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THE MARKET FOR UNITED STATES RICE: DOMESTIC

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SUMMARY

This report is an analysis of the domestic market for United States rice. A second report is an analysis of the world market. Changes in acreage, yields, production, carry-over, domestic and territorial utilization, exports, and prices are described for the various segments of the United States rice industry. Statistical analysis of the determinants of prices, exports, shipments, and imports is in the main applicable to the entire United States since all segments of the industry are closely interrelated. Relationships prevailing among such major determinants are measured in several time periods.

Over the last three decades, production has tripled in the face of a slow increase in domestic-territorial utilization and nearly stable domestic use as food. The increase in production has been in response to drastic changes in world demands since the beginning of the second world war. Nearly 60 per cent of United States rice production now depends on overseas outlets at prevailing prices. Until 1936, minor quantities were exported to Europe. The Latin American market expanded thereafter. Since the end of the war, the export market has consisted mainly of Cuba and Asiatic countries. Asiatic sales have generally represented crisis markets financed frequently by noncommercial sources of dollar exchange.

California production has effectively paralleled United States developments. Territorial sales and manufacturing outlets have absorbed large proportions of California output, but utilization in the various channels has fluctuated widely. Most important, there has been a sharply increasing percentage of steadily increasing total production sold to unstable export markets. Loss of such markets or decline in the prices received in them would result in shrinkage of the United States rice industry through bankruptcy or the imposition of controls.

Prices have fluctuated violently over the 40-year history of the industry. Total production has risen steadily, but acreage in long-grain types has exceeded acreage in medium-grain types since 1945. Short-grain acreage, mainly in California, has increased steadily. Yields have been highest in California but have fluctuated sharply in all areas. All states demonstrate potential for rapid expansion of output. Changes in California and United States average annual on-farm prices have been very highly correlated. In general, separate statistical analysis of variation in prices and utilization for California alone was unsatisfactory.

There is evidence that over the entire 40-year history, a given percentage increase in United States supply, with no change in United States buying power, has been associated with a larger percentage decline in price and, therefore, a reduction in gross farm income. Thus, a relatively small increase in output can lead to a relatively large decrease in price unless offset by an increase in purchasing power. The net relationship of United States farm price to total annual supply has varied among the several time periods. However, an increase of 1,000,000 hundredweight, rough basis, in the annual United States supply was associated on the average with a decrease in farm price of about 15 cents, with no change in national income. With a given total supply, a rise of one point in the index of national income was associated with a rise in price per hundredweight, rough basis, of about 2.5 cents. Farm prices from various outlets--domestic continental, territorial, or export--were the same in each year. Continental and territorial markets were segments of a single integral

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Prices have fluctuated violently over the 10-year history of the industry; total production has risen steadily, but acreage in long-grain type has exceeded acreage in medium-grain types since 1945. Short-grain acreage, mainly in California, has increased steadily. Yields have been highest in California but have fluctuated sharply in all areas. All states demonstrate potential for rapid expansion of output. Changes in California and United States average annual on-farm prices have been very highly correlated. In general, separate statistical analysis of variation in prices and utilization for California alone was unsatisfactory.

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market. Until recently, variation in volume of United States exports had little effect upon world prices. United States annual supply has exceeded the amount which, if sold in domestic-territorial outlets, would have yielded reflected farm prices equal to the United States farm price reflected from export sales. Thus, the export price reflected at the United States farm was a floor level which effectively determined farm price in domestic-territorial outlets and the quantities sold therein each year.

Analysis of determinants of price and utilization was not significantly improved by deflation of prices and national income to eliminate the effects of changes in the general economy. Statistically stable interrelationships could not be discovered for the time period 1941-1952. Acceptable analyses were obtained for the years 1921-1940 and for 1921-1952, excluding the price-control years. Disposition of 25,700,000 sacks, rough basis, in domestic-territorial outlets in 1952-53 yielded an average farm price of $6.05. Without price support, sale of the entire supply would have lowered United States price to $2.36. If demand were lowered by a 5-per cent decrease in the index of income and if the entire 1953-54 supply were sold in domestic-territorial outlets, average farm price would fall to about $1.22. If the world price reflected at the United States farm were to fall to support-price level, it is estimated that about 21,000,000 sacks would go to government storage under 1952-53 conditions and about 24,000,000 sacks if national income were to fall by 5 per cent. Increased export supplies in other nations, declines in demand, or scarcity of dollar exchange in importing nations could lead to this contingency.

Imports into the United States have never been heavy. On the average, in the 1921-1939 period, a net increase of United States milled price of $1.00 was associated with an increase of annual imports of 216,000 sacks. A net increase of one kilogram in the per-capita Asiatic rice production was associated with an increase of imports into the United States of about 20,000 sacks.

Over the years 1921-1940, a net decrease of $1.00 per sack, rough basis, in United States farm price was associated with an increase of United States exports of about 3,500,000 sacks. A net increase of one kilogram in average annual Asiatic per-capita production was associated with an increase of United States exports of about 140,000 sacks. A net rise in the national income index of one point was associated on the average with an increase in United States exports of about 110,000 sacks. Variation in United States exports could also be explained satisfactorily in terms of variation in other related factors.

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Imports into the United States have never been heavy. On the average in the 1921-1939 period, a net increase of United States milled price of $1.00 was associated with an increase of annual imports of 210,000 bales. A net increase of one kilogram in the per-capita Asiatic rice production was associated with an increase of about 20,000 bales.

Over the years 1921-1940, a net decrease of $1.00 per bale, rough basis, in United States farm price was associated with an increase of United States exports of about 3,500,000 bales. A net increase of one kilogram in average annual Asiatic per-capita production was associated with an increase of United States exports of about 110,000 bales. A net rise in the national income index of one point was associated on the average with an increase in United States exports of about 110,000 bales. Variation in United States exports could also be explained satisfactorily in terms of variation in other related factors.

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Questions at Issue

General Questions.--This inquiry into markets for California rice originated from interest of California producers of several commodities in export outlets upon which farm incomes partly depend. Supply, distribution, prices, and income prevailing before the war have changed drastically and perhaps permanently. Exportation has been expanded by recurrent economic dislocations. Some export markets have been financed by noncommercial funds. There have been international allocations and a full-scale battery of control and support devices affecting both domestic and foreign trade. In some industries, California production has increased sharply to meet unusual foreign demands. Sudden loss of unstable foreign markets might require that production be decreased either through bankruptcy or through governmental controls.

With foreign trade still at a relatively high level, successful analysis may provide partial basis for policy to mitigate the impact of possible future contingencies. This exploratory analysis encompasses four major objectives: (1) to describe trends in distribution of California agricultural commodities, (2) to estimate the impact of changes in foreign sales upon California farm price and income, (3) to measure the net effect upon sales in major channels of changes in the major determinants of supply and distribution, and (4) to appraise ideas offering prospect for the maintenance of export volume. Rice was chosen for a pilot study including: a quantitative analysis of the importance of foreign trade to producers and handlers; measurement of the factors determining the volume of exports from California; and feasibility of changes in trade promotion, methods of trade, government policy, or industrial organization as possible means of maintaining or increasing foreign trade.1/

Rice Questions.--There are four specific questions at issue in the pilot study: (1) variations in California and United States supply and distribution of rice, (2) effects of changes in supply and distribution--or in the components or determinants of those series--upon price and income, (3) control over supply and distribution or both to maintain price and income, and (4) methods to hold or expand present foreign markets.

1/ Trade promotion might encompass a variety of devices intended to lift or at least to hold current levels of foreign demand. Such devices might include continuous contact with foreign trade and government agencies after the model set by several American industries. It might also include commercial demand promotion methods. Methods of trade would include the kind of product--as paddy versus undermilled versus fully milled--methods of delivery, and terms or methods of payment. Industry organization could include such questions as proper methods for the maintenance of long-run markets of lesser immediate importance than some of the new foreign markets, two-price systems, or stabilization payments out of voluntary industry organizations. Government policy would include appraisal of the entire battery of government devices to foster or to control foreign trade movements and to adjust domestic production to changes in demand.

Methods of Analysis.--Major determinants of domestic supply and distribution are identified. Interrelations among them are measured. Quantitative estimates of the net effects upon price and income of changes in each of the major variables are derived.2/ Procedures for controlling price-determining factors are considered. The same procedure was followed for analysis of changes in the volume of imports, of territorial shipments, and of exports.

Several conclusions became apparent at the outset of the analysis. Relationships between prices, output, and distribution differed in various periods of the years 1912-1952. Therefore, the relationships prevailing in each of several time periods were analyzed separately. Annual average prices received by California producers are so very highly correlated with other state and the United States national annual average on-farm prices that virtually the same results would be obtained from analysis of California and United States average farm price. Major variables were highly correlated with national purchasing power. Generally, in years of relatively high purchasing power, both output and price of rice were relatively high. Generally, in years of relatively low national income, both prices and outputs were relatively low. This intercorrelation has significant implications with respect to the analytical methods which could be used and with respect to the reliability of statistical results.

The Data

United States Supply and Distribution.--The basic supply and distribution data for the United States are assembled in Table 1. Data are generally available after 1910. However, the industry became commercially significant about 1912. Price-output-distribution relationships during World War I clearly deviated from the basic relationships which prevailed over the next twenty years. The impact of war demand carried over through the season of 1920. Thus, summary tables were prepared from the season of 1921 to date. However, analysis of some phases of price and distribution determination covered the years 1912-1952. Other analyses applied to shorter subperiods. There are two main periods during which stable interrelationships prevailed: (1) the interwar years of 1921-1940, and (2) 1921-1952, excluding the price-control periods of 1942-1945 and 1951.

Annual farm supply and farm production were highly correlated.3/ Supply information was classified under carry-over imports, farm production, and

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2/ This step in the analysis can be described by posing this question: with no changes in the magnitude of other determinants of any one of the variables, what is the change in such variable consequent upon or associated with some specified amount of change in any one of the other factors with which it varies systematically?

3/ The regression of total United States supply, X_1, on United States farm production, X_2, is as follows:

1921-1952: $X_1 = -2.53 + 1.007\ X_2$; $r = 0.9957$

1921-1940: $X_1 = +2.23 + .7745X_2$; $r = 0.9738$

1941-1952: $X_1 = +0.52 + .9414X_2$; $r = 0.9905$

TABLE 1

United States Rice: Supply and Distribution, Rough Basis, 1921-1953

Year beginning August 1	Supply						Distribution											
	Carry-over											Export			Shipment			
	Warehouse and mills	USDA holdings	Total carryover	Farm production	Imports	Total supply	Civilian food	Seed	Feed and other	Brewers' use	Total United States continental disappearance	Commercial	USDA nonmilitary	Total export	Commercial	USDA nonmilitary	Total shipment	Total military procurement
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1,000 hundredweight																	
1921	1,441	--a/	1,441	17,673	1,192	20,306	7,523	1,102	370	--	8,995	6,522	--	6,522	3,231	--	3,231	--
1922	893	--	893	18,748	1,126	20,767	8,997	912	360	--	10,269	6,005	--	6,005	3,730	--	3,730	--
1923	1,301	--	1,301	14,957	619	16,877	9,062	876	346	112	10,396	3,690	--	3,690	4,092	--	4,092	--
1924	319	--	319	14,689	934	15,942	9,418	900	330	74	10,722	1,815	--	1,815	3,668	--	3,668	--
1925	145	--	145	14,866	2,136	17,147	9,323	1,082	326	191	10,922	780	--	780	3,622	--	3,622	--
1926	1,242	--	1,242	18,911	1,151	21,304	10,263	1,092	321	174	11,850	4,931	--	4,931	3,934	--	3,934	--
1927	1,745	--	1,745	20,024	715	22,484	11,338	1,027	322	72	12,759	5,018	--	5,018	4,132	--	4,132	--
1928	1,358	--	1,358	19,725	596	21,679	10,795	899	336	114	12,144	6,362	--	6,362	4,558	--	4,558	--
1929	784	--	784	17,790	506	19,080	9,992	1,009	342	85	11,428	4,690	--	4,690	4,654	--	4,654	--
1930	754	--	754	20,218	575	21,547	10,995	1,015	350	82	12,442	4,552	--	4,552	4,889	--	4,889	--
1931	1,486	--	1,486	20,076	332	21,894	10,183	919	331	75	11,508	4,450	--	4,450	4,922	--	4,922	--
1932	2,880	--	2,880	18,729	351	21,960	11,723	842	367	95	13,027	2,879	--	2,879	5,459	--	5,459	--
1933	2,119	--	2,119	16,943	682	19,744	8,509	854	375	398	10,136	1,633	--	1,633	4,766	--	4,766	--
1934	2,865	--	2,865	17,571	1,304	21,740	11,215	854	370	1,470	13,909	1,988	--	1,988	5,022	--	5,022	--
1935	884	--	884	17,753	947	19,584	10,477	1,046	358	1,995	13,876	1,369	--	1,369	4,884	--	4,884	--
1936	1,360	--	1,360	22,419	2,945	26,724	12,046	1,194	412	1,661	15,313	840	--	840	4,759	--	4,759	--
1937	2,608	--	2,608	24,040	1,723	28,371	12,046	1,144	393	3,286	16,869	5,024	--	5,024	5,448	--	5,448	--
1938	2,386	--	2,386	23,628	1,093	27,107	11,292	1,120	359	3,714	16,485	5,562	--	5,562	4,518	--	4,518	--
1939	3,699	--	3,699	24,328	788	28,815	11,969	1,168	367	2,828	16,332	4,936	--	4,936	5,605	--	5,605	--
1940	4,166	--	4,166	24,495	375	29,036	11,892	1,353	373	2,698	16,316	6,371	--	6,371	4,054	--	4,054	--
1941	2,784	--	2,784	23,095	138	26,017	10,815	1,620	317	2,918	15,670	7,031	46	7,077	3,323	1,000	4,323	307
1942	295	--	295	29,082	147	29,524	11,292	1,675	348	2,447	15,762	4,261	2,476	6,737	600	3,877	4,477	1,261

(Continued on next page.)

Table 1 continued.

Year beginning August 1	Supply						Distribution											
	Carry-over			Farm production	Imports	Total supply	Civilian food	Seed	Feed and other	Brewers' use	Total United States continental disappearance	Export			Shipment			Total military procurement
	Warehouse and mills	USDA holdings	Total carry-over									Commercial	USDA non-military	Total export	Commercial	USDA non-military	Total shipment	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1,000 hundredweight																	
1943	661	1,631	2,292	29,264	92	31,648	10,677	1,630	392	2,178	14,877	5,184	2,555	7,739	--	4,815	4,815	1,231
1944	277	2,754	3,031	30,974	6	34,011	9,723	1,628	342	2,653	14,346	6,646	1,169	7,815	--	3,938	3,938	6,215
1945	646	385	1,031	30,668	161	31,860	8,292	1,751	435	3,066	13,544	6,430	4,492	10,922	3,831	1,031	4,862	2,954
1946	714	569	1,283	32,497	58	33,838	10,123	1,893	248	3,440	15,704	6,938	5,923	12,861	2,831	15	2,846	1,077
1947	446	246	692	35,217	99	36,008	10,861	2,005	281	2,457	15,604	9,369	3,892	13,261	5,015	--	5,015	1,431
1948	405	15	420	38,275	73	38,768	11,262	2,066	359	4,318	18,005	12,461	1,061	13,522	5,108	--	5,108	662
1949	1,124	--	1,124	40,737	84	41,929	11,723	1,810	301	4,286	18,120	14,439	107	14,546	5,831	--	5,831	1,062
1950	2,145	185	2,330	38,689	724	41,691	13,446	2,236	237	4,583	20,502	13,639	31	13,670	5,354	--	5,354	1,569
1951	3,279	45	3,324	45,797	808	49,856	12,385	2,306	240	4,844	19,775	20,569	892	21,461	5,354	--	5,354	5,246
1952	1,358	--	1,358	48,660	360	50,292	12,538	2,438	210	4,676	19,862	19,169	--	19,169	5,846	--	5,846	7,692
1953[b]	[c]		2,308	52,529	106	54,556								10,311			2,421	

a/ Dashes indicate zero.
b/ Imports and exports, July-October; shipments, August 1, 1953-January 21, 1954. Exports include relief shipments.
c/ Blanks indicate data not available.

Sources:

Col. 2: Carry-over for southern states, August 1, and for California, October 1 year. For the period 1921-1931, carry-over, or stocks at the beginning of season, represents only the southern states. For California, no reliable data are available for the same period. From 1931 on, carry-over stocks represent the sum of the stock of the two rice-growing regions. U.S. Production and Marketing Administration. Annual Market Summary of California Rice, 1936 and succeeding issues. For the southern states: U.S. Production and Marketing Administration. Annual Market Summary of Southern Rice, 1952. Carry-over for 1953 is the estimate of Mr. Karl Fox, U.S. Bureau of Agricultural Economics.

Col. 3: Data for USDA holdings of rice obtained and converted to rough rice on the basis of 1 pound rough to 65 pounds milled rice. U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10.

(Continued on next page.)

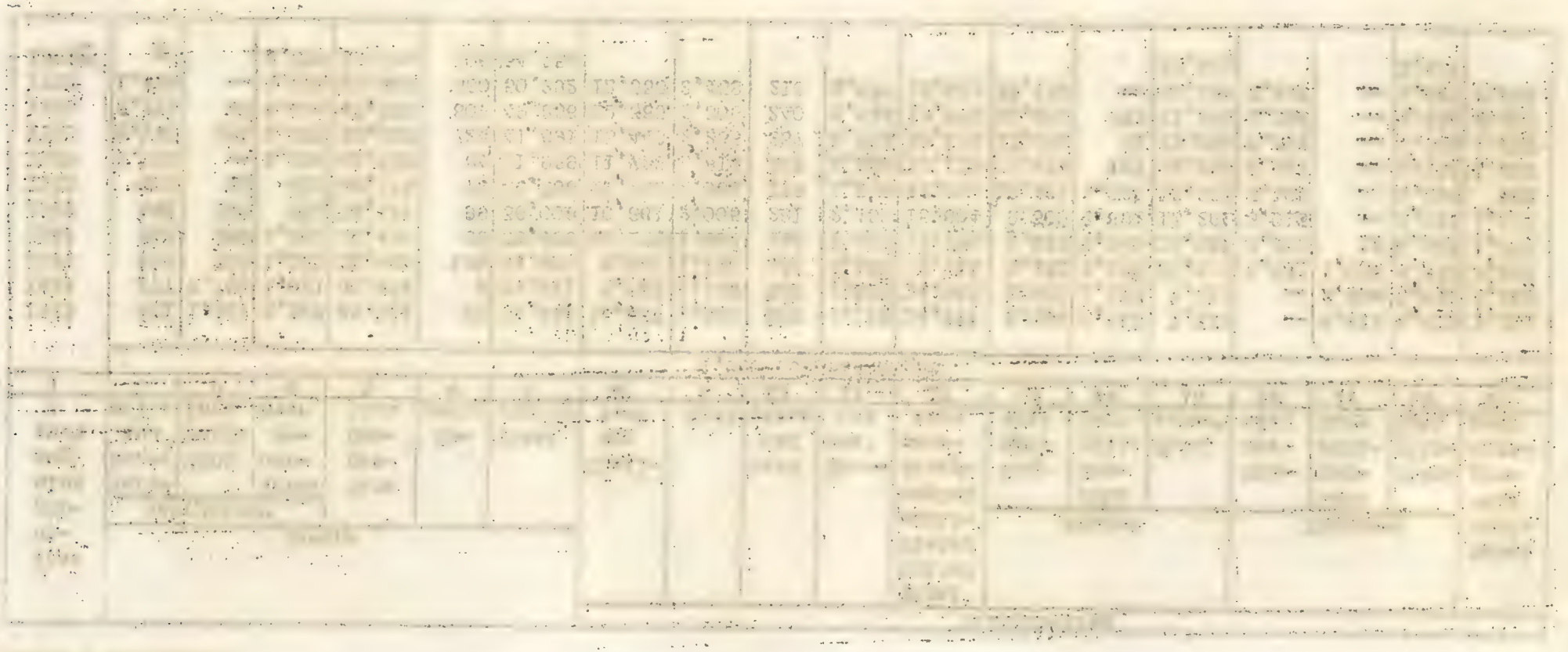

Table 1 continued.

Col. 4: Column 2 + column 3.

Col. 5: Data for the years 1921-1950: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Rice, 1909-1950. For the years 1951 and 1952: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Principal Crops, 1951-1952, p. 23. For 1953, farm production is an estimate as of November 1, 1953, by U.S. Bureau of Agricultural Economics, Crop Reporting Board, in Crop Production, December 17, 1953.

Col. 6: Data for the years 1921-1949: U.S. Foreign Agricultural Service. United States Farm Products in Foreign Trade. Statistical Bulletin No. 112, p. 172. For the years 1950-1953: U.S. Foreign Agricultural Service. Foreign Agricultural Trade, monthly summaries for June. Data converted for the three years on the basis of 1 pound of milled rice (broken, etc.) = 1.65 pounds rough rice. Import data based on July 1 year.

Col. 7: Column 4 + column 5 + column 6. Estimate for 1953 by U.S. Department of Agriculture for determination of necessity for quotas or allotments.

Col. 8: Civilian food consumption for the period 1921-1933 is based on the per-capita consumption and the total United States population, adjusted for undernumeration of children under 5, converted to rough base (100 pounds rough = 65 pounds milled rice). January 1 population was used because data are based on crop year, that is, for 1930-31 crop year, used January 1, 1931, population. Some downward adjustment was made on the per-capita consumption (not exceeding .2 pound) to make the data for 1921-1933 comparable to the data used in the next period 1934-1952. This downward adjustment was necessary to account for the military procurement and use of broken rice by brewers. Basic data available in Consumption of Food in the United States, 1909-1948. U.S. Bureau of Agricultural Economics, Misc. Pub. No. 691. For the period 1934-1951, data taken from U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, issue, p. 10, and converted on the basis of 65 pounds milled = 100 pounds rough rice. For 1952, the estimate is given in terms of milled rice (and converted to rough) by Mr. Karl Fox, Head, Division of Statistical and Historical Research, U.S. Bureau of Agricultural Economics.

Col. 9: Data for the years 1921-1950: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Rice, 1909-1950. For the years 1951 and 1952: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Principal Crops, 1951 and 1952, p. 23.

Col. 10: Data represent rice fed to livestock and farm household use. Sources are the same as for column 9.

Col. 11: Brewers' use includes brewers' as well as broken rice. Data for the years 1921-1953: U.S. Bureau of Foreign and Domestic Commerce. Statistical Tables on Alcoholic Beverages (Revised), undated mimeo. For 1933: U.S. Bureau of Industrial Alcohol. Statistics Concerning Intoxicating Liquors, December, 1933. For 1934-1941: U.S. Bureau of Internal Revenue. Statistics on Fermented Malt Liquors, annual mimeo. For 1942-1952: U.S. Bureau of Internal Revenue. Annual Report. All figures are based on year beginning July 1. Original data converted to rough rice on the basis of 70 pounds milled (broken) = 100 pounds rough rice.

Col. 12: Column 8 + column 9 + column 10 + column 11.

Col. 13: Data for the years 1921-1949: U.S. Foreign Agricultural Service. United States Farm Products in Foreign Trade. Statistical Bulletin No. 112, p. 172. For the years 1941-1951: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, issue, p. 10. Corrected: 65 pounds milled = [illegible]

(Continued on next page.)

Table 1 continued.

Col. 4: Column 2 + column 3.

Col. 5: [illegible]

Col. 6: [illegible]
pounds of milled rice (broken, etc.) = 1.56 pounds rough rice. Import data based on July 1 year.

Col. 7: [illegible]
[illegible] for [illegible] of alterations.

Col. 8: [illegible]
States population, adjusted for underenumeration of children under 5, converted to rough base (100 pounds
[illegible]
rice by brewers. Basic data available in Consumption of Food in the United States, 1909-1952. U.S.
[illegible]
of Agricultural Economics. The Wheat Situation, October-November-December, 1952, issue, p. 10, and converted
[illegible]

Col. 9: [illegible]

Col. 10: [illegible]

Col. 11: Brewers' use includes brewers' as well as broken rice. Data for the years 1921-1939: U.S. Bureau of Foreign
[illegible]

Col. 12: [illegible]

Col. 13: [illegible]

Table 1 continued.

100 pounds rough. For 1952, commercial export is the estimate of Mr. Karl Fox, U.S. Bureau of Agricultural Economics, Washington, D. C. All figures in this column based on years beginning July 1.

Col. 14: Primarily relief shipments (Lend-Lease, UNRRA, postwar aid program, and MSA). Data from: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, issue, p. 10. These USDA shipments exclude military shipments abroad (fiscal year beginning July 1).

Col. 15: Column 13 + column 14. Total exports for 1952-53 through all outlets are estimated at 25,154,000 hundredweight, rough basis.

Col. 16: Shipments to United States territories: Hawaii, Puerto Rico, Alaska, and Virgin Islands since 1935. From 1921-1940: U.S. Department of Agriculture. Agricultural Statistics, 1942, p. 40. Converted on the basis of 1 bushel of rough rice = 45 pounds. For 1940: figures represent only July-March, inclusive, and were not published later. For 1941-1951: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10. Estimate for 1952 is test of Mr. Karl Fox (converted on the basis of 65 pounds milled = 100 pounds rough rice).

Col. 17: Nonmilitary shipments by the U.S. Department of Agriculture to the territories (stockpiling). Data obtained from: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10. The same conversion factor was used: 65 pounds milled = 100 pounds rough rice.

Col. 18: Column 16 + column 17.

Col. 19: Wherever it was possible, military procurements were broken down into direct military use by the armed forces and military relief shipments to the occupied territories or countries. Column 19 represents total military procurements for both civilian relief feeding in occupied areas and military food use. The National Food Situation publishes figures (generally in October-December issue) on Distribution of United States Food Supplies on Fiscal Year Basis and gives the percentages of United States civilian, United States military, United States territory, and export use of foods. Rice is one of the commodities listed. Since exports include food by United States military for civilian relief feeding programs in occupied areas, the United States military use is exclusively for the armed services. In the fiscal year 1947-48, for example, the National Food Situation in its October-December, 1948, issue, p. 21, shows United States military for armed services has taken 4.3 per cent of the available 2,031,000 pounds of milled rice. This corresponds in terms of rough to about 870,000 bags in milled equivalent which is about 1,343 bags in terms of rough rice (65 pounds milled = 100 pounds rough). Total military takings are based on the table in the U.S. Bureau of Agricultural Economics, The Wheat Situation, October-November-December, 1952, issue, p. 10. The difference between total military takings and direct military food use represents foreign relief shipments generally included in official export estimates. These military relief shipments (Japan, Korea, Ryukyu Islands, etc.) since 1944 in terms of rough rice equivalent, 1,000 hundredweight, were as follows: 5,138 in 1944, 1,989 in 1945, 8 in 1946, 88 in 1947, 453 in 1948, 1,062 in 1949, 1,400 in 1950, and 4,751 in 1951. For 1952, no data available on relief shipments, but it is likely that direct military use was of minor importance of the total military takings. Data based on July 1 year.

(Continued on next page.)

Table 1 continued.

Note: Wherever it was possible, data of rough rice were used directly from available sources. With respect to accuracy, some discrepancies may be present in the table wherever conversion of milled to rough rice appears. A separate column of balancing item may reflect the magnitude of these discrepancies. Drying loss, waste, differences arising from the use of July-year exports, shipments and brewers' use, and error in date of conversion would be reflected in the last "error" column as plus or minus item to balance the total supply and total distribution with year's end carry-out.

total supply. Distribution data were divided into United States continental disappearance, exports, territorial shipments, and military procurement. Each classification was further divided into its most important components. Data were assembled for both rough rice and for milled rice equivalents.

Supply.--Changes in United States supply and civilian food consumption are shown in Figure 1 and in columns (2) through (8) of Tables 1 and 2. Total supply is now more than three times the total supply of 1924. Carry-overs were heaviest in years of low purchasing power or of war crisis. Imports fluctuated widely with unusually heavy importation in 1925 and in 1936-37. Imports increased in the past three years but are still no significant part of total supply. Changes in components of United States imports are shown in Figure 2 and Table 3.

The United States, which 20 years ago produced 20,000,000 or fewer sacks, now produces more than 50,000,000 sacks of rice per year. Domestic utilization has increased relatively little. There has been a continuous uptrend in farm production since 1912, but the rate of increase accelerated sharply in 1935. Further expansion was stimulated by the second world war and by relief feeding necessitated by political difficulties in rice-producing and rice-using areas. The upward drift of United States supply was again accelerated by the Korean War. Both supply response and the market for United States rice have reflected international emergency for more than 15 years.

Distribution.--Variations in total continental disappearance of rice and in each of the major components of total continental utilization are shown in columns (8) through (12) of Tables 1 and 2 and in Figure 3. Utilization for food had increased steadily after the end of World War I. From 1926 through 1935, about 11,000,000 sacks of rice were so used. For a few years thereafter, domestic food utilization rose to about 12,000,000 sacks, declining during the years of war rationing. Civilian food consumption now provides outlet for from 12-13,000,000 sacks, rough basis, per year. There has been no significant change in per-capita consumption. Use as seed has kept pace with total production.4/ However, civilian food and seed use still absorb considerably less than one third of the total supply of rice in the United States. Feed, farm waste, and other uses are relatively insignificant. Brewers' use of rice and rice products has become a fairly stable outlet, accounting for as much as 10 per cent of total farm production. Total United States continental disappearance--civilian food, seed, feed, waste, other uses, and brewers' use--absorbs about 20,000,000 sacks out of a total supply exceeding 50,000,000. At prevailing price levels, some 60 per cent of production must find a home outside the continent.

Exports, shown in columns (13) through (15) of Tables 1 and 2, have increased sharply. Overseas shipments are shown in Figure 4. Exports by destinations are shown in Table 4 and in Figure 5. Exports fluctuated between 1,000,000 and 6,000,000 sacks, rough basis, during the interwar years. Combined commercial and Department of Agriculture nonmilitary exports have increased from about 6,500,000 sacks, rough basis, in 1940 to about 20,000,000

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4/ In some areas, the proportion of rice production used as seed has increased. Per-capita consumption and per-capita disappearance are indicated in Table 18 below.

TABLE 2

United States Rice: Supply and Distribution, Milled Basis,[a] 1921-1953

Year	Supply						Distribution											
	Carry-over[b]											Export[d]			Shipment[d]			
	Warehouse and mills	USDA holdings	Total carryover	Farm production	Imports	Total supply	Civilian food[c]	Seed	Feed and other	Brewers' use	Total United States continental disappearance	Commercial	USDA non-military	Total export	Commercial	USDA non-military	Total shipment	Total military procurement[e]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1,000 hundredweight																	
1921	937	--[f]	937	10,910	736	12,583	4,890	680	228	--	5,798	5,415	--	5,415	1,994	--	1,994	--
1922	580	--	580	11,570	695	12,845	5,848	563	222	--	6,633	3,707	--	3,707	2,302	--	2,302	--
1923	840	--	840	9,230	382	10,458	5,890	541	214	73	6,718	2,278	--	2,278	2,526	--	2,526	--
1924	207	--	207	9,050	576	9,833	6,122	555	204	48	6,929	1,120	--	1,120	2,264	--	2,264	--
1925	94	--	94	9,090	1,318	10,502	6,060	668	201	124	7,053	482	--	482	2,236	--	2,236	--
1926	807	--	807	11,500	710	13,017	6,671	674	200	113	7,658	3,043	--	3,043	2,428	--	2,428	--
1927	1,134	--	1,134	12,340	441	13,915	7,370	634	200	47	8,251	3,098	--	3,098	2,551	--	2,551	--
1928	883	--	883	12,060	368	13,311	7,017	555	207	74	7,853	3,927	--	3,927	2,813	--	2,813	--
1929	510	--	510	10,980	312	11,802	6,495	623	211	55	7,384	2,895	--	2,895	2,873	--	2,873	--
1930	490	--	490	12,480	355	13,325	7,147	626	216	53	8,042	2,810	--	2,810	3,018	--	3,018	--
1931	966	--	966	12,390	305	13,661	6,619	567	204	45	7,435	2,747	--	2,747	2,887	--	2,887	--
1932	1,872	--	1,872	11,560	217	13,649	7,621	520	226	62	8,429	1,777	--	1,777	3,370	--	3,370	--
1933	1,377	--	1,377	10,460	390	12,227	5,531	526	231	279	6,568	1,008	--	1,008	3,063	--	3,063	--
1934	1,740	--	1,740	11,250	427	13,417	7,290	770		1,030	9,090	1,229	--	1,229	3,110	--	3,110	--
1935	530	--	530	11,550	585	12,665	6,810	890		1,397	9,097	847	--	847	3,010	--	3,010	--
1936	840	--	840	13,780	1,716	16,336	7,830	1,360		1,163	10,353	520	--	520	2,937	--	2,937	--
1937	1,690	--	1,690	15,190	1,063	17,943	7,830	1,090		2,307	11,227	3,109	--	3,109	3,389	--	3,389	--
1938	1,500	--	1,500	15,230	675	17,405	7,340	930		2,602	10,872	3,439	--	3,439	3,019	--	3,019	--
1939	2,320	--	2,320	15,300	506	17,934	7,780	950		1,983	10,713	3,049	--	3,049	3,161	--	3,161	--
1940	2,700	--	2,700	15,410	232	18,342	7,730	1,090		1,889	10,709	3,940	--	3,940	3,314	--	3,314	--
1941	1,690	--	1,690	14,620	110	16,420	7,030	1,220		2,043	10,293	4,570	30	4,600	2,160	650	2,810	200
1942	190	--	190	18,900	90	19,180	7,340	1,280		1,714	10,334	2,770	1,610	4,380	390	2,520	2,910	820

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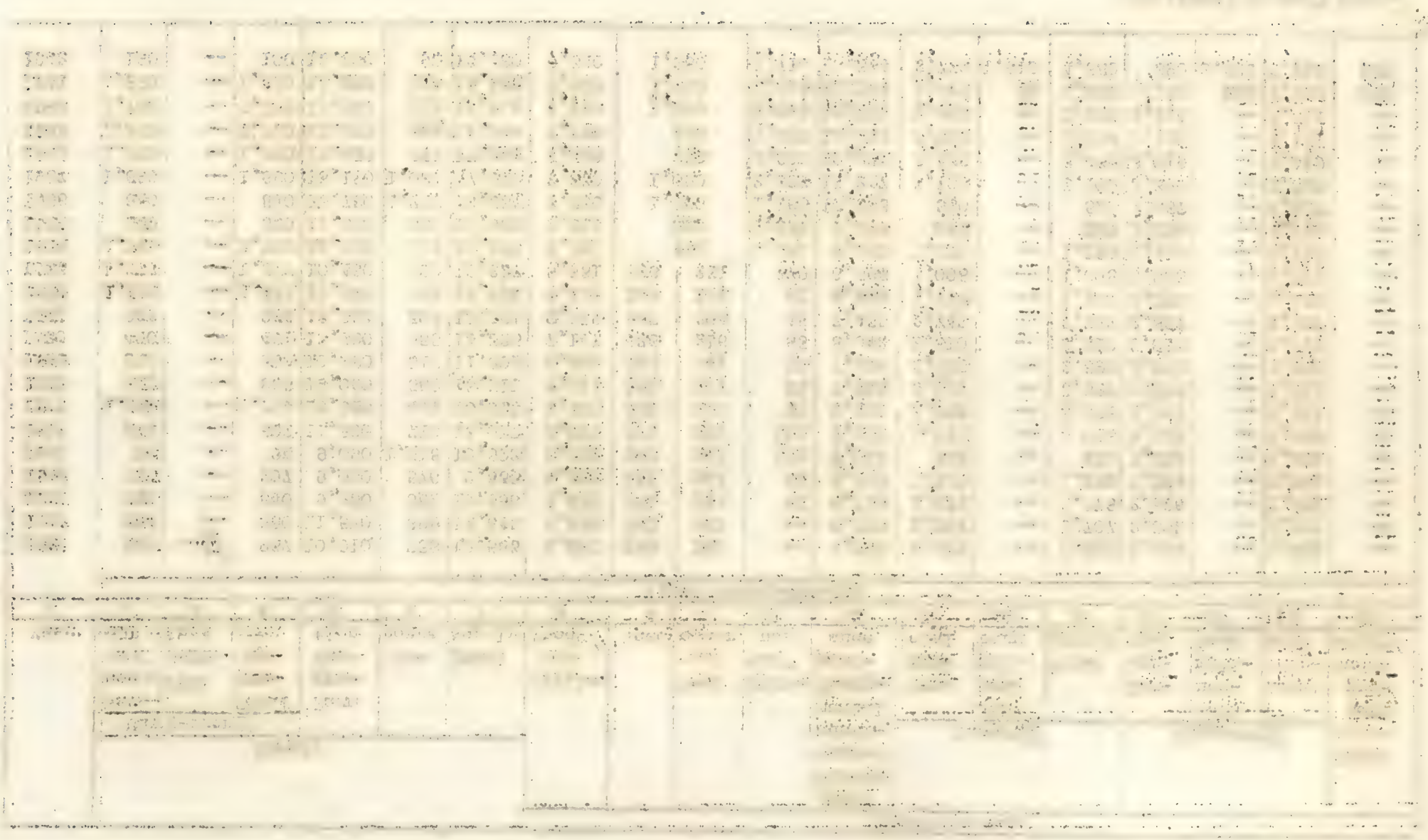


Table 2 continued.

Year	Supply						Distribution										
	Carry-over[b]																
	Warehouse and mills	USDA holdings	Total carryover	Farm production	Imports	Total supply	Civilian food[c]	Seed	Feed and other	Brewers' use	Total United States continental disappearance	Export[d]			Shipment[d]			Total military procurement[e]
												Commercial	USDA nonmilitary	Total export	Commercial	USDA nonmilitary	Total shipment	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1,000 hundredweight																	
1943	430	1,060	1,490	19,480	61	21,031	6,940	1,300		1,525	9,765	3,370	1,660	5,030	--	3,130	3,130	800
1944	180	1,790	1,970	20,450	4	22,424	6,320	1,260		1,857	9,437	4,320	760	5,080	--	2,560	2,560	4,040
1945	520	250	770	20,440	99	21,309	5,390	1,350		2,146	8,886	4,180	2,920	7,100	2,490	670	3,160	1,920
1946	480	370	850	21,890	38	22,778	6,580	1,430		2,408	10,418	4,510	3,850	8,360	1,840	10	1,850	700
1947	290	160	450	22,990	61	23,501	7,060	1,480		1,722	10,262	6,090	2,530	8,620	3,260	--	3,260	930
1948	260	10	270	25,030	45	25,345	7,320	1,560		3,023	11,903	8,100	690	8,790	3,320	--	3,320	430
1949	730	--	730	26,440	50	27,220	7,620	1,370		2,999	11,989	9,380	70	9,450	3,790	--	3,790	690
1950	1,390	120	1,510	25,220	437	27,167	8,740	1,590		3,208	13,538	8,860	20	8,880	3,480	--	3,480	1,020
1951	2,130	30	2,160	29,660	490	32,298	8,050	1,650		3,391	13,091	13,370	580	13,950	3,480	--	3,480	3,410
1952	940	--	940	32,790	218	33,948	8,150	1,715		3,373	13,238	12,460	--	12,460	3,800	--	3,800	5,000
1953[g]	[h]				63									6,702			1,579	

a/ Wherever it was possible, milled data were used. Until 1933, data available in rough terms and not in milled terms. A conversion factor of 1.62 was used--that is, 62 pounds of milled rice = 100 pounds rough.
b/ Carry-over until 1931 for southern states only. Crop year for California, October 1; for South, August 1.
c/ Civilian food data from Agricultural Statistics until 1933 (1940, p. 49) which are comparable to the Wheat Situation table from 1934 on. Marketing year, August 1 base.
d/ Both exports and shipments from 1921 to 1952 are on July 1 base.
e/ Military procurement broken down to relief and military food use. Based on National Food Situation yearly disappearance tables. For breakdown, see Sources to Table 1, Col. 19.
f/ Dashes indicate zero.
g/ Imports and exports, July-October; shipments, August 1, 1953-January 21, 1954. Exports include relief shipments.
h/ Blanks indicate data not available.

(Continued on next page.)

(Continued on next page)

Table 2 continued.

Sources:

Col. 1: Year is marketing year. For California, October 1, and southern states, August 1.

Col. 2: Carry-over for California, as of October 1, and, for the southern states, August 1. Data from 1921 to 1931 represent stocks for the southern states only; there are no reliable stock data available for California prior to this date. Data for 1932 and 1933 represent the sum of California and southern states carry-over from the Annual California Rice Market Review and the Annual Southern Rice Market Review, both issued by the U.S. Production and Marketing Administration, and converted 62:100 pounds. From 1934 on, carry-over stock is identical with the U.S. Bureau of Agricultural Economics, The Wheat Situation, October-November-December, 1952, table, p. 10.

Col. 3: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, table, p. 10.

Col. 4: Column 2 + column 3.

Col. 5: 1921-1933 production figures: U.S. Department of Agriculture. Agricultural Statistics, 1942, p. 41. Conversion: 1 bushel = 45 pounds rough rice, and 100 pounds rough = 62 pounds milled. 1934-1952: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10.

Col. 6: Import data, 1921-1939: U.S. Department of Agriculture. Agricultural Statistics Yearbooks of 1924, 1926, 1927, 1936, and 1942; and Imports of Principal Agricultural Products in the U.S. by Country of Origin. For 1940-1952: U.S. Office of Foreign Agricultural Relations. Foreign Agricultural Trade. U.S. Foreign Trade in Agricultural Products, by Commodities and by Country, Annual Fiscal Year. All import figures are based on fiscal years beginning July 1.

Col. 7: Column 4 + column 5 + column 6.

Col. 8: Civilian food data for years 1921-1933: U.S. Department of Agriculture. Agricultural Statistics Yearbook, 1940, p. 49. For 1934-1952: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10.

Col. 9: Prior to 1934, rough figures converted to milled base. From 1934-1952: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10.

Col. 10: Same as for column 9.

Col. 11: See Table 1, Sources, Col. 11.

Col. 12: Column 8 + column 9 + column 10 + column 11.

Col. 13: Based on fiscal year beginning July 1. Figures converted on the basis that 1 pound milled rice is equivalent to 1.62 pounds of rough rice.

Col. 14: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10.

Col. 15: Column 13 + column 14.

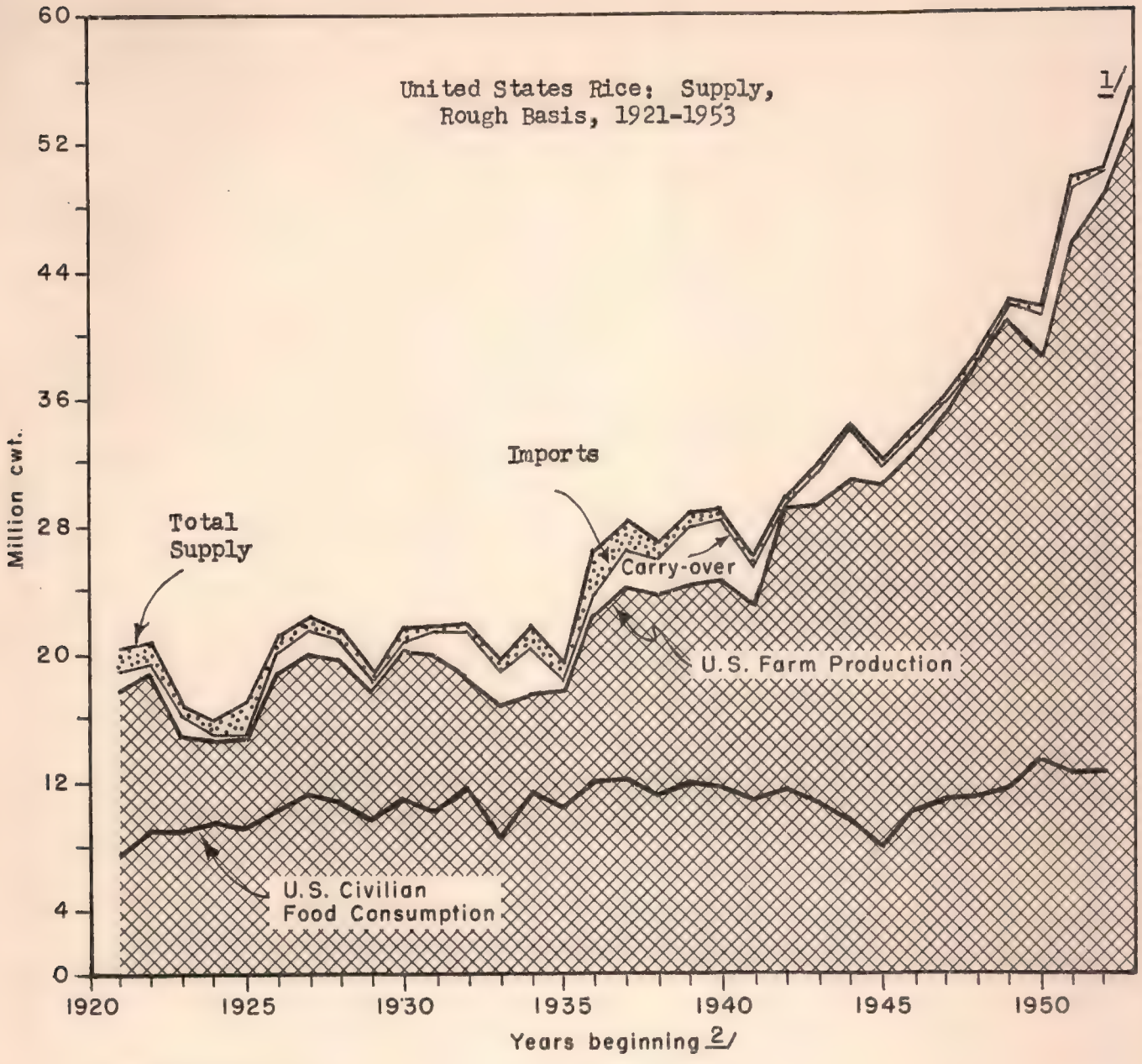
Col. 16: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10. Prior to 1934, see footnote to Table 1.

Col. 17: Same as for column 16.

Col. 18: Column 16 + column 17.

Col. 19: U.S. Bureau of Agricultural Economics. The Wheat Situation, October-November-December, 1952, p. 10, for column 31, but broken down to military and nonmilitary procurement. See note to Table 1.

FIGURE 1

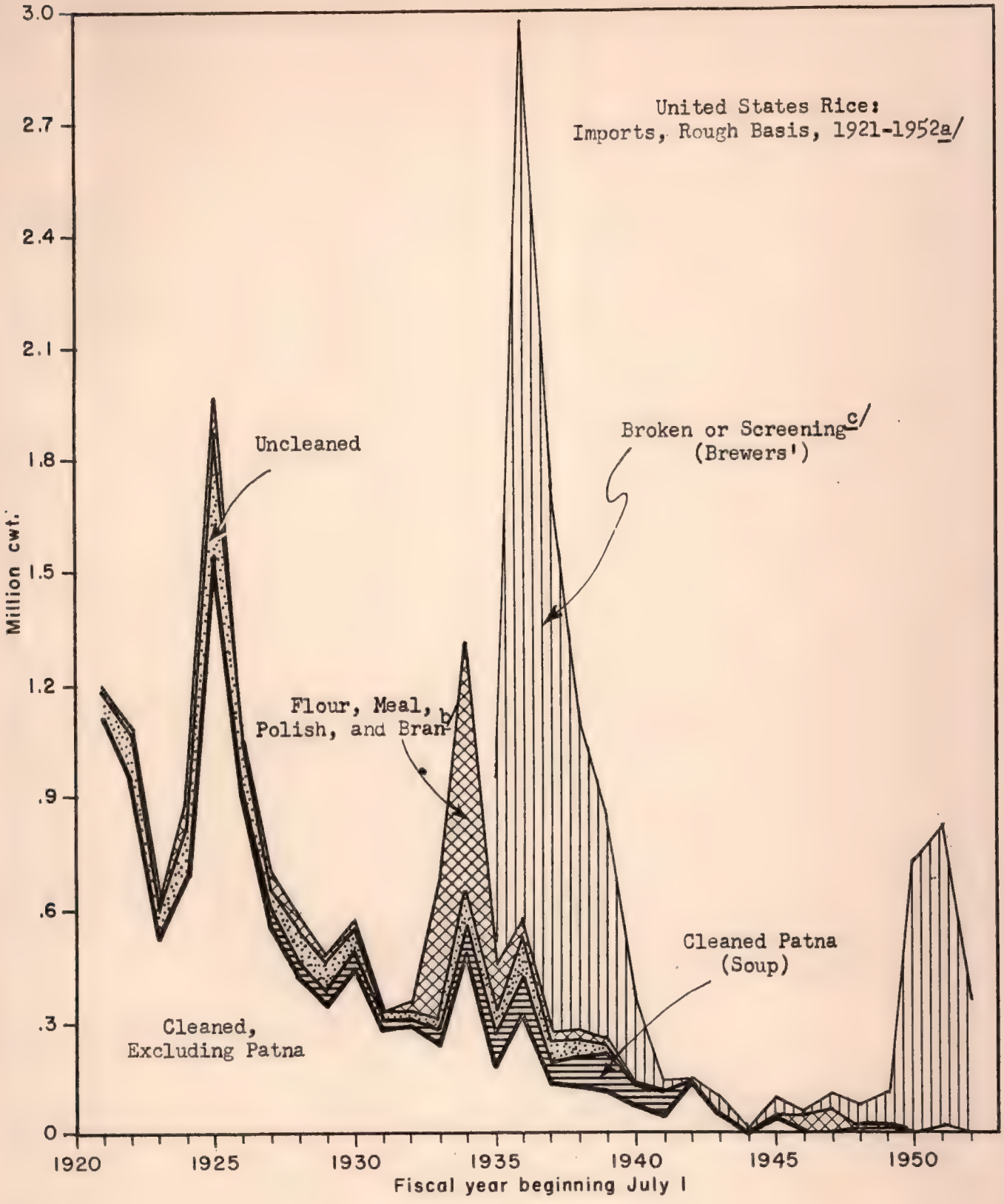


1/ Preliminary.

2/ August 1 for southern states and October 1 for California.

Source: Table 1.

FIGURE 2



a/ Outturn, 60 per cent.

b/ Includes broken rice prior to February 1, 1936.

c/ Included with flour, meal, etc., prior to February 1, 1936.

Source: Table 3.

TABLE 3

United States Rice: Imports of Rice and Rice Products, Rough Basis,[a] 1921-1953

Fiscal year beginning July 1	Uncleaned (rough)	Cleaned, excluding Patna	Cleaned Patna (soup)	Flour, meal, polish, and bran[b]	Broken on screening (brewers')[c]	Total imports[d]
1	2	3	4	5	6	7
	1,000 hundredweight					
1921	61	1,114	[e]	13		1,188
1922	117	950		15		1,082
1923	51	536		17		604
1924	120	695		67		882
1925	307	1,546		110		1,963
1926	117	908	20	50		1,095
1927	60	564	30	43		697
1928	81	421	38	20		560
1929	70	351	37	18		476
1930	62	448	35	10		555
1931	17	286	18	8		329
1932	16	294	13	27		350
1933	33	254	25	369		681
1934	65	493	53	703		1,314
1935	36	194	82	134	506	952
1936	111	321	95	43	2,390	2,960
1937	59	134	53	27	1,463	1,736
1938	45	125	82	22	825	1,099
1939	24	114	97	17	591	843
1940	10	75	53	5	239	382
1941	1	50	107	1	23	182
1942	--[f]	145	--	--	5	150
1943	--	47	--	8	40	95
1944	--	--	--	--	5	5
1945	--	37	--	22	108	167
1946	--	3	--	48	6	59
1947	--	--	--	77	25	102
1948	--	7	--	15	53	75
1949	--	10	--	16	60	86
1950	--	--	--	6	728	734
1951	--	16	--	--	802	818
1952	--	--	--	--	364	364
1953[g]	--	--	--	--	106	106

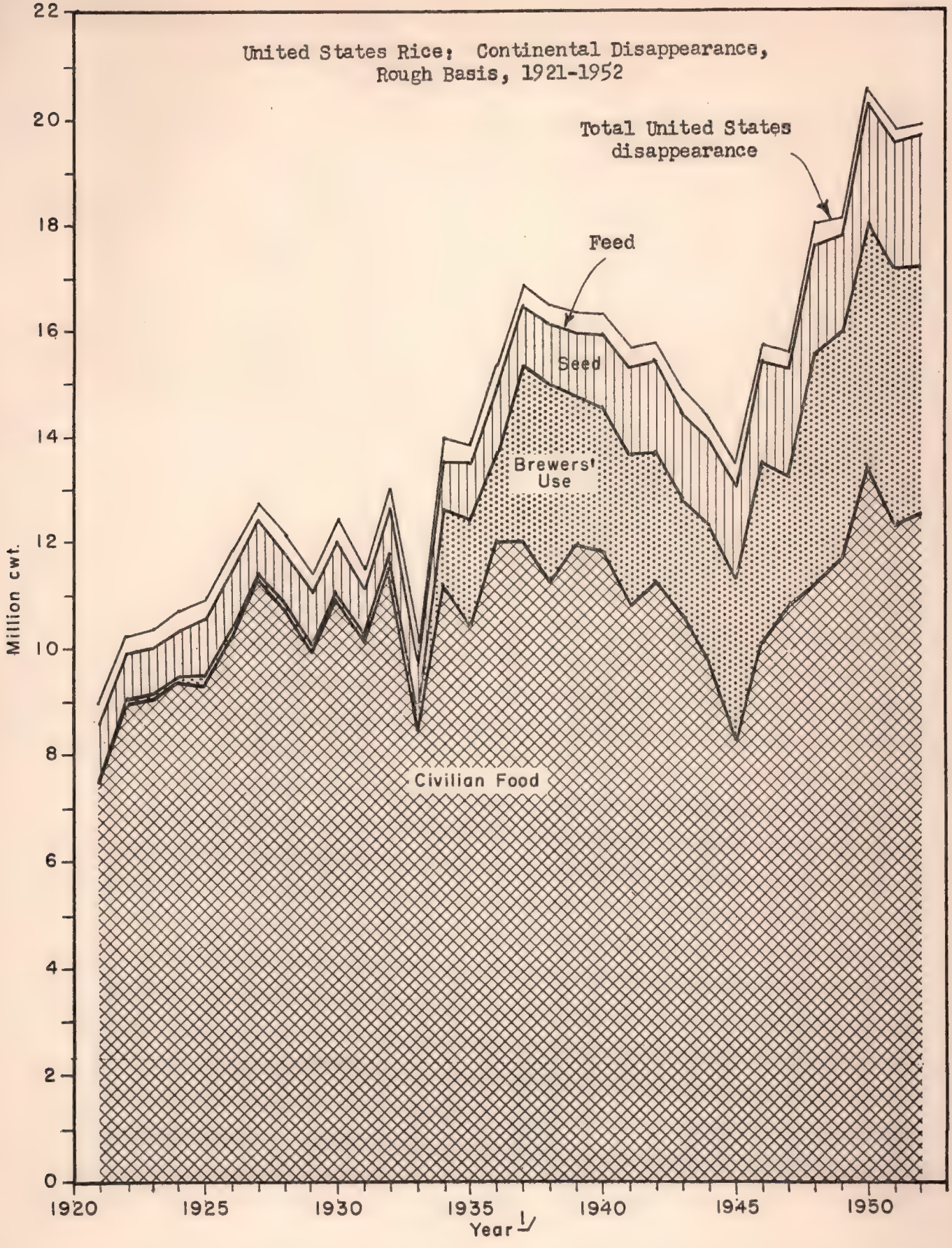
a/ Sixty per cent outturn or 1 pound milled = 1.67 pounds rough.
b/ Includes broken rice prior to February 1, 1936.
c/ Included with rice flour, meal, polish, and bran prior to February 1, 1936.
d/ There may be a slight difference between the total imports of Table 1 and the present series due to conversion from milled rice to rough.
e/ Blanks indicate data not available.
f/ Dashes indicate zero.
g/ July-October.

Sources:

1921-1939: U.S. Department of Agriculture. Agricultural Statistics Yearbooks of 1924, 1925, 1927, 1935, and 1941. Washington, D.C.

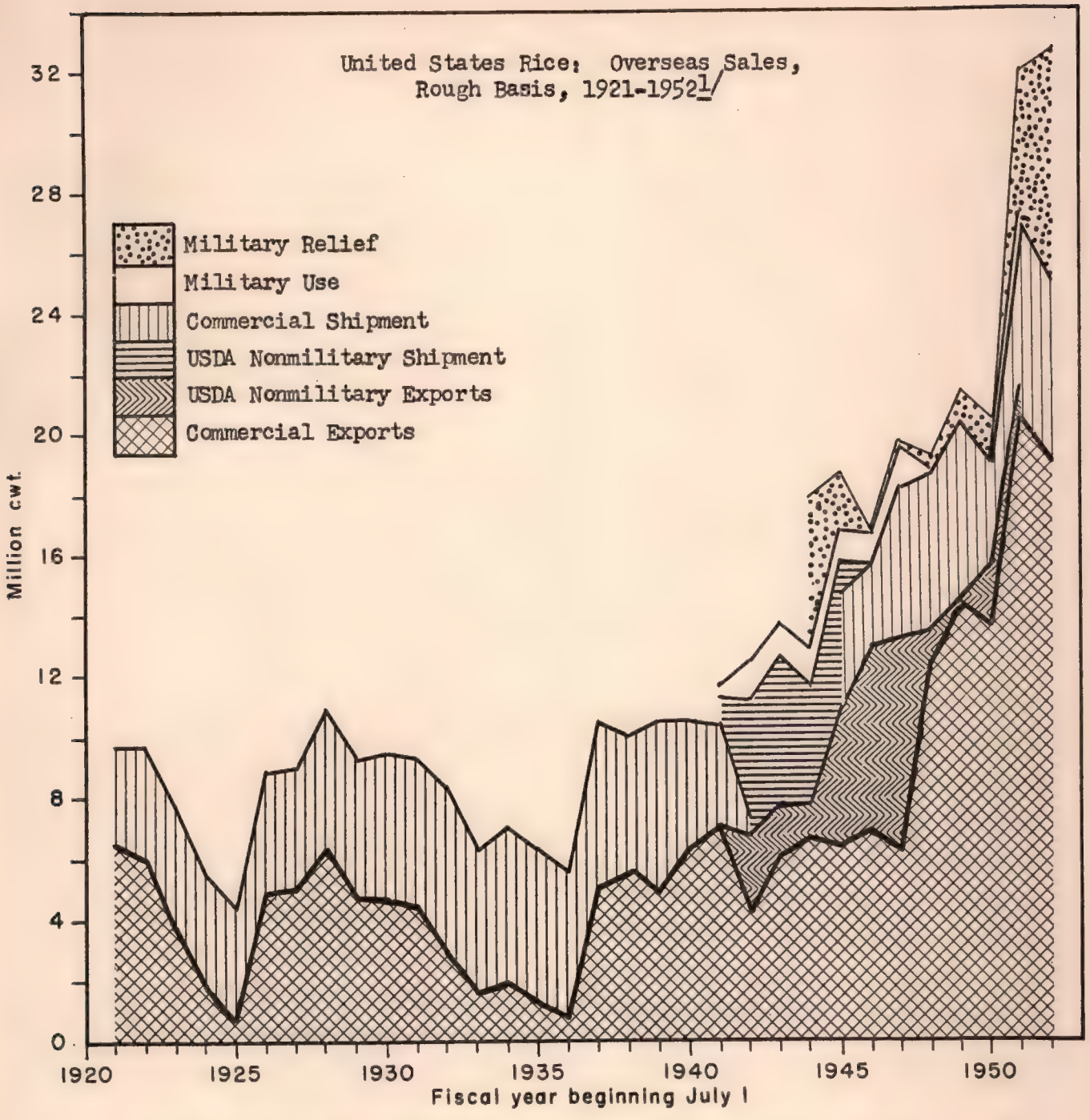
1940-1952: U.S. Office of Foreign Agricultural Relations. Foreign Agricultural Trade, U.S. Foreign Trade in Agricultural Products by Commodity and by Country, Annual Fiscal Years. Washington, D.C. Processed.

FIGURE 3



1/ Marketing year in general except for brewers' use which starts July 1.

FIGURE 4



1/ Total military procurement given for 1952. Individual figures not available. Overseas sales include shipments to United States territories and exports including relief shipments.

Source: Table 1.

sacks now. Commercial exports are now a larger outlet than domestic food use. Aggregate nonmilitary and commercial exports have absorbed greater volume than domestic food consumption since about 1945. Overseas sales now comprise about three fifths of the total annual supply.

There has been a relatively stable increase in the sales of United States rice to the territories. These now account for well over 10 per cent of total United States supplies. Military procurement has risen sharply since the beginning years of World War II. Changes in sales to these outlets are shown in Figure 4.

The dependence of the rice industry upon overseas markets and the effects of war crises is clear. The crisis markets must be maintained or replaced by other foreign markets if drastic reduction in output or price is to be avoided.

The relative importance of different regions and countries as United States markets is shown in Table 4 and Figure 5. European sales have increased from the low point of 15 years ago. Immediately after World War II, relief shipments to distressed nations accounted for relatively large proportions of aggregate exports to Europe. The Canadian market remains important. Wartime exports to the United Kingdom and to the U.S.S.R. were heavy. Sales of rice to Germany virtually ceased with the accession of Hitler. The relatively large commercial exports to Europe of 1926-1930 have not been paralleled in recent years.

Shipments to Latin America have represented a large part of total exports since 1936. By far the most important market in this region has been Cuba. Sales to the British West Indies and Venezuela have tailed off sharply since the Korean War. Cuba now represents nearly the entire Latin American market. This nation is not a market for short-grained rice, however.5/

Prior to World War II, sales to Asiatic countries were negligible. Heavy postwar shipments to the Philippine Republic, China, Indonesia and, since 1950, to Japan and Korea reflect the economic dislocations of war. Relief shipments to Korea and sales to Indonesia absorbed heavy volume with sharp expansion of Japanese sales in the past two years. In 1953, Japan obtained a large part of its total supply from Thailand and Burma. Taiwan, Italy, and Spain were other important suppliers. These data are shown in Table 6. Rehabilitation of normal supply areas may adversely affect the United States. The Asiatic market is of highest importance to the California industry.

Territorial sales, comprised almost entirely of shipments to Puerto Rico and to Hawaii, are shown in Table 5 and Figure 6. Minor sales have been made to the Virgin Islands, and fairly heavy shipments have been made to Guam. Southern states dominated the Puerto Rico market prior to World War II. California has shipped more than the South since then. California has always been the most important supplier to the Hawaiian market. Southern states penetrated

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5/ Cuba is also fostering internal development of rice production. Venezuela has invested heavily in domestic rice production, has made rice importation and internal distribution a state monopoly, and has maintained a domestic price twice as high as the world price.

TABLE 4

United States Rice: Exports[a] by Country of Destination, Milled Basis,[b] 1923-1953 (Fiscal Year Beginning July 1)

Country and continent of destination	1923[c]	1924	1925	1926	1927	1928	1929	1930	1931	1932[d]	1933
	1,000 hundredweight										
Europe											
Belgium	95	84	25	188	128	232	90	147	120	102	90
France	65	34	3	52	124	161	134	182	222	191	236
Germany	51	36	34	369	358	438	379	345	417	299	182
Greece	[e]					67	47	85	123	25	54
Netherlands						194	151	182	117	88	67
Sweden						76	28	41	42	31	26
Switzerland											
United Kingdom	321	210	81	337	355	418	359	324	357	155	129
USSR											
Other Europe[f]	246	72	23	274	373	145	131	118	130	62	79
Total, Europe	778	436	166	1,220	1,338	1,731	1,319	1,424	1,528	953	863
Canada	231	70	9	75	142	198	182	173	203	122	90
Latin America											
Argentina							284	191	--[g]	--	4
Chile							194	201	--	--	7
Cuba							67	10	--	--	19
Venezuela											4
Canal Zone											
British West Indies											
French West Indies											
Netherlands West Indies											2
Other Latin America[f]	230	203	56	282	470	846	216	--	202	160	6
Total, Latin America	230	203	56	282	470	846	761	402	202	160	42
Asia											
Ceylon											
China											
Indonesia											
Japan	597	6	4	685	20	146	9	4	4		
Korea											
Philippine Republic											2
Saudi Arabia											
Total, Asia	597	6	4	685	20	146	9	4	4	--	2
All others											
Asia and Africa	70	31	41	83	334	213	81	242	207	124	9
Total, world	1,906	746	276	2,345	2,304	3,134	2,352	2,245	2,144	1,359	1,006

(Continued on next page.)

Table 4 continued.

Country and continent of destination	1934	1935	1936	1937	1938	1939	1935-1939 average	1940	1941	1942	1943
	1,000 hundredweight										
Europe											
Belgium	101	42	28	141	139	50	80	--	--	--	--
France	175	34	40	84	2	6	33	--	--	--	--
Germany	89	28	8	15	2	--	11	--	--	--	--
Greece	82	85	27	164	136	32	89	--	--	--	40
Netherlands	52	11	13	108	103	16	50	--	--	--	--
Sweden	34	26	4	27	34	75	33	71	160	--	--
Switzerland					3	45	10	--	157	--	--
United Kingdom	122	47	54	71	109	111	78	--	--	890	833
USSR										438	467
Other Europe[f/]	61	27	11	62	97	95	58	10	20	4	7
Total, Europe	716	300	185	672	625	430	442	81	337	1,332	1,347
Canada	102	71	59	139	187	154	122	252	237	487	397
Latin America											
Argentina	--	--	16	139	--	--	51	--	68	--	--
Chile	71	90	5	144	81	--	46	--	10		
Cuba	310	364	239	1,947	2,452	2,369	1,469	3,475	3,651	2,228	2,914
Venezuela	--	--	--	2	3	24	6	15	66	26	4
Canal Zone											
British West Indies						2			43	5	88
French West Indies						5	1	43			14
Netherlands West Indies	1	1	2	2	1	3	2	4	3	8	7
Other Latin America[f/]	12	8	4	46	--	16	20	35	96	--	--
Total, Latin America	394	463	266	2,280	2,537	2,419	1,595	3,572	3,937	2,267	3,027
Asia											
Ceylon											
China											
Indonesia											
Japan											
Korea											
Philippine Republic		3		3	12	6	5	7	3		
Saudi Arabia											
Total, Asia		3		3	12	6	5	7	3	--	--
All others											
Asia and Africa	12	5	6	2	4	28	10	18	59	153	175
Total, world	1,224	842	516	3,096	3,365	3,037	2,174	3,930	4,573	4,239	4,946

(Continued on next page.)

Table 4 continued.

Country and continent of destination	1944	1945	1946	1947 h/	1948	1949	1950	1951 i/	1952 i/	1953 j/
	1,000 hundredweight									
Europe										
Belgium	--	9	1	1	58	271	184	57	52	124
France	69	26	--	--	27	--	--	--	--	--
Germany	--	--	--	2	45	23	--	--	--	--
Greece	63	20	--	87	220	231	295	209	--	--
Netherlands	212	--	--	--	--	11	2	--	--	--
Sweden	--	--	--	--	--	--	--	--	--	--
Switzerland	71	--	--	--	38	109	100	21	39	41
United Kingdom	174	4	--	2	--	--	--	--	--	--
USSR	376	81	--	--	--	--	--	--	--	--
Other Europe f/	14	62	9	100	211	60	7	24	9	47
Total, Europe	979	193	10	192	599	705	588	290	100	212
Canada	362	301	241	547	434	472	307	443	601	206
Latin America										
Argentina	--	--	--	--	--	--	--	--	--	--
Chile										
Cuba	3,483	3,424	4,535	5,456	4,926	5,250	7,321	5,118	4,858	3,178
Venezuela	1	2	3	5	103	255	324	196	86	110
Canal Zone		45	3	36	47	32				
British West Indies	48	100	20	120	112	162	46	54	81	
French West Indies		14			19	163	15			
Netherlands West Indies	5	8	5	4	10	21	24	25	41	
Other Latin America f/	34	31	25	3	3	10	--	34	9	57
Total, Latin America	3,571	3,624	4,591	5,624	5,220	5,893	7,730	5,427	5,075	3,345
Asia										
Ceylon								741	647	--
China		636	492	2,028	810	--	--	--	--	--
Indonesia		601	--	10	886	1,731	4	1,799	1,100	--
Japan			60	1	10	669	910	5,430	4,420	1,824
Korea				488	94	--	15	2,821	4,460	1,054
Philippine Republic		1,679	2,724	--	852	431	--	71	--	--
Saudi Arabia				134	163	83	101	91	139	61
Total, Asia	--	2,916	3,276	2,661	2,815	2,914	1,030	10,953	10,766	2,939
All others										
Asia and Africa	194	87	292	83	62	146	38	126	849	--
Total, world	5,106	7,121	8,410	9,107	9,130	10,130	9,693	17,239	17,391	6,702

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]

Table 4 continued.

a/ The totals may differ from other export listings due to the fact that this table has been compiled from different sources. Also, some sources include and others exclude paddy rice prior to 1933 and after.

b/ Rice other than milled converted to terms of milled at 65 per cent.

c/ No data available by country of destination of rice exports prior to 1923.

d/ Prior to 1932, rough rice excluded.

e/ Blanks indicate data not available.

f/ Prior to 1929, several countries listed are included in "Other Europe" and "Other Latin America" due to unavailability of separate data.

g/ Dashes indicate zero.

h/ Exports from 1947 on include military relief.

i/ August-July year.

j/ July-November year.

Sources:

1923-1950: U.S. Department of Agriculture. Yearbooks of Agricultural Statistics.

1951-1952: U.S. Foreign Agricultural Service. Foreign Agricultural Circular. FR13-53. October, 1953.

1935-1939 (Average): U.S. Foreign Agricultural Service. Foreign Agricultural Circular. FR13-53. October, 1953.

Table 1 continued.

exclude paddy rice prior to 1933 and after.

b/ Rice other than milled converted to terms of milled at 65 per cent.

c/ No data available by country of destination of rice exports prior to 1923.

d/ Prior to 1938, rough rice excluded.

e/ Blanks indicate data not available.

"Other Latin America" due to unavailability of separate data.

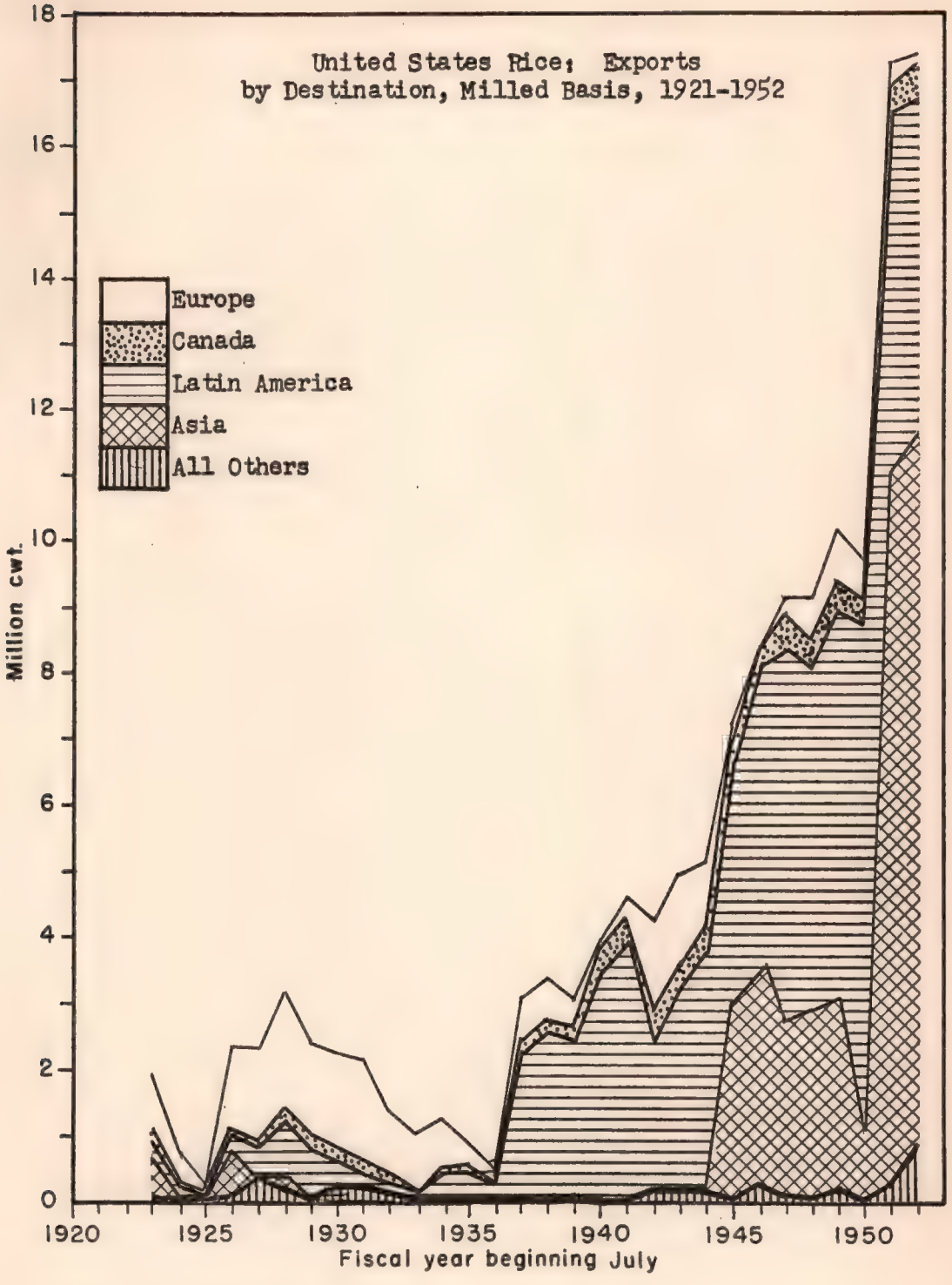
g/ Dashes indicate zero.

h/ Imports from 1947 on include military relief.

i/

j/

FIGURE 5



Source: Table 4.

TABLE 5

United States Rice: Shipments, Milled Basis, 1921-1953

Year beginning July 1	Total United States shipments	Puerto Rico	Hawaii	Alaska	Virgin Islands	Guam
	1,000 hundredweight					
1921	1,994	1,591	392	11	a/	
1922	2,302	1,745	543	14		
1923	2,526	1,905	608	13		
1924	2,264	1,694	558	12		
1925	2,236	1,697	526	13		
1926	2,428	1,744	674	10		
1927	2,551	1,838	701	12		
1928	2,813	2,012	787	14		
1929	2,873	2,020	839	14		
1930	3,018	2,122	885	11		
1931	2,887	1,987	892	8		
1932	3,370	2,444	915	11		
1933	3,363	2,022	871	10		
1934	3,110	2,273	826	11		
1935	3,010	2,163	836	11		
1936	2,937	2,256	669	12	4	
1937	3,389	2,347b/	729b/	13b/	6b/	
1938	3,019	2,290b/	803b/	11b/	6b/	
1939	3,161	2,461b/	843b/	10b/	14b/	
1940	3,314	2,551b/	831b/	9b/	8b/	
1941c/	2,810	2,155b/	862b/		6b/	
1942c/	2,910	1,416b/	92b/		8b/	
1943c/	3,130	2b/	1b/			
1944c/	2,560					
1945c/	3,160					
1946	1,850	1,130d/	710		10	--e/
1947	3,317	2,661	587		12	57
1948	3,374	2,801	510f/		9	54
1949	3,914	3,196	627		15	76
1950	3,731	2,981	665		15	70
1951	3,543	2,826	597		14	106
1952	3,860	3,108	629		15	108
1953	1,579	1,211g/	333h/			35h/

a/ Blanks indicate data not available.
b/ Calendar year base--otherwise, year beginning July 1
c/ Complete data not available.
d/ Normal low.
e/ Dashes indicate zero.
f/ Since April 7, 1948, shippers are exempted from the requirement of filing declaration for merchandise moving between continental United States and the two territories of Alaska and Hawaii. Shipments, therefore, to Hawaii are not listed in the FT800 reports since April, 1948. Figures for Hawaiian rice shipments are obtained from the Annual Market Summary of California Rice, U.S. Production and Marketing Administration.
g/ August 1, 1953-January 21, 1954.
h/ July, 1953-January, 1954.

Sources:

1921-1942: U.S. Department of Commerce. Foreign Commerce and of United States.

1942-1953: U.S. Bureau of the Census. U.S. Trade in Merchandise and Gold and Silver with U.S. Territories and Possessions. Monthly reports, FT800.

TABLE 6

Japanese Rice: Imports by Countries of Origin, Milled Basis, 1935-1939 and 1946-1953

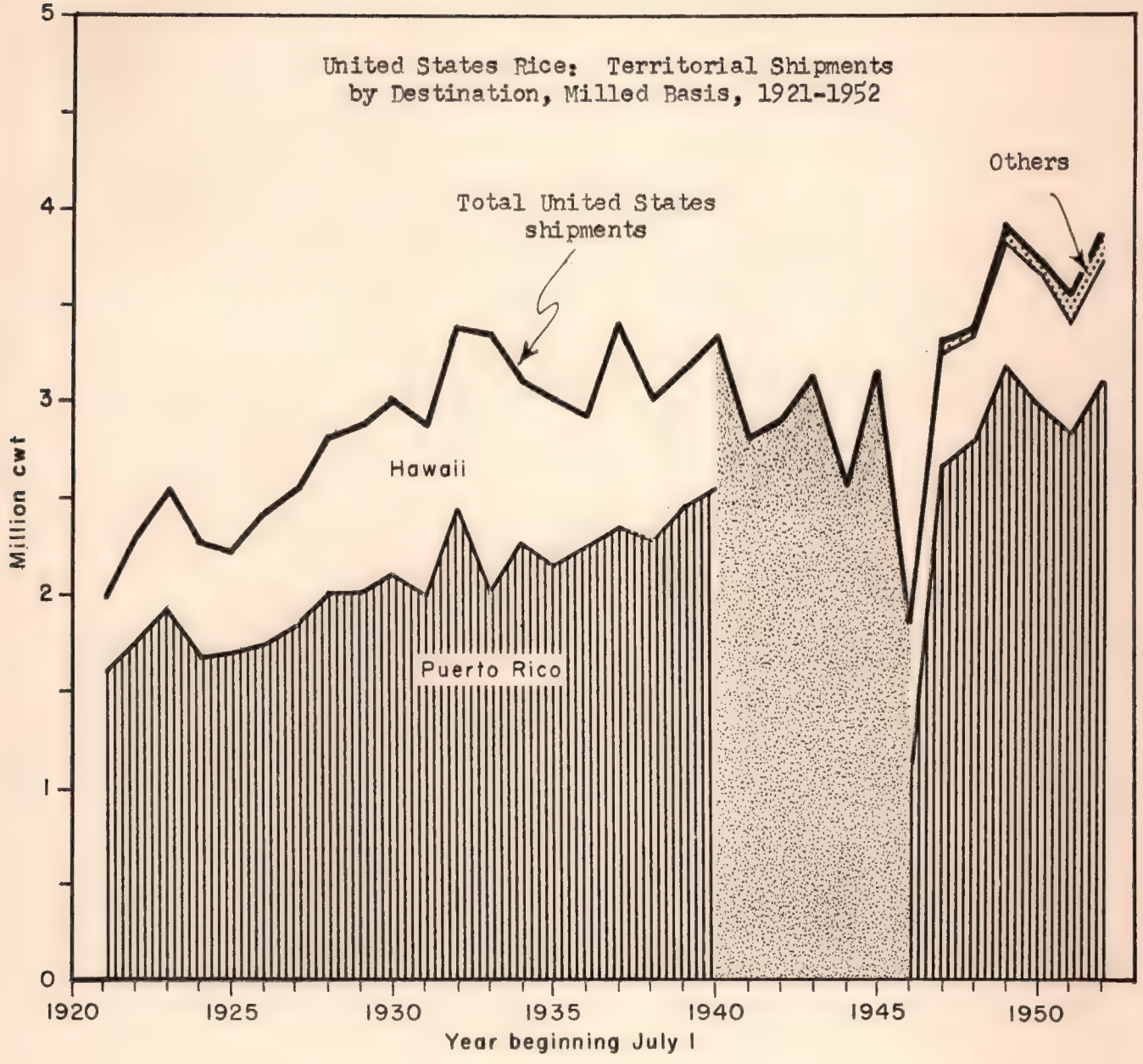
Calendar year	Total imports	Imports from: Burma	United States	Taiwan	Thailand	Egypt	Korea	Italy	Spain	Others
	1,000 hundredweight									
1935-1939 average	42,450	20	--[a]	15,290	680	--	2,644	--	--	20
July-December, 1949	2,150	880	10	--	1,260	--	--	--	--	--
January-December, 1950	14,800	3,200	1,130	--	7,240	540	1,980	--	--	710
January-December, 1951	19,660	3,620	910	1,820	8,230	4,580	--	190	--	310
January-December, 1952	21,970	3,160	6,010	1,130	6,870	--	--	2,400	1,040	1,360
January-December, 1953	23,254	4,158	3,520	1,166	9,196	--	--	594	880	3,740

a/ Dashes indicate zero.

Source: U.S. Foreign Agricultural Service. Foreign Crops and Markets. Washington, D.C., February 1, 1954.

Continued from previous page

FIGURE 6



Source: Table 5.

that market a short time before the outbreak of the second world war but now make few sales there. Puerto Rico absorbs about two thirds of total shipments.

California Supply and Distribution.--The difference between the utilization patterns of California and other United States rice is indicated in Table 7.

Supply.--Carry-over as a proportion of total supply has decreased in recent years. Carry-over stocks have been held by the United States Department of Agriculture only in wartime years and in 1949. Farm production remained fairly constant--oscillating about a yearly output of around 4,000,000 sacks, rough basis--until shortly before the outbreak of the second world war. Within the past 30 years, crops as small as 2,000,000 sacks have been produced. There has been an uptrend since 1924, sharply accelerated upon the outbreak of the second world war. The upward trend has since been maintained. Present production of nearly 12,000,000 sacks, rough basis, is more than twice as high as the California production of 1941. Domestic disappearance in all uses absorbs only about one fifth of output. The supply data for California rice are shown graphically in Figure 7.

Distribution.--Changes in distribution of California rice are indicated in columns (7) through (21) in Table 7 and are charted in Figure 8. The most important long-run outlet for California production has been shipment to offshore United States territories. United States continental disappearance, to a large measure for military use, was the major channel during the years of the second world war. Exports increased and the relative shipments to territories decreased during that period of controlled distribution. Domestic channels have taken a relatively minor proportion of total California production since World War II ended. In the past 15 years, there has been a slow but stable rate of increase in utilization of California rice by cereal manufacturers. Internal shipments to other parts of the United States for territorial reshipment have been relatively minor except for heavy diversions made in one year by the Surplus Marketing Administration. Army utilization within the nation was large during the second world war. Utilization of California rice by brewers was heavy from 1936 to 1942 and is still a relatively important outlet.6/

Since the beginning of the second world war, exportation has been one of the significant markets for California production. Exports were relatively small in the decade 1929-1939. Wide year-to-year variations reflect the political or military source of much of the California export demand in recent years. The general uptrend in aggregate domestic use roughly parallels the changes in annual total production. Figure 9 indicates significant annual fluctuations in domestic uses: civilian food, seed, feed and other farm use, brewers' use, and cereal manufacture. The net farm prices received for rice of a given type and grade from sale for food use, feed, brewers' use, feed, or cereal manufacture seem to have been equal. Net farm prices from different uses could not now be differentiated. Data are not available to analyze the impact upon farm income of price discrimination among different domestic channels.

- -

6/ Brewers' use is apparently a stable outlet. Substitutes for rice are used only in response to major changes in price differentials.

that market a short time before the outbreak of the second world war but now make few sales there. Puerto Rico absorbs about two thirds of total shipments.

California supply and distribution.--The difference between the utilization patterns of California and other United States rice as [illegible] in [illegible].

Supply.--Carry-over as a proportion of total supply has decreased in [illegible] years. Carry-over stocks have been held by the United States Department of Agriculture only in [illegible] years and in 1949. Farm production remained fairly constant--oscillating about a yearly output of around [illegible] sacks, rough basis--until shortly before the outbreak of the second world war. Within the past 30 years, crops as small as 2,000,000 sacks have been produced. There has been an upward [illegible] since 1941, sharply accelerated upon the outbreak of the second world war. The upward trend has since been maintained. Present production of nearly 12,000,000 sacks, rough basis, is more than twice as [illegible] as the California production of 1941. Domestic disappearance in all uses absorbs only about one fifth of output. The supply data for California rice are shown graphically in Figure 7.

Distribution.--Changes in distribution of California rice are indicated in columns (7) through (21) in Table 7 and are charted in Figure 8. The most important long-run outlet for California production has been shipment to other United States territories. United States continental disappearance, in a large measure for military use, was the major channel during the years of the second world war. Exports increased and the relative shipments to territories [illegible]. Domestic channels have taken a relatively minor proportion of total California production since World War II ended. In the past 15 years, there has been a slow but steady rate of increase in utilization of California rice by cereal manufacturers. Internal shipments to other parts of the United States for territorial requirements have been relatively minor except for heavy diversions made in the [illegible] large during the second world war. Utilization of California rice by brewers was heavy from 1936 to 1942 and is still a relatively important outlet.3/

Since the beginning of the second world war, exports [illegible] has been one of the significant markets for California production. Exports were relatively small in the decade 1939-1949. Wide year-to-year variations reflect the political or military source of much of the California export demand in recent years. The general uptrend in aggregate domestic use roughly parallels the changes in annual total production. Figure 9 indicates significant annual fluctuations in domestic uses: direct food, seed, feed and other farm uses, brewers' use, and cereal manufacture. The net farm prices received for rice of a given type and grade [illegible] for food use, feed, brewers' use, feed, or cereal manufacture seem to have been equal. Net farm prices from different uses could not now be differentiated. Data are not available to analyze the impact upon farm income of price discrimination among different domestic [illegible].

- -

3/ Brewers' use is apparently a stable outlet. Substitutes for rice are used only in response to major changes in price differentials.

TABLE 7

California Rice: Supply and Distribution, Rough Basis,[a] 1921-1953

Year beginning October 1	Supply			Distribution													
										Total United States continental disappearance[f]	Shipment to:[g]			Export and shipment[h]	Export[i]		
	Carryover[b]	Farm production	Total supply	Civilian food[c]	Cereal manufacture[c]	Domestic shipment[d]	Brewers' use[e]	Seed	Feed and other		Puerto Rico	Hawaii	Total shipment		Commercial	Military and USDA	Total export
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1,000 hundredweight																
1921	1,357	3,280	4,637	397		j/		196	1	594		986[k]	986[k]		2,606	--[l]	2,606
1922	451	3,465	3,916	676				141	1	818		1,288[k]	1,288[k]		1,067	--	1,067
1923	743	2,552	3,295	782				126	1	909		1,418[k]	1,418[k]		413	--	413
1924	455	1,964	2,419	581				144		725		1,318[k]	1,318[k]		68	--	68
1925	108	2,160	2,268	476				209	1	686		1,254	1,254		41	--	41
1926	87	3,594	3,681	573				224	1	798		1,316	1,316		1,150	--	1,150
1927	117	4,032	4,149	562				185	1	748		1,462	1,462		228	--	228
1928	1,411	3,677	5,088	456				133	1	590	475	1,620	2,095		1,293	--	1,293
1929	1,110	2,574	3,684	503				154	3	660	698	1,662	2,360		152	--	152
1930	512	3,272	3,784	374				175	4	553	955	1,778	2,733		139	--	139
1931	359	3,712	4,071	186				154	3	343	979	1,813	2,792		127	--	127
1932[m]	809	3,510	4,319	934				151	45	1,130	1,041	1,773	2,814	24	37	--	37
1933[k]	314	3,110	3,424	641				151	30	822	708	1,532	2,240	4	17	--	17
1934	463	3,715	4,178	769				140	50	959	1,051	1,690	2,741	38	60	--	60
1935	193	3,330	3,523	469		6	409	193	30	698	696	1,509	2,205	34	12	--	12
1936	510	4,223	4,733	506		120	883	208	750	1,584	852	1,451	2,303	24	606	--	606
1937	283	4,099	4,382	368	148	--	956	175	300	991	1,063	1,464	2,527	34	165	--	165
1938	674	3,769	4,443	387	227	15	624	168	40	837	817	1,503	2,320	119	125	--	125
1939	997	4,050	5,047	135	276	1,049	763	165	60	1,685	918	1,219	2,137	148	113	--	113
1940	972	4,248	5,220	324	266	79	1,293	214	75	956	1,120	1,606	2,726	375	464	--	464
1941	786	3,787	4,573	669	277	42	525	297	75	1,360	1,244	1,637	2,881	46	194	--	194
1942	82	5,682	5,764	279	254	339	423	331	35	1,238	672	777	1,449	353	846	1,096	1,942

(Continued on next page.)

Table 7 continued.

Year beginning October 1	Supply			Distribution													
										Total United States continental disappearance[f]	Shipment to:[g]			Export and shipment[h]	Export[i]		
	Carryover[b]	Farm production	Total supply	Civilian food[c]	Cereal manufacture[c]	Domestic shipment[d]	Brewers' use[e]	Seed	Feed and other		Puerto Rico	Hawaii	Total shipment		Commercial	Military and USDA	Total export
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1,000 hundredweight																
1943	859	6,552	7,411	1,783	396	757	221	344	50	3,330	--	1,021	1,021	155			1,731
1944	1,096	6,750	7,846	545	408	4,017	476	341	50	5,361	478	1,083	1,561	104	140	448	588
1945	185	6,262	6,447	965	462	549	332	370	50	2,396	1,369	1,052	2,421	129	347	976	1,323
1946	191	7,913	8,104	1,736	346	412	298	363	75	2,932	1,967	1,192	3,159	150	881	910	1,791
1947	44	8,035	8,079	788	431	--	624	370	75	1,664	2,795	1,107	3,902	168	369	1,881	2,250
1948	93	6,832	6,925	752	440	--	588	436	68	1,696	2,500	1,087	3,587	119	176	734	910
1949	800	10,218	11,018	685	391	--	1,163	337	102	1,515	3,806	1,066	4,872	245	1,460	2,674	4,134
1950	177	8,270	8,447	1,102	421	--	757	447	83	2,053	3,312	1,010	4,322	236	336	1,064	1,400
1951	394	10,676	11,070	768	376	--	561	469	104	1,717	2,704	853	3,557	191	5,146	328	5,474
1952	51	11,715	11,766	774	755	--	569	535	115	2,179	3,118	929	4,047	246	2,764	2,104	4,868
1953[n]	116	11,948	12,064			--	234	720		569	890	372	1,315				3,903

a/ Only milled head converted to rough: from 1921-1932, on the basis of 50 pounds milled = 100 pounds rough; from 1933 on, milled head converted on the basis of actual head outturn.

b/ Stocks from 1933 on, taken as reported by U.S. Production and Marketing Administration, California Rice Market Review. Prior to that date, stocks represent the stocks reported in the Rice Journal every year on rice statistics converting milled rice to rough on the basis of 1 pound milled = 1.62 pounds rough rice. Stocks until 1932, on August 1 year base. Stocks include USDA holdings in 1,000 hundredweight as follows: 611 in 1943, 1,035 in 1944, 91 in 1945, 7 in 1946, and 755 in 1949.

c/ For 1921-1932, civilian food (domestic trade) has been arrived at by deducting from total supply: seed and other uses, shipments, exports, and closing stocks. No breakdown available on civilian food and use by cereal manufacturers prior to 1937.

d/ Includes small shipments to the South; U.S. Surplus Marketing Administration shipments in 1939 and 1940; and, during World War II, army takings primarily for overseas relief.

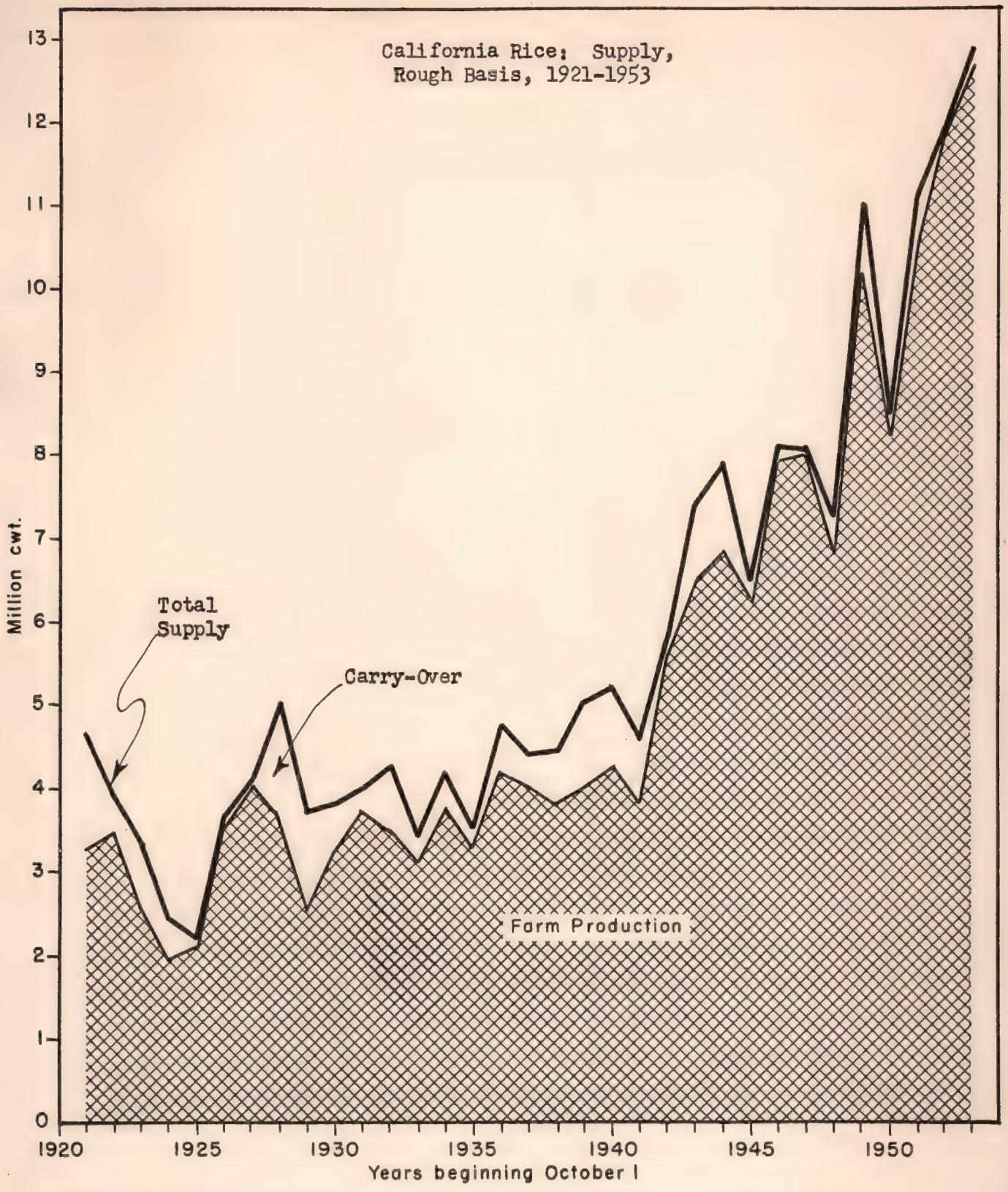
(Continued on next page.)

| | | |

Table 7 continued.

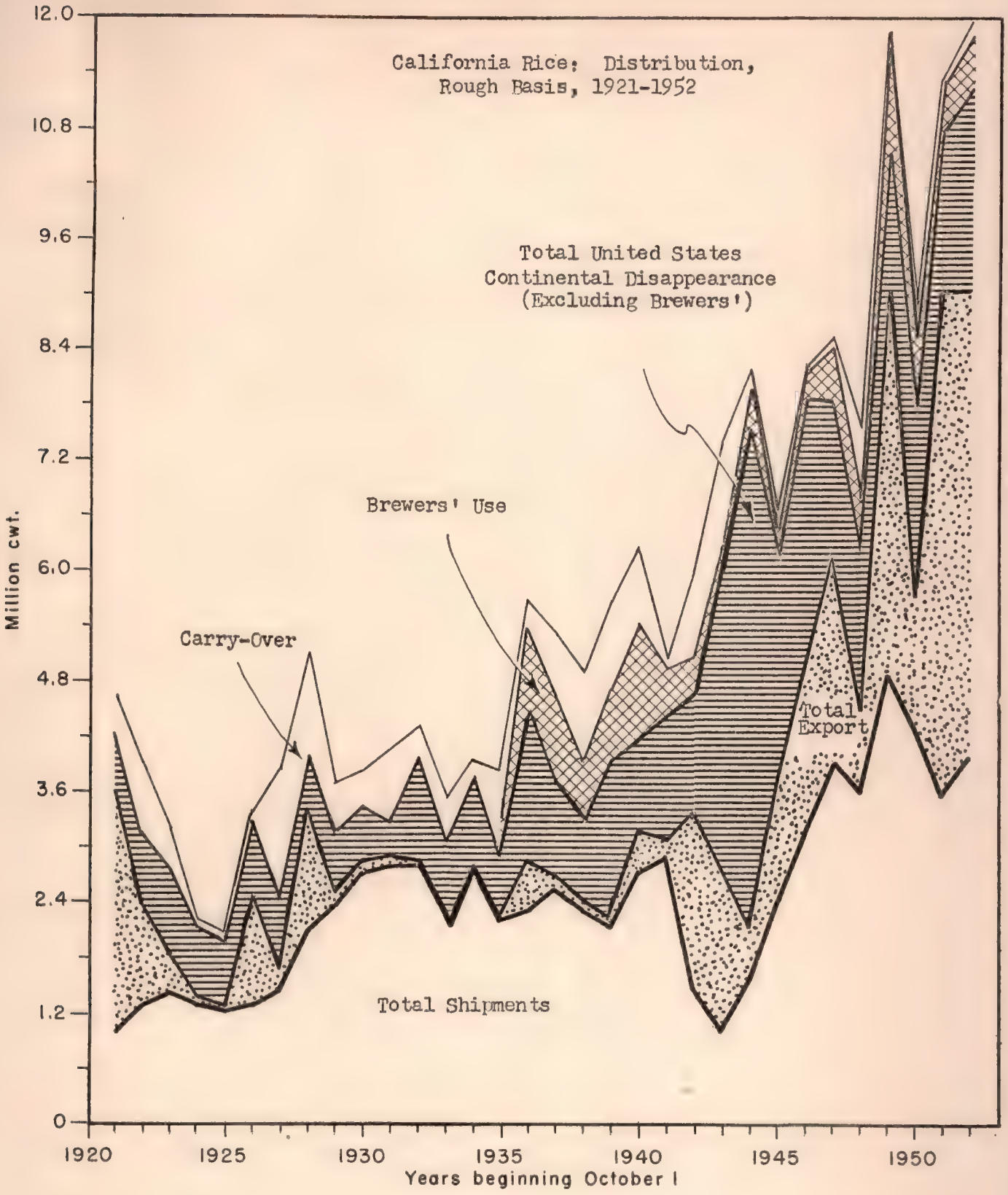
e/ Brewers' rice converted to rough base by actual total milling outturn. The conversion factor differs from those used on head rice. Therefore, brewers' rice is not included into the total United States disappearance; for the period, 1921-1934, excluded from total United States disappearance.
f/ Excluding brewers' use.
g/ Shipments to territories during and after World War II also include U.S. Department of Agriculture shipments. No data available for separate commercial and U.S. Department of Agriculture shipments.
h/ Shipped as rough.
i/ Exports include U.S. Department of Agriculture and military relief shipment, including the following: 1944--448,000 bags for relief (Europe); 1945--976,000 bags to the Philippine Islands and United Nations (UNRRA); 1946--640,000 bags for Philippine and China relief and 346,000 to Cuba; 1947--1,881,000 bags to China; 1948--734,000 bags to China, Austria, and Germany; 1949--2,674,000 bags to Japan and Okinawa; 1950--1,064,000 bags to Japan and Okinawa; 1951--328,000 bags to Japan and Okinawa; and 1952--2,104,000 bags to Korea and Ryukyus.
j/ Blanks indicate data not available.
k/ Estimates: Hawaiian shipment for 1921-1924 on the assumption that total United States shipments to Hawaii are exclusively from California.
l/ Dashes indicate zero.
m/ In general, figures prior to 1933 are only rough estimates based on scarce data available obtained primarily from the Rice Journal. Farm production and seed use are those obtained from the U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Rice, 1909-1950. Exports and territorial shipments are those reported by the U.S. Production and Marketing Administration, Annual Summary of California Rice.
n/ October, 1953-January, 1954.

FIGURE 7



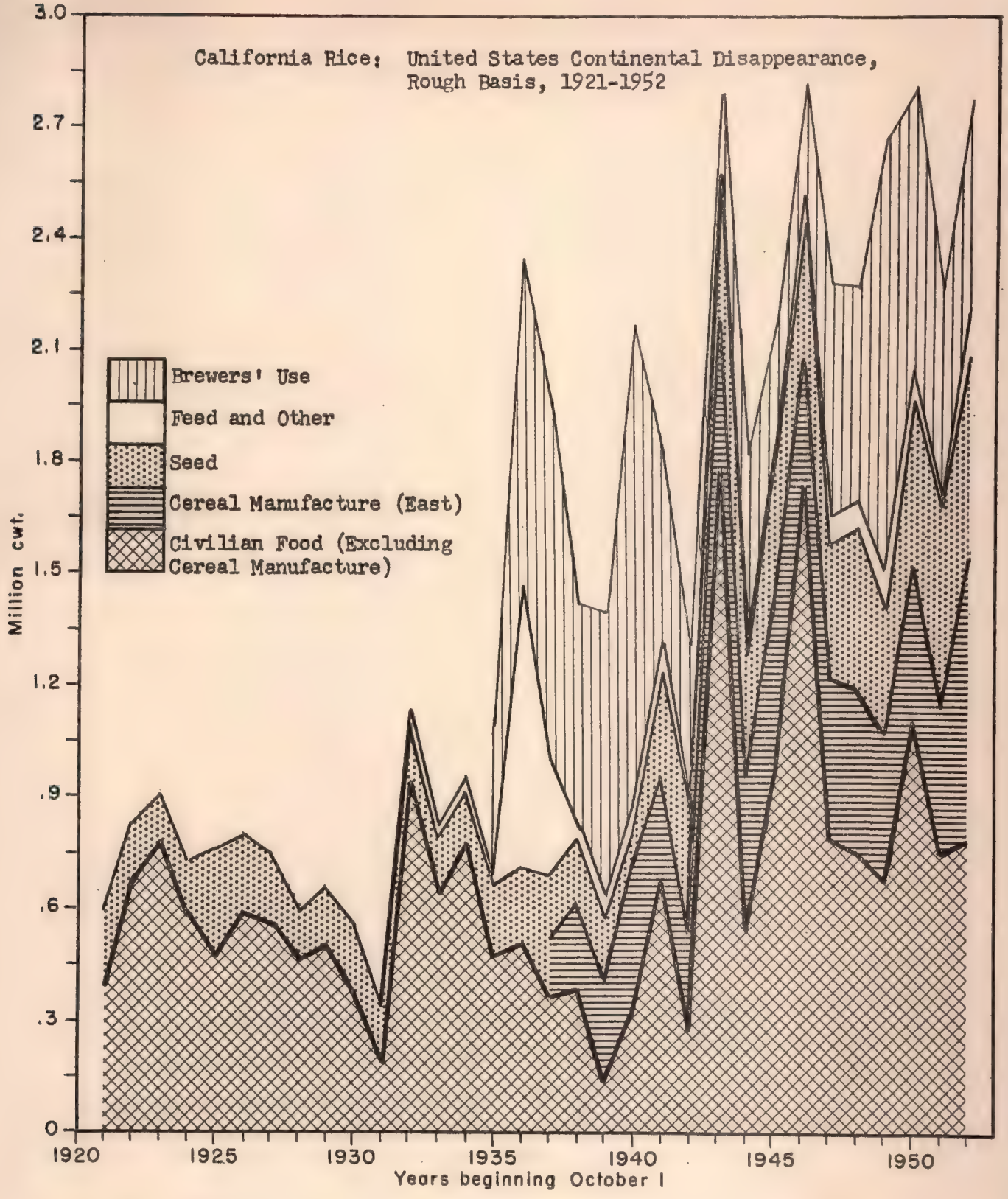
Source: Table 7.

FIGURE 8



Source: Table 7.

FIGURE 9



Source: Table 7.

Total overseas sales include territorial shipments, commercial exports, and exports made by the United States Department of Agriculture and the military. Territorial shipments were also made by the United States Department of Agriculture during World War II. Shipments from California to Puerto Rico have increased greatly since the war ended. Shipments to Hawaii have decreased as a percentage of overseas sales, although California is still the major supplier. Commercial exports declined after 1929, have fluctuated violently since the war, have trended upward in both absolute and relative magnitude, and in some cases have been financed by noncommercial sources of foreign exchange. Military and United States Department of Agriculture procurement together have accounted for heavy overseas sales. Territorial sales are still the largest and most stable overseas outlet. The downtrend in shipments to Hawaii has been continuing since 1932. The sharp upturn in Puerto Rican shipments, which has compensated in part for shrinkage of the Hawaiian market, dates from World War II. Trade sources indicate that retention of the Puerto Rican market by California may be endangered if shrinkage of exports should induce efforts by southern states to recapture that market. None of the overseas channels appear to have been stable either on a year-to-year basis or over the long run of three decades. The purchasing agency and the destination of California rice exports have also varied. Since 1944, Commodity Credit Corporation and military acquisitions have been important export outlets. Latin American outlets were important in the immediate postwar years but have since tended to decrease. Rice has been exported in heavy volume over the past few years to the Japanese market. The instability of that outlet was indicated in Table 6. Prior to World War II, Japan imported mainly from Taiwan, Korea, and Thailand. Until after World War II, the United States made virtually no impact upon the Japanese market.

Details of territorial shipments are shown in Figures 11 and 12. Since 1921, the volume sold to Puerto Rico has doubled--from about 1,500,000 sacks, milled basis, in 1921 to about 3,000,000 now. Shipments from California increased from about 500,000 sacks, milled basis, to about 2,000,000 sacks. Southern states penetrated the Hawaiian market during the war. Minor quantities had been shipped thereto prior to the war. Total Hawaiian shipments rose from about 400,000 sacks in 1921 to more than 900,000 sacks, milled basis, in 1932, and then drifted downward to about 600,000 sacks. The decrease in Hawaiian per-capita consumption may continue.

By far, the bulk of export sales still originate from the South. California exports increased sharply after 1941 but southern exports increased faster. There is little stability in the proportion of total United States exports originating from the two areas. California has exported as much as one fourth and as little as 5 per cent of annual exports within the past five years.

Commodity Credit Corporation and military exportation of California rice, shown in Figure 14, have fluctuated widely. The category "others" in Figure 14 is largely comprised of nominally commercial exports to Asiatic markets. Especially in Japan, such exports appear to have been made in the face of dollar deficits on trade balance, apparently made up largely by expenditures of the occupation and military forces.

The proportion of annual United States production of rice originating in California over the past decade has varied from one fifth to one fourth. There have been similar fluctuations in the percentage of California output used in each of the three major classes of outlets--domestic, territorial, and export.

Total overseas sales include territorial shipments, commercial exports, and exports made by the United States Department of Agriculture and the military. Territorial shipments were also made by the United States Department of Agriculture during World War II. Shipments from California to Puerto Rico have increased greatly since the war ended. Shipments to Hawaii have decreased as a [illegible] war, have trended upward in both absolute and relative magnitude, and in some [illegible] tary and United States Department of Agriculture procurement together have accounted for heavy overseas sales. Territorial sales are still the largest and most stable overseas outlet. The downtrend in shipments to Hawaii has been continuing since 1952. The sharp upturn in Puerto Rican shipments, which has [illegible] II. Trade sources indicate that retention of the Puerto Rican market by California may be endangered if shrinkage of exports should induce efforts by southern states to recapture that market. None of the overseas channels appear to have been stable either on a year-to-year basis or over the long run of three decades. The purchasing agency and the destination of California rice exports have also varied. Since 1944, Commodity Credit Corporation and military acquisitions have been important export outlets. Latin American outlets were important in the immediate postwar years but have since tended to decrease. Rice has been exported in heavy volume over the past few years to the Japanese market. The instability of that outlet was indicated in Table 6. Prior to World War II, Japan imported mainly from Taiwan, Korea, and Thailand. Until [illegible]

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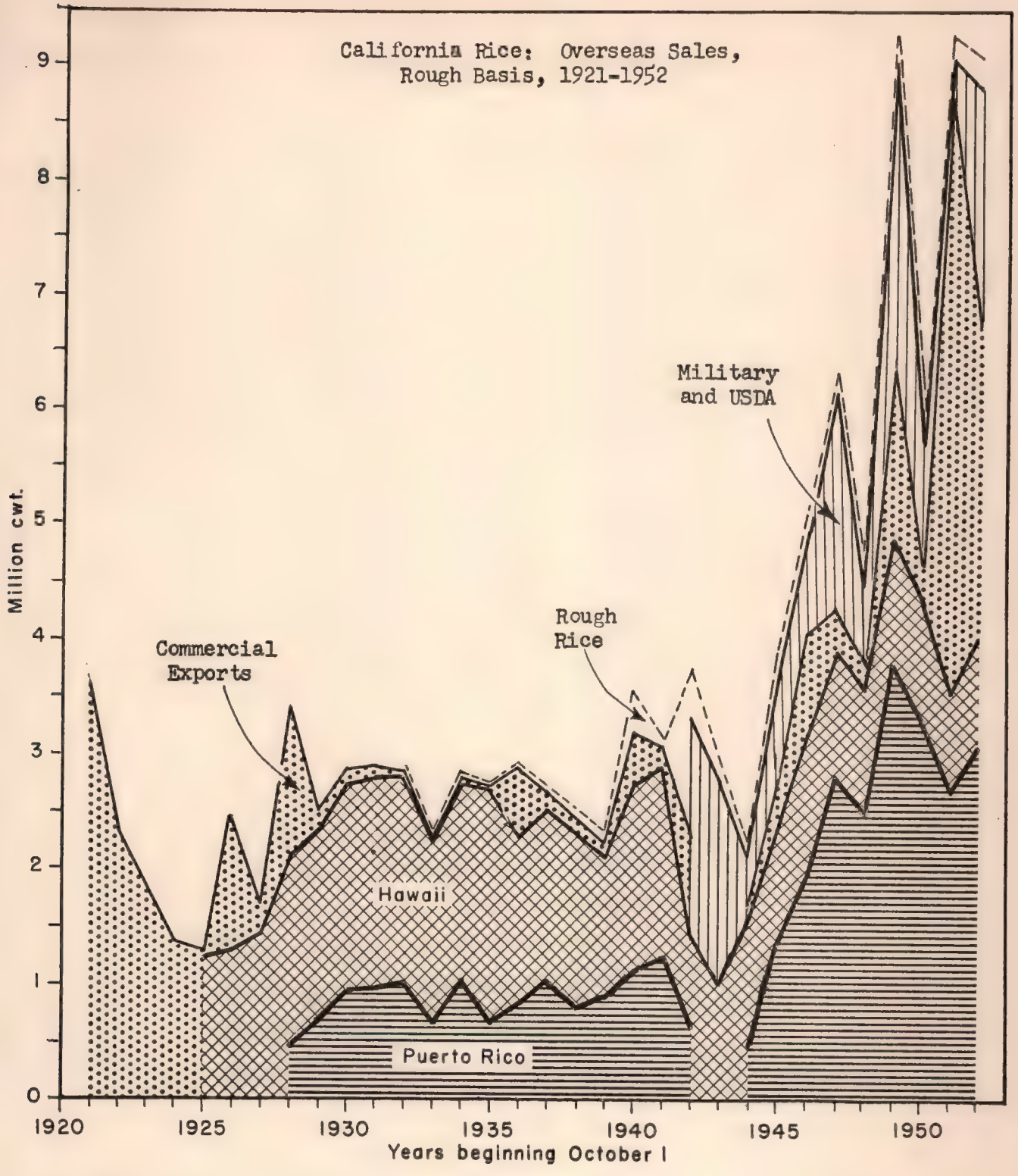
FIGURE 10



Source: Table 7.

TABLE 8

United States Rice: Shipments to Puerto Rico and Hawaii by Areas of Origin, Milled Basis, 1921-1953

Year beginning July 1	Puerto Rico			Hawaii		
	Total United States	From California	From South	Total United States	From California	Apparent shipment from South
	1,000 hundredweight					
1921	1,591	a/		392		
1922	1,745			543		
1923	1,905			608		
1924	1,694			558		
1925	1,697			526		
1926	1,744			674	674	--b/
1927	1,838			701	701	--
1928	2,012			787	787	--
1929	2,020	338	1,682	839	807	32
1930	2,122	470	1,652	886	886	--
1931	1,987	448	1,539	892	892	--
1932	2,444	550	1,894	915	915	--
1933	2,022	457	1,565	871	871	--
1934	2,273	527	1,746	826	826	--
1935	2,163	399	1,764	836	836	--
1936	2,256	380	1,765	669	669	--
1937c/	2,347	542	1,805	729	729	--
1938c/	2,290	431	1,859	820	781	39
1939c/	2,461	434	2,027	843	730	113
1940c/	2,551	465	2,086	831	676	155
1941c/	2,155			862		
1942						
1943						
1944						
1945						
1946	1,130			710	591	119
1947	2,661	1,622	1,039	587	587	--
1948	2,801	1,316	1,485	510	510	--
1949	3,196	1,955	1,241	627	627	--
1950	2,981	1,966	1,015	665	665	--
1951	2,826	2,013	813	597	597	--
1952	3,108	2,049	1,059	629	629	--
1953	1,211d/	738d/	473d/	330e/	330e/	--

(Continued on next page.)

TABLE 8

United States Rice: Shipments to Puerto Rico and Hawaii, by Areas of Origin, Milled Basis, 1921-1955

Year						
1921						
1922						
1923						
1924						
1925						
1926						
1927						
1928						
1929						
1930						
1931						
1932						
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1949						
1950						
1951						
1952						
1953						
1954						
1955						

1/ Included in total figure.

Table 8 continued.

a/ Blanks indicate data not available.

b/ Dashes indicate zero.

c/ For the years 1937-1941, total United States shipments to Puerto Rico and Hawaii are based on calendar year since these totals are not available on fiscal year base.

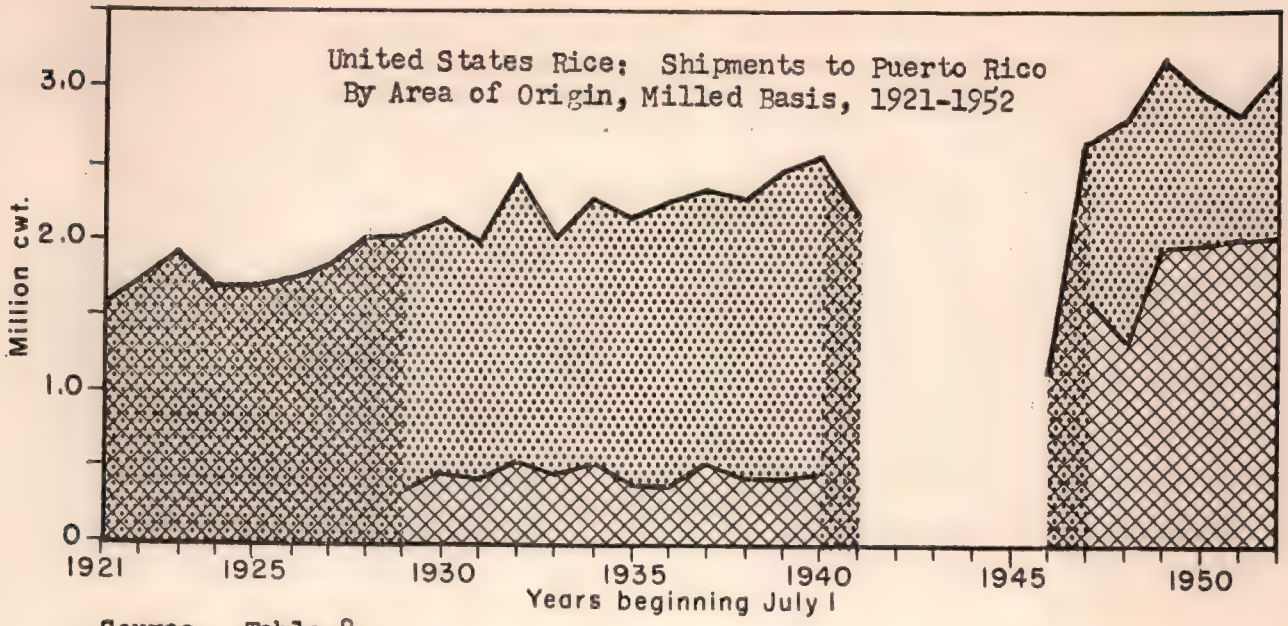
d/ August 1, 1953-January 21, 1954.

e/ July, 1953-January, 1954.

Source: For Puerto Rican and Hawaiian totals, 1921-1941: U.S. Department of Commerce. Foreign Commerce and Navigation of United States. 1946-1952: U.S. Bureau of the Census. United States Trade in Merchandise and Gold and Silver, with United States Territories and Possessions. Monthly reports FT800. California shipments to Puerto Rico and Hawaii were compiled from: U.S. Production and Marketing Administration. Annual Market Summary of California Rice.

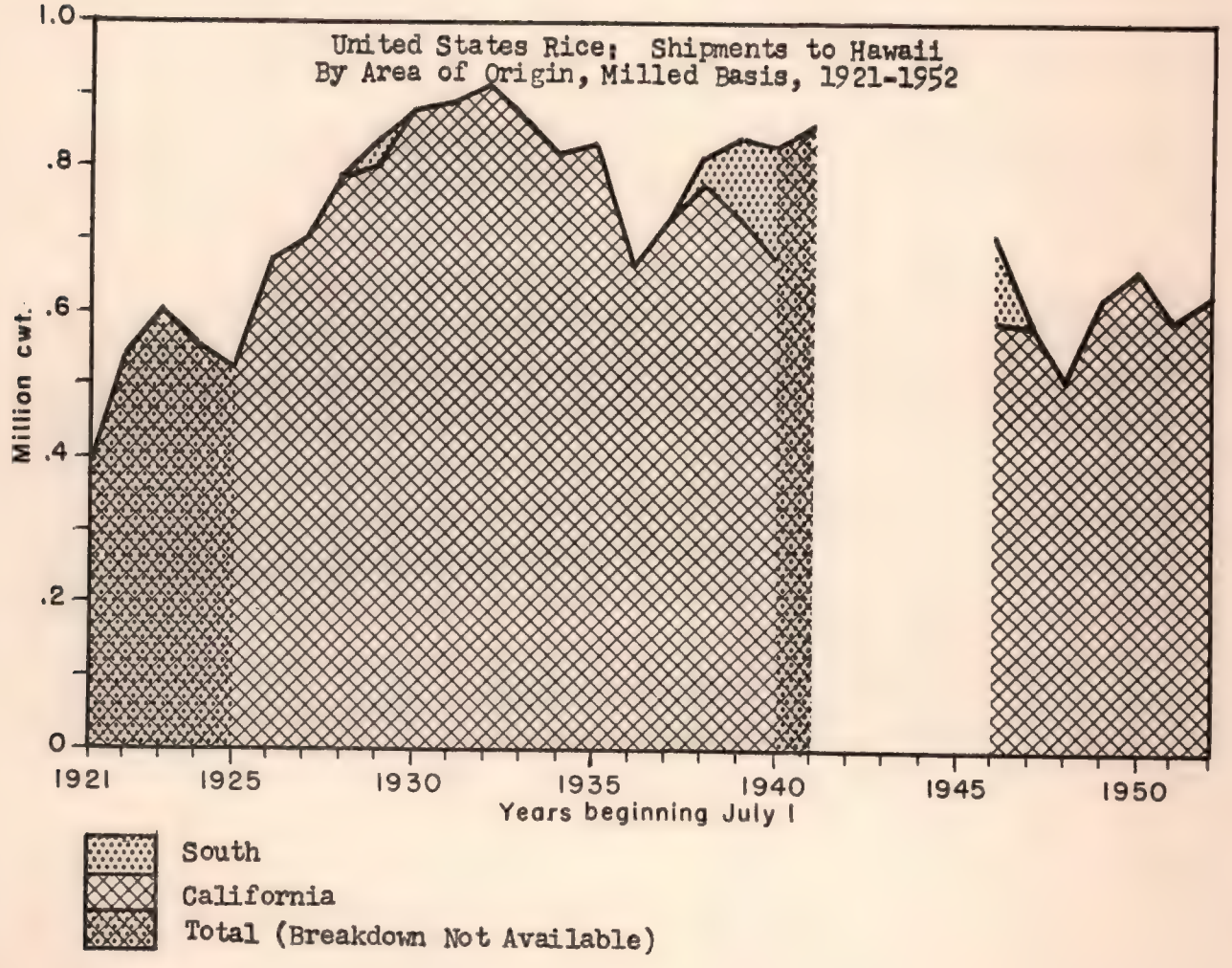
The difference between the total United States shipments to the two territories and California shipments represents apparent territorial sales from the South.

FIGURE 11



Source: Table 8.

FIGURE 12



Source: Table 8.

TABLE 9

United States Rice: Exports by Areas of Origin, Milled Basis, 1921-1953

Year beginning July 1	United States exports[a]	California exports[b]	Southern exports (apparent)[c]
	1,000 hundredweight		
1921	5,415	1,451	3,964
1922	3,707	646	3,061
1923	2,278	694	1,584
1924	1,129	52	1,068
1925	452	16	436
1926	3,043	711	2,332
1927	3,098	87	3,011
1928	3,927	297	3,630
1929	2,895	175	2,720
1930	2,810	202	2,608
1931	2,747	68	2,679
1932	1,777	44	1,733
1933	1,008	7	1,001
1934	1,229	28	1,201
1935	847	10	837
1936	520	18	502
1937	3,109	307	2,802
1938	3,439	69	3,370
1939	3,049	68	2,981
1940[d]	3,940	220	3,720
1941	4,600	105	4,495
1942	4,380	1,148	3,232
1943	5,030	983	4,147
1944	8,420	324	8,096
1945	8,393	716	7,677
1946	8,365	1,394	6,971
1947	8,677	1,297	7,380
1948	9,084	424	8,660
1949	10,140	1,863	8,277
1950	9,790	763	9,027
1951	17,038	4,040	12,998
1952[e]	17,391	2,975	14,416
1953	6,702[f]	606[f]	6,096

a/ Include U.S. Department of Agriculture military and nonmilitary relief shipments since 1944. See Table 2.

b/ Include rice and grain, milled and paddy, through December, 1932. Exclude paddy beginning January 1, 1933. Include U.S. Department of Agriculture military and nonmilitary relief shipments.

c/ Southern apparent export is the difference between total United States and California exports.

d/ From 1940-1945, California exports available only on October 1 year base--otherwise, years begin July 1.

e/ United States exports based on August 1 year.

f/ July-November includes relief shipments if any.

Source: Compiled from Annual Marketing Summary of California Rice, U.S. Production and Marketing Administration.

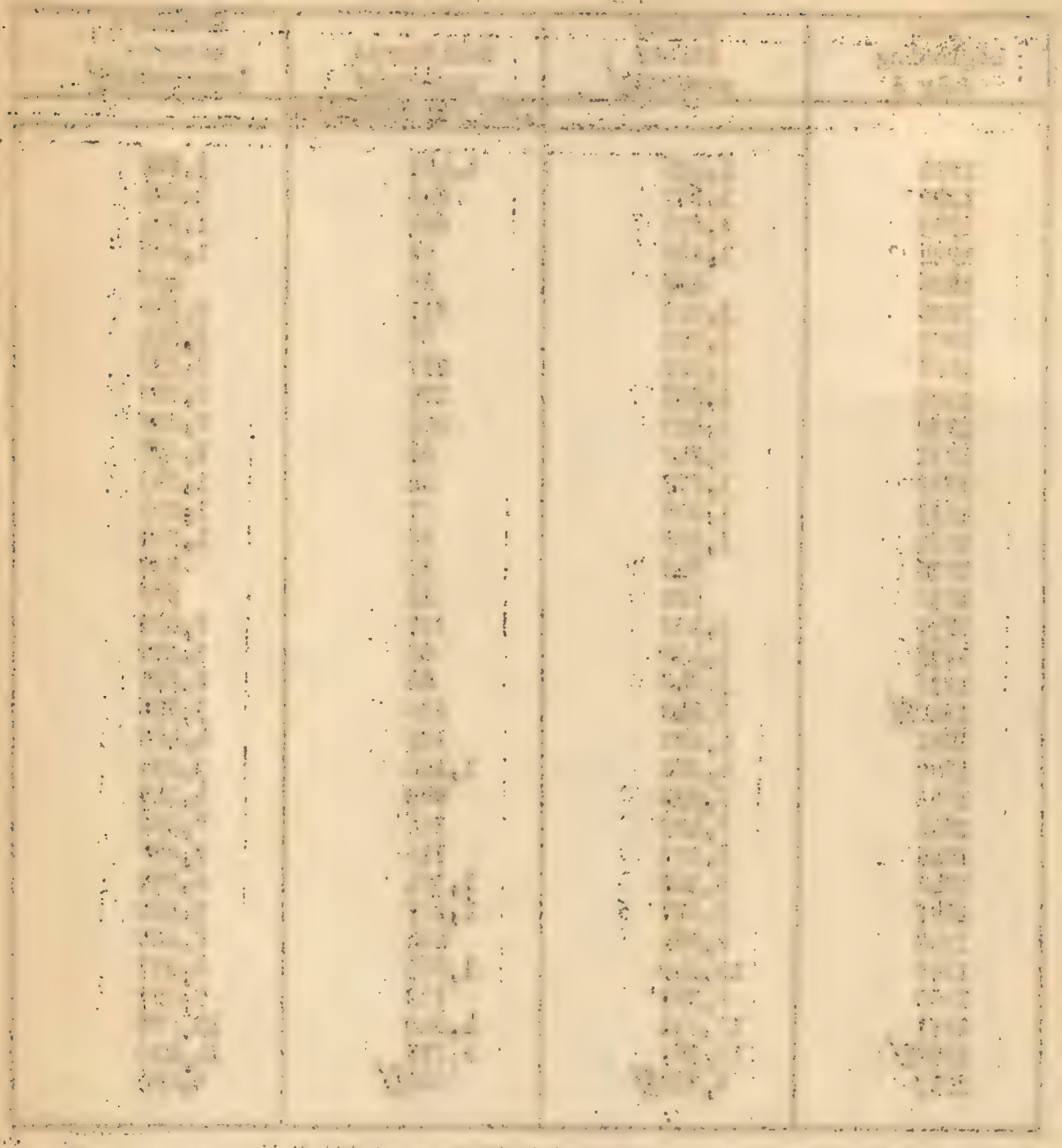
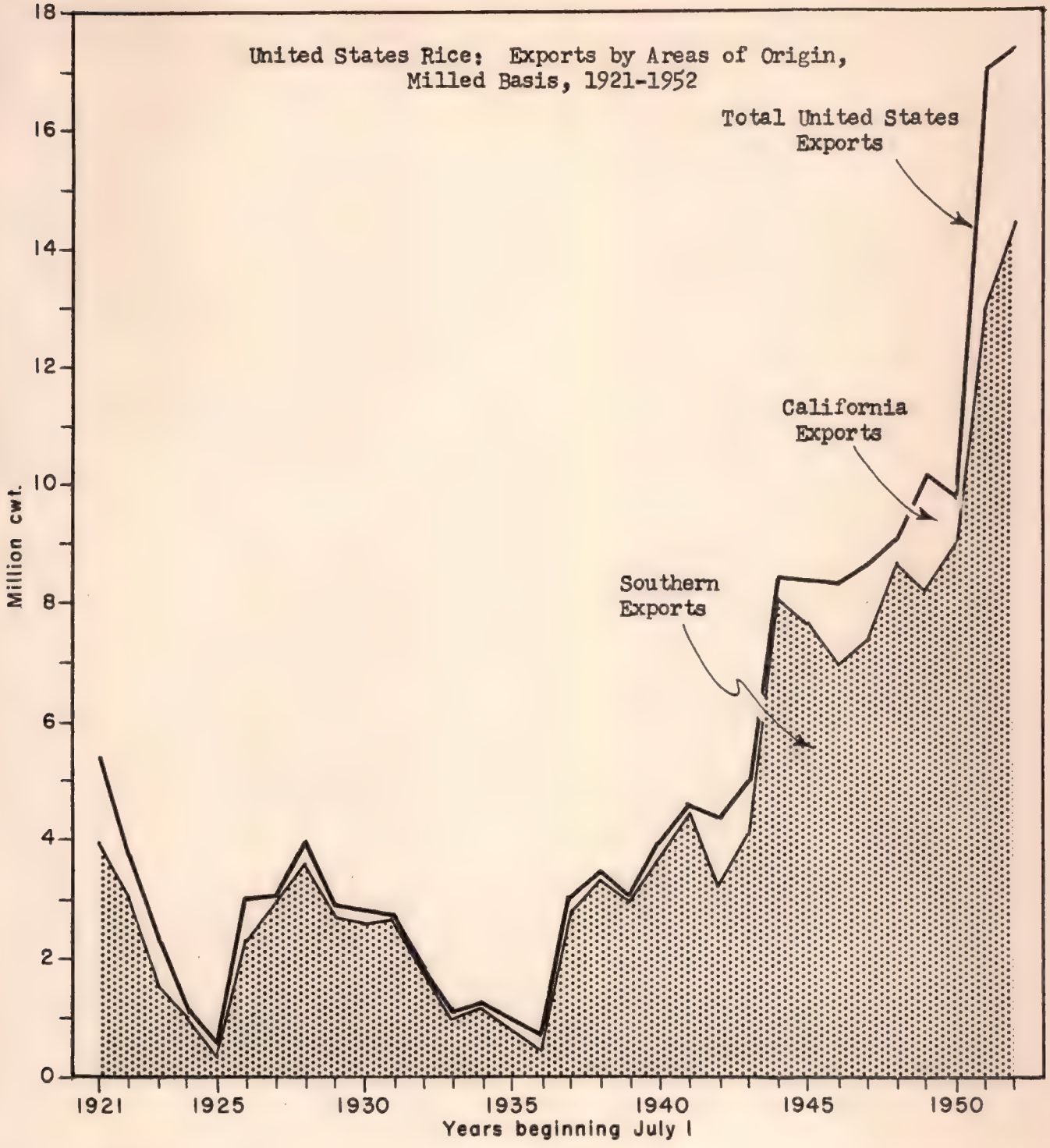


FIGURE 13



Source: Table 9.

TABLE 10

California Rice: Exports by Destination, Milled Basis, 1921-1953

Year beginning October 1	Total exports	Latin America (Cuba)	Europe (other)	Asia (Far East)[a]	Relief, CCC, and military[b]
	1,000 hundredweight				
1921	1,606	[c]			
1922	659				
1923	255				
1924	42				
1925	25				
1926	710				
1927	141				
1928	798				
1929	94				
1930	86				
1931	79				
1932	23				
1933	11				
1934	30				
1935	7	--[d]	7	--	--
1936	260	216	44	--	--
1937	83	48	35	--	--
1938	69	54	13	2	--
1939	51	21	25	5	--
1940	220				
1941	105				
1942	1,148				
1943	983				
1944	324	77	--	--	247
1945	716	188	--	--	528
1946	1,035	465	--	--	570
1947	1,305	214	--	--	1,091
1948	517	100	--	--	416
1949	2,381	290	110	440	1,541
1950	832	100	100	--	632
1951	3,635	133	--	3,284	218
1952	3,224	59	--	1,771	1,394
1953[e]	2,537			2,537[e]	

[a] Primarily to Japan.

[b] Primarily to Far East: Japan, Korea, and Ryukyus.

[c] Blanks indicate data not available.

[d] Dashes indicate zero.

[e] October, 1953-January, 1954, primarily to Japan.

Source: U.S. Production and Marketing Administration. Annual Market Summary of California Rice, 1935-1952.

1/ Primarily to Japan.

b/ Primarily to Far East: Japan, Korea, and Syngman.

c/ Trade included data not available.

d/ Below 500 metric tons.

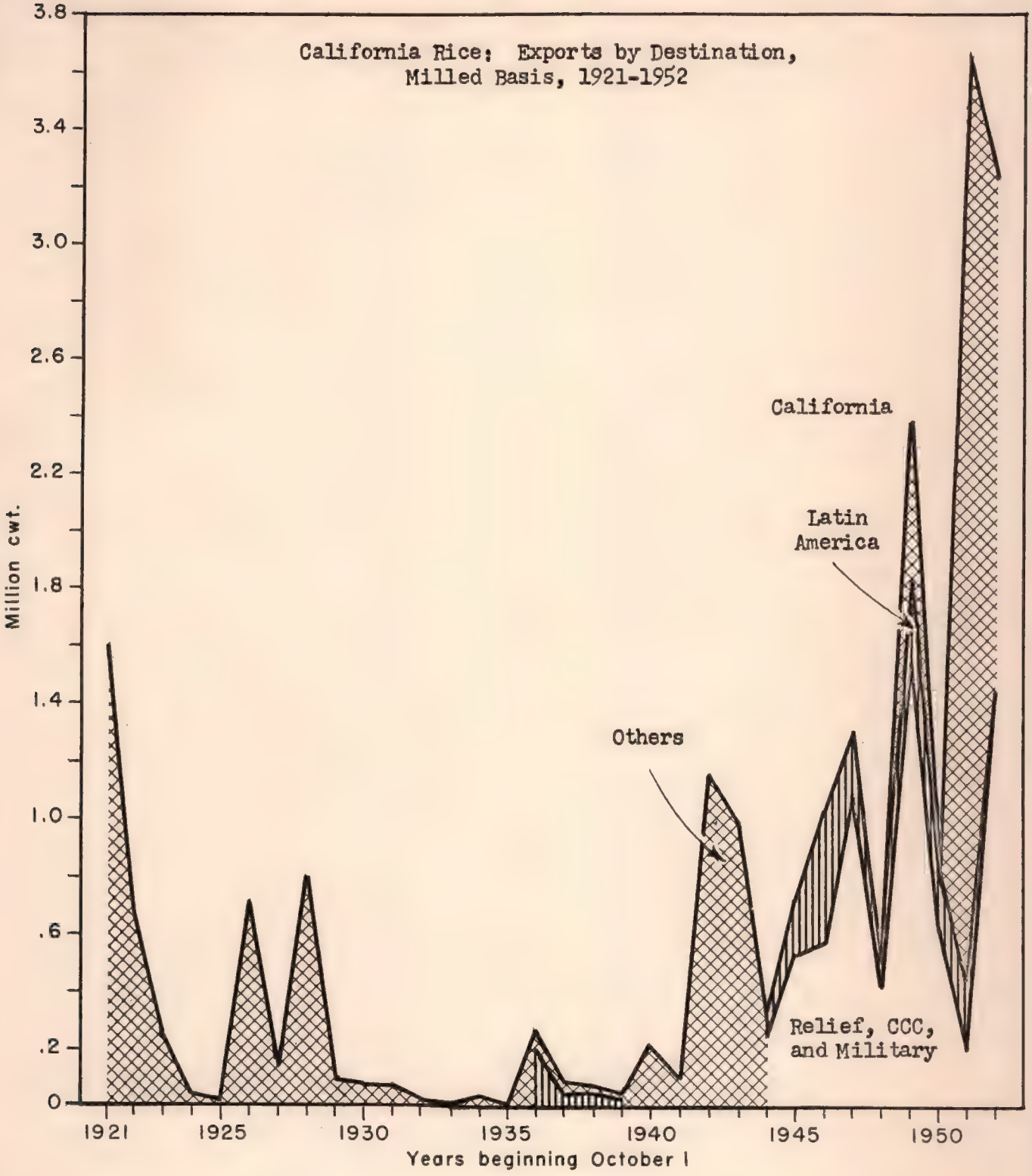
e/ Below 500 metric tons. Data primarily to Japan.

f/ Below 500 metric tons.

g/ Primarily to Japan.

of California Tech. 1946-1948.

FIGURE 14



Source: Table 10.

TABLE 11

California and Southern Rice: Percentage of Supplies Utilized in Major Outlets, 1935-1952[a]

Year	Total supply[b]		Domestic market		Territorial shipments		Exports, including relief	
	California	South	California	South	California	South	California	South
	1,000 hundredweight		per cent					
1935	3,501	15,080	13.5	62.2	63.0	17.3	1.3	7.7
1936	4,729	18,962	13.2	58.1	48.2	16.2	13.3	5.2
1937	4,392	22,169	11.7	51.9	57.5	14.6	4.5	20.5
1938	4,469	21,516	14.1	49.5	52.0	12.4	5.5	22.8
1939	5,006	22,913	29.2	48.5	42.8	14.7	5.2	19.9
1940	5,240	23,307	12.1	48.9	52.0	13.3	16.0	23.4
1941	4,597	21,203	21.4	50.3	62.7	10.0	5.2	30.7
1942	5,758	23,612	15.1	51.3	25.2	11.5	39.8	21.1
1943	7,399	24,333	39.7	28.4	13.8	17.5	25.5	26.5
1944	7,845	25,694	63.4	47.6	19.9	12.6	8.8	26.6
1945	6,439	25,166	30.7	42.9	37.6	9.5	22.6	38.9
1946	8,099	25,112	30.8	37.3	39.0	6.8	23.9	45.4
1947	8,082	27,436	15.1	44.5	48.3	6.2	30.0	39.1
1948	6,914	31,755	17.2	37.8	51.9	7.3	14.9	45.1
1949	11,062	31,521	9.7	37.8	44.0	6.2	39.6	43.5
1950	8,447	32,401	18.0	41.3	51.2	4.5	19.4	39.7
1951	11,070	38,052	10.4	33.7	32.2	4.1	51.3	33.4
1952	11,766	38,114	12.8	32.7	33.9	4.7	42.8	56.8

a/ For California crop year, October 1.

b/ Rough basis. California and southern total supplies do not necessarily add up to the total United States supplies as indicated in Table 1 because of the absence of imports.

California total supply based on annual reports of U.S. Production and Marketing Administration, Annual Market Summary of California Rice--for the South, U.S. Production and Marketing Administration, Annual Market Summary of Southern Rice.

These data are assembled in Table 11. The percentage of California production sold in domestic channels has varied from one tenth to about one fifth. The percentage of annual production of the southern states sold in domestic outlets has fallen from about 60 per cent in 1935 to about one third in recent years. The percentage of California production sold in territorial channels has decreased from about three fifths of annual output to about one third. For the south, territorial shipments have dropped from about one eighth of southern output to about 5 per cent in recent years. Since the end of the war, the percentage of California production exported has ranged from 15-50 per cent. Over the same years, from one third to one half of the larger southern production has been sold in foreign channels.

Allocation of crops among the three major outlets probably depends on several major determinants: size of total crop, relative sizes of output in different areas, grade and type constituency of the total supply, shifts in demand in the domestic and territorial markets, changes in world prices, and changes in the margins for processing and handling. All evidence indicates that with occasional exceptions the allocation of crop among the alternative outlets is effectuated by equalization of on-farm prices among the several outlets. Thus, annual differences in the percentages of total supply from the various areas going to any one of the outlets would be expected. The crucial fact is the increasing percentage of increasing outputs going into export from all the producing regions of the nation. Offshore markets now absorb the bulk of output from all areas. Loss of those outlets would almost certainly result in disastrous price decreases and painful shrinkage of productive capacity.

Price and Output Data.--United States average annual farm prices peaked sharply from the 1915 low to the 1919 peak, broke drastically in 1920-21, recovered until 1925, sagged to the depression low of 1932, remained fairly stable from 1933 until 1941, spiraled to the peak of 1947, broke in 1948 and 1949, and recovered with the outbreak of the Korean War. These general variations in average farm price have been fairly closely related to variations in national income. Fluctuations in California and United States average annual on-farm prices, per hundredweight, rough basis, are indicated in Table 12 and Figure 15. Sales data are assembled in Table 12 and charted in Figure 15. There has been a 40-year uptrend, but the rate of increase was sharply accelerated in 1935. Since 1941, variation in sales and farm prices have been positively and highly correlated. In recent years, the dominance of Louisiana in production has been overcome.

Variation in acreages of long, medium, and short-grain rice harvested in the major rice states and in the United States is indicated in Table 13. United States harvested acreage of medium-grain types exceeded harvested acreage of long-grain types until 1946. Except for 1948, harvested acreage in long-grain types has exceeded acreage in other types. The uptrend in long-grain types has been sharp and continuous for two decades. Acreage in medium-grain rice has varied widely from year to year but little long-run trend is apparent. There was a minor uptrend until 1942 and a slight downtrend thereafter. For the country as a whole, short-grain rice is relatively unimportant, although it has increased steadily over the past quarter century. California dominates in production of these varieties. Medium- and long-grain rice has not been planted in significant volume in California in the past two decades. There has been little short-grain rice acreage in Texas or Louisiana with a slight peak in Arkansas about 1947. In Texas, medium-grain rice acreage has declined since 1941, offset by increases in long-grain varieties since 1934.

TABLE 12

United States Rice: Annual Average On-Farm Prices and Annual On-Farm Sales, United States and Four Major States, Rough Basis, 1912-1953

Year[a]	Season average prices received by farmers					Quantities sold				
	United States	California	Texas	Louisiana	Arkansas	United States	California	Texas	Louisiana	Arkansas
1	2	3	4	5	6	7	8	9	10	11
	dollars per hundredweight					1,000 hundredweight[b]				
1912	1.98	1.98	2.02	1.96	1.98	9,546	18	3,399	4,375	1,614
1913	1.98	2.09	2.00	1.93	2.04	9,868	141	3,384	4,427	1,834
1914	1.98	2.24	2.00	1.98	1.91	9,455	363	2,785	4,525	1,623
1915	1.86	2.13	1.89	1.80	1.89	10,519	754	2,694	5,094	1,886
1916	2.19	2.76	2.16	2.11	2.20	16,423	1,470	4,011	8,230	2,623
1917	4.27	4.51	4.29	4.20	4.20	14,068	2,207	2,570	6,334	2,870
1918	3.99	4.96	3.91	3.84	3.51	16,428	2,887	3,184	7,279	2,974
1919	5.45	5.62	5.58	5.53	4.93	17,532	3,957	2,757	7,576	3,161
1920	2.48	2.51	2.47	2.51	2.38	21,818	3,528	4,110	10,421	3,759
1921	2.18	2.47	2.18	2.13	2.00	16,201	3,083	2,481	7,503	3,134
1922	2.19	2.56	2.22	2.11	1.98	17,476	3,316	2,898	7,952	3,310
1923	2.49	2.89	2.49	2.42	2.29	13,735	2,425	2,548	6,458	2,304
1924	2.99	3.56	2.98	2.93	2.78	13,459	1,820	2,546	6,108	2,968
1925	3.30	3.42	3.36	3.31	3.16	13,458	1,950	2,613	5,634	3,138
1926	2.51	2.87	2.56	2.47	2.29	17,498	3,369	2,902	6,548	4,409
1927	2.02	2.09	1.98	2.04	1.91	18,675	3,846	3,402	8,184	3,221
1928	2.02	2.02	2.02	2.09	1.89	18,490	3,543	3,490	7,772	3,505
1929	2.22	2.24	2.31	2.22	2.11	16,439	2,417	2,961	7,722	3,339
1930	1.74	1.76	1.78	1.71	1.76	18,853	3,093	4,420	7,885	3,455
1931	1.08	0.89	1.20	1.16	0.98	18,826	3,555	4,578	6,535	4,158
1932	0.93	0.91	0.98	0.96	0.84	17,520	3,355	3,943	6,691	3,531
1933	1.73	1.58	1.80	1.73	1.78	15,714	2,956	3,142	6,582	3,034
1934	1.75	1.49	1.84	1.82	1.82	16,347	3,570	3,138	6,846	2,793
1935	1.60	1.49	1.60	1.58	1.82	16,349	3,134	3,696	7,015	2,504
1936	1.85	1.47	1.93	2.00	1.82	20,813	3,939	4,512	8,685	3,677
1937	1.46	1.29	1.58	1.53	1.33	22,503	3,888	5,605	8,511	4,499
1938	1.42	1.24	1.53	1.44	1.38	22,149	3,596	5,880	8,544	4,129
1939	1.62	1.31	1.73	1.64	1.67	22,793	3,879	6,535	8,797	3,582
1940	1.80	1.53	1.87	1.89	1.80	22,769	4,025	7,144	7,578	4,022

(Continued on next page.)

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TABLE 12

Annual Average On-Farm Prices and Annual On-Farm Sales,

Table 12 continued.

Year[a]	Season average prices received by farmers					Quantities sold				
	United States	California	Texas	Louisiana	Arkansas	United States	California	Texas	Louisiana	Arkansas
1	2	3	4	5	6	7	8	9	10	11
	dollars per hundredweight					1,000 hundredweight[b]				
1941	3.01	3.20	3.24	2.96	2.73	21,158	3,481	4,829	8,291	4,557
1942	3.61	3.49	3.78	3.60	3.56	27,059	5,345	6,764	9,588	5,362
1943	3.96	3.64	4.29	4.02	3.80	27,242	6,203	7,121	8,861	5,057
1944	3.93	3.67	4.13	3.98	3.87	29,834	6,489	7,703	9,049	6,593
1945	3.98	3.64	4.24	4.07	3.84	29,513	5,979	7,960	9,840	5,734
1946	5.00	4.80	5.02	5.13	5.04	31,273	7,636	7,670	9,788	6,179
1947	5.97	6.13	6.24	5.73	5.78	33,961	7,752	9,303	9,534	7,372
1948	4.88	4.40	5.38	4.87	4.64	36,979	6,499	10,784	10,761	8,935
1949	4.10	3.42	4.51	4.37	4.07	39,621	9,960	10,442	10,408	8,665
1950	5.09	4.54	5.46	5.07	5.13	37,436	7,925	11,275	10,545	7,506
1951	4.82	4.95	4.86	4.55	4.98	44,418	10,314	13,205	11,594	8,673
1952	6.05	5.95	6.20	6.10	5.90	47,290	11,469	13,369	12,337	9,100
1953[c]	5.34	4.90[d]	[e]							

a/ Year beginning August 1 for the southern states and October 1 for California.

b/ Figures rounded up to the second decimal.

c/ Preliminary. United States price estimated by U. S. Department of Agriculture for December 15, 1953. California price estimates as of January 5, 1954, bulk, country warehouse receipt basis, No. 1 California Pearl. Particularly good milling quality, $5.05-$5.15. California Pearl, rough, yielding 48 pounds milled head and 70 pounds total milled, $5.00, bulk, country warehouse receipt basis, with differentials 1/2-1 cent per hundredweight for each pound variation in milled head yields and 6 cents for total milled rice yields. Sacked differential 10-15 cents. No. 1 Calrose 15 cents above No. 1 California Pearl.

d/ $4.90-$5.175.

e/ Blanks indicate data not available.

Source: U.S. Bureau of Agricultural Economics, Crop Reporting Board, 1912-1950 and 1951-52.

FIGURE 15

Source: Table 12.

TABLE 13

United States Rice: Acreage Harvested, by Types of Rice, United States and Four Major States, 1931-1953

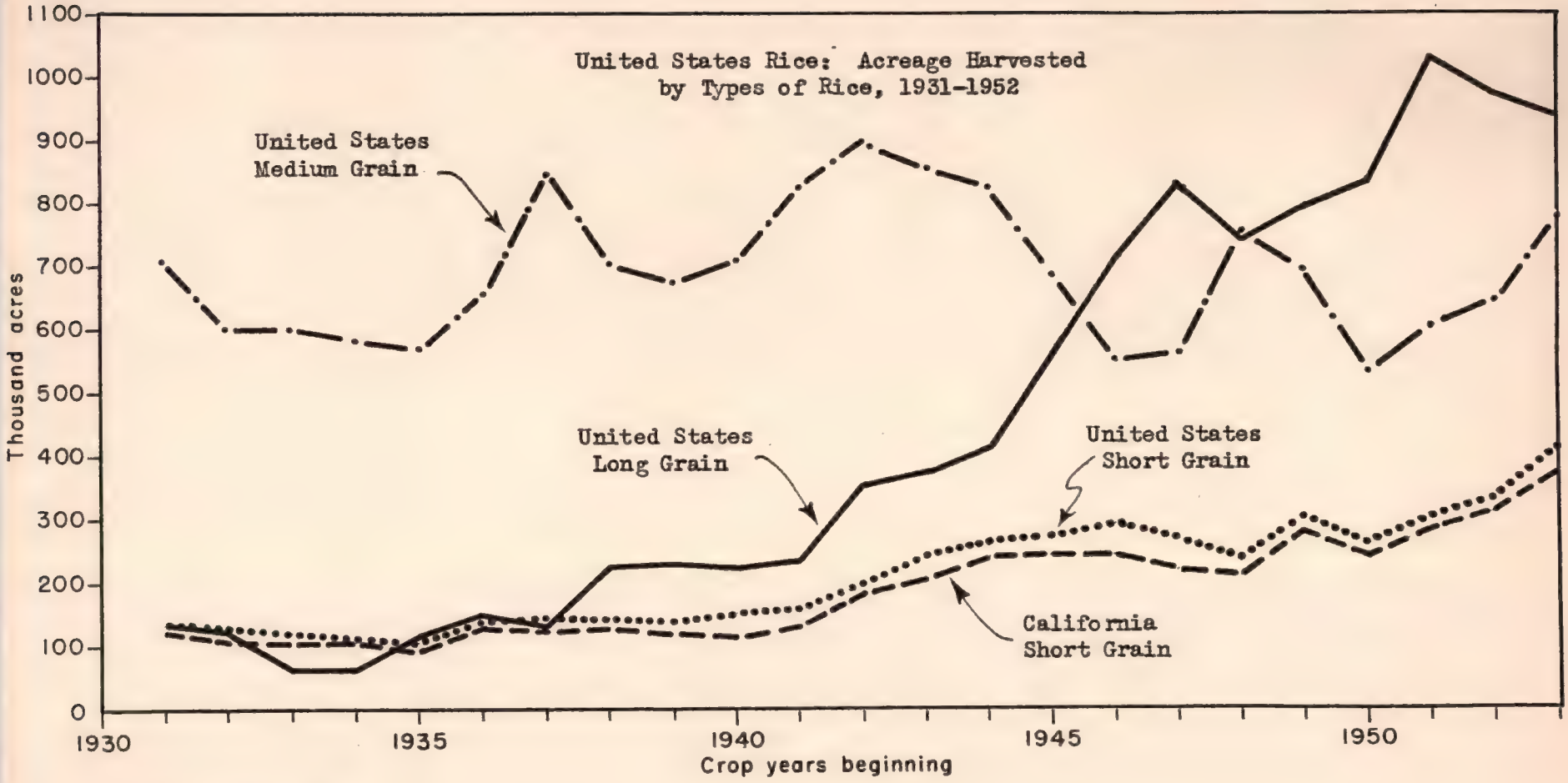
Year	United States[a]			California			Texas			Louisiana			Arkansas		
	Long	Medium	Short	Long	Medium	Short	Long	Medium	Short	Long	Medium	Short	Long	Medium	Short
	1,000 acres														
1931	135	709	137	1	1	123	64	130	9	56	412	--[b]	15	167	5
1932	123	603	130	1	--	110	54	112	17	55	348	--	14	142	2
1933	67	601	120	3	--	103	34	98	14	25	364	--	4	140	3
1934	66	584	116	1	--	106	30	109	7	28	351	--	10	125	3
1935	117	572	106	4	--	94	51	113	8	52	335	--	9	125	4
1936	150	657	140	2	8	130	67	123	7	76	379	--	7	145	3
1937	134	841	144	3	15	129	64	180	8	63	479	3	5	167	4
1938	223	704	145	2	5	130	123	125	7	81	406	2	17	168	6
1939	229	677	140	--	1	120	126	125	8	87	392	3	17	159	8
1940[c]	224	711	151	[d]	2	118	125	144	11	79	406	7	22	159	14
1941	235	827	157	3	2	135	135	190	9	74	451	2	24	182	12
1942	352	898	200	5	16	184	197	180	6	114	490	1	36	212	9
1943	376	858	243	--	13	209	219	158	8	141	464	--	35	222	8
1944	414	829	262	5	10	242	206	171	8	159	409		44	239	11
1945	563	685	278	3	5	247	261	128	10	230	359	--	70	192	21
1946	741	556	291	5	4	246	316	88	11	295	294	2	124	169	32
1947	833	561	276	1	5	226	403	70	9	297	312	2	132	174	39
1948	749	752	241	2	6	215	406	116	1	225	412	--	116	218	26
1949	798	694	305	--	11	281	448	75	--	213	393	--	135	212	24
1950	831	534	264	--	4	247	429	47		254	293	1	154	184	10
1951	1,034	608	303	--	25	287	520	41	--	322	297	1	179	230	13
1952	997	649	335	--	16	316	505	46	--	263	318	1	201	234	17
1953[c]	947	775	416	--	18	376	522	51	--	201	402	1	183	265	37

[a] United States total includes, also, acreage harvested in minor states like Mississippi.
[b] Dashes indicate zero.
[c] Acreage planted
[d] Blanks indicate data not available.

Source: Compiled from the annual reports of the Rice Millers Association. Rice Acreage, 1932-1952. No data available prior to 1931 by states and types of rice grown.

| | | |

FIGURE 16



Source: Table 12.

There has been a similar decline in medium-grain plantings in Louisiana but a lesser increase in long-grain acreage than in Texas. Both long- and medium-grain acreages have increased steadily in Arkansas. As in Louisiana, medium-grain acreage still exceeds the long-grain acreage. California leads in short-grain production but is a negligible source for other types. Changes in total acreage harvested among the various states have been quite similar. In the main, states have ranked much as now in acreage: Louisiana, Texas, Arkansas, and California. In all of the states acreage diminished until 1933. The rate of increase since then has been sharper in Texas and California than in Louisiana.

Yields per acre have been significantly higher in California than in other states, second highest in Texas and Arkansas, and lowest in Louisiana. Annual production, harvested acreage, and yields for the United States and the four major states are shown in Table 14. Average yield per acre in California diminished over 1913-1925 from about 2,800 to 2,100 pounds, increased to more than 3,400 pounds in 1934, dropped to 3,100 pounds in 1938, and rose to the all-time high of 1940. From 1940 to 1941 yields in California fell from 3,600 pounds to less than 2,500 pounds.7/ A similar decrease in yields occurred in Texas. Since 1941, there has been an upward trend in California yields at about the same arithmetic rate as in 1925-1940. Yield data are charted in Figure 17.

Thus, both acreage and yields have varied widely in California. Production of rice is consequently elastic to a variety of determinants. However, once new producers are tooled up, sharp and prolonged decreases in returns may be required to induce withdrawal from production. In many crops, short-run response of output to relative price increases is greater than short-run response to a relative price decrease of the same magnitude.

Production had reached more than 4,000,000 bags, rough basis, in California in 1919, fell to less than 2,000,000 in 1924, and oscillated about 4,000,000 until 1942 when the upswing to nearly 12,000,000 sacks began. Texas production at almost 15,000,000 sacks, rough basis, has nearly tripled since 1941. Louisiana, with 12,500,000 sacks, rough basis, produces about twice as much as in 1925 but little more than in 1920. Changes in volume of production in Arkansas have been similar to the increases in California. Volume of production by states is charted in Figure 18. Productive capacity in all of the states appears to be elastic to price prospects, but California and Texas seem to be able most readily to expand output.

Factors Affecting United States Farm Prices

Regional Price Relationships.--Average annual on-farm prices in California and in the United States are shown in Table 15. Annual average farm prices for other states were shown in Table 12. United States annual average farm prices, per hundredweight, rough basis, and those for California were so closely

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7/ The fall in yields in 1941 was apparently due mainly to weather. The increase in yields up to 1940 is attributed by the trade to new lands and improved technology. Expanded use of fertilizer is considered strategic in obtaining increased yields in the last decade.

TABLE 14

United States Rice: Acreage Harvested, Production, and Yields Per Acre, United States and Four Major States, Rough Basis, 1912-1953

Year	United States			California			Texas			Louisiana			Arkansas		
	Acreage harvested[a]	Production[b]	Yield per acre harvest[c]	Acreage harvested[d]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]
	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds
1912	723	10,665	1,561	1	26	2,250	265	5,663	1,582	352	5,032	1,429	90	1,781	1,979
1913	827	10,394	1,400	6	162	2,700	303	3,600	1,188	405	5,040	1,429	104	1,984	1,907
1914	694	10,565	1,534	15	405	2,700	259	3,015	1,261	336	5,184	1,543	92	1,779	1,933
1915	803	11,748	1,625	30	837	2,790	260	2,923	1,124	401	5,804	1,447	100	2,070	2,070
1916	869	17,795	2,115	59	1,593	2,700	235	4,245	1,806	443	9,004	2,032	125	2,841	2,272
1917	981	15,621	1,593	88	2,376	2,700	230	2,819	1,225	500	7,202	1,440	146	3,112	2,131
1918	1,119	17,999	1,553	120	3,105	2,588	245	3,416	1,394	580	8,136	1,402	170	3,213	1,890
1919	1,063	19,310	1,777	155	4,185	2,700	212	3,053	1,440	540	8,552	1,584	158	3,420	2,164
1920	1,339	23,242	1,755	162	3,718	2,295	281	4,299	1,530	700	11,256	1,608	175	3,969	2,268
1921	921	17,673	1,836	135	3,280	2,430	166	2,697	1,625	480	8,326	1,734	125	3,370	2,696
1922	1,055	18,748	1,764	140	3,465	2,475	191	3,071	1,607	555	8,691	1,566	154	3,521	2,286
1923	895	14,957	1,697	106	2,552	2,408	145	2,718	1,874	495	7,146	1,443	135	2,541	1,882
1924	850	14,689	1,764	90	1,964	2,183	146	2,718	2,012	440	6,773	1,557	164	3,212	1,921
1925	883	14,866	1,692	103	2,160	2,097	168	2,794	1,664	430	6,371	1,481	175	3,406	1,946
1926	1,034	18,911	1,829	149	3,594	2,412	166	3,080	1,855	501	7,306	1,458	199	4,657	2,340
1927	1,003	20,024	1,996	160	4,032	2,520	165	3,579	2,169	500	8,915	1,783	175	3,464	1,979
1928	956	19,725	2,063	132	3,677	2,786	165	3,652	2,240	487	8,487	1,742	164	3,729	2,274
1929	860	17,790	2,068	95	2,574	2,709	144	3,162	2,195	465	8,474	1,822	156	3,580	2,295
1930	966	20,218	2,095	110	3,272	2,974	192	4,631	2,412	491	8,617	1,755	173	3,698	2,137

(Continued on next page.)

Table 14 continued.

Year	United States			California			Texas			Louisiana			Arkansas		
	Acreage harvested[a]	Production[b]	Yield per acre harvest[c]	Acreage harvested[d]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]	Acreage harvested[e]	Production[b]	Yield per acre harvest[c]
	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds	1,000 acres	1,000 hundredweight	pounds
1931	965	20,076	2,080	125	3,712	2,970	205	4,769	2,326	458	7,214	1,575	177	4,381	2,475
1932	874	18,729	2,142	110	3,510	3,131	186	4,101	2,205	415	7,377	1,777	163	3,741	2,295
1933	798	16,943	2,123	108	3,110	2,880	148	3,304	2,232	395	7,288	1,845	147	3,241	2,204
1934	812	17,571	2,163	108	3,715	3,440	148	3,316	2,233	415	7,545	1,818	141	2,995	2,124
1935	817	17,755	2,172	100	3,330	3,330	167	3,908	2,340	412	7,783	1,889	138	2,732	1,979
1936	981	22,419	2,285	138	4,223	3,060	204	4,774	2,340	479	9,484	1,980	160	3,938	2,461
1937	1,099	24,040	2,187	132	4,099	3,105	261	5,872	2,250	517	9,306	1,800	189	4,763	2,520
1938	1,076	25,628	2,195	125	3,769	3,015	268	6,151	2,295	494	9,336	1,878	189	4,372	2,313
1939	1,045	24,328	2,327	120	4,050	3,375	269	6,827	2,538	485	9,603	1,980	171	3,848	2,250
1940	1,069	24,495	2,296	118	4,248	3,600	291	7,490	2,573	469	8,442	1,800	191	4,315	2,259
1941	1,214	23,095	1,902	153	3,787	2,475	305	5,215	1,710	544	9,180	1,688	212	4,913	2,317
1942	1,457	29,082	1,996	207	5,682	2,745	370	7,160	1,935	615	10,516	1,710	265	5,724	2,160
1943	1,472	29,264	1,988	224	6,552	2,925	388	7,508	1,935	603	9,769	1,621	257	5,435	2,115
1944	1,480	30,974	2,092	240	6,750	2,812	392	7,850	2,002	561	9,593	1,710	287	6,781	2,363
1945	1,499	30,668	2,046	235	6,262	2,665	400	8,100	2,025	583	10,363	1,778	281	5,943	2,115
1946	1,582	32,497	2,054	261	7,913	3,032	412	7,972	1,925	589	10,204	1,732	320	6,408	2,002
1947	1,708	35,217	2,061	256	8,035	3,139	474	9,599	2,025	613	9,951	1,620	365	7,652	2,096
1948	1,804	38,275	2,122	256	6,832	2,669	526	11,007	2,092	631	11,216	1,777	391	9,220	2,358
1949	1,860	40,737	2,190	305	10,218	3,350	542	10,704	1,975	593	10,822	1,825	412	8,858	2,150
1950	1,620	38,689	2,388	238	8,270	3,475	482	11,568	2,400	551	10,882	1,975	342	7,780	2,275
1951	1,946	45,797	2,353	314	10,676	3,400	564	13,514	2,200	596	11,934	1,900	445	9,011	2,025
1952[f]	1,972	48,660	2,468	330	11,880	3,600	552	13,662	2,475	588	12,642	2,150	453	9,420	2,075
1953[f]	2,157	52,628	2,439	412	12,772	3,100	580	14,790	2,550	606	12,423	2,050	490	11,270	2,300

(Continued on next page.)

Table 14 continued.

a/ United States acreage:
1912-1928: Based on U.S. Bureau of Agricultural Economics. Agricultural Yearbook.
1929-1940: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Rice, Revised Estimates 1929-1940.
1940-1948: The acreage harvested is the sum of the four rice-producing states.
1949-1953: Allowance is given to Mississippi acreage at 2,400 pounds yield per acre in addition to the four rice-producing states.
Prior to 1929 the United States total acreage is somehow greater than the sum of acreages of the four rice-producing states indicating limited production in other states, too.

b/ Annual production of rough rice (for California, October 1, and, for the rest, August 1 year) based on U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value, 1909-1950. For 1951-52, U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Principal Crops, p. 23.

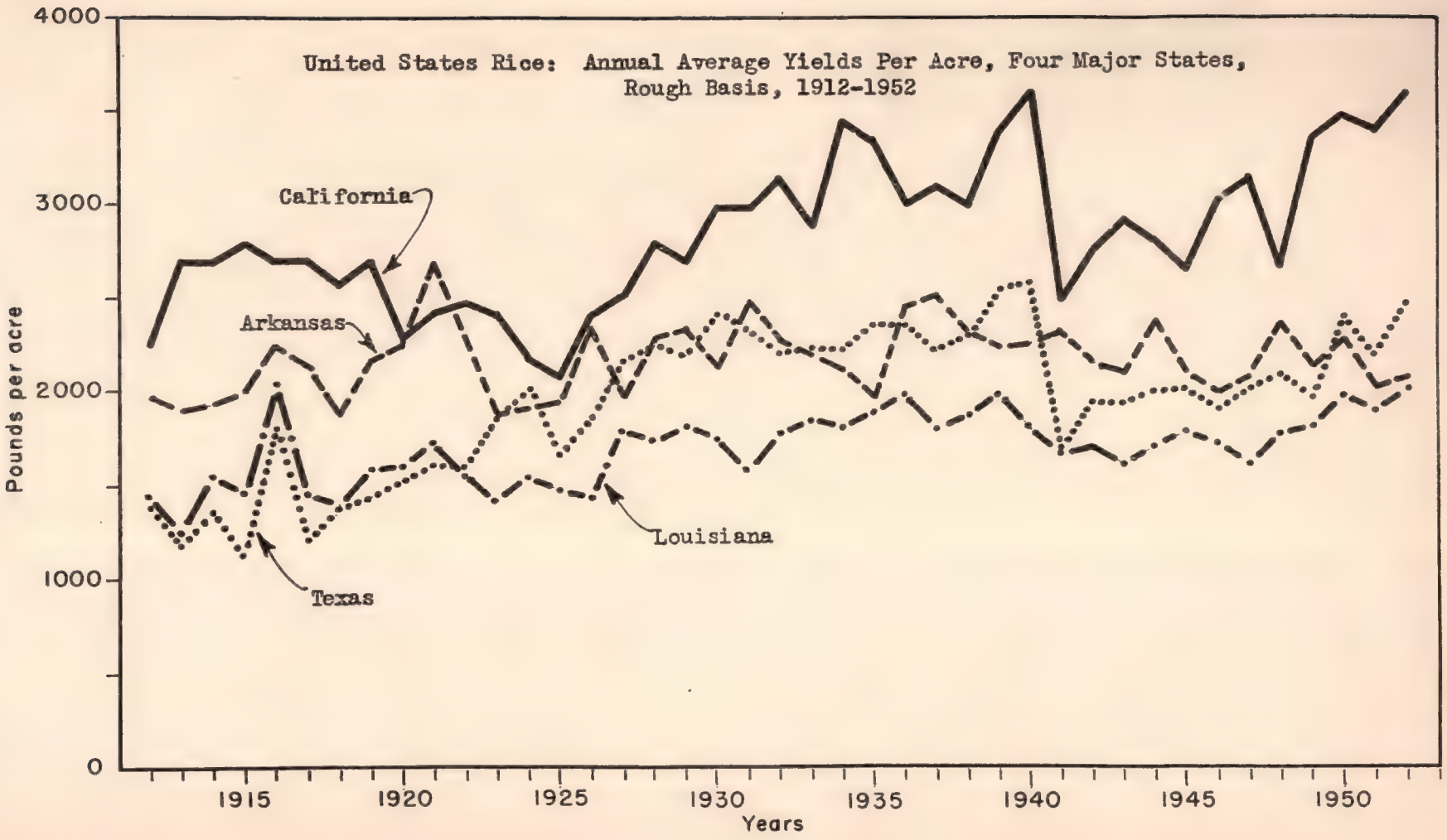
c/ Yield per acre is calculated by dividing annual production by the acreage.

d/ California acreage harvested is based on U.S. Production and Marketing Administration, San Francisco. Rice, 1952, annual review with reference to U.S. Bureau of Agricultural Economics. These figures also correspond to the harvested acreage which appeared from 1929 on in the four U.S. Bureau of Agricultural Economics publications which show the breakdown by counties and states.

e/ No distinction is made in the Agricultural Yearbook prior to 1924 between seeded and harvested acreage. From 1929 on, harvested acreage is taken from the following sources:
1929-1940: U.S. Bureau of Agricultural Economics. Rice, Revised Estimates.
1933-1942: U.S. Bureau of Agricultural Economics. Rice, Estimates of Acreage, Yield, and Production.
1939-1946: U.S. Bureau of Agricultural Economics. Rice, Estimates of Acreage, Yield, and Production.
1944-1950: U.S. Bureau of Agricultural Economics. County Estimates of Rice Acreage, Yield, and Production.
1951 : U.S. Bureau of Agricultural Economics. Agricultural Yearbook.

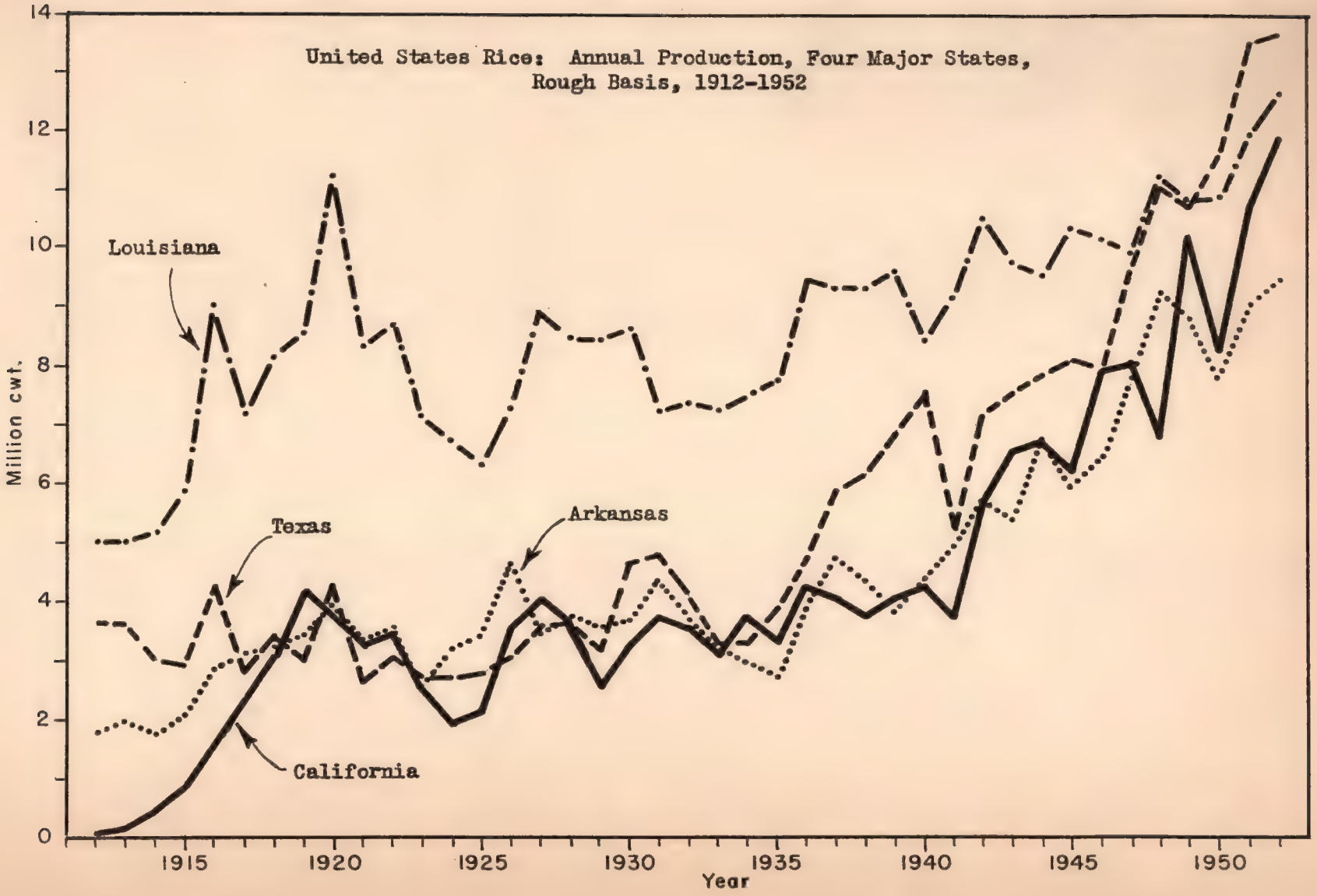
f/ Figures for 1952 and 1953 based on U.S. Bureau of Agricultural Economics, Crop Reporting Board. Crop Production, November 1, 1953, Estimates.

FIGURE 17



Source: Table 14.

FIGURE 18



Source: Table 14.

correlated that either could be used as representative of the other in measuring the impact upon price of changes in the several associated variables. For the years 1912-1930, the coefficient of correlation between California and United States prices was .975. However, during these years, California average annual price maintained on the average a premium over the United States average annual price. For the years 1931 through 1952, the correlation coefficient between United States and California price was .992. In these latter years, the California price bore on the average a discount with respect to the United States price.[8/] One set of prices could be substituted for the other with no significant differences in the analysis of the factors determining variations in price or in the net relationships of any one of the determinants to price. Thus, in most of this study, only the United States season average price is analyzed since its determinants appear to be nearly identical with those of California prices.

1912-1952 Relationships: United States.--Variation in United States and California farm prices for rice over the entire 40-year history of the industry was first analyzed. Annual farm sales varied over that period from about 9,500,000 sacks, rough basis, to nearly 50,000,000 sacks; income from less than 45 per cent to more than 400 per cent of the average prevailing in the base period 1935-1939; and prices from a depression low of 93 cents per hundredweight, rough basis, to more than $6.00.

There were high gross relationships between annual variations in farm price and farm sales, between farm price and United States income, and between

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8/ The regression of California farm price, X_3, for United States farm price, X_1, can be expressed as follows:

$$(1):\ 1912\text{-}1930:\ X_3 = .050411 + \underset{(18.260230)}{1.077893}\, X_1$$

$$(2):\ 1931\text{-}1952:\ X_3 = -.200369 + \underset{(34.970428)}{.997101}\, X_1$$

The numbers in parentheses are t-ratios. Equation (1) means that, on the average over the years 1912-1930, the California average on-farm price of rice, per hundredweight, rough basis, could be estimated by multiplying the United States annual average on-farm price, per hundredweight, rough basis, by 1.08 and adding 5 cents per hundredweight to the resultant product. Equation (2) means that, on the average over the years 1931-1952, the California price could be estimated by multiplying the associated United States price by .997 and subtracting 20 cents per hundredweight from the resultant product. The correlation coefficients indicate that nearly all of the variation in California price can be explained by associated variation in the United States price. Predictions of California price from given United States prices by the equations noted above would have been highly accurate. Finally, factors which explain the variation in United States price would also explain and almost identically the patterns of variations in California price.

correlated that either could be used as representative of the other in measuring the impact upon prices of changes in the several generated variables. For the years 1910-1930, the coefficients of correlation between California and [illegible] were rather low, .773. However, during these years, California average annual price maintained on the average a premium over the United States average annual price. For the years 1931 through 1939, the correlation coefficient between United States and California price was .992. In these latter years, California prices bore on the average a discount with respect to the United States price.[1/] One set of prices could be substituted for the other with no significant difference in the results of the [illegible] regressions [illegible] in price or in the net relationships of any one of the determinants to price. Thus, in most of this study, only the United States season average price is employed since the determinants appear to be nearly identical with those of California's prices.

1910-1930 Relationships: United States.--Correlation in United States and California farm prices for rice over the entire 21-year history of the industry was fairly close. Like all [illegible] [illegible] [illegible]

TABLE 15

California and United States Rice: Factors Affecting Prices, Supply, and Distribution, Rough Basis, 1912-1952

Year[a]	X_1 United States season average on-farm price	X_2 United States annual farm sales	X_3 California average on-farm price	X_4 California seasonal farm sales	X_5 United States minus California sales	X_6 Index of United States nonagricultural income, 1935-1939=100[b]
1	2	3	4	5	6	7
	dollars per hundredweight	1,000 hundredweight	dollars per hundredweight	1,000 hundredweight		per cent
1912	1.98	9,546	1.98	18	9,528	44.5
1913	1.98	9,868	2.09	141	9,727	46.4
1914	1.98	9,455	2.24	363	9,092	44.6
1915	1.86	10,519	2.13	754	9,765	51.9
1916	2.19	16,423	2.76	1,470	14,953	59.8
1917	4.27	14,068	4.51	2,207	11,861	70.6
1918	3.99	16,428	4.96	2,887	13,541	76.7
1919	5.45	17,532	5.62	3,957	13,575	91.6
1920	2.48	21,818	2.51	3,528	18,290	87.2
1921	2.18	16,201	2.47	3,083	13,118	82.7
1922	2.19	17,476	2.56	3,316	14,160	95.2
1923	2.49	13,735	2.89	2,425	11,310	102.9
1924	2.99	13,459	3.56	1,820	11,639	105.4
1925	3.30	13,458	3.42	1,950	11,508	113.4
1926	2.51	17,498	2.87	3,369	14,128	115.9
1927	2.02	18,675	2.09	3,846	14,829	116.7
1928	2.04	18,490	2.02	3,543	14,947	121.3
1929	2.22	16,439	2.24	2,417	14,022	119.4
1930	1.74	18,853	1.76	3,093	15,760	104.0
1931	1.08	18,826	0.89	3,555	15,271	82.8
1932	0.93	17,520	0.91	3,355	14,165	67.9
1933	1.73	15,714	1.58	2,956	12,758	76.2
1934	1.75	16,347	1.49	3,570	12,777	82.4
1935	1.60	16,349	1.49	3,134	13,215	94.5

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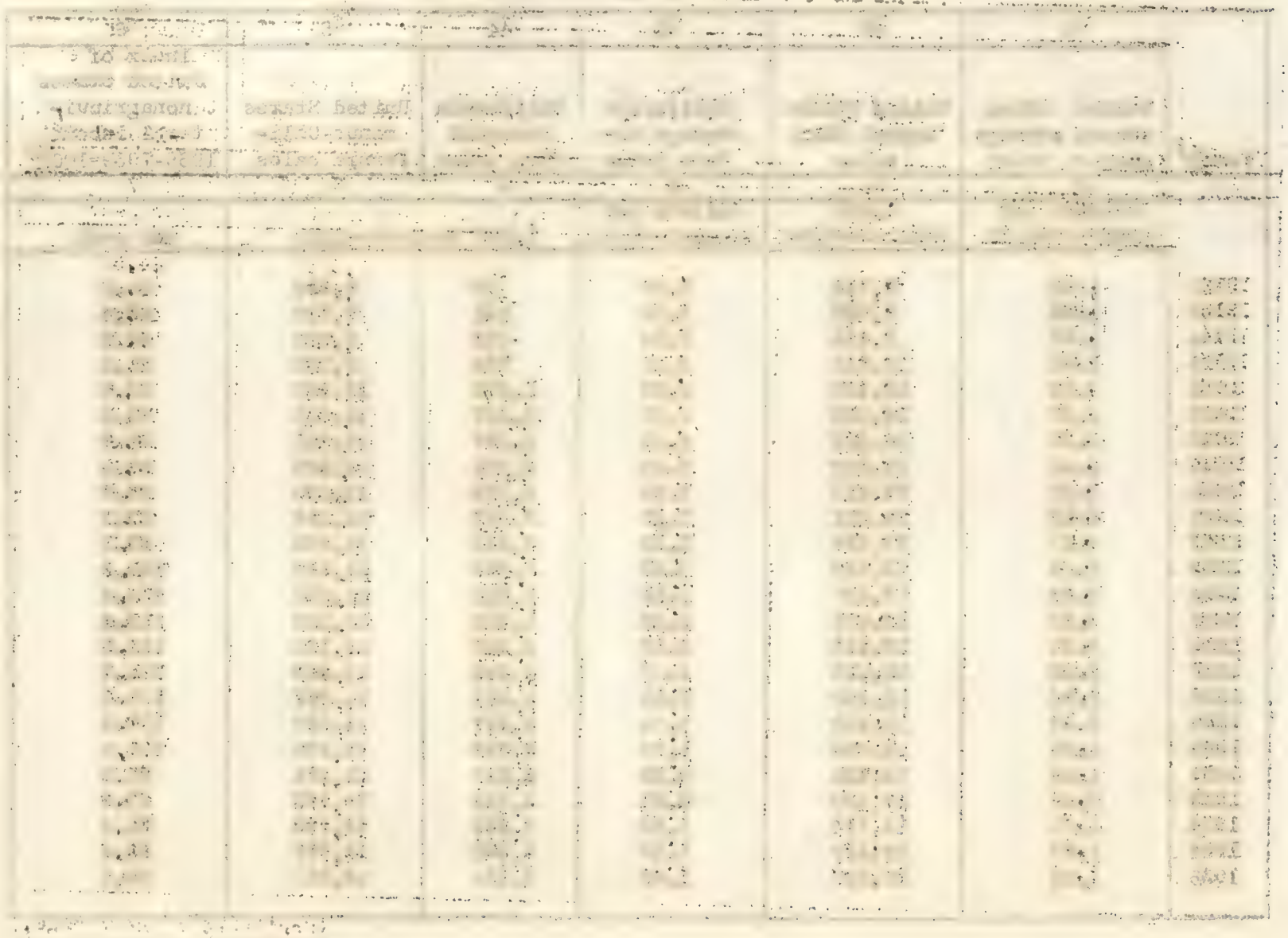


Table 15 continued.

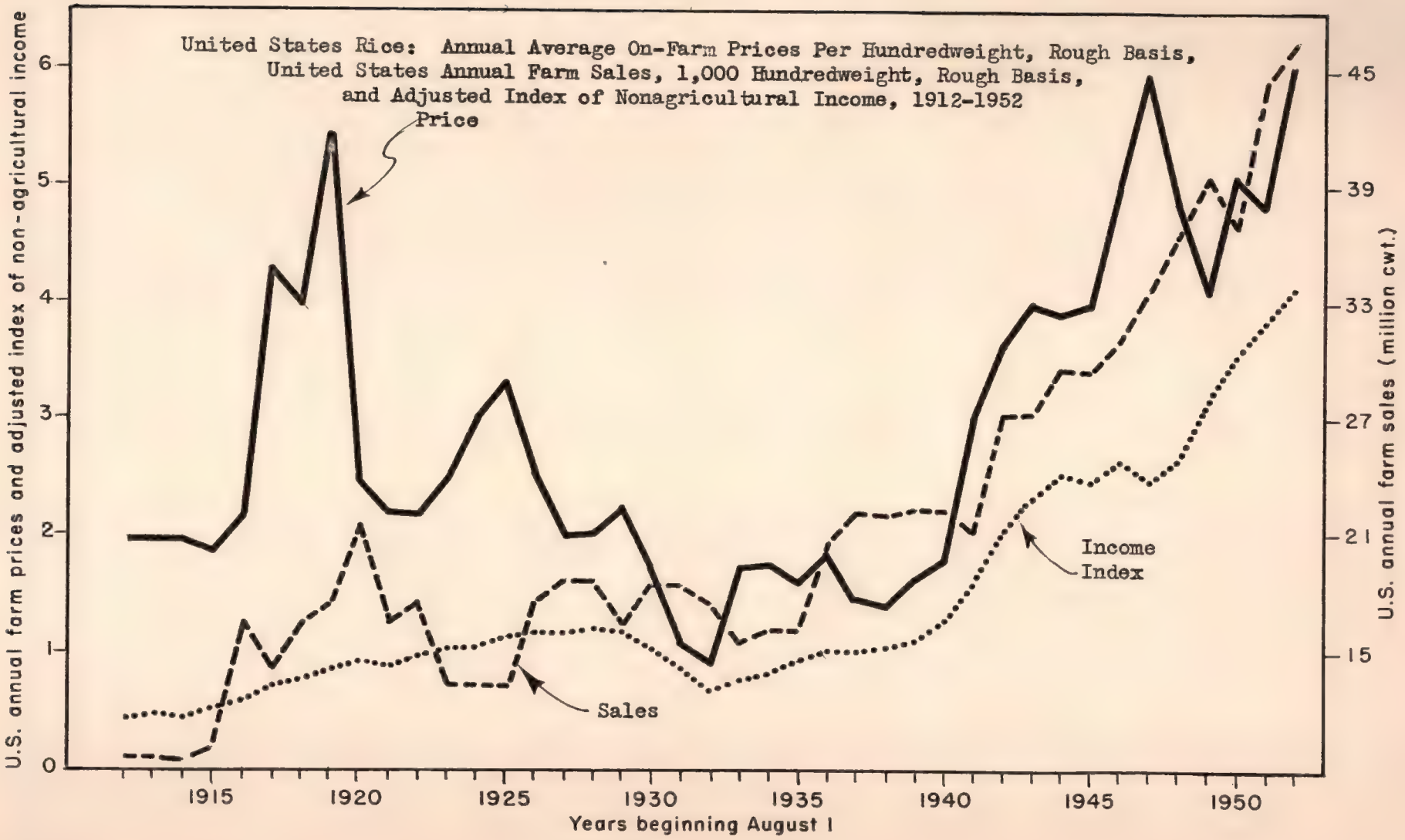
Year[a]	X_1 United States season average on-farm price	X_2 United States annual farm sales	X_3 California average on-farm price	X_4 California seasonal farm sales	X_5 United States minus California sales	X_6 Index of United States nonagricultural income, 1935-1939=100[b]
1	2	3	4	5	6	7
	dollars per hundredweight	1,000 hundredweight	dollars per hundredweight	1,000 hundredweight		per cent
1936	1.85	20,813	1.47	3,939	16,874	101.6
1937	1.46	22,503	1.29	3,888	18,615	101.5
1938	1.42	22,149	1.24	3,596	18,553	103.3
1939	1.62	22,793	1.31	3,879	18,914	111.0
1940	1.80	22,769	1.53	4,025	18,744	126.4
1941	3.01	21,158	3.20	3,481	17,677	157.7
1942	3.61	27,059	3.49	5,345	21,714	203.1
1943	3.96	27,242	3.64	6,203	21,039	232.7
1944	3.93	29,834	3.67	6,489	23,345	251.3
1945	3.98	29,513	3.64	5,979	23,534	248.1
1946	5.00	31,273	4.80	7,636	23,637	265.3
1947	5.97	33,961	6.13	7,752	26,209	248.1
1948	4.88	36,979	4.40	6,499	30,480	265.3
1949	4.10	39,621	3.42	9,960	29,661	313.2
1950	5.09	37,436	4.54	7,925	29,511	355.9
1951	4.82	44,418	4.95	10,314	34,104	382.8
1952	6.05	47,290	5.95	11,469	35,821	412.9

a/ Marketing year beginning October 1 for California and August 1 for southern states.

b/ August 1-July 31--simple averages of 12-month indices.

Source: U.S. Bureau of Agricultural Economics, Crop Reporting Board. Farm Production, Farm Disposition and Value of Rice, 1909-1950, and Farm Production, Farm Disposition and Value of Principal Crops, 1951-1952.

FIGURE 19


United States Rice: Annual Average On-Farm Prices Per Hundredweight, Rough Basis,
United States Annual Farm Sales, 1,000 Hundredweight, Rough Basis,
and Adjusted Index of Nonagricultural Income, 1912-1952
Price
Sales
Income
Index
U.S. annual farm prices and adjusted index of non-agricultural income
U.S. annual farm sales (million cwt.)
0
1
2
3
4
5
6
15
21
27
33
39
45
1915
1920
1925
1930
1935
1940
1945
1950
Years beginning August 1

farm sales and national income.9/ In years of relatively high national income, there were relatively high outputs and high prices. In years of relatively low income, production and prices were relatively low. It is, therefore, difficult statistically to measure the net relationship of changes in sales and price since variations in national income sharply affect both price and sales over the entire period.

Three questions are implicit in the price analysis: (1) how closely could the average annual on-farm price of rice be estimated from known magnitudes of farm sales and of national income; (2) with the income index held constant, how much on the average would farm price change for a given change in the magnitude of annual farm sales; and (3) with the magnitude of farm sales held constant, how much would the average annual on-farm price of rice change in association with a given change in the level of the index of nonagricultural income? The annual average on-farm price could be estimated with about equal accuracy either from known values of both sales and income or from known values of sales alone. The statistical significance of the net regression of price on sales is unacceptably low.10/ The dependence of both price and output upon national income is clearly indicated.

The magnitude of annual farm sales could be predicted from given values of annual average price and the index of nonagricultural income more accurately than the average annual price could be predicted from known values of sales

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9/ The gross correlations for the years 1912-1952 were as follows: (1) price on sales, -.689; (2) price on income, +.761; and (3) sales on income, +.956. If all the variation in farm sales could have been explained by associated variation in national income, the gross correlation coefficient would have been 1.00. A correlation coefficient of .956 indicates that it would have been possible to predict the magnitude of farm sales nearly perfectly if given the level of the index of national income in the same year.

10/ The regression of annual average on-farm price of rice on annual farm sales and the income index is as follows for 1912-1952:

$$\text{(3): 1912-1952:} \quad X_1 = 1.95110 - \underset{(1.258928)}{.000066}\, X_2 + \underset{(3.378469)}{.017168}\, X_6 \qquad \bar{R} = .758$$

The symbols X_1, X_2, and X_6 have the same meanings as in Table 15. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

and income.11/ However, the statistical significance of the estimated change in sales associated with a given change in price--with no change in national income--is unacceptably low.

It is implicitly assumed above that: (1) the change in price associated with given net changes in farm sales or in national income would be the same whether the change in sales or in income were made from large or small bases, and (2) the same kind of a relationship describes the dependence of changes in farm sales upon farm prices and national buying power.

A somewhat different hypothesis is tested by expressing all three of the variables in logarithmic form and measuring the linear relationships among the logarithms, again first with price variation dependent upon variation in sales and income and then with sales dependent upon price and national income. Such expression implicitly assumes that, regardless of the level from which a given percentage change is made in either farm sales or in income (with no change in the other determinant), the associated proportionate change in the price is the same. Similarly, such logarithmic expression assumes that the proportionate or percentage average change in farm sales as a result of a given percentage change in either farm price or national income (with no change in the other of the two determinants) is the same regardless of the level of farm price or national income from which the given percentage change was measured. This latter is of considerable importance in appraising the probable effects of two-price proposals for rice.

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11/ The regression of annual farm sales of rice, rough basis, in the United States upon average annual on-farm price and the adjusted index of nonagricultural income is as follows:

$$(4):\quad 1912\text{-}1952:\quad X_2 = 9{,}178.240733 - \underset{(\ 1.258928)}{604.520500}\ X_1 + \underset{(14.196340)}{98.990299}\ X_6 \qquad \bar{R} = .955$$

The symbols X_1, X_2, and X_6 have the same meanings as in Table 15. The numbers in parentheses are t-ratios. The equation could be interpreted as follows, within the limitations set out in the text: with national income held constant, a change of one cent in farm price was associated on the average with a change in the opposite direction of 604,520 sacks in annual farm sales. With no change in farm price, a change of one point in the index of national income was associated on the average with a change in the same direction of 98,990 sacks in annual farm sales, rough basis. Finally, the annual farm sales of rice could be estimated by multiplying farm price, X_1, and the index of income, X_3, by the respective regression coefficients and adding 9,178,241 sacks to the sum of the two products. The estimate of farm sales so obtained would be closer than the estimate obtainable from either farm price or national income alone. By usual criteria, the net regression of sales on price is not statistically significant; that of sales on income is. Since the supply variable is probably predetermined, the rationale of the price-dependent equation is probably the sounder.

There were fairly high gross relationships between the logarithms of price, sales, and income.12/ The net regression of the logarithms of annual average price upon the logarithms of national income was not statistically significant. However, it is indicated that, on the average, (1) a given percentage increase in farm sales--with no counterbalancing change in national income--was associated with a larger percentage decrease in farm price and therefore a decrease in gross revenue to producers,13/ and (2) a given percentage change in national income--with no counterbalancing change in the volume of farm sales--was associated with a greater percentage change in the same direction in average annual farm price. Thus, within the noted limitations of data and method, evidence is disclosed of two attributes of the domestic demand for rice over the extreme long run which are of major significance in the formulation of price policy: (1) the coefficient of price flexibility exceeds unity, or, in other words, a given percentage increase in supply with no change in buying power is on the average associated with a larger percentage fall in farm price; and (2) a given percentage rise in national income, with no change in farm sales, is associated with a larger percentage increase in farm price, or, alternatively stated, the income elasticity of the price of rice exceeds unity.

The net regression coefficient of the logarithms of farm sales upon the logarithms of farm prices, with the logarithms of national income held constant, is an estimate of the coefficient of the elasticity of demand.14/ This coefficient is the quotient of the associated percentage change in sales and a given percentage change in price with no change in the magnitude of any other sales-determining variable. If this ratio is less than unity, a given percentage decrease in price would be associated with a smaller percentage increase in volume of sales and a consequent decrease in gross returns to producers. A one per cent decrease in price was associated on the average with an increase in

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12/ The gross correlation coefficients between the logs were as follows: log price on log sales, -.413; log price on log income, .556; and log sales on log income, .931.

13/ The regression of the logarithms of annual on-farm price of rice upon the logarithms of annual sales and national income is as follows:

$$(5):\quad 1912\text{-}1952:\quad \log X_1 = 3.042779 - \underset{(2.259276)}{1.329823} \log X_2 + \underset{(3.707601)}{1.475874} \log X_6$$

$$\bar{R} = .599$$

The symbols X_1, X_2, and X_6 have the same meanings as in Table 15. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

14/ The regression of the logarithms of annual farm sales upon the logarithms of annual average farm price and national income is as follows:

$$(6):\quad 1912\text{-}1952:\quad \log X_2 = 2.909041 - \underset{(2.259276)}{.089048} \log X_1 + \underset{(15.159463)}{.686410} \log X_6$$

$$\bar{R} = .936$$

The symbols X_1, X_2, and X_6 have the same meanings as in Table 15. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

sales of only .09 per cent. Thus, there is further support for the hypothesis that the long-run demand for rice is inelastic, or that, with a given level of national income, total farm sales can be increased significantly only by proportionately greater decreases in price.

1912-1952 Relationships: California.--Relationships between California annual average on-farm prices, California annual farm sales, United States sales of domestic rice from states other than California, and the adjusted index of nonagricultural income were measured through arithmetic analysis, explaining first the variation in California prices and then in California farm sales and logarithmic analysis of the same two variables. Three conclusions emerge: (1) despite the differences in products and markets, prices and sales in California and in other states are highly correlated;15/ (2) the high intercorrelation of all variables with national income renders difficult the measurement of the net relationship between the price and output series; and (3) demands have differed among subperiods of the four-decade history of the industry. Statistical analysis of California annual average farm prices and California farm sales, sales from other states of the United States, and national income failed to yield significant results.16/

Interwar Relationships.--More stable relationships can be developed from data for the period 1921-1940. These were years of great economic flux, but

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15/ The following gross correlations were obtained: California price on California sales, -.579; California price on non-California sales, -.550; California price on national income, .647; California sales on non-California sales, .951; California sales on national income, .944; and non-California sales on national income, .947.

16/ The regression of California average annual on-farm price, per hundredweight, rough basis, upon California farm sales in thousand hundredweight, rough basis, farm sales from other United States states, and national income is as follows:

$$(7)\text{: } 1912\text{-}1952\text{: } X_3 = 2.552835 - \underset{(.076707)}{.000018}\, X_4 - \underset{(1.414068)}{.000131}\, X_5 + \underset{(2.893642)}{.017791}\, X_6$$

$$\bar{R} = .644$$

The regression of California farm sales on California price, non-California sales, and national income is as follows:

$$(8)\text{: } 1912\text{-}1952\text{: } X_4 = -1{,}324.629464 + \underset{(.076707)}{8.824923}\, X_3 + \underset{(3.775747)}{.214331} X_5 + \underset{(2.602637)}{11.385463} X_6$$

$$\bar{R} = .958$$

$$(9)\text{: } 1912\text{-}1952\text{: } \log X_3 = 3.805364 - \underset{(1.583163)}{.247034} \log X_4 - \underset{(1.749144)}{1.502822} \log X_5 + \underset{(3.498886)}{1.804992} \log X_6$$

$$\bar{R} = .513$$

$$(10)\text{: } 1912\text{-}1952\text{: } \log X_4 = -1.831406 - \underset{(1.583163)}{.256819} \log X_3 + \underset{(.749287)}{.677870} \log X_5 + \underset{(2.127550)}{1.218617} \log X_6$$

$$\bar{R} = .753$$

The subscripts X_3, X_4, X_5, and X_6 have the same meanings in equations (7)-(10) as in Table 15. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

TABLE 16

California and United States Rice: Factors Affecting Prices, Supply, and Distribution, Rough Basis, 1921-1940

Year	X_1 United States seasonal average on-farm price	X_2 United States annual total supply	X_3 Adjusted index of nonagricultural income, 1935-1939 = 100	X_4 United States farm sales	X_5 United States farm production	X_6 United States continental disappearance	X_7 United States annual exports plus territorial shipments	X_8 United States annual exports	X_9 United States annual territorial shipments	X_{10} United States continental disappearance plus territorial shipments
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight						
1921	2.18	20,306	82.7	16,201	17,673	8,795	9,753	6,522	12,026	3,231
1922	2.19	20,767	95.2	17,476	18,748	10,269	9,735	6,005	13,999	3,730
1923	2.49	16,877	102.9	13,735	14,957	10,396	7,782	3,690	14,488	4,092
1924	2.99	15,942	105.4	13,459	14,689	10,722	5,483	1,815	14,390	3,668
1925	3.30	17,147	113.4	13,458	14,866	10,922	4,402	780	14,544	3,622
1926	2.51	21,304	115.9	17,498	18,411	11,850	8,865	4,931	15,784	3,934
1927	2.02	22,484	116.7	18,675	20,024	12,759	9,150	5,018	16,891	4,132
1928	2.02	21,679	121.3	18,490	19,725	12,144	10,920	6,362	16,702	4,558
1929	2.22	19,080	119.4	16,439	17,790	11,428	9,344	4,690	16,082	4,654
1930	1.74	20,793	104.0	18,853	20,218	12,442	9,441	4,552	17,331	4,889
1931	1.08	21,894	82.8	18,826	20,076	11,508	9,372	4,450	16,430	4,922
1932	0.93	21,960	67.9	17,520	18,729	13,027	8,338	2,879	18,486	5,459
1933	1.73	19,744	76.2	15,714	16,943	10,136	6,399	1,633	14,902	4,766
1934	1.75	21,740	82.4	16,347	17,571	13,909	7,010	1,988	18,931	5,022
1935	1.60	19,584	94.5	16,349	17,753	13,876	6,255	1,369	18,760	4,884
1936	1.85	26,724	101.6	20,813	22,419	15,313	5,599	840	20,072	4,759
1937	1.46	28,371	101.5	22,503	24,040	16,869	10,472	5,024	22,317	5,448
1938	1.42	27,107	103.3	22,149	23,628	16,485	10,080	5,562	21,003	4,518
1939	1.62	28,815	111.0	22,793	24,328	16,332	10,541	4,936	21,937	5,605
1940	1.80	29,036	126.4	22,769	24,495	16,316	10,425	6,371	20,370	4,054

Source: Variables used in this and subsequent tables were obtained from Tables 1 through 15 unless otherwise stated. On these tables, footnotes indicate the source and method of computation for the variables used in the analysis.

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they were relatively free of the impact of war and controls. However, there appear to be some differences in the basic economic conditions which existed in different subperiods of those two decades especially with respect to foreign trade.

1921-1930: United States.--The hypothesis that United States average annual on-farm price, per hundredweight, rough basis, was determined by the level of exports, by the index of nonagricultural income, and by continental disappearance plus territorial shipments over the decade 1921-1930 was first tested. High-order gross intercorrelations existed.17/ Apparently, there was little gross relationship between volume of sales in the domestic and territorial markets and sales in export outlets.

More than 95 per cent of the variation in prices over that decade could be explained by variation in the three factors. A change of one point in the adjusted index of nonagricultural income--with no change in the other two variables--was associated on the average with a change in the same direction of about 2.35 cents per sack in the price of rice. A change of 1,000,000 sacks in domestic disappearance plus territorial shipments--with no change in income or exports--was accompanied by a change in the opposite direction of 25 cents in the price. A similar change in the volume of exports--with no change in income or in domestic disappearance plus territorial shipments--was associated on the average with a change in the opposite direction of about 16.8 cents in the on-farm price of rice.18/

1921-1940: United States.--The relationships of various determinants to the average on-farm price over the years 1921-1940 are summarized in Table 17. In all cases, the factor in which variation is explained is United States average annual on-farm price per hundredweight, rough basis. Sales and volume data are also in rough units. The meanings of the various independent variables, designated X_2 ... X_{10}, are indicated in the headings of the columns in Table 16, above. The numbers in parentheses in Table 17 are t-ratios. Where the entry in Table 17 is marked by the footnote indicator "b"/, the variable is expressed in logarithmic form.

The net relationships to price of each of its determinants are stable statistically except in equations (24) and (26). On the average over the years

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17/ The following gross correlations were obtained: price on domestic disappearance plus shipments, -.416; price on income, .08; price on exports, -.836; domestic disappearance plus shipments on income, .78; domestic disappearance plus shipments on exports, .043; income on exports, -.218.

18/ The regression of average farm price, per hundredweight, rough basis, on domestic disappearance plus territorial shipments, adjusted national income index, and exports over the years 1921-1930 is as follows:

$$(11):\quad 1921\text{-}1930:\quad X_1 = 4.386650 - \underset{(6.424417)}{.000250X_{10}} + \underset{(4.409351)}{.023499X_3} - \underset{(7.799170)}{.000168X_8}$$

$$\bar{R} = .972$$

The symbols X_1, X_{10}, X_3, and X_8 have the same meanings as in Table 16. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

TABLE 17

United States Rice: Factors Affecting Average Annual On-Farm Price, Rough Basis, 1921-1940 [a]

Equation number	Constant term	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	$\bar{R}$
		Regression coefficients and t-ratios									
		1,000 hundredweight	per cent	1,000 hundredweight							
12	23.025909	-5.343846 [b] (5.312588)	.020755 (4.350820)								.821
13	15.701303	-5.310650 [b] (5.391286)	4.639610 [b] (4.512352)								.828
14	2.245458		.023708 (5.715018)	- .000150 (6.706494)							.873
15	26.327674		.022986 (5.913568)	-6.285112 [b] (7.254843)							.888
16	18.284182		5.148182 [b] (6.260695)	-6.267264 [b] (7.553864)							.897
17	2.503971		.024022 (5.607195)		- .000144 (6.443445)						.865
18	27.512902		.023372 (5.794075)		-6.523380 [b] (6.936759)						.880
19	19.346981		5.237979 [b] (6.136739)		-6.509904 [b] (7.207411)						.889

(Continued on next page.)

Table 17 continued.

Equation number	Constant term	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	$\bar{R}$
		Regression coefficients and t-ratios									
		1,000 hundredweight	per cent	1,000 hundredweight							
20	2.166282		.026060 (6.586500)			- .000133 (4.997930)	- .000137 (4.174348)				.890
21	10.487794		.025163 (6.627686)			- .000133 (5.200693)	-2.398769[b]/ (4.433395)				.897
22	25.750842		.025613 (7.222646)			-4.104631[b]/ (5.800700)	-2.44547[b]/ (4.878251)				.912
23	1.631929		.027788 (5.918038)			- .000159 (5.402206)		-.000118 (3.107317)			.854
24	3.221691		.020600 (4.915982)			- .000079 (2.425002)		- .000127 (4.322038)	-.000411 (3.429363)		.915
25	16.110396		.025056 (7.115909)			- .000090 (3.535377)		- .000145 (6.184400)	-.005350[c]/ (3.748863)		.950
26	3.032205		.016367 (2.767480)			- .000087 (1.849942)			- .000363 (2.095933)		.812
27	2.247167		.025650 (6.401567)					- .000121 (3.674663)		- .000140 (6.616174)	.892
28	26.048950		.024704 (7.015271)					-.819907[b]/ (4.320759)		-5.604539[b]/ (7.399164)	.913

a/ The variables designated by the symbols, X_2 . . . X_{10}, have the same meanings as in Table 16.
b/ Logarithms of the variable.
c/ X_9^2 was introduced into this equation; b = 0, t = 3.30411.

| | | |

1921-1940, a change of one point in the adjusted index of nonagricultural income--with no change in the magnitude of any other determinant of farm price--was associated with a change in the same direction of about 2.5 cents in price. On the average over those two decades, a change of 1,000,000 sacks in total United States supplies--with no change in any other determinant of farm price--was associated with a change in the opposite direction in price of some 14-15 cents per sack. In general, accuracy of estimation is somewhat improved by expression of the data in logarithmic form. The stability of the net relationships between price and the adjusted index of nonagricultural income is apparent from examination of the several formulations in Table 17. Total annual United States supply of rice, annual United States farm sales, and total annual farm production are all closely related. In consequence, little difference is made by substitution among these variables as indices of the total annual supply. Apparently, farmers and handlers distributed the crop in such a way as to equalize farm prices from all the outlets. The effect upon domestic price of given variation in sales in any of the outlets was about the same. Apparently, no effort was made to discriminate in prices or volume of sales between domestic and overseas outlets.

Equations 12 and 13 relate variation in annual price to variation in annual total supply and in the adjusted index of income. Equations 14-16 express price variation as dependent upon variations in income and in annual farm sales. The latter set of equations provides somewhat more complete explanation of variance in annual prices. The net regression of price upon such measures as farm supply, farm sales, domestic disappearance, farm production, overseas sales, territorial shipments, and exports is very stable. In equations 17-19, variation in annual average on-farm price is related to variations in the income index and in total annual farm production. Since sales, supply, and production are highly correlated, the results of equations 12-19 are all about the same. The findings indicate: (1) that a change of one point in income was associated with a change in price in the same direction of about 2.4 cents, and (2) that a change in sales of 1,000,000 sacks was associated with a change in the opposite direction of from 14-15 cents per sack in price.

In equations 20, 21, and 22, the total annual movement of United States rice is divided into United States domestic disappearance, X_6, and total overseas shipments, X_7. This latter variable is the sum of exports and commercial shipments to territories. There is some improvement in accuracy of estimation by splitting the supply variable into these components. Little change in the net regression of price on income appears. Apparently, the net effect upon average annual farm price of a change in either domestic disappearance and overseas sales was identical. Equation 20 indicates that, with no change in the index of nonagricultural income, a change of 1,000,000 hundredweight in either domestic disappearance or overseas sales--with no simultaneous change in any other price determinant--was associated on the average with a change in farm price in the opposite direction of about 13.5 cents per sack. Equation 27 further indicates that the net effects upon farm price of a given change in exports or in domestic disappearance plus territorial shipments were about the same.

In equation 23, price is related to income, domestic continental disappearance, and exports. No reference is made to territorial shipments in this equation. The difference between the net regression coefficients of price upon continental disappearance and upon exports is not significant. Similarly, the differences in the net regressions of price upon exports and upon shipments in equation 24 do not appear to be statistically significant.

Equations 12 and 13 relate variation in annual price to variation in annual total supply and in the adjusted index of income. Equations 14-16 express price variation as dependent upon variations in income and in annual farm sales. The latter set of equations provides somewhat more complete explanation of variance in annual prices. The net regression of price upon such measures as farm supply, farm sales, domestic disappearance, farm production, overseas sales, territorial shipments, and exports is very stable. In equations 17-19, variation in annual average on-farm price is related to variations in the income index and in total annual farm production. Since sales, supply, and production are highly correlated, the results of equations 12-19 are all about the same. The findings indicate: (1) that a change of one point in income was associated with a change in price in the same direction of about 1.4 cents, and (2) that a change in sales of 1,000,000 bushels was associated with a change in the opposite direction of from 1½-1⅝ cents per bush in price.

In equations 20, 21, and 22, the total annual movement of United States price is divided into United States domestic disappearance, X_1, and total overseas shipments, X_2. This latter variable is the sum of exports and commercial shipments to territories. There is some improvement in accuracy of estimation by splitting the supply variable into these components. Little change in the regression of price on income appears. Apparently, the net effect upon average annual farm price of a change in either domestic disappearance and overseas sales was identical. Equation 20 indicates that, with no change in the index of nonagricultural income, a change of 1,000,000 bushelweights in either domestic disappearance or overseas sales--with no simultaneous change in any other price determinant--was associated on the average with a change in farm price in the opposite direction of about 1.5 cents per bush. Equation 22 further indicates that the net effects upon farm price of a given change in exports or in domestic disappearance plus territorial shipments were about the same.

In equation 23, price is related to income, domestic consumptive disappearance, and exports. No reference is made to territorial shipments in this equation. The difference between the net regression coefficients of price upon domestic disappearance and upon exports is not significant. Similarly, the differences in the net regressions of price upon exports and upon shipments in equation 21 do not appear to be statistically significant.

The price elasticity of demand for rice at the farm level was less than unity.[19] With no change in any other determinant of sales, a given percentage change in farm price would have been associated with a greater percentage change in the opposite direction in sales. Elasticity of demand in export markets at world prices must have been very high since United States exports were a minor part of total world trade movement in rice. In the relatively stable decade of 1921-1940, United States gross returns from sale of rice would have been higher had it been possible to control sales in the domestic market and sell the difference between domestic sales and total supply at world prices.

Variation in combined domestic disappearance and territorial shipments was related to variation in season average farm price and in income and to those two variables and exports.[20] Continental United States and territorial outlets were a single market. Average annual farm prices have been equalized in the two outlets. In the decades 1921-1940, export outlets were not differentiated from domestic and territorial markets.

Annual average on-farm price of rice, barley, and wheat are fairly highly correlated. There is similar correlation in the prices of rice and barley. However, these products do not appear to be competitive in demand.[21]

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19/ See Table 34 below.

20/ The following regression equations are also relevant to the period 1921-1940:

(28): 1921-1940: $X_{10} = 15{,}491.233332 - \underset{(4.950306)}{4{,}267.468040X_1} + \underset{(3.209891)}{99.592413X_3}$, $\bar{R} = .743$

(29): 1921-1940: $X_{10} = 15{,}648.240362 - \underset{(6.616140)}{5{,}215.534713X_1} + \underset{(4.784041)}{141.418387X_3} - \underset{(2.915342)}{.641387X_8}$, $\bar{R} = .830$

(30): 1921-1940: $\log X_1 = 1.073750 - \underset{(2.116761)}{1.600394 \log X_4} + \underset{(3.979778)}{2.974273 \log X_3}$, $\bar{R} = .672$

(31): 1921-1940: $\log X_4 = 2.183713 - \underset{(2.116761)}{.130337 \log X_1} + \underset{(2.065463)}{.547406 \log X_3}$, $\bar{R} = .390$

(32): 1921-1940: $X_4 = 1{,}4573.446604 - \underset{(6.706494)}{4{,}829.069853X_1} + \underset{(4.887846)}{126.672702X_3}$, $\bar{R} = .843$

The symbols X with subscripts have the same meanings as in Table 16. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

21/ The regression of X_1, annual average farm price of rice, per hundredweight, rough basis, upon X_2, barley price, and upon X_3, the adjusted index of nonagricultural income, is:

1921-1940: $X_1 = -.149220 + \underset{(2.877710)}{2.148070X_2} + \underset{(1.454613)}{.009863X_3}$, $\bar{R} = .646$

The gross correlation of X_1X_2 was .643. Where X_1 and X_3 have the same meanings as above and X_2 is the farm wheat price, the regression is:

1921-1940: $X_1 = .160620 + \underset{(6.504877)}{1.778743X_2} + \underset{(.130384)}{.001957X_3}$, $\bar{R} = .867$

The gross correlation of rice and wheat prices was .880.

[illegible]

[illegible]

[illegible]

1921-1940: California.--Analysis of California price determination over the two decades 1921-1940 was not satisfactory.[22] More useful analysis can be made in terms of United States prices than in terms of California prices and sales separately.

1930-1951 Deflated Relationships: United States.--The United States average annual farm price, per hundredweight, rough basis, was deflated by the all-food items component of the United States Bureau of Labor Statistics Consumer Price Index, 1947-1949 = 100, indicating roughly the changes in the price of rice as a relative of all food prices in the United States. Most marked are the increases in the relative price from 1937-1941 and its stability during 1941-1945. Following the postwar rises of 1946-47, there has been a steady downward trend in the relative price of rice except for the boom year of 1950. Thus, the absolute prices of rice mask a quite different pattern of changes in rice prices relative to prices of all foods. These relationships are shown in Table 18 and Figure 20.

There has been a gradual but steady upward trend in total United States continental disappearance, from about 12,000,000 sacks, rough basis, during the depression era, to about 14,000,000 sacks, rough basis, in the decade 1936-1946, to about 16,000,000 or 17,000,000 over the last seven years. Domestic disappearance includes seed, feed or other farm use, waste, brewers' use, and civilian food consumption. This series bears a low gross relation to the deflated price series.[23] Use for seed and by brewers has increased significantly. Per-capita consumption and per-capita disappearance of rice show little systematic long-run change.

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22/ The regression of California price on California sales, non-California United States sales, and adjusted index of national income is shown in equations (33) and (35). The regression of California sales on California annual average farm price, non-California United States sales, and national income is shown in equations (34) and (36).

(33): 1921-1940: $X_3 = 3.14877 - \underset{(1.674883)}{.000403X_4} - \underset{(2.588895)}{.000171X_5} + \underset{(4.098845)}{.026034X_6}$
$\bar{R} = .863$

(34): 1921-1940: $X_4 = 1{,}967.217344 - \underset{(1.674883)}{370.175382X_3} + \underset{(1.834553)}{.125625X_5} + \underset{(.157858)}{1.374742X_6}$
$\bar{R} = .807$

(35): 1921-1940: $\log X_3 = 3.292475 + \underset{(.222695)}{.286055 \log X_4} - \underset{(1.673656)}{3.091070 \log X_5} + \underset{(3.797571)}{4.367644 \log X_6}$
$\bar{R} = .679$

(36): 1921-1940: $\log X_4 = -.646524 + \underset{(.222695)}{.010801 \log X_3} + \underset{(4.870285)}{1.202532 \log X_5} - \underset{(1.492095)}{.430815 \log X_6}$
$\bar{R} = .778$

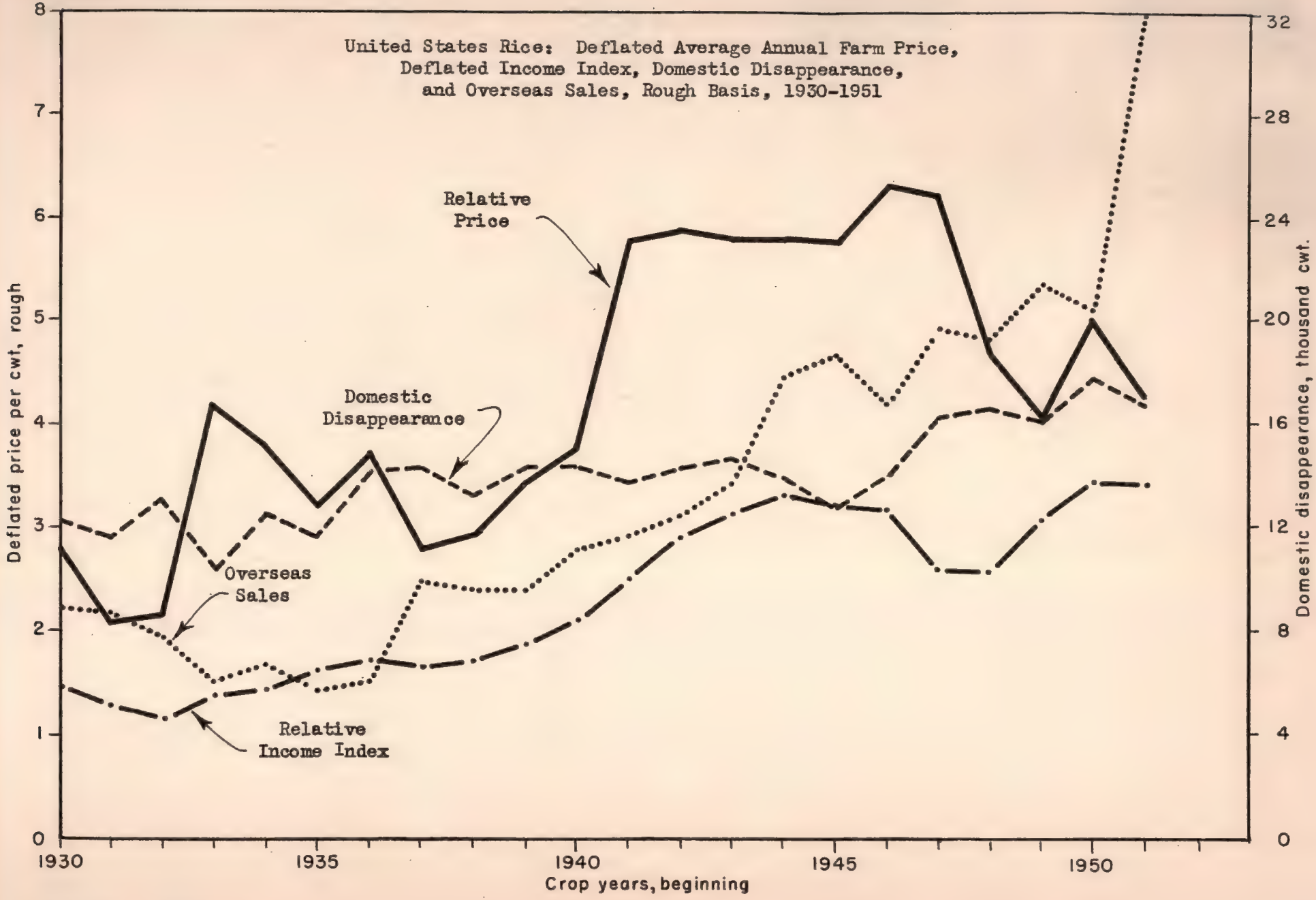
The symbols X_3 ... X_6 have the same meanings as in Table 15. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation. The logarithmic expressions in equations (35) and (36) are even less stable than those in the preceding two equations.

23/ The gross correlation of deflated price and domestic disappearance is .389. The gross relationship is positive, although, if the net effects of other variables upon price are eliminated, the resultant net relationship is negative.

TABLE 18

United States Rice: Factors Affecting "Real" or Deflated Average Annual On-Farm Prices of Rice, Rough Basis, 1930-1951

Year	X_1 United States annual average farm price ÷ BLS consumer price index, food items	X_2 United States continental disappearance	X_3 Overseas sales: exports plus territorial shipments plus military	X_4 Nonagricultural income index ÷ BLS cost of living index, all items 1935-1939 = 100	X_5 Domestic disappearance plus overseas sales	United States per-capita consumption	United States disappearance ÷ United States population
	dollars per hundredweight	1,000 hundredweight		per cent	1,000 hundredweight	pounds	
1930	2.79	12,208	8,909	145.7	21,117	8.96	10.13
1931	2.10	11,651	8,658	127.4	20,309	8.22	9.29
1932	2.17	13,007	7,798	116.3	20,805	9.40	10.45
1933	4.16	10,552	6,025	137.8	16,577	6.78	8.08
1934	3.77	12,451	6,692	144.1	19,143	8.76	9.86
1935	3.22	11,834	5,753	161.0	17,587	8.15	9.31
1936	3.69	14,328	6,015	171.3	20,343	9.38	11.20
1937	2.80	14,338	9,905	165.3	24,243	9.23	11.14
1938	2.93	13,267	9,769	171.3	23,036	8.61	10.24
1939	3.44	14,310	9,630	186.9	23,940	9.08	10.95
1940	3.77	14,393	11,169	211.0	25,562	8.93	10.92
1941	5.77	13,788	11,707	250.7	25,495	8.15	9.83
1942	5.89	14,249	12,475	291.4	26,724	8.61	10.60
1943	5.80	14,643	13,785	314.5	28,428	8.31	10.74
1944	5.83	13,973	17,968	334.2	31,941	7.54	10.12
1945	5.78	12,815	18,738	322.6	31,555	6.15	9.18
1946	6.33	14,001	16,784	318.1	30,785	7.08	9.93
1947	6.23	16,249	19,707	259.8	35,956	7.54	11.32
1948	4.69	16,601	19,292	258.1	35,893	7.69	11.37
1949	4.10	16,175	21,439	307.7	37,614	7.84	10.89
1950	5.03	17,929	20,593	346.2	38,522	8.90	11.86
1951	4.28	16,814	32,061	344.9	48,875	8.15	10.94



Source: Table 18.

Overseas sales have risen sharply since 1935. Since 1944, such sales--which include territorial shipments, exports, and, after 1941, both United States Department of Agriculture nonmilitary shipments and exports and military procurement for military feeding and relief--have exceeded all domestic uses combined. Overseas deliveries now absorb about 60 per cent of the total output. Relief feeding has been a major component of overseas sales since 1951. Overseas sales bear a fairly high and positive gross relationship to average annual farm price. Domestic disappearance and overseas sales are also positively and fairly highly correlated over the years 1930-1951.24/

The adjusted index of nonagricultural income was divided by the Consumer Price Index (1947-1949 = 100) in order to obtain a rough indication of the changes in "real" purchasing power. The "real" income index rose steadily from 1932-1944, decreased through 1948, and has risen steadily since then. There was an especially high interrelation of the variables to the deflated or "real" income index.25/ Deflated price is highly and positively related to deflated income. All of the output or sales series are similarly related to income. Delfation of the price and income series does not significantly change the pattern of interelationships among the price and sales determinants, although the relations in particular years are changed.

The relationships among the price determinants in the deflated model are set out in equations 37 and 38.

(37): 1930-1951: $X_1 = 1.946298 + \underset{(6.048828)}{.021702}\, X_4 - \underset{(2.720537)}{.000097}\, X_5$

$\bar{R} = .848$

(38): 1930-1951: $X_1 = 1.856345 - \underset{(.669787)}{.000090}\, X_2 - \underset{(1.945159)}{.000098}\, X_3 + \underset{(5.855547)}{.021723}\, X_4$

$\bar{R} = .839$

The symbols $X_1 \ldots X_5$ have the same meanings as in Table 18. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

Equation 37 indicates that on the average over the years 1930-1951 a change of one point in the index of "real" income, with no change in total sales, was associated with a change in the same direction of about 2.17 cents per hundredweight, rough basis, in the deflated or "real" United States average annual farm price of rice. Equation 38 indicates that the impact of a change in either domestic shipments or total overseas sales--with no change in the level of "real" income--upon deflated price was about the same during the two decades. A net change of 1,000,000 sacks in United States continental disappearance, total overseas sales, or the sum of continental and overseas sales,

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24/ The gross correlation coefficient between total overseas sales and deflated price was .511; between domestic disappearance and total overseas sales, .758.

25/ Using the subscripts of Table 18, the following gross correlations are obtained: X_1X_4, .804; X_2X_4, .679; X_3X_4, .841; X_5X_1, .506; and X_5X_4, .841.

resulted in an opposite change in "real" price of from 9-10 cents.[26] The net regression coefficients of price upon the several quantity or sales variables do not meet conventional tests for statistical significance. However, these equations are rather better descriptions of the relationships which existed in those two decades than could be obtained by use of undeflated price and income data.[27]

1941-1952 Relationships: United States.--After 1941, the data and the relationships differed from those of the interwar years. There were few stable or meaningful relationships. The yearly observations for the several price, supply, and distribution variables are in many cases not homogeneous variables. Demands for rice during and after World War II reflect successive but unrelated crises in major production or importing areas rather than stable business responses based on stable preference patterns and income structures.

Basic data are presented in Table 19. From 1941 through 1951, the United States Department of Agriculture exported rice and, except in 1949, shipped to its account to the United States territories. Procurement of rice by the military for food exceeded 1,000,000 sacks, rough basis, in each of several years. Procurement by the military for relief purposes became a major channel. Noncommercial demands seriously affected farm price. There was pressure for expansion of rice production. Maximum prices were set. International trade in rice was allocated by international agreement.

The stable relationships of the interwar years did not exist. The average annual United States farm price, per hundredweight, rough basis, rose sharply upon American participation in the war, held stable at a little less than $4.00

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26/ The regression of deflated price on domestic disappearance and deflated income is described by

$$(39):\ 1930\text{-}1951:\ X_1 = 3.424726 - \underset{(1.678859)}{.000214}\, X_2 + \underset{(5.780892)}{.016805}\, X_4$$

$$\bar{R} = .812$$

The symbols X_1, X_2, and X_4 have the same meanings as in Table 19. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

27/ The symbols $X_1 \ldots X_4$ have the same meanings as in Table 18 except that neither X_1 (United States average annual on-farm price, per hundredweight, rough basis) nor X_4 (adjusted index of nonagricultural income) is deflated as in the above three equations. The intercorrelations are as follows: X_1X_2, .726; X_1X_3, .839; X_1X_4, .915; X_2X_4, .791; and X_3X_4, .945. Thus, in all cases, the gross intercorrelations are higher with the undeflated price and income series. Relatively low levels of significance were found among the net regressions. The regression of undeflated price on domestic disappearance, overseas sales, and undeflated national income is as follows:

$$(40):\ 1930\text{-}1951:\ X_1 = .339264 + \underset{(.064908)}{.000008}\, X_2 - \underset{(.958557)}{.000066}\, X_3 + \underset{(3.763730)}{.018830}\, X_4$$

The symbols $X_1 \ldots X_4$ have the same meanings as in Table 18. The numbers in parentheses are t-ratios.

TABLE 19

United States Rice: Prices, Supply, and Distribution, Rough Basis, 1941-1952

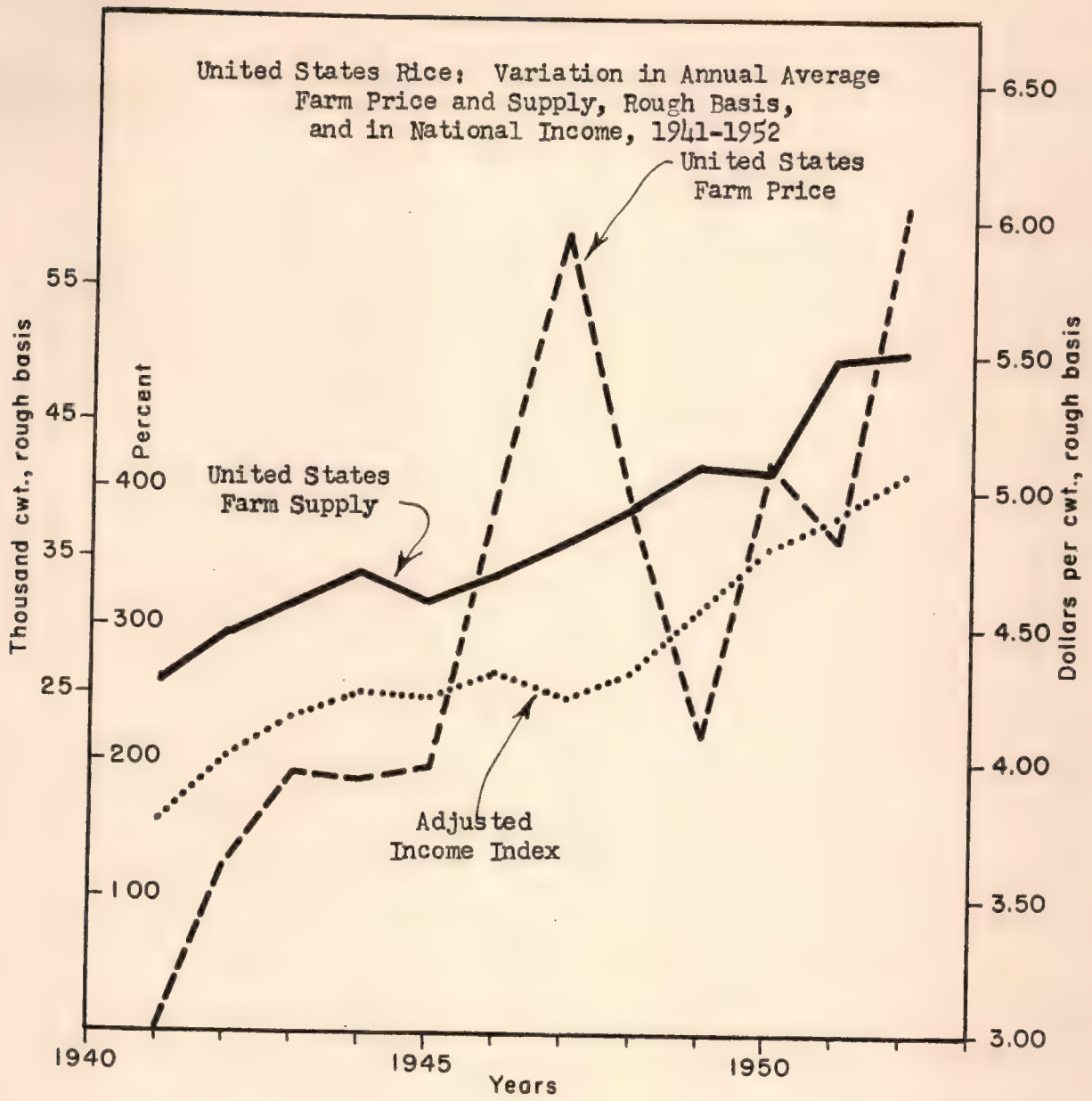
Year	X_1 United States average annual farm price	X_2 United States annual total supply	X_3 Index of United States nonagricultural income, 1935-1939=100	X_4 United States farm sales	X_5 United States farm production	X_6 United States continental disappearance	X_7 United States exports (commercial	X_8 USDA exports	X_9 United States total exports	X_{10} United States annual territorial shipments	X_{11} United States military food	X_{12} United States military relief	X_{13} United States total military	X_{14} United States total overseas sales (all exports, military, and territorial shipments)	X_{15} United States commercial exports plus territorial shipments	X_{16} USDA relief plus military
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight												
1941	3.01	26,017	157.7	21,158	23,095	15,670	7,031	46	7,077	4,323	307	a/	307	11,707	11,354	353
1942	3.61	29,524	203.1	27,059	29,082	15,762	4,261	2,476	6,737	4,277	1,261		1,261	12,275	8,538	3,737
1943	3.96	31,648	232.7	27,242	29,264	14,877	5,184	2,555	7,739	4,815	1,231		1,231	13,785	12,554	1,231
1944	3.93	34,011	251.3	29,834	30,974	14,346	6,646	1,169	7,815	3,938	1,077	5,138	6,215	17,968	10,584	7,384
1945	3.98	31,860	248.1	29,513	30,668	13,544	6,430	4,492	10,922	4,862	965	1,989	2,954	18,738	11,292	7,446
1946	5.00	33,838	265.3	31,273	32,497	15,704	6,938	5,923	12,861	2,846	1,069	8	1,077	16,784	9,784	7,000
1947	5.97	36,008	248.1	33,961	35,217	15,604	9,369	3,892	13,261	5,015	1,343	88	1,431	19,707	14,384	5,323
1948	4.88	38,768	265.3	36,979	38,275	18,005	12,461	1,061	13,522	5,108	209	453	662	19,292	17,569	1,723
1949	4.10	41,929	313.2	39,621	40,737	18,120	14,439	107	14,546	5,851	--b/	1,062	1,062	21,439	20,270	1,169
1950	5.09	41,691	355.9	37,406	38,689	20,502	13,639	31	13,670	5,354	169	1,400	1,569	20,593	18,993	1,600
1951	4.82	49,856	382.8	44,418	45,797	19,775	20,569	892	21,461	5,354	495	4,751	5,246	32,061	25,923	6,138
1952	6.05	50,292	412.9	47,290	48,660	19,862	19,169	--	19,169	5,846			7,692	32,707	25,015	7,692

a/ Blanks indicate data not available.

b/ Dashes indicate zero.

| | | |

FIGURE 21



Source: Table 19.

during the control years of 1943-1945, peaked in 1947 at nearly $6.00, declined for two years, and shot up again upon the outbreak of the Korean War. The adjusted index of nonagricultural income leveled off from 1944, through 1947 but rose rapidly thereafter to more than twice the level of 1941. Total annual United States supply of rice almost exactly doubled. Exports nearly tripled.

In World War II and subsequent years, the price, supply, and distribution variables were highly intercorrelated. This reflects the simultaneous upsurges in prices, incomes, production, and exports associated with war and postwar emergencies. The analytical difficulties attributable to high intercorrelations and to serial correlation in deriving net relationships have already been described. Average farm price was highly and positively related to national income.28/ But price and total annual farm sales of rice--and all other indicators of the total annual supply--were quite as highly and positively related. For constant levels of income, average annual price usually decreases as annual volume increases. This so-called law of demand is not controverted by the price-output relationships for rice which existed in 1941-1952. The interrelationships among the data preclude effective empirical measurement of the normal demand relation. Exports were very closely related to total supply over these years.29/

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28/ Using the designations for subscripts as in Table 19, following are some of the gross correlations among the variables set out in that table: X_1X_3, .902; X_1X_4, .892; X_1X_6, .512; X_1X_{14}, .667; X_6X_{15}, .877; X_6X_{14}, .698; X_8X_{10}, .901; X_3X_4, .959; X_3X_{15}, .881; X_3X_6, .808; and X_3X_{14}, .924.

29/ The regression of total exports, including United States Department of Agriculture, on total supply was as follows:

(41a): 1941-1952: $X_9 = -8.91 + .574\ X_2$; $r = .936$

The regression of exports, including both United States Department of Agriculture and military, upon total supply was as follows:

(41b): 1941-1952: $(X_9 + X_{13}) = -15.75 + .809\ X_2$; $r = .954$

However, there was relatively little gross relationship between exports including United States Department of Agriculture and territorial shipments.

(42): 1941-1952: $X_9 = -2.22 + 3.046\ X_{10}$; $r = .543$

The quantity variables are in thousand hundredweight, rough basis. Statistical explanation of variation in combined continental disappearance and territorial shipments over the years 1941-1952 was not satisfactory.

(43): 1941-1952: $X_{10} = 9{,}516.574570 - 5{,}536.839231 \log X_1 + 95.877383X_3 - .184027X_8$
$\bar{R} = .356$ (2.288641) (1.915330) (.538111)

(44): 1941-1952: $X_{10} = 16{,}314.385973 + 530.955242\ X_1 + .440277X_8 - .390814X_{12}$
$\bar{R} = .943$ (1.223986) (6.480500) (3.246368)

(45): 1941-1952: $X_{10} = 20{,}139.760131 + 234.656661\ X_1 + 98.520534 \log X_{11}$
$\bar{R} = .529$ (.197492) (1.563988)

The symbols X with subscripts have the same meanings as in Table 20. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

[illegible] by [illegible] per capita [illegible] (6,30) [illegible] for the [illegible] and [illegible] upon the [illegible] The adjusted index of nonagricultural income levels [illegible] through 1939 but rose rapidly thereafter to more than twice the level of 1941. Total annual [illegible].

In World War II and subsequent years, the prices, supplies, and distribution variables were highly intercorrelated. This reflects the simultaneous upsurge in prices, incomes, population, and exports associated with war and postwar prosperity. The analytical difficulties which high intercorrelation and serial correlation in deriving net relationships have already been discussed. Average farm price was highly and positively related to national income.25/ Net price and total annual farm value of rice—and all other indicators of the total annual supply—were quite as highly and positively related. For certain levels of income, average annual price [illegible] decreases as actual volume increases. This so-called law of demand is not contradicted by the price-output relationships for rice which existed in 1941-1952. The interrelationships among the data preclude effective statistical measurement of the normal demand relation. Exports were more closely related to total supply than were other items.26/

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25/ Using the designations for subscripts as in Table 19, following are some of the gross correlations among the variables set out in that table: [illegible]

26/ The regression of total exports, including [illegible], upon total supply was as follows:

(41a): 1941-1952: $X_6 = -8.91 + .574 X_8$; r = .946

The regression of exports, including both United States Department of Agriculture and military, upon total supply was as follows:

(41b): 1941-1952: $(X_6 + X_{12}) = -15.75 + .809 X_8$; r = .954

[illegible] the United States Department of Agriculture and territorial shipments.

(42): 1941-1952: $X_9 = -9.92 + 3.046 X_{10}$; r = .543

The quantity variables are in thousand hundredweight, rough basis. Statistical explanation of variation in combined continental disappearance and territorial shipments over the years 1941-1952 was not satisfactory.

(43): 1941-1952: $X_{10} = 9,516.574530 - 5,536.63921 \log X_1 + 95.87[illegible]$ [illegible]
(2.2086[illegible])
R = .946

(44): 1941-1950: $X_{10} = 16,314.385973 + 530.955282 X_1$ [illegible]
(1.223960)
R = .943

(45): 1941-1952: $X_{10} = 20,139.760131 + 234.556661 X_1$ [illegible]
[illegible]
R = [illegible]

[illegible]

In equations 46-55, the average annual farm price, per hundredweight, rough basis, is dependent upon the specified independent variables.[30] Average annual price could have been estimated more closely from a single variable--usually national income--than from any of the equations. Net regressions of annual average price upon the several variables are not significant by standard tests.[31] The signs of the net regressions are in some cases opposite to those which would usually be expected. It is impossible by these techniques and with these data to explain adequately the variation of seasonal average price in terms of associated variation in other factors usually related to price variation for this commodity over the years 1941-1952.

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30/ Dependence of price upon supply, distribution, and income determinants, 1941-1952:

(46): $X_1 = 1.407872 + \underset{(1.027612)}{.006175}\, X_3 + \underset{(.592852)}{.000035}\, X_4$ $\bar{R} = .878$

(47): $X_1 = 2.602156 + \underset{(.658062)}{.006810}\, X_3 - \underset{(.189740)}{.000033}\, X_6 + \underset{(.319047)}{.000030}\, X_{14}$ $\bar{R} = .531$

(48): $X_1 = .629388 + \underset{(.336763)}{.003771}\, X_3 + \underset{(.517899)}{.000147}\, X_6 - \underset{(.073253)}{.000008}\, X_{15} + \underset{(.820672)}{.000120}\, X_{16}$ $\bar{R} = .501$

(49): $X_1 = 4.004436 + \underset{(1.050279)}{.000112}\, X_8 - \underset{(.149887)}{.000030}\, X_{10}$ $\bar{R} = .429$

(50): $X_1 = -6.823580 + \underset{(1.353887)}{3.166823} \log X_8 - \underset{(.315850)}{.000056}\, X_{10}$ $\bar{R} = .489$

(51): $X_1 = 2.538827 + \underset{(.249752)}{.000026}\, X_{10} + \underset{(1.851575)}{.000092}\, X_{11}$ $\bar{R} = .580$

(52): $X_1 = -11.058463 + \underset{(.197492)}{.000018}\, X_{10} + \underset{(2.340805)}{3.670058} \log X_{11}$ $\bar{R} = .656$

(53): $X_1 = -2.318474 - \underset{(.404329)}{.000051}\, X_8 + \underset{(1.223986)}{.000297}\, X_{10} + \underset{(1.925227)}{.000218}\, X_{12}$ $\bar{R} = .373$

(54): $X_1 = 1.463096 + \underset{(1.218676)}{.000107}\, X_2 - \underset{(.218673)}{.001971}\, X_3$ $\bar{R} = .663$

(55): $\log X_1 = -2.757896 + \underset{(1.267267)}{.793567} \log X_2 - \underset{(.140129)}{.074122} \log X_3$ $\bar{R} = .948$

The subscripts $X_1 \ldots X_{16}$ have the same meanings as in Table 19. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

31/ A net regression is an estimate of the average change in the dependent variable--here, annual average on-farm price--for a change of one unit in one of the independent variables with no change in the magnitude of any of the other determinants of price. Theoretically, the net regression of price on any measure of quantity sold should be negative. If the effects of simultaneous change in other variables were in fact eliminated, such net regression coefficients would in fact be negative in sign.

Unsatisfactory results were obtained in analysis of variation in total seasonal sales. Accuracy of estimate was higher than in the price-dependent equations.32/ The net regressions of sales upon income are positive and the t-ratios are high. However, the net regressions of quantity upon price are positive and the t-ratios are low. These explanations of variations in sales are, therefore, unacceptable.

Variations in exports during the years 1941-1952 were first expressed as dependent upon variations in annual average price and in combined domestic disappearance and shipments to territories. Next, the effect of military shipments on exports was appraised. In both cases, high coefficients of multiple correlation were obtained, but some of the regression coefficients did not meet the criteria for statistical significance and the signs of the export-price net regressions did not conform to logical expectations. Unsatisfactory results were obtained in the analysis of domestic and territorial disappearance over the years 1941-1952.33/

1941-1952 Relationships: California.--California farm prices and farm sales of rough rice are presented in Table 20 and in Figure 20, which demonstrate the high interrelationship among the price determinants over the years 1941-1952. The California farm sales almost tripled. Variation in national income was very similar to variation in sales and prices. California and United States farm prices changed almost identically.

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32/ Factors affecting annual United States farm sales of rough rice, 1941-1952:

(56): 1941-1952: $X_2 = 3{,}958.959072 + 1{,}316.737037\ X_1 + 85.914759\ X_3$
$\bar{R} = .948$ (1.218676) (6.410574)

(57): 1941-1952: $\log X_2 = 2.697335 + .190811 \log X_1 + .698809 \log X_3$
$\bar{R} = .953$ (1.267267) (6.090236)

The symbols X_1, X_2, and X_3 have the same meanings as in Table 19. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

33/ Factors affecting exports of rice, rough basis, 1941-1952:

(58): 1941-1952: $X_8 = -26{,}842.226984 + 997.777153\ X_1 + 1.523287\ X_{10}$
$\bar{R} = .892$ (1.050279) (5.197164)

(59): 1941-1952: $X_8 = -35{,}523.513229 + 393.837336\ X_1 + 1.907868\ X_{10} + .678610\ X_{12}$
$\bar{R} = .928$ (.404329) (6.480500) (2.233245)

Factors affecting continental and territorial sales, 1941-1952:

(60): 1941-1952: $X_{10} = 20{,}139.760131 + 234.651666\ X_1 + 98.525354\ X_{11}$
$\bar{R} = .530$ (.197492) (1.563988)

(61): 1941-1952: $X_{10} = 16{,}314.385973 + 530.955242\ X_1 + .440277\ X_8 - .390814\ X_{12}$
$\bar{R} = .943$ (1.223986) (6.480500) (3.246368)

The symbols X_1 ... X_{12} have the same meanings as in Table 20. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

Unsatisfactory results were obtained in analysis of variation in total [illegible] [illegible] [illegible] are high. However, the net regressions of quantity upon price are positive and the t-ratios are low. These explanations of variations in sales [illegible]

[illegible]ariations in exports during the years 1941-1952 were first expressed as dependent upon variations in annual average price and in combined domestic disappearance and shipments to territories. Next, the effect of military shipments in exports was appraised. In both cases, high coefficients of multiple correlation were obtained, but some of the regression coefficients did not meet the criteria for statistical significance and the signs of the export-price net regressions did not conform to logical expectations. Unsatisfactory results [illegible] the years 1941-1952.[3]

1941-1952 Relationships: California.--California farm prices and farm [illegible] 1941-1952. The California farm sales almost tripled. Variation in national income was very similar to variation in sales and prices. California and [illegible]

---

[2] Factors affecting annual United States farm sales of rough rice, [illegible]:

(56): 1941-1952: $X_2 = 3,056.959072 + 1,314.737037\, X_1 + 65.241739\, X_3$
(1.216575) (6.410971)
$\bar{R} = .948$

(57): 1941-1952: $\log X_2 = 2.587335 + .190811 \log X_1 + .590569 \log X_3$
(1.267257) [illegible]
$\bar{R} = .953$

[illegible]

[3] Factors affecting exports of rice, rough basis, 1941-1952:

(58): 1941-1952: $X_8 = -26,842.226994 + 997.777153\, X_1 + 1.523817\, X_{10}$
[illegible]
$\bar{R} = $ [illegible]

[illegible]

[illegible]

The symbols $X_1, \ldots, X_{10}$ have the same meanings as in table [illegible]. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

TABLE 20

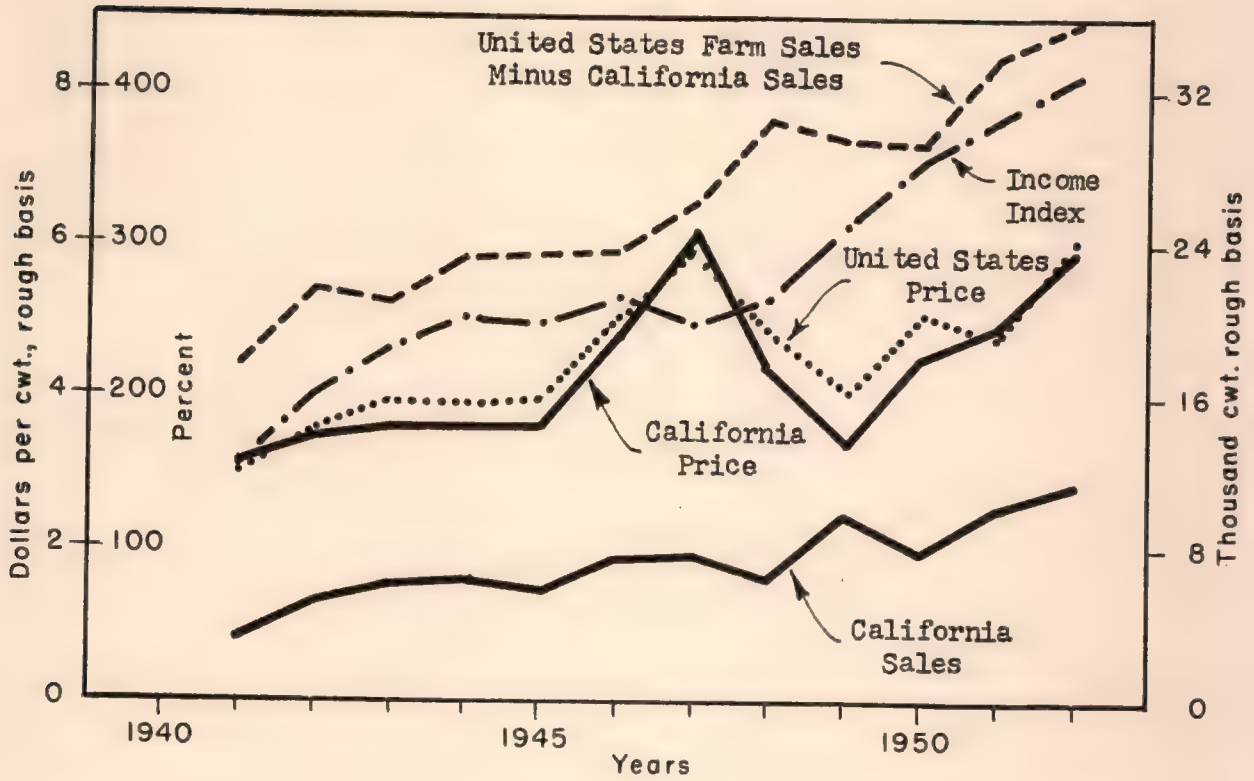
California and United States Rice: Variation in Annual Average On-Farm Price and Sales, Rough Basis, 1941-1952

Year	X_1 United States season average on-farm price	X_2 United States annual farm sales	X_3 California average on-farm price	X_4 California seasonal farm sales	X_5 United States minus California sales	X_6 Index of United States nonagricultural income, 1935-1939=100
1	2	3	4	5	6	7
	dollars per hundredweight	1,000 hundredweight	dollars per hundredweight	1,000 hundredweight		per cent
1941	3.01	21,158	3.20	3,481	17,677	157.7
1942	3.61	27,059	3.49	5,345	21,714	203.1
1943	3.96	27,242	3.64	6,203	21,039	232.7
1944	3.93	29,834	3.67	6,489	23,345	251.3
1945	3.98	29,513	3.64	5,979	23,534	248.1
1946	5.00	31,273	4.80	7,636	23,637	265.3
1947	5.97	33,961	6.13	7,752	26,209	248.1
1948	4.88	36,979	4.40	6,499	30,480	265.3
1949	4.10	39,621	3.42	9,960	29,661	313.2
1950	5.09	37,436	4.54	7,925	29,511	355.9
1951	4.82	44,418	4.95	10,314	34,104	382.8
1952	6.05	47,290	5.95	11,469	35,821	412.9

Calcitonin and Other Factors Affecting Calcium Metabolism in Animal Tissues

FIGURE 22

United States and California Rice: Variation in California Average Annual Farm Price and California Farm Sales, Rough Basis, 1941-1952



Source: Table 20.

There were high gross correlations between California price and both California and non-California farm sales, between California sales and non-California sales, between both of these factors and national income, between California price and national income, and between California price and United States price.34/ None of the equations expressing variation in California price as dependent upon variation in California farm sales, farm sales from other United States states, combined United States farm sales, and national income were acceptable by conventional criteria. Multiple correlation coefficients were low, net regression coefficients were not statistically significant, and the signs of many of the net regressions were the opposite of those which would logically be expected. Expression of variations in California farm sales as dependent upon farm prices and national income yielded better but still unacceptable results. Coefficients of multiple correlation were high but lower than the gross correlation of California farm sales and national income. Signs of the net sales-price regression coefficients were the reverse of those normally expected. Most net regression coefficients were not statistically significant.35/

There were no results which would be useful in measuring the net impact of changes in domestic sales upon domestic price nor in measuring the determinants of volume of export sales.

- -

34/ The gross correlation coefficients in the order indicated above are as follows: .626 and .630; .893; .926 and .925; .586; and .959.

35/ Factors affecting California price of rice, 1941-1952:

(62): 1941-1952: $X_3 = 1.598264 + \underset{(.623598)}{.000200\ X_4} + \underset{(.677220)}{.000088\ X_5} - \underset{(.339088)}{.003906\ X_6}$
$\bar{R} = .457$

(63): 1941-1952: $X_3 = 1.389619 + \underset{(1.090013)}{.000115\ X_2} - \underset{(.319470)}{.003450\ X_6}$
$\bar{R} = .540$

(64): 1941-1952: $X_3 = 2.828103 + \underset{(1.109014)}{.878346 \log X_2} - \underset{(.317041)}{.212105 \log X_6}$
$\bar{R} = .578$

(65): 1941-1952: $\log X_3 = -2.53231 + \underset{(.691315)}{.354488 \log X_4} + \underset{(.781150)}{.586529 \log X_5} - \underset{(.427095)}{.327337 \log X_6}$
$\bar{R} = .578$

Factors affecting California farm sales of rice, 1941-1952:

(66): 1941-1952: $X_4 = -1,115.346176 + \underset{(.141287)}{182.630435\ X_1} + \underset{(.131624)}{144.078448\ X_3} + \underset{(4.521140)}{25.486594\ X_6}$
$\bar{R} = .905$

(67): 1941-1952: $X_4 = -1,472.995841 + \underset{(.623598)}{232.451334\ X_3} + \underset{(.541573)}{.076762\ X_5} + \underset{(2.095810)}{21.090701\ X_6}$
$\bar{R} = .909$

(68): 1941-1952: $\log X_4 = .970005 + \underset{(.691315)}{.159022 \log X_3} + \underset{(.177412)}{.092375 \log X_5} + \underset{(2.520366)}{.976881 \log X_6}$
$\bar{R} = .922$

The symbols X_1 ... X_6 have the same meanings as in Table 21. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

[illegible] California sales, [illegible] were acceptable by conventional criteria. Multiple correlation coeffi- [illegible] and the signs of many of the net regressions were the opposite of those which [illegible] unacceptable results. Coefficients of multiple correlation were high but lower [illegible] of the net sales-price regression coefficients were the reverse of those nor- [illegible]

There were no results which would be useful in measuring the net impact of changes in domestic sales upon domestic price nor in measuring the determinants of volume of export sales.

- -

[illegible]/ The gross correlation coefficients in the order indicated above are as follows: .6?5 and .6??; .8??; .926 and .925; .586; and .5??.

[illegible]

(62): 1941-1952: $X_5 = 1.596261 + .000900 X_4 + .000098 X_5 - .003908 X_6$
(.921??) (.677220) (.339006)
$\bar{R} = .?57$

(63): 1941-1952: $X_5 = 1.389619 + .000115 X_2 - .003480 X_6$
(1.000113) (.339470)
$\bar{R} = .940$

(64): 1941-1952: $X_5 = 2.828103 + .578346 \log X_2 - .228165 \log X_6$
(1.109011) (.357041)
$\bar{R} = .548$

[illegible]

Factors affecting California farm sales of rice, 1941-1952:

[illegible]

$\bar{R} = .9??$

[illegible]

(65): 1941-1952: $\log X_1 = .270005 + .159?? \log X_? + .???? \log X_? + [illegible]$
[illegible]

The symbols $X_1 \ldots X_6$ have the same meanings as in Table 2. The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple [illegible]

1921-1952 Relationships: United States.--Variations in season average farm price, in domestic and territorial disappearance, in exports and imports, and in other related series were analyzed over the period 1921-1952, excluding the price-control years, 1942-1945 and 1951.36/ The major variables are shown in Table 21. Export data include both nonmilitary exports by the United States Department of Agriculture and procurement by the military for overseas use and relief exports after 1941. Territorial shipments also include United States Department of Agriculture operations after 1941. Other variables in Table 21 are the same as in prior tables.

Intercorrelations again rendered the price analysis difficult. United States average on-farm price was highly and positively correlated with most of the variables representing either the total annual United States supply of rough rice or its annual movement into the various distribution channels. Similarly, most of the supply and distribution variables were closely associated with variations in the adjusted index of nonagricultural income. Exports, domestic plus territorial sales, and total supply were highly and positively correlated. The gross correlation between annual imports and United States average farm price was negative, as would be expected. The gross relationship between imports and the index of per-capita production in ten Asiatic countries was also positive.37/ This is the expected magnitude for such a relationship since, the greater the index of foreign production in the rice bowl countries, the greater would be the expected importation into the United States. However, the gross relationships of the index of per-capita production in ten Asiatic countries were negative with the following United States variables: average farm price, income, exports, domestic disappearance, and total supply. This consistency in the magnitude of these gross relationships may be fortuitous.38/

The relationships among the determinants of variation in annual average on-farm price, per hundredweight, rough basis, are shown in Table 22. The net relationship between annual average price and the adjusted income index for each of the various supply factors is very much the same as that discovered for the two continuous decades 1921-1940. Elimination of the most grossly abnormal years yields workably stable measures of the net effect of the various price determinants.

It is indicated in equation 69 that the net impact of a change of 1,000,000 sacks in the combined disappearance in the continental United States and territorial shipments was a change in the opposite direction of 14.8 cents per sack in United States farm price. Both the regressions of price on income and price on the combined United States disappearance plus territorial shipments variable were significant statistically. The magnitude of the coefficient of the

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36/ While price control apparently held down prices during the Office of Price Stabilization years, control was not in effect for the entire 1952 crop.

37/ The method of constructing this index is indicated in Giannini Foundation Mimeographed Report No. 163.

38/ The following gross correlations were obtained, in which the subscripts have the same meanings as in Table 23: X_1X_3, .903; X_1X_8, .842; X_1X_{10}, .468; X_1X_2, .761; X_3X_8, .944; X_3X_{10}, .716; X_3X_2, .927; X_8X_{10}, .655; X_8X_2, .926; $X_{10}X_2$, .863; $X_{12}X_1$, -.363; $X_{12}X_{11}$, .445; $X_{11}X_1$, -.580; $X_{11}X_3$, -.662; $X_{11}X_8$, -.585; $X_{11}X_{10}$, -.775; and $X_{11}X_2$, -.731.

TABLE 21

United States Rice: Factors Affecting Prices, Sales, Exports, and Imports, Rough Basis, 1921-1952, Excluding 1942-1945 and 1951

Year	X_1 United States average annual on-farm price	X_2 United States total farm supply	X_3 Adjusted non-agricultural income index, 1935-1939 = 100	X_8 United States annual exports[a/]	X_{10} Annual United States continental disappearance plus annual territorial shipments	X_{11} Per-capita production, ten Asiatic countries	X_{12} Annual United States imports
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight		quintals	1,000 hundredweight
1921	2.18	12,583	82.7	6,522	12,226	1.621	1,192
1922	2.19	12,845	95.2	6,005	13,999	1.652	1,126
1923	2.49	10,458	102.9	3,690	14,488	1.447	619
1924	2.99	9,833	105.4	1,815	14,390	1.533	934
1925	3.30	10,502	113.4	780	14,544	1.512	2,136
1926	2.51	13,017	115.9	4,931	15,784	1.483	1,151
1927	2.02	13,915	116.7	5,018	16,891	1.453	715
1928	2.02	13,311	121.3	6,362	16,702	1.501	596
1929	2.22	11,802	119.4	4,690	16,082	1.437	506
1930	1.74	13,325	104.0	4,552	17,331	1.503	575
1931	1.08	13,661	82.8	4,450	16,430	1.447	332
1932	0.93	13,649	67.9	2,879	18,486	1.433	351
1933	1.73	12,227	76.2	1,635	14,902	1.447	682
1934	1.75	13,417	82.4	1,988	18,931	1.341	1,304
1935	1.60	12,665	94.5	1,369	18,760	1.310	947
1936	1.85	16,336	101.6	840	20,072	1.398	2,945
1937	1.46	17,943	101.5	5,024	22,317	1.427	1,723
1938	1.42	17,405	103.3	5,562	21,003	1.362	1,093
1939	1.62	17,934	111.0	4,936	21,937	1.326	788
1940	1.80	18,342	126.4	6,371	20,370	1.240	375

(Continued on next page.)

Table 21 continued.

Year	X_1	X_2	X_3	X_8	X_{10}	X_{11}	X_{12}
	United States average annual on-farm price	United States total farm supply	Adjusted non-agricultural income index, 1935-1939 = 100	United States annual exports[a]	Annual United States continental disappearance plus annual territorial shipments	Per-capita production, ten Asiatic countries	Annual United States imports
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight		quintals	1,000 hundredweight
1941	3.01	16,420	157.7	7,384	19,993	1.219	138
1942	3.61	19,180	203.1	7,998	20,239	1.221	147
1943	3.96	21,031	232.7	8,970	19,692	1.287	92
1944	3.93	22,424	251.3	14,030	18,284	1.168	6
1945	3.98	21,309	248.1	13,876	18,406	1.073	161
1946	5.00	22,778	265.3	13,938	18,550	1.157	58
1947	5.97	23,501	248.1	14,692	20,619	1.186	99
1948	4.88	25,345	265.3	14,184	23,113	1.218	73
1949	4.10	27,220	313.2	15,608	23,951	1.304	84
1950	5.09	27,167	355.9	15,239	25,856	1.217	724
1951	4.82	32,298	382.8	26,707	25,128	1.203	808
1952	6.05	33,948	412.9	26,861	25,708	1.241	360

[a] Include USDA nonmilitary and military procurement after 1941.

Table 11 continued.

TABLE 22

United States Rice: Variation in Annual Average On-Farm Price and Associated Variables, Rough Basis, 1921-1952, Excluding 1942-1945 and 1951

Equation number	Constant term	X_2	X_3	X_8	X_{10}	$\overline{R}$
		United States total farm supply	Index of adjusted United States nonagricultural income, 1935-1939 = 100	United States annual exports[a]	Annual United States continental disappearance and territorial shipments	
		1,000 hundredweight	per cent	1,000 hundredweight		
69	2.684406		.018551 (11.506196)		-.000148 (3.618531)	.933
70	1.559264	-.000132 (2.623839)	.022386 (6.797018)			.919
71	2.641497		.021018 (5.636152)	-.000039 (.735426)	-.000151 (3.634726)	.931
72	26.048950		.024704 (7.015271)	-.819907[b] (4.32075)	-5.604539[b] (7.399164)	.913

a/ Include USDA nonmilitary and military procurement after 1941.

b/ Logarithm.

multiple correlation indicates that United States average price could be predicted from known values of income and of domestic disappearance plus shipments with fair accuracy.

On the average over the years 1921-1952, excluding 1942-1945 and 1951, a change in total farm supply of 1,000,000 hundredweight, rough basis, was on the average associated with a change in farm price in the opposite direction of 13.2 cents per hundredweight, rough basis.39/ On the average, a change of one point in the adjusted index of income was associated with a change in the same direction in farm price of 2.24 cents per hundredweight, rough basis. For any year, the season average on-farm price, per hundredweight, rough basis, could have been estimated with considerable accuracy by multiplying the income index for that year by .022386, multiplying the farm supply figure for that year in thousand hundredweights by -.000132, and adding the sum of these products to $1.559264.

The explanation of variation in annual average price was not improved by introduction of exports in natural numbers.40/ Expression of continental disappearance plus territorial shipments and of exports in logarithms does not improve the accuracy of estimate of price but does yield statistically significant regression coefficients.41/

On the average over the years 1921-1952, a change of 100 points in the adjusted income index--with no change in any other determinant of price--was associated with a change in the same direction in the average annual on-farm price of rice, rough basis, of about $2.25-$2.50 per sack. Similarly, with no change in the index of purchasing power, an increase of 1,000,000 sacks in domestic disappearance plus territorial sales brought a decrease in farm price of about 15 cents per hundredweight. Price variation over this three-decade era can be explained adequately in terms of two variables: (1) the adjusted index of nonagricultural income and (2) the combined magnitude of the annual continental disappearance plus territorial shipments.42/

The relationship of changes in the combined magnitude of continental disappearance plus territorial shipments to other variables is shown in Table 23. With no change in any other determinant of the domestic disappearance and territorial sales, a change of one dollar in the average annual United States on-farm price was associated with an average change in the opposite direction of about 2,400,000 sacks of rice. Similarly, with no change in the price of rice, a change of one point in the index of buying power was associated on the average with a change in sales (domestic disappearance plus territorial shipments) in the same direction of about 60-70,000 sacks of rice.

Over the three-decade period, acceptable analyses of both price and aggregate utilization in continental and territorial outlets can be obtained. In both cases, variation in income is a major determinant. Little gain is obtained by introducing into the analysis variables other than disappearance plus shipments, price, and income.

39/ See equation 70, Table 22.

40/ See equation 71, Table 22.

41/ See equation 72, Table 22.

42/ The net relationship of price to the latter variable appears to be best expressed by a semilogarithmic function. However, improvement of the fit is not sufficient to justify use of this expression in an industry report.

multiple [illegible] that United States average price could be predicted from known values of income and of domestic disappearance plus shipments with fair accuracy.

[illegible] a change of one point [illegible] For any year, [illegible]

[illegible]

[illegible] disappearance plus territorial sales brought a decrease [illegible] of about [illegible] cents per hundredweight. [illegible]

[illegible] no change in [illegible] and territorial sales, [illegible]

Over the [illegible] period, acceptable analyses of both price and aggregate [illegible] and territorial outlets can be obtained. In [illegible] cases, variation in [illegible] by introducing into the analysis [illegible] shipments, prices, and income.

39/ See equation 70, Table 22.

40/ See equation 71, Table 22.

41/ See equation [illegible], Table 22.

42/ The [illegible] of price [illegible] the latter variable [illegible] However, improvement of the fit is not sufficient to justify use of this expression in an industry report.

TABLE 23

United States Rice: Variation in Annual Continental Disappearance, Plus Territorial Shipments, and Associated Variables, Rough Basis, 1921-1952, Excluding 1942-1945 and 1951

Equation number	Constant term	X_1	X_3	X_8	X_{11}	$\bar{R}$
		United States average annual on-farm price	Index of adjusted United States nonagricultural income, 1935-1939 = 100	United States annual exports[a]	Per-capita production, ten Asiatic countries	
		dollars per hundredweight	per cent	1,000 hundredweight	quintals	
73	15,735.146643	-2,378.095061 (3.618531)	62.328279 (5.956014)			.811
74	15,387.588576	-2,413.952339 (3.634726)	73.006662 (4.235020)	-.166397 (.783249)		.808
75	37,059.802888		13.819456 (.891540)	.005796 (.026268)	-14,815.875372 (3.334943)	.795
76	37,020.806070	-2,255.871282 (4.547525)	47.381632 (5.515572)		-13,983.890000 (4.388320)	.898
77	47,486.680509		68.747636 (.176136)		-20,952.126288 (4.800423)	.754

a/ Include USDA nonmilitary and military procurement after 1941.

There is no conclusive evidence of any trend in level of demand. Deviations of estimated prices from actual prices fall within a narrow range from 1921 through 1935. Deviations are much greater over the years 1937-1947. If the years 1940-1946 were omitted from the analysis, there would be some indication of an upward drift in the level of domestic-territorial demand calculated from the price-dependent equations. Similarly, deviations between the estimated sales, as calculated from the equations, and the actual annual sales widen sharply after 1936. If the data for 1940-1947 were eliminated from the analysis, there would be evidence of a rising trend in demand.

Current Price-Quantity Relationships.--The demand for rice in the 1952-53 season could be expressed as--1952-53: $X_1 = \$9.90 - \$0.15\ X_2$--where X_1 is the average annual United States on-farm price in dollars, per hundredweight, rough basis, and X_2 is the aggregate annual sales in million hundredweights, rough basis, made in continental and territorial outlets.43/ This function is plotted as D_{52-53} in Figure 23. If the same relationships among price, sales, and income prevail in 1954, the level of demand could be projected to that year by assuming the probable level of the income index. If the level of nonagricultural income were to fall by 5 per cent, or by 20 index points, the demand for rice could be expressed as follows: $X_1 = \$9.40 - \$0.15\ X_2$. This demand is shown in Figure 21 as D'.

The farm prices for alternative amounts used in domestic-territorial outlets under 1952-53 demand conditions and prices which would have been yielded for alternative quantities, assuming a 5 per cent lower national income, are as follows:

TABLE 24

United States Rice: Average Annual On-Farm Prices, Rough Basis, at Alternative Volumes of Sale in Domestic and Territorial Markets under 1952-53 Demand Conditions and with 5 Per Cent Lower National Income.

Sales in domestic and territorial markets	Average annual farm price, 1952-53 demand	Average annual farm price, 5 per cent lower national income
1,000,000 hundredweight	dollars per hundredweight	
10	8.40	7.90
15	7.65	7.15
20	6.90	6.40
25	6.15	5.35
30	5.40	4.90
35	4.65	4.15
40	3.90	3.40
45	3.15	2.65
50	2.40	1.90
55	1.65	1.15
60	0.90	0.40

43/ This function was obtained by passing $b_{12} = -0.15$ through the 1952-53 coordinate of 25,700,000 sacks and $6.05.

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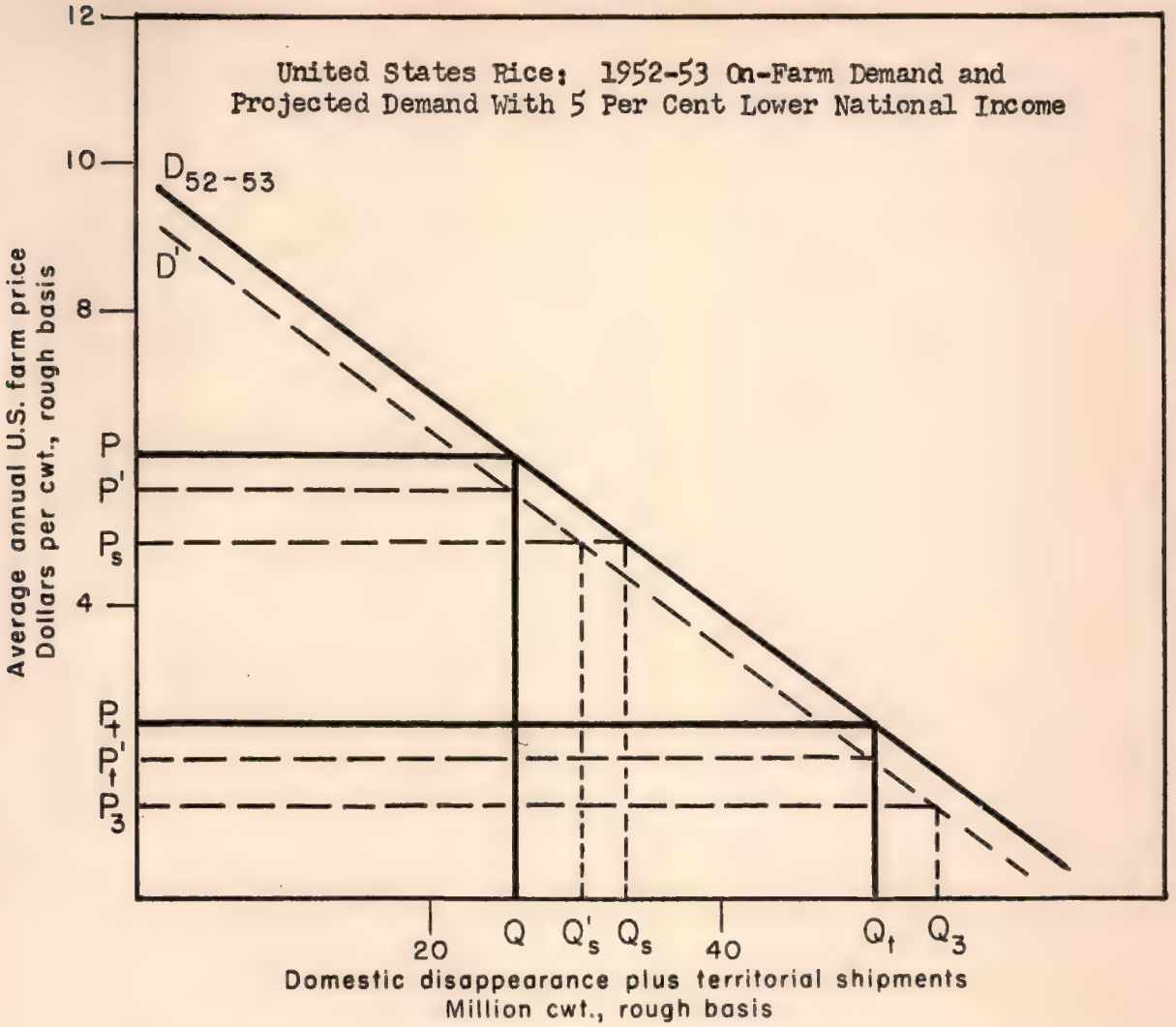
FIGURE 23



Q: 1952-53 domestic-territorial disappearance, 25,700,000 sacks.
P: 1952-53 average annual farm price, $6.05.
P': Average annual farm price of 25,700,000 sacks used in domestic-territorial outlets with 5 per cent lower income, $5.55.
Q_t: 1952-53 total supply, 50,300,000 sacks.
P_t: Price of 50,300,000 sacks used in domestic-territorial outlets, $2.36.
P_t': Price of 50,300,000 sacks used in domestic-territorial outlets with 5 per cent lower income, $1.86.
Q_3: Estimated 1953-54 total supply, 54,600,000 sacks.
P_3: Price of 54,600,000 sacks used in domestic-territorial outlets with 5 per cent lower national income, $1.22.

Thus, had 20,000,000 sacks been used in domestic-territorial outlets in 1952-53, the price would have been about $6.90. With a 5 per cent lower national income, the price for 20,000,000 sacks would have been $6.40. With 40,000,000 sacks on the domestic-territorial market in 1952-53, the price would have fallen to $3.90; with 50,000,000, to $2.40.

In 1952-53, approximately 25,700,000 sacks, rough basis, were used in combined domestic and territorial markets at an average farm price of $6.05. This is shown by the coordinate Q,P in Figure 23. Assuming a 5-per cent decrease in the adjusted index of nonagricultural income, the same quantity would have yielded an average farm price of $5.55. This is shown by the coordinate Q,P' in Figure 21.

If the export outlet had been snuffed out completely in 1952-53, it would have been necessary to move the total supply of 50,292,000 sacks, or approximately 24,600,000 sacks more than was actually used in the domestic-territorial market. The price would have fallen to about $2.36 per sack. Under the assumption of a 5-per cent lower national income, the farm price would have dropped to about $1.86. These adjustments are indicated in Figure 21 by the coordinates Q_tP_t and Q_tP_t'.

Under the assumed conditions of a 5-per cent decrease in the income index--which may be a reasonable assumption for 1953-54 demand--forced sale on the combined domestic-territorial market of 62,660,000 sacks would reduce the farm price to zero. This is approximately the magnitude of total supply which would now require the promulgation of marketing quotas. The estimate of the United States Department of Agriculture at the end of December, 1953 was a supply of 54,556,000 sacks in the 1953-54 year.44/

Disposition of the entire supply of 54,600,000 sacks on the United States markets would, therefore, reduce the price to about $1.22 per sack in the absence of support-price legislation and assuming 5-per cent lower national income. This is shown by Q_3P_3 in Figure 21. Such heavy decreases in prices probably will not occur since complete loss of export outlets is most doubtful. However, if domestic-territorial utilization were to increase by 10,000,000 sacks with the assumed lower demand, the average annual farm price would fall to about $4.04 per sack, rough basis.

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44/ In the Federal Register, Volume 19, Number 1, Page 5, of January 1, 1954, the Secretary of Agriculture determined the total supply of rice for the marketing year beginning August 1, 1953 to be 54,556,000 100-pound bags. The "normal supply" was determined to be 56,918,000 bags. Since the total supply is smaller than the normal supply, marketing quotas shall not be in effect on the 1954 crop of rice. The Secretary may dispense with quotas or acreage allotments if found necessary to meet an increase in export demand, among other things. The Secretary has determined that "there is a materially increased export demand for rice." Therefore, to meet the increased demand and to effectuate the declared policy of the Agricultural Adjustment Act of 1938, the Secretary has dispensed with acreage allotments for the 1954 crop of rice. The "supply percentage" is the ratio of total supply to "normal supply." For rice in 1953-54, the Secretary has found this ratio to be .9585. With the sliding scale of price supports in the Agricultural Act of 1949, 90 per cent of parity is the minimum support-price level so long as the supply percentage does not exceed 1.02.

Most important, if world price reflected on the United States farm were to fall as low as $2.10, the United States farm price would follow it down since supplies would be so allocated as to equalize export and domestic prices. Sale of the total supply of 54,600,000 with 1952-53 demand would yield a farm price of $2.11. With a 5-per cent lower demand, farm price would be $1.61. (This assumes for the moment that support prices would not catch hold.)

Current Support Price.--However, the government is committed to mandatory 90 per cent of parity support prices for 1954, or a reflected farm price of approximately $4.81. But, at $4.81, only about 33,930,000 sacks could be sold in the combined continental-territorial markets under 1952-53 demand conditions. This is shown by Q_s, P_s in Figure 23. Thus, if world prices, as reflected on farm, were to fall below the support-price level, it would be expected that approximately 20,700,000 sacks of rice--or the difference between a total supply of 54,600,000 and domestic-territorial sales of 33,900,000 sacks at an average farm price of $4.81--would go into storage. This would assure the necessity to proclaim quotas. With a 5-per cent lower national income, domestic-territorial sales at a farm price of $4.81 would be 30,600,000 sacks. About 24,000,000 sacks would go into government storage.45/

The estimate of 24,000,000 sacks is exaggerated in two respects. First, farm price may actually fall considerably below announced support levels under conditions of surplus and, therefore, domestic consumption would be somewhat larger than were the support prices actually made effective at the announced level. Second, there are probably some producers who could not or would not put rice of specified types under support at any time. However, with present production, stocks need increase only by about 8,000,000 hundredweight, rough basis, in order to exceed the percentage of normal supply at which quotas are announced. Two contingencies might easily lead to that result: (1) a substantial fall in world prices, or (2) loss of the abnormally financed outlets to which United States production has gone in recent years.

Unquestionably, there would still be exports of lower grades and of specialty items so long as the world price for them, reflected at the United States farm level, exceeded the support price minus the differential for the grade or location. However, a relatively small fall in the world price would involve accumulation of extremely heavy stocks and, therefore, almost assure the imposition of controls.

Since all evidence indicates that on-farm demands are inelastic, the short-run aggregate returns to producers would be higher with accumulation of support stocks than by sale in the world market at a price lower than the support level. It is, therefore, almost certain that the support route would be taken if world prices were to sag sufficiently to lower domestic prices at the farm level by 60 cents or more below the present estimated farm price of about $5.35 per hundredweight, rough basis.

There is some evidence that domestic-territorial demands have sagged about to the extent indicated by a 5-per cent decline in national income. However, there is indication that the export market has softened but has not broken

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45/ Domestic-territorial sales with 1952-53 demand at $4.81 are shown by Q_s in Figure 21; domestic-territorial sales at $4.81 with a 5-per cent lower national income are shown by Q_s'.

Most important, if world price reflected on the United States farm were to fall as low as $2.10, the United States farm price would [illegible] since [illegible]

[illegible]

Current [illegible] [illegible] This is shown by Q_5, P_5 in Figure 23. Thus, if world price, [illegible] [illegible] average farm price of $4.81--would go into storage. This would assure the [illegible]

[illegible] surplus and, therefore, domestic consumption would be somewhat [illegible] announced. Two contingencies might easily lead to that result: (1) a substantial fall in world prices, or (2) [illegible] which United States production has gone in recent years.

[illegible] States farm level, exceeded the support price minus the differential for the grade or location. However, a relatively small fall in the world price would involve accumulation of extremely heavy stocks and, therefore, almost assure the imposition of controls.

[illegible] are inelastic, the short-run aggregate returns to producers would be [illegible] stocks than by sale in the world market at a [illegible] It is, therefore, almost certain that [illegible] were to sag sufficiently to lower domestic prices at the farm level [illegible] hundredweight, rough basis.

[illegible]

[illegible] 1952-53 demand at $4.81 are shown by Q_5 [illegible]

for the moment. Exports of milled rice from the United States for August-November, 1953 were 5,500,000 hundredweight as compared with 4,800,000 in the same months of 1952. A little more than half the 1953 exports have been made to Cuba. That nation with Japan and Korea account for a little more than 5,000,000 hundredweight, milled basis, in August-November, 1953. Exports to Cuba at 3,400,000 hundredweight, milled basis, as of January 21, 1954, are about one third above last season.

Availability of loans or purchase agreements terminated on February 1, 1954. Loans mature on April 30, 1954 or earlier on demand. Intention to deliver under purchase agreements must be filed within a thirty-day period ending April 30, 1954. Rough rice of any class other than "mixed rough rice" grading United States No. 5 Rough Rice or better is eligible. Special grades are not eligible. Thus, only rough rice actually in storage or under agreement on January 31, 1954 will be supported during the remainder of the crop year. Milled prices and prices for rough rice not under support may sag in response to market conditions.

Factors Affecting United States Annual Imports

Statistical analysis of variation in annual imports of milled rice is satisfactory only for the years 1921-1940.[46] In the last dozen years, both importation and exportation have been under stringent unilateral and international controls. By the mid-thirties, direct intervention by government into foreign trade had begun to appear. Relationships adduced in the import analysis in some measure reflect such intervention.

Variation in annual imports was related to the following variables: total annual farm supply, average annual California milled price, per-capita production in ten Asiatic countries, and the adjusted index of nonagricultural income.[47] These data are shown in Table 25. California milled price per 100 pounds, No. 2 or Fancy California Pearl, basis San Francisco docks, was used since this series alone was continuously available. Milled prices are probably more closely related to import volume than rough prices.

Results are shown in Table 26. One of the major determinants of the magnitude of imports was the level of California average annual milled price. The higher such price, the greater was the magnitude of imports. In the six equations in which California price, per hundredweight, milled basis, was one of the determinants related to annual imports, the t-ratios indicate high-order levels of statistical significance. In general, statistically significant net regressions of imports upon total annual supply were not obtained. In general, the net regressions of United States imports upon the volume of per-capita production in ten major rice-producing nations of Asia were statistically significant.

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46/ Equation 85 in Table 27 indicates the extremely low coefficients of multiple correlation and the low t-ratios of the regression coefficients when the analysis is extended to years since World War II.

47/ Methods of calculating per-capita annual production are shown in Giannini Foundation Mimeographed Report No. 163.

[illegible] November, 1953, were 5,500,000 hundredweight as compared with 4,500,000 in the [illegible] 5,000,000 hundredweight, milled basis, in August-November, 1953. Exports to Cuba at 3,450,000 hundredweight, milled basis, as of January 21, 1954, are about one third above last season.

[illegible] 1954. Loans mature on April 30, 1954 or earlier on demand. Intention to deliver under purchase agreements must be filed within a thirty-day period ending April 30, 1954. Rough rice of any class other than "mixed rough rice" [illegible] are not eligible. Thus, only rough rice actually in storage or under agreement on January 31, 1954 will be supported during the remainder of the crop year. [illegible] to market conditions.

[illegible]

[illegible] importation and exportation have been under stringent unilateral and inter- [illegible]

Variation in annual imports was related to the following variables: [illegible] production in ten Asiatic countries, and the adjusted index of nonagricultural income.[illegible] These data are shown in Table 25. California milled price per 100 pounds, No. 2 or Fancy California Pearl, basis San Francisco docks, was used since this series alone was continuously available. Milled prices are probably more closely related to import volume than rough prices.

Results are shown in Table 26. One of the major determinants of the magnitude of imports was the level of California average annual milled price. The higher such price, the greater was the magnitude of imports. In the six [illegible] levels of [illegible] In general, statistically significant net [illegible] supply were not obtained. In general, [illegible] imports upon the volume of per-capita [illegible]

[illegible] multiple correlation and the low t-ratios of the regression coefficients when the analysis is extended to years since World War II.

[illegible]

TABLE 25

United States Rice: Factors Affecting United States Imports, Rough Basis, 1921-1939

Year	X_1	X_2	X_3	X_4	X_5
	United States annual imports[a/]	United States total annual farm supply	California average annual price, milled basis	Per-capita production, ten Asiatic countries	Adjusted index of nonagricultural income, 1935-1939 = 100
	1,000 hundredweight		dollars per hundredweight	kilograms	per cent
1921	1,175	19,114	4.72	162.1	82.7
1922	1,067	19,641	4.75	165.2	95.2
1923	587	16,258	5.23	144.7	102.9
1924	815	15,008	6.64	153.3	105.4
1925	1,853	15,001	7.35	151.2	113.4
1926	1,025	20,153	5.70	148.3	115.9
1927	624	21,769	4.90	145.3	116.7
1928	502	21,083	3.83	150.1	121.3
1929	421	18,574	4.23	143.7	119.4
1930	510	20,972	3.77	150.3	104.0
1931	303	21,562	3.01	144.7	82.8
1932	310	21,609	2.34	143.3	67.9
1933	287	19,062	2.66	144.7	76.2
1934	558	20,436	3.84	134.1	82.4
1935	230	18,637	4.40	131.0	94.5
1936	431	23,779	4.14	139.8	101.6
1937	193	26,648	3.54	142.7	101.5
1938	170	26,017	3.12	136.2	103.3
1939	138	28,027	3.61	132.6	111.0

a/ Exclude Patna, flour, meal, polish, and brewers' rice.

TABLE 26

United States Rice: Variations in Annual Imports and Associated Variables, Rough Basis, 1921-1939

Equation number	Constant term	X_2	X_3	X_4	X_5	$\bar{R}$
		United States total annual farm supply	California average annual price, milled basis	Per-capita production, ten Asiatic countries	Adjusted index of nonagricultural income, 1935-1939 = 100	
		1,000 hundredweight	dollars per hundredweight	kilograms	per cent	
76	240.773939	-29.680290 (1.531311)	222.034270 (3.688300)			.804
77	-1,542.549169	-43.038933 (2.006274)		20.880368 (2.484218)		.730
78	-2,989.438043	- 4.190395 (.240333)	210.488071 (4.347262)	18.991592 (3.228528)		.879
79	-2,799.276335	12.156373 (.603588)	281.150110 (4.204203)	17.518648 (3.039581)	-6.169683 (1.476971)	.888
80	-1,635.007380	-77.695842 (3.868258)			5.612424 (1.154878)	.640
81	-3,195.760676		216.452040 (5.356725)	19.631685 (3.851301)		.886
82	-2,424.188865		253.205175 (5.354673)	16,553235 (3.050712)	-4.784105 (1.398895)	.892
83	67.590897		329.520149 (6.730344)		-9.015456 (2.363743)	.835
84	-4,590.600541			31.923518 (4.276834)	5.390584 (1.169476)	.682
85[a/]	-1.456.892188	-71.192038 (.715634)		1,768.250596 (1.589595)		.386

a/ 1921-1952, excluding 1942-1945 and 1951.

Equation 81 in Table 26 indicates that, on the average over the years 1921-1939, a change of $1.00 per hundredweight in the milled price of rice, farm level, was associated with a change in the same direction of about 216,000 sacks in the importation of rice. A net change of one unit in per-capita production in ten Asiatic countries was associated on the average with a change in the same direction of about 19,632 sacks of rice in annual United States imports.

Fairly high-level relationships appeared between imports and other determinants. However, the average annual California milled price and a measure of per-capita output in the rice bowl countries gives the best basis by which the volume of imports into the United States under relatively free market conditions could be estimated.

Factors Affecting Territorial Shipments

Territorial shipments should properly be amalgamated with United States continental disappearance. However, tests were made to determine whether variation in shipments to territories bore any systematic relationship to the other major determinants analyzed in other parts of the study. Basic data are assembled in Table 27. Little stability appeared in the analysis of shipments over the period 1921-1952. Somewhat better results were obtained in analysis of the years 1921-1940. Gross correlations among the major variables were not excessively high in those years. In general, the signs of intercorrelations were much as would be expected.[48]

None of the equations explaining variation in the magnitude of territorial sales provide statistically acceptable analysis of such variation. In consequence, throughout most of the analysis, territorial shipments are combined with domestic disappearance. In fact, these appear to be two components of a single variable.

There was little interrelationship between territorial shipments from California and those from the southern states or between California shipments and the United States supply minus territorial shipments from all United States producing areas. The relationship between California and southern territorial shipments was fairly high and negative. Similarly, the relationship of southern shipments to total United States supply minus all shipments was negative.[49] Where X_1, X_2, and X_3 have the meanings indicated in footnote [49] below, the following equation expresses the dependence of territorial shipments of California rice upon southern territorial shipments and upon United States supply minus all shipments. Both regression coefficients are statistically significant.

(96): 1921-1940: $X_1 = 1{,}554.630519 + \underset{(4.631712)}{.839128}\ X_2 - \underset{(3.097139)}{.044826}\ X_3$

$\bar{R} = .796$

The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of multiple correlation.

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[48] The following gross correlation coefficients were obtained: X_1X_9, -.756; X_2X_9, .474; X_3X_9, -.266; X_6X_9, .599; and X_8X_9, -.155. The symbols X with subscripts have the same meanings as in Table 28.

[49] Where X_1 = California shipments, X_2 = southern shipments, and X_3 = United States supply minus all shipments, the following gross relationships were obtained: X_1X_2, -.736; X_1X_3, .630; and X_2X_3, -.439.

Equation 81 in Table 26 indicates that, on the average over the years 1921-1939, a change of $1.00 per hundredweight in the milled price of rice, farm [illegible] in ten Asiatic countries was associated on the average with a change in the same direction of about 19,032 sacks of rice in annual United States imports.

Fairly high-level relationships appeared between imports and other determinants. However, the average annual California milled price and a measure of per-capita output in the rice bowl countries gives the best basis by which the [illegible] could be estimated.

[illegible]

[illegible] continental disappearance. However, tests were made to determine whether [illegible] major determinants analyzed in other parts of the study. Basic data are assembled in Table 27. Little stability appeared in the analysis of shipments over the period 1921-1952. Somewhat better results were obtained in analysis of the [illegible] sively high in those years. [illegible] much as would be expected.[18]

[illegible] with domestic disappearance. [illegible] single variable.

There was little interrelationship between territorial shipments from California and those from the southern states or between California shipments and [illegible] the rice upon southern territorial shipments and upon United States supply minus [illegible]. Both regression coefficients are statistically significant.

[illegible]

The numbers in parentheses are t-ratios. The symbol $\bar{R}$ is the coefficient of [illegible]

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[18] [illegible] X_1X_3, .599, and X_2X_3, -.155. The symbols X [illegible] as in Table 26.

[19] [illegible] the following cross relationships were [illegible] .630, and X_2X_3, -.139.

TABLE 27

United States Rice: Variations in Annual Shipments to United States Territories, Rough Basis, 1921-1952

Year	X_1 United States average annual farm price	X_2 United States annual total supply	X_3 Adjusted index of nonagricultural income 1935-1939 = 100	X_6 United States domestic disappearance	X_8 United States annual exports	X_9 United States annual territorial shipments
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight		
1921	2.18	12,583	82.7	8,795	6,522	3,231
1922	2.19	12,845	95.2	10,269	6,005	3,730
1923	2.49	10,458	102.9	10,396	3,690	4,092
1924	2.99	9,833	105.4	10,722	1,815	3,668
1925	3.30	10,502	113.4	10,922	780	3,622
1926	2.51	15,017	115.9	11,850	4,931	5,934
1927	2.02	13,915	116.7	12,759	5,018	4,132
1928	2.02	13,311	121.3	12,144	6,362	4,558
1929	2.22	11,802	119.4	11,428	4,690	4,654
1930	1.74	13,325	104.0	12,442	4,552	4,889
1931	1.08	13,661	82.8	11,508	4,450	4,922
1932	0.93	15,649	67.9	13,027	2,879	5,459
1933	1.73	12,227	76.2	10,136	1,635	4,766
1934	1.75	15,417	82.4	13,909	1,988	5,022
1935	1.60	12,665	94.5	13,876	1,369	4,884
1936	1.85	16,336	101.6	15,313	840	4,759
1937	1.46	17,945	101.5	16,869	5,024	5,448
1938	1.42	17,405	103.3	16,485	5,562	4,518
1939	1.62	17,934	111.0	16,332	4,936	5,605
1940	1.80	18,342	126.4	16,316	6,371	4,054

(Continued on next page.)

Table 27 continued.

Year	X_1 United States average annual farm price	X_2 United States annual total supply	X_3 Adjusted index of nonagricultural income 1935-1939 = 100	X_6 United States domestic disappearance	X_8 United States annual exports	X_9 United States annual territorial shipments
	dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight		
1941	3.01	16,420	157.7	a/	7,384	
1942	3.61	19,180	203.1		7,998	
1943	3.96	21,031	232.7		8,970	
1944	3.93	22,424	251.3		14,030	
1945	3.98	21,309	248.1		13,876	
1946	5.00	22,778	265.3		13,938	
1947	5.97	23,501	248.1		14,692	
1948	4.88	25,345	265.3		14,184	
1949	4.10	27,220	313.2		15,608	
1950	5.09	27,167	355.9		15,239	
1951	4.82	32,298	382.8		26,707	
1952	6.05	33,948	412.9		26,861	

a/ Blanks indicate data not available.

a/ Blanks indicate data not available.

TABLE 28

United States Rice: Variation in Annual Shipments to Territories, Rough Basis, 1921-1952, Excluding 1942-1945 and 1951

Equation number	Constant term	X_1	X_2	X_3	X_6	X_8	$\bar{R}$
		United States annual average farm price	United States annual total supply	Index of United States nonagricultural income, 1935-1939 = 100	United States continental disappearance	United States exports[a]	
		dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight		
86	5,909.302723	-831.059107 (3.733439)	.009265 (.283424)				.724
87	5,817.839863	-810.939010 (4.118556)	.034011 (1.108852)			-.124377 (2.401431)	.793
88	5,614.264017	-1,069.589697 (3.431187)		12.231959 (1.170289)	.024662 (.398560)	-.148667 (2.490113)	.825
89	4,822.954603	-698.539674 (3.608699)			.080866 (1.744538)		.771
90	5,393.181102	-767.187949 (4.346246)			.078721 (1.890229)	-.103103 (2.252094)	.820
91	6,729.135315	-932.969428 (5.675966)				-.105082 (2.139706)	
92	4,010.713844		.090955 (2.722826)	-15.021304 (1.834789)			.697
93	3,863.484312			-18.408848 (2.638743)	.195485 (4.211470)		.701
94	3,863.391612			-17.481970 (2.309192)	.195285 (4.09329)	-.022967 (.376636)	.682
95	6,184.779106	-867.572805 (4.906202)					

a/ Include U.S. Department of Agriculture and military after 1941.

Factors Affecting Exports

Interwar Relationships.--Analysis of variation in annual United States exports over the two periods 1921-1930 and 1931-1940 is summarized in Table 30.

In the first of the two decades, variation in annual exports was fairly closely related to variations in annual average farm price and to total farm supply. Other factors apparently bore relatively little relationship to exports. There were few gross intercorrelations of disturbing magnitude in the first decade.50/

Data for 1931-1940 reflect the disturbances of foreign trade due to exchange controls antecedent to the second world war. None of the relationships shown in Table 30 provide adequate analysis for variation in exports in the single decade 1931-1940. The gross relationships which prevailed among the variables in that decade differed considerably from the relationships prevailing in the first of the two decades.51/

More stable relationships prevailed over the two decades 1921-1940 as a whole. These are shown in Table 31. Over the two decades as a whole, variations in per-capita production in the ten Asiatic nations were fairly closely related to American export volume. With no change in any other determinant of United States exports, an increase of one kilogram in average annual per-capita production in ten Asiatic nations was associated with an increase of about 140,000 sacks in United States exports. It would be assumed that a decrease in Asiatic per-capita production would reduce competition with United States exports in competitive markets. However, the reverse situation seems to have prevailed. Exports were significantly and negatively related to variations in United States average farm price. Equations 108-110 indicate roughly the net impact of a change in price of $1.00 upon total exports with no changes in any of the other determinants of export variation. On the average, with no change in any other determinant of export volume, a shift of $1.00 per sack, rough basis, in the farm price was associated with a change in exports in the opposite direction of from 3,200,000-3,800,000 sacks. On the average, with no change in any other determinant of exports, a shift of one point in national income in the United States appears to have been associated with a change in the same direction of about 100-120,000 sacks in exports.

Cross correlations were relatively low for the two-decade period 1921-1940.52/

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50/ Where the subscripts have the same meanings as in Table 27, the following gross correlations for the years 1921-1930 were discovered: X_1X_8, -.836; X_1X_{10}, -.416; X_2X_3, .134; X_2X_8, .794; X_3X_{10}, .780; X_3X_8, -.218; and X_8X_{10}, .043.

51/ Where the subscripts have the same meanings as in Table 27, the following intercorrelations were obtained: X_1X_8, -.216; X_1X_{10}, .178; X_2X_3, .819; X_2X_8, .685; X_3X_8, .581; X_3X_{10}, .699; and X_8X_{10}, .492.

52/ Where the subscripts have the same meanings as in Table 27, the following gross intercorrelations were found: X_1X_8, -.185; X_2X_8, .376; X_3X_8, .352; and X_8X_{10}, .026.

Factors Affecting Exports

In the first of the two decades, variation in annual exports was fairly closely related to variations in annual average farm price and to total farm supply. Other factors apparently bore relatively little relationship to exports. There were few gross interventions of the trading mechanism in the first decade.[1]

During the 1931-1940 period the disturbance of foreign trade due to economic warfare [illegible] the ten Australia nations were fairly closely [illegible] in any other determinant of [illegible] in ten Australia nations one was associated with an increase of about [illegible] the diagram in average annual per-capita [illegible] over the ten-year period. However, the reverse situation seems to have [illegible] exports were significantly and negatively related to variations in [illegible] Eleven countries [illegible] Australia [illegible] with dimension of 1 or 3,000,000-3,000,000 bales. On the average, with no [illegible] in any other determinant of exports, a shift of one unit in national income in the United States appears to have been associated with a change in the same direction of about 100,000 bales in exports.

These correlations were relatively low for the two-decade period [illegible]

TABLE 29

United States Rice: Variations in Annual Exports and Associated Variables, Rough Basis, 1921-1930 and 1931-1940

Equation number	Years	Constant term	X_1 United States average annual on-farm price	X_2 United States total supply	X_3 Index of adjusted United States nonagricultural income, 1935-1939 = 100	X_{10} United States continental disappearance and territorial shipments	$\bar{R}$
			dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight	
97	1921-1930	8,088.252393			-33.909856 (.632861)		-.218[a]
98	1921-1930	-8,580.953325		.662874 (3.696001)			.794[a]
99	1921-1930	-3,779.098929		.699738 (4.293291)	-51.311969 (1.692136)		.814
100	1921-1930	20,265.147554	-3,941.723637 (5.486638)			-.427132 (2.046204)	.871
101	1921-1930	5,599.863532			-99.817361 (1.163816)	.629674 (.985294)	.000
102	1931-1940	-5,151.306072		.353371			.685[a]
103	1931-1940	-4,205.614771			52.318125 (1.090243)	.142507 (.394877)	.408
104	1931-1940	-2,140.482915	-2,258.101202 (1.140937)			.470334 (1.804790)	.422
105	1931-1940	-5,171.880421		.327851 (1.325198)	6.814590[b] (.125921)		.565

[a] r.
[b] Logarithm.

TABLE 30

United States Rice: Variations in Annual Exports and Associated Variables, Rough Basis, 1921-1940

Equation number	Constant term	X_1	X_2	X_3	X_{10}	X_{11}	$\bar{R}$
		United States average annual on-farm price	United States total supply	Index of adjusted United States nonagricultural income, 1935-1939 = 100	United States continental disappearance and territorial shipments	Per-capita production, ten Asiatic nations	
		dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight	kilograms	
106	-24,442.831320	-2,575.496485 (2.576316)	.106480 (.847950)	93.775068 (3.188802)		149.494126 (3.752997)	.720
107	245.888786	-1,478.065310 (1.867149)		65.200279 (2.288428)			.418
108	8,623.784154	-3,786.371580 (3.674641)		119.080208 (3.958931)	-.540887 (2.915342)		.654
109	-21,580.743017	-3,131.519088 (4.186965)		107.405925 (4.400486)		143.878726 (3.695587)	.726
110	-12,145.178286	-3,809.292945 (4.129212)		122.316857 (4.535739)	-.255938 (1.220694)	107.815907 (2.227154)	.736

TABLE 31

United States Rice: Variations in Annual Exports and Associated Variables, Rough Basis, 1941-1952

Equation number	Constant term	X_1	X_{10}	X_{12}	$\bar{F}$
		United States average annual on-farm price	United States continental disappearance plus territorial shipments	Military and United States relief shipments	
		dollars per hundredweight	1,000 hundredweight		
111	-35,523.513229	393.837336 (.404329)	1.907868 (6.480500)	.678610 (2.233245)	.928
112	-26,842.226984	977.777153 (1.050279)	1.523287 (5.197164)		.892

United States Steel Variations in Annual

1941-1952 Relationships.--High coefficients of multiple correlation between exports and other variables were obtained for the period 1941-1952. These are almost entirely attributable to the high intercorrelation between the income index and nearly all other variables. The regression of exports upon major determinants is shown in Table 31. Despite the high coefficients of multiple correlation, no satisfactory explanation could be obtained. Intercorrelations in the period 1941-1952 were high.[53] The annual volume of exports for the years 1941-1952 was closely related to the magnitude of total supply but bore little relationship to territorial shipments.[54]

1921-1952 Relationships.--Explanations of variation in total exports were developed for the period 1921-1952, excluding the control years 1942-1945 and 1951. These relationships are shown in Table 32. Over this long period, the volume of exports was closely related to the level of domestic purchasing power. It would, however, be expected that in years of low purchasing power prices would be low and exports relatively high. In fact, the opposite situation seems to have prevailed. The relationship of exports to total supply appears significant. Equation 118 provides what appears to be the best explanation of long-run variation in annual exports of rice from the United States. This equation indicates that, on the average over the years 1921-1952, a change in total supply of 1,000 units was associated with the change in exports of about half that amount--with no change in any other determinant of exports. The relationship between the index of nonagricultural income and the per-capita production of Asiatic countries was also positive. A high coefficient of multiple correlation indicates that, on the average, the magnitude of annual exports could be predicted fairly closely from known values of United States total supply, United States nonagricultural income, and the index of per-capita production in the rice bowl countries.

53/ Where the subscripts have the same meanings as in Table 20, the following gross correlations for the years 1941-1952 were discovered: X_1X_8, .575; X_8X_{10}, .910; and X_8X_{12}, .039.

54/ (113): $X_a = -8.91 + 0.574\ X_2$; $r = .936$.
X_a = exports plus United States Department of Agriculture exports.

(114): $X_b = -15.75 + 0.809\ X_2$; $r = .955$.
X_b = exports plus United States Department of Agriculture exports plus military relief.

(115): $X_a = -2.22 + 3.046\ X_9$.

Other variables have the same meanings as in Table 27.

[illegible] of [illegible] for the peri[illegible] entirely attributable to the [illegible] and nearly all other variables. The [illegible] of exports [illegible] determinants is shown in Table 31. Despite the high coefficient of [illegible] correlation, no satisfactory explanation could be obtained, [illegible] in the period 1914-1932 were [illegible]. The annual volume of exports for the years 1914-1932 was closely related to the magnitude of total supply but bore little relationship to territorial shipments.[illegible]

[illegible] relationships.--Explanations of variation in total exports [illegible] 1934. These relationships are shown in Table 32. Over this long period, [illegible] volume of exports was closely related to the level of domestic production [illegible] be expected that in years of low purchasing power [illegible] and exports relatively high. In fact, the opposite situation [illegible]. The relationship of exports to total supply appe[illegible] s[illegible]ficant. [illegible] to be the best explanator[illegible] [illegible]. A high coefficient of [illegible], the magnitude of a[illegible] [illegible] fairly closely from known values of United States [illegible] nonagricultural income, and the index of per-capita [illegible].

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5/ Where the subscripts have the same meanings as in Table 30, the following gross correlations for the years 1914-1932 were discovered: [illegible]; and [illegible].

[illegible] $X_4 = -6.91 + 0.[illegible] X_5$; $r = .936$.
X_4 = exports plus United States Department of Agriculture [illegible].

[illegible] $X_5 = -15.75 + 0.869 X_5$; $r = .955$.
X_5 = exports plus United States Department of Agriculture [illegible] plus military relief.

[illegible] $X_5 = -2.22 + 3.046 X_5$.

Other variables have the same meanings as in Table 27.

TABLE 32

United States Rice: Variations in Annual Exports and Associated Variables, Rough Basis, 1921-1952, Excluding 1942-1945 and 1951

Equation number	Constant term	X_1	X_2	X_3	X_{10}	X_{11}	$\bar{R}$
		United States average annual on-farm price	United States total supply	Adjusted index of nonagricultural income, 1935-1939 = 100	Continental disappearance plus territorial shipments	Per-capita production, ten Asiatic nations	
		dollars per hundredweight	1,000 hundredweight	per cent	1,000 hundredweight	quintals	
116	368.030428	-586.788974 (.735426)		75.905579 (4.593998)	-.156132 (.783248)		.938
117	-4,943.959119		.558332 (2.201595)	39.329417 (3.691835)			.949
118	-18,381.259089		.504680 (3.011511)	38.058659 (3.809632)		8,068.177688 (2.095712)	.956

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Jupiter Square Mile: western 1951–1952 sandstone 1951 bus 1851
