World War I and the Expansion of Canadian Wheat Supply

May 28, 2007

Byron Lew* and Marvin McInnis**

*Department of Economics

Trent University

**Department of Economics

Queen's University

*contact: blew@trentu.ca

The experience of Canadian Prairie wheat farmers has figured prominently in accounts of how World War I and its immediate aftermath affected the Canadian economy. The acreage and output of wheat in Western Canada increased dramatically over the years of the war. The war certainly brought major changes to the world wheat market. Canada emerged from the war as the world's foremost exporter of wheat. Despite all of that the generally offered historical account portrays Prairie agriculture in a downbeat, pessimistic manner. Prairie farmers were just one more group of victims of the war. We show that depiction to be misleading and inaccurate.

Canadian acreage and output expanded dramatically through the war years. Canada became the world's largest exporter of wheat during and after the war. Wheat's share in Canadian GDP increased through the war particularly due to high wartime prices. Yet despite these changes, historians have viewed farmers as having been hard hit by the war. While output prices rose, the government intervened in the wheat market and imposed a price ceiling. But at the same time, farm input prices also rose so it has been assumed that farmers' profits were eroded. Further, because farmers were asked to produce as much food as possible for the war effort, some view the wartime expansion as excessive and unsustainable, compromising future output leading to declining wheat yields in the later war years. And because of the impetus to bring more acreage into production, the world wheat market became glutted when peace returned and prices during the 1920s and particularly during the 1930s were depressed. In what follows these three views – overexpansion and decline in farm yields, declining farm profits, glutting of world wheat markets – are addressed and shown to be completely wrong or highly overstated.

Writers generally conclude that wartime demand induced overexpansion of Prairie wheat capacity. Wheat prices rose dramatically, from about \$0.80/bu in 1913 to a fixed price of \$2.25/bu in 1918. The runup in prices induced a tremendous supply response and Prairie wheat acreage planted to wheat increased. Yet historians go farther and suggest that farmers' responded patriotically, that is without full economic incentive, and increased output even before the full extent of the price increases were realized. Prairie wheat acreage increased from 10 million acres in 1914 to 14 million acres in 1915, a whopping 40% increase over one year. Acreage continued to expand though the war and immediately after as prices remained high, peaking at 22 million acres in 1921. In other words, over the course of the war and its immediate aftermath, Prairie wheat acreage more than doubled.

This overexpansion is seen to have had several negative consequences. By expanding too rapidly in a very short period, farmers overworked their land and thereby depressed yields for the next several years. Indeed grain yields declined sharply from 1916 through 1921. But the very sharpness of the decline itself should raise doubts about the cause being excessive utilization of land. Poor field husbandry would lead to a gradual decline, not a sudden drop followed by sustained low yields. As well, excessive Prairie wheat capacity has been

seen as the source of a postwar world wheat market glut. Wheat prices fell after the postwar readjustment and remained low through the first half of the 1920s. So the combination of reduced yields in a period of record high prices and falling prices after a period of increasing supply left farmers without benefit. They are seen as another group losing because of the war.

These conclusions are incomplete or even incorrect. The data series illustrating the timing of the over-expansion - Prairie wheat acreage – will be shown to be unreliable. As well, the expansion of Prairie wheat acreage will be set in the context of Prairie settlement. It is merely coincident that the war occurred during this same period. Evidence of farmers' choices on crop mix, fallow, and production of livestock all support the alternative hypothesis that the war did little to alter farmers' behaviour. The low yields of the later war years were in fact a natural occurrence. The impact of Canadian wheat supply on the world market will also be considered. Canadian supply expansion was part of the shift of the source for western European demand from eastern Europe – the Danube Basin and Ukraine – to the New World.

Wheat Acreage Expansion at the Onset of War

One important piece of evidence used to support the overexpansion hypothesis is the series of Prairie wheat acreage. Figure 1 illustrates the dramatic and rapid expansion of acreage devoted to wheat over this period. These data are drawn from the *Handbook of Agricultural Statistics* published by Statistics Canada (then the Dominion Bureau of Statistics). They were originally published in a monthly (later quarterly) bulletin titled *Census and Statistics Monthly*, later *Monthly Bulletin of Agricultural Statistics*, and still later *Quarterly Bulletin of Agricultural Statistics*. From 1908 onwards, the original sources of these data were annual surveys of farmers and district agricultural reporters.[1] The departments of agriculture of the individual provinces had carried out these surveys, in some cases for many years prior to 1908, and continued their own surveys for some years after as well before eventually being subsumed by the Statistics Canada annual survey after 1918. There are, therefore, several acreage series with some non-trivial inconsistencies among them.

The method by which Statistics Canada conducted the surveys of farmers was highly biased. The surveys were distributed to farmers through the schools to children of farm families. Unfortunately, areas of new settlement were substantially under reported by these surveys because farmers in these areas either tended to be young and single, or had arrived ahead of their families to prepare the farm. Therefore the survey results did not keep up with the frontier of settlement, a particularly egregious problem during a period of massive settlement. In addition to the annual surveys, Statistics Canada also collected agricultural statistics though the Censuses, taken on the Prairies at five-year intervals. Each census recorded acreage planted in the Census year and in the preceding year thereby providing two years of acreage data.

In putting together the annual series, Statistics Canada seems to have have melded the results of the two types of surveys, the annual and the Census, together into one series. The 1911 Census is the source of the acreage reported for 1910 and 1911 in the annual series, and the 1916 Prairie Census is the source for the 1915 and 1916 data points. So the annual series is drawn from Census data for the 1910 and 1911 observations and the 1915 and 1916 observations, and from the annual surveys for the 1912-1914 and 1917-1919 observations.

Statistics Canada was aware of the problem of undersampling on the expanding frontier and began to change their system of annual surveys. The method of correction is not clearly described. But due to changes in the annual surveys, Statistics Canada did not incorporate the 1921 Census report for the 1920 acreage; instead reporting that figure as drawn from the annual surveys. Fortunately, the Census acreage figures for 1920 and the annual series are very similar suggesting that by 1920 the annual surveys were becoming more accurate. Settlement was nearing completion. But the 1921 result in the annual series is uniquely peculiar and does not agree with the 1921 Census value nor with the annual survey value. The *Monthly Bulletin* reports an upward adjustment to the annual survey estimate using Census survey results; which appears to be double-counting. As a result the 1921 figure reported in the annual series is about 15% higher than that of the Census, 22 million acres rather than 19 million acres.

The *Monthly Bulletin* reported preliminary figures for years covered by the Census before the Census returns had been fully processed. These figures were then updated once the Census returns were available so that adjustment can be illustrated. Figure 2 illustrates these multitude of observations. The dark solid line depicts the acreage from the annual survey reported in the *Monthly Bulletin* as the final result and contained in the official Statistics Canada acreage series. The lighter solid line shows the annual series acreage values for years in which Census returns were ultimately used in the official series. The Census-derived values themselves are shown as circles. The dotted line then indicates the break introduced into the official series from shifting sources from annual series to Census.

Figure 2 shows the peculiar shift in 1921. The 1920 value is the annual survey result which is retained in the official series, not having been updated by the 1921 Census for the 1920 acreage. In fact, the two values are very similar; the official acreage is reported as 16.8 million for 1920 and the 1921 Census reports 16.7 million acres in 1920. The 1921 figure is clearly odd. The lighter line shows the 1921 survey result of 17.5 million acres while the solid line shows the adjusted value reported in the official series of 22.1 million acres. The Census itself reports 19.3 million acres for 1921. Because of this inflated 1921 figure in the official acreage series, acreage appears to have peaked in 1921, declined for the next couple of years, then flattened out until 1928.

The results of this hodgepodge of sources used in constructing the official annual series of wheat acreage are two very large increases in wheat acreage: one from 1914 to 1915 and another from 1920 to 1921. Both

increases are products of the series construction and highly likely not due to sudden expansion. The expansion shown from 1914 to 1915 is particularly unfortunate because it is the evidence of the Prairie farmers' patriotic call to arms, or in their case, call to implements. In fact it is unclear how much of the intercensal increase from 1911 to 1915 occurred from 1914 to 1915. As well, the 1921 value probably overstates the final prairie acreage value associated with the war and its aftermath. Using the official series, Prairie acreage increased from 9.1 million acres in 1914 to 22.1 million acres in 1921. Alternatively, the increase might possibly only have been from approximately 12.5 million acres in 1914 to 19 million acres in 1921. This is not a trivial increase by any standard, but it is an increase of about 50% rather than the officially reported increase of 140%. The 50% acreage increase over the span of 7 years would be consistent with the ongoing process of settlement then fully underway. The war's influence was in fact rather modest.

The implications of this Frankenseries become even greater when looking at provinces individually. While Prairie acreage increases were 40% from 1913-1915 according to the official series, Manitoba was essentially fully settled and showed almost no increase. But in Saskatchewan and Alberta, provinces of ongoing active settlement, acreage increased by 56% and 60% respectively. Determining the source of this surplus available land is a puzzle. An increase in acreage of such a magnitude seems hard to reconcile with the basic economics of Prairie grain farming because it is not just the land but the factors of production – labour, horses, machinery, feed – needed to farm the land that must also have been available. It would imply either a massive shift of resources out of some other agricultural activity like the production of another grain, or else a substantial stock of slack resources. Evidence against the former possibility will be presented below in the assessment of the degree to which wartime demand caused farmers to specialize in wheat. While the latter availability of a large stock of slack resources is certainly a possibility, it seems far fetched for an increase of the magnitudes implied by the data.

An alternate source of acreage data on wheat acreage can be found in the provincial agriculture departments' annual reports on new breaking. This alternative series is presented in Figure NewBreaking. It is constructed under the assumption that 40% of new land was devoted to wheat, the average ratio of wheat to all cultivated land. From 1911 to 1915, Prairie new breaking increased by 4.5 million acres while the Census reports an increase of 4.1 million acres. As the Census itself is likely not perfectly reliable in the context of rapid new settlement, that these two figures are quite close suggests a degree of confidence can be put in a value within this range.

From Acreage Expansion to Monoculture and Beyond

While the wheat acreage series appears to show an expansion that was undoubtedly accumulating over more than one year, wartime conditions are said to have induced farmers to adopt poor farming practices and to expand onto submarginal land. Thompson (1978, p. 60-1) suggests that farmers were induced to extreme monoculture, forcing them exclusively into wheat production eschewing diversification. Excessive land utilization devoted to growing wheat in response to the war yielded immediate benefits – the 1915 bumper crop yield was the highest yet recorded – but at the cost of lowered long-run yields. Farmers struggled from 1916-1919 to produce enough surplus to meet excess Allied demand, and in 1917 Britain was dangerously close to rationing bread.

The data do not support this view of a change in farmers' behaviour caused by the war. Crop mixes and livestock herd sizes on the Prairies remained unaffected by the war. The Prairie crop mix was dominated by wheat before, during and after the war, accounting for about 60% of seeded acreage through this entire period (Figure 3). If anything, the share of acreage seeded to wheat fell slightly after 1916.[2] Oats held steady around 33% of seeded acreage through 1920 when it began a steady decline in importance reflecting the aggregate shift from horses to internal combustion as the source of motive power. Of minor significance were barley and flax: barley accounted for about 6-8% of seeded acreage. Flax was also planted and had accounted for just over 10% of acreage in 1912, but had declined substantially thereafter, and was below 5% after 1914.

So while the official series shows a large jump in wheat acreage in 1915, no such jump is apparent in the series of the other principal crop, oats. Prairie acreage for oats increases by 13% from 1914-15 and 12% from 1915-1916, then 20% from 1916-1917. While it is possible that wheat acreage would have increased independent of oat acreage, there is good reason to believe that the two series should move fairly closely together. Oats was not only a crop, it was an input to production. If farmers were increasing acreage as dramatically as the data suggest, then their horses would have had to have been working overtime. To keep horses working, an increase in oats would be required. While farmers may have had temporary stocks of oats and other feed concentrates on hand for increases in horse utilization, or may have had access to stocks from other regions, it seems difficult to fathom a stock of feed necessary for such a tremendous increase in acreage. So the relatively smaller increase in acreage devoted to the production of oats provides a check on the potential for acreage expansion for other crops.

Despite the importance of wheat, Prairie farmers kept livestock. There is no evidence of a reduction in livestock on Prairie farms through the war; rather just the opposite. Livestock numbers on the Prairies increased from 1911 through the war, accelerating sharply after 1915. Cattle stock and swine numbers for

the Prairie provinces and for Ontario are illustrated in Figures 4 and 5 respectively. Cattle herds increased steadily over the entire period. But the market for Prairie cattle was essentially in the U.S., and the U.S. had eliminated tariffs on imported cattle with the Underwood-Simmons tariff of 1913. The tariff was raised again with the Emergency Tariff Act of 1921 and the Fordney-McCumber tariff of 1922 back to 30%.

Hog stocks on the Prairies increased to 1917, but then declined thereafter bottoming out in 1920 before increasing again. But this decline during the war was due to a drawing down of inventories to supply the increased demand for pork in the UK during the war. The pattern on the Prairies is the reverse of Ontario. As stocks were drawn down in Ontario, stocks increased on the Prairies. So the trough in Ontario in 1917 was also the peak on the Prairies as swine shipments west to east rose through the war.

Given that Prairie settlement was still underway, growth in livestock herds partially reflected settlement expansion. Even with farm growth, average stock sizes per farm were increasing through the war as depicted in Figure 6. Numbers of cattle per farm across the Prairies were rising while in Ontario cattle per farm declined to 1916.[3]Average numbers of hogs per Prairie farm increased to 1916, but then declined modestly to 1921. Only in Manitoba did the average number of hogs per farm in 1921 fall below that of 1911, but that was true in Ontario as well. However, since average cattle stocks in Manitoba rose at the same time, farmers in Manitoba were likely substituting a more valuable for a less valuable product. We cannot conclude that the war somehow inhibited the ability of Prairie farmers to expand their livestock.

Thompson (1978, p. 66-7) also accuses Prairie farmers of resorting to poor techniques to increase yields in the short run and take advantage of high prices, thereby shortsightedly sacrificing yields in the longer run. Average prairie wheat yields did in fact decline sharply from their peak in 1915 of 26 bushels per acre and then remained lower; 15 bushels per acre in 1916 and 1917, and 10 bushels per acre in 1918 and 1919. While a variety of reasons could explain a decline in yields including expansion onto sub-marginal land, burning of stubble, etc., the suddenness of drop suggests other factors. The most likely cause was simply poor growing conditions, common across the Great Plains as discussed below.

One specific accusation is that farmers reduced acreage summer-fallowed to increase production in the short run thereby reducing long-run yields. There is some evidence that farmers did overwork their land as the ratio of acreage seeded on land previously summer-fallowed to total acreage seeded fell from 1914 through 1917.[4] But in fact the quantity of acreage devoted to summer-fallow remained stable through 1916 and even increased in 1917 so the expansion in crop acreage did not come at the expense of summer-fallow.

While summer-fallow remained constant or increased, new land brought into production began to decline. The proportion of land seeded on newly broken land declined in Saskatchewan from 1914, and declined sharply after 1916. The ratio of land seeded on newly broken or summer-fallowed land – that is, on high yielding land – declined from 40% in 1914 to 22% in 1917 before recovering to about 30% in the years following. As

yields were much higher on newly broken or summer-fallowed land, a decline of 10% in the seeded proportion would contribute non-trivially to a decline in aggregate yields.

But the most important factor was weather. Weather determines growing conditions which was then the most important determinant of year to year variation in yields in an era when chemical fertilizers and pesticides were not yet in use. After what now appears to have been a relatively humid couple of decades on the Prairies coincident with the settlement period, a return to drier conditions ensued. Over the next few decades, there were two dry weather cycles: one during the war from 1916-1919, and another during the Depression from 1932-1937. Grain yields were low during both these dry periods. From their peak in 1928, yields remained low through 1937. A period of extended poor weather conditions was generally responsible for the lengthy period of declining yields.

Not only was the weather generally drier after 1915, the weather cycle was also more volatile. What follows is a summary of weather reports taken from the *Monthly Bulletin*. A particularly hot August in 1916 across the Prairies led to wheat rust, and hail in Alberta lowered yields even further that year. The winter of 1917 was harsh and long, persisting with frosts into May. General seeding was not underway in Saskatchewan until May 5, over 3 weeks later than during a typical year.[5] This delay put the crop at risk of late summer and early fall frosts. Then the summer of 1917 was unusually dry. The weather conditions of 1918 were a repeat of 1917. The spring of 1918 came late in some regions delaying seeding, and the drought of 1917 carried into the summer of 1918. And if that wasn't enough, there was a freak frost over the period July 23-25, 1918! 1919 was also characterized by summer drought and excessive heat, causing uneven and early ripening thereby lowering yields. While seeding was again delayed in 1920, weather conditions did improve over the year as the drought let up and relief finally came with rains in July. The drought returned in August so crops did not fill out and the improvement to yields was only modest. The weather patterns of 1921 and 1922 were better and as a consequence yields were up across the Great Plains.

Wheat yields were also generally below average on the U.S. Great Plains at this time, and low yields were particularly acute in North Dakota over these years.[6] The weather pattern was a continental phenomenon. But the weather-related decline in yields extended beyond North America. Grain yields declined in Europe as well and the decline was essentially weather-related and not due to war (Bennett, 1939, p. 77).[7] Importantly, the steady decline in yields after 1915 occurred only in Saskatchewan and Alberta but not in Manitoba. Yields in Manitoba recovered in 1917 and 1918. By then Manitoba was the smallest wheat-producing province and so the Manitoba recovery had little impact on the size of the Canadian crop. Yields in North Dakota look somewhat similar to those of Saskatchewan, except that yields in North Dakota rose in 1918 rather than continuing to decline as they did in Saskatchewan. If poor farming practices induced by wartime prices were responsible, these practices must not have been adopted uniformly across the Plains grain-growing regions.

And because yield patterns appear to cross the US - Canada border, it is logical to conclude that North American farmers as a whole shared common circumstances.

This long run shift in weather patterns did indeed expose some regions as being excessively dry for grain cultivation. Many farms in southeastern Alberta and southwestern Saskatchewan had to be abandoned from 1921-1926. 55% of farms in the driest regions were abandoned by 1926 (Murchie, 1936, p. 17-18).[8] For the southern Alberta districts surveyed by Craig and Coke (1938, p. 27), 22% of all farms abandoned between 1910-35 were abandoned between 1921 and 1925, with virtually all of these abandonments occurring in 1921 and 1922.

While historians have focused on the farm expansion into a dry region of southwestern Saskatchewan and southeastern Alberta and linked it to the war, the expansion onto the dry belt predates the war and undoubtedly was hardly influenced by it. This expansion took place before the detail of the climate cycles were known. But as has already been noted, the long-run weather pattern turned much drier after 1915, whereas the weather conditions of the recent past had been sufficiently wet to support grain-growing. In other words, both farmers and the Canadian government may have mistaken short-run patterns for the long-run outlook. It was coincidence that the war and the onset of a dry cycle overlapped. Farmers and government continued to explore and refine methods of dry-farming suitable for the semi-arid plain and these methods continued evolving until after World War II.

Farm settlement did not stop with the end of the war; it continued, though at a decelerating pace, through the 1920s and the 1930s. The number of Prairie farms peaked in 1936. But in response to the reassessment of the climate of the southwestern Saskatchewan and southeastern Alberta, farm settlement moved farther north into the Park region, an area with more predictable rainfall.

Farm Income During and After the War

While the war did not bring about lower Prairie wheat yields the war did cause wheat prices to rise. Wheat prices had been on the rise since the beginning of the war, and while the bumper crop of 1915 reversed the rise, prices began climbing again the following year (see Figure 7). The run up in wheat prices in the spring of 1917 was so extreme, temporarily rising above $3.00/bu, that the U.S. and Canadian governments resorted to market controls and froze wheat prices.[9] In Canada, wheat prices were set by government, in concert with the U.S., from September 1917 until August 1920 in the range of $2.15 to $2.24 per bushel.

Prewar wheat prices averaged under $0.90 per bushel from January 1913 through July 1914. The controlled price was 2.5 times the immediate prewar value. And importantly, not only were prices high, there was no volatility. Farmers had high and predictable prices upon which to base their production decisions. While

it is clear that output prices moved substantially in farmers' favour, the general inflation of the period also raised farm costs which has been taken by some historians to imply that the benefits of high output prices were eroded by high input costs. Other prices, which included farm input prices, adjusted with the general wartime inflation, an inflation which had almost doubled the cost of living from 1913 to 1920. As well, farm output prices responded more elastically than input prices which has also been interpreted to mean that farmers were hurt when output prices finally began falling in 1920.

Generally, farm input price indexes rose less than wheat prices until 1919 (Figure 8). Wheat prices rose relative to their 1914 level and stayed above input prices, with the exception of wages, through 1919. Wages rose more rapidly than did wheat prices except in 1916. Despite the rise in wages, farmers were unlikely to have been much affected. It is not the price index behaviour that is important, but the net profit position of farmers of which price index behaviour is a very imperfect gauge. While farmers did need to employ some labour during harvest, their actual expenditures on labour were small relative to revenues. In addition, the smaller harvests for 1916-1919 meant less demand for labour as harvest labour constituted the majority of farm labour demand.

Farmers were concerned about labour supply during the war years, but it was not the price that worried them. Rather, they were worried about the availability of labour during the critical harvest period of peak labour demand. Prairie farming particularly has a huge spike in labour demand at harvest time as the window for harvesting the crop once it is ripe is narrow. Delay increases the risk of damage due to bad weather. Before the war, a complex national market for seasonal labour moved workers around the country among the seasonal extractive industries.[10] The war interrupted this market and left a distinct shortage of available seasonal labour.[11]

In contrast to the view that farmers' incomes were susceptible to wartime-induced inflation, the reality was that of any group in society, farmers were undoubtedly the most insulated from the volatility of price changes. In this period, actual out-of-pocket farm operating expenses were small, farmers were able to produce much of what they needed. Farmers did not suffer from rising housing rents. Much of their food consumption was grown on the farm. Farmers and their families maintained much of their own equipment and buildings themselves and so avoided the cost of rising wages.

The data support this on aggregate. The ratio of operating expenses to gross income averaged about 13-14% in the prewar years (Urquhart, 1993, p. x). During the war this ratio fell slightly from 1915-17 to about 12% due the relative rise in output prices. Prairie farmers were a bit more dependent on purchased inputs than were farmers in the rest of the country. In particular, Prairie farms used more machinery and gasoline.[12] On the other hand, labour and fertilizer costs were lower on the Prairies. Generally, there was little change in the ratio of operating costs to gross income until after 1920 implying that the benefit of rising

wheat prices more than outpaced the costs of rising operating expenses.

After 1919 the price index patterns summarized above reversed. Output prices declined more rapidly than did input prices. Wages had risen relatively the highest, followed by taxes and interest, while equipment and materials prices remained only modestly higher than wheat prices.[13] While higher input prices implied reduced farm profitability, no conclusion can be drawn regarding farm profitability itself without cost data. There is no doubt that farm profits were lower in the post-1920 period, but that is relative to an extreme high. Statistics Canada reports farm profits starting in 1926. These data show healthy profits for Prairie farmers in the late-1920s even with the wheat price index below the input cost indexes benchmarked to 1914 (Canada 1966). There are no data allowing projection of input price indexes back before 1914, but wheat prices in 1914 were already rising at the onset of war, before wartime inflation more generally began setting in. Therefore the comparison of the wheat index to its 1914 relative will show an understated return in the 1920s due to the initial height of the benchmark.

There is evidence, however, indicative of the benefits accruing to farmers due to high wheat prices. Farmers used their windfall cash proceeds to purchase automobiles and trucks. Also, farm size expanded during this period and many land purchases were made with cash.[14] Even those who did have to finance their purchases, they were assuming mortgage debt during a period of the most rapid inflation to date, albeit only for a few years. This inflation was not expected – interest rates did not rise – so borrowers were able to pay off the debt in deflated money.[15]

While there is evidence of concern over consequences of farm debt of Canadian Prairie farmers after wheat prices declined in 1920, the problem seems to have been serious only in regions that were experiencing the driest conditions.[16] Widespread debt exposure through excessive mortgaging of land did not seem to be a problem generally on the Canadian Prairies.[17] As the sources of the time described it, the mortgage debt problems were mostly among inexperienced farmers and on lands not tested, in other words, on new lands settled in the drier southern parts of Alberta and Saskatchewan. The focus on farm debt may have simply been adopted by Canadian historians familiar with the U.S. experience.

Farmers did assume debt to finance short-term borrowing, generally for operations such as the harvest, for construction, or for acquisition of new machinery (Voisey, 1988, p. 132-3). Average Prairie farm size had increased from 289 acres in 1911 to 335 acres in 1916 to 344 acres by 1921. Since larger farms were more mechanized, demand for credit for machinery purchases and operations would have increased as well. And given that growth in average farm size was occurring as the number of farms was also increasing, and since new farms were most likely quarter sections, increases to average farm size of farms already operating must have been even greater. Farm expansion was a perfectly rational response regardless of wartime prices. The quarter section farm was suboptimally sized for the arid conditions of the Prairies. In fact, part of the

Dominion's land policies was to offer land to homesteaders and to the railroads in checkerboard patterns so that homestead land was always contiguous to land being offered for sale. This was a policy designed to accommodate farm expansion so there was certainly knowledge of scale economies associated with larger farms. Therefore, increased debt was not necessarily evidence of speculation on wartime price-inflated land values.

Farm credit in Canada was provided through two distinct channels. As banks were legally not allowed to hold real estate as security, all mortgages were held by loan companies and by insurance companies. These institutions were generally national in scope and therefore well diversified. Farmers also needed credit for their operations. Equipment financing was largely provided by the equipment manufacturers. The other form of operating credit was required to bridge the seasonal cash flow gap. Most farm expenses were incurred in the spring and summer, while farm revenues were received in the fall and winter. So farmers would cyclically incur debt, and of course a bad year of low yields could compromise the farmer's ability to repay the debt, implicitly or explicitly secured against the harvest. Farmers who went down because of debt were most likely to have fallen into arrears on operating loans.

Claims of increased incidence of bankruptcies after the war on the Prairies are not supported by data.[18] Moreover, while bankruptcies were part of the farm problem in the U.S., the institutional structure of lending differed as well. Unlike in Canada, small, local banks and loan companies were common in the U.S. There is anecdotal evidence suggesting that Canadian lenders were willing to restructure loans rather than foreclose; whereas foreclosure seems to have been much more prevalent in the U.S. The provinces also introduced agricultural credit programs, and perhaps as further evidence of the small scale of the crisis, these programs were not heavily used.

Canadian Output Expansion and World Wheat Supply

Canada's share of world wheat trade increased rapidly during World War I, but essentially Canada replaced Russia as the supplier of wheat to western and northern Europe. Canada averaged about 14% of world wheat exports from 1909-1913, or about 86 million bushels per year. From 1921-1925, Canada averaged about 240 million bushels per year, about 35% of world wheat trade. An increase of that magnitude might have lowered world prices, but the increase in wheat supply from Canada and the other New World producers was mostly offsetting declining supply from eastern Europe.

In the half-decade preceding the war, eastern Europe was the world's principal exporter of wheat. Russia, and the countries of the Danube Basin: Romania, Hungary, Bulgaria and Yugoslavia together supplied 41% of world wheat export demand. Of that, Russia supplied more than half. For the half-decade 1921-1925, that

same region supplied under 3%. Not only had Russia become a net importer of wheat, supply had diminished across the entire Danube Basin region. It was this lost supply that Canada as well as the U.S., Australia and Argentina were replacing.[19]

Because Canada's wheat trade loomed so large during the war, it appears that Canada's position as a wheat supplier was somehow transformed by the war. This came in two phases: during the war and then after. During the war the Allies relied on Canada's surplus after the closing of the Dardanelles and the cutting off of Eastern European supply to Western Europe. Canada then became the natural supplier to western Europe. Both Argentina and Australia were too far and shipping costs were too high. After the war, Canadian wheat acreage hardly increased, but yields improved and export surplus increased. It was in fact the U.S. which demonstrated the more elastic response to the war and its aftermath. Canada was merely undergoing its settlement phase.

The U.S. was the world's largest wheat producer, and Europe's principal supplier after the closing of the Dardanelles. But its large domestic market meant the exportable surplus was potentially more volatile and this contributed to the sharp spike in wheat prices in early 1917 when prices jumped to over $3.00/bu before price ceilings were put in place. As it turned out, however, the U.S. supply response to the wartime demand was more elastic than had been anticipated at the time. Midwestern farmers were able to substitute away from other crops, principally corn, and plant more wheat. In 1919 U.S. wheat acreage peaked. That year wheat acreage in the large Midwestern states of Illinois and Missouri was double what it had been in 1914. U.S. wheat output and exports continued to increase after 1919 not because of acreage expansion but because yields improved; 1919 was a year of particularly low yields. By 1921, the U.S. exported a record 360 million bushels. The U.S.'s expanded capacity to produce wheat undoubtedly contributed to the rapid price decline after 1921. After the fall in wheat prices, Midwestern farms substituted back into corn and U.S. wheat production and exports began declining. If there had been any significant supply response to the war, it was this Midwestern substitution into wheat.

There was no obvious oversupply of wheat in the first half of the 1920s once normalcy had returned to Western Europe. Average world wheat exports for 1921-25 exceeded those of the prewar period 1909-13, but total world wheat production did not exceed its 1915 peak until 1927, and remained below its five-year prewar average until 1925, principally due to the declines in eastern Europe (Bennett, 1933). The world was not flooded with excess wheat. Rather, food deficits were still characteristic of several western European countries. Postwar European wheat production remained well below the five-year prewar average until 1925.

Western European countries like France and Germany were large grain producers but were also grain importers. Wheat production in France and other northwestern European countries had returned to near their prewar averages by 1921, but even that meant there was demand for imported wheat since most western

European countries were in food deficit. Though Italy, for example, had returned to its prewar average level of production by 1921, it imported more wheat in the 1921-25 period than it had in 1909-13. The same was true of France. Germany, on the other hand, could only produce from 50-70% of its five-year prewar average through 1925 so while imports were reduced, the fall in domestic production was larger. Overall, western European food deficit countries imported slightly more in 1921-25 on average than for 1909-13. However, even with a small decrease in output in western Europe, European per capita consumption remained below its prewar average through the middle of the 1920s (Timoshenko, 1928, p. 16). Western Europe was capable of absorbing more wheat imports than were actually received.

And while European consumption remained slightly below prewar levels for several years after the end of the war, Canadian wheat acreage remained almost without increase from 1921-1927. There was a modest acreage expansion in the latter part of the 1920s, and a record crop in 1928. The acreage expansion of the 1920s was the last stages of settlement and was mostly in the northern park regions of Saskatchewan and Alberta. Despite the increase in farm numbers, which didn't peak on the Prairies until 1936, farm settlement in the north did not add much to wheat acreage. Wheat did not grow as well in the northern regions of the Canadian Prairies. There is adequate moisture, but the growing season is simply too short. Fodder crops are much better suited for the northern areas.

Conclusion

Canada's wheat economy expanded rapidly after 1910. World War I occurred within this period of settlement. But the data of wheat acreage upon which historians have relied is misleading. It shows a dramatic expansion of wheat acreage from 1914 to 1915, an expansion of approximately 50%. It turns out the jump was due to the splicing together of two different series. An alternate, smoothed expansion series based on acreage newly broken was developed. It shows the continual expansion of acreage due to settlement, a period covering World War I.

During the war Canadian wheat capacity kept increasing and Russian and eastern European supply was lost during and after the war. After the war, Canada became the world's largest wheat exporter and the world wheat market was now supplied by the New World suppliers: Canada, U.S., Argentina and Australia. Canadian wheat supply, however, responded very little to the war. It was the U.S. that was able to marshal its resources as Midwestern U.S. grain farms shifted into wheat producing record quantities of wheat for world consumption. There was a bump after the war as improving yields gave rise to a modest increase in world supply and therefore a price decline. But that was due to U.S. grain production which peaked in 1921. Canadian grain exports did not peak until 1923, well after the downward price shock. Canada became the

largest wheat exporter simply due to the ongoing process of settlement onto high quality land. The process would likely have looked nearly identical without the war. The reorganization of the world wheat supply would have progressed rather differently however. The U.S. would not have had such an influence.

As well, there is no evidence to support views that high wartime prices induced Prairie farmers to adopt poor field husbandry, and to expand onto submarginal lands. Lands that would prove too arid were being settled before the war during a period when they appeared to have ample moisture for wheat cultivation. The return to the arid conditions occurred during the war, coincidentally, but was actually part of a continental, and even possibly an international weather cycle. Farmers did not rush onto land that could be mined for wheat in the very short run, and farmers then did not go bankrupt because of the rapid decline that followed. There was in fact an adjustment period in the U.S. after wheat prices fell in 1921. Farmers that could substitute away from wheat, Midwestern farmers, did so, while farmers of the U.S. Northern Great Plains that could not substitute into alternate crops did indeed experience hardship. But the experience was not shared in Canada. Canadian Prairie farmers did enjoy a cost advantage over their southern neighbors and were therefore able to produce wheat profitably even after wheat prices had returned to their peacetime levels.

Notes

[1]It is also unclear just what data was collected. The crop yield figures reported are exactly equal to output divided by acreage. While it is possible that that per acre yields were calculated, there is evidence to suggest that the crop correspondents submitted estimates of the yields themselves. It is not clear if this was collected in the surveys. Therefore one of either the output figure or the acreage figure as simply a calculated result. This is important when reconciliation of acreage calculations are attempted, as presented below.

[2]These data are based on the Statistics Canada annual acreage series and are therefore flawed. For example, wheat's share of crop acreage jumps from 60% in 1914 to 80% in 1915 then falls back to 66% in 1916. This was not at the expense of other crops. The acreage of the other principal crop, oats, also increases from 1914 to 1915 and the reductions in barley and flax acreage are trivial. So as the increase in wheat's share of crop acreage results only from the large apparent increase in wheat acreage, an increase that has been shown to be a figment of the data, it is unlikely there was any significant change in wheat's share of total crop acreage during the war.

[3]There was no Census of Ontario in 1916 so the number of farms in Ontario is interpolated between the numbers in the 1911 and the 1921 Census: 212,108 and 198,053 respectively. The averages for 1916 are lower using the smaller number of farms in 1921 rather than the interpolated value.

[4]Thompson (1978, p. 67) suggests reduced summer-fallow persisted until 1919, but the data indicate the ratio of summer-fallowed to seeded acreage reached its minimum in 1916. Unfortunately data are available from 1913 only so the long run trend cannot be discerned (Saskatchewan, Department of Agriculture).

[5]Seeding dates from Saskatchewan, Department of Agriculture Annual Reports.

[6]Johnson (1985, p. 116-17) too argues that low yields resulted from a general drought in the Northern Great Plains through the period 1917-1921. He also discusses the impact of stem rust and other yield-reducing blights, plagues that appeared across the entire grain-growing belt. He makes no suggestion that changes in farming technique induced by the war may have played a role.

[7]Bennett (1939) acknowledges that yields declined in parts of Central and Eastern Europe due to reduction in supply of fertilizer with increased demand in munitions and the call up of horses to active duty, but yield declines were widespread.

[8]This is the region described as Palliser's triangle after the surveyor who in his expedition of 1857-1860

characterized the climate as too arid for agriculture. It is generally the Canadian part of the Great Plains on the leeward side of the Rocky Mountains, whose eastern edge, extends from approximately Calgary, Alberta to the junction of the borders of South Dakota, Nebraska and Iowa. In Canada, this dry belt includes southeastern Alberta, almost the entire southern quarter of the province of Saskatchewan, and the southwest corner of Manitoba. A botanist sent by the Canadian government in the 1870s, and perhaps under different weather conditions, provided more optimistic assessments and recommended the region as suitable for wheat cultivation. Ultimately the areas leeward of the Rockies experience the leveraged effects of two major weather cycle-inducing phenomenon: El Niño and the Southern Oscillation. It is, therefore, an area cyclically prone to drought.

[9]Because of expected lower yields for 1917 due to a late spring, there was uncertainty whether the U.S. would have any exportable surplus that fall. The yields of the winter wheat crop of the southern plains ripening in the summer of 1917 were sufficient to allay serious fears. This is reflected in the modest decline of prices from their peak before controls were instituted.

[10]This market even extended between Canada and the U.S., linking workers to the staggered regional harvests of grains, starting in the U.S. South and ending on the Canadian Prairie.

[11]The Canadian government even tried to induce rapid mechanization to save on labour by distributing 2000 tractors to Prairie farmers (Brown and Cook, 1974, p. 238), and by eliminating the tariff on imports of small tractors. What was needed was mechanization in harvesting, but the combined reaper-harvester would take a few more years to be adapted to the Canadian Prairie. Tractors as a more general purpose technology were not yet ripe for adopting.

[12]Machinery and gasoline made up about 17.5% of costs of farmers in eastern Canada, but almost 38% of costs of Prairie farmers (Canada, 1948).

[13]Concern by farmers over high wages was an issue particularly late in the war and into the postwar period. While labour costs were small, harvest labour was the single largest drain on cash, all the more apparent when revenues are declining.

[14]See Craig and Coke (1938, p. 18) who report that 42% of land transactions in their area surveyed during this period were with cash, and the average cash payment for land was greatest during the 1915-1919 period.

[15]It may not be quite so simple. There was an almost equally large deflation beginning in the summer of 1921 injuring borrowers. However, for a farmer borrowing in 1915, the costs of inflated debt in 1921 on was heavily discounted. Those borrowing late in the war or the early 1920s would not have been as fortunate.

[16]For example, see discussion in Monetary Times Annual (1922, 86-7; 1923, 94).

[17]There are no available data on the status of land financed by the vendor, i.e. the CPR, Hudson's Bay Company, etc. See Voisey (1988, p. 133, footnote 14) for a discussion.

[18]Such data exist in the U.S. and have been utilized by Johnson (1985) to show a significant rise in bankruptcies on the U.S. northern Great Plains.

[19]Argentina was the world's third largest surplus supplier of wheat after Canada and the U.S., but its share of world wheat trade increased the least from the prewar half-decade to the postwar, from 15% to 18%. In comparison, the U.S. share increased from 14% to 27% and Australia's share increased from 8% to 13%.

References

Alberta. Department of Agriculture. *Annual Reports.*

Bennett, Merrill K. 1933. World Wheat Crops, 1885-1932: New Series With Areas and Yields by Countries *Wheat Studies of the Food Research Institute* 9(7): 239-74.

Bennett, Merrill K. 1939. Wheat and War, 1914-1918 and Now. *Wheat Studies of the Food Research Institute* 16(3): 67-117.

Brown, Robert Craig and Cook, Ramsay. 1974. *Canada, 1896-1921: A Nation Transformed.* Toronto: McClelland and Stewart.

Canada. Department of Trade and Commerce. *Census of Canada.* various years.

Canada. Department of Trade and Commerce. *Census of Prairie Provinces, Population and Agriculture.* various years.

Canada. Dominion Bureau of Statistics. 1948. *Price Index Numbers of Commodities and Services Used by Farmers, 1913 to 1948.* Ottawa.

Canada. Statistics Canada. 1965. *Handbook of Agricultural Statistics, Part 2: Farm Income, 1926-65.* Ottawa.

Canada. Statistics Canada. *Quarterly Bulletin of Agricultural Statistics.* Ottawa.

Craig, G.H. and J. Coke. 1938. *An Economic Study of Land Utilization in Southern Alberta.* Canada Department of Agriculture Publication 610, Technical Bulletin 16.

Johnson, H. Thomas. 1985. *Agricultural Depression in the 1920's: Economic Fact or Statistical Artifact?* NY: Garland.

Murchie, R. W. 1936. *Agricultural Progress on the Prairie Frontier.* Toronto: The MacMillan Company.

Saskatchewan. Department of Agriculture. *Annual Reports.*

Thompson, John Herd. 1978. *The Harvests of War: The Prairie West, 1914-1918.* Toronto: McClelland and Stewart.

Timoshenko, Vladimir P. 1928. *Wheat Prices and the World Wheat Market.* Ithaca, NY: Cornell University Press.

Urquhart, M. C. 1993. *Gross National Product, Canada, 1870-1926: The Derivation of the Estimates.* Kingston: McGill-Queen's University Press.

Voisey, Paul. 1988. *Vulcan: The Making of a Prairie Community.* Toronto: University of Toronto Press.

Figure 1: Prairie Wheat Acreage, 1900-1940

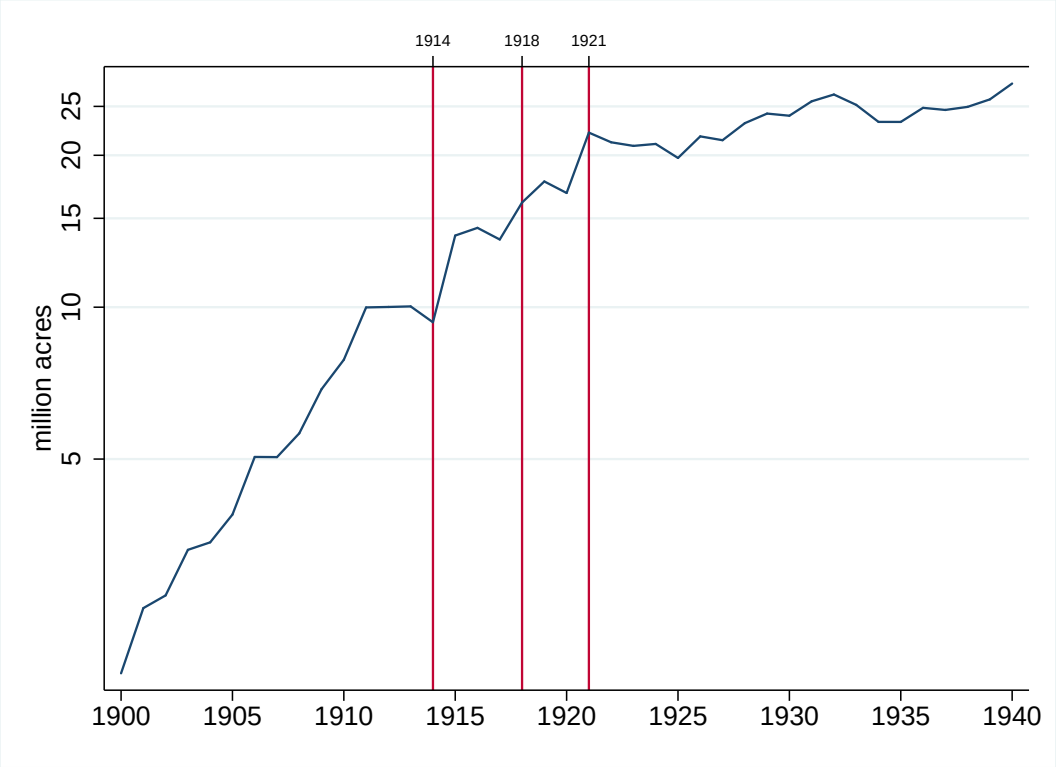


Figure 2: Prairie Wheat Acreage, 1910-1924 (Spliced)

Figure 3: Percentage of Acreage Devoted to Individual Crops, Prairies, 1908-1929

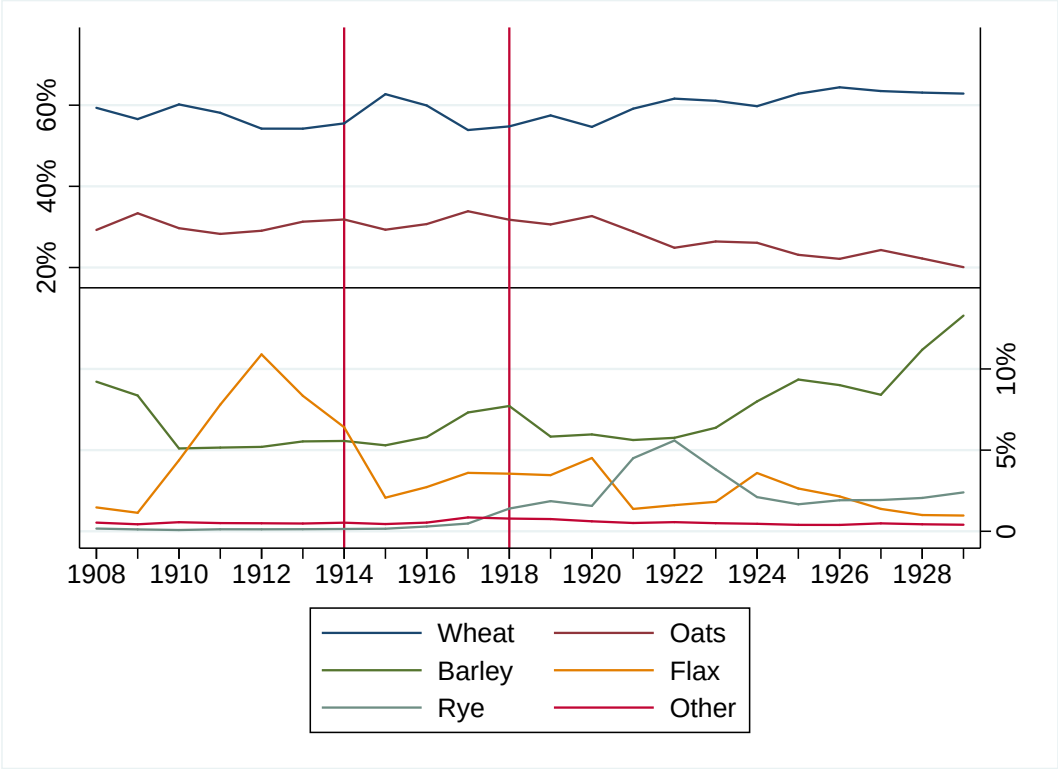


Figure 4: Cattle Stocks, Ontario and Prairie Provinces, 1909-1922

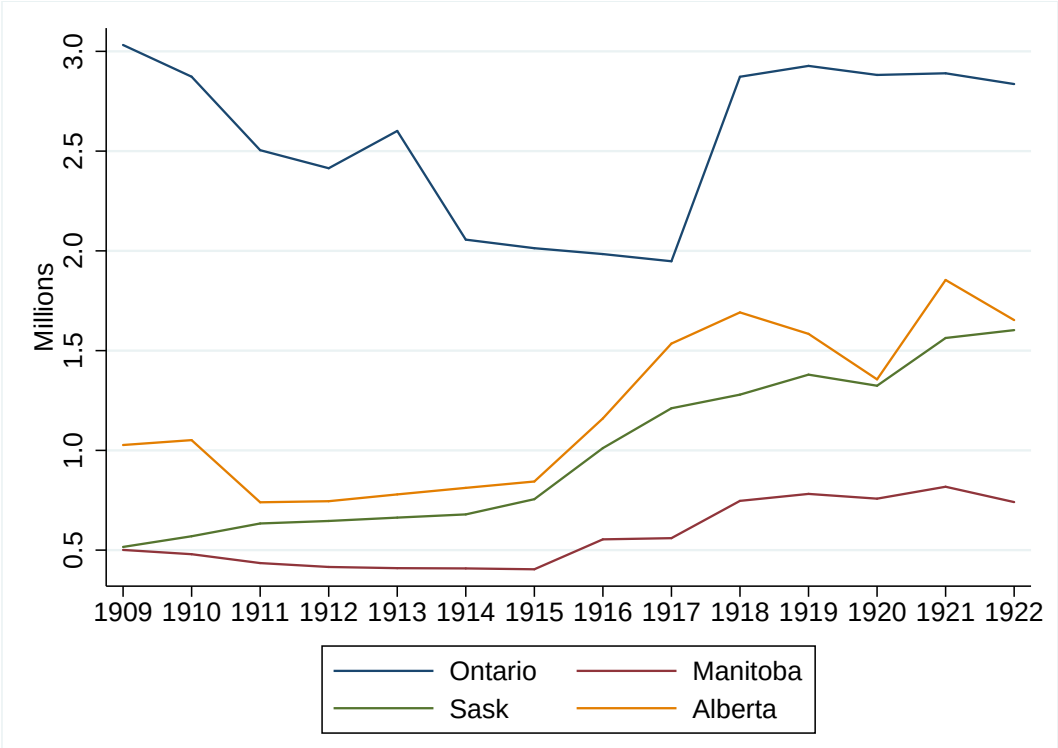


Figure 5: Hog Stocks, Ontario and Prairie Provinces, 1909-1922

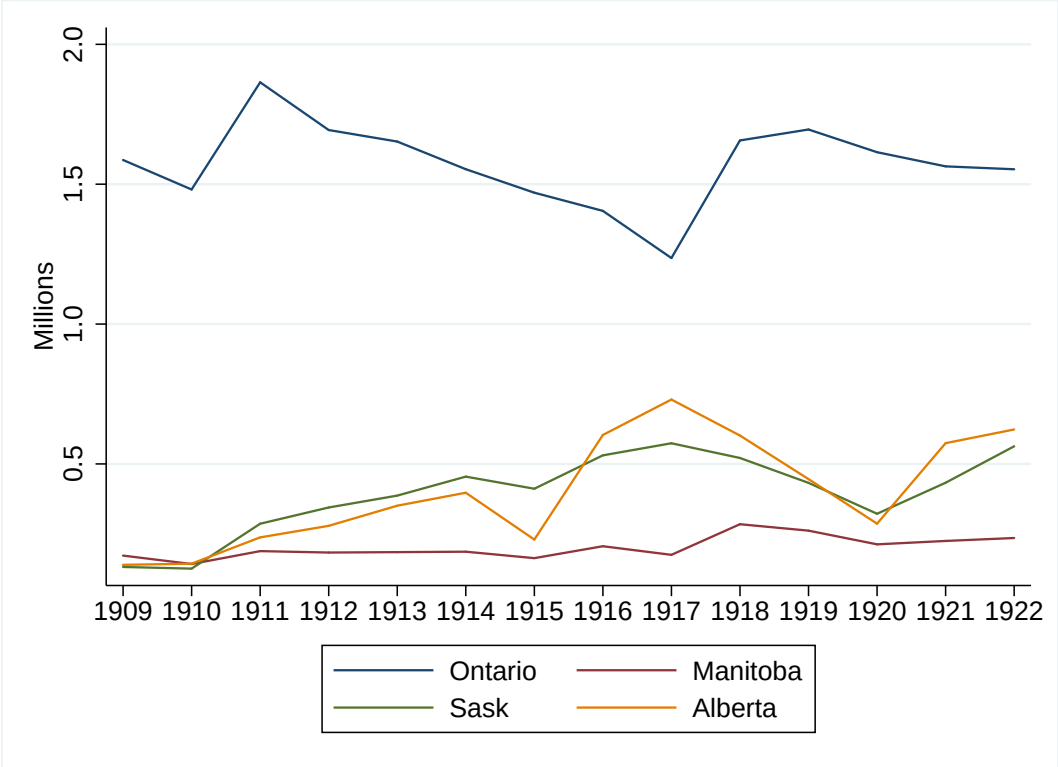
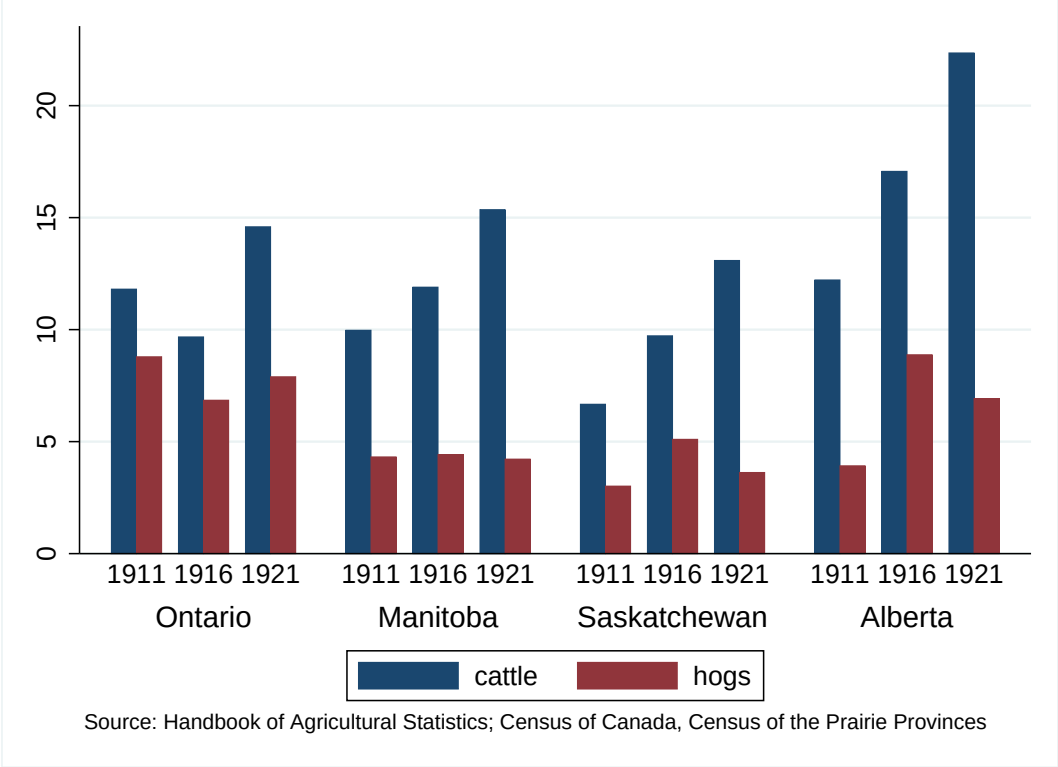


Figure 6: Livestock, Average per Farm, Ontario and Prairie Provinces, 1911, 1916, 1921



Source: Handbook of Agricultural Statistics; Census of Canada, Census of the Prairie Provinces

Figure 7: Wheat Prices, 1913-1921 (cents/bu, Winnipeg No. 1 Northern)

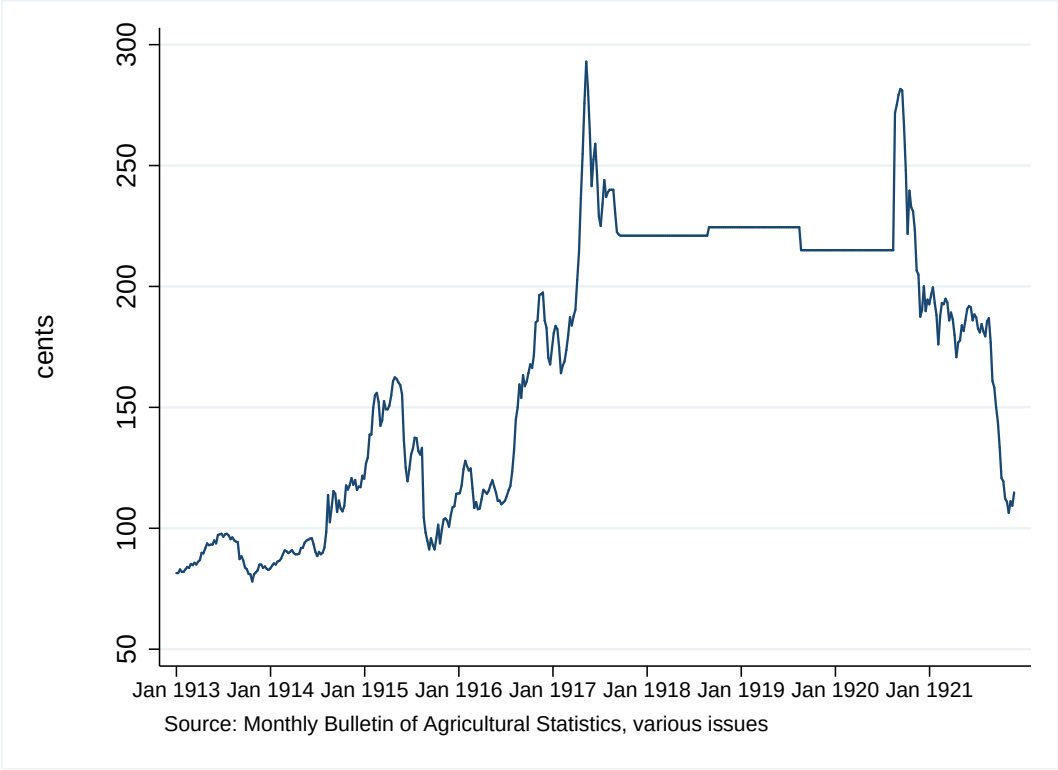


Figure 8: Wheat and Farm Input Price Indexes, Prairies, 1914=100