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AVERAGE PRE-WAR AND POST-WAR FARM COSTS OF WHEAT PRODUCTION IN THE NORTH AMERICAN SPRING-WHEAT BELT

I. SCOPE AND PURPOSE OF THE STUDY

It is generally recognized that money costs of wheat production have risen in both Canada and the United States between pre-war and post-war years. The recent agricultural depression in the North-west is often charged to the failure of wheat

wheat belt of the United States and Canada under pre-war and post-war conditions.

THE AREAS

The spring-wheat belt of North America falls chiefly within the boundaries of the American states of Minnesota, North Dakota, South Dakota, and Montana, and the Canadian provinces of Manitoba, Saskatchewan, and Alberta. During the past twenty years the four American states have produced about 80 per cent of all spring wheat grown in the United States; and the three Canadian provinces have produced about 98 per cent of all spring wheat grown in Canada.¹

Scope and Purpose of the Study
Pre-War Costs, Excluding Land
Charges, in Different Areas
Increases in Costs Excluding Land
Charges

Post-War Costs Including Land
Charges

Canadian and American Costs
The Cost-of-Production Formula
and the Tariff on Wheat
Broad Changes in the Level of
Costs

Costs in Relation to Farm Pros-
perity

Summary and Conclusions

wheat. As a matter of fact, however, little is generally known about the degree or the causes of increases in costs of wheat production, about relative costs in Canada and the United States, or even about the meaning of "cost of production of wheat."

The present paper summarizes an extensive analysis of available data on farm costs of producing wheat in the spring-

Within these seven political areas as a whole, spring-wheat production is undoubtedly the most important source of farm income. It is not, however, of equal importance in all of the sub-areas. The costs of wheat production are, therefore, not of equal importance to farmers in all of the

¹ See Appendix Table IV.

seven sub-areas. But in the spring-wheat belt as a whole, no other crop is of comparable importance.

TYPES OF WHEAT

Winter wheat, durum wheat, and hard spring wheats of various varieties such as Marquis, Red Fife, Blue Stem, and Velvet Chaff, all are grown in the spring-wheat belt. These varieties differ one from the other in quality, in price, in yield, and to a certain limited extent, perhaps, in cost of production. It is impossible, however, to distinguish in the present paper between different wheat varieties, since available statistical data take no account of such distinctions. In general, hard spring wheat as distinguished from durum and winter wheats constitutes by far the bulk of production, although in Montana, Alberta, and Minnesota winter wheats are or have been of some importance, and in the Dakotas durum wheat is extensively grown. The statistics hereafter employed apply, strictly speaking, to *all* wheat grown in the spring-wheat belt—winter and durum as well as hard spring. But, since hard spring wheat constitutes the bulk of production, generalizations drawn from the cost and profit statistics apply with reasonable accuracy to the production of hard spring wheat.

THE PERIODS

For present purposes the pre-war period is defined as the years 1908–14. This period has definite advantages for the present study, and no important disadvantages. The influence of the war on farm prices and production was not felt until late in 1914; the influence of the crisis of 1907 seems not to have been considerable in the spring-wheat belt during 1908; and certain phenomena, including acreage, production, number of livestock on farms, and yields per acre, all of which are important in interpretation or calculation of cost statistics, were unaffected either by the crisis or by the first year of the war. The post-war period is not susceptible of accurate definition. It is here defined as the years 1921–24. These years have clearly been more similar

one to the other than others of the six years which have elapsed since 1918.

The pre-war period may be regarded as a fairly normal period, while the post-war period was largely one of agricultural depression.

BASIC MATERIAL

Seven cost investigations exist which fall within the pre-war and post-war periods and which present average farm costs representative of costs in sub-areas of the spring-wheat belt. The first of these was conducted by the Bureau of Statistics of the United States Department of Agriculture for 1909.¹ The second and third, modeled upon the first, were conducted by the Canadian Census and Statistics Office for 1911 and 1913.² The fourth and fifth were conducted by the Division of Cost of Production and the Division of Crop and Livestock Estimates of the United States Department of Agriculture for 1922 and 1923.³ In these two investigations costs applicable to geographical divisions rather than to separate states were published; but averages applicable to states have kindly been furnished by the Department. The sixth investigation was pursued by the United States Tariff Commission for 1923 and for the period 1921–23.⁴ It presents costs applicable to localities in all seven areas of the spring-wheat belt, and averages applicable to the American and Canadian portions of the spring-wheat belt. The seventh investigation was conducted by the Dominion Bureau of Statistics for 1923.⁵

ADJUSTMENTS TO SECURE COMPARABILITY

A fundamental difficulty in all comparisons of cost studies is to secure compara-

¹ "Cost of Producing Wheat in 1909," *Crop Reporter*, May 1911, XIII, pp. 36 ff.

² "Cost of Grain Production in Canada, 1911," *Census and Statistics Monthly*, March 1912, V, pp. 51–57; "Cost of Grain Production in Canada, 1913," *ibid.*, December 1914, V, pp. 299–306.

³ "Cost of Producing Corn, Wheat, and Oats, 1922," *Weather, Crops, and Markets*, September 1923, IV, No. 9, p. 218; "Cost of Producing Field Crops, 1923," *Crops and Markets*, June 1924, I, Supp. 6, pp. 176–177.

⁴ *Wheat and Wheat Products*, Washington, 1924.

⁵ *Cost of Grain Production in Canada, 1923*. Ottawa, 1924. (Partially reprinted from the *Monthly Bulletin of Agricultural Statistics*, June 1924.)

bility between different producers, areas, and periods. Because of divergencies of practice and the inadequacy of resulting data, some critics are disposed to characterize all deductions from farm cost analyses as "solemn nonsense."¹ Certainly there are numerous instances of fallacious reasoning and unsound conclusions from cost studies, especially when the data are employed to deal not with problems of farm management but with issues of broad economic significance.

These difficulties are present in the basic data employed in this study. Only scattered years are represented. The data are not equally inclusive. Certain important deficiencies exist. Accordingly, the first task has been to construct, on the basis of this material, constituting the best available information, schedules of average costs of wheat production, in the several areas concerned, for the average year of the period 1908-14 and that of the period 1921-24. For this purpose the American studies of 1909 and 1923, and the Canadian studies of 1911 and 1923, have furnished the principal material.²

It has been considered desirable to calculate average yearly costs incurred during the pre-war and post-war periods rather than to compare Canadian costs in 1911 with American costs in 1909 or even costs in both countries in 1923 alone. Yield has a strong effect upon costs; and every year is in a sense an exceptional year. Comparisons of costs applicable to given years are often more misleading than comparisons of costs applicable to periods, particularly when costs in one area are obtained for one year, while costs in a second area are obtained for another. When costs applicable

to the same areas over periods neither too long nor too short are taken, comparisons may have more than ephemeral significance.

The laborious procedure of adjustment, approximation, and expansion of reported costs into comparable averages for the different areas before and since the war is omitted here but is set forth in detail, together with some considerations respecting the reliability of the resulting figures, in a mimeographed document obtainable from the Food Research Institute on request. The official data for specific years, and our adjusted and expanded data, which furnish the basis for discussion in this study, are given in Appendix Tables I and II.

The resulting statistics cannot be regarded as highly accurate. At many points rough approximations have been necessary. Even so, they are perhaps not much more inaccurate than current statistics of acreage, yield, production, and farm price; and since pains have been taken, without bias, to make reasonable estimates and adjustments with the object of securing comparability, the figures are believed to afford a satisfactory basis for the discussion here presented.

DEFICIENCIES OF ADJUSTED DATA

Five deficiencies in the cost statistics hereinafter employed may be emphasized here. In the first place, no costs can be determined for any area in each of the years of each period, desirable though a yearly series may be for the study of yearly variations. Second, pre-war land charges cannot be determined on what is at present recognized as the soundest basis—by averaging actual and potential cash rentals. Third, the costs of abandonment are not determinable on the basis of available data. Fourth, average costs can be calculated only to apply to political areas, not to natural economic areas, of the spring-wheat belt. Finally, the basic data do not provide information on the costs of transportation from local elevators to central markets; the costs hereinafter employed are farm costs of production, not total costs of production.

All of these deficiencies are unavoidable. They are for the most part inherent in the basic data. Their effects on conclusions

¹ Editor, *Farm Journal*, November 1924, p. 12.

² The Canadian study of 1913 could not be used because it did not record yields of farmers reporting costs. The American investigation of 1922 was disregarded to simplify necessary calculations. Farm management cost investigations, several of which have been conducted in restricted areas of the spring-wheat belt in one period or the other, have been ignored except for certain supplementary information, because their results are not representative of the larger areas. The Tariff Commission investigation has been useful in calculating land charges for the post-war period, and otherwise. Additional information has been utilized in supplying deficiencies or otherwise supplementing the reported data.

drawn from adjusted data have not, however, been disregarded.

SCOPE OF THIS PAPER

The primary purpose of this paper is to extract from such figures what significance they contain and to indicate what significance they, and similar schedules, do not possess. It may serve to augment current knowledge by systematizing and comparing available data, and also to correct some erroneous impressions concerning differences in American and Canadian costs and the utility of wheat-cost statistics.

Sections II, III, and IV deal with detailed comparisons of costs incurred in different

sub-areas of the spring-wheat belt in the pre-war and post-war periods, with special reference to the causes of variations in costs. Section V considers the relation of American spring-wheat costs to Canadian. In Section VI certain important difficulties involved in basing a tariff on wheat upon differences in Canadian and American costs are pointed out. Section VII deals, on the whole inconclusively, with the possibility of a change in the level of real costs and the influence upon the wheat-price level of a change in the real cost level of wheat production. The final section deals with variations in profits, but chiefly with some limitations upon the use of profit figures in the measurement of farm prosperity.

II. PRE-WAR COSTS, EXCLUDING LAND CHARGES, IN DIFFERENT AREAS

Farm costs of producing wheat may be expressed either per acre or per bushel, in either case exclusive or inclusive of land charges. Each of these forms has its appropriate use. Costs per acre excluding land charges best reflect differences in technical conditions of wheat production. Costs per acre including land charges best reflect financial and technical conditions combined, and are needed for discussion of profits and farm prosperity. Costs per bushel including land charges are necessary in judging the relative ability of areas to produce cheaply. Costs per bushel excluding land charges serve the same purpose, but less satisfactorily.

For the pre-war period, land charges cannot be satisfactorily computed; hence no analysis of variations in costs including land charges is possible for the pre-war period, and no comparison of pre-war and post-war costs including land charges is possible. In this section pre-war costs excluding land charges, among the seven political subdivisions of the spring-wheat belt, are considered with special reference to the degree and causes of variations in costs.

Costs per bushel, though they and not costs per acre partially indicate competitive ability in production because they give due weight to the influence of yield, are not easily analyzed without reference to costs

per acre. Yield is not the only factor influencing cost per bushel and competitive ability; yet the influence of these other factors is easily obscured in reviewing costs per bushel alone. Costs per bushel run into small rather than large numbers; and costs per acre serve to show the influence of factors other than yield on costs much more clearly. Consequently both costs per bushel and costs per acre excluding land charges are employed in the present section. Costs per bushel display—so far as they can do so when land charges are not included—the relative competitive ability of the various areas. Costs per acre are of service in explaining the causes influencing competitive ability. The determination of these causes constitutes the chief purpose of the present section.

THE FACTORS CAUSING VARIATIONS AND INCREASES IN COSTS

When average farm costs per acre excluding land charges differ between two areas in the same period, the difference can be due only to differences between the two areas in prices of materials or of labor, or in quantity requirements.¹ Similarly, net

¹ By "quantity requirements" is meant simply the amounts as distinguished from the wage rates and the prices of materials employed in production.

changes in prices and in labor and materials requirements have also caused all increases in costs per acre between the pre-war and post-war periods.

These price and quantity concepts, however, must be subdivided for purposes of clarity. In the spring-wheat belt seven factors have been influential in causing variations and increases in costs per acre. These factors are prices of labor, prices of materials, yields per acre, farm machinery and methods, the practice of summer fallowing, the adequacy of transportation facilities between farms and local markets, and the practice of new breaking.

These seven factors are amenable to statistical treatment only in a limited degree.¹ Yield per acre is known for all areas, though perhaps not with a high degree of accuracy. Labor rates can be computed for all areas in certain years, but Canadian figures are not strictly comparable with American. Prices of certain materials may be roughly ascertained for the United States as a whole, but not for Canada. Statistics of summer fallowing are available for Canadian areas, but only to a limited degree for American areas; and such statistics applicable to the pre-war period are decidedly deficient. The same is true of statistics of new breaking. The adequacy of transportation facilities is difficult to ascertain for any areas, although information of a general sort exists. The effect of improved farm machinery, though presumably of considerable importance, is not subject to definite measurement.

Three factors—yield per acre, summer fallowing, and new breaking—deserve special comment.

High yield per acre affects costs per bushel both as an advantage and as a disadvantage. High yield increases per acre costs of threshing and marketing by increasing the quantities of grain per acre to be threshed and marketed. Hence, in a sense, it also increases cost per bushel, since cost per bushel is obtained by dividing cost per acre by yield per acre. High yield of course decreases cost per bushel by increasing the divisor in the calculation.

¹ See Appendix Tables VI-X for available statistical data.

The practice of summer fallowing increases per acre costs both excluding and including land charges, because it necessitates extra cultivation and because it involves double charges for land. The crop of wheat grown on fallow should be charged with all the cultivation which it has had applied to it, whether or not that cultivation was done over two years rather than one. Similarly it should be charged with two years' taxes or rents. If the yield obtained from fallowing is sufficiently large, costs per bushel may not be increased, although costs per acre must be.

To break new sod also involves additional expense through the greater labor required for plowing and cultivation. Land newly broken must be disked and harrowed more intensively than old land, if a suitable seed-bed is to be obtained.

VARIATIONS IN PRE-WAR COSTS EXCLUDING LAND CHARGES

Table 1 shows average yearly costs per acre and per bushel, excluding land charges, in the seven areas of the spring-wheat belt during the pre-war period. Costs per acre in Alberta were highest, being 61 per cent

TABLE 1.—AVERAGE YEARLY PRE-WAR COSTS PER BUSHEL AND PER ACRE OF PRODUCING WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, EXCLUSIVE OF LAND CHARGES

Area	Cost per bushel <i>a</i> \$	Per cent above lowest cost	Cost per acre <i>b</i> \$	Per cent above lowest cost	Yield per acre <i>c</i> bu.
Montana	.412	—	10.23	54	24.8
Manitoba	.503	22	8.96	35	17.8
Alberta	.508	23	10.72	61	21.1
Minnesota	.568	38	7.95	19	14.0
Saskatchewan	.581	41	10.63	60	18.3
South Dakota	.610	48	6.65	—	10.9
North Dakota	.663	61	7.36	11	11.1

a Calculated by dividing cost per acre (column 3) by yield per acre (column 5).

b From Appendix Table II.

c From Appendix Table VI.

above costs in South Dakota. Costs per bushel, however, were highest in North Dakota, being 61 per cent above costs in Montana. Obviously, low per-acre costs do not accompany low per-bushel costs; nor do high per-acre costs accompany low per-

bushel costs. The relation between costs per acre and costs per bushel is such that a sharp distinction must be made in speaking of "the cost of wheat production." The words may have quite different meanings as different kinds of costs are considered.

Table 2 throws some light on the causes of variations in costs among the different areas. The table arrays the seven areas, in the pre-war period, with respect to costs per bushel and per acre excluding land charges, as well as with respect to the major factors affecting those costs. In certain instances the array is arbitrary; and relative ranking in prices of materials and farm efficiency, which also affect costs, is impossible to ascertain. The table helps to explain, however, some rankings of areas in costs per bushel which seem at first glance unusual in view of yields.

duced on fallowed land. Higher expenses for fallowing were evidently offset by lower expenses for labor, marketing, and new breaking.

Why, again, were costs per bushel excluding land charges lower in Minnesota than in Saskatchewan, when yield per acre was only 14 bushels as against 18.3 bushels in Saskatchewan? Saskatchewan costs were lower than Minnesota costs so far as they were influenced by labor rates and higher yields alone. Minnesota, on the other hand, was better equipped with transportation facilities, incurred practically no expenses for summer fallowing or new breaking, and had the advantage of lower yield so far as lower yield constitutes an advantage. Here the necessity for summer fallowing and the practice of new breaking sufficed to raise costs per bushel in Saskatchewan, as com-

TABLE 2.—RANK OF SEVEN AREAS OF THE SPRING-WHEAT BELT IN COST OF PRODUCTION AND RELATED FACTORS UNDER PRE-WAR CONDITIONS*

Cost per bushel <i>a</i>	Cost per acre <i>a</i>	Yield per acre <i>b</i>	Labor rates <i>a</i>	Summer fallow <i>a</i>	New breaking <i>a</i>	Transportation facilities <i>c</i>
Montana	South Dakota	Montana	Manitoba	Minnesota	Minnesota	Minnesota
Manitoba	North Dakota	Alberta	Saskatchewan	South Dakota	South Dakota	South Dakota
Alberta	Minnesota	Saskatchewan	Alberta	North Dakota	North Dakota	North Dakota
Minnesota	Manitoba	Manitoba	Minnesota	Montana	Manitoba	Manitoba
Saskatchewan	Montana	Minnesota	South Dakota	Alberta	Montana	Saskatchewan
South Dakota	Saskatchewan	North Dakota	North Dakota	Saskatchewan	Saskatchewan	Montana
North Dakota	Alberta	South Dakota	Montana	Manitoba	Alberta	Alberta

* Rank of various areas in factors affecting cost is based upon Appendix Tables VI, VIII-X.

a Lowest first.

b Highest first.

c Best equipped first. By "transportation facilities" is meant distance from farms to elevators and quality of roads over which grain must be hauled.

Differences in yield per acre explain why costs per bushel were lower in Montana than in North and South Dakota, lower in Alberta than in Saskatchewan, lower in Minnesota than in South Dakota. But why could wheat be produced at a lower cost per bushel excluding land charges in Manitoba than in Alberta or Saskatchewan, when the last two areas obtained higher yields per acre? Compared to the neighboring provinces, Manitoba enjoyed the advantages of lower labor rates, lower expenses for new breaking, lower expenses due to better transportation facilities, and lower yields, although summer fallowing charges were presumably higher in Manitoba than in the other two provinces because a larger proportion of Manitoba's crop was pro-

pared to those in Minnesota, more than good yield and lower labor rates could lower them. This instance constitutes the most striking illustration of the fact that costs per bushel excluding land charges—and hence competitive ability, so far as costs per bushel excluding land charges indicate that ability—do not depend on yield alone.

Where, however, wide differences in yield occur—as between Montana with 24.8 bushels per acre and North Dakota with 11.1 bushels per acre—the high yield areas will in general be the areas of low costs per bushel excluding land charges. When yields are more nearly equalized between areas, other factors affecting costs appear more effective and important.

If land charges could be calculated for the pre-war period, a much smaller range between areas in costs per bushel, and hence in competitive ability, would probably be shown. Land charges should, theo-

retically, tend to be higher in areas of higher yields, but whether or not this tendency was present in the pre-war period cannot be determined from the data which is available.

III. INCREASES IN COSTS, EXCLUDING LAND CHARGES, IN DIFFERENT AREAS

We may now turn to post-war costs per bushel and per acre excluding land charges. These are shown in Table 3, together with percentage ranges in costs and percentage increases in post-war costs over pre-war costs. Since land charges may be approximated for the post-war period, we need not discuss the variations of costs excluding land charges among the different areas; for costs excluding land charges are of little significance compared to costs including land charges in indicating competitive ability. Changes in factors affecting costs exclusive of land charges are, however, of considerable importance in view of their bearing on comparative costs in Canada and the United States, as discussed in Section V. They also help to explain the rank of areas in competitive ability so far as that rank is determinable.

which ranked fifth before the war, ranks first after the war. Manitoba falls from second place to fifth. The other areas maintain much the same relative rank in both periods.

Costs excluding land charges, whether per bushel or per acre, differed considerably less between areas in the post-war period than in the pre-war. The highest pre-war per-bushel and per-acre costs were 61 per cent above the lowest; but the highest post-war per-acre cost stood only 41 per cent above the lowest, and the highest post-war per-bushel cost stood only 20 per cent above the lowest. Sharp increases in costs, both per acre and per bushel, occurred in all areas between the two periods; but increases were more marked in some areas than in others. Thus per-bushel costs excluding land charges rose 136 per cent in

TABLE 3.—AVERAGE YEARLY POST-WAR COSTS PER BUSHEL AND PER ACRE OF PRODUCING WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, EXCLUSIVE OF LAND CHARGES

Area	Basis: Cost per bushel ^a	Per cent above lowest cost	Per cent increase over pre- war cost	Cost per acre ^b	Per cent above lowest cost	Per cent increase over pre- war cost	Yield per acre ^c
	\$	%	%	\$	%	%	bu.
Saskatchewan .....	.815	—	40	13.37	33	26	16.4
South Dakota .....	.854	4	40	10.08	—	52	11.8
Alberta .....	.864	6	70	13.13	30	23	15.2
Minnesota .....	.868	6	55	12.59	25	57	14.5
Manitoba .....	.892	9	77	13.29	32	48	14.9
North Dakota .....	.977	20	47	11.14	11	51	11.4
Montana .....	.981	20	136	14.22	41	39	14.5

^a Calculated by dividing cost per acre (column 4) by yield per acre (column 7).

^b From Appendix Table II.

^c From Appendix Table VI.

Comparing Table 1 and Table 3, one is struck by the shifts in relative position in respect to costs per bushel. Montana, which was the low-cost area before the war, becomes the high-cost area. South Dakota, which was the area of second highest costs before the war, has the second lowest costs per bushel after the war. Saskatchewan,

Montana but only 40 per cent in South Dakota and Saskatchewan. Increases in costs in all areas and the equalization of costs between areas are the significant developments between the pre-war and post-war periods. It is of interest to determine what changes in factors affecting costs have contributed to these developments.

FACTORS AFFECTING INCREASES

The factors making for increases in costs per bushel excluding land charges were three: (1) increases in prices of labor and materials; (2) increases in quantity requirements due to extension of the practice of summer fallowing; and, in certain areas, (3) decreases in yield per acre. Since general increases in costs per bushel have occurred, these factors have been stronger in their influence than have counteracting factors. These counteracting factors have been (1) the improvement and equalization of transportation facilities; (2) the improvement of farm efficiency as brought about by better machinery; (3) the decline of new breaking; and, in certain areas, (4) increases in yield per acre.

Little need be said of the improvement in transportation facilities between the two periods. The improvement has probably been most marked in Saskatchewan, Alberta, and Montana, the areas where transportation was least developed in the pre-war period. At present, one area is about as well served with railroads and local elevators as another, but hauling distances are greater in the more newly settled areas. The tendency has been to equalize transportation facilities in all respects by extension of the railway network and by improvement of country roads, and thus to iron out conditions making for inequalities in costs. Much the same is true of farm efficiency, although equalization between areas has probably not taken place. The use of the gang-plow, the five- and six-section harrow, and the small combined harvester and thresher has everywhere, so far as can be determined, become more common, but presumably not more so in one area than in another. Prices of materials have likewise probably increased about as much in one area as in another. On all these matters statistical evidence is deficient. About yield per acre, labor rates, summer fallowing, and new breaking, more definite information is available.

Average yields per acre as between the two periods increased very slightly in Minnesota, North Dakota, and South Dakota (from 14 to 14.5, 11.1 to 11.4, and 10.9 to

11.8 bushels per acre, respectively); decreased somewhat in Manitoba and Saskatchewan (from 17.8 to 14.9 and from 18.3 to 16.4 bushels); and decreased considerably in Montana and Alberta (from 24.8 to 14.5 and from 21.1 to 15.2 bushels). The pre-war range in yield per acre was from 10.9 bushels in South Dakota to 24.8 bushels in Montana, while the post-war range was much smaller—from 11.4 bushels in North Dakota to 16.4 bushels in Saskatchewan. Other things being equal, the reduced variation in yield per acre would tend to have the effect of equalizing costs. This effect is clearly evident.

These increases and decreases in average yields per acre may be partially due to the accident of season in the years which go to make up the averages. It is none the less possible that the slight increases in yield shown in Minnesota and the Dakotas have been partially due to the development and cultivation of new varieties, most notably durum, the highest yielding of spring wheats. The decreases in average yield in Montana and Alberta, and perhaps also in Saskatchewan, have been due, in part, to the process of expanding wheat acreage to include relatively poor land. Other developments affecting average yield per acre, such as increased diversification, soil exhaustion, abandonment of poor land and the taking up of good land, and increasing inroads of weeds, pests, and diseases, have also taken place between the two periods. But these developments appear to have been largely compensating; and it remains probable that increases and decreases in average yield have been due either to the accidents of seasons included in averages, to the introduction of new varieties, or to the expansion of wheat production.

The practice of summer fallowing has increased greatly in Manitoba, Saskatchewan, Alberta, and Montana, and has tended to increase costs per acre, perhaps per bushel, in those areas. During the post-war period, about 50 per cent of all wheat in Manitoba, 40 per cent in Alberta and Saskatchewan,¹ 20 to 25 per cent in Montana,² and 6 per

¹ See Appendix Table IX.

² Estimate of the Department of Farm Management, Montana.

cent in North Dakota,¹ was grown on fallowed land. For the pre-war period, complete data are not available; but about 35 per cent of all wheat in Manitoba and 25 per cent in Saskatchewan and Alberta, appear to have grown on fallow. New breaking decreased relatively in all areas, notably Montana, Alberta, and Saskatchewan²; but the decrease was less sharp in Manitoba, since the practice had been less general there during the pre-war period.

During the pre-war period the Canadian provinces appear to have enjoyed labor rates substantially lower than rates in the United States. This advantage seems practically to have disappeared during the post-war period, and with it the tendency for wages to vary considerably between different areas. In the pre-war period, the extreme range of wages was from \$30.35 per month in Manitoba in 1914 to \$54.00 in Montana in 1913; but in the post-war period wages ranged only from \$50.00 in Minnesota in 1922 to \$69.10 in Montana in 1924. Wages in Montana are still substantially above wages in all other areas, but not so far above as was true in the pre-war period.³ The effect of the reduction in the range of labor rates has been, like the effect of reduction in the range of yield per acre, to equalize costs of production between the different areas.

The most striking increases in costs per bushel excluding land charges, those of 136 per cent, 77 per cent, and 70 per cent in Montana, Manitoba, and Alberta, have clearly been due chiefly to decreases in yield per acre—decreases of 10.3, 2.9, and 5.9 bushels, respectively. Percentage increases in cost per bushel might be expected to correspond directly with decreases in yield; but apparently the increase in cost per bushel was greater in Manitoba than in Alberta, in spite of a smaller decline of yield per acre in Manitoba. Other factors were therefore important. Their relative importance in these areas and in others is most apparent on analyzing percentage increases in costs per acre.

Post-war costs per acre in Minnesota were 57 per cent, and in North Dakota, South Dakota, and Manitoba, 51 per cent, 52 per cent, and 48 per cent above pre-war costs. In Minnesota, North Dakota, and South Dakota this 51 to 57 per cent increase was for the most part caused by rising prices of labor and materials, but partially also by a slight increase in yield per acre. In Manitoba much the same percentage increase in cost was due not at all to increase in yield, but to price increases as well as to increases in labor requirements caused by the increasing practice of summer fallowing. Yield decreased, thus lowering cost; but its effect was quite offset by increases in prices and in summer fallowing. Costs per acre in Montana increased only 39 per cent. The increase was less than that in Manitoba because yield per acre and new breaking declined more in Montana than in Manitoba, while wage rates increased less sharply. These developments prevented costs from rising as high in Montana as they rose in Manitoba, in spite of the fact that summer fallowing increased quite as much, if not more, in the former area. In Saskatchewan and Alberta, costs per acre increased only 26 per cent and 23 per cent, respectively. In these areas, as in Montana, new breaking decreased, summer fallowing increased, and yields decreased. But summer fallowing increased less, and yields decreased less; and hence Montana costs rose higher. The difference between the percentage increases of costs in Manitoba compared to Saskatchewan and Alberta is explicable chiefly by the greater increase in the practice of summer fallowing in Manitoba, on the one hand, and the greater decrease in the practice of new breaking in Alberta and Saskatchewan on the other.

Clearly wages of labor and prices of materials have not been the only important influences on costs of production in the spring-wheat belt, though these two factors are commonly regarded as more significant than any others. Yield per acre, new breaking, and summer fallowing have also been of considerable importance in causing both variations in costs between areas and increases in costs between periods.

¹ R. E. Willard, "Cost of Production and Farm Organization." *North Dakota Agricultural Experiment Station Bulletin* 165, December 1922, p. 65.

² See Appendix Tables V and X.

³ See Appendix Table VIII.

IV. POST-WAR COSTS, INCLUDING LAND CHARGES, IN DIFFERENT AREAS

For the post-war period it is possible to obtain approximate land charges per acre, and hence to calculate costs inclusive of these charges. Such costs throw more light on relative competitive ability, and therefore deserve special consideration. Here the discussion will be confined to the comparison of costs including land charges among the various political sub-areas.

CALCULATION OF LAND CHARGES PER ACRE

Average yearly land charges per acre can be most satisfactorily computed on the basis of the Tariff Commission's cost investigation of 1923. Here, and here only, can be obtained land charges applicable to all areas (though only for the single year 1923), compiled on an identical basis for all areas, including summer fallowing charges, and applicable to wheat land rather than to all farm land. Detailed reasons for employing the Tariff Commission figures in preference to any others are set forth in the mimeographed supplement to this study, reference to which has been made above. Methods of calculation are also given there in detail.

The Tariff Commission recorded average cash rentals actually paid by renters or average cash rentals which owners expressed themselves as willing to accept. It also recorded taxes, but submerged these in "indirect cash costs." A suitable cash rental figure consists of a sum paid or chargeable as rent and a sum chargeable as taxes. To reach a suitable figure it has been necessary to estimate what sums per acre were taxes in the Tariff Commission's "indirect cash costs," and to add the estimates thus reached to the Commission's net cash rental figures. The resulting sums are regarded as fair approximations of land charges per acre of wheat in each area during 1923. Further adjustment has been necessary to reach charges for rent and taxes applicable to the period 1921-24.

Adjustments and computations lead to estimates of yearly taxes per acre of wheat ranging as follows: 75 cents in Minnesota, 65 cents in Manitoba and Alberta, 55 cents in Saskatchewan, North Dakota, and South

Dakota, and 35 cents in Montana. These estimates need not be defended in detail. They have the certain merit of not being too low for any area. They reflect the tendency of taxes to run higher in old communities than in new. They accord with the tendency for taxes to be high in areas where summer fallowing is a common practice. They do not make costs in Canadian areas unduly high as compared with American costs. Finally, they distinguish between taxes on wheat land and taxes on all agricultural land.

Net cash rentals excluding taxes are estimated for each area in the average year of the pre-war period as follows: Alberta, \$4.45; Saskatchewan, \$3.80; Minnesota, \$3.40; Manitoba, \$3.30; South Dakota, \$2.25; North Dakota, \$2.00; and Montana, \$1.75. These estimates are defensible in the same manner as the estimates of taxes. On adding tax costs and net cash rentals, we reach average yearly land charges per acre of \$5.10 in Alberta, \$4.35 in Saskatchewan, \$4.15 in Minnesota, \$3.95 in Manitoba, \$2.80 in South Dakota, \$2.55 in North Dakota, and \$2.10 in Montana.

These estimates show land charges per acre of wheat to have been considerably higher in Canadian areas than in American. This finding is of considerable importance, and it is not commonly accepted.¹ Yet the estimates are sounder than most; for comparisons of land charges in Canada and in the United States have commonly been based upon comparisons of general land values,—not of wheat land values, nor of cash rentals for wheat land. Other comparisons have also ignored the extremely important fact that extensive practice of summer fallowing necessarily increases land charges for wheat production. Yet whoever chooses to examine the Tariff Commission's statistics cannot escape the conclusion that land charges per acre of wheat in Canadian areas have exceeded those in most American spring-wheat areas during recent years.

¹ See the report of the late Secretary of Agriculture on "The Wheat Situation," *Agriculture Yearbook*, 1923, p. 114, among other articles.

POST-WAR COSTS INCLUDING AND EXCLUDING LAND CHARGES

Table 4 arrays average yearly post-war costs per bushel and per acre, including and excluding land charges.

The effect of including land charges in costs per bushel is in the first place to reduce the range between areas of costs per bushel. Thus per-bushel costs excluding land charges varied from 82 cents to 98 cents, a maximum difference of 16 cents; but per-bushel costs including land charges ranged from \$1.08 to \$1.20, a maximum difference of 12 cents. This tendency of per bushel costs in various areas to approach the same figure when land charges are included in costs is to be expected in the light of economic theory.

between areas is impossible so long as transportation costs differ. It must also be slow in its action and uncertain in its results under actual conditions so long as prices of produce and yield per acre are not predictable. Land charges as reflected in cash rentals are made by the renter's and the owner's compromise on normal net profits. This calculation depends primarily on estimates of normal yield, normal farm price, and normal margin between value of produce and cost excluding rent. It is at best a highly uncertain calculation, so that land charges on wheat in the spring-wheat belt can probably never be made with enough exactness to equalize precisely total costs per bushel calculated to include both land and transportation costs, still less farm

TABLE 4.—AVERAGE YEARLY POST-WAR COSTS OF PRODUCING WHEAT PER BUSHEL AND PER ACRE, INCLUDING AND EXCLUDING LAND CHARGES, IN THE SPRING-WHEAT BELT

Area	Basis:			Yield per acre bu.	Cost per acre including land charges \$	Cost per acre excluding land charges \$	Land charges per acre \$
	Cost per bu. including land charges \$	Cost per bu. excluding land charges \$	Land charges per bu. \$				
Saskatchewan	1.08	.815	.26	16.4	17.72	13.37	4.35
South Dakota.....	1.09	.854	.24	11.8	12.88	10.08	2.80
Montana	1.13	.981	.15	14.5	16.32	14.22	2.10
Minnesota	1.15	.868	.29	14.5	16.74	12.59	4.15
Manitoba	1.16	.892	.27	14.9	17.24	13.29	3.95
Alberta	1.20	.864	.34	15.2	18.23	13.13	5.10
North Dakota.....	1.20	.977	.22	11.4	13.69	11.14	2.55

Under free competition and mobility of capital and over long periods of time, costs per bushel of production including land charges and charges for transportation from local elevators to central markets will tend to become equal in all areas. This is true because land charges will operate to equalize differences in other costs: in an area where cultivation costs and transportation costs to central markets are high, land charges will be low; and where cultivation and transportation costs are low, land charges will be high. The cost figures here employed take no account of transportation charges. But since these are not widely divergent between the areas, it may be said that land charges tend to iron out differences in farm costs per bushel.

That this tendency should ever equalize farm costs per bushel including land charges

costs per bushel not including transportation costs. But that costs per bushel including land and transportation charges tend to become equal in the long run is certain; and, in areas where differences in transportation costs are not great, farm costs per bushel including land charges will tend to become equal also.

In the second place, to include land charges in costs is to alter the rank of areas in costs per bushel, and in competitive ability, if costs per bushel be a serviceable index of competitive ability. Saskatchewan and South Dakota remain the areas where wheat could be produced most cheaply. But Montana, where post-war costs per bushel excluding land charges were highest, has costs per bushel including land charges which are third lowest. Alberta, with third lowest costs per bushel excluding land

charges, becomes the area where costs per bushel including land charges were highest.

But to determine what area was able during the post-war period to produce wheat most cheaply is far different from ascertaining what area has normally produced wheat most cheaply, or which area can be designated as the area most advantageously situated with regard to competition. It is quite impossible, when so many factors affect costs, to conclude that any given area can *consistently* produce wheat more cheaply than any other. If yield per acre should happen in 1925 to be considerably higher in Alberta than in Saskatchewan, it is perfectly possible that an array of 1921-25 farm costs per bushel including land charges would place Saskatchewan in third rank—or almost any other—rather than in first, and Alberta in fourth rank—or any other—rather than in seventh.

The fact is that consistent or permanent differences in farm costs per bushel including land charges are unlikely to exist, while temporary differences are always present. Prices, labor and materials requirements, yields, and land charges, are continually

fluctuating both between areas and between years. They never in any given year attain such equilibrium that all areas are in that year of equal competitive ability. A long-time average of farm costs per bushel including land charges—say one of 25 years—might show all seven areas of the spring-wheat belt with about, but not precisely, the same average costs. The shorter the period to which averages apply, the more likelihood there is of wide divergencies in costs. In a sense, therefore, the measurement of competitive ability by comparisons of average farm costs between wide areas except when those costs are applicable to specific years, is futile, since differences must disappear as the periods to which costs are applicable are lengthened. To speak of permanent, semi-permanent, or normal differences in costs—when those costs are farm costs per bushel including land charges, the sort which, next to costs including transportation charges also, best reflects differences in competitive ability—is at best questionable. The conception that such “normal” differences exist becomes important when Canadian and American costs are discussed.

V. CANADIAN AND AMERICAN COSTS

We are now in a position to compare farm costs including land charges between the Canadian and American spring-wheat areas, each taken as a unit.

There is widespread impression that the farm cost per bushel of producing wheat is considerably lower in Canada than in the United States, *i. e.*, in the prairie provinces as compared with the American spring-wheat area. This opinion has been frequently expressed during the past two or three years. The late Secretary of Agriculture Wallace, in his report to the president on the wheat situation, phrased it as follows:¹ “While satisfactory comparisons between the cost of producing wheat in Canada and the United States cannot be made on the basis of available studies, it is quite apparent that the Canadian farmer

has advantages which enable him to produce at *materially lower costs per bushel* than the American farmer.”

Early in 1924, a few months after this opinion was expressed, the Tariff Commission conducted an elaborate investigation into comparative costs of wheat production in the United States and Canada, to which reference has already been made. The conclusions drawn from the investigation served to support the Secretary's conclusion and to strengthen the general conviction that Canadian farm costs are normally lower than American. The Tariff Commission found Canadian costs per bushel (including land charges calculated on a cash rental basis, but not transportation charges) to have been 52 cents lower than American costs in 1923, and 33 cents lower than American costs for the three years 1921-23.²

No contradiction of these conclusions has emanated from Canadian official sources.

¹ Submitted November 3, 1923; reprinted in *Agriculture Yearbook, 1923*, p. 115. Italics ours.

² U. S. Tariff Commission, *op. cit.*, p. 4.

On the contrary, Canadian official and public opinion holds with American that Canadian costs are materially lower than American as a normal thing. Thus, Mr. E. H. Godfrey of the Dominion Bureau of Statistics has recently stated: "The fact that the recent inquiries, both those of the United States and those of the Dominion Government, have demonstrated that the cost of grain production is less in Canada than it is in the United States is in itself of no little significance."¹

The most important practical effect of such a belief is perhaps the feeling that a high tariff on Canadian wheat is necessary and proper in order to protect the interests of wheat producers in the United States. But it is more than possible that the conviction leads legislators and economists to emphasize the advantages possessed by Canada over the United States in wheat production, and hence to expect curtailment of wheat production in the Northwestern United States and its expansion in Canada more rapidly and extensively than would be probable if Canada appeared to be less advantageously situated.

A careful study of the data assembled and adjusted reveals important qualifications of the impression that farm costs of production are materially lower in Canada than in the United States. These are considered in this section. The next section will deal with some fallacies and difficulties involved in basing the tariff on wheat upon differences in costs of production. No attempt will be made here to point out the consequences to economic thinking involved in formulating more exact impressions of the advantages enjoyed by Canada in the production of wheat.

Undoubtedly there is some basis for the usual conception. It is indisputable that labor rates and land values have in the past been lower in Canada than in the United States, while yields there have ordinarily been higher. Yet little thought has been given to the possibilities that lower labor rates and land values in Canada may be counterbalanced by the necessity of em-

ploying more labor and more land in wheat production. It has been also customary to overemphasize the difference in yield per acre between the two countries. Finally, there has been too great a tendency to regard temporary differences in costs per bushel as normal or semi-permanent or permanent.

Under conditions which have prevailed since 1920, it is certain that lower labor rates and land values in Canada have been more than counterbalanced by higher labor and land requirements. This is true because more than 40 per cent of the spring-wheat crop of Canada is grown on fallowed land, whereas, on a liberal estimate, not more than 10 per cent is so produced in the United States.

EFFECT OF FALLOWING

The effect of extensive summer fallowing is to increase both labor and land charges per acre. The fallowed land must be cultivated while it lies idle; and cultivation is an expense. The crop of wheat grown on fallowed land must be charged not with one year's rent, but with two. Thus, if the annual cash rental is \$1.00 in an area where 40 per cent of the wheat crop is grown on fallow, the land charge per acre of wheat is not \$1.00, but \$1.40. In another area where the annual cash rental charge per acre is \$1.20 and 10 per cent of the wheat crop is grown on fallow, the land charge per acre of wheat is not \$1.20, but \$1.32. The same reasoning applies to labor costs. The primary difference between labor rates in the two areas and between land values must be large if it is not to be quite counterbalanced by differences in labor and in land requirements; and, as between Canada and the United States, the primary differences have not been in the past few years sufficiently great. Costs per acre have been in fact higher in Canada than in the United States in spite of lower labor rates and lower annual land charges in Canada.

EFFECT OF YIELD

The difference has been accentuated by higher yields. We have already indicated that higher yields do not result simply in

¹ "Costs of Grain Production," *Journal of the Canadian Bankers' Association*, April 1925, XXXIII, 305.

lowering per-bushel costs, but also, in a sense, in raising them by raising that part of per-acre cost which comprises threshing and marketing operations. This complication makes appropriate illustration of the effect of fluctuating yields on per-bushel costs a difficult matter, although fluctuating yield is the normal thing and must be reckoned with.

Let us assume that in a given area, A, where fallowing is not practiced, yield is 12 bushels, and the cost per acre is \$12.00. In another area, B, where fallowing is extensively practiced, yield is 15 bushels, cost is \$15.00. Then cost per bushel will be \$1.00 in each area. (In general an area where summer fallowing is extensively practiced will be an area of high yield but also of high cost per acre; consequently the illustrative figures approximate facts.) Suppose, now, that in the next year the yield in area A rises to 13 bushels, while that in B falls to 14 bushels. Cost per acre will rise slightly in area A, say 20 cents and it will fall slightly in area B, say the same amount. Then cost per bushel in area A will be $\$12.20 \div 13$, or 94 cents, and in area B it will be $\$14.80 \div 14$, or \$1.06. The cost per bushel will thus be higher in the area where yield was higher.

Summer fallowing is in fact extensively practiced in Canada, but not in the United States; yield per acre is ordinarily—not invariably—higher in Canada than in the United States. But when the Canadian yield falls below the American—as was true in 1924—Canadian costs per bushel inevitably rise above American; when the Canadian yield is only slightly above the American—a perfectly conceivable situation—Canadian costs per bushel are likely to exceed American; and only when Canadian yields are considerably above American will Canadian costs per bushel fall below American. Clearly more than the usual fact of higher yield in Canada must be considered in concluding that Canada can ordinarily produce at lower cost per bushel than can the United States. The degree to which Canadian yields are higher must also be considered.

To overemphasize the effect of yield on per-bushel cost is easy, while to measure the

effect exactly is difficult, if not impossible. It has been customary in discussion of Canadian and American costs to focus attention simply on the fact of higher yield in Canada as a general thing, and to ignore the possibility that costs per bushel in Canada may conceivably be higher than American costs even when yield in Canada is higher. *No one knows precisely how much higher Canadian yields must be above American in order that Canadian costs may be lower.* So long as we lack this knowledge no one is justified in assuming that Canadian costs are materially lower than American ordinarily, normally, permanently, or semi-permanently.

Beyond a doubt Canadian farm costs per bushel including land charges were lower than American in 1923; for in that year the average Canadian yield¹ was 21.7 bushels, while the average American yield was 9.6 bushels. The Tariff Commission fixed the precise difference at 52 cents. Beyond a doubt the opposite was true in 1924: American costs were lower than Canadian; for the American yield was 16.3 bushels, the Canadian only 11.2. What the precise difference was in costs per bushel is not known. In 1921 the Canadian yield exceeded the American by 3.2 bushels, in 1922 by 3.7 bushels. Whether Canadian costs per bushel exceeded American or not in those years is not determinable, because this moderate advantage in yield may or may not suffice to push Canadian costs below American.² A five-bushel advantage certainly will; a one-bushel advantage certainly will not. When the Canadian advantage in yield ranges between two and four bushels, only an actual investigation can determine where costs per bushel are lower. If in the past four years Canadian costs have exceeded American once and have fallen below American once, while what relation existed in two other years is unknown, it is manifestly an error to assume that any constant relationship exists between Canadian and

¹ The figures of yield apply to the prairie provinces of Canada and the states of Minnesota, the Dakotas, and Montana. See Appendix Table VI.

² For the period 1921–24, Canada had the advantage of 3.4 bushels per acre in yield on the average, but an advantage of only \$.04 per bushel in farm costs, including land charges. See Table 5.

American farm costs. To compare Canadian and American yields before 1921 will not serve to throw light on the problem, for yield alone does not determine cost per bushel, and other factors influencing cost in the years before 1921 cannot be traced satisfactorily.

COMPARISON OF AVERAGE COSTS

Table 5 compares average yearly farm costs per acre and per bushel of producing wheat in Canada and the United States, 1921-24, when the influence of summer fallowing as well as of yield is given proper

TABLE 5.—AVERAGE YEARLY POST-WAR AMERICAN AND CANADIAN FARM COSTS PER BUSHEL, INCLUDING LAND CHARGES, OF PRODUCING WHEAT IN THE SPRING-WHEAT BELT.

Area	Costs per acre <i>a</i> \$	Costs per bushel <i>b</i> \$	Yield per acre <i>c</i> bu.
United States	14.40	1.16	12.4
Canada	17.78	1.12	15.8

a Averages of costs per acre in separate areas as shown in Table 4 weighted by average post-war acreages in all wheat as shown in Appendix Table V.

b Averages of costs per bushel in separate areas as shown in Table 4 weighted by average post-war production of all wheat as shown in Appendix Table III.

c All wheat. See Appendix Table VI.

weight. It appears that the Canadian farmer has, in the four-year period, been able to produce wheat at a cost per bushel *only slightly* lower than the American farmer, not at a cost *materially* lower. The figure applies to a four-year period only. If in 1925 Canadian yields are high, American low, then the difference for the period 1921-25 will be more marked. If in 1925 American

yields exceed Canadian, the cost per bushel for the five-year period will be lower in the United States than in Canada. What relative yields will be in years to come no one can say. Conclusions as to normal differences between Canadian and American costs per bushel, if made in 1926 or 1927 or 1928, will depend upon what yield has been in preceding years. Yield is notoriously uncertain; consequently differences in costs per bushel are uncertain. Under actual conditions, the assumption that the Canadian farmer "has advantages which enable him to produce at materially lower costs per bushel than the American farmer," is unsound so far as it implies normal or long-time advantages or applies to farm costs. It was sound in November 1923, for either the year 1923 or the period 1921-23, simply because the Canadian yield in 1923 exceeded the American by the great amount of 11.3 bushels. It was unsound for 1924 and for the period 1921-24. It may or may not be unsound for the period 1921-31, or for the period 1910-21. The advantage in farm cost per bushel may lie with Canada in one year, with the United States in the next; this we know. We do not know how often it has lain or is likely to lie with Canada, or how great the advantage has been or is likely to be in any given year. Only by overemphasizing differences between the two countries in yield per acre, land values, and labor rates, and by neglecting the effect of summer fallowing, is it possible to conclude that Canadian farmers normally have a considerable advantage over American farmers in spring-wheat production.

VI. THE COST-OF-PRODUCTION FORMULA AND THE TARIFF ON WHEAT

The Republican party at present endorses, as the most equitable and proper method of determining rates for a protective tariff, the cost-of-production formula. Tariff rates are to be determined by ascertaining the difference between costs of production per unit in the United States and in the principal competing countries, and by fixing the rate at the precise amount of difference in costs. It is the purpose of the present section to examine some difficulties and incon-

sistencies involved in applying the cost-of-production formula to the tariff on wheat. To discuss the general soundness of basing a tariff upon differences in cost of production,¹ or the general desirability of a protective tariff whether on wheat or other

¹ Details regarding the general purposes of protection, discussion of costs of production as a basis for tariff-making, and existing provisions in tariff acts now in force are to be found in T. W. Page's *Making the Tariff in the United States*, McGraw-Hill, New York, 1924.

commodities, or the economic effects of past and present tariffs on wheat, is not within the scope of the present inquiry.

PROCEDURE IN FIXING PRESENT DUTY

The Tariff Act of 1922 fixed the tariff on wheat at 30 cents per bushel; but in the so-called "flexible provision" Congress directed the President to proclaim changes in the duty (on wheat or other commodities) when, after investigation, the existing duty was found not sufficient to "equalize differences in cost of production in the United States and the principal foreign countries." The Tariff Commission is directed to "assist the President in ascertaining differences in costs of production," and no change in duty may be made by proclamation until investigation has been made. Regardless of the findings of the Commission, however, the Act restricts total increases or decreases in duties by the President to 50 per cent of the rates specified in the Act.¹ Thus, under the Act of 1922, the duty on wheat may not fall below 15 cents per bushel or exceed 45 cents per bushel. How frequently the President shall alter rates is not specified by the law.

On March 7, 1924, the President by proclamation raised the duty on wheat from 30 to 42 cents per bushel, on the ground that differences in costs of production between Canada, the principal competing country, and the United States amounted to 42 cents, as had been determined after adequate investigation by the Tariff Commission. The 42-cent duty is still in effect.

This figure was not reached without serious disagreement among members of the Tariff Commission. Three commissioners argued that the difference between Canadian and American costs in 1923 alone should be employed in computing the tariff; that "costs of production" should not be construed to include costs of transportation from local elevators to central markets; and that "bulk-line" costs, not weighted average costs, should be compared. On these principles the difference in costs of production amounted to 70 cents; and the three commissioners recommended a duty

of 45 cents, the highest permissible under the 50 per cent increase over 30 cents per bushel allowed by the Act of 1922. The other three commissioners argued that average 1921-23 costs should be employed in computing the tariff; that costs of transportation should be included in total costs; and that weighted average costs, not bulk-line costs, should be compared. These three commissioners found the difference between Canadian and American costs to be 42 cents, and recommended a duty of that amount.

This recommendation was accepted by the President. In accepting it he stamped official approval on the measurement of differences in costs by reference to a period of years, on the inclusion of transportation charges in costs, and on the use of the weighted arithmetic average rather than the bulk-line. But not all of these principles are sound for the fixing of a duty on wheat, nor do they achieve the aim sought by the cost-of-production formula.

If the purpose of the protective tariff is primarily to equalize competitive conditions in wheat production in Canada and the United States, then costs of transportation to central American markets must be included as or with costs of production. Competition takes place in wholesale markets, not on the farms. Wholesale market prices must cover transportation charges as well as farm costs if wheat production is to be profitable. It is by affecting wholesale prices that the tariff is supposed to equalize competitive advantages. On this general theory there was, in fact, no real disagreement between members of the Tariff Commission. The exclusion of transportation charges from costs of production by three members was based on the contention that Congress had not specifically or by implication authorized their inclusion in the Act of 1922. "If," wrote these three, "the Courts should construe the statute [as not including transportation costs], a proclamation based on their inclusion would utterly fail. . . . No one disputes that transportation costs are a factor in competition."² They further contended that "the natural and ordinary meaning of the words 'costs of production' does not include costs of trans-

¹ Proviso to Section 315 (a).

² *Wheat and Wheat Products*, p. 34.

portation." The contention would doubtless not have been raised had the Tariff Act specifically required the inclusion of transportation charges as costs. The action of the President in approving their inclusion is scarcely open to criticism on theoretical grounds, though it may be on the ground of legality.

PERIOD AVERAGES OR YEARLY AVERAGES?

Congress, in fixing the duty on wheat at 30 cents, three members of the Tariff Commission, in employing a 1921-23 average of costs which lead to a figure of 42 cents, and the Administration, in approving the 42-cent figure, all apparently assumed that a semi-permanent or normal difference exists between Canadian and American farm costs of wheat production. We have shown that no such semi-permanent difference is demonstrable on the basis of available data; it can be assumed only by ignoring the effect of summer fallowing, by overemphasizing lower land values and labor rates in Canada, and by overemphasizing differences between Canadian and American yield per acre. Canadian costs, excluding transportation charges, would have been found only about 4 cents per bushel lower on the average for the four-year period, 1921-24, or about 12 cents lower when transportation charges are included; not 33 cents (excluding transportation) nor 42 cents (including transportation) as was found by the Tariff Commission for the period 1921-23. A low yield in Canada and a high one in the United States in 1925 might readily suffice to bring Canadian costs, excluding or even including transportation charges, for the period 1921-25 above the American costs. A high yield in Canada and a low yield in the United States would have the opposite effect.

A neat dilemma presents itself if tariff rates are to be based upon differences in average costs over a period of years rather than on differences in costs in specific years. In the long run, costs per bushel of producing wheat including land charges and trans-

portation costs from local elevators to central markets, must tend to become almost equal in any two areas,¹ though lack of mobility of capital and imperfect adjustment of land charges will doubtless never allow complete equalization. Land charges will eventually increase in the area where other costs are lower. It may happen that the difference between average American and Canadian costs per bushel including land rent, but excluding transportation costs, over the period 1924-44 will be very low. For short periods the difference between the two types of costs may be at one time considerably in favor of Canada, at another time in favor of the United States.

To base the tariff on long-time differences in costs per bushel including land rent and transportation charges, will thus eventually result in a tariff rate of next to nothing. To base the tariff on long-time differences in costs including land rent but not costs of transportation, will result in a rate not far from the difference between the two countries in costs of transportation.² A 1921-23 average showed a net difference between costs not including transportation of 33 cents. A 1921-24 average shows a net difference in similar costs of 4 cents. A 1921-28 average may conceivably show a net difference of 2 cents. Meanwhile, in any particular year, Canadian costs may be lower than American by 52 cents. In such a year American producers will inevitably demand high protection. They will obtain it under the cost-of-production formula only if the Executive excludes land rent as an element in cost of production, or abandons the practice of obtaining averages applicable to a period of years. To base the tariff on differences between long-time averages of costs including land rent will appeal to free-traders because it must result in something approximating free trade; but it will not appeal to protectionists.

In order to fulfill the purpose underlying the cost-of-production formula as applied to wheat, differences between American and Canadian costs would have to be determined every year by the "survey method," and the duty revised to accord with yearly differences. What moderate protectionists desire, as distinguished from those who

¹ See above, p. 183.

² The difference between the two countries in transportation to Buffalo was less than 10 cents per bushel. U. S. Tariff Commission, *op. cit.*, p. 13.

seek a prohibitive tariff, is equal competitive ability at any given immediate time.¹

But to ascertain costs every year involves some serious practical difficulties. It involves abandonment of restricting the Tariff Commission to a 50 per cent increase or decrease in tariff rates; for in one year the Canadian costs may be lower than American by 52 cents, while in another year they may be actually higher than American. It involves considerable expense. Moreover, there is some doubt whether or not differences in costs could be ascertained with sufficient rapidity. New tariff rates ought to become effective at the moment when American and Canadian wheats begin to compete in American markets. A cost inquiry involves interviews with some 2,000 farmers, transmission and tabulation of records, compilation of findings, agreement among members of the Commission, and proclamation by the President. Inquiry cannot begin until much of the Canadian crop has been harvested. The new rate could scarcely become operative until a considerable amount of wheat had come into competition.

The only practicable method of ascertaining differences in costs promptly and inexpensively appears to be to calculate them by some mathematical method. If prices of materials, labor, and land were known to be much the same in any two years, and costs had been determined in the first, it might be possible to calculate costs in the second year with some accuracy. Costs per acre would be much the same except as different yields in the two years caused differences. If basic information on the effect of

yield on per-acre costs could be obtained, then per-acre costs could be calculated, and per-bushel costs could be calculated from them by the usual method. Such a device would not result in prompt changes of rates unless statistics of yield were available promptly. On the whole, such a method is not greatly to be recommended. It would be open to criticism on the ground of inexactness—though no more so in fact than the method now in use. Surveys would at best be required frequently, since labor rates, materials, prices, labor and materials requirements, and land charges are unlikely to remain stable over a period of several years.

WHO SHALL BE PROTECTED?

There is, however, a more important objection to basing the wheat duty on yearly determinations of difference in costs. Shall all American producers be protected, or what proportion of them? It is a well established fact that costs of production vary widely between individual producers in a given year. What kind of averages ought to be compared is therefore a question of vital importance. Averages of individual costs may be reached in different ways; by the use of the median, the mode, the simple arithmetic average, the weighted arithmetic average, the bulk-line method. In practice, the merits of the last two only have been extensively debated.

The use of the weighted average may result in inadequate protection for as high as 35 per cent of the producers,² since variations in individual costs are so extensive—a result probably not contemplated by ardent protectionists, certainly not by the 35 per cent of producers, who are themselves quite likely to constitute the element most earnestly seeking protection. The use of the bulk-line method may result in inadequate protection for anywhere from 1 to 49 per cent of producers. Under actual cost conditions, the weighted average is unlikely to run above the costs of more than 75 per cent of the total number of producers; so that 25 per cent are likely to receive inadequate protection if the tariff is based on comparisons of weighted averages. But can these 25 per cent be defined

¹ The "survey method" of obtaining cost data, whereby field agents visit individual farmers, seems necessary in order to eliminate any tendency toward bias. It cannot be supposed that Canadian farmers, knowing that low costs in Canada would raise the American tariff, would not "pad" their costs if that were possible. This is said, probably with truth, to be impossible when field men are able to check one answer of a farmer with another. But a cost questionnaire, which must necessarily be simple and easily tampered with, could not be employed in foreign countries once farmers were aware that the American tariff could be kept down by reporting high costs.

² The weighted average of American 1921-23 costs was above the costs of 65 per cent of American producers; the weighted average of 1923 costs was above the costs of 67 per cent of producers.

as abnormally high-cost producers, and hence not deserving of adequate protection? No one denies that a certain percentage of inefficient producers exists, but no one knows how large that percentage is in any given year. Those who advocate the weighted average method obviously lean toward the notion that anywhere from 25 to 35 per cent of wheat producers are inefficient and undeserving of complete protection.

The bulk-line method provides a means for protecting a larger proportion of producers. The Tariff Commissioners who advocated the method chose 85 per cent as the point where differences in cost should be measured; but they might equally well have chosen 70 per cent or 90 per cent. The bulk-line method is at best arbitrary. Its results depend upon the definition of "bulk of production." Bulk of production was defined by three commissioners as "simply the whole production less that part of it which is produced at abnormally high costs." If "abnormally high costs" could be defined mathematically, the bulk-line method would seem satisfactory. But the cost curve has a gradual slope, not an abrupt one; and abnormally high-cost producers cannot be selected except arbitrarily.

Obviously the question of what proportion of producers deserve protection needs to be settled before even yearly determination of differences in costs will serve to fulfill the ideal of equalizing competitive opportunities, which lies behind the cost-of-production formula. The proportion of inefficient and undeserving producers must be ascertained. At present no such classification is possible.

It is of interest to observe that the duty on wheat is likely in practice in the next

few years¹ to move only upward under existing provisions of the law. An investigation of costs followed by a proclamation is likely to come only at the instigation of producers seeking additional protection in a year when Canadian yields—and hence costs—are low, while American yields and costs are high. Consumers' interests are not as yet so highly organized as to petition for reduction, force a hearing before the Tariff Commission, and compel a downward revision. It is certain that American costs for 1924 were lower than Canadian; but demands for a reduction of the 42-cent duty were not and are not heard. The tariff remains almost prohibitive, in a year when protection to the American farmer is clearly unwarranted by the cost-of-production formula. So far as one can see at present, the possibility of a reduction is remote, while that of an increase is easily conceivable in any of the next few years when Canadian yields are good but American yields poor. Under the existing law, however, the increase could not exceed 3 cents per bushel, since a 45-cent duty is the highest permitted under the flexible-tariff provision.

The conclusion is that the cost-of-production formula as applied to wheat is neither scientific nor capable of achieving the end sought by its advocates. In the long run it will fail to give protection when protection is wanted, if long-time averages continue to be used. If this difficulty is avoided by employing yearly averages and broadening the restrictions of the flexible-tariff provision, a method must be found to distinguish inefficient producers from efficient. If such a method cannot be developed, the application of the cost-of-production formula to the wheat duty will remain unscientific.

VII. BROAD CHANGES IN THE LEVEL OF COSTS

In an earlier section attention has been directed toward changes in cost levels since the pre-war period in the various political subdivisions of the spring-wheat belt. Here

we may consider these changes more broadly, with reference to the belt as a whole.

Orthodox economic theory attaches great importance to the influence of cost of production upon price. In the long run, prices of commodities like wheat, produced under competitive conditions and at varying costs,

¹ In the long run, if long-time averages were employed, differences in costs would diminish and the tariff rate would fall. See p. 189.

are said to be determined by the marginal cost of production or by the cost of production of the most expensive increments of the supply.¹ Costs of production—or expenses of production, the term used in orthodox theory—include not only labor and materials charges, but expenses of management and interest at normal rates on invested capital as well. They do not, however, include true land rent, which is regarded as a result of prices rather than as a factor determining price.

In order to determine whether or not there have been between the pre-war and post-war periods changes in the costs of wheat production which must affect prices in the long run, we should require first of all cost figures for marginal producers in each period, these figures compiled to include labor, materials, interest, and management costs. Since wheat prices are at least partially determined by world conditions, the marginal producer must be sought in many countries. He cannot, of course, be located; and if he could be, his costs could not be calculated to include interest or management charges; for under actual conditions investment in capital cannot be separated from investment in land, and there exists no criterion for a reasonable charge for management. There is, therefore, no possibility of testing by statistical methods the adequacy of orthodox economic cost-and-price relation theories.

The cost statistics applicable to both the pre-war and post-war periods employed in the present paper apply only to the spring-wheat belt of North America, do not include charges for taxes or for wages of management, and are average costs of all producers rather than marginal costs. But there is, perhaps, enough connection be-

tween theoretical marginal costs and imperfect, weighted-average costs to justify consideration of changes in the level of average costs between periods. If the level of average costs has changed radically, it is conceivable that the level of marginal costs has changed as well and that a permanent influence on prices has been exerted.

MEASUREMENT OF INCREASES

Table 6 shows percentage increases in the costs per bushel, excluding land charges, of producing wheat in the spring-wheat belt between the pre-war and post-war periods. In the spring-wheat belt as a whole, per-bushel costs increased 52 per cent. This increase can have been due either to increases in prices of labor and materials, or to increases in quantitative requirements of labor and materials, or to decreases in average yields per acre. Yield per acre decreased only slightly—two-tenths of a bushel per acre—between the two periods; hence its influence in increasing per-bushel cost can have been but slight. There is no statistical method of measuring the effect on per-bushel costs of increases or decreases in quantitative requirements. The effect of increases in prices is measurable, if at all, by reference to index numbers of wholesale prices, with prices of the years 1908–14 taken as 100.

TABLE 6.—PERCENTAGE INCREASES IN YEARLY AVERAGE COSTS PER BUSHEL, EXCLUDING LAND CHARGES, OF PRODUCING WHEAT IN CANADA, THE UNITED STATES, AND THE SPRING-WHEAT BELT AS A WHOLE, BETWEEN THE PRE-WAR AND POST-WAR PERIODS.

Area	Pre-war cost per bushel <i>a</i>	Post-war cost per bushel <i>a</i>	Per cent increase	Pre-war yield per acre <i>b</i>	Post-war yield per acre <i>b</i>
	\$	\$	%	bu.	bu.
United States	.608	.945	55	12.2	12.4
Canada	.545	.837	54	18.5	15.8
Belt	.579	.878	52	14.4	14.2

a Costs in sub-areas as shown in Tables 1 and 3, weighted by production in each area as shown in Appendix Table III.

b See Appendix Table VI.

¹ Taussig, *Principles of Economics*, II, 55. That the "most expensive portion of the supply of most agricultural products regulates the long-run value of the whole supply"—the price—is doubtful. If in any given year or series of years many producers, perhaps as high as 10 per cent, continue to produce while receiving less than "normal" returns on capital, labor, and management, then a considerable amount of product is offered continually at less than marginal cost. Orthodox economic doctrine gives too little consideration to extra-marginal producers in agriculture, though such producers are always present to greater or less degree under dynamic social conditions.

The two series of index numbers of wholesale prices which can be calculated on a 1908–14 base are those of the American Bureau of Labor Statistics currently pub-

lished on a 1913 base,¹ and those of the Canadian Department of Labour (old series) published on an 1890-99 base.² The American series recalculated on a 1908-14 base shows the American price level of 1921-24 to have averaged 153.5; the Canadian series similarly adjusted shows the Canadian 1921-24 price level to have averaged 178.4. Hence the cost per bushel of wheat in the spring-wheat belt as a whole appears not to have risen between the pre-war and post-war periods so high as the general wholesale price level: costs of wheat production rose only 52 per cent, while wholesale prices rose 53.5 per cent in the United States, 78.4 per cent in Canada. Thus it would seem possible to conclude that the average level of *real* costs of wheat production has declined between the two periods. If this is true, and if the long-run price of wheat is determined by its cost of production, one might infer that the normal post-war price of wheat will not be so much above the pre-war average as seems true of commodities in general.

QUALIFICATIONS NECESSARY

Such a conclusion cannot be regarded as definitive. In the first place, costs per bushel are necessarily affected by yield per acre. The average yield per acre in the spring-wheat belt for such a period as 1921-27 may exceed or fall below the average yield for the period 1921-24. If the yield in the next few years exceeds the 1921-24 average even by one bushel per acre, it will be possible to conclude—for that period at least—that the level of real costs has declined. But if the average yield in the next few years falls below that of 1921-24, we may conclude that the real cost level has risen. An opinion about the possibility that a real and permanent decline in the cost of wheat production in the spring-wheat belt has occurred, must be based on the notion that 14.2 bushels per acre is the normal long-time average yield in the belt. No one, of course, knows whether 14.2 bushels per acre is or is not the normal long-time yield. Hence it is possible to conclude only that, as between a

period including the years 1908-14 and another period 1921-24, the level of average costs of wheat production did in fact decline somewhat. It is not possible to conclude that the decline was of a permanent nature capable of affecting the future price level, even if average costs were marginal costs and costs in the spring-wheat belt were costs throughout the world. There is no evidence to support the conclusion that in the spring-wheat belt as a whole sufficient progress has been made through the introduction of new machinery, new methods, and new varieties of wheat, decisively to overbalance rising prices, soil exhaustion, plant diseases, and increased practice of summer fallowing in their effect upon costs of production. If real costs between the two periods have declined, they have not only declined slightly, but they may not have declined permanently. The inclusion of another year in the post-war period might change the decline into an increase.

Furthermore, the index numbers chosen, at least the Canadian, are by no means clearly suitable for comparison with farm costs of production. Index numbers are made up from the wholesale prices of many commodities, while farm costs contain the prices of comparatively few; and the composition and weighting processes used in index numbers are still matters of dispute. Again, one may err greatly in assuming that marginal costs of production vary with average costs. Since no one has as yet been able to locate the marginal cost, its relation to the average cost is uncertain. Finally, what has happened to the real cost level in the winter-wheat belt of the United States or in the wheat areas of Argentina, Australia, India, and Europe is not known. Yet costs in these areas have perhaps as important a bearing on price as have costs in the spring-wheat belt.

The foregoing discussion does, however, suggest the possibility of a reduction in real costs per bushel in producing wheat, and it tends to discredit the common assumption that there is an unchanging normal relationship between the price of wheat and the general level of prices, upon which the advocates of a "ratio price" for wheat seek to found their case.

¹ In the *Monthly Labor Review*.

² In the *Labour Gazette*.

VIII. COSTS IN RELATION TO FARM PROSPERITY

Farm cost-of-production statistics are perhaps more generally employed for the diagnosis and measurement of farm prosperity than for any other purpose. For such diagnosis profits must be calculated, and their calculation involves the use of price statistics. It is the purpose of the present section to point out some limitations on the use of profit statistics per acre of wheat as an index of farm prosperity in the spring-wheat belt. Table 7 arrays yearly maximum and net profits per acre¹ of wheat during the pre-war and post-war periods so far as both are calculable, together with the factors—cost, yield, and price—chiefly influencing profits.

period, while farmers in Minnesota received \$.91, or 33 per cent more. In the post-war period Minnesota farmers received \$1.069 per bushel as against \$.848 in Alberta; but the percentage difference was reduced from 33 per cent to 26 per cent. The rank of the various areas in farm price ran much the same in both periods—Minnesota, North Dakota, South Dakota, Montana, Manitoba, Saskatchewan, and Alberta in the pre-war period, with Montana and South Dakota changing places in the post-war period; and in both periods Canadian prices were lower than American.

Distance from central markets, quality of grain, and tariff protection account for the

TABLE 7.—AVERAGE YEARLY PRE-WAR AND POST-WAR MAXIMUM AND NET PROFITS PER ACRE FROM PRODUCING WHEAT IN THE SPRING-WHEAT BELT, BY AREAS

Period and area	Cost per acre excluding land charges <i>a</i>	Cost per acre including land charges <i>a</i>	Yield per acre <i>a</i>	Farm price per bushel <i>b</i>	Value of produce per acre <i>c</i>	Basis: Maximum profits per acre <i>d</i>	Net profits or loss per acre <i>e</i>
	\$	\$	bu.	\$	\$	\$	\$
PRE-WAR							
Montana	10.23	—	24.8	.801	19.91	9.68	—
Manitoba	8.96	—	17.8	.794	13.90	4.94	—
Minnesota	7.95	—	14.0	.910	12.64	4.69	—
Alberta	10.72	—	21.1	.683	14.41	3.69	—
South Dakota	6.65	—	10.9	.856	9.24	2.59	—
North Dakota	7.36	—	11.1	.877	9.60	2.24	—
Saskatchewan	10.63	—	18.3	.711	12.85	2.22	—
POST-WAR							
Minnesota	12.59	16.74	14.5	1.069	15.99	3.40	-.75
South Dakota	10.08	12.88	11.8	.961	11.57	1.49	-1.31
Manitoba	13.29	17.24	14.9	.913	13.85	.56	-3.39
North Dakota	11.14	13.69	11.4	.983	11.52	.38	-2.17
Montana	14.22	16.32	14.5	.980	14.34	.12	-1.98
Saskatchewan	13.37	17.72	16.4	.868	13.48	.11	-4.24
Alberta	13.13	18.23	15.2	.848	12.03	-1.10	-6.20

a From Tables 1, 3, and 4.

c Calculated by averaging yearly values of produce computed from Appendix Tables VI and VII.

d Differences of figures in columns 1 and 5.

b From Appendix Table VII.

e Differences of figures in columns 2 and 5.

Farm prices² exhibit a surprising range between areas in the same period. Farmers in Alberta received, on the average, only \$.683 per bushel for wheat in the pre-war

differences of farm prices between areas; but detailed explanation is impracticable here. The tariff has been effective in some years, but not in others. Quality is good in some areas but not in others in the same year. Quality has become of increasing importance with the growing practice of millers in buying wheat on the protein-content basis. Durum wheat has become of larger importance, and winter wheats of

¹ Maximum profits are profits calculated without reference to land charges; net profits include land charges. Profits per bushel need no consideration. They must show the same facts, though in smaller figures, as profits per acre.

² See Appendix Table VII for methods of calculating farm prices.

less. Transportation facilities and expenses have changed. These developments require intensive analysis if their relative effect on farm prices in various areas of the spring-wheat belt is to be ascertained. It suffices for present purposes merely to indicate that farm prices have differed, for the most part consistently, in the different areas; and that the extent of the differences has been somewhat reduced between post-war and pre-war times.

MAXIMUM PROFITS PER ACRE

Maximum profits per acre have clearly varied considerably between areas in the same period. This variation also characterizes net losses in the post-war period—a result scarcely to be expected if land charges as reflected in cash rentals are accurately made on the basis of profits normally to be expected from the experience of past years. We should rather expect net profits or losses to vary less than maximum profits. The fact is that cash rentals are not under actual conditions based upon the expectations of normal profits so far as those can be ascertained, but often upon the hope, frequently not reasoned, of higher future prices and yields and upon a complex of psychological factors not amenable to measurement or even enumeration. What is true of cash rentals is also true of land values.

Clearly maximum profits per acre of wheat have not been higher in Canada than in the United States in either period. Net profits have not been higher in Canada nor net losses lower in the post-war period, though a contrary opinion is common. This opinion has been due in part to the notion that costs are normally lower in Canada, in part to the notion that Canadian farm prices are not much below American, and in part to higher yields in Canada. But, although Canada has in both periods had the advantage in yield per acre, she has not had the advantage either in farm price or in costs per acre.

There has been a general decrease in maximum profits per acre between the two periods, and presumably in net profits also. This decrease is the proximate cause of the

recent agricultural depression in the north-western states. The usual expression of the causes of the depression has been that sharp increases in costs of production have not been counterbalanced by corresponding increases in price. The expression is accurate for North and South Dakota and Minnesota, but not for Montana. In that state a decrease in yield was fully as important in affecting prosperity as was the failure of price increases to balance increases in costs. Nor is the expression of the same accuracy when applied to each of the states of North and South Dakota and Minnesota. Decreases in profits were not equally sharp in these areas, nor were increases in yield or in price equally great in each, although increases in costs were much the same.

NET PROFITS

Net profits per acre of wheat appear, at first glance, to provide as reliable a measure of farm prosperity in the spring-wheat belt as any that can be devised. Thus it seems proper to say, since farmers in Alberta in the post-war period sustained the highest loss per acre of wheat while farmers in Minnesota sustained the lowest, that farm prosperity was at its lowest ebb in Alberta, Saskatchewan, and Manitoba in the order named, but suffering was less acute in Minnesota, South Dakota, Montana, and North Dakota. What the range of net profits may have been in the pre-war period is not determinable for lack of data on land charges; consequently, which areas suffered the greatest reversal in prosperity between the two periods or which areas were most prosperous in the pre-war period cannot be determined. Presumably the general decline between periods of maximum profits per acre serves to establish the fact of less prosperous conditions in the post-war than in the pre-war period. But this fact is equally well attested by evidence of other less complex sorts—such as tax delinquency, bank failures, foreclosures of mortgages, and the like. From statistics of profits per acre of wheat no obviously satisfactory conclusions regarding farm prosperity in the spring-wheat belt can be drawn other than to indicate the relative prosperity of the differ-

ent areas in the post-war period. But even this indication is subject to qualification.

RELATIVE IMPORTANCE OF WHEAT-GROWING

The first and most obvious limitation on the use of net profit per acre figures as a measure of farm prosperity is the fact that wheat was a less important source of income in some areas than in others. We may, on the basis of profit statistics, properly or improperly conclude that wheat production was least profitable in Alberta, most profitable in Minnesota, and profitable in other areas in accordance with the size of the net profit or loss figure. It might likewise be possible to demonstrate that wheat production was extremely profitable in Massachusetts; but wheat production has slight bearing on farm prosperity in Massachusetts. In the same way wheat production is and has been of different degrees of importance in the various areas of the spring-wheat belt.

In the pre-war period,¹ wheat production was of greatest importance in North Dakota, Manitoba, and Saskatchewan. In these areas 27 per cent, 25 per cent, and 19 per cent of all land in farms was planted to wheat. In Minnesota and South Dakota 14 per cent of all farm land was in wheat, and in Alberta and Montana 10 per cent and 3 per cent, respectively. In North Dakota, Manitoba, and Saskatchewan 60 per cent of the crop land was in wheat; but in Alberta the percentage was 49 per cent, in South Dakota 38 per cent, in Minnesota 33 per cent, and in Montana 23 per cent. Livestock provided a much more important source of income in Montana, South Dakota, and Minnesota than elsewhere, and was least important in Saskatchewan, Manitoba, and North Dakota. The number of animal units² per farm in 1910 and 1911 ran as follows: Montana, 36.4; South Dakota, 23.5; Minne-

sota, 17.6; Alberta, 13.3; North Dakota, 11.5; Manitoba, 10.8; and Saskatchewan, 7.5. Profits per acre of wheat were thus of distinctly secondary importance in Montana, where livestock was the chief source of income and where wheat occupied only 3 per cent of total farm acreage. It was of relatively slight importance in South Dakota, Minnesota, and Alberta, and of vital importance only in North Dakota, Manitoba, and Saskatchewan. Thus, even if net profits per acre of wheat were known for all areas in the pre-war period, we should be quite unjustified in assuming that farm prosperity in the various areas coincided with the size of the net profits per acre of wheat figures. The fact might be true of North Dakota, Manitoba, and Saskatchewan, and approaching the truth in Minnesota, South Dakota, and Alberta; but it would be quite untrue of Montana.

Between the two periods wheat production declined in relative importance in Minnesota, South Dakota, Manitoba, and North Dakota—considerably in the first two areas, slightly in the second two. In Minnesota land in wheat fell from 14 to 10 per cent of all land and from 33 to 21 per cent of crop land, and the number of animal units per farm rose from 17.6 to 19.7. In South Dakota similar developments took place, land in wheat falling to 8 per cent of all land and 26 per cent of crop land, while animal units per farm increased to 38.3. In Manitoba, however, 24 per cent of all land and 56 per cent of crop land remained in wheat, while animal units per farm increased only to 13.6; and in North Dakota 27 per cent of all land and 56 per cent of crop land remained in wheat, animal units per farm increasing to 19.1. In Montana, Saskatchewan, and Alberta wheat production increased in importance. The percentage of all land in wheat rose in the areas named from 3 to 8 per cent, 19 to 31 per cent, and 10 to 18 per cent; the percentage of crop land in wheat rose from 23 to 54, 61 to 62, and 49 to 55. Animal units per farm decreased from 36.4 to 27.7 in Montana, but increased from 7.5 to 11.5 in Saskatchewan and from 13.3 to 18.5 in Alberta.

It is, therefore, easy to exaggerate the

¹ The calculations and deductions in ensuing paragraphs are based partially on census data, partially on annual reports of statistical offices. It is assumed that the American census of 1910 and the Canadian census of 1911 represent pre-war distributions of acreage fairly well, while post-war distributions are represented by the censuses of 1920 and 1921. See Appendix Tables XII-XIII.

² One mature cow or steer, five hogs, or seven sheep equals one animal unit. Calculations are made without reference to maturity.

bearing of wheat production on farm prosperity in Minnesota, South Dakota, and Montana in the post-war period, and to measure farm prosperity in these areas by the size of net profits per acre of wheat is quite impossible. Doubtless profits on wheat affected farm prosperity; but profits on livestock must have been of far greater significance. In Manitoba, Saskatchewan, Alberta, and North Dakota wheat production was of more importance. But even in these areas some income came from livestock, and from 40 to 45 per cent of the crop land was devoted to other crops than wheat. An adequate measure of farm prosperity even in these four areas where wheat is the most important source of income requires statistics of profits on all types of farm produce, together with definite knowledge of the proportion of total income of the average farmer furnished by each type. Furthermore, ascertaining of profits on livestock is notoriously difficult; and the apportioning of total income to its various sources has never been attempted on an extensive scale, for large areas or for small ones. Hence, profits in wheat production even in Manitoba, Saskatchewan, and North Dakota provide only an uncertain and unsatisfactory measure of farm prosperity.

RENTED LANDS

A second limitation upon the use of profit statistics as a measure of farm prosperity is the fact that different conditions of tenure exist in different areas, and render the significance of land charges different in different areas. Land charges are of greater significance during a period of depression to the farmer who must pay them in cash than to the farmer who has no rent or mortgage charges to pay. If 50 per cent of the farmers in one area are renters, while only 5 per cent are renters in another area, land

charges affect the prosperity of the first area more seriously than that of the second. Renters *must* receive a sufficient sum per acre to cover costs including land charges if they are to remain on farms; owners *prefer* to obtain such a sum, but are able to remain on their farms if such a sum is not forthcoming. Thus, in the post-war period, losses per acre were \$4.24 in Saskatchewan, \$2.17 in North Dakota, and the importance of wheat production was much the same in both areas. If net profits provided a measure of farm prosperity, we should conclude that farmers in Saskatchewan were less prosperous than farmers in North Dakota. But in North Dakota 26 per cent of all farmers were renters, and hence in a position to feel the \$2.17 loss to the full; but only 11 per cent were renters and in a position to feel the \$4.34 loss to the full in Saskatchewan.¹ The size of the net profit or net loss figure may often be less important than the number of farmers suffering losses; accordingly it is quite possible that in the post-war period prosperity was at a lower ebb in North Dakota than in Saskatchewan. Similar reversals of conclusions drawn from net profit figures are conceivable even if net profits were obtained on all types of farm produce. Conditions of tenure² are quite as important in their bearing on farm prosperity as are profits.

UNPAID LABOR

A third qualification of the use of average profit figures to measure prosperity is the fact that unpaid labor—that of the operator and his family—is in cost statistics recorded as hired labor. This practice is open to little objection when costs alone are under consideration. But in one area perhaps 10 per cent of the labor on wheat must be hired, and so paid for in cash, while in another area 50 per cent must be hired. If so—though on this point practically no information is available—farmers in certain areas are more nearly in a position to feel the full weight of labor costs than farmers in other areas, and find their prosperity more insecure when values do not equal costs. If profit statistics are to be employed as a measure of prosperity, clearly

¹ See Appendix Table XI. Canadian figures are perhaps not satisfactory, since many Canadian farmers officially recorded as owners may have been practically in the status of renters on account of the sale of land for a small sum down and amortization payments over a term of years.

² The relative proportions of mortgage indebtedness in different areas is also of importance; but on this point satisfactory data for Canada are not available.

possible differences of practice in hiring labor must be ascertained.

STATE AREAS NOT HOMOGENEOUS

A final qualification applicable to the interpretation of profits in the spring-wheat belt is dictated by the use of state averages. Minnesota is not in fact an area marked out by special characteristics from other areas in the spring-wheat belt; nor is any other state or province. Subdivisions of the spring-wheat belt which are truly homogeneous are not definitely known. It is doubtful if state or provincial boundaries serve to distinguish homogeneous areas one from the other. Thus the conditions of wheat production in the Red River Valley may be truly homogeneous, and quite different from the conditions of wheat production in the semi-arid regions of Montana and western North Dakota or on the prairie lands of Saskatchewan. But the Red River Valley falls within three political areas: Minnesota, North Dakota, and Manitoba. An adequate analysis of costs and profits in wheat production should be based not upon political geography, but upon type-of-farming geography. In this field so little investigating has been done that the distinct areas of even the American part of the spring-wheat belt cannot, without exhaustive inquiry, be distinguished one from the other.

The importance of such delimitation is clear with respect to Minnesota. This state

contains in the southwestern corner an area where corn and hogs, not wheat, are the chief farm products; an area in the southeastern corner where dairying is of foremost importance; an undeveloped area in the northeast, and an area devoted to small grains, chiefly wheat, in the northwest. In this last area wheat is probably quite as important a crop as it is in Manitoba; the system of farming differs decidedly from that in the other three sections of the state; and costs and profits on wheat in this section are quite as important as they are in Saskatchewan. But it is possible to conclude from the use of state averages that wheat is of comparatively no importance in Minnesota, when, as a matter of fact, it is of very great importance in a comparatively small portion of the state, and of no importance in other portions.

What is true of Minnesota is perhaps equally true of the other political divisions of the spring-wheat belt. Before accurate analysis of differences in the conditions of agricultural production between areas of the spring-wheat belt can be made, the areas must be properly delimited. State averages, whether of cost, profit, yield, or price, are perhaps of value to combine, but not always of equal value to compare. Some useful information is provided from state averages; but far more promises to be forthcoming if and when type-of-farming areas are delimited and statistical data are presented not on a state basis but upon the basis of homogeneous agricultural areas.

IX. SUMMARY AND CONCLUSIONS

This study consists primarily of an analytical interpretation of average costs of producing wheat in the seven political subdivisions of the spring-wheat belt of North America, for a pre-war period, 1908-14, and a post-war period, 1921-24. By methods fully set forth in a supplementary document, data given by official investigations for specific years were used to construct comparable cost schedules for each area in the average year of the pre-war and post-war periods. This process, while involving numerous estimates and approximations,

yielded material more significant for intensive comparative study than any previously published data as they stand. In particular it brought out the importance of certain matters heretofore under-emphasized—the influence of yields on costs per acre, the effect of summer fallowing on costs per acre, and the significance of computing land charges on cash rental compared to other bases.

Comparisons of costs excluding land charges in the pre-war period show wide variations in the different areas. Per-bushel

costs in North Dakota were 61 per cent higher than in Montana; per-acre costs were 61 per cent higher in Alberta than in South Dakota. No consistent relationship was observable between per-acre and per-bushel costs. Differences in pre-war per-bushel costs were due chiefly to differences in yields per acre; but different labor rates, cultural methods, and transportation facilities were also influential.

Between the two periods, costs per bushel excluding land charges rose by a minimum of 40 per cent in Saskatchewan and South Dakota, and a maximum of 136 per cent in Montana. Per-acre costs rose only 23 per cent in Alberta, but 57 per cent in Minnesota. In all areas prices of labor and materials rose, but less extensively in some areas than in others. In some areas, notably Montana and Alberta, yield declined; and this contributed to sharp increases in costs per bushel while keeping down increases in costs per acre. Summer fallowing was of importance in increasing costs in Manitoba. The different factors affecting costs have been many—wages; prices of materials and land; yield; changes in machinery and methods; summer fallowing; new breaking; and transportation facilities. They have been of unequal effect on costs in each area, and they have worked in different directions. The rank of areas in costs changed strikingly between periods.

The calculation of land charges and their inclusion as costs, possible only for the post-war period, showed diminished differences in costs per bushel. Costs per bushel excluding land charges ranged from 81.5 cents in Saskatchewan to 97.7 cents in North Dakota; but costs per bushel including land charges ranged only from \$1.08 to \$1.20 in the same areas. Since costs per bushel depend so greatly upon yield per acre, it was impossible to designate the area which could consistently produce most cheaply. Costs per bushel including land charges tend in the long run to become equal, since land charges tend to offset other differences. Hence costs per bushel including land charges are likely to vary among areas less and less as the periods to which costs are applicable are extended.

The general impression that Canadian

spring-wheat growers are able consistently to produce at materially lower costs per bushel than American farmers is not well founded. In both countries, and notably in Canada, costs vary greatly from year to year. Although land prices are generally lower in Canada than in the United States, land charges per acre for wheat-growing in the spring-wheat belt are not considerably lower in Canada; yet the contrary is commonly assumed.

The prevalence of the practice of summer fallowing in Canada raises not only land charges per acre, but labor and materials charges as well. At present it appears that the yield per acre in Canada must be about three or four bushels in excess of American yield before costs per bushel are equalized in the two countries. If the Canadian yield surpasses the American by more than three bushels, Canadian farm costs per bushel will be lower than American, but otherwise not. For the period 1921–24, Canadian costs per bushel have been slightly, but not materially, lower than American. They may be either higher or lower for the periods 1921–25 or 1921–26, depending on yield per acre. Canada cannot consistently and invariably produce spring wheat at a lower farm cost than the United States.

To base a wheat tariff on differences between costs of production in Canada and the United States is neither scientific nor practical. It is improper to assume that a normal or semi-permanent difference in production costs exists; yet such an assumption lies behind the present duty of 42 cents. Carried out to its logical conclusion, this method would yield little or no protection. In order to satisfy the basic ideal of the cost-of-production formula, differences between American and Canadian costs should be ascertained yearly, and it should be possible promptly to increase or decrease the duty by more than 50 per cent of 30 cents. Even if yearly differences should be ascertained, however, the problem of determining what costs to compare would remain. If weighted-average costs are compared, inadequate protection is given to between 25 and 35 per cent of American producers. If bulk-line

costs are compared, the percentage of American producers who do not deserve protection on account of their inefficiency must be arbitrarily designated. Under the present law and accepted methods of revision, the tariff on wheat can easily be increased though only slightly; but it can be decreased only with difficulty.

The level of average wheat production costs, when changes in the value of money are eliminated, at first glance appears to have declined in the spring-wheat belt as a whole between the two periods, since costs rose only 52 per cent, while the general price level rose 53.5 per cent in the United States and 78 per cent in Canada. Farm technique appears to have improved. But the decline in the level of "real" costs is not marked. It cannot be designated as a permanent decrease capable of affecting the wheat-price level ultimately. For the 1921-24 average yield is not necessarily the normal yield; a change in the level of average costs is not necessarily a change in price-affecting marginal costs; and costs in the spring-wheat belt may not be representative of world costs. Yet there is at least a possibility that the level of marginal wheat-production costs has declined, and hence that wheat prices under post-war conditions should not be expected to be in the same ratio to prices of other commodities as they were before the war.

Profits per acre have varied considerably between areas in the same period, for costs per acre, yield per acre, and price per bushel have varied. Net losses in Canada were not lower than in the United States during the post-war period, for Canadian costs were higher and prices lower than American to an extent sufficient to counterbalance higher Canadian yields. Profits declined in all areas between the two periods, for costs rose faster than prices; but the decline was more marked in some areas than in others—notably in areas like Montana and Alberta where yield declined decidedly between the periods.

Variations in profits per acre of wheat or a general decline in profits per acre do not measure prosperity in the spring-wheat belt satisfactorily. Wheat was and is a less important source of income in Minnesota,

South Dakota, Montana, and Alberta than it was and is in Manitoba, North Dakota, or Saskatchewan. It was and is of unequal importance between any two areas, or between Canada and the United States, because other crops and livestock were and are of unequal importance as sources of farm income. Again, conditions of tenure differ considerably in different areas; and low profits or actual losses per acre are more of a menace to prosperity in an area where tenants or mortgaged farms are many. Further, farmers who must hire much labor feel the effects of losses per acre more than farmers who hire little, and of this matter little is known. Finally, to employ state averages is in a sense to misrepresent the facts not only of profits, but of yields, prices, and costs as well. This misrepresentation cannot be avoided, so long as published statistical material is compiled upon the basis of political geography rather than upon that of economic geography.

Analysis of the best cost statistics obtainable on wheat in the spring-wheat belt thus throws no great light upon fundamental economic problems. The fact is that cost statistics, particularly those applicable to crops whose yield is variable, are exceedingly unstable. Under static conditions, statistics of cost covering long periods of years would be of considerable value, but under dynamic conditions their value remains problematical. The most significant aspect of cost statistics is that they sum up and reflect—when properly compiled—changes in the conditions of agricultural production. Their value in diagnosing agricultural prosperity or in providing a sound basis for price-regulating legislation, direct or indirect, is slight. They are perhaps more subject to misinterpretation than any other type of agricultural statistics. Their forms are many, and they may be put to some uses and many abuses. It is hoped that the preceding pages have shown what can and what cannot properly be deduced from the best available statistics of wheat production costs in the spring-wheat area. Negative deductions outnumber positive; but even negative conclusions are not without considerable significance.

This issue has been prepared chiefly by M. K. Bennett, with substantial assistance from Joseph S. Davis and with suggestions from Carl L. Alsberg and Alonzo E. Taylor.

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APPENDIX

SOME ANALOGIES TO EXPENSE OF SUMMER FALLOWING

The analysis in this paper brings out the fact that the practice of summer fallowing, in Canada to a notable degree, involves expenses which are commonly overlooked in computing the costs of wheat production. Indeed, summer fallowing is of such importance in its influence on costs that it serves largely to invalidate the current opinion that costs of wheat production are lower in the Canadian than in the American section of the spring-wheat belt.

The cost of wheat production in the winter-wheat belt is probably increased more than is commonly realized by a cultural necessity roughly analogous to that of summer fallowing in Canada: that is, by abandonment. There is one important difference: abandonment varies greatly from year to year, whereas the acreage of summer fallow varies to a much smaller degree. In certain years, and in certain localities, as high as 92 per cent¹ of the fall-sown winter-wheat acreage may be abandoned. Part of the abandoned land may be, and is, sown to substitute crops; but part of it is either cultivated as fallow, simply allowed to grow up as weeds, or employed as pasture. An accurate accounting for the cost of the winter-wheat crop must include the costs of tilling and planting the acreage subsequently abandoned, allowing proper credits for substitute crops or pasture when the abandoned acreage is so employed. In order to achieve an accurate accounting on a large scale, however, more must be known than we know at present concerning the uses to which abandoned winter-wheat acreage is ordinarily put.

This lack of knowledge of the uses to which abandoned wheat acreage is actually put from year to year is capable of affecting cost statistics considerably. The Department of Agriculture has published statistics of average costs of production in Kansas, Nebraska, and Missouri in the years 1913-23.² These statistics were computed on the basis of costs determined in 1919. Yet costs of abandonment in other years may not have been the same in proportion to other costs as they were in 1919, though how nearly they were the same nobody knows with any accuracy.

In certain sections of the corn belt the cultivation of oats is a necessity in the crop rotation, just as fallowing is a necessity in Canada. When corn-livestock is the main farm enterprise, the accounting for the corn crop might better regard the cultivation of oats as part of the expense of producing corn, oats being given appropriate credits. This procedure would result in increasing the costs of corn production, since the value of the oats crop seems often not to equal its specific costs of production. To regard oats as a by-product would also affect orthodox economic reasoning. If oats is a by-product of corn production, there seems to be no good reason to suppose that the price of oats should in the long run, or ever, be determined by the cost of production of the marginal producer. Oats would continue to be produced, regardless of margins between cost and price, simply because their cultivation is necessary as a part of the crop rotation.

This reasoning might conceivably be extended to all crops and other farm products which in important producing areas are by-products in the farm enterprise. Almost all crops—wheat in the corn belt, corn in the cotton belt, and so on—may be so regarded to a greater or less degree.

¹ In Ford County, Kansas, in 1917. *Agriculture Yearbook*, 1923, p. 646.

² *Agriculture Yearbook*, 1923, p. 649.

TABLE I.—AVERAGE ITEMIZED COSTS PER ACRE OF PRODUCING WHEAT, EXCLUDING LAND RENT, IN THE SPRING-WHEAT BELT, BY AREAS FOR SPECIFIC YEARS, AS PUBLISHED*

Area	Year	Number of reports	Commercial fertilizer \$	Manure \$	Preparation of soil \$	Seed \$	Planting or seeding \$	Cultivating \$	Harvesting \$	Threshing \$	Preparing for market \$	Hauling and cleaning \$	Market \$	Wear and tear of impl. \$	Miscellaneous \$	Total \$	Yield per acre bu.	Credit for by-products \$
PRE-WAR																		
Minnesota	1909	210	.18	c	1.90	1.59	.42	c	1.35	b	1.34 ^a	d	d	b	.55 ^k	7.33	16.4	.45
North Dakota	1909	177	.06	c	1.95	1.31	.44	c	1.03	b	1.60 ^a	d	d	b	.38 ^k	6.77	14.4	.24
South Dakota	1909	190	.11	c	1.46	1.38	.41	c	1.18	b	1.22 ^a	d	d	b	.39 ^k	6.15	14.4	.20
Montana	1909	22	b	c	2.55	1.36	.54	c	1.72	b	2.05 ^a	d	d	b	1.00 ^k	9.22	28.6	b
Manitoba	1911	131	c	c	2.16	1.43	.80 ^f	b	1.26	2.38 ^g	c	b	b	.44	b	8.47	21.0	1.00
Saskatchewan	1911	326	c	c	3.21	1.33	.91 ^f	b	1.17	2.81 ^g	c	b	b	.45	b	9.88	20.0	1-2.00
Alberta	1911	153	c	c	3.13	1.56	.71 ^f	b	1.61	2.59 ^g	c	b	b	.43	b	10.03	24.0	1.00
POST-WAR^a																		
Minnesota	1923	300	.06	.90	3.52 ^e	1.81	b	b	1.95	1.89	c	b	1.11 ^j	b	2.51 ^k	13.75	14.6	.78
North Dakota	1923	411	.01	.25	3.25 ^e	1.34	b	b	1.28	1.83	c	b	.68 ^j	b	1.85 ^k	10.49	8.6	.32
South Dakota	1923	318	b	.32	2.50 ^e	1.36	b	b	1.50	1.82	c	b	1.02 ^j	b	2.24 ^k	10.76	11.8	.40
Montana	1923	283	.02	.32	4.71 ^e	1.10	b	b	1.62	2.41	c	b	1.84 ^j	b	2.97 ^k	14.99	16.0	.84
After stubble																		
Manitoba	1923	146	c	c	2.44	1.53	.50	.69	1.55	1.88	c	.97 ⁱ	b	.58	b	10.14	12.75	c
Saskatchewan	1923	207	c	c	2.46	1.30	.59	.51	1.60	2.63	c	1.37 ⁱ	b	.52	b	10.98	18.50	c
Alberta	1923	118	c	c	2.55	1.28	.62	.57	2.05	2.78	c	1.90 ⁱ	b	.62	b	12.37	24.75	c
After fallow																		
Manitoba	1923	146	c	c	3.88	1.57	.52	.99	1.72	2.21	c	1.05 ⁱ	b	.71	b	12.65	15.75	c
Saskatchewan	1923	207	c	c	4.15	1.40	.59	.60	1.76	3.38	c	1.72 ⁱ	b	.60	b	14.20	24.75	c
Alberta	1923	118	c	c	4.23	1.42	.63	.80	2.29	3.75	c	2.37 ⁱ	b	.69	b	16.18	33.00	c

* Sources: *Crop Reporter*, May 1911, XIII, 36f; *Census and Statistics Monthly*, March 1912, V, 51-57; *Crops and Markets*, June 1924, I, Supplement 6, pp. 126-27; *Cost of Grain Production in Canada, 1923*.

^a American figures for 1923 have been furnished by the U. S. Department of Agriculture. The published results of the 1923 investigation list costs not by states but by geographical divisions.

^d Items not certainly requested, reported, or included in other items.

^g Includes hauling to market or marketing.

^j Includes hauling and cleaning.

^b Items requested but not reported, or not reported separately.

^e Includes planting or seeding.

^h Includes threshing.

^k Includes wear and tear of implements.

^c Items not requested.

^f Includes cultivation.

ⁱ Includes marketing.

TABLE II.—AVERAGE ITEMIZED YEARLY COSTS PER ACRE, EXCLUDING LAND CHARGES, OF PRODUCING WHEAT IN THE SPRING-WHEAT BELT UNDER PRE-WAR AND POST-WAR CONDITIONS, BY AREAS*

Area	Number of reports	Seed \$	Operations before harvest \$	Harvest- ing and marketing \$	Wear and tear of implements \$	Miscel- laneous \$	Total \$	Yield per acre bu.	Area
PRE-WAR									PRE-WAR
Minnesota	210	1.59	2.32	2.84	.45	.75	7.95	14.0	Minnesota
North Dakota	177	1.31	2.39	2.57	.38	.71	7.36	11.1	North Dakota
South Dakota	190	1.38	1.87	2.37	.39	.64	6.65	10.9	South Dakota
Montana	22	1.36	3.09	4.31	.50	.97	10.23	24.8	Montana
Manitoba	131	1.43	2.96	3.28	.44	.85	8.96	17.8	Manitoba
Saskatchewan	326	1.33	4.12	3.74	.45	.99	10.63	18.3	Saskatchewan
Alberta	153	1.56	3.84	3.89	.43	1.00	10.72	21.1	Alberta
POST-WAR									POST-WAR
Minnesota	300	1.81	3.57	5.16	.55	1.50	12.59	14.5	Minnesota
North Dakota	411	1.34	3.37	4.97	.45	1.01	11.14	11.4	North Dakota
South Dakota	318	1.36	2.49	4.41	.50	1.32	10.08	11.8	South Dakota
Montana	283	1.10	4.83	5.78	.60	1.91	14.22	14.5	Montana
Manitoba	146	1.55	4.65	4.96	.65	1.48	13.29	14.9	Manitoba
Saskatchewan	207	1.34	4.48	5.40	.55	1.60	13.37	16.4	Saskatchewan
Alberta	118	1.34	4.46	4.95	.65	1.73	13.13	15.2	Alberta

*This table displays in final form the results of adjustments and estimates made to render data of Table I comparable and to transform costs in specific years into average yearly costs for each period. Details of computation are given in a mimeographed supplement obtainable from the Food Research Institute on request.

TABLE III.—VOLUME OF PRODUCTION OF ALL WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Million bushels)

Year	Minnesota	North Dakota	South Dakota	Montana	Total four states	Total United States	Manitoba	Saskatchewan	Alberta	Total three provinces	Total Canada	Year
1908	68.6	68.4	37.9	3.7	178.6	664.6	50.3	34.7	6.8	91.9	112.4	1908
1909	57.0	116.8	47.1	6.3	227.2	683.4	52.7	85.2	9.6	147.5	166.7	1909
1910	64.0	38.5	46.7	7.7	156.9	635.1	34.1	67.0	9.1	110.2	132.0	1910
1911	43.9	73.2	14.8	12.3	144.2	621.3	62.7	109.1	36.6	208.4	230.9	1911
1912	67.0	143.8	52.2	19.3	282.4	730.3	63.0	107.0	34.3	204.3	224.2	1912
1913	68.0	78.9	34.0	20.7	201.5	763.4	53.3	121.6	34.4	209.3	231.7	1913
1914	43.0	81.6	31.6	18.4	174.5	891.0	38.6	73.5	28.9	141.0	161.3	1914
Average 1908-14	58.8	85.9	37.7	12.6	195.0	712.7	50.7	85.4	22.8	158.9	179.9	Average 1908-14
1921	22.9	80.8	25.9	33.4	163.0	814.9	39.1	188.0	53.0	280.1	300.9	1921
1922	27.3	126.6	40.0	52.7	246.6	867.6	60.1	250.2	65.0	375.2	399.8	1922
1923	23.4	71.4	27.5	47.7	170.0	797.4	35.8	271.6	144.8	452.3	474.2	1923
1924	36.5	134.6	34.1	51.7	256.9	872.7	41.5	132.9	61.3	235.7	262.1	1924
Average 1921-24	27.5	103.3	31.9	46.4	209.1	838.1	44.1	210.7	81.0	335.8	359.2	Average 1921-24

* Sources: Canada—*Census and Statistics Monthly*, December 1908, p. 119; December 1909, p. 239; January 1915, pp. 4ff. *Monthly Bulletin of Agricultural Statistics*, January 1925, pp. 15ff. United States—*Agriculture Yearbook*, 1908, p. 609; 1912, p. 571; 1914, p. 525; 1921, p. 603. *Crops and Markets*, December 1924 Supplement, p. 462.

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TABLE IV.—VOLUME OF PRODUCTION OF SPRING WHEAT, INCLUDING DURUM, IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Million bushels)

Year	Minne- sota	North Dakota	South Dakota	Mon- tana	Total four states	Total United States	Mani- toba	Sas- katche- wan	Alberta	Total three provinces	Total Can- ada	Year
1908	68.6	68.4	37.9	3.7	178.6	226.7	50.3	34.7	3.8	88.8	^a	1908
1909	94.1	90.8	47.6	4.8	237.3	265.6	52.7	85.2	7.6	145.5	150.6	1909
1910	94.1	36.1	46.7	4.3	181.2	201.0	34.0	67.0	6.7	107.7	111.7	1910
1911	43.9	73.2	14.8	5.0	136.9	190.7	62.3	109.0	28.9	200.2	205.1	1911
1912	67.0	143.8	52.2	7.7	270.7	330.3	62.7	106.9	29.7	199.3	203.8	1912
1913	67.2	78.9	33.1	8.4	187.6	239.8	52.9	121.5	30.1	204.5	209.1	1913
1914	42.0	81.6	30.6	7.3	161.5	206.0	38.4	73.4	24.2	136.0	140.4	1914
1921	21.7	80.8	24.9	27.5	154.9	214.6	39.1	188.0	51.6	278.7	285.3	1921
1922	26.0	126.6	38.2	41.0	231.8	280.7	60.1	250.2	64.1	374.4	380.8	1922
1923	21.6	71.4	26.3	37.1	156.4	225.4	35.8	271.6	142.5	449.9	454.9	1923
1924	34.3	134.6	33.0	40.8	242.7	282.6	41.5	132.9	60.8	235.2	239.8	1924

* Sources: Canada—See Table III. United States—*Agriculture Yearbook*, 1908, p. 610; 1909, p. 447; 1910, p. 513; 1911, p. 532; 1912, p. 570; 1913, p. 380; 1914, p. 523. *Weather, Crops, and Markets*, December 29, 1923, pp. 670f. *Crops and Markets*, December 1924 Supplement, p. 400.

The 1908-10 figures for state areas and the 1908 figure for the United States are not comparable with those of Table II, which were revised on the basis of the 1910 census.

^a Not available.

TABLE V.—ACREAGE OF ALL WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Thousand acres)

Year	Minnesota	North Dakota	South Dakota	Montana	Manitoba	Saskatche- wan	Alberta	Year
1908	5,356	5,899	2,958	153	2,957	2,396	271	1908
1909	3,277	8,189	3,217	258	2,808	3,685	385	1909
1910	4,000	7,700	3,650	350	2,760	4,228	879	1910
1911	4,350	9,150	3,700	429	3,095	5,256	1,640	1911
1912	4,325	7,990	3,675	803	2,839	5,582	1,590	1912
1913	4,200	7,510	3,775	870	2,804	5,720	1,512	1913
1914	4,050	7,285	3,469	910	2,616	5,348	1,371	1914
Average								Average
1908-14	4,223	7,675	3,492	539	2,840	4,602	1,093	1908-14
1921	2,371	9,500	2,845	2,715	3,501	13,557	5,123	1921
1922	1,989	8,980	2,989	3,618	3,126	12,332	5,766	1922
1923	1,840	9,650	2,812	3,274	2,916	12,791	5,173	1923
1924	1,674	8,685	2,296	3,154	2,459	13,033	5,574	1924
Average								Average
1921-24	1,968	9,204	2,736	3,190	3,000	12,928	5,409	1921-24

* Sources: Canada—*Census and Statistics Monthly*, December 1910, p. 292; January 1915, pp. 17ff. *Monthly Bulletin of Agricultural Statistics*, January 1925, pp. 15ff. United States—*Agriculture Yearbook*, 1908, p. 609; 1912, p. 571; 1914, p. 525; 1923, p. 603. *Crops and Markets*, December 1924 Supplement, p. 402.

TABLE VI.—AVERAGE YIELD PER ACRE OF ALL WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Bushels per acre)

Year	Minnesota	North Dakota	South Dakota	Montana	Average four states ^a	Manitoba	Saskatchewan	Alberta	Average three provinces ^a	Average all areas ^a	Year
1908	12.8	11.6	12.8	24.2	12.4	17.0	14.5	25.2	16.3	13.5	1908
1909	16.8	13.7	14.1	30.8	14.8	18.8	23.1	24.9	21.4	16.9	1909
1910	16.0	5.0	12.8	22.0	10.0	12.4	15.8	10.3	14.0	11.3	1910
1911	10.1	8.0	4.0	28.7	8.2	20.3	20.8	22.3	20.9	12.8	1911
1912	15.5	18.0	14.2	24.1	16.8	22.2	19.2	21.6	20.4	18.2	1912
1913	16.2	10.5	9.0	23.8	12.3	19.0	21.3	22.7	20.9	15.6	1913
1914	10.6	11.2	9.1	20.2	11.1	14.8	13.7	21.0	15.1	12.6	1914
Average 1908-14	14.0	11.1	10.9	24.8	12.2	17.8	18.3	21.1	18.4	14.4	Average 1908-14
1921	9.7	8.5	9.1	12.3	9.4	11.2	13.8	10.4	12.6	11.2	1921
1922	13.7	14.1	13.4	14.6	14.0	19.3	20.3	11.3	17.7	16.0	1922
1923	12.7	7.4	9.6	14.6	9.6	12.3	21.3	28.0	21.7	16.2	1923
1924	21.8	15.5	14.9	16.4	16.3	16.9	10.2	11.0	11.2	13.4	1924
Average 1921-24	14.5	11.4	11.8	14.5	12.4	14.9	16.4	15.2	15.8	14.2	Average 1921-24

* Sources: Canada—*Census and Statistics Monthly*, December 1908, p. 119; December 1909, p. 239; December 1915, pp. 17ff. *Monthly Bulletin of Agricultural Statistics*, January 1925, pp. 15ff. United States—*Agriculture Yearbook*, 1923, p. 605; *Crops and Markets*, December 1924 Supplement, p. 402.

^a Weighted averages calculated on acreage statistics of Table V.

TABLE VII.—AVERAGE FARM PRICES RECEIVED BY PRODUCERS FOR ALL WHEAT IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Dollars per bushel)

Year	Minnesota	North Dakota	South Dakota	Montana	Manitoba	Saskatchewan	Alberta	Year
1908	.940	.908	.892	.852	.83	.75	.68	1908
1909	.956	.908	.890	.878	.87	.81	.73	1909
1910	.976	.936	.914	.906	.80	.69	.69	1910
1911	.944	.910	.912	.804	.67	.58	.62	1911
1912	.780	.740	.728	.652	.67	.56	.54	1912
1913	.770	.738	.722	.645	.71	.64	.61	1913
1914	1.010	.998	.934	.874	1.01	.95 ^a	.91	1914
Average 1908-14	.910	.877	.856	.801	.794	.711	.683	Average 1908-14
1921	1.026	.918	.924	.926	.91	.76	.77	1921
1922	.982	.864	.854	.876	.83	.85	.77	1922
1923	.986	.892	.830	.890	.67	.65	.65	1923
1924	1.285	1.258	1.238	1.230	1.24	1.21	1.20	1924
Average 1921-24	1.069	.983	.961	.980	.913	.868	.848	Average 1921-24

* American prices are averages of prices received by producers (as reported by crop correspondents in periodical publications of the United States Department of Agriculture) on the first of the five months, September to January, except: a) for 1913, when January 1 prices were not available; b) for 1923, when the first of the month prices for January 1924 were not reported, and a January 1 price was calculated upon reported December 1 and January 15 prices; and c) 1924, for which an average of prices reported for the 15th of the four months, September to December, has been calculated. This method of averaging is regarded as rendering American farm prices comparable with Canadian.

Canadian prices are from estimates of average prices "at local markets" or "as received by producers" submitted yearly by Canadian crop correspondents in December, and published in *Census and Statistics Monthly* or the *Monthly Bulletin of Agricultural Statistics*. See sources for Table VI.

^a The reported farm price in Saskatchewan for 1914 was \$1.48 per bushel. This figure is palpably an error, probably clerical, in view of the fact that spot prices of No. 1 Manitoba wheat during the months September to December, 1914, at Fort William and Port Arthur never exceeded \$1.18. Farm price for all wheat in Saskatchewan must have been considerably lower than spot prices of No. 1 Manitoba at these ports, and hence the 1914 price has been brought into line with farm prices in Alberta and Manitoba.

TABLE VIII.—AVERAGE MONTHLY WAGES OF MALE FARM LABOR HIRED BY THE YEAR, INCLUDING THE VALUE OF BOARD, IN SEVEN AREAS OF THE SPRING-WHEAT BELT, 1908-14 AND 1921-24*

(Dollars)

Year	Minnesota	North Dakota	South Dakota	Montana	Manitoba	Saskatchewan	Alberta	Year
1908.....	a	a	a	a	a	a	a	1908.....
1909.....	38.90	45.96	40.75	53.32	30.50	32.50	35.15	1909.....
1910.....	38.00	42.00	39.00	50.00	33.35	33.65	34.75	1910.....
1911.....	a	a	a	a	a	a	a	1911.....
1912.....	a	a	a	a	a	a	a	1912.....
1913.....	41.00	42.50	43.00	54.00	a	a	a	1913.....
1914.....	40.80	45.10	43.50	52.80	30.35	30.50	30.40	1914.....
1921.....	53.10	60.20	53.50	53.00	66.50	66.25	62.15	1921.....
1922.....	50.00	55.50	53.00	63.00	53.35	56.00	52.50	1922.....
1923.....	55.50	58.80	61.70	65.50	52.60	54.35	58.75	1923.....
1924.....	54.50	58.00	59.50	69.10	49.35	55.25	55.40	1924.....

* Sources: Canada—February issues of *Census and Statistics Monthly* and *Monthly Bulletin of Agricultural Statistics*. Monthly figures are obtained by dividing reported figures of yearly values of wages and board by 12. United States—*The Agricultural Outlook* (Farmers' Bulletin No. 665), March 1915, p. 20; *Agriculture Yearbook*, 1920, p. 819; 1921, p. 784; 1922, p. 996; 1923, p. 1149. Figures for 1924 are averages of wages reported in January, April, July, and October issues of monthly supplements to *Crops and Markets*.
a Not available.

TABLE IX.—AREA UNDER WHEAT IN RELATION TO AREA UNDER SUMMER FALLOW IN PRECEDING YEARS, PRAIRIE PROVINCES*

(Thousand acres)

Area and year	Area under wheat	Summer fallow of previous year	Ratio of fallowed acreage to wheat area %
Manitoba			
1906	2,039	682	33.4
1914	2,616	1,144	43.7
1915	2,800	1,208	43.1
1921	3,501	1,410	40.3
1922	3,126	1,612	51.6
1923	2,916	1,597	54.8
1924	2,459	1,518	61.7
Saskatchewan			
1906	1,692	425	25.1
1914	5,348	2,775	51.9
1915	8,929	2,601	29.1
1921	13,557	3,752	27.7
1922	12,332	5,908	47.9
1923	12,791	5,403	42.2
1924	13,033	5,346	41.0
Alberta			
1906	187	47	25.1
1914	a	a	a
1915	a	a	a
1921	5,123	1,834	35.8
1922	5,766	2,276	31.8
1923	5,173	2,460	41.3
1924	5,574	2,760	45.8

* Sources: 1906 figures from Census of 1906, others from table furnished by the Dominion Bureau of Statistics in revision of a similar table appearing in the *Monthly Bulletin of Agricultural Statistics*, November 1923, p. 459.
a Not available.

TABLE X.—ACREAGE OF NEW BREAKING^a IN THE PRAIRIE PROVINCES*

(Thousand acres)

Year	Manitoba	Saskatchewan	Alberta
1913.....	156	1,149	b
1914.....	175	1,076	b
1920.....	188	550	486
1921.....	158	616	517
1922.....	129	433	494
1923.....	97	425	487

* Source: See Table IX.

a Land newly broken in the years specified would chiefly have been part of the wheat acreage of the years immediately following.
b Not available.

TABLE XI.—CONDITIONS OF TENURE ON FARMS IN THE SPRING-WHEAT BELT IN CENSUS YEARS*

Area and year	Total number of farms	Percentages of all farms		
		Owned	Tenanted	Mortgaged
Minnesota				
1910.....	156,137	79	21	36
1920.....	178,478	76	24	39
North Dakota				
1910.....	74,360	86	14	43
1920.....	77,690	74	26	52
South Dakota				
1910.....	77,644	75	25	28
1920.....	74,637	65	35	36
Montana				
1910.....	26,214	91	9	18
1920.....	57,677	89	11	52
Manitoba				
1911.....	44,328	90	10	a
1921.....	53,252	89	11	a
Saskatchewan				
1911.....	95,013	96	4	a
1921.....	119,451	89	11	a
Alberta				
1911.....	60,559	96	4	a
1921.....	82,954	90	10	a

* Sources: Appropriate censuses.

a Not available.

TABLE XII.—UTILIZATION OF ALL FARM LAND IN THE SPRING-WHEAT BELT, CENSUS YEARS, 1910, 1920, 1911, 1921*

Area and year	Land in farms (000 acres)	Percentage of all farm land									
		Unimproved	Improved but not in field crops	In wheat	In oats	In corn	In barley	In flax	In rye	In potatoes	In hay
Minnesota											
1910	27,676	29.0	27.8	14.4	10.8	7.4	4.6	1.7	0.4	0.6	3.2
1920	30,222	28.9	25.5	9.5	12.2	10.9	3.0	1.1	1.7	1.1	6.1
North Dakota											
1910	28,427	28.0	28.5	27.1	7.7	0.8	3.5	3.6	*	0.1	0.7
1920	36,215	32.2	24.2	24.6	6.9	1.6	3.0	2.1	2.6	0.1	2.7
South Dakota											
1910	26,017	39.1	24.1	14.0	6.0	8.1	3.9	2.5	0.1	0.2	2.0
1920	34,636	47.4	19.9	8.4	6.4	10.5	2.9	0.6	0.5	0.2	3.2
Montana											
1910	13,546	73.1	15.9	2.6	2.9	0.1	0.4	0.4	0.0	0.2	4.4
1920	35,071	68.6	16.6	8.0	1.5	0.5	0.2	1.2	0.1	0.1	3.2
Manitoba											
1911	12,228	44.8	13.3	25.3	10.7	0.1	3.7	0.6	0.0	0.2	1.3
1921	14,600	44.9	12.4	24.0	7.1	0.2	7.1	0.5	1.8	0.3	1.7
Saskatchewan											
1911	28,099	57.8	11.5	18.7	8.3	*	0.9	2.4	*	0.1	0.2
1921	44,023	43.1	7.4	30.8	12.0	0.2	1.1	1.0	2.7	0.2	0.6
Alberta											
1911	17,359	74.9	5.9	9.5	7.0	0.0	1.0	0.6	0.1	0.1	0.9
1921	29,293	59.8	8.2	17.5	9.9	0.0	1.9	0.1	0.8	0.2	1.6

* Sources: Appropriate censuses.

* Less than .1.

TABLE XIII.—UTILIZATION OF CROP LAND AND NUMBERS OF ANIMAL UNITS PER FARM AND PER 100 ACRES IN THE SPRING-WHEAT BELT, CENSUS YEARS, 1910, 1920, 1911, 1921*

Area and year	Acreage in field crops (000 acres)	Percentage of crop land								Animal units ^a per farm	Animal units ^a per 100 acres
		In wheat	In oats	In corn	In barley	In rye	In flax	In potatoes	In hay		
Minnesota											
1910	11,962	33.4	24.9	17.0	10.7	1.0	3.9	1.4	7.6	17.6	10.0
1920	13,778	20.9	26.9	23.9	6.5	3.7	2.3	2.3	13.5	19.7	11.2
North Dakota											
1910	12,365	62.3	17.5	1.7	8.0	0.1	8.6	0.3	1.5	11.5	3.0
1920	15,822	56.4	15.9	3.6	6.8	6.2	4.8	0.5	5.8	19.1	4.0
South Dakota											
1910	9,585	38.0	16.2	21.9	10.7	0.4	6.9	0.6	5.3	23.5	7.0
1920	11,303	25.9	19.6	32.3	9.1	1.8	2.0	0.7	8.6	38.3	8.3
Montana											
1910	1,497	23.4	26.0	1.1	3.5	0.2	4.0	1.7	40.1	36.4	7.1
1920	5,179	53.8	10.3	3.6	1.2	1.1	7.9	0.8	21.3	27.7	4.6
Manitoba											
1911	5,124	60.4	25.5	0.2	8.7	0.1	1.6	0.5	3.0	10.8	3.9
1921	6,222	56.3	16.8	0.5	16.8	4.1	1.0	0.6	3.9	13.6	5.0
Saskatchewan											
1911	8,626	60.9	27.1	0.0	3.2	0.0	7.9	0.3	0.6	7.5	2.5
1921	21,772	62.3	26.1	0.3	2.2	5.5	2.0	0.3	1.3	11.5	3.2
Alberta											
1911	3,333	49.2	36.6	0.1	4.9	0.4	3.2	0.7	4.9	13.3	4.6
1921	9,366	54.7	31.1	0.1	6.1	2.4	0.3	0.5	4.8	18.5	5.3

* Sources: Appropriate censuses.

^a Counting as equal to one animal unit, one cow, horse, or steer, 5 hogs, or 7 sheep. All animals have been calculated as mature.

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OF THE

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