WHEAT STUDIES

of the FOOD RESEARCH INSTITUTE

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"WORLD" WHEAT STOCKS, 1890-1914 AND 1922-39

Helen C. Farnsworth

Scarcely noted before the World War, but increasingly recognized over the past decade, was the importance of a comprehensive series of estimates of year-end "world" wheat stocks. Several such series have been published covering the past five to eighteen years; but no similar estimates have been available for the period prior to the World War of 1914–18. The present study attempts to fill this gap with a stocks series for the twenty-five years beginning in 1890. For comparison with this prewar series, *adjusted* postwar estimates are presented for a "wheat world" somewhat smaller than that covered by the postwar series regularly published in earlier issues of WHEAT STUDIES. Occasion has also been taken to revise the latter series, though the changes made can hardly alter major generalizations based upon the original estimates.

Comparisons between prewar and postwar years show a materially higher level of stocks in the postwar period. This is largely attributable to growth of population and to the persistence of an unprecedented world surplus of wheat after the bumper harvest of 1928. Less important but significant factors were the increase in world trade and the development of Argentina and Australia as major exporters. Tending slightly to offset these influences were the lower postwar level of per capita wheat consumption and the several factors that combined to speed delivery of new-crop wheat from farms to consuming centers.

The stocks series here presented show two major periods of persistent wheat surplus—1893–96 and 1929–35—and five years of notably small stocks—1898, 1909, 1925, 1937, and 1938. As compared with the prewar period, the two decades since the war have been characterized by much heavier wheat surpluses and less marked wheat shortage.

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Over the past decade students of the wheat situation have come to recognize as never before the value of adequate statistics on year-end wheat stocks. The short world crops of 1929, 1934, and 1935 did much to point the lesson. These were associated with market developments characteristic not of world wheat scarcity but of persistent wheat surplus. In each year the deciding factor was a heavy surplus of old-crop wheat. The surplus was very far from being reflected in the current statistics on visible supplies, and not adequately suggested even in the officially reported carryover estimates for the several countries publishing such records. With surplus old-crop supplies so widely scattered as they were in the summers of 1929, 1934, and 1935, only comprehensive summations of the stocks in most of the chief wheat-consuming countries could give the correct picture.

If all of the important wheat-producing and -consuming countries of the world took annual inventories of their wheat stocks at a date near the end of the Northern Hemisphere crop year, it would be relatively simple to adjust and add the reported figures to obtain good annual approximations to "world" wheat carryovers. But even now official estimates of year-end wheat stocks are lacking for practically all large wheat-consuming countries except the United States, Canada, Australia (November 30), and Germany. To fill this gap, the Food Research Institute has published during the past decade rough approximations to the wheat carryovers in the major wheat-consuming areas for which official data are not available, and total estimates for the world ex-Russia. These figures are revised in the present study, mainly to take account of changing "normal" carryovers and to omit India and Japan from the revised "world" total.

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A decade of experience with our postwar estimates of wheat carryovers has definitely established the great usefulness of this statistical series. Large changes in "world" wheat carryovers from one year to the next have normally been associated in the postwar period with opposite changes in the purchasing power of wheat on the international market. Moreover, on a number of markets the price spreads between certain futures appear to have depended largely upon the magnitude of the stocks held in particular positions. Finally, the carryover estimates for individual countries make possible improved estimates of annual wheat consumption, and furnish a more adequate basis for current forecasts of international trade in wheat and of prospective changes in the level of "world" wheat prices. At the present time, when Western nations face the possibility of a second prolonged war involving many European and overseas countries, judgments as to the wheat requirements of belligerents and neutrals alike can be soundly based only on estimates of total domestic supplies—including initial carryovers.

The proved value of our wheat carryover estimates for postwar years suggested the desirability of constructing similar estimates for earlier years. For certain studies, the postwar period alone is too short to serve as an adequate basis for important conclusions; and prewar stocks statistics are required to test various fundamental assumptions and observed relationships. Furthermore, a recent tendency in the United States, France, and some other countries to base national agricultural policies upon prewar price or income relationships implies the need for detailed historical study of agriculture and general economic conditions in the immediate prewar decades. And the fact that another European war has recently begun suggests that the cur-

rent wheat situation in Europe might better be evaluated by comparison with the supply position at the outset of the World War of 1914–18. For these varied objectives the present study of prewar and postwar wheat carryovers furnishes needed basic material. Stocks estimates for 1915–21, which would also be desirable for the specific purposes of appraising the wheat situation during and immediately after the World War, cannot be constructed satisfactorily, without an undue amount of labor, on the basis of the available statistical information. Omission of these years, however, does not detract from the value of our present stocks series for analysis of conditions in times of peace.

In many respects it would be advantageous to have prewar stocks estimates for the same "wheat world" that is covered by our current postwar series (now revised to exclude India and Japan). But a prewar series for the present world ex-Russia ex-Asia would be open to so many serious theoretical and practical objections (pp. 41–42) that we have been forced to look for a more acceptable alternative. This lies in the construction of a carryover series for 1890–1914 covering only those countries important in the "wheat world" of that time, and comparison of this series with an *adjusted* postwar series somewhat less comprehensive in scope than the one we publish currently for the postwar period.

Although the prewar-postwar stocks series here presented for the "world ex-Asia" is probably about as homogeneous as any that could be constructed for the long period covered, the prewar estimates in the series cannot be regarded as strictly comparable with the adjusted postwar estimates. Comparability, however, is mainly a matter of degree. Our postwar estimates of "world" stocks are, in a sense, not strictly comparable from one year to the next, because of the changed location of the carryovers. Surplus stocks of a given magnitude may have a very different meaning for the international wheat position depending on their location—whether, for example, in the United States, Argentina, Spain, or the Danube basin. Moreover, with the passage of time, changes in wheat production and consumption in different countries, and changes in methods of estimation of crops and trade, add to the margin of incomparability. For this reason, our "world" stocks estimates for 1939 are probably more closely comparable with those for 1938 than with those for 1922–24. We judge that comparisons between our prewar and adjusted postwar stocks series are open to the same types of objection, exaggerated, however, by the greater length of time covered and by the important boundary changes made after 1914.

Despite their limitations from the standpoint of strict comparability, the stocks data here presented are adequate for broad judgments as to prewar and postwar levels of carryover, for conclusions as to the major positions in which stocks have been held in different periods, and for inferences as to the occurrence and timing of wheat-surplus conditions prior to and since the World War. These subjects are briefly discussed in the later sections of the present study, following a detailed description of the methods of estimation used.

Stocks Positions Covered

Three comprehensive "world" stocks series are currently available for the past five or more postwar years.[1] In order of time of original publication these are: (1) estimates beginning with 1922 published by the Food Research Institute, in Wheat Studies;[2] (2) estimates from 1934 published by the United

[1] Two other series also warrant attention. In *La situation mondiale du blé en 1938–39* (Rome 1938) the International Institute of Agriculture presented world stocks figures for 1923–38, which cover the same positions covered by the three series considered above; and except for the United States, Argentina, and Australia, the estimates for the major areas are identical with those carried by the Food Research Institute. It is not yet clear that the International Institute will continue publication of this series, and therefore these estimates cannot be said to be "currently available."

Broomhall has recently published (*Corn Trade News*, June 21, 1939) reasonably comprehensive stocks figures for 1931 and 1937–39; these cover total stocks in the four major exporting countries, on passage to Europe, and in Europe ex-Russia. This series is not now available in published form for years other than those noted. Broomhall's revised figures for 1939 may be found in the *Corn Trade News*, Aug. 30, 1939.

[2] Currently in the issues for September, December, January, and May.

States Department of Agriculture, in *The Wheat Situation;*[1] and (3) estimates from 1922 published by the Secretariat of the International Wheat Advisory Committee, in *The International Wheat Situation.*[2] Broadly these three series cover the same positions:[3] the United States, Canada, Argentina, Australia, afloat to Europe and to ex-Europe, India, Japan (or Japan and Chosen), Egypt, French North Africa, the Danube basin, and 21 countries in Europe ex-Danube ex-Russia. In addition, New Zealand is included in the stocks series of the Wheat Advisory Committee, but this does not add significantly to the total.

Our experience with "world" stocks figures, now extending over more than ten years, points to the advisability of omitting stocks estimates for India from the "world" total. Not only is the available information on these stocks too scanty to result in reasonably satisfactory estimates, but such stocks normally have little if any bearing on the international wheat position. Moreover, with Indian stocks omitted, there seems to be little reason for continuing publication of stocks estimates for Japan—the only other Asiatic country included in our original stocks series. Our revised postwar series, here published for the first time (Table III), therefore applies to a smaller "world" than the original series—specifically to a "wheat world" exclusive of all of Asia as well as of the USSR.[4]

In construction of a prewar stocks series, it is necessary to cover a somewhat different area than is covered by our regular postwar series. Stocks estimates must be based on statistics for entire countries, and a significant part of the territory included in postwar years in Europe ex-Russia was a part of the Russian Empire in the prewar period. Among the 25 countries of Europe ex-Russia included in the postwar stocks series are Poland, Lithuania, Latvia, and Estonia—countries carved wholly or in large part out of prewar Russia. Obviously no reasonable approximations to the wheat stocks in these areas could possibly be devised for 1890–1914.

On the other hand, it is possible to prepare an adjusted postwar series that is reasonably comparable with a feasible prewar series. This may be done by excluding from the postwar total our stocks estimates for Poland, Lithuania, Latvia, and Estonia. Such a procedure necessarily involves, however, the omission of a sizable area in Poland covered in our prewar stocks estimates for Austria and Germany. This omission may be regarded as relatively unimportant, especially in view of the fact that the wheat stocks in Bessarabia, excluded in the prewar period (or included under Russia), are counted in the postwar period under Rumania. The other boundary changes made in Europe after the World War are of little significance as regards "world" stocks, though they prevent one from making certain regional comparisons as between prewar and postwar years.

Outside of Europe, changes in boundaries have been unimportant. Yet on different grounds we consider it advisable also to omit from the prewar stocks series (and from the *adjusted* postwar series as well) stocks approximations for the four countries in northern Africa (Morocco, Algeria, Tunis, and Egypt) and for afloat to ex-Europe. In these five positions variations in year-end wheat stocks have been of questionable international significance even in the postwar period; and for the countries of northern Africa the basic crop and trade statistics required for the stocks estimates are clearly inadequate for the prewar period. No acceptable official crop estimate was published for Egypt prior to 1909 or for Morocco prior to 1915; nor are crop-year trade figures available before 1902

[1] Usually in the September issue.

[2] This publication, issued in January 1938 and January 1939, may be published with revised figures in January 1940. The estimates for most individual countries prior to 1936 are practically identical with figures previously carried by the Food Research Institute.

[3] The scope of our postwar stocks estimates was discussed by M. K. Bennett in "Estimation of End-Year World Wheat Stocks from 1922," WHEAT STUDIES, February 1933, IX, 172–73.

[4] It excludes also the smaller producing countries in South America and Africa. Although official stocks figures are available for postwar years for the Union of South Africa, we have not seen fit to include these in our revised "world" total: the figures are small, have little bearing on the international wheat position, and are not included in any of the other comprehensive series of "world" stocks.

for Algeria and Tunis, before 1918 for Egypt, or before 1927 for Morocco.[1] Moreover, the weekly shipments data required for estimation of stocks afloat to ex-Europe are presumably less complete in the prewar period.

For prewar and postwar comparisons of "world" wheat stocks, it is necessary to consider not only the problem of omission of certain positions covered by current postwar series but also the question of possible desirable additions. Over a period of forty to fifty years, there are inevitably shifts in the relative importance of different countries with respect to the world wheat position. Canada, Argentina, and Australia, of slight international significance prior to 1900 and of only moderate significance prior to 1914, have recently tended to dominate the wheat-export field. In contrast, Russia, the Danube countries, and India have declined notably in importance.

For Russia, estimates of year-end wheat stocks were issued by the Department of Direct Taxes of the Ministry of Finance during 1897–1914. These estimates, collected by regional tax inspectors to furnish information on the general economic position of the country (not for purposes of direct tax levies) are presumably reasonably accurate. No corresponding postwar estimates are available; but even if they were, it would seem reasonable to neglect them on the ground that Russian wheat carryovers have recently been very largely unrelated to the world wheat situation. Russia's prominence in the prewar wheat world, however, suggests the desirability of making some allowance for her changing year-end stocks during 1890–1914. This is accomplished in the present study by including in the annual "world" stocks totals for 1890–1914 the *surplus* stocks in Russia—stocks that might have been exported without exhausting end-season working reserves for domestic use.

The part of the expanding world import market supplied in prewar years with Russian wheat has been supplied in postwar years mainly with wheat from Canada, Australia, and Argentina. The growth in importance of the two Southern Hemisphere exporting countries, whose crop years terminate at the end of November and December respectively, complicates prewar-postwar comparisons of world wheat stocks as of about August 1. For such comparisons it seems preferable to include in our world stocks series not the *total* stocks available in Argentina and Australia on August 1 but only the *exportable* supplies remaining in these countries (pp. 47–49). Even the inclusion of these smaller supplies tends artificially to raise the postwar level of "world" stocks for some purposes of comparison.

The estimates of year-end stocks here presented generally apply to July 31 (expressed frequently as August 1), the date usually taken as the end of the Northern Hemisphere crop year for wheat.[2] But United States stocks estimates apply to July 1, and the Russian estimates for 1897–1914 to July 15. We need not here defend the use of August 1 as the date of inventory for old-crop wheat stocks in most countries, nor our acceptance of somewhat earlier dates for the United States and

[1] It may be argued that certain other countries should also be excluded on this ground. Several that we have not seen fit to omit also had poor crop and/or trade statistics in the prewar period. This is true of Greece and some other small wheat-consuming countries where the absolute volume of wheat stocks normally varies slightly from year to year. The inclusion of such countries cannot detract from the significance or reliability of our "world" stocks estimates, whereas it does serve to increase the comparability between our prewar stocks series and the three available postwar series.

Inclusion of Spanish stocks, however, may be open to more serious objection. The official wheat statistics for that country do not appear entirely trustworthy, particularly in the early prewar period; consumption probably varies markedly from one year to the next (though less than in French North Africa or India); and the magnitude of Spanish wheat stocks is great enough to influence significantly the year-to-year changes in "world" stocks, although the changes may hold little meaning for the international wheat position. Clearly, Spain represents a borderline case: the argument for omitting this county is less conclusive than that for omitting India and French North Africa; on the other hand, the inclusion of Spain cannot be defended as convincingly as the inclusion of most other European nations or the four chief exporting countries.

[2] While a few Northern Hemisphere countries harvest part or all of their wheat crops in the two or three months prior to August 1 and several harvest during September, the principal importing countries of western Europe normally secure their new crops during August. Hence, for international trade, the Northern Hemisphere crop year has usually been considered to begin on August 1.

Russia. This general subject was discussed at the time our postwar stocks series was first published,[1] and the chief conclusions then reached still hold: (1) the selection of any specific date for year-end stocks estimates involves a certain amount of arbitrariness; and (2) the August 1 basis, most commonly used in Europe, can be employed most conviently and with results as good as seem to be promised by any alternative.[2] Of the two other postwar series currently available, that of the Wheat Advisory Committee is based upon the same dating as our series, while that of the Department of Agriculture applies to August 1 for Europe and Japan, to July 1 for the United States, Canada, Argentina, Australia, afloat to Europe and to ex-Europe, and to about April 1 for India.

Methods of Estimation

Before the World War, the governments of the principal wheat-producing countries had not come to recognize the importance of data on year-end wheat stocks. No country except Russia attempted to collect comprehensive stocks statistics; and even in Russia the statistics were collected to supply additional information on the economic position of the country rather than to throw light on the domestic wheat situation. It is true that in several countries commercial or official estimates were then made to cover the stocks in certain specific positions; but usually the stocks so covered represented but a small percentage of the total domestic stocks.

In view of these facts, it is clear that an acceptable series of "world" year-end wheat stocks for 1890–1914 can be obtained only by the laborious process of estimating the stocks in each of 25 to 30 individual countries or positions.[3] As the basis of estimation, we must rely on such incomplete stocks reports as are available, supplemented by data on domestic wheat production and trade and by the published impressions of contemporary observers relative to wheat consumption and stocks. The following paragraphs outline the methods used in the construction of our stocks estimates for different countries, and indicate which estimates may be regarded as most trustworthy.

United States.—For the United States, the largest national holder of wheat stocks in the world ex-Russia in prewar years, the Food Research Institute published in an earlier issue of Wheat Studies estimates of wheat carryovers from 1896.[4] This carryover series, still acceptable for 1896–1914,[5] is here extended back to 1890 as well as the available data would permit.

Reports on terminal elevator stocks (at eighteen specified eastern points covered by the Chicago Board of Trade "visible supply" and at four western points covered by Bradstreet's "visible")[6] could be obtained for 1890–95 in the sources used for our original stocks series. Similarly, it was possible to estimate

[1] Bennett, *op. cit.*, pp. 173–74.

[2] Actually, our stocks estimates for several southern European countries may as well be said to apply to July 1 as August 1; since they represent estimates of the amount of old-crop wheat remaining at the time the new crop begins to move (say July 1 in southern Europe) modified by the small differences between July net trade in wheat in successive pairs of years. Similarly, in our original stocks series, the estimates for India might as well be said to have applied to April 1 as to August 1, since they rested upon statistics for crops harvested in March–May and net trade in the following August–July.

[3] The type of analysis required was made for the major exporting and importing countries, but not carried to the point of making actual estimates of stocks, in Holbrook Working, "The Changing World Wheat Situation," Wheat Studies, September 1930, VI, 421–56.

[4] Holbrook Working, "Disposition of American Wheat since 1896, with Special Reference to Changes in Year-End Stocks," Wheat Studies, February 1928, IV, 135–180.

[5] The estimates of farm stocks included in this series for the years 1896–1911 were derived by applying official estimates of the percentage of the crop remaining on farms on July 1 to Working's 1926 adjusted estimates of production. A revised official series of production estimates, published in 1934, deserved to be considered as a basis for possible current revision of the estimates of farm stocks. But because the revised production estimates only partly remedy the major defect of the earlier estimates (falling short of the accountable disposition of wheat during the 1890's), it appears likely that a revision of our earlier farm stocks estimates on this basis would decrease rather than increase their credibility.

[6] For the particular points covered, see Working, *op. cit.*, p. 148, footnote 2, and Table 3 on p. 150. Stocks in Kansas City were not reported in 1890 and New Orleans stocks were not recorded at all during 1890–95; we have therefore raised the recorded figure for 1890 by 300,000 bushels and the figures for 1891–95 by 150,000 bushels.

total "outside commercial" stocks as of July 1, 1892–95, by using the same series of recorded data and the same methods employed by Working. But the basic data required for estimation of "outside commercial" stocks were not available for 1890 and 1891; and for each of these two years it seemed best to accept a rough approximation of 50 million bushels—a figure unlikely to be as much as 10 million bushels in error.[1] Finally, since official percentage estimates of farm stocks on July 1 date only from 1895, it was necessary to derive approximate estimates of July 1 farm stocks from official data for March 1.[2]

Regardless of minor differences in the methods of estimation used in different years, the total carryover figures here presented for the United States for 1890–1914 represent in each year a simple summation of the stocks at 23 terminals, estimated "outside commercial" stocks, and estimated stocks of old-crop wheat on farms. Since the basic data for estimation are less complete prior to 1895 than for 1895–1914, the earlier estimates are somewhat less trustworthy than the later ones; yet throughout the entire period, the carryover series for the United States is not only satisfactory but presumably more accurate than the year-end stocks series for most other countries. It may be regarded, too, as reasonably comparable with the official carryover series now available from 1923.

Our estimates of United States carryovers in 1890–1914 and 1922 are shown in Chart 1 in comparison with (1) the estimates of total carryover accepted by Broomhall during the prewar period, (2) the *Daily Trade Bulletin* series of visible supplies as of July 1, and (3) official stocks figures since 1923.[3] The chart requires but little comment. Particularly interesting is the fact that despite the inaccuracy of the early official crop reports and the inadequacy of the available data on visible supplies, Broomhall's estimates of *annual change* in the United States carryover were in most years quite similar to those calculated from our present estimates. However, Broomhall's approximations, averaging only about 70 per cent as large as ours, show annual changes which also average about 70 per cent of the changes in our estimates.

United States wheat in Canada.—In addition to the domestic carryover of wheat in the United States, there is often a significant and occasionally a substantial amount of United States wheat in Canadian ports at the end of the crop year.[4] Estimates of such stocks are available weekly in United States official sources since 1927 and in *Canadian Grain Statistics* since 1920.

In only two of the past twenty years did United States stocks in Canada exceed 5 million bushels on July 1: this was in 1931 and 1932 when they were artificially raised to over 15 million bushels through operations of the Grain Stabilization Corporation under the Federal Farm Board. More typically, from 1920 to 1928 these stocks never totaled as much as 3 million bushels, and during 1934–39 they failed even to reach 1 million. In the prewar period, when United States wheat-transit trade through Canada was extremely small, the amount of United States wheat in

[1] From 1892 to 1914 estimated total outside commercial stocks ranged in most years only between 42 and 69 million bushels. They were much lower in two years characterized by a tight supply position, 1898 and 1909, and much larger in four years of abundant supplies, 1893, 1899, 1900, and 1907.

[2] If the percentage of the crop remaining on farms on March 1 is large, the percentage remaining on July 1 tends also to be large. During the first 12 years for which estimates of July 1 farm stocks were published (1895–1906), stocks remaining on farms on July 1 averaged about 32 per cent of the stocks on March 1 when the latter were about 29 per cent of the crop, and about 25 per cent of the stocks on March 1 when the latter were about 20 per cent of the crop. After 1906, stocks on July 1 tended to average lower in relation to stocks on March 1 than in the earlier years. In estimating farm stocks on July 1, 1890–94, we have used the average relation to March 1 stocks that held during 1895–1906.

[3] The figure shown for 1922 represents our adjustment of an early official estimate which was not strictly comparable with the later official stocks figures.

[4] For the construction of a world stocks series, it might seem preferable to record United States stocks in Canada as of about August 1 even though the domestic carryover of the United States is necessarily given as of July 1. But since the amount of United States wheat in Canada is seldom large, since more new-crop wheat may be counted in the stocks as of August 1, and since it is often convenient to speak of the total amount of United States wheat in North America at the end of the United States crop year, we continue in the present study our past practice of dating these stocks as of July 1.

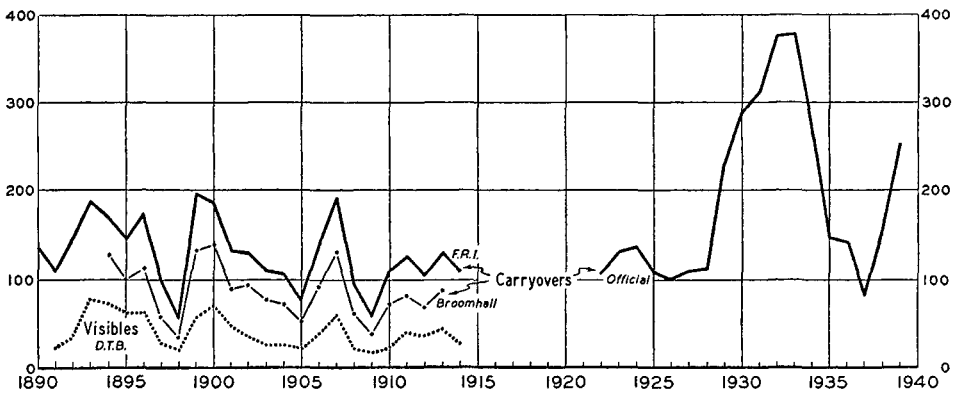
store in Canada on July 1 was presumably negligible. For 1890–1914, therefore, these stocks are here estimated at zero.

Canada.—Official carryover figures for Canada as of August 1 are available only from 1924. For 1922 and 1923, the figures here presented are our estimates based on the summation of Canadian visible supplies as reported for August 1 in the Chicago *Daily Trade Bulletin* and our approximations of August 1 farm stocks, based on official data as of August 31.

Prior to 1929, when the Canadian carryover first exceeded 100 million bushels, official estimates of Canadian wheat carryovers compared as follows with summations of reported Canadian commercial supplies and farm stocks, in million bushels. This tabulation clearly suggests that fairly reliable estimates for earlier postwar years can probably be constructed from published data on August 1 commercial stocks combined with reasonable approximations to farm stocks (farm stocks normally varying little from year to year). Our approximations to farm stocks as of August 1, 1922 and 1923 (3.9 and 3.4 million bushels, respectively) are based upon the official estimates of farm stocks as of August 31 in these two years. With allowances of 4 and 5 million bushels, respectively, to cover stocks in other positions (allowances suggested by the data for August 31) the carryovers of 1922 and 1923 may be placed at 27 and 22 million bushels, respectively.

CHART 1.—ESTIMATES OF UNITED STATES CARRYOVERS, JULY 1, WITH COMPARISONS*

(Million bushels)



* Food Research Institute estimates, 1890–1914 and 1922, described in the text. Broomhall's estimates of total United States carryovers from various issues of Broomhall's *Corn Trade News*. United States "visible supplies" from the *Daily Trade Bulletin* (Chicago) monthly reports for July on commercial wheat and flour stocks in North America, omitting Canadian stocks and United States stocks of flour. From 1923, standing official estimates of the United States Department of Agriculture.

Aug. 1	Visible supplies[a]	Farm stocks[b]	Total	Reported carryover	Difference
1924	31.3	7.4	38.7	45.2	+6.5
1925	23.3	2.7	26.0	27.7	+1.7
1926	28.0	4.0	32.0	36.5	+4.5
1927	42.4	4.3	46.7	50.8	+4.1
1928	68.9	4.2	73.1	77.5	+4.4

[a] As reported in the Chicago *Daily Trade Bulletin*.
[b] Official estimate.

The *Daily Trade Bulletin* series on Canadian commercial stocks dates back to 1891, thus furnishing the principal basis for estimating Canadian carryovers prior to 1914. There is no satisfactory evidence that the early data are homogeneous, nor that they are strictly comparable with data published in the same source for recent years for which detailed official stocks reports have been available weekly. Yet since no other available series appears more promising for the prewar period, it seems appropriate to construct carryover estimates on the basis of the visible data as published plus our own approximations to August 1 farm stocks. The latter rest for 1910–14 upon the average relationship between farm stocks (as percentages of the pre-

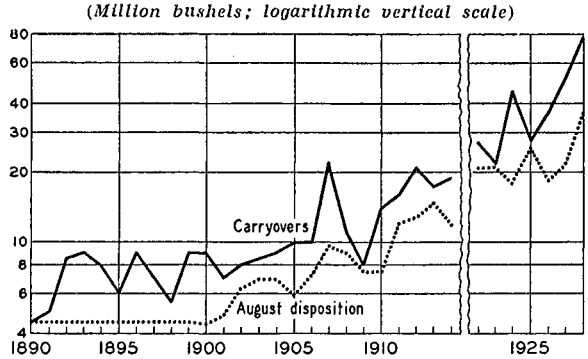
ceding crops) on March 31 and August 1;[1] but for earlier years for which data on March 31 holdings are not available (1890–1909), August 1 farm stocks are taken as equal to the trend values of the percentage figures.

To estimate total Canadian stocks, we have added to the summation of commercial stocks and farm stocks 3 million bushels in each year from 1890 through 1909 (excepting 1907), and 4 million bushels in 1907[2] and in each year from 1910 through 1914. These additions purport to cover unreported stocks in other positions. It is an open question whether these or somewhat larger or smaller allowances should be made for unreported stocks in the prewar period. If the commercial stocks series were known to be homogeneous, it would be reasonable to assume that unreported stocks increased more markedly than we have indicated from 1890 to 1914, the increase being associated with increase of Canadian wheat production and consumption. On the other hand, if it were known that the reported commercial supplies covered fewer positions in the 'nineties than in the late prewar period and fewer positions in the late prewar period than since 1920, it would be more reasonable to assume that unreported stocks declined from 1890 to 1914 and that they were larger in 1910–14 than in 1924–28.

Since the character of the reported visible supply series is not known, we see no way to determine even the direction of the trend of the unreported stocks. If, however, the allowances made for these stocks are too much out of line, this should be apparent from a comparison of our carryover estimates with the disposition that would normally be made of August 1 stocks. In prewar years, the amount of wheat exported during August and the amount retained for domestic consumption in August and early September were presumably drawn from the August 1 carryover. If, then, our estimates of carryover are compared with Canadian exports of wheat and flour in August and one-tenth of the normal annual domestic utilization ex-seed, one may gain some idea as to whether the estimates are set on about the proper level in the early prewar period. The indicated comparison, shown in Chart 2, broadly supports the level of carryover estimates here presented. The relatively wide percentage margins between August 1 carryovers and their normal disposition in 1892–94, 1896, 1899–1900, and 1907 may be explained largely on the ground that these years were years of abundant world wheat supplies, when Canadian stocks of old-crop wheat probably remained relatively large on September 1.[3]

CHART 2.—ESTIMATED CANADIAN CARRYOVERS, AUGUST 1, 1890–1914 AND 1922–28, AND APPROXIMATE AUGUST DISPOSITION*

(Million bushels; logarithmic vertical scale)



* Our estimates of Canadian carryovers 1890–1914, 1922, and 1923 (see text), and official estimates, technically as of July 31, from 1924. "Approximate disposition" items are 10 per cent of estimated normal annual domestic utilization ex-seed and exports of wheat and flour during August. Exports from 1907 as officially reported in terms of quantity of wheat; for 1900–06, estimated from data on the value of wheat and flour exports during August; and for 1890–99, our rough approximation to average exports.

Canadian wheat in the United States.— Stocks of Canadian wheat in bond at lake and seaboard ports in the United States have been officially recorded since 1921.[4] Normally these stocks are moderately higher than reported stocks of United States wheat in Canada; but except in years of international wheat sur-

[1] The statistical method employed was similar to that used in estimating July 1 farm stocks in the United States for 1890–94 (see footnote 2, p. 44).

[2] In 1907 the large visible stocks suggested that this figure would be more appropriate.

[3] It should be noted also that the disposition line prior to 1899 simply represents an approximation to *average* August exports and consumption during 1890–99: the actual disposition figures, if available, might show quite different margins in different years.

[4] These data, available in *Canadian Grain Statistics*, apparently do not cover appreciable quantities of bonded wheat in transit by rail in the United States, and some wheat imported by United States millers for milling in bond for export.

plus or extraordinarily heavy Canadian exports, there has seldom been more than 4 to 6 million bushels of Canadian wheat stored in the United States on August 1. From 1890 to 1914 these stocks presumably increased slowly as Canadian exports expanded; but even in 1912, when the prewar maximum for August 1 was probably reached, the total stocks of bonded wheat at six United States ports did not exceed 1.6 million bushels.[1] This figure may be taken as practically equal to the total amount of bonded Canadian wheat in store in the United States on August 1, 1912; and similar data, available for 1911, 1913, and 1914, serve as reasonable total estimates back to 1911. For earlier years, however, comparable data are not available. The estimates here published for 1890–1910 are therefore only rough approximations, representing in each year one per cent of the Canadian export movement during the twelve preceding months.

Australia, Argentina. — Our stocks estimates for Australia and Argentina are based upon a method of calculation consisting broadly of three steps: (1) estimation of year-end stocks as of November 30 for Australia and December 31 for Argentina—when possible on the basis of official or privately published stocks estimates, otherwise on the basis of data on domestic utilization ex-seed;[2] (2) to the estimated stocks as of November 30 (Australia) and December 31 (Argentina) are added reported net exports (since 1922) or Broomhall's cumulated weekly shipments during August – November and August – December, respectively, the sums representing August 1 "exportable supplies"; and (3) to these exportable supplies are added four-twelfths of the net domestic mill grindings in Australia and five-twelfths in Argentina.[3] The figures so calculated are believed to approximate fairly closely the total amount of wheat remaining in Australia and Argentina on August 1.

For short-period comparisons *total* stocks estimates may be quite satisfactory. But for comparisons involving years both prior to and since the World War, the inclusion of ever increasing amounts to cover domestic consumption in Australia and Argentina from August 1 to the dates of harvest of the new crops tends artificially to raise the level of Southern Hemisphere and "world" stocks estimates in the later years. In Table I, therefore, estimates are presented both of total stocks and of exportable supplies in Australia and Argentina on August 1.[4]

Chart 3 (p. 48) shows not only the two series of stocks estimates given in Table I but also estimates of Australian and Argentine carryovers at the end of the Southern Hemisphere crop year. This chart illustrates well the theoretical problems and difficulties resulting from the selection of a single date—in this case August 1—for inventory of old-crop stocks in both Northern Hemisphere and Southern Hemisphere countries. If Australia and Argentina harvested their wheat crops, as do the principal Northern Hemisphere countries, in July or August, their stocks on August 1 would presumably approximate the low carryover figures shown here for November 30 and December 31, respectively. But on August 1 Australia and Argentina must carry enough wheat to cover domestic requirements and exports for another four or five months as well as such minimum end-season stocks as are required in the Northern Hemisphere countries. Recently August 1 stocks have exceeded the year-end carryover in Australia by over 30 million bushels on the average and in Argentina by over 60 million. Should these extra stocks for exportation and consumption in the Southern Hemisphere countries be in-

[1] As reported by the Chicago Board of Trade in their weekly visible supply (Chicago *Daily Trade Bulletin*, Monday issues). The ports covered were Duluth, Buffalo, New York, Boston, Philadelphia, and Baltimore.

[2] For a description of stocks estimates based on domestic utilization data, see illustrated calculation of French stocks in Bennett, *op. cit.*, pp. 175–79.

[3] Both Australia and Argentina publish official data on flour milled minus flour exported: Australian figures are for July–June years and Argentine figures for calendar years.

[4] It is convenient at times to recall that the supplies here designated as "exportable" are equal to either (1) the *total* August 1 stocks minus allowances for four (Australia) or five (Argentina) months of domestic consumption, or (2) net exports or shipments during August–November (Australia) or August–December (Argentina) plus the estimated November 30 carryover in Australia or the December 31 carryover in Argentina.

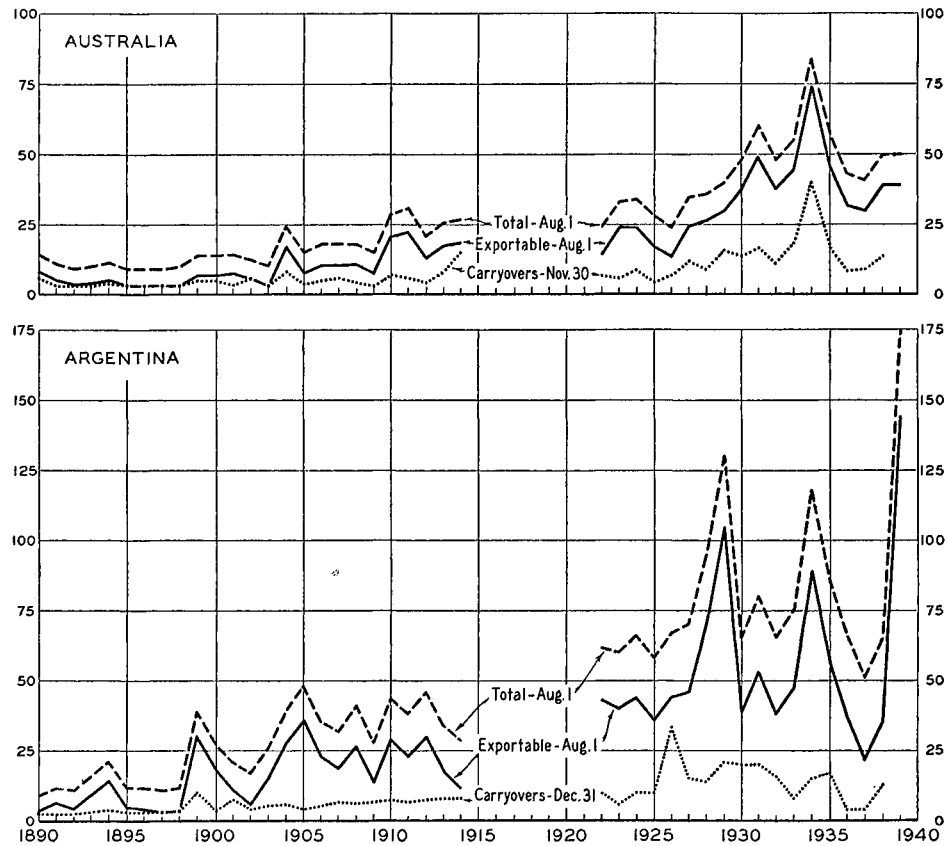
cluded as part of the world total stocks on August 1?

If the wheat position of the two Southern Hemisphere countries had remained unchanged from 1890 to 1939 the answer to this question would have little or no practical significance. But since 1890 the annual consumption of milled wheat in Argentina and Australia has increased from about 30 to 105 million bushels and the combined annual exports of these two countries have increased from something like 30 to 240 million. These changes in consumption and trade have tended markedly to increase the total stocks carried on August 1 in Australia and Argentina. Yet if the same changes in consumption and trade had occurred in two Northern Hemisphere countries with similar consumption requirements and export "patterns," August 1 stocks would have increased but slightly, and no more, perhaps, than the end-season stocks of November 30 and December 31 in Australia and Argentina respectively.

For comparative purposes, then, it might seem better to count only the November 30 and December 31 stocks in Australia and Argentina, treating these as we do the July 1 stocks in the United States. For some purposes this would give the best and most homogeneous series of world stocks estimates. But for the purpose for which world stocks estimates are most frequently used — to give some idea of the magnitude of the supplies of old-crop wheat which remain on about August 1 to supplement the new-crop supplies that then become available in the Northern Hemisphere—it is important to know not only how much wheat will be left in the South-

CHART 3.—ESTIMATED STOCKS IN AUSTRALIA AND ARGENTINA, AUGUST 1 AND END OF CROP YEAR*

(Million bushels)



* Our estimates (see text), except that data on Australian stocks as of Nov. 30, 1925–38 are official.

ern Hemisphere on the following January 1 but also how much is available for export from August 1 to the time of the Southern Hemisphere harvests. The amount of wheat needed in Argentina and Australia to cover domestic needs for this period holds no significance for the international position and can well be disregarded;[1] but the exportable surplus remaining in the Southern Hemisphere on August 1 constitutes part of the world supply of wheat most likely to affect international trade and wheat prices during the ensuing Northern Hemisphere crop year. In the estimates of total "world" stocks shown in Table I, therefore, Australian and Argentine stocks are represented in terms of their "exportable supplies" as of August 1 (supplies which cover exports but not domestic consumption for the four or five ensuing months plus the stocks remaining at the end of the Southern Hemisphere crop year).

Afloat to Europe.—The series in Table I on stocks afloat to Europe are Broomhall's published data on the amount of wheat on ocean passage to the United Kingdom, the Continent, and orders as of the end of the week nearest August 1.[2] These data, derived by Broomhall from detailed reports on wheat shipments and arrivals, are probably more accurate than most of the other stocks series shown in Table I. Yet since there is some evidence that Broomhall's reports on shipments became more complete with the passage of time, it is possible that his estimates of afloat stocks are somewhat too low in the early decades. On the other hand, the expansion in scope of Broomhall's reports on shipments to Europe may not have involved *ocean* shipments of wheat (on which afloat stocks are based) but only shipments by river and across land frontiers.

Chart 4 (p. 50) shows stocks afloat as of about August 1 as compared with shipments to Europe in the preceding crop year and in the six weeks ending closest to August 1. Particularly noteworthy is the horizontal trend of the stocks figures from 1890 to 1914, when wheat shipments to Europe were tending to increase, both in total and less noticeably in the last six weeks. Other factors constant, stocks afloat on August 1 would normally increase as shipments increased, especially as shipments increased in the six weeks or two months immediately preceding August 1. From 1890 to 1914, however, other factors did not remain constant. On the one hand, the increased shipments originated mainly in Argentina, Australia, and Canada, so changing the proportional distribution of exports that the average distance of ocean voyage per bushel of wheat was raised from about 3,950 nautical miles in 1890–95 to 4,400 miles in 1910–14.[3] Since an increase in the average distance of ocean voyage, other things being equal, would normally mean an increase in the number of days wheat would be afloat, the change in sources of exports from 1890–95 to 1910–14 presumably tended, like the increase in total shipments, to swell stocks afloat.

But operating strongly in the opposite direction were important changes in ocean transportation during this period. No striking technical improvements were made to increase the speed of tramp steamers or freight liners; nor did the passenger lines, which were much improved, carry enough wheat to warrant particular attention. Nevertheless, there was a revolutionary shortening of the time required for transporting wheat from the most distant areas, a shortening effected by rapid substitution of steamers for sailers on the longer voyages. In 1890–95 practically all of the wheat exported from Australia and the Pacific Coast of North America and probably about 40 per cent of the wheat exported from Argentina was shipped in sailing vessels, whereas by 1910–14 steamers had practically displaced sailers in the Argentine trade and steamers had won something like 55 to

[1] This is preferable also in view of the fact that the Southern Hemisphere crops not commercially available before December or January are normally counted in world total supplies for the August–July crop year. Thus, to include in the old-crop stocks the wheat required to cover domestic requirements in August–December and at the same time to add in the Southern Hemisphere crop which will cover the requirements of the following January–December (or December–November) results in undesirable duplication.

[2] Data published in Monday and Tuesday issues of Broomhall's *Corn Trade News*.

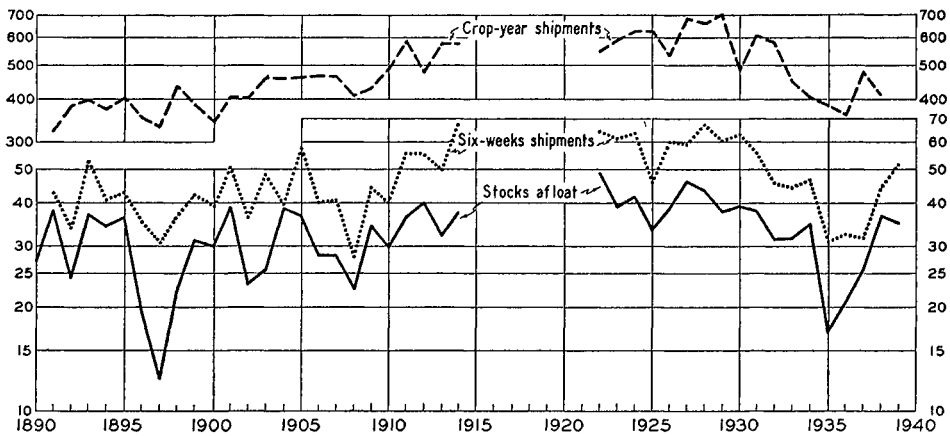
[3] Approximate averages for the periods cited, counting only the exports from the larger exporting areas: North America, Argentina, Australia, Russia, India, Danube basin.

65 per cent of the Australian trade and 45 to 65 per cent of the Pacific North American trade.[1]

On the basis of these rough estimates of the change in proportional shipments by sailers and steamers, official data of crop-year net exports, and Broomhall's estimates of the average number of days required for ocean passage of grain by sailers and steamers from various countries, it is possible to compute the average number of days that were required to transport a representative bushel of wheat in 1890–95 as contrasted with 1910–14. With the sources of exports as they were in 1890–95 and under the conditions of transport then prevailing, the average length of voyage was in the neighborhood of 33 days; by 1910–14 it had been reduced to about 28 days. This change probably goes far to explain the horizontal trend of August 1 afloat stocks in the face of increasing shipments and rising importance of such remote exporting areas as Australia and Argentina. Despite the increase in average miles of voyage between 1890–95 and 1910–14, there was a reduction in the average time of transport which resulted in a reduction of the period of time the average cargo of wheat remained afloat. Since the number of cargoes shipped was tending upward, these two factors combined to keep the level of stocks afloat about constant up to 1914.

CHART 4.—STOCKS AFLOAT TO EUROPE, AUGUST 1, AND SHIPMENTS TO EUROPE DURING PRECEDING SIX WEEKS AND PRECEDING CROP YEAR*

(Million bushels; logarithmic vertical scale)



* Data compiled from Broomhall's *Corn Trade News.*

Europe ex-Russia. — For recent postwar years relatively complete year-end stocks data have been published for Germany; some less complete estimates of French stocks have been issued by the French Wheat Office; and various official, semi-official, and private reports have revealed the amounts of wheat held by the Czechoslovakian and Norwegian State Grain Monopolies, the amounts in store in public and co-operative warehouses in Hungary, and in public warehouses and customs depots in Italy, and the quantities held at major British and Continental ports. These data,

[1] These estimates, averages for the periods cited, are based upon Broomhall's detailed reports on wheat afloat on about March 1 for Australia and Argentina and on about November 1 for Pacific North America. These particular dates have been chosen because they are close to the seasonal peak of the export movement of the countries concerned and are yet at such an early stage in the export movement that but few, if any, of the steamers sent out with new-crop wheat would have reached their destination. For Australia and Pacific North America, the average percentages indicated for 1910–14 are not truly representative of the whole period, since steamers rapidly displaced sailing vessels on these routes between 1910 and 1914. The *Official Year Book of New South Wales* for 1913 comments (p. 789) that "the proportion of wheat now carried in sailing vessels is very small...." This may also have been true of Victoria, but was probably not true of South or Western Australia. Broomhall's data suggest that by 1914 about 25 to 30 per cent of Australian and Pacific North American wheat was shipped in sailing vessels.

complete or incomplete, constitute important direct evidence on the year-to-year changes that have recently occurred in the wheat carryovers of some of the principal consuming countries of Europe. Unfortunately, however, they have practically no counterpart in the period prior to the World War, and in many cases they are too incomplete to be very significant even for recent years.

In the absence of statistical reports on stocks during 1890–1914, the year-end stocks of the different countries can best be estimated on the basis of (1) crop-year data on domestic wheat utilization exclusive of estimated seed use[1] and (2) published statements of contemporary observers as to the level or changing course of wheat stocks in various countries. Broomhall's *Corn Trade News* is the most valuable single source of information on contemporary opinion in the period before the World War. But several American milling and grain-trade journals[2] serve at times to supplement and check the opinions found in Broomhall's paper.

Even for countries for which opinions on carryover were most frequently expressed prior to 1914, there is a large margin of estimation in the stocks figures here published. Neither such general remarks as "Reserves in many quarters are decidedly light and nowhere that we can think of is there any great surplus of an old crop being carried forward into the new season,"[3] nor such specific comments as "the United Kingdom .... has fairly liberal reserves" of old-crop wheat[4] carry any definitive quantitative implication. Yet when observations like these are pieced together year by year for the major consuming countries and are supplemented by data on domestic production and net trade, one may feel reasonably confident that the stocks estimates derived therefrom are not too seriously out of line with the actual facts.

[1] See Bennett, *op. cit.*, pp. 175–79.

[2] Several sources that might prove valuable have not been available to the writer; but of the journals and papers at her disposal, the Chicago *Daily Trade Bulletin* and the *Northwestern Miller* have proved most helpful.

[3] *Corn Trade News*, Aug. 6, 1912, p. 446.

[4] *Ibid.*, Aug. 9, 1910, p. 447.

The absolute errors in the stocks estimates shown in Table I are necessarily small for countries with small carryovers that normally vary little from one year to the next—countries such as Belgium, Netherlands, Switzerland, Portugal, the Scandinavian countries, and Finland. For several of the larger consuming countries, which carry larger and more variable stocks, the evidence supplied by contemporary opinion appears reasonably reliable and complete. This is especially true for the British Isles, France, and Germany, whose aggregate stocks in prewar years represented over half of the total in importing Europe. Presumably our errors of estimation are greatest for Spain, the Danube basin (most notably Rumania), and Italy, countries characterized by moderately heavy, variable consumption and by sizable, variable carryovers about which relatively little information was given in the trade press during 1890–1914.

To interpret the remarks of contemporary observers on the level of wheat stocks in various countries, it is necessary to establish two points of reference for each country: (1) the amount of wheat that may reasonably be considered as "low normal" stocks (not an average but a smaller amount that might be expected to characterize years of moderate tightness in wheat supplies); and (2) the amount of wheat that may be taken to represent minimum working stocks—the lowest level to which wheat stocks would probably ever be drawn under conditions of international peace, and free, competitive wheat markets.

The selection of these two points of reference involves a degree of arbitrariness that cannot be avoided in the absence of stocks data for the countries concerned. If actual carryover records were available for all of the principal wheat-consuming countries, they would probably show large differences among the different countries in the number of weeks' domestic or domestic-and-export requirements represented by "low normal" and "minimum" stocks. But reasonably complete official records are confined before the World War to Russia (1897–1914), and in the past two decades to Germany (since 1932), the

United States (since 1923), Canada (since 1924), and Australia (since 1925). These records may be interpreted about as follows:

Period and country	Minimum stocks			"Low normal" stocks		
	Year	Weeks' requirements		Year	Weeks' requirements	
		Domestic[a]	Total[b]		Domestic[a]	Total[b]
Postwar						
United States (July 1)..	1937	7.3	6.5	1927	10.5	7.8
Canada (July 31).....	1938	16.0	4.4	1937	23.0	6.2
Australia (Nov. 30).....	1925	7.2	2.0	1936	11.3	3.0
Germany (July 31).....	1932	4.8	...	1937	5.7	...
Prewar						
Russia (July 15).....	1912[c]	7.5	5.6	1907	9.0	6.5

[a] Equivalent of stocks in terms of estimated normal requirements for total domestic utilization excluding seed (trend considered).

[b] Equivalent of stocks in terms of estimated normal requirements for net exports and for domestic utilization excluding seed (trend considered). This may also be expressed as the equivalent of stocks in terms of estimated normal production minus seed.

[c] The stocks reported for both 1908 and 1909 appear about equally low in terms of weeks' requirements.

There is some reason to question whether the lowest carryover reported for each of these countries (designated in the tabulation as "minimum" stocks) satisfies the definition of "minimum" stocks that we have set up: probably actual minimum stocks would be lower, and by different amounts for the different countries. In any case, the tabulation suggests certain important conclusions which may be generalized as follows: (1) In Germany, and presumably in most other importing countries also, year-end wheat stocks are normally smaller relative to ordinary domestic requirements than are the stocks in exporting countries. (2) On the basis of German stocks records, it seems not unreasonable to assume that in most European importing countries "low normal" stocks represent about 10 per cent or 5.2 weeks of the nation's normal annual requirements for domestic consumption exclusive of seed, with true "minimum" stocks corresponding to about 8 per cent or 4.2 weeks of such requirements. (3) On the basis of American, Canadian, Australian, and Russian stocks estimates it seems evident that the stocks of exporting countries show greater uniformity when expressed in terms of weeks' requirements for domestic use and export than when expressed in terms of weeks' requirements for domestic use alone. (4) The same records suggest that for exporting countries such as those in eastern Europe it is not unreasonable to assume that "low normal" carryovers of wheat represent something like 12 per cent or 6.2 weeks of the nation's normal annual requirements for domestic use and export, with "minimum" stocks falling at least as low as 10 per cent (5.2 weeks) and perhaps as low as 8 per cent (4.2 weeks) of the same requirements.

We accept the percentage values indicated above as the basis of estimation of postwar low normal and minimum stocks in individual European countries. For some countries these values are presumably too low, and for others probably too high. The actual minimum and low normal stocks of different countries probably differ markedly, depending upon the type and adequacy of grain-storage facilities, the extent of consumption of other grains, the general type of domestic agriculture (whether peasant, small-farm, or large-farm), the storage characteristics of the domestic wheat produced, seasonal habits of exportation and importation, and various other factors.[1] But since adequate stocks data are available for too small a group of countries to untangle the effects of the numerous influences that affect the relative levels of minimum and low normal stocks, we have seen no better way than to accept for postwar years the uniform percentage values suggested in the foregoing paragraph.

Historically, the percentage of "minimum" and "low normal" stocks kept by European countries has probably declined. In the early prewar period, particularly prior to 1900, both importing and exporting countries probably found it necessary to keep somewhat larger stocks for normal working reserves than they did either just prior to 1914 or than they have since 1920. The time from beginning of harvest to date of market delivery was longer in the earlier years, and importing countries were

[1] As of exactly August 1, minimum and normal stocks of old-crop wheat would be relatively smaller in southern Europe, where the new crops are harvested in June–July, than in northern Europe, where August harvests predominate. But our estimates "as of about August 1" may be said to apply for southern Europe to year-end stocks at dates somewhat earlier than August 1.

then unable to secure delivery on foreign orders as rapidly as they could later (p. 50). This assumption is supported by statistical evidence on British port stocks and on reported Russian carryovers.[1]

How much decline in percentage minimum and low-normal stocks should be allowed for in our estimates of European stocks from 1890 to 1914? Since there is no basis for securing a satisfactory answer to this question, we arbitrarily accept the folowing quantitative definitions: (1) In the countries of Europe ex - Danube ex - Russia, *low - normal* stocks are taken as equal to 12 per cent (6.2 weeks) of normal domestic consumption ex-seed in 1890, thereafter declining to about 11 per cent in 1898 and to about 10 per cent (5.2 weeks) after 1905. (2) In the same countries, *minimum* stocks are assumed to have declined from 11 per cent (5.7 weeks) of normal domestic requirements ex-seed in 1890 to 10 per cent in 1898 and then to 9 per cent (4.7 weeks) after 1905. (3) In the Danube countries, estimated *low normal* stocks are assumed to have tended downward from 14 per cent of normal production minus seed (7.3 weeks' requirements for export and domestic use ex-seed) in 1890 to 13 per cent in 1898, and to 12 per cent (6.2 weeks' requirements) after 1905. (4) *Minimum* stocks in the Danube basin are assumed to have declined during the same time from 12 per cent in 1890 (6.2 weeks' domestic and export requirements) to 11 per cent in 1898, and finally to 10 per cent (5.2 weeks' requirements) after 1905.

Chart 5 (p. 54) shows our aggregate stocks approximations for Europe ex-Russia (excluding also Poland and the three Baltic states since the World War) and for two groups of countries separately: (1) countries of central and eastern Europe substantially affected by boundary changes after the World War; and (2) western and northern countries whose boundaries were barely altered, if at all. The upper section of the chart shows the course of total year-end stocks; the lower section, annual variations in "surplus" stocks (i.e., in the excess above "low normal" carryovers). It is noteworthy that the aggregate "surplus" stocks fluctuate about a fairly horizontal trend from 1890 to 1939, with less change from prewar to postwar levels in the central and eastern countries subjected to major boundary changes than in the western group which was not so affected.

The two major wheat-surplus periods of the early eighteen-nineties and the early nineteen - thirties are prominently reflected in these figures, as are also most of the years of striking world wheat scarcity — 1897–98, 1908–09, and 1924–25 (but not 1936–37 or 1937–38). These facts tend broadly to support our stocks approximations for individual European countries. Yet for none of the individual countries are the annual stocks approximations likely to be as accurate as the European aggregates of which they are a part. Nor are the stocks estimates for individual European countries likely to be as trustworthy as the estimates for the United States, Canada, Australia, or Argentina, for which the basic data are much more adequate and less personal judgment is involved.

Russia.—In prewar years back to 1897, the Ministry of Finance of Russia collected reports as of July 15 on the stocks of old-crop grains remaining in European Russia in the hands of producers, merchants, millers, and distillers, in railroad warehouses, at river loading points, in transit, and on boats.[2]

[1] Between August 1, 1895 and August 1, 1907—dates when abundant stocks of old-crop wheat remained in the world ex-Russia—British port stocks declined from 9.2 to 8.9 per cent of the normal annual domestic wheat consumption. And there was a similarly small but significant decline in British port stocks (from 4.5 to 3.9 per cent of the normal consumption) between August 1, 1898 and August 1, 1909, which were both years of extremely light wheat carryovers. For Russia, data are available only for the latter set of years. From 1898 to 1909 reported Russian stocks of old-crop wheat declined from 20 to 11 per cent of the estimated normal production less seed or of the estimated normal domestic and export requirements exclusive of seed. That this decline is more or less typical for Russia is evidenced by the fact that the Russian carryovers of 1897–1901 averaged 26 per cent of normal production minus seed whereas those of 1909–13 averaged only 15 per cent.

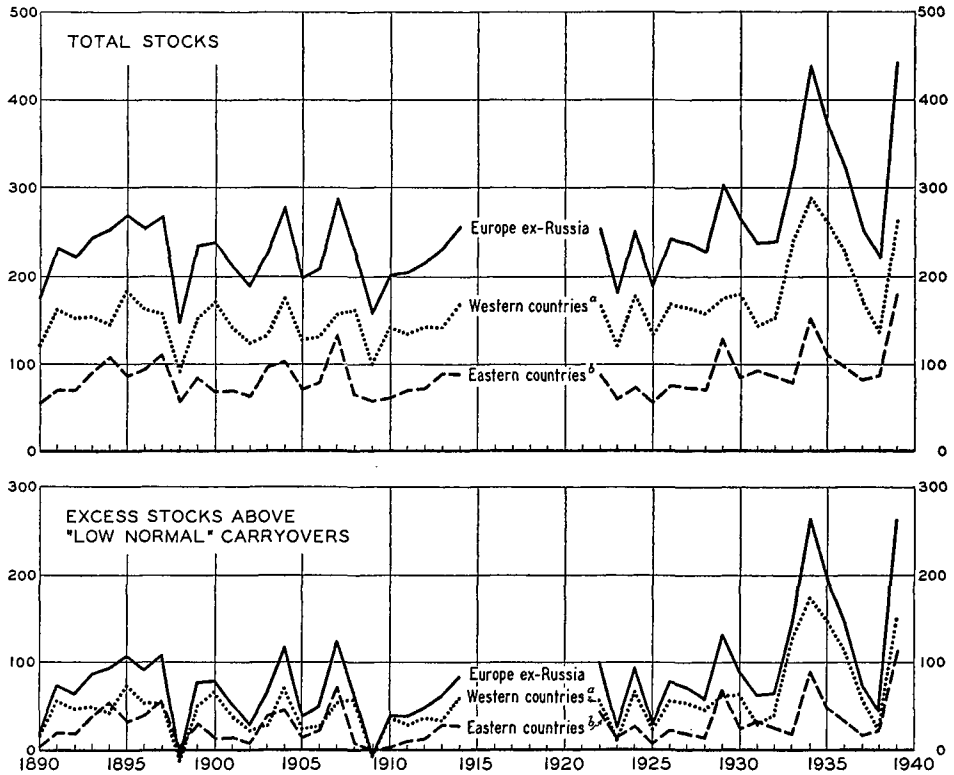
[2] The writer is indebted to N. Jasny and V. P. Timoshenko for calling attention to the following references in which these data are found: Russia, Ministry of Finance, *Narodnoe Khoziaistov v. 1914 godu* ["National Economy in 1914"] (Petrograd, 1916), p. 11; and P. I. Liashchenko, *Ocherki agrarnoi evolutsii Rosii* ["Essays on Agrarian Evolution of Russia"] (2d ed., Moscow, 1923), pp. 204–05.

The estimate here given for 1914 shall be referred

These data do not cover any of the Asiatic provinces and in this sense are incomplete. Yet it seems desirable to publish here the official estimates for European Russia rather than to add to the official figures approximations to cover stocks in Asiatic Russia. The stocks in the Asiatic area had virtually no effect in prewar years either upon the world wheat market or upon the wheat-supply situation in western Russia. Moreover, since the wheat yields in eastern Russia fluctuate violently from year to year, the percentage variation in stocks in this area was presumably greater than on the average throughout European Russia. Thus, the addition of rough, uncertain approximations to Asiatic Russian stocks seems more likely to worsen than to improve the official stocks series for European Russia.

CHART 5.—TOTAL AND "SURPLUS" WHEAT STOCKS IN EUROPE EX-RUSSIA, AUGUST 1*

(*Million bushels*)



* Our estimates, except for Germany since 1924 (see text and Table I). For comparison with prewar years, the postwar estimates shown are exclusive also of the stocks of Poland, Lithuania, Latvia, and Estonia. "Surplus" stocks represent estimated stocks above "low-normal" levels.

[a] Countries other than those mentioned in note *b*.

[b] Countries with major boundary changes after the World War: Germany, Austria, Czechoslovakia, Hungary, Yugoslavia, Rumania, Bulgaria, and Greece.

For 1890–96, years for which published official stocks data apparently do not exist, we have constructed rough approximations to Russian carryovers. In this we have been guided by the general relationship between domestic wheat utilization and stocks suggested by the official data for 1897–1914.

In Table I, Russian stocks are shown both in *total* and in terms of surplus above an estimated low-normal level. While it is possible that the 25 years from 1890 to 1914 were characterized by either upward or downward trends in "minimum" and "low normal" carryovers, the available official stocks data show no clear signs of this. It seems probable that

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to as "official," although it actually is the officially estimated figure for European Russia ex-Poland raised by 1 million bushels to cover our approximation to the stocks in Poland.

the recognized trend toward carrying smaller stocks of wheat per unit of production or consumption[1] was about offset by the existing upward trends in production and consumption. For the entire period from 1890 to 1914, therefore, we have taken 55 million bushels as the approximate "low-normal" level from which to measure "surplus" Russian stocks.

Prewar and Postwar Levels

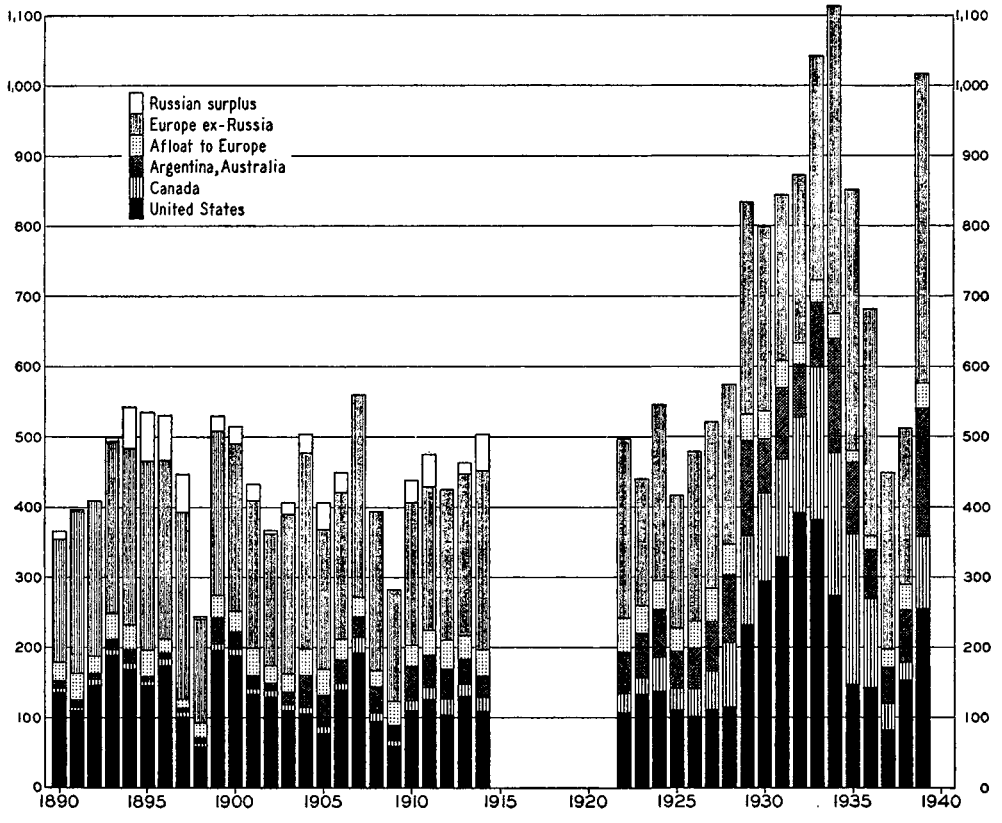
Our aggregate estimates of wheat stocks as of about August 1 in the United States, Canada, Argentina (exportable), Australia (exportable), Europe ex-Russia, and afloat to Europe are shown in Chart 6 for 25 prewar and 18 postwar years. In the prewar period *surplus* Russian stocks are included in the totals, since these stocks then held a meaning for the world wheat position similar to that which Argentine, Australian, or Canadian stocks hold today.

Even cursory inspection of Chart 6 suggests the important question: Why is the postwar level of "world" wheat stocks so much higher than the prewar level? Some advance in level with the passage of time might reasonably have been anticipated in a wheat world in which the population was tending upward and wheat consumption was gradually expanding. But on these grounds alone one would scarcely expect the wheat carryovers of 1890–1914 to fluctuate about a fairly constant level so much below that witnessed in the postwar period.

To rule out the direct effect of population growth on world wheat stocks, the aggregate stocks figures in Chart 6 are shown on a per

Chart 6.—Comparable Series of "World" Wheat Stocks, August 1, 1890–1914 and 1922–39*

(*Million bushels*)



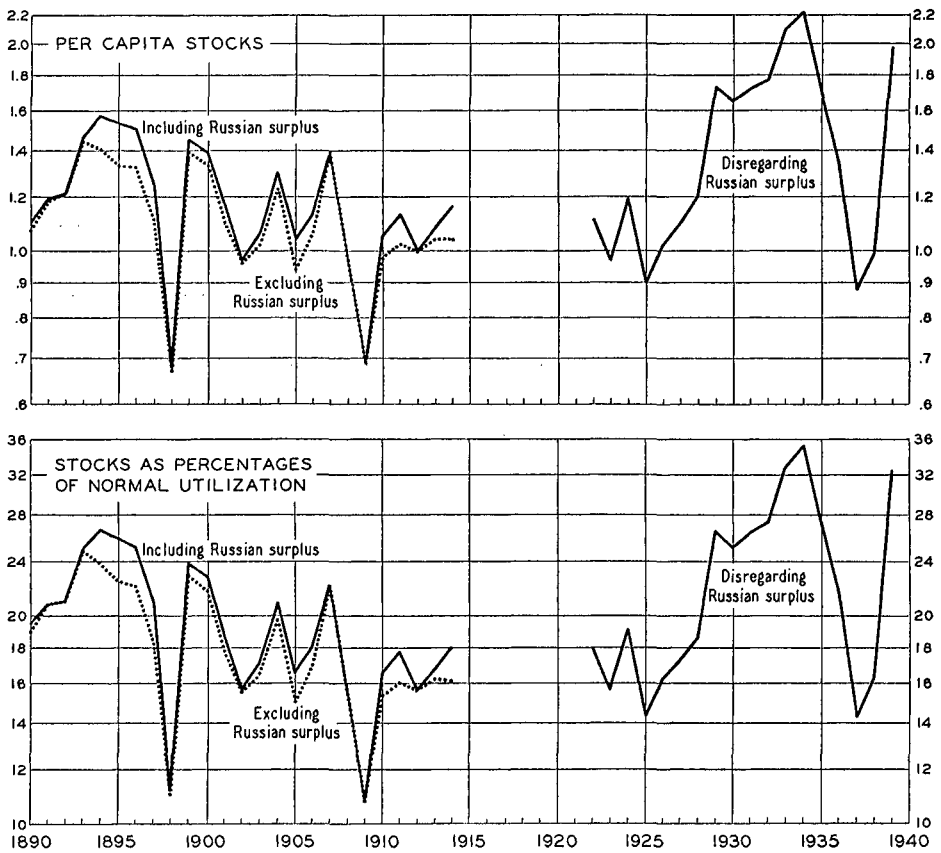
* Data in Table I.

[1] V. P. Timoshenko, *Agricultural Russia and the Wheat Problem* (Stanford University, 1932), pp. 397–99.

capita basis in the upper section of Chart 7 below. The per capita figures show a less pronounced elevation of level in the postwar period than is indicated in Chart 6. Indeed, the nine years 1922–28, 1937, and 1938 seem to have been characterized by a level of per capita carryover somewhat lower than the average in prewar years, while only the eight years from 1929 to 1936, and 1939, were characterized by per capita carryovers notably higher than the prewar average.

CHART 7.—PER CAPITA "WORLD" STOCKS, AND "WORLD" STOCKS AS PERCENTAGES OF ESTIMATED NORMAL UTILIZATION, AUGUST 1*

(Bushels per capita and percentages; logarithmic vertical scale)



* Stocks data in Table I divided by (1) estimated population on January 1 in the four chief exporting countries and Europe ex-Russia (in postwar years exclusive also of Poland, Estonia, Latvia, Lithuania), or (2) trend values of "world" wheat utilization.

A full explanation of the unprecedentedly high level of per capita wheat stocks in 1929–36 and 1939 cannot be undertaken here. Such an explanation would necessarily involve consideration of (1) the rapid expansion of world wheat acreage after the war and particularly after 1935; (2) the phenomenally heavy "world" yields of wheat in 1928 and 1938; (3) the drastic decline of world wheat prices and the concurrent onset and later deepening of world economic depression; (4) the attempts of certain importing countries to encourage domestic wheat production even before 1928, and the later efforts of most governments to combat declining or low prices, to aid their own agriculturists, and to protect their foreign exchanges; and (5) the resulting curtailment of world wheat consumption without offsetting contraction of wheat acreage. These various and partially conflicting factors produced an unprecedented accumulation of old-crop wheat which persisted in the form of surplus stocks for eight years and, after tem-

porary exhaustion in the crop year 1936–37, reappeared with good crop yields in 1938–39. The reflection of this surplus in the per capita figures in Chart 7 is striking, but certainly no more striking than the effects it produced upon the wheat markets and national economies of various wheat-producing countries. No one who has studied the world wheat situation of the past fifteen years could believe that Chart 7 overemphasizes the magnitude, duration, or importance of the world wheat surplus that first emerged after the bumper harvest of 1928; but neither could he regard the stocks of 1929–36 or of 1939 as "normal" for the postwar period.

Population growth and the combination of factors responsible for the wheat surplus of 1929–36 and 1939 largely account for the differences in prewar and postwar levels of total carryover indicated in Chart 6. But several less important factors have also operated over the past half-century to change the general level of world wheat carryovers.

From 1890 to 1914 wheat consumption expanded not only in response to population growth but also as a result of increased per capita use of wheat in the world ex-Russia ex-India. From 1890 to about 1905 the trend of per capita wheat consumption was significantly upward, while from about 1905 to 1914 the upward trend apparently continued at a reduced rate. In contrast, the early postwar period was characterized by a level of per capita consumption substantially below that of the late prewar years; the higher prewar level was reached only temporarily about 1930; and thereafter per capita consumption tended markedly downward.[1]

Other factors constant, these broad movements in per capita wheat consumption might have been expected to be associated with somewhat similar trends in normal per capita year-end stocks. But there is little indication of this in the per capita stocks figures in Chart 7, presumably mainly because other factors did not remain constant.

Comparison of the per capita stocks figures in the upper section of Chart 7 with the data in the lower section, showing the percentage relationships of "world" stocks to corresponding annual trend values of world wheat consumption, is illuminating. Whereas the per capita figures rule out only the effect of changes in consumption attributable to population growth, the percentage figures show the course of stocks as it might have been without any change in the trend of consumption, due either to population growth or to changing trends of per capita wheat utilization. The curves in the two sections of Chart 7 are very similar. This reflects the small influence upon stocks exerted by the gradual changes that occurred in per capita wheat utilization. Scarcely perceptible are the relatively greater declines in the two lower curves from the early 'nineties to 1914, the slightly higher relative level of these two curves in the early 'twenties, and their slightly smaller percentage decline from the early 'thirties to 1937.

The combined influence upon wheat stocks exerted by factors other than population growth and changing trends of per capita wheat consumption is well reflected in the course of the curves in the lower section of Chart 7. Tending to reduce the volume of year-end stocks held in the later prewar years, and in the postwar period as compared with the years immediately preceding the World War, were the changes introduced in rail and ocean transportation and in wheat-harvesting equipment. These changes combined to speed the delivery of wheat to leading consuming markets. We have already observed the effect of the transition from sailing vessels to steamships upon the volume of wheat on ocean passage (pp. 49–50), and we have made arbitrary allowance for increased speed of grain-delivery in our estimates of the prewar wheat carryovers of European countries (p. 53). But presumably some of the same factors operated also to reduce the amount of wheat required for working stocks on August 1 in the United States, Canada, Argentina, and

[1] These movements are shown in the data on world wheat utilization ex-Russia (in postwar years ex-USSR) presented by M. K. Bennett in "World Wheat Utilization since 1885–86," WHEAT STUDIES, June 1936, XII, 357 (Chart 8); and the same broad movements are indicated by estimated wheat-consumption figures for the world ex-Russian Empire ex-Asia (based on revised crop data and on the world stocks series shown in Table I).

Australia, countries whose stocks estimates rest but slightly, when at all, upon our own arbitrary assumptions.

In view of the increased speed of harvest and transport since the World War, it might seem reasonable to expect the percentage figures in the lower section of Chart 7 to suggest a relatively lower level of world wheat stocks than it does in the pre-surplus years from 1922 to 1928. That the level appears no lower is attributable in significant part to the increased volume of international trade in wheat[1] and to the development of Argentina and Australia as major wheat-producing and wheat-exporting countries to fill part of the gap left in the world import market after the war by Russia, the Danube countries (principally Rumania), and India.

The importance, for world wheat stocks, of the geographical change in distribution of the world wheat crop between prewar and postwar years can best be illustrated by a hypothetical example. Let us assume a world in which population and habits of wheat consumption remain constant, total wheat production remains at 3,000 million bushels, and there is no significant change over a decade except that 10 per cent of the world's wheat production is supplied at the end of the period by Southern Hemisphere countries which at the beginning produced no wheat. Let us further assume that in the first years of the decade 100 per cent of the world's crop is harvested in early August, whereas later 90 per cent is harvested in August and 10 per cent in January. What influence would such a shift in production have upon the level of August 1 wheat stocks? In the Northern Hemisphere, world wheat stocks on August 1 may be assumed to average about 15 per cent of the Northern Hemisphere crop—450 million bushels at the beginning of the decade and 405 million at the end. In the Southern Hemisphere, on the other hand, stocks may average 15 per cent of the production not on August 1 but on January 1, five months later. On August 1 the Southern Hemisphere countries may therefore be supposed to carry reserves for exportation and domestic consumption (exclusive of seed) for the last five months of their own crop year. In terms of percentage of the Southern Hemisphere crop, the August 1 stocks (assuming a seasonal distribution of exports more or less similar to that of Argentina today) may be assumed to approximate 35 to 40 per cent *in total*, or about 25 per cent disregarding domestic needs. On this basis, the Southern Hemisphere countries would hold no stocks on August 1 at the beginning of the decade, and 105 to 120 million bushels in total, or 75 million "exportable," at the end. Thus, with no change other than a shift of 10 per cent of the production from the Northern to the Southern Hemisphere, world wheat stocks might be increased from 450 to 510–525 million bushels in total, or to 480 million if exportable stocks only are counted for the Southern Hemisphere.

This hypothetical example appears very simple as compared with the actual changes in wheat production and stocks that occurred during 1890 to 1939. Yet it shows, without material exaggeration, the possible percentage change in world stocks that might have resulted from a proportional shift in the world's wheat production barely larger than really took place over this period.

To summarize, the higher postwar level of world wheat stocks shown in Chart 6 is attributable mainly to two factors: growth in population, and the persistence of an unprecedented world wheat surplus after the bumper harvest of 1928. Operating in the same direction were the increasing dependence of European countries upon imported wheat and the development of Argentina and Australia, two distant Southern Hemisphere countries, as major exporters to expanded import markets no longer supplied with large quantities of wheat from Russia, the Danube countries, and India. The cumulated effect of these four influences was only slightly offset by

[1] We have already observed that the normal level of stocks in exporting countries is higher in relation to domestic wheat consumption than is the level of stocks in importing countries (p. 52). With increase in the volume of world trade (other factors constant), exporters' stocks might be expected to increase more than importers' stocks would decline. Furthermore, with increase of trade, there is normally an increase in stocks afloat on August 1: in 1922–27 afloat stocks averaged about 10 million bushels higher than in the early nineteen-hundreds.

two minor factors that were operating concurrently to lower the postwar level of world wheat stocks: (1) reduction in per capita consumption of wheat in the world ex-Russia ex-India; and (2) changes in transportation (mainly prewar) and in harvesting (mainly postwar), which tended to speed the delivery of wheat from the harvest fields and export markets to the principal consuming centers.

Periods of Surplus and of Scarcity

A reasonably comparable series of world stocks estimates is perhaps most valuable as an index of the net supply-demand position of wheat in different years. Such a series differentiates clearly between years of wheat surplus, characterized by a "buyer's market," and years of wheat scarcity, favorable to sellers. For periods as short as 10 to 15 years, estimated *total* stocks are adequate for comparative purposes, but for significantly longer periods, per capita stocks figures or stocks expressed as percentages of normal consumption are definitely superior. Consequently, discussion in this section of the major periods of wheat surplus and wheat scarcity in the last half-century will rest mainly upon the data in Chart 7 (p. 56).

During the past five years, international wheat markets have had to adjust to unprecedentedly large changes in the world wheat position. A condition of record heavy wheat surplus in 1933–34 gradually gave way to relative scarcity in 1936–37 and 1937–38; and this was followed in 1938–39 by the largest absolute increase of stocks ever recorded during a single crop year. That these changes were unprecedented in magnitude is clear from Chart 7. But the chart also indicates that similar changes of only moderately smaller magnitude occurred in the last decade of the nineteenth century. Close study of the wheat situation in the 1890's[1] definitely supports the implications of Chart 7 that (1) the period 1893–96 was a period of world wheat surplus, (2) the crop year 1897–98 was characterized by pronounced symptoms of wheat scarcity, and (3) the two following years witnessed re-emergence of the specter of wheat surplus, which finally disappeared in 1900–01 and 1901–02.

Not again in prewar years nor, indeed, until 1929 did another large accumulation of surplus stocks persist over a period of several years. Surplus carryovers in 1904 and 1907 were wiped out by small world harvests in those years; and later prewar crops were not large enough to create a heavy surplus in the face of a rapidly growing population and an upward trend in per capita wheat consumption.

In the major wheat-surplus periods of the past half-century, large differences have been apparent in the stocks-holding power of different countries (Chart 6, p. 55). In general, year-end stocks have tended to accumulate most heavily in North America, least heavily in afloat positions and in certain European countries. In recent years Canada has proved to be almost as important a holder of surplus wheat stocks as has the United States. In contrast, Argentina and Australia have never carried large surplus stocks at the end of their own crop years; and they have held sizable surpluses on August 1 only in years characterized both by abundant world wheat supplies and by above-average domestic crops in the Southern Hemisphere.

Over the past fifty years, world wheat supplies have been relatively scarce in at least five years of peace—1897–98, 1908–09, 1924–25, 1936–37, and 1937–38. Various bits of historical evidence suggest that the greatest degree of deficiency was encountered in 1897–98. But the historical evidence supports less clearly the implication of Chart 7 that 1908–09 was characterized by a similar shortage, much more severe than any since witnessed in peace times.

This question, and more specifically the question as to why our stocks estimates show for the postwar period no such marked shortage of wheat as is implied for 1897–98 and 1908–09, can best be answered in the light of the following data (in bushels) on the geo-

[1] See Helen C. Farnsworth, "Decline and Recovery of Wheat Prices in the 'Nineties," Wheat Studies, June and July 1934, X, 289–352. The estimates of year-end wheat stocks presented in that study are here revised, with substantial changes (based on adjusted direct stocks reports) indicated for the United States in 1890–93.

graphical distribution of per capita stocks in the five years of recognized scarcity.[1]

Position	Prewar 1898	Prewar 1909	Postwar 1925	Postwar 1937	Postwar 1938
United States	.163	.146	.240	.163	.300
Canada	.016	.021	.066	.072	.048
Australia[a]	.008	.018	.037	.059	.076
Argentina[a]	.010	.034	.078	.043	.068
Afloat to Europe.	.062	.084	.072	.050	.071
Europe ex-Russia.	.410	.385	.408	.490	.432
Russian surplus..	.006	0	...	...	...
Total	.675	.688	.901	.877	.995

[a] Exportable stocks.

It is clear that the higher levels of total stocks in 1925, 1937, and 1938 is attributable in substantial part to consistent increases in Canada, Australia, and Argentina, countries whose wheat production was expanded after 1909 in response to an enlarged import demand for overseas wheat in Europe and to growing populations at home. The fact that Australia and Argentina are Southern Hemisphere countries and hence do not harvest their new crops before December–January contributes an element of artificial increase to the postwar figures (pp. 47–48). But entirely aside from these factors, there is some evidence that the total wheat stocks position was somewhat less tight in 1925, 1937, and 1938 than in either 1898 or 1909. In 1925 excess stocks were by no means exhausted in the United States and they were reduced less than in some other postwar years in Argentina and Canada. In 1937 the world deficiency was much more pronounced; yet in the Danube basin and importing Europe, stocks could have been drawn down further (as indeed they were in 1938) and Canadian stocks, though low, stood slightly higher than in the following year. The stocks position in 1938 was presumably easier than in any of the other years here designated as years of wheat-scarcity: significant surpluses remained in the United States and Australia; and Argentine stocks were materially larger than they had been in 1937.

[1] The figures represent the stocks in each of the positions named divided by the aggregate population in the four chief exporting countries and in Europe exclusive of the approximate territory of the old Russian empire.

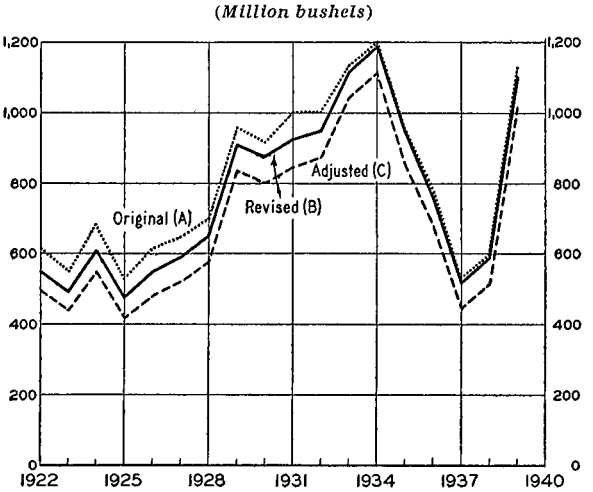
Contraction of year-end stocks under conditions of world wheat scarcity, like the expansion of stocks under conditions of surplus, has usually been most pronounced in North America (Chart 6, p. 55). In prewar years, when Canadian wheat production was much smaller, annual changes in Canadian wheat carryovers were necessarily small, and the contraction and expansion of North American stocks was attributable almost wholly to changes in United States carryovers. Since the war, however, both United States and Canadian carryovers have fluctuated widely from year to year, showing a greater response to changes in the world wheat supply position than the stocks in any other major area.

A Revised Postwar Series

In preceding sections our discussion of "world" wheat stocks has been based for postwar years upon a stocks series for 1922–39 especially adjusted for comparison with the prewar stocks estimates presented in Table I. Chart 8 shows the relation of this "adjusted"

Chart 8.—Original, Revised, and Adjusted Series of "World" Wheat Stocks, about August 1, 1922–39*

(*Million bushels*)



* Data on *adjusted* series from Table I, on *revised* series from Table III, on *original* series chiefly from "The World Wheat Situation, 1937–38," Wheat Studies, December 1938, XV, 243, and "World Wheat Survey and Outlook," September 1939, *ibid.*, September 1939, XVI, 9.

series (C) to our "original" postwar stocks series (A) that has appeared regularly in current *Survey* and *Review* issues of Wheat

STUDIES over the past six years,[1] and to the "revised" postwar series (B), here published for the first time in Table III, that will appear in future issues of WHEAT STUDIES.

The three postwar series shown in Chart 8 differ mainly as a result of differences in the stocks positions covered. Indeed the adjusted series differs from the revised only because the latter includes stocks estimates for nine additional positions (Morocco, Algeria, Tunis, Egypt, Poland, Lithuania, Latvia, Estonia, and afloat to ex-Europe) and makes allowances for the domestic wheat requirements of Australia and Argentina from August 1 to the approximate dates of harvest of the Australian and Argentine crops (see Tables I and II).

The positions covered by our revised stocks series are the same as those covered by the original series, except that the revised series excludes India and Japan. We have already commented on the extreme difficulties of obtaining reasonably accurate stocks approximations for India, and on the questionable importance of Indian stocks for the world wheat position (p. 41). Japan, the only other country in Asia for which we have previously estimated stocks, is omitted here mainly because our world stocks series is somewhat more homogeneous if all Asiatic countries are excluded.

Although the revised stocks figures always stand below the original figures in reflection of the smaller number of positions covered, it is noteworthy that the differences between these two series are greater in the earlier than in the later postwar years. This is attributable to the fact that our original estimates were made in terms of deviations from "low normal" carryovers which were assumed to be constant for each of the countries for which we estimated stocks; whereas in the present revision we have made allowance for changes in normal stocks with changes in national trends of domestic wheat consumption and trade. With the expansion of total wheat consumption from 1920 to about 1930, and with the expansion of exports from the Danube basin during this same period, there was presumably a significant increase in the "low-normal" wheat carryovers of a number of countries; this is reflected in approximate degree in the steeper trend of the revised stocks series in Chart 8.

Finally, some small part of the changing annual differences between the original and revised series shown in Chart 8 is due to changes in our judgment of the course of wheat consumption in certain countries. At the time that our original stocks series was constructed, we had not seen the accumulation of evidence that has more recently established the presumption that in Spain, northern Africa, and parts of the Danube basin, wheat consumption varies strikingly with the size of domestic wheat supplies and to a lesser extent with changes in the relationship of wheat prices to prices of other grains. Our original series allowed for significant variations in consumption in these countries, but for variations smaller than it now seems reasonable to credit.

The net effect of assuming larger variations in consumption in these several areas has been to reduce significantly the average level of estimated "world" stocks. This reduction has been more than offset, however, by the increases we have felt it necessary to make in the estimated minimum and low-normal stocks of France and of the exporting countries of the Danube basin and northern Africa. Several years ago we were influenced by reports from France of so-called "official" stocks estimates to reduce our original allowance (10 per cent of normal domestic utilization exseed) for "low-normal" French stocks.[2] But incomplete evidence on stocks recently made available by the French Wheat Office tends to

[1] Minor revisions and adjustments that have been made since the earlier part of the series was first published in February 1933 are included in the series here designated as "original."

[2] In Bennett's study on "Estimation of End-Year World Wheat Stocks," published in February 1933, "minimum" French stocks (now referred to as "low normal") were placed at 30 million bushels; but in the following autumn the French "low-normal" figure was reduced to 17 million, a figure that has been maintained until the present time. In our current revision we place "low normal" French stocks at 27 million bushels, on the basis of the recent stocks estimates of the French Wheat Office; but we feel no confidence that this figure will be maintained in our statistics throughout the coming decade. There is much room for improvement in French stocks figures, and the passage of time should bring forth better official estimates that will necessitate further revision in our "world" stocks series.

support our earlier ideas of a higher level of "low-normal" stocks in France. In the present revision, therefore, we have raised French stocks 10 million bushels above the level indicated by figures we have published during the past few years. Our estimates of low-normal stocks for the exporting countries of the Danube basin and northern Africa are here raised on the basis of considerations discussed on pages 51–52. We now figure the low-normal stocks for these countries at 12 per cent of their total normal supplies for exportation and domestic consumption ex-seed; whereas formerly we allowed for these low-normal carryovers only 10 per cent of the average domestic consumption ex-seed. This change tended to increase the revised stocks totals by something like 10 to 12 million bushels.

Thus far attention has been directed to the *differences* between the three stocks series shown in Chart 8 and to the *changes* in postwar estimates introduced in the current revision. But emphasis may more properly be placed on the striking correspondence of annual movement of the three series here contrasted. Clearly, almost any generalization that might have been made with confidence on the basis of our original "world" stocks series, would appear equally true from the revised estimates or even from the less comprehensive estimates adjusted for comparison with the prewar totals. The revisions here indicated presumably improve the stocks figures of certain individual countries and make possible a more accurate continuation of our aggregate stocks series in future years; but they do not materially change the general picture of the course of world wheat stocks during 1922–39.

The writer has received valuable suggestions from various members of the Institute staff and from Romain Cresin, of the Central Statistical Office of Rumania. She is indebted also to P. Stanley King for the charts and to Marion Theobald for clerical assistance.

APPENDIX TABLES

TABLE I.—APPROXIMATE WHEAT STOCKS ABOUT AUGUST 1, 1890–1914 AND ADJUSTED STOCKS 1922–39*

(Million bushels)

Year	Total[a]		Four exporters[b]	North America	Europe ex-Russia			Russia[c]		United States grain[f]	
	Including Russian surplus	Excluding Russian surplus			Total[c]	Lower Danube[d]	Other Europe[c]	Total	Surplus	In United States	In Canada
1890.....	365	354	152	141	175	32	143	66.0	11.0	136.4	0
1891.....	397	395	126	115	231	43	188	57.0	2.0	109.6	0
1892.....	409	409	163	155	222	44	178	47.0	0	146.2	0
1893.....	499	493	212	198	244	61	183	61.0	6.0	188.9	0
1894.....	541	484	198	178	252	79	173	112.0	57.0	170.0	0
1895.....	535	465	160	152	269	52	217	125.0	70.0	145.6	0
1896.....	529	465	192	184	254	52	202	119.0	64.0	175.2	0
1897.....	447	393	114	108	267	63	204	108.5	53.5	100.4	0
1898.....	243	241	71	65	148	30	118	57.2	2.2	58.7	0
1899.....	529	508	242	205	235	53	182	75.7	20.7	195.8	0
1900.....	514	490	222	197	238	36	202	79.4	24.4	188.2	0
1901.....	433	410	160	141	211	33	178	77.8	22.8	134.2	0
1902.....	366	362	150	138	189	34	155	58.5	3.5	130.4	0
1903.....	407	390	137	119	227	59	168	71.9	16.9	109.7	0
1904.....	504	477	160	115	278	71	207	82.5	27.5	106.3	0
1905.....	406	368	132	88	199	38	161	93.3	38.3	78.1	0
1906.....	449	421	184	150	209	38	171	82.7	27.7	139.7	0
1907.....	559	559	244	215	287	82	205	52.0	0	192.4	0
1908.....	394	394	145	107	226	31	195	46.9	0	95.5	0
1909.....	282	282	90	69	158	30	128	48.8	0	59.8	0
1910.....	437	406	174	125	202	26	176	86.4	31.4	110.1	0
1911.....	475	429	188	143	205	36	169	100.9	45.9	126.0	0
1912.....	425	425	170	127	215	39	176	51.8	0	104.6	0
1913.....	463	447	184	149	231	47	184	70.6	15.6	130.5	0
1914.....	504	452	159	129	255	37	218	107.0	52.1	109.5	0
1922.....	...	496	193	135	254	22	232	....	....	106.6	.5
1923.....	...	441	221	157	181	30	151	....	....	132.3	1.2
1924.....	...	545	253	185	250	40	210	....	....	137.1	.3
1925.....	...	417	195	142	189	22	167	....	....	108.4	2.7
1926.....	...	480	199	141	242	38	204	....	....	100.2	1.0
1927.....	...	520	237	167	237	39	198	....	....	109.5	1.4
1928.....	...	574	302	206	228	28	200	....	....	112.4	2.5
1929.....	...	835	494	359	303	72	231	....	....	228.4	3.3
1930.....	...	800	497	421	264	46	218	....	....	288.9	4.7
1931.....	...	845	570	468	237	60	177	....	....	313.3	15.3
1932.....	...	873	603	527	239	55	184	....	....	375.5	15.9
1933.....	...	1,042	691	600	319	31	288	....	....	377.9	4.1
1934.....	...	1,113	640	477	438	67	371	....	....	274.3	.0
1935.....	...	852	464	362	371	34	337	....	....	147.5	.0
1936.....	...	681	338	269	322	34	288	....	....	142.1	.0
1937.....	...	449	172	120	251	40	211	....	....	83.2	.1
1938.....	...	512	253	179	222	36	186	....	....	153.3	.7
1939.....	...	1,017	540	357	442	82	360	....	....	254.3	.6

* A roughly comparable stocks series for the four chief exporting countries, afloat to Europe, and Europe exclusive of the territory in the old Russian empire. Methods of estimation are described in the text.

[a] A summation of stocks of United States grain in North America and of stocks in the positions named on the two following pages, except that for Australia and Argentina exportable stocks only are included. For comparison with the total stocks figures for postwar years we regard the prewar figures including surplus Russian stocks as better than the prewar totals exclusive of surplus Russian stocks.

[b] United States and Canadian grain in North America and exportable stocks in Australia and Argentina.

[c] Actual boundaries prior to 1914; since 1922 exclusive of Poland, Estonia, Latvia, and Lithuania—areas largely included in the old Russian empire.

[d] Hungary, Servia (or Yugoslavia), Rumania, and Bulgaria—actual boundaries.

[e] European Russia only (see text, pp. 53–54). Official data as of July 15 for *total* stocks, 1897–1914; our approximations for earlier years. *Surplus* stocks are the total stocks minus 55 million bushels.

[f] As of July 1. Estimates of the Food Research Institute for 1890–1914 and 1922 (see text, pp. 43–44); official estimates from 1923.

TABLE I (*Continued*)

Year	Canadian grain[a]		Australia[b]		Argentina[b]		Hungary	Serbia, Yugoslavia	Rumania	Bulgaria	Afloat to Europe[c]	British Isles	France
	In Canada	In United States	Total	Exportable	Total	Exportable							
1890....	4.5	.0	14.0	8.0	9.0	3.5	18.0	3.0	5.5	5.0	27.1	30.5	36.0
1891....	5.0	.0	11.0	5.0	12.0	6.5	31.0	2.5	5.5	4.0	38.0	27.0	75.0
1892....	8.5	.1	9.5	3.5	11.0	4.5	29.0	2.0	5.5	8.0	24.2	45.0	50.5
1893....	9.0	.1	10.0	4.0	16.0	9.5	31.0	3.0	13.5	13.5	36.9	46.0	47.5
1894....	8.0	.1	11.5	5.0	21.0	14.5	43.0	2.5	17.5	16.0	34.3	39.0	35.0
1895....	6.0	.1	9.5	3.0	12.0	5.0	35.5	2.0	5.0	9.0	36.3	49.5	51.0
1896....	9.0	.1	9.5	3.0	12.0	4.5	41.5	1.5	6.0	3.0	19.4	35.0	53.5
1897....	7.0	.1	9.5	3.0	11.0	3.0	45.5	1.0	13.0	4.0	12.4	32.5	56.0
1898....	5.5	.2	10.0	3.0	12.0	3.5	15.5	4.5	6.5	3.5	22.2	22.5	30.0
1899....	9.0	.1	14.0	7.0	39.0	30.5	21.5	3.0	19.5	9.0	31.2	35.5	57.5
1900....	9.0	.2	14.0	7.0	27.0	17.5	23.5	3.5	5.5	4.0	29.9	35.5	76.0
1901....	7.0	.1	14.5	7.5	21.0	11.0	21.5	1.5	6.5	3.5	38.9	34.0	60.5
1902....	8.0	.3	12.5	5.5	17.0	6.0	14.0	.8	14.0	5.5	23.4	27.5	34.5
1903....	8.5	.4	10.5	3.0	26.0	15.0	24.0	2.0	22.0	11.0	25.6	29.5	38.0
1904....	9.0	.2	24.5	17.0	39.0	28.0	28.0	2.0	32.5	8.0	38.7	34.5	64.5
1905....	10.0	.2	15.0	7.5	48.0	36.0	20.5	2.0	10.5	5.5	36.8	35.0	34.0
1906....	10.0	.5	18.0	10.5	36.0	23.0	22.5	1.5	10.5	3.5	28.3	40.5	32.0
1907....	22.0	.5	18.0	10.5	32.0	18.5	44.5	3.5	27.5	6.5	28.2	42.5	30.0
1908....	11.0	.5	18.0	11.0	41.0	27.0	13.5	1.5	12.5	3.0	22.6	42.0	66.0
1909....	8.0	.6	15.0	7.5	28.0	14.0	17.5	1.0	7.5	3.5	34.4	24.0	32.0
1910....	14.0	.7	28.5	20.5	43.0	29.0	13.5	2.7	6.5	3.5	29.8	36.5	43.0
1911....	16.0	.7	31.0	22.5	38.0	23.0	20.0	2.5	9.0	4.0	36.4	32.0	40.5
1912....	21.0	1.6	21.0	13.0	46.0	30.0	23.0	3.5	8.0	4.5	39.9	30.0	32.0
1913....	17.5	1.2	26.0	17.5	34.0	17.5	25.0	.8	13.0	8.0	32.3	38.0	42.0
1914....	19.0	.3	27.0	18.5	29.0	12.0	19.0	1.0	8.5	9.0	37.5	32.0	62.0
1922....	27.0	1.1	24.0	14.5	62.0	43.0	5.5	7.0	8.0	2.0	48.9	32.0	49.5
1923....	22.0	1.0	33.0	24.0	60.0	40.0	9.5	4.5	13.0	3.0	38.9	28.0	27.0
1924....	45.2	3.0	34.0	24.0	66.0	44.0	13.0	8.0	16.5	2.5	41.7	44.5	38.5
1925....	27.7	3.0	28.0	17.0	58.0	36.0	6.0	5.5	8.5	2.5	33.4	45.5	36.0
1926....	36.5	3.7	24.0	13.5	67.0	44.0	7.5	14.5	10.5	5.5	38.6	27.0	57.5
1927....	50.8	4.8	35.0	24.5	70.0	46.0	7.5	14.5	14.5	3.0	46.1	34.5	44.0
1928....	77.5	13.6	36.0	26.5	95.0	70.0	7.5	7.0	9.5	3.5	43.6	43.5	34.5
1929....	104.3	22.9	40.0	30.0	130.0	105.0	23.0	22.0	17.5	9.5	37.6	32.0	51.0
1930....	110.5	16.1	48.0	37.5	65.0	39.0	11.0	17.0	13.5	4.0	39.2	28.0	63.0
1931....	133.1	5.5	60.0	49.5	80.0	53.0	17.0	13.5	22.0	7.0	37.9	36.0	27.0
1932....	130.1	5.9	48.0	37.5	65.0	38.0	12.0	16.0	16.5	10.5	31.4	44.5	40.0
1933....	210.0	7.7	55.0	44.5	75.0	47.0	9.0	6.0	9.0	7.5	31.6	36.0	105.0
1934....	192.9	10.0	84.0	74.0	118.0	89.0	14.5	19.5	23.0	10.0	34.8	44.5	141.0
1935....	202.1	11.7	57.0	46.0	85.0	56.0	7.5	11.0	10.5	4.5	16.9	39.0	116.0
1936....	108.1	19.3	43.0	32.0	66.0	37.0	10.0	8.0	11.5	4.5	20.6	41.5	80.0
1937....	32.9	4.1	41.0	30.0	51.0	22.0	9.5	12.5	12.0	5.5	25.6	38.0	49.0
1938....	23.6	1.0	50.0	39.0	65.0	35.0	8.5	8.5	13.0	6.0	36.5	35.0	27.0
1939....	95.0	7.1	50.0	39.0	175.0	144.0	19.0[f]	20.0	28.0	15.5	34.9	74.5	94.0

[a] Our estimates of Canadian carryovers in Canada prior to 1924 and of Canadian stocks in the United States through 1914; official data for later years.

[b] For description of meaning and method of estimation of *total* and *exportable* stocks in Australia and Argentina, see text, pp. 47–48.

[c] Broomhall's data.

[f] Boundaries as changed after division of Czechoslovakia.

TABLE I (*Concluded*)

Year	Italy	Germany[k]	Austria	Czechoslovakia	Belgium	Netherlands	Switzerland	Denmark	Norway	Sweden	Finland	Spain	Portugal	Greece
1890.....	19.5	13.5	8.0	...	5.0	2.6	2.0	.8	.2	.9	.1	21.0	1.8	1.5
1891.....	21.5	16.0	9.5	...	10.5	2.6	2.4	.5	.3	.9	.1	18.0	2.0	1.8
1892.....	29.0	15.5	8.5	...	7.0	2.7	2.2	.6	.4	1.3	.1	11.0	2.2	1.6
1893.....	28.0	16.0	12.0	...	7.0	2.5	2.1	.6	.4	2.3	.1	15.0	2.0	1.1
1894.....	33.0	15.5	11.0	...	5.5	2.9	2.1	.9	.4	2.3	.3	23.0	1.0	1.1
1895.....	22.0	19.0	14.0	...	10.5	3.1	2.3	.8	.4	2.6	.3	39.0	1.7	1.2
1896.....	20.0	22.5	18.0	...	12.0	3.3	3.1	.8	.4	1.7	.2	29.0	1.8	1.1
1897.....	32.5	25.5	19.5	...	9.5	3.1	3.2	.7	.3	1.6	.2	17.0	1.1	1.1
1898.....	16.5	16.5	10.0	...	5.5	2.2	2.2	.7	.3	.9	.2	8.0	1.6	1.1
1899.....	19.0	20.5	9.0	...	6.5	2.5	2.1	.7	.3	1.4	.2	24.0	1.3	1.3
1900.....	26.0	18.0	12.5	...	4.0	3.2	2.0	.8	.3	1.8	.4	18.0	1.8	1.6
1901.....	19.5	24.0	11.0	...	5.0	2.8	2.0	1.7	.4	1.2	.5	11.0	2.4	1.7
1902.....	26.5	17.5	10.0	...	6.0	2.7	2.1	.8	.4	1.2	.4	22.0	1.1	1.8
1903.....	20.0	22.5	12.5	...	6.5	3.5	2.1	1.1	.4	1.5	.3	27.0	1.6	1.8
1904.....	30.0	21.0	10.0	...	6.5	3.3	3.2	.9	.4	1.9	.3	28.0	1.3	1.5
1905.....	24.0	20.5	10.5	...	6.0	2.3	3.3	1.0	.3	1.9	.3	18.0	2.1	1.3
1906.....	22.0	26.5	12.5	...	9.5	3.1	3.8	1.1	.3	1.8	.4	14.0	2.0	1.6
1907.....	31.0	26.0	20.5	...	10.5	3.0	3.8	1.1	.3	1.5	.5	30.5	1.4	2.1
1908.....	23.0	22.0	10.5	...	8.0	3.3	2.1	1.1	.6	1.3	.6	11.5	1.2	2.0
1909.....	16.5	17.0	10.5	...	8.0	2.4	2.1	.9	.6	1.5	.5	9.5	1.6	1.4
1910.....	24.5	24.0	9.5	...	5.5	3.3	2.1	1.3	.5	1.7	.5	21.5	.9	1.3
1911.....	16.5	23.0	10.0	...	9.0	4.1	2.1	1.1	.4	2.0	.6	26.5	.7	1.3
1912.....	23.5	19.0	11.5	...	10.5	2.9	2.3	1.1	.4	1.2	.5	36.5	1.3	3.2
1913.....	25.0	24.0	16.5	...	9.5	2.7	2.9	1.1	.4	1.5	.9	16.5	1.1	1.7
1914.....	38.5	30.5	18.5	...	6.5	3.2	2.8	2.7	.5	2.3	1.5	12.0	2.8	1.9
1922.....	38.5	52.0	4.3	7.0	8.0	2.8	1.8	1.5	.7	1.7	.5	27.5	1.5	2.3
1923.....	35.5	20.0	2.3	5.0	5.5	3.0	2.2	1.5	1.5	2.2	.7	12.5	1.7	2.4
1924.....	44.5	20.0	3.9	7.5	6.0	3.7	3.6	3.3	1.1	4.3	.7	23.5	2.5	2.5
1925.....	24.0	22.0	2.9	5.5	5.0	3.4	1.9	1.5	.7	3.0	.5	10.5	1.5	2.6
1926.....	39.0	22.0	2.5	9.5	6.0	3.5	1.9	1.5	.9	3.0	.7	23.5	2.5	2.7
1927.....	47.5	22.0	2.5	6.0	5.5	3.6	2.0	1.6	.7	2.2	.6	20.5	1.5	3.0
1928.....	32.5	28.0	3.1	9.0	6.5	4.4	3.8	1.8	.7	3.8	.8	20.5	4.5	3.0
1929.....	45.5	39.0	2.6	10.0	7.5	4.4	3.4	5.1	2.4	4.3	1.3	14.5	3.5	4.5
1930.....	44.0	21.0	5.0	9.5	5.5	3.7	2.2	2.3	1.7	4.0	.9	20.0	3.5	3.7
1931.....	37.0	15.0	4.6	10.5	8.5	5.3	2.2	2.1	2.1	3.4	.7	17.0	2.5	3.2
1932.....	26.5	15.0	2.5	10.5	9.5	4.5	4.3	4.2	2.2	2.2	.7	13.0	1.5	3.2
1933.....	26.5	30.0	2.5	11.5	7.0	5.0	4.7	2.2	2.3	4.0	.7	39.0	8.0	3.5
1934.....	47.0	58.0	2.5	20.5	7.0	4.8	4.7	2.2	2.3	5.5	.7	21.0	6.0	3.5
1935.....	22.0	52.0	2.5	19.0	5.5	3.7	4.9	3.0	2.8	5.0	.7	46.5	11.0	3.5
1936.....	27.0	27.0	2.5	28.5	5.5	3.7	4.9	2.7	2.7	4.0	.9	43.5	10.0	3.8
1937.....	26.0	20.0	3.2	14.5	7.0	4.2	5.2	2.1	3.6	2.5	.8	30.0	1.5	3.5
1938.....	30.0	32.0	3.0	10.5	5.5	3.7	4.5	2.1	3.6	3.0	1.4	19.0	1.5	4.5
1939.....	40.0	90.0[l]		1.5[m]	8.5	10.0	6.5	2.1	4.4	8.0	2.4	11.0	2.0	5.0

[k] Our approximations, 1890–1914, 1922, and 1923; approximations suggested by N. Jasny, 1924–31; official figures (slightly adjusted), from 1932.

[l] Including the former postwar German Reich, Austria, Sudeten, and Bohemia-Moravia.

[m] Slovakia only.

TABLE II.—STOCKS NOT INCLUDED IN THE ADJUSTED STOCKS SERIES, 1922–39*

(*Million bushels*)

Year	Total	Poland and Baltic States					Northern Africa					Afloat to ex-Europe
		Poland	Lithuania	Latvia	Estonia	Total	Morocco	Algeria	Tunis	Egypt	Total	
1922.....	24	4.0	.3	.2	.2	4.7	5.5	2.5	2.0	4.0	14.0	5
1923.....	21	4.0	.3	.2	.2	4.7	2.0	2.0	.5	4.0	8.5	8
1924.....	31	6.5	.3	.4	.2	7.4	2.0	6.0	1.5	6.0	15.5	8
1925.....	26	4.5	.3	.4	.2	5.4	7.5	2.0	.5	4.2	14.2	6
1926.....	33	5.0	.9	.4	.2	6.5	7.5	5.0	1.5	5.5	19.5	7
1927.....	35	5.0	.4	.3	.2	5.9	5.5	5.0	5.5	4.5	20.5	9
1928.....	42	11.5	.4	.3	.2	12.4	4.0	3.0	4.5	5.0	16.5	13
1929.....	41	7.5	.5	.8	.2	9.0	2.5	4.0	4.5	5.0	16.0	16
1930.....	37	5.5	2.0	.6	.2	8.3	5.5	6.0	3.0	7.5	22.0	7
1931.....	42	10.5	1.5	1.0	.2	13.2	3.0	5.0	1.5	5.0	14.5	14
1932.....	41	16.5	.9	.5	.2	18.1	3.0	3.5	1.0	5.0	12.5	10
1933.....	36	6.0	1.0	.6	.2	7.8	3.0	3.0	3.5	8.0	17.5	11
1934.....	36	10.0	.7	1.2	.2	12.1	2.5	3.0	2.5	5.0	13.0	11
1935.....	48	10.0	1.0	1.7	.4	13.1	10.5	7.5	1.5	4.5	24.0	11
1936.....	37	6.0	.7	.8	.2	7.7	5.0	5.0	3.5	4.5	18.0	11
1937.....	29	7.0	.7	.6	.2	8.5	2.0	3.5	1.4	5.5	12.4	8
1938.....	34	6.0	.7	.9	.2	7.8	2.1	3.5	3.2	5.5	14.3	12
1939.....	42	10.0	.7	1.3	.4	12.4	2.2	7.5	1.5	5.5	16.7	13

* The *adjusted* series in Table I differs from the more comprehensive series in Table III not only because it excludes the stocks positions named here, but also because it includes *exportable* rather than *total* stocks in Australia and Argentina.

TABLE III.—REVISED SERIES OF WORLD WHEAT STOCKS EX-RUSSIA AND EX-ASIA, ABOUT AUGUST 1, 1922–39*

(*Million bushels*)

Year	Total	Total exporters[a]	Four chief exporters[b]	North America[c]	United States grain[c]	Canadian grain	Australia	Argentina	Lower Danube[d]	Europe ex-Danube	French North Africa,[e] Egypt	Afloat		
												To Europe	To ex-Europe	Total
1922....	547	253	221	135	107	28	24	62	22	236	14	49	5	54
1923....	491	284	250	157	134	23	33	60	30	156	8	39	8	47
1924....	609	335	285	185	137	48	34	66	40	218	16	42	8	50
1925....	475	260	228	142	111	31	28	58	22	172	14	33	6	39
1926....	546	284	232	141	101	40	24	67	38	210	20	39	7	46
1927....	590	327	272	167	111	56	35	70	39	204	20	46	9	55
1928....	651	376	337	206	115	91	36	95	28	213	16	44	13	57
1929....	911	612	529	359	232	127	40	130	72	240	16	38	16	54
1930....	874	594	534	421	294	127	48	65	46	226	22	39	7	46
1931....	925	678	608	468	329	139	60	80	60	190	14	38	14	52
1932....	951	703	640	527	391	136	48	65	55	202	12	31	10	41
1933....	1,118	771	730	600	382	218	55	75	31	296	18	32	11	43
1934....	1,188	754	679	477	274	203	84	118	67	383	13	35	11	46
1935....	940	558	504	362	148	214	57	85	34	350	24	17	11	28
1936....	758	426	378	269	142	127	43	66	34	296	18	21	11	32
1937....	518	259	212	120	83	37	41	51	40	220	12	26	8	34
1938....	587	339	294	179	154	25	50	65	36	194	14	37	12	49
1939....	1,101	675	582	357	255	102	50	175	82	372	17	35	13	48

* This series supplants the stocks series that has appeared regularly in current *Survey* and *Review* issues of WHEAT STUDIES since 1933. For a discussion of the differences between the original and revised series, see text, pp. 60–62.

[a] Four chief exporters, Lower Danube, French North Africa.

[b] United States, Canada, Argentina, Australia.

[c] United States data as of July 1.

[d] Hungary, Yugoslavia, Rumania, Bulgaria.

[e] French Morocco, Algeria, Tunis.

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