (in value terms) in recent years, but the basic export data indicate that this position has not been attained exclusively at the expense of other items. There have been large absolute increases since the first World War in exports of apples, prunes and raisins

[109] *Agricultural Statistics, 1940,* Table 302.

Chart 32

FRUIT EXPORTS, 1913 - 38



For source and notes see Appendix D

(Chart 32). It is interesting to note that the one important fruit imported, bananas, is usually about equal in weight to the aggregate fruit tonnage exported, including citrus fruit. In terms of value, however, banana imports amount only to about 30 percent of total fruit exports.

CITRUS FRUIT

No other agricultural product even approaches citrus fruit in rapidity and scale of expansion. The average annual rate of growth for the entire period is 5.8 percent, which is nearly

TABLE 16

FRUIT

Relative Contribution to Total Agricultural Exports, 1894–1938[a]

Five-year Average	*Percent*
1894–98	0.9
1899–1903	1.5
1904–08	1.6
1909–13	2.7
1914–18	2.0
1919–23	2.6
1924–28	6.9
1929–33	10.5
1934–38	11.5[b]

Source: Frederick Strauss, *The Composition of Gross Farm Income since the Civil War,* Bulletin 78 (National Bureau of Economic Research, 1940), Table 7. Data relate to years beginning July.

[a] The underlying data are export values.

[b] The 5-year average derived from figures published in *Foreign Crops and Markets,* Annual Supplement (U. S. Department of Agriculture, 1941) was substituted for the 4-year average used by Strauss.

three times as high as that of dairy products, its closest ranking competitor.[110] In sharp contrast to the milk group, however, the average rate at which the citrus enterprise expanded slowed down markedly between the pre- and the post-war periods, from 8.9 to 5.9 percent.

Equally illustrative of the phenomenal development of citrus fruit is its contribution to total production in 1897–1901 and 1935–39, respectively: .2 percent during the former and 1.9 percent during the latter period (Table 2). Indeed, in 1935–39 the share for which citrus fruit was responsible

[110] It must be admitted that our choice of terminal years serves to exaggerate the rise, since Florida's citrus production, which in the early 1890's was still outdistancing that of its younger rival, California, was all but wiped out by the disastrous freeze of 1895. No wonder, then, that our index, particularly in its initial years, records startling percentage increases, for as far as Florida is concerned citrus culture had to be rebuilt from practically nothing.

was double that contributed by sugarcane and sugar beets together, and only slightly smaller than the contribution made by all grains outside of wheat and corn. Since 1933 per capita consumption of citrus fruit has grown progressively larger than that of apples (Chart 34).

California and Florida are the outstanding citrus-producing states. California supplies all the lemons and the two states together produce practically all the oranges grown in this country. Until a decade ago grapefruit cultivation also was confined to the two states named, but in recent years Texas has entered the field and at present contributes close to 40 percent of total grapefruit output. In terms of income Florida is most dependent on citrus fruit, deriving around 40 percent of its gross income from this source, whereas California's income from citrus fruit represents on the average no more than 10 to 20 percent of its total gross farm income.

Though rapid rates of growth have been common features of all citrus crops, there has been considerable inequality among the relative speeds at which their production has expanded. Due weight must of course be given to the fact that the points of time at which these crops began to be exploited on a commercial scale do not always coincide. Inevitably very young industries have very rapid rates of growth, but sooner or later these rates decline even if they remain substantial.

The first shipment of *oranges* left California in 1877,[111] and by 1899 the state had assumed a position of leadership in orange production which it never relinquished thereafter.

[111] Nephtune Fogelberg and A. W. McKay, *The Citrus Industry and the California Fruit Growers Exchange System,* Circular No. C-121 (Farm Credit Administration, 1940), p. 13. The completion of the Southern Pacific railroad in 1876 marks the beginning of the industry on a national scale. Not only did it expedite transcontinental shipments, but it also freed a large army of Chinese railroad laborers for work in fruit orchards; see Carey McWilliams, *Factories in the Field* (Little, Brown, 1939). The navel orange had appeared in Florida as early as 1830, but did not reach California until 1873; Valencia oranges were introduced in both states during the 1870's.

Chart 33

CITRUS FRUIT: NET OUTPUT

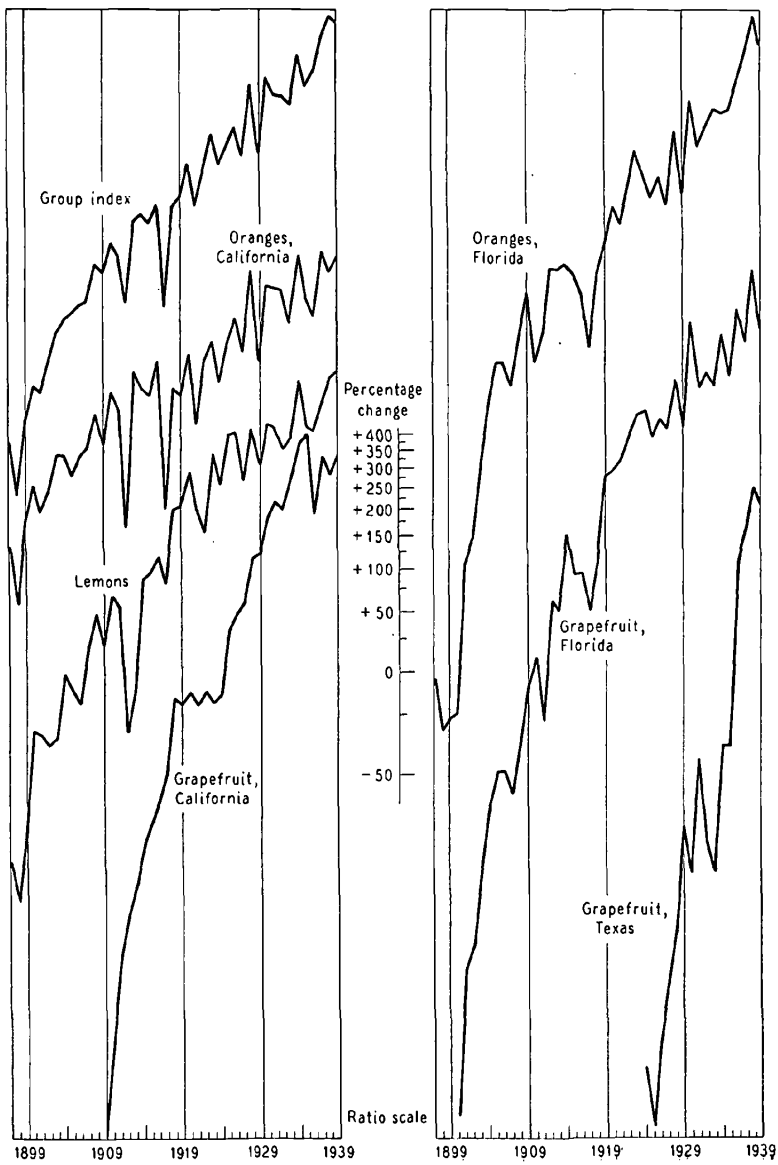


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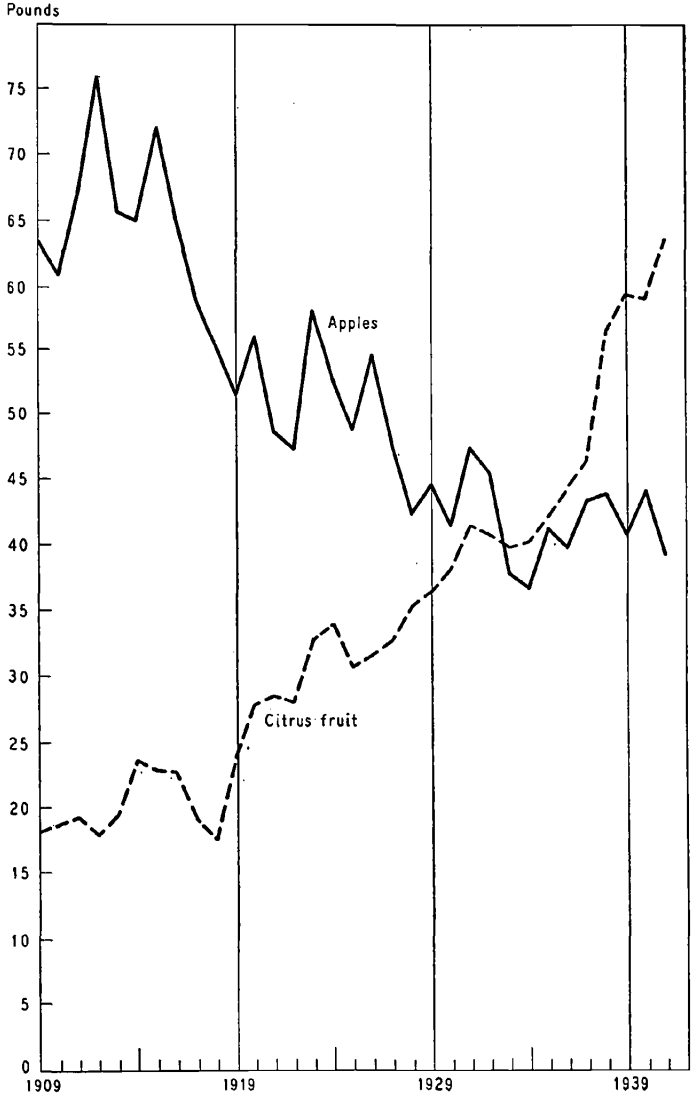
Chart 34

FRUIT CONSUMPTION PER CAPITA, 1909-41



For source and notes see Appendix D

The growth between that year and the present is not as impressive as the rate of increase of other citrus crops, though it amounts to between 500 and 600 percent over the entire period. By 1903 output first reached and surpassed the 10-million-box level; [112] ten years later the figure was 20 million, and by 1934 output had doubled once more. It is difficult to determine how far the early establishment of cooperative marketing is responsible for the position which the California citrus industry has attained.[113] In any case the tight organization under whose tutelage the California industry developed must be considered in any appraisal of its astonishing growth.[114]

In rate of increase, though never in absolute size, Florida orange production, which started from almost zero in 1897, naturally outstrips California output. Once it had regained the volume that preceded the freeze of 1895, its rise slowed down considerably; with the exception of the most recent years, post-1918 output has ranged from two to four times the volume obtaining prior to the war.

Grapefruit has grown more rapidly in output than any other citrus fruit, not only in Florida and California, but very recently in Texas as well. Indeed the speed of its rise has probably not been paralleled by that of any other agricultural product during the period covered by our data (Chart 33). The ease with which the fruit lends itself to canning, both in segments and as juice (Tables 17 and 18), has no doubt been

[112] In California and Arizona a box of oranges contains 70 pounds, in Florida and other states 90 pounds.

[113] First attempts at organizing the California fruit growers were made as early as 1885, and the basis for the Exchange System was laid in 1893. There were a number of organizational changes, but the system grew steadily, and finally adopted its present form in 1905; see Fogelberg and McKay, *op. cit.*, pp. 13-20. The Florida Citrus Exchange, modeled in the image of the California Exchange, was not chartered until 1909; nor was it preceded by earlier attempts at organized selling.

[114] For a brief summary of the role played by advertising and research, see *ibid.*, pp. 65-70.

a factor in its meteoric ascent. The industry is, moreover, a very young one. Florida shipped no grapefruit until the 1880's,[115] produced only 20,000 boxes in 1890,[116] and fell a

TABLE 17

GRAPEFRUIT, FRESH AND CANNED

Pounds Consumed Per Capita, 1923–38[a]

Year[b]	*Fresh*	*Canned*[c]
1923	5.7	.2
1924	5.7	.3
1925	4.7	.4
1926	5.5	.7
1927	4.8	.6
1928	6.7	.8
1929	5.7	1.2
1930	8.6	2.1
1931	7.4	.7
1932	6.3	1.4
1933	6.2	1.3
1934	7.9	3.3
1935	7.3	2.3
1936	10.0	5.3
1937	9.9	5.5
1938	11.7	6.9

Source: Statistical Information on the Grapefruit Industry (California Fruit Growers Exchange, Marketing Research Department, 1940), Table 6.

[a] Excluding government purchases for relief distribution.

[b] Beginning in September.

[c] Equivalent number of pounds of fresh grapefruit.

victim to the freeze of 1895 before its output had attained sizable proportions; it was not until 1909 that the yield rose to one million boxes. In California grapefruit was cultivated

[115] *Ibid.*, p. 4.

[116] F. W. Risher, *Statistics of Florida Agriculture and Related Enterprises* (Florida Department of Agriculture, 1932?), p. 7. In Florida and Texas a box of grapefruit contains 80 pounds, and in California and Arizona, 60 pounds.

TABLE 18

CANNED GRAPEFRUIT

Relation to Total Grapefruit Production and Percent Utilized as Juice, 1920–40[a]

Season	Number of Cases Canned		Juice Pack as Percent of Total Number of Cases Canned
	Thousands[b]	Percent of Total Production[c]	
1920–21	2	[d]	0
1921–22	10	0.1	0
1922–23	150	1.6	0
1923–24	200	1.9	0
1924–25	350	3.2	0
1925–26	400	4.2	0
1926–27	700	6.4	0
1927–28	600	5.7	0
1928–29	1,162	7.9	17.6
1929–30	1,509	14.8	12.7
1930–31	3,174	15.1	14.6
1931–32	1,248	7.4	27.3
1932–33	2,960	17.6	26.2
1933–34	2,900	18.2	24.4
1934–35	6,267	26.5	42.6
1935–36	4,772	24.5	50.8
1936–37	10,801	30.1	59.6
1937–38	12,670	32.5	69.7
1938–39	16,252	32.0	71.5
1939–40	n.a.	44.5	n.a.

Source: Statistical Bulletin, Season 1939–40 (Florida Citrus Exchange, Nov. 1940), p. 41.

[a] Data relate to output of California, Florida, Texas and Arizona.

[b] Equivalent cases of 24 cans, No. 2 size.

[c] Derived from field boxes used in canning.

[d] Less than 0.05 percent.

even later; in 1909–10 only 19,000 boxes were produced, whereas the 1939–40 crop was one hundred times as large. Of still more recent origin is the raising of grapefruit in Texas

and Arizona. Texas, which has enjoyed a more spectacular boom than the other producing states, started with the production of 3,000 boxes in 1919. Within ten years it had surpassed California and by 1939, with a crop of nearly 15 million boxes, was running a close second to Florida, with which it had attained rough equality in respect of total number of trees, bearing and nonbearing, as early as 1935.[117]

Lemons hold a position intermediate between the phenomenal growth of grapefruit and the more gradual expansion of California oranges. Almost wholly confined to California since the Florida freeze, the growing of lemons in this country has a rather long history, though it appears that most of today's lemon crop stems from varieties that were not planted until the 1870's.[118] Once lemon output had approached the million-box level [119]—in 1900 [120]—it did not rise sharply again for several years; nor did it stay permanently above the 2-million-box level until 1914. That year marked the beginning of an accelerated rate of growth, and by the mid-1920's seven lemons were harvested for every one picked in 1900. Since then, with the exception of the most recent years, output has risen but little. However, data on nonbearing acreage indicate a strong likelihood that a prolonged period of rising output is under way, inasmuch as only 4 percent of total lemon acreage was nonbearing in 1927–28, whereas 30 percent was nonbearing in 1936–37, after which plantings dropped somewhat.[121]

Though exports of both oranges (Chart 32) and grapefruit

[117] *Census of Agriculture, 1935,* Vol. III, p. 378.

[118] Fogelberg and McKay, *The Citrus Industry,* p. 6.

[119] A box of lemons contains 76 pounds.

[120] This in itself is a remarkably rapid development: in 1887 only 12 carloads had been shipped out of California; see John Perrin, *The Lemon Industry in the State of California,* Special Report No. 5 (Federal Reserve Bank of San Francisco, 1922), p. 4.

[121] "Statistical Information on the Lemon Industry" (release by California Fruit Growers Exchange, Marketing Research Department, 1940), p. 5.

have expanded at a rapid rate,[122] possibly faster than total output, their relative importance is so slight as to prove that the main drive toward higher production has originated in the domestic market.

TREE NUTS

This group consists of walnuts, almonds and pecans. Though closely related to the fruits, tree nuts are most conveniently treated in a separate category. With the exception of pecans, commercial production is confined to California and parts of Oregon. In California nut production contributes at most 2 or 3 percent of the state's gross farm income.

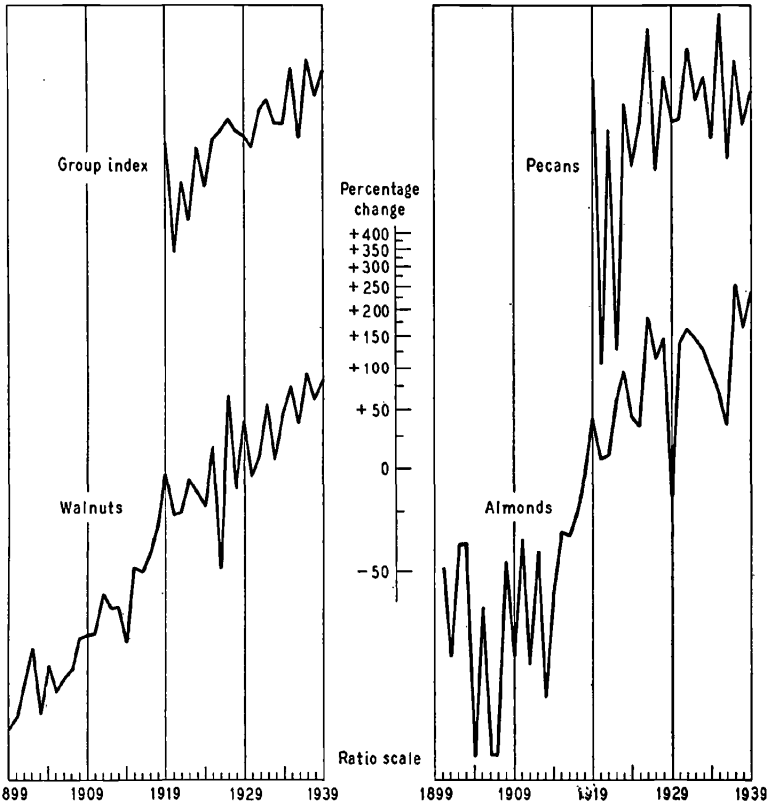
For the period 1921–38, average annual growth for the group has been computed at 3.9 percent, a rate surpassed only by citrus fruit (Table 4 above). All three series fluctuate with great violence, but the upward tendency appears to have been strongest in walnut production (Chart 35). Except in some of the southern states, the growing of nuts is a comparatively young enterprise in this country.[123] This fact must be remembered if the rapid rise of nut production is to be assessed in its true light, for, as in the case of citrus fruit, we are really dealing with a new industry.

[122] First separately reported in 1922–23, grapefruit exports then amounted to 252,000 boxes; they rose to a high of 1.3 million boxes by 1938–39. Orange exports have had a longer development. Since exports were not separately reported by quantity until 1907–08, we can gauge their early history only through value data: in 1901–02 they accounted for 5 percent of the value of all fruits exported, in 1907–08 for 11 percent. In the latter year 650,000 boxes were exported, constituting not quite 5 percent of total orange production of that year. In 1913–14, 1.6 million boxes or 6 percent were exported, and in recent years an export of 4 to 5 million boxes has been the rule, equivalent to about 8 percent of output.

[123] Even in Georgia and other parts of the Deep South, long a source of pecans, production on a commercial scale did not start until the end of last century.

Chart 35

TREE NUTS: NET OUTPUT



For source and notes see Appendix D

TRUCK CROPS

This group comprises nineteen vegetables, excluding potatoes, sweetpotatoes and dry edible beans,[124] all three of which are grown under conditions substantially different from those attending the cultivation of truck crops proper. We may draw a distinction, for statistical purposes, between four kinds of

[124] These are treated above, pp. 65-68. The nineteen vegetables included in our index (see Chart 5 above) are listed on p. 331.

vegetable production: (1) commercial truck crops for fresh market shipment; (2) commercial truck crops for processing; (3) market garden vegetables; and (4) the produce of farm gardens.[125]

Five states—California, Texas, Florida, New York and New Jersey—usually account for about half the value of the nation's commercial truck crops. The first three ship almost exclusively for fresh consumption, whereas New York and New Jersey divert about a third of their crop to processing channels. The latter two states, plus Maryland and the Corn Belt, account for about 70 percent of the supply of truck crops for processing. Between 10 and 20 percent of the total supply of truck crops is usually processed.

Output data are available only for the first and second categories of production mentioned above; thus market garden vegetables and the product of farm gardens are alike omitted from our index (Chart 5). Nor is this defect unimportant; on the contrary, from figures for gross income it appears that commercial truck crops account for less than half the total output of vegetables (Table 19). Value data suggest, furthermore, that commercial output has risen somewhat faster than

[125] This classification and the following quotations are taken from U. S. Department of Agriculture, *Income Parity for Agriculture* (Washington, 1941), Pt. I, Sec. 14, pp. 2, 11. Distinguishing commercial truck crops is the ". . . extensiveness of cultivation and the concentration of production in fairly well defined areas where soil and climatic conditions are especially adapted to their production." Crops for fresh market shipment are ". . . usually produced in areas some distance from market centers, and shipped by rail or boat in carlots, or trucked to market," while crops for processing (canning or preserving) ". . . are usually produced under processor-grower contracts which provide the processor with considerable control over the output." Market garden vegetables ". . . include primarily those vegetables produced by growers located near large cities. This production is largely trucked to the nearby markets and sold at certain periods of the year in wholesale and retail markets. Cultural practices are intensive. In the estimates of income for this group of vegetables there is also included income from some vegetables grown under conditions similar to commercial truck crops but not of sufficient importance to justify separate estimates." Finally, farm gardens include all vegetables grown on the farm (other than potatoes, sweetpotatoes, and dry edible beans) ". . . for fresh consumption, canned, pickled, or dried for home use."

noncommercial production, so that our index probably has an upward bias. So far as the index for agricultural output as a whole is concerned (Table 1 and Chart 1), this upward bias is tempered by the fact that the truck crop index, which rises more rapidly than total output, is given the weight derived from commercial production only. How far these two types of bias cancel one another cannot be estimated, but it

TABLE 19

GROSS INCOME FROM TRUCK CROPS, INCLUDING FARM GARDENS, AND FARM VALUE OF COMMERCIAL TRUCK CROPS, 1919–39

Million dollars

Year	*Gross Income from Truck Crops including Farm Gardens*	*Farm Value of Commercial Truck Crops*
1919	443	164
1920	486	175
1921	415	161
1922	464	192
1923	509	219
1924	530	234
1925	586	266
1926	547	236
1927	541	236
1928	576	267
1929	601	289
1930	563	276
1931	492	220
1932	405	172
1933	428	173
1934	433	205
1935	506	233
1936	516	252
1937	562	276
1938	511	247
1939	534	259

Source: Col. 1: U. S. Department of Agriculture, *Income Parity for Agriculture* (Washington, 1941), Pt. I, Sec. 14, p. 17. Col. 2: U. S. Department of Agriculture, *Agricultural Statistics, 1941*, Table 368. Data relate to calendar years.

is certain that the error in the total index since 1919 on this account is very small.[126]

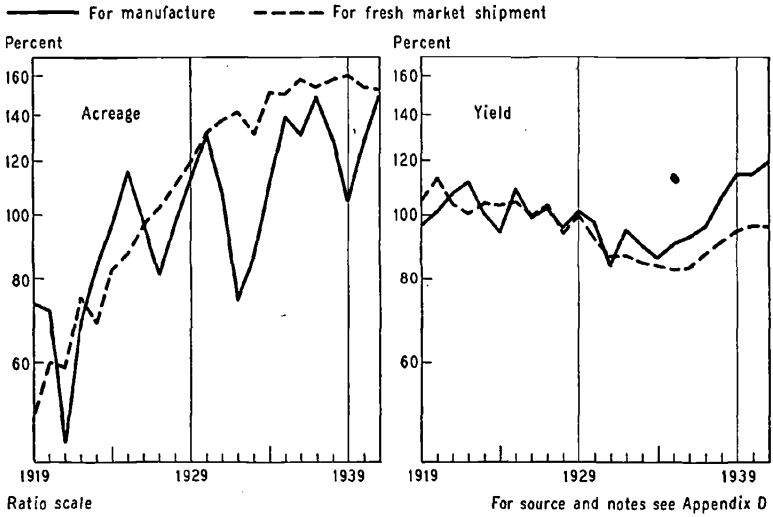
Truck crops grew at an average annual rate of 3.6 percent from 1921 to 1938; this far exceeds the rate for agricultural output as a whole and is surpassed for this period only by the growth of citrus fruit and tree nuts (Table 4). A significant difference may be observed between the behavior of crops intended for processing and those sent to market for fresh consumption, the latter being characterized by large increases, whereas only one or two of the processed crops have expanded in volume. The increase in fresh vegetables might have been still larger had not yields declined somewhat from 1920 to 1935; during this period yields were reduced by roughly 25 percent. Recovery in recent years, accompanied by retardation of output expansion, has not been sufficient to meet previous levels; in contrast, vegetables for manufacture, which also suffered from sagging yields during the second half of the 1920's, have registered record crops in the last three years (Chart 36). By far the most rapid rise has occurred in the production of fresh peas, which increased roughly fifteenfold during the two post-war decades and boosted the income of the growers from slightly over $1 million in 1918 to more than ten times that amount in recent years. Snap beans, carrots, spinach and lettuce—the latter being one of the leading truck crops—have increased as much as fivefold during the period under consideration. Fresh beets, though of secondary importance, are distinguished by the tenfold increase which they achieved within a space of five years (1923–28). Other truck crops—cabbage, sweet corn, onions, tomatoes—have expanded only slightly or not at all.

OIL CROPS

This group comprises four crops which in part or in their entirety constitute the raw material from which crushing

[126] See Appendix A, pp. 327-29.

Chart 36
TRUCK CROPS
Indexes of Acreage and Yield
(1924–29 : 100)



For source and notes see Appendix D

mills manufacture vegetable oils of varying composition for a number of purposes. Two of them—cottonseed and flaxseed —have already been discussed earlier in this chapter.[127]

Of the four, *cottonseed* is by far the most important; indeed with minor exceptions [128] the oil-crops index closely resembles the cotton index (in which, it will be recalled, cot-

[127] Pp. 76-78 and 63-65, respectively.

[128] As has been mentioned earlier in this chapter, we include only the amount of cottonseed which is used neither for feed nor for fertilizer. This amount is equivalent to mill deliveries. At present roughly 80 percent of the total crop is thus utilized, but at the beginning of our period less than 50 percent was crushed, and even that percentage represented a vast increase over the preceding decade when only one quarter of all cottonseed harvested went to the oil mills. (U. S. Department of Agriculture, *Fats, Oils and Oleaginous Raw Materials,* Statistical Bulletin 59, Washington, 1937, Table 40.) The divergences between cotton production and cottonseed production are thus largely due to differences in *net* rather than *gross* output. This is particularly noteworthy for the years 1897–1905, a period during which cotton and cottonseed production show very diverse movements.

tonseed has also been included). Cottonseed output has always accounted for more than 50 percent of the output of oil crops, and after 1909 its share grew substantially larger. However, since sizable amounts of vegetable oils are imported, cottonseed oil constitutes a somewhat smaller proportion of all oils consumed.

Of the remaining three crops, *soybeans* did not attain commercial importance as an oil-producing crop until the late 1920's; and *flaxseed* outranked *peanuts* until just before the War of 1914–18. At that time the "insufficiency of vegetable oils for use in the manufacture of munitions and butter substitutes," [129] coupled with the crisis in cotton planting which was just then beginning, led to an expansion in the planting and commercial utilization of peanuts.

Peanuts ceded second place to flaxseed in the mid-1920's—the period in which there was a sudden revival of flaxseed growing [130]—but, after a few years of approximate equality, regained it in 1931. This crop continued to rank second until 1939, when rising soybean output pushed it into third place.

Over the four decades oil-bearing crops as a group have grown at an annual rate of 1.2 percent. The expansion of the group is brought out more vividly when we compare indexes of 5-year moving averages based on 1897–1901 as 100. Such a comparison shows oil crops to have passed the 200 mark by 1935–39, outdistanced only by citrus fruit and sugar (Table 6).

The reason why annual rates of growth are less impressive than moving averages is to be found in the severe decline suffered by the group from 1914 to 1921. This slump, mainly a reflection of cottonseed contraction (except in 1919 when all three constituents registered sizable losses), almost cut output in two, depressing it from a high of 102.9 (1929:100)

[129] *Prices and Competition among Peanut Mills*, Sen. Doc. No. 132, 72nd Congress, 1st Session (Washington, 1932), p. 15.

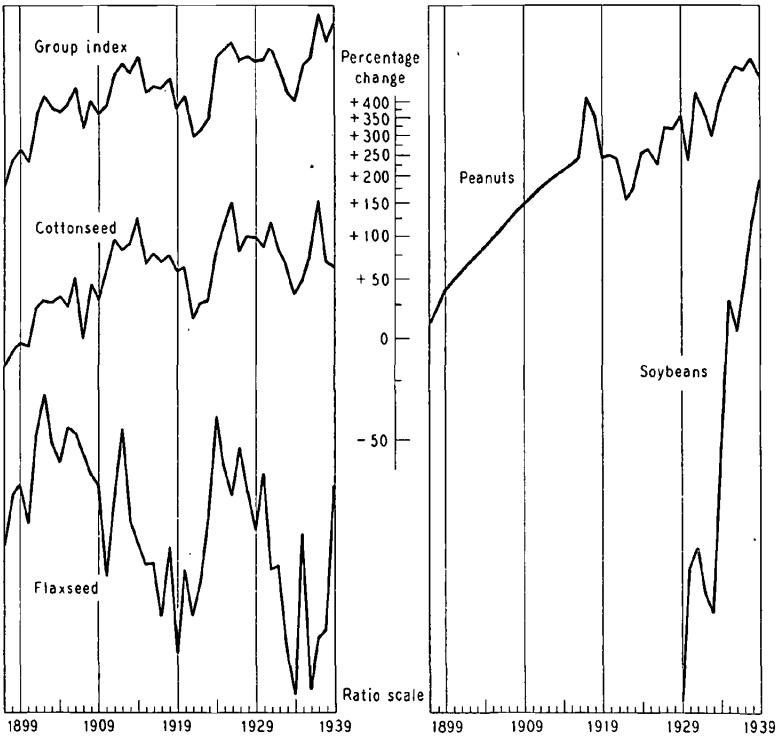
[130] See p. 64 above.

in 1914 to 59.8 in 1921. And it is precisely this span of years which would have no effect upon a comparison of terminal years, or upon the trend rates of our customary half-periods.

Summarizing the various measures, we may say that this

Chart 37

OIL CROPS: NET OUTPUT



For source and notes see Appendix D

group is one of the most thriving of the fifteen considered here. As additional evidence of its resilience, we can point to the fact that it took only three years after each of the two major declines—1921 and 1934—for output to regain or exceed the previously recorded peak (Chart 37).

Since the domestic oils discussed above are replaceable in varying measure by imported oils, and since relative price positions and tariff policies have much to do with their development, to trace further the reasons for the differences in growth of the various oils would lead us far beyond the framework of this study.[131] Regarding other aspects of the individual series, it should be pointed out that only a minor fraction of total *peanut* output is converted to oil; the principal destinations of peanuts harvested as such are the peanut stand and the confectionery shop. The amount going to the crushing mills is largely determined by the price of peanuts in relation to that of competing oil crops, and year-to-year fluctuations in crushings are therefore violent. Since in addition a large amount of peanuts—in some years equivalent in magnitude to the entire net output—is not picked and threshed but used as feed, it is hard to classify peanuts in any of our groups.

As mentioned earlier, the net output of peanuts advanced only gradually up to the World War, when it enjoyed a sudden upswing which by 1917 had carried it to almost twice the 1910 volume. However, this volume of output was neither maintained nor reached again until 1931. Since then a high level has prevailed and from 1935 on net output has stayed above the billion-pound mark. Governmental efforts toward crop diversification in the South, coupled with intensified research into new uses of peanuts, have no doubt fostered the recent expansion.

One of the most remarkable developments in contemporary agricultural history has been the rise of the *soybean*. Though long known in this country, its domestic cultivation had al-

[131] A great deal has been written on the subject, and particular reference may be made here to two studies: (1) U. S. Tariff Commission, *Report to the Congress on Certain Vegetable Oils, Whale Oil, and Copra,* Report No. 41, Second Series (Washington, 1932); (2) G. M. Weber and C. L. Alsberg, *The American Vegetable-Shortening Industry,* Fats and Oils Studies No. 5 (Food Research Institute, Stanford University, 1934).

ways been secondary to its importation, and it was not until after the war that soybeans became a domestic crop.[132] In 1922, the first year for which we have reliable data, no more than 159,000 bushels were crushed and the value to the growers was just over $300,000. In 1939, however, more than 57 million bushels were delivered to the mills,[133] yielding the growers a return of roughly $43 million.[134]

The increasingly wide variety of uses for soybeans pertains for the most part to the crushed bean and its derivatives, oil and meal, rather than to the whole bean which is used largely for feed and for some food products. The spectacular growth of the industry is indicated by the following comparison of production figures for soybean oilmeal, linseeed oilmeal and cottonseed meal in 1925–26 and 1935–39.[135]

	1925–26	*1938–39*
	(thousand tons)	
Soybean oilmeal	8	1,050
Linseed oilmeal	750	506
Cottonseed meal	2,800	2,023

At first principally used as a drying oil in the manufacture of paints and varnishes, soybean oil was long considered unfit for human consumption because of its unpleasant odor. But suitable processing led, in 1930, to its introduction into

[132] The large imports of soybean oil during the war years stimulated interest in the crop, and tariffs on oil (1921) and beans (1922) further promoted its growth.

[133] An additional 30 million bushels harvested for beans in 1939 were used for purposes other than crushing. These are not included in our index, even though a small amount no doubt enters nonagricultural markets. Most of this portion presumably consists of beans for human consumption, but statistics are scanty. Excluded also, of course, is the portion that is fed to livestock as silage or in other unprocessed forms.

[134] The value of imported soybean oil in the same year amounted only to about $150,000, that of soybeans to $5,000. Gross income for 1939 came to more than $50 million, i.e., exceeded the income derived from any grain except corn and wheat.

[135] K. J. Maltas, "Utilization and Merchandising of Soybeans," *Papers Presented at the Program on Grain Marketing* (University of Illinois, 1940).

oleomargarine; ten years later it represented a third of all oils and fats used in making this product.[136] By 1940, moreover, almost 80 percent of all soybean oil consumed in factories was concentrated in the food industries, despite the fact that its keeping qualities are still inferior to those of other vegetable oils. In terms of total factory consumption of all oils, soybean oil ranked fourth, behind cottonseed oil, in-

TABLE 20

FATS AND OILS

Percentage Distribution of Factory Consumption,[a] 1931–40

Year	*Cotton-seed Oil*	*Coconut Oil*	*Linseed Oil*	*Palm Oil*	*Soy-bean Oil*	*Other Vegetable Oils*	*Animal Fats and Oils*
1931	30.2	15.7	7.9	6.2	0.7	9.1	30.1
1932	32.3	16.4	6.5	6.2	0.8	6.6	31.2
1933	31.7	16.6	6.9	6.6	0.7	7.9	29.7
1934	34.2	14.6	6.4	4.8	0.5	7.9	31.6
1935	29.7	13.0	6.5	5.6	2.0	12.9	30.3
1936	27.3	12.6	6.4	6.3	3.9	14.0	29.6
1937	34.0	8.6	7.6	6.7	3.6	12.9	26.7
1938	33.2	12.0	6.4	5.5	5.1	9.4	28.4
1939	27.5	11.0	7.2	5.6	7.7	9.8	31.1
1940	27.0	11.1	8.2	3.3	9.1	8.1	33.2

Source: U. S. Bureau of the Census, *Animal and Vegetable Fats and Oils* (Washington, 1936 and 1941). Data relate to calendar years.

[a] Including butter.

edible tallow and coconut oil, having within the preceding four years overtaken linseed oil, palm oil, grease and fish oils (see Table 20).[137]

The data on soybean output, however regarded, cannot

[136] U. S. Bureau of the Census, *Animal and Vegetable Fats and Oils, 1936–40* (Washington, 1941), p. 27; also U. S. Tariff Commission, *Fats, Oils and Oil-Bearing Materials in the United States* (Washington, 1941).

[137] *Animal and Vegetable Fats and Oils*, pp. 21-24.

fail to impress the reader as a record of rapid and continuing growth. Present indications, furthermore, point to broader industrial utilization of soybean derivatives, which are already so numerous as to rival the catalog of corn products. When used in paint, soybean oil dries more slowly than linseed oil, but has the advantage that it does not yellow with age. It is also used in soap manufacture and as a constituent of printers' ink. Soybean meal, which contains a residue of oil, is converted primarily into commercial feeds, but it has also been used as a base for the manufacture of glues and adhesives, plastics, synthetic fibers and linoleum.[138]

MISCELLANEOUS CROPS

Of the crops that are not readily allocated to any homogeneous group, *hay* is much the most important. Closely related to the feed grains, it differs from them in that it is used exclusively for feeding animals—on farms or elsewhere. Of the gross output of hay, much the largest part—79.5 percent in 1897–1901, 97.0 percent in 1935–39, as closely as we can estimate—is used for feeding livestock on the farm itself and forms no part of net output. The remainder—about one fifth of total production at the turn of the century, but only 3 percent today—is used for feeding horses not on farms, mainly in cities. A sharp fall in net output (Chart 5), occasioned by the disappearance of the city horse, reduced the contribution of hay to the aggregate net output of agriculture from 2.1 percent to 0.3 percent (Table 2). It should not be thought, however, that hay is any less important in the farm economy

[138] For a description of present and suggested uses see the previously cited survey, *Regional Research Laboratories*. See also H. E. Barnard, "Prospects for Industrial Uses for Farm Products," *Journal of Farm Economics*, Vol. XX (Feb. 1938), pp. 119-33; and E. W. Grove, *Soybeans in the United States; Recent Trends and Present Economic Status*, Technical Bulletin 619 (U. S. Department of Agriculture, 1938).

as a whole: indeed the gross output of tame hay increased by about one third between 1899 and 1937.[139]

Hops is a crop that cannot conveniently be included in any category, except the very broad one of "industrial raw materials." Since the sole purpose for which hops are grown is the manufacture of beer and other fermented malt liquors and cereal beverages, our output series registers a substantial setback during the "dry" years. From a pre-Prohibition level of 40 to 60 million pounds, production of hops receded to less than 30 million pounds beginning in 1918, and did not again touch the 40-million level until 1933, when beer was restored to legality. The contribution of hops to total agricultural output has never been more than 0.1 percent, though concentration of cultivation in a very narrow area—Oregon, California and Washington—invests it with some local importance. In 1935–37 over one half of the domestic hops produced and nearly one sixth of the world's output of hops was centered in Oregon,[140] and in this state between 7 and 8 percent of the farmer's income is derived from hops.

[139] Frederick Strauss and L. H. Bean, *Gross Farm Income and Indices of Farm Production and Prices in the United States, 1869–1937,* Technical Bulletin 703 (U. S. Department of Agriculture, 1940), p. 62. In fact there is some difficulty in estimating the fraction of gross output leaving agriculture, a fraction which, as mentioned in the text, has steadily declined. The series we have employed (*ibid.,* Table 24) is based on the number of animals not on farms and their estimated per capita consumption of hay. The diminishing number of city horses alone would be sufficient to impart a downward tendency to such a series. However, recent data published in U. S. Bureau of Agricultural Economics, *Disposition of Hay, Crop Years 1909–1936, by States* (Washington, 1939), based on sales, agree closely with our series for the early years (1909–12) though they remain above our series thereafter. Since this second series represents total sales, including sales within agriculture, it is quite certain that year by year it overstates to an increasing degree the amount "sold off farms"; for this reason the series presented here is probably more satisfactory for our purposes.

[140] G. W. Kuhlman and R. E. Fore, *Cost and Efficiency in Producing Hops in Oregon,* Bulletin 364 (Oregon Agricultural Experiment Station, 1939), p. 6.