The Cost of Producing Wheat in Five Regions of North America and Europe

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Abstract

The paper compiles the on-farm costs associated with producing a tonne of wheat for each year between 1970 and 1989 for five wheat growing regions, namely; the brown soil zone of Saskatchewan, Canada, northwestern North Dakota, U.S.A., East Anglia of England, the Borde region south east of Hannover, Germany, and the Paris Basin of France. The costs include direct cash costs and allocated costs. The only costs not included are an allowance for the operator's management and risk taking. The costs have also been adjusted for inflation in the originating country and converted to Canadian dollars. The results indicate that over the twenty years between 1970 and 1989 the lowest cost wheat producing regions have shifted from Saskatchewan and North Dakota to East Anglia and the Paris Basin primarily due to increasing European yields and decreasing yields in Saskatchewan and North Dakota.

Introduction

Comparing the costs of producing wheat between Canada, the USA, and Europe can give insights into the competitiveness of a particular country in world wheat production. However, it is perhaps impossible or at the very least highly inaccurate to calculate country wide average costs of producing wheat due to the many varied climatic regions and production technologies within any one country. Therefore this paper calculates the costs of producing wheat in major wheat producing regions within each country, namely; the brown soil zone of Saskatchewan, northwestern North Dakota, East Anglia, England, the Borde region southeast of Hannover, Germany and the Paris Basin of France. It is more likely the data reflect a technology that is more suited to wheat production and more consistent among farms within the region. The technology is perhaps also more up-to-date because the farmers within the area are more likely to be wheat production specialists. The resulting calculation would be close to the most competitive cost of producing wheat within a given country.

Cost comparisons among countries at a particular point in time may not accurately reflect the long run cost of production or the relative conditions under which the costs are incurred and the wheat produced. The time frame used in this paper is from 1970 to 1989. Twenty years is long enough to allow for the effects of droughts, diseases, technological changes, and competitiveness from other crops to be absorbed in averages and for trends to emerge. Cost of production estimates also have an additional problem. They are usually reported as averages per unit of area or output for a specified region. These averages are usually from a sample of different sized farms employing different technologies, unless the region is relatively small and

the farms are oriented to the production of a similar commodity as is the case in this paper. The cost estimates represent the average of single points on each farm's average cost curve. Data representing the farm's marginal cost curve and in combination the industry's underlying supply curve is more relevant if supply responses to changing conditions is wanted (Ahern et al.)[1]. However, despite the above argument, it is still important to know the average cost of producing a commodity in various regions.

Data dealing with the relationship between assets, debts, and gross income are also valuable in building a picture of the relative conditions under which wheat is produced. The extent to which farms in the region in question are financed by debt capital is an indication of the amount of financial risk their businesses are facing and is measured by the debt/asset (D/A) ratio. Financial risk can be defined as the amount of variation in net returns emanating from changes in interest rates and other lending policies. The relationship between the amount of gross income generated and the value of the assets used to generate the gross income, indicates the relative productivity of the assets and whether either the asset price will have to adjust, or the asset put to more productive use. This is measured by the ratio of gross income/assets value (capital turnover ratio).

The remainder of the paper is divided into five sections. The next section deals with the conceptual framework in which concepts such as costs of production, intercountry competitiveness and comparative advantage are discussed. The methodology section follows and is concerned with the costs included and how they are calculated as well as how missing data, inflation and currency exchange rates are handled. The data sources section outlines the type and sources of the data used in the study. The results of the study are presented in the next section

and include the average real, that is, inflation adjusted cost of producing a tonne of wheat in 1989 Canadian dollars for each year from 1970 to 1989 for each of the five regions analyzed. In addition the relative financial risk associated with wheat production as measured by the D/A ratio and the productivity of assets devoted to wheat production as measured by the capital turnover ratios will be presented for each region. Conclusions and implications derived from the results will complete the paper.

Conceptual Framework

Comparisons of the cost of producing wheat between countries lead into a discussion of intercountry competitiveness and comparative advantage. Intercountry competitiveness not only deals with the costs of production but also historic trading volumes, perceived reliability in trade, product quality, and the filling of market niches. In addition, the agricultural infrastructure within a country, trends in agricultural productivity, domestic agricultural and trade policy, and exchange rates also affect a country's competitiveness (Barkema and Drabenstott[2], Ahern et al.[1]). A recent article points out that income tax and social program policies can also have important impacts on intercountry competitiveness (Perry et al.[3]). Comparative advantage on the other hand is a much more theoretical concept dealing with the choice of goods and services production, importing, and exporting between trading partner countries. The objective here is to briefly outline the concepts of competitiveness and comparative advantage in order to put the present cost of production study into context.

Canada's historically significant share of the world wheat trade, generally reliable record

in fulfilling trade contracts on time, and customer satisfaction with a high quality product are important competitive edges. Even with the trend away from using high protein hard red spring wheat in bread making, Canada will probably continue to control a niche market for this type of wheat in the future.

A well developed agricultural infrastructure consisting of world class research facilities and a comparatively efficient grain transportation and exporting system may allow Canada to compete satisfactorily without being the lowest average cost producer in the world. The important point here is that Canada may have very low costs for delivering wheat to importing countries and thereby have the lowest price to the importer despite higher production costs.

Trends in agricultural productivity as measured by agricultural output per unit of labour input are generally in Canada's favour. Agricultural labour productivity between 1975 and 1984 rose by 70% in Canada as compared to 55% in the USA, 46% in Australia, and 83% in the UK (Barkema and Drabenstott[2]).

Domestic agriculture and trade policy also influence current and future competitiveness. Canada has traditionally supported its wheat producers through various grain transportation subsidies, stabilization programs and the establishment of the Canadian Wheat Board (CWB). The CWB is a respected organization worldwide which markets all of Canada's wheat grown in the prairie region and returns a pooled price to the individual farmers. The stabilization programs of the 1980s had previously proved inadequate to combat the effects of the grain trade war. New stabilization programs in the form of the Gross Revenue Insurance Program (GRIP) and the Net Income Stabilization Account (NISA) will help the more efficient producers survive. GRIP allows participants to insure both crop yields (based on historical area averages) and prices (based

on fifteen year moving average and indexed for inflation to the current year). NISA allows participants to set aside a portion of their net income (which the government matches) for future use in low or negative years. Subsidized grain transportation has allowed wheat to be delivered to export facilities at lower than market cost to the farmer and in turn has allowed for the development of a relatively efficient and modern grain handling system.

Currency exchange rates influence a country's competitiveness. Exchange rates between the four countries and Canada analyzed in this paper have fluctuated a great deal over the last 20 years (Appendix Table A1). A strong (weak) exchange rate greatly decreases (increases) the competitiveness of a country in trading a relatively homogeneous product such as wheat.

Finally, income tax and social program policy have also been shown to affect intercountry competitiveness (Perry et al.[3]). Perry et al. used the case study approach and found that farmers from Alberta, Canada have significant tax and social program advantages that outweigh government farm program and production costs advantages enjoyed by farmers from Montana, U.S.A. These, and the efforts outlined above by the government of Canada assist Canada's competitiveness in the world wheat market as can be seen by its rather consistent share of world wheat exports (Table 1).

Comparative advantage is the cornerstone of economic trade theory and deals with the issue of which products should be produced in a given country and which should be imported. Accordingly, each country should specialize in the production and export of those goods and services produced by abundant local resources. Similarly, each country should import those goods and services produced with resources in relatively scarce local supply. Scarce local resources are then available for more profitable uses. By each country specializing in the

production of goods and services in which they have a comparative advantage and trading for others, all trading partners make the most efficient use of their resources. However, comparative advantage requires perfect markets where prices are free from market distorting government policies. Considering the amount of market distorting government policies toward wheat enacted in the recent past throughout the world, intercountry competitiveness measures are the most applicable form of analysis. However, it is not the objective of this paper to measure total intercountry competitiveness but rather the cost of producing wheat in the five regions in question.

Methodology

The methodology employed in this paper is concerned with the items included in the costs of wheat production calculations and how they are calculated as well as how missing data, inflation and currency exchange rates are handled. The costs included and their calculation method must be consistent from country to country. It is important to have a complete data set from each country for the time period in question, therefore data that is missing from any source must be supplied from a comparable source or estimated through a method that is rigorous and acceptable. Domestic inflation within each country and the exchange rate of its currency with the Canadian dollar must also be taken into account in order to make cost comparisons over time and between countries.

The calculation of wheat production costs in this paper includes both direct and indirect costs and uses opportunity cost calculations where needed. The goal here is to calculate the total

economic costs associated with wheat production. The only costs of production not included in this paper is an opportunity cost allowance for the producer's management and risk taking. The issues of cash versus noncash and variable versus fixed costs are not addressed although these cost categories were included in the calculations. The categories used here are referred to as direct and indirect costs. The direct costs are all those costs directly associated with the production of wheat and include seed, fertilizers, pesticides, fuel, and custom work. The indirect costs are those costs incurred in the farm business in general and therefore need to be allocated to the various enterprises within the business. Indirect costs include machinery and building repairs, hired labour, depreciation on machinery and buildings, interest on debt, and a number of opportunity cost calculations. The opportunity cost calculations include an interest allowance for equity capital investment in machinery, buildings, and land and an allowance for the operator and family labour used in the farm business. The interest rate used in the calculation is near commercial interest rates at the time and for the country in question; usually the prime rate plus one or two percent. The opportunity cost calculation for land uses an interest rate of 5% on market value or splits the asset between the portion owned and rented and combines the rental rate with the interest calculation. Including land costs is consistent with the principle of opportunity cost and treats the land resource like any other resource that has alternative uses. The labour wage rate used is an estimate of that for hired farm labour at the time and for the country in question.

The allocation procedure used annually to allocate the indirect costs specifically to wheat production differed slightly between countries but followed the ensuing general procedure. The percentage of land devoted to each crop including wheat was weighted by the ratio of it's direct

costs with those of wheat. The percentage of land devoted to wheat was then divided by the total of the weighted percentages. The resulting calculation was the percentage of indirect costs allocated to wheat production. This procedure allows for other more high costing crops like potatoes and sugar beets to get a higher percentage of the indirect costs as well. Indirect costs associated with livestock enterprises were not included in the total where possible and where not possible were allocated to pasture and forage land according to the above procedure.

Unfortunately the data sets used did not all have data for each year between 1970 and 1989. Missing cost data was supplied by multiplying the preceding or following year's data by either the consumer price index (CPI) or the agricultural input price index (Ag Index) for the appropriate year and country in question (Appendix Table A2). The CPI and Ag Index were used in separate calculations as there were instances in all countries where they differed and thereby may influence the results. Missing land use data was supplied by averages from the years where data was available. Missing yield data for the regions being analyzed was supplied by multiplying available national or state data for the years in question by the ratio of the yield data from the region and the national or state data for the years where both where available. The above procedures generally resulted in data that continued trends that were apparent in the available regional data.

Next, the entire data set was adjusted for inflation using the CPI and then for comparison purposes by the Ag Index. The resulting real costs were standardized by setting 1970 to 100 and their 10 year moving averages between 1970 and 1989 were compared.

The real costs were then converted to a common currency for comparison between countries. Average annual exchange rates in Canadian dollars per unit of foreign exchange were

used for this conversion (Appendix, Table A1). The exchange rates were in nominal terms and therefore had to be adjusted for the differences in inflation between the two countries during the time period in question. The inflation adjusted exchange rates were calculated using the CPI and then the Ag Index for comparison purposes according to equation (1).

$$(1) \qquad REX = \frac{CI_n / CI_i}{XI_n / XI_i} * NEX$$

where:

REX = Real (Inflation Adjusted) Exchange Rate in Cdn$/Unit of Foreign Exchange.
CI = Annual Western Canadian Inflation Rate, 1970 - 89, as measured by the CPI and Ag Index.
XI = Annual Inflation Rate by Region, 1970 - 89, as measured by the CPI and the Ag Index.
NEX = Nominal Exchange Rate in Cdn$/Unit of foreign exchange.

Data Sources

The data sources used in this paper endeavour to represent specialized wheat producing farms from areas within each country that are specialized cereal and wheat producing regions. The Canadian data is from the brown soil zone of Saskatchewan which is in the southwestern part of the province where hard red spring wheat is the number one crop on almost all farms. The data is from a number of farmer based accounting information studies and has been updated from a previous study (Brown, 1989[4]). The calculations include the costs and yields associated with following a 50% summerfallow and 50% wheat on summerfallow rotation. The U.S.A. data is from the North Dakota Vocational Agriculture Farm Business Management Education Annual Reports run by Bismarck State College and is based on averages from a sample of farm accounts

(North Dakota State Board of Vocational Education[5]). The precise data used is for spring wheat on summerfallow which is most likely grown in the northern and western parts of the state making it very similar to the conditions from which the Saskatchewan data is derived. Data for the Northern Plains available from the Agriculture and Rural Economy Division of the Economic Research Service (ERS) of the United States Department of Agriculture (USDA) was not used as it was not as complete in terms of time span as the North Dakota data and included a larger area thereby containing several different technologies, wheats, and farm types (McElroy et al.[6]). The UK data is perhaps the most precise and consistent and is based on a sample of mainly cereal farms from the East Anglia region of England (Murphy[7]). The German data is also quite consistent and is based on a sample of mainly cereal farms in the Borde region east and south of Hannover (Landwirtschaftskammer, Hannover[8]). The French data is based on a sample of mainly cereal farms in the Beauce-Gatinais area in the Paris Basin region (Carles[9]). The Beauce-Gatinais data is supplemented between 1977 and 1980 by data from the Seine-et-Marne area also from the Paris Basin region (Stanton[10]).

The European data is primarily based on the costs associated with soft winter wheat production while the North American data is primarily based on hard red spring wheat production. The two kinds of wheat are used to produce the same products but the price of hard red spring wheat has averaged 11% higher during the 1979 - 89 period (Canadian Wheat Board[11]). In addition, the soft winter wheats usually out yield the hard red spring wheats under similar conditions. It would appear the North American regions could lower their costs per tonne by growing the higher yielding soft winter wheats. However the farmers of the regions have chosen to stay with the hard red spring wheat for a number of reasons, including tradition, profit,

and risk. The wheat of choice in the North American regions analyzed will continue to be hard red spring wheat until varieties of soft wheat can be developed to compete on a profit and risk basis.

Results

Wheat Yields

Wheat yields from the brown soil zone of Saskatchewan are the lowest of the five regions analyzed and also have the largest coefficient of variation (CV) (Table 2). The Saskatchewan yields average 92.5%, 30.6%, 29.4%, and 27.0% of the North Dakota, East Anglia, the Borde region, and the Paris Basin yields respectively. The CV is highest in Saskatchewan, North Dakota and East Anglia and lowest in the Paris Basin. The CV is a better measure of relative risk for the North American than the European regions because much of the European variation comes from the increasing yield trend rather than the vagaries of weather. Both the Saskatchewan and North Dakota yields show a decrease in 10 year average yields from the 1970s to the 1980s whereas the European yields have consistently and substantially moved upward. Water is the most limiting factor of production in the two North American regions, and therefore wheat yields are very sensitive to growing season rainfall. The North American yields are decreasing partly due to droughts in 1984 and 1988 in Saskatchewan and 1980 and 1988 in North Dakota, but also due to lower rainfall generally in the 1980s versus the 1970s (Saskatchewan Agriculture and Food[12], North Dakota Agricultural Statistics Service[13]). The increasing yield trend in Europe is due to the substitution of capital and new technology for land and labour, the

development of new short stemmed disease resistant varieties, the enlargement of fields, and improvements in the mechanization of most operations and other production practices (Stanton[10]).

Real Cost of Production Within Regions

Figure 1 presents the real, adjusted for inflation by the CPI, 10 year moving average cost of producing wheat by region in local currency. The data in Figure 1 has been standardized with 1970 equal to 100. A graph using the Ag Index to adjust for inflation is not included because the results are very similar. The brown soil zone of Saskatchewan is shown to be the only region where the real costs have risen substantially between 1970 and 1989. The Borde region of Germany is the only region where the real costs have decreased rather substantially during the same period. The other three regions have managed to keep their real cost of production relatively constant between 1970 and 1989.

Real Cost of Production in Canadian Dollars

Table 3 presents the real, adjusted for inflation by the CPI, cost of production by region in 1989 Canadian dollars. A table using the Ag Index to adjust for inflation is not included because the results are very similar.

The cost of production for any one region varies a great deal from year to year and varies inversely with the yield. On average for the 20 year period from 1970 to 1989 the lowest cost producer of wheat has been East Anglia, England, followed by the brown soil zone of Saskatchewan, the Paris Basin, France, northwest North Dakota, and the Borde region of Germany. The CVs are very similar, however they are higher in the North American regions

than in Europe.

Year to year cost of production and a 20 year averages are of interest but do not give information on any trends that may be developing. Figure 2 presents the 10 year moving average real cost of production by region in 1989 Canadian dollars. The trend in all regions was upward during the 1970s. The Borde region of Germany shows a rather consistent downward trend, starting in the 1980s, but is still significantly higher than the other four regions. The only region with a slight upwards trend throughout the entire time period is the brown soil zone of Saskatchewan. Throughout most of the period the European regions have higher costs than the North American regions. However the data for 1979-88 and 1980-89 show that East Anglia, England and the Paris Basin of France have averaged lower costs of production in 1989 Canadian dollars per tonne of wheat than do the brown soil zone of Saskatchewan and northwest North Dakota.

Debt/Asset (D/A) and Capital Turnover Ratios

The D/A and the capital turnover ratios are good measures of relative financial risk and asset productivity respectively. These ratios were calculated for each of the regions (Table 4). Data was available for all regions between 1982 and 1988.

Debt/Asset ratios varied amongst the five regions and were lowest in East Anglia and the Borde region of Germany and highest in the Paris Basin. The level of the D/A ratios of East Anglia and the Borde region indicate an extremely low level of financial risk and thereby a strong degree of financial conservatism on the part of farmers. The D/A ratios in Saskatchewan and North Dakota are quite similar but higher than those in East Anglia and the Borde region.

In the 1980s the Saskatchewan ratios tend to lag behind the North Dakota ratios mainly due to the similarly lagged land values (Saskatchewan Agriculture and Food[12] and North Dakota Agricultural Statistics Service[13]). The D/A ratios for the Paris Basin are the highest of the five regions analyzed and there does not seem to be any noticeable trend. The levels of the D/A ratio for the Paris Basin are extremely high and either reflect extreme financial daring on the part of farmers or some form of financial guarantee to protect against decreases in either asset values or incomes, or the threat of foreclosure.

Capital turnover ratios varied amongst the five regions analyzed and were lowest in Saskatchewan, North Dakota, and East Anglia and highest in the Paris Basin. It would appear, that at least for the two North American regions, the capital turnover ratio is highest when land values have either reached the bottom of a cycle (North Dakota 1985) or are rising very rapidly (Saskatchewan 1972 to 1975). The opposite phenomena also appears to be true (North Dakota 1980 to 1984 and Saskatchewan 1980 to 1986). There does not seem to be any discernable trend in the capital turnover ratios for East Anglia, the Borde region nor the Paris Basin. The underlying reasons for East Anglia having the same level as the North American regions and the Borde region staying constant around 25% and the Paris Basin fluctuating around 28% is unknown. One can speculate that the profits associated with wheat production are similar and low or negative in Saskatchewan, North Dakota, and East Anglia but increase substantially in the Borde region of Germany and the Paris Basin.

Conclusions and Implications

The primary conclusion resulting from this analysis is that over the 20 years from 1970

to 1989 the least cost producing regions for wheat have shifted from Saskatchewan and North Dakota to East Anglia and the Paris Basin. The Borde region of Germany is also becoming more competitive but Germany's strong currency exchange rate is countering this trend. The reasons for the shift in competitiveness can for the most part be related back to yields. The yields in the European region have increased rapidly and consistently in the last 20 years. New higher yielding and more disease resistant varieties are almost a yearly occurrence in Europe. New yield increasing production technologies have been adopted very rapidly in Europe probably because of the high guaranteed price for wheat. The weather in the European regions is usually much more consistent and conducive for wheat production than the North American regions thereby resulting in lower CVs of yields and costs per tonne in Europe.

North American conditions have also contributed to this shift of the least cost producing regions to Europe. The 1988 drought alone raised the average cost per tonne for the 1980 to 1989 period in Saskatchewan by 9.8% and in North Dakota by 8.4%. Add to this the poor yield in Saskatchewan in 1984 and in North Dakota in 1980 and the average cost per tonne for the 1980 to 1989 period is much higher than in East Anglia and the Paris Basin. In addition Saskatchewan and North Dakota farmers have not had the price incentive to adopt new technology and have therefore continued to use the least cost and least risk method of production, that is, high summerfallow and low fertilizer and pesticide use (Saskatchewan Agriculture and Food[12], North Dakota Agricultural Statistics Service[13]). Finally, the decreased value of machinery investment can be used as a proxy for the lack of adoption of wheat technology in Saskatchewan and North Dakota (Saskatchewan Agriculture and Food[12], North Dakota Agricultural Statistics Service[13]).

The analysis of the D/A and capital turnover ratios indicate differences between the North American and European regions. The D/A ratios in East Anglia and the Borde region of Germany demonstrate financial conservatism on the part of the farmers of the regions. The D/A ratio for Saskatchewan and North Dakota have been proven in the recent past to be too high. The very high D/A ratios in the Paris Basin indicate some form of guarantee against loss that encourages farmers to borrow at such high levels.

The capital turnover ratios are a basic measure of asset productivity. It appears there is not much room for profitability of wheat production in the brown soil zone of Saskatchewan, northwest North Dakota, and East Anglia, England. Assets appear to generate more gross income in the Paris Basin of France, and the Borde region of Germany, thereby allowing for a higher chance of profits from wheat production in these regions.

The future competitiveness of the North American regions is also in doubt. The cost levels of the 1980s have been substantially higher than the prices received. Most farm businesses can survive this for a period of time due to savings, off farm employment, and the low opportunity cost nature of many of the factors of production. However, the costs have been greater than returns for at least ten years, and it is at this stage when the theoretical "opportunity" nature of many of the costs in the farm business make their influence known through the lack of entry of new farmers into the business of farming. The numbers of full time commercial wheat farms have dropped significantly in the past 10 to 20 years in Saskatchewan and all indications are that they will continue to do so in the future (Saskatchewan Agriculture and Food[12]). However, this does not mean that the amount of land devoted to wheat production will also decrease substantially. In fact, the amount of land devoted to wheat production in North

Dakota and Saskatchewan has not fallen significantly in the last ten years, however its price has (Saskatchewan Agriculture and Food[12], and North Dakota Agricultural Statistics Service[13]).

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Table 1: Percentage of World Trade in Wheat and Wheat Flour, 1970 - 89.

Year	Canada	U.S.A.	EEC[1]	Others
1970-71	21.5	36.7	5.7	36.1
1971-72	26.1	32.2	8.9	32.8
1972-73	23.0	46.6	9.6	20.8
1973-74	18.1	49.7	8.7	23.5
1974-75	17.1	45.0	11.3	26.6
1975-76	18.4	47.4	11.6	22.6
1976-77	21.6	42.1	6.3	30.0
1977-78	22.1	43.5	6.2	28.2
1978-79	18.4	45.4	10.3	25.9
1979-80	18.1	42.5	11.7	27.7
1980-81	17.5	45.0	13.6	23.9
1981-82	18.3	48.4	13.9	19.4
1982-83	22.0	41.2	14.5	22.3
1983-84	21.7	38.7	15.0	24.6
1984-85	17.2	37.3	16.9	28.6
1985-86	21.5	30.3	17.4	30.7
1986-87	23.2	31.9	17.4	27.5
1987-88	22.3	41.1	13.9	22.8
1988-89	12.9	39.0	20.1	28.0
1989-90	18.6	35.8	20.2	25.4

[1]European Economic Community
Source: The Canadian Wheat Board, Annual Reports, 1983-84, 1991-92. Winnipeg, Canada.

Table 2: Wheat Yields in Five Wheat Growing Regions, 1970 - 89.

Year	Wheat on Fallow Yield Tonne/Ha Saskatchewan	Wheat on Fallow Yield Tonne/Ha North Dakota	Wheat Yield Tonne/Ha England	Wheat Yield Tonne/Ha Germany	Wheat Yield Tonne/Ha France
1970	2.02	2.02	4.01	3.84	5.50
1971	1.92	2.02	4.55	5.32	5.71
1972	1.46	2.00	4.39	4.77	6.70
1973	1.41	2.03	4.21	4.92	6.62
1974	1.34	1.82	5.13	4.71	6.76
1975	1.68	1.61	4.35	5.45	5.68
1976	2.09	2.15	3.83	5.02	5.57
1977	1.95	1.61	5.10	5.49	5.50
1978	1.88	2.07	5.10	5.83	5.80
1979	1.63	1.92	5.70	5.57	5.60
1980	1.59	1.03	5.30	5.89	6.10
1981	1.75	1.93	6.39	5.66	5.65
1982	2.15	2.24	6.36	6.20	6.29
1983	2.09	1.82	6.85	6.67	6.34
1984	1.21	2.11	8.29	6.68	8.13
1985	1.41	2.45	6.56	7.09	7.32
1986	2.09	2.00	7.43	7.45	6.03
1987	2.26	1.99	5.60	7.29	6.30
1988	0.75	0.89	6.24	7.34	7.58
1989	1.68	1.58	7.39	5.80	8.30
Mean	1.72	1.86	5.64	5.85	6.37
Std Dev	0.37	0.37	1.23	0.97	0.84
CV	0.21	0.20	0.22	0.16	0.13
Averages					
1970-79	1.74	1.92	4.64	5.09	5.94
1980-89	1.70	1.80	6.64	6.61	6.80

Std Dev - Standard Deviation
CV - Coefficient of Variation
Source: Brown[4]. North Dakota State Board of Vocational Education[5]. Murphy[7]. Landwirtschaftskammer[8]. and Carles[9].

Table 3: Wheat Production Costs Dollars Per Tonne: Adjusted for Inflation by the CPI and in 1989 Canadian Dollars, 1970 - 89.

Year	Saskatchewan Canada	North Dakota	East Anglia England	Borde Region of Germany	Paris Basin France
1970	$146.48	$257.06	$179.37	$481.77	$198.96
1971	147.90	247.56	163.99	357.60	188.42
1972	193.89	247.54	182.69	428.32	175.75
1973	216.32	251.93	207.06	525.61	213.76
1974	250.68	291.80	182.03	565.92	204.83
1975	190.02	247.91	253.82	520.92	296.53
1976	192.82	169.70	237.05	504.23	260.00
1977	197.02	256.82	200.08	504.60	271.61
1978	198.57	209.43	252.98	537.59	318.68
1979	242.65	248.28	313.11	630.37	362.93
1980	290.69	502.78	411.11	612.08	355.22
1981	302.62	270.91	317.97	517.32	332.03
1982	239.04	193.49	293.41	405.01	254.53
1983	216.35	229.27	223.68	313.91	224.95
1984	396.54	197.79	166.94	289.04	161.54
1985	314.16	189.48	207.75	262.47	184.41
1986	191.08	235.71	200.20	312.63	289.74
1987	161.74	234.40	249.79	333.30	288.23
1988	446.84	380.76	228.72	302.49	220.59
1989	198.53	212.42	174.35	328.02	193.38
Mean	$236.70	$253.75	$232.30	$436.66	$249.80
Std Dev	78.87	71.76	60.94	113.65	60.48
CV	0.32	0.28	0.26	0.26	0.24

Std Dev - Standard Deviation
CV - Coefficient of Variation
Source: Brown[4]. North Dakota State Board of Vocational Education[5]. Murphy[7]. Landwirtschaftskammer[8]. and Carles[9].

Table 4: Debt/Asset and Capital Turnover Ratios for the Five Regions Analyzed, 1970 - 1989.

Year	Brown Soil Zone of Saskatchewan		North Dakota		East Anglia, England		Borde Region, Germany		Paris Basin, France	
	Debt/ Asset Ratio(%)	Capital Turnover Ratio(%)	Debt/ Asset Ratio(%)	Capital Turnover Ratio(%)	Debt/ Asset Ratio(%)	Capital Turnover Ratio(%)	Debt/ Asset Ratio(%)	Capital Turnover Ratio(%)	Debt/ Asset Ratio(%)	Capital Turnover Ratio(%)
1970	16.5%	13.2%								
1971	16.5%	17.5%								
1972	16.7%	21.1%								
1973	16.7%	21.8%								
1974	15.9%	25.0%								
1975	15.1%	24.2%								
1976	14.9%	18.0%								
1977	14.7%	15.3%								
1978	14.2%	14.5%			10.0%	11.9%	9.2%	22.8%		
1979	13.1%	14.6%					9.5%	24.9%		
1980	10.8%	12.1%	16.4%	9.7%			9.6%	25.9%		
1981	11.1%	12.7%	17.3%	12.2%			10.5%	26.3%	27.3%	24.9%
1982	11.7%	12.0%	19.0%	12.1%	6.3%	14.0%	9.8%	27.5%	23.2%	26.3%
1983	13.5%	12.0%	22.5%	12.2%	7.5%	15.9%	10.5%	24.8%	23.9%	27.2%
1984	14.3%	13.4%	23.0%	13.9%	7.6%	15.9%	10.7%	27.3%	23.2%	28.7%
1985	16.7%	13.3%	23.6%	17.2%	8.6%	12.2%	10.5%	26.1%	22.3%	29.5%
1986	20.9%	14.2%	22.3%	17.0%	8.0%	14.1%	10.5%	25.4%	26.6%	27.0%
1987	22.9%	16.6%	19.5%	16.3%	8.4%	11.5%	9.9%	24.1%	28.4%	28.8%
1988	22.5%	18.0%	17.8%	12.9%	10.8%	9.5%	10.0%	24.0%	27.2%	34.7%
1989	20.9%	18.2%	16.6%		10.8%	14.8%	9.7%	23.2%		
Mean	16.0%	16.4%	19.8%	13.7%	8.7%	13.3%	10.0%	25.2%	25.3%	28.4%
Std Dev	3.4%	3.9%	2.7%	2.4%	1.5%	2.0%	0.5%	1.4%	2.8%	2.8%
CV	0.21	0.24	0.13	0.18	0.17	0.15	0.05	0.06	0.09	0.10
1982-88										
Mean	17.5%	14.2%	21.1%	14.5%	8.2%	13.3%	10.3%	25.6%	25.0%	28.9%
Std Dev	4.3%	2.1%	2.1%	2.1%	1.3%	2.2%	0.3%	1.3%	2.2%	2.6%
CV	0.24	0.15	0.10	0.14	0.16	0.16	0.03	0.05	0.09	0.09

Std Dev - Standard Deviation
CV - Coefficient of Variation
Source: Brown[4]. North Dakota State Board of Vocational Education[5]. Murphy[7]. Landwirtschaftskammer[8]. and Carles[9].

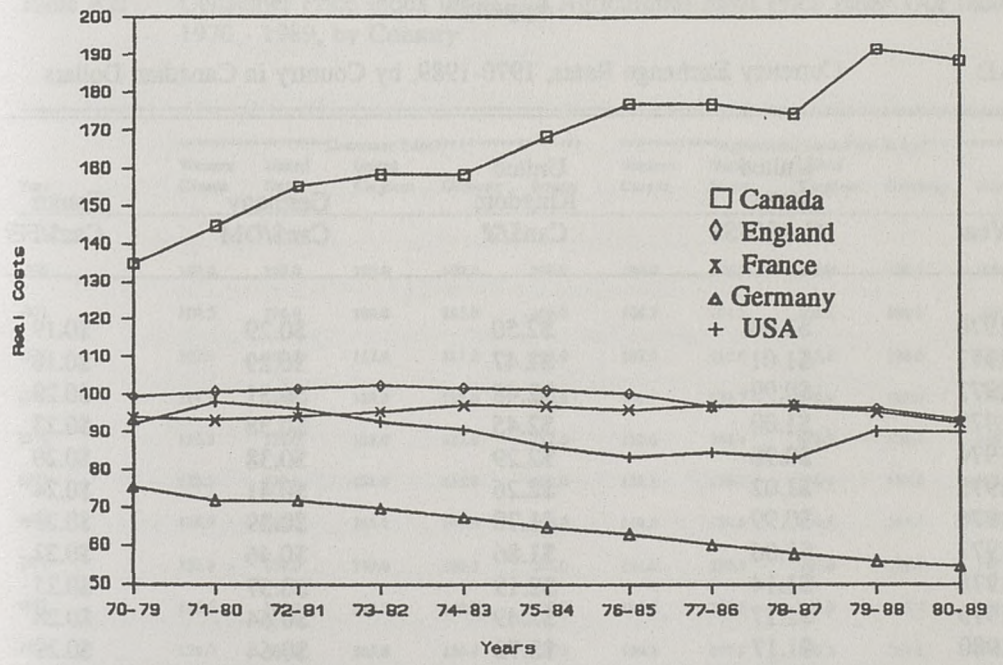

Figure 1: Real, Adjusted for Inflation by the CPI, Ten Year Moving Average Cost per Tonne of Wheat by Region in Local Currency, 1970 = 100.

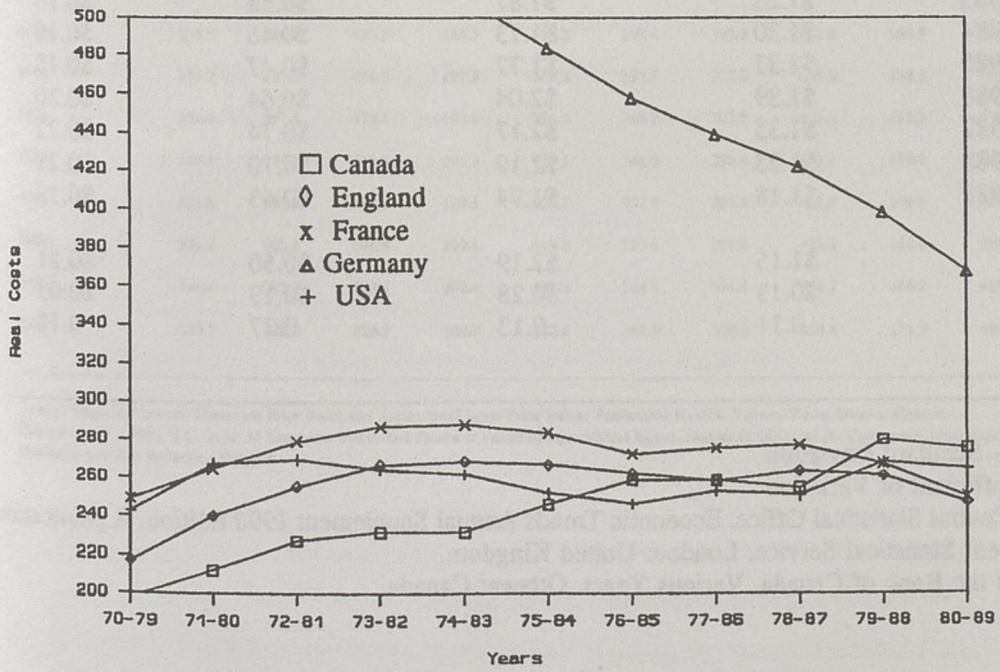

Figure 2: Real, Adjust for Inflation by the CPI, Ten Year Moving Average Cost per Tonne of Wheat by Region in 1989 Canadian Dollars.

Appendix

Table A1: Currency Exchange Rates, 1970-1989, by Country in Canadian Dollars

Year	United States Can$/US$	United Kingdom Can$/£	Germany Can$/DM	France Can$/FFr
1970	$1.04	$2.50	$0.29	$0.19
1971	$1.01	$2.47	$0.29	$0.18
1972	$0.99	$2.48	$0.31	$0.20
1973	$1.00	$2.45	$0.38	$0.23
1974	$0.98	$2.29	$0.38	$0.20
1975	$1.02	$2.26	$0.41	$0.24
1976	$0.99	$1.78	$0.39	$0.21
1977	$1.06	$1.86	$0.46	$0.22
1978	$1.14	$2.19	$0.57	$0.25
1979	$1.17	$2.49	$0.64	$0.28
1980	$1.17	$2.72	$0.64	$0.28
1981	$1.20	$2.43	$0.53	$0.22
1982	$1.12	$2.16	$0.51	$0.19
1983	$1.23	$1.87	$0.48	$0.16
1984	$1.30	$1.73	$0.46	$0.15
1985	$1.37	$1.77	$0.47	$0.15
1986	$1.39	$2.04	$0.64	$0.20
1987	$1.33	$2.17	$0.74	$0.22
1988	$1.23	$2.19	$0.70	$0.21
1989	$1.18	$1.94	$0.63	$0.19
Mean	$1.15	$2.19	$0.50	$0.21
Std Dev	$0.13	$0.28	$0.13	$0.03
CV	0.11	0.13	0.27	0.17

Std Dev - Standard Deviation
CV - Coefficient of Variation
Source: Central Statistical Office. Economic Trends Annual Supplement 1990 Edition. A publication of the Government Statistical Service. London: United Kingdom.
Report of the Bank of Canada. Various Years. Ottawa: Canada.

Table A2: Consumer Price Index (CPI) and Agricultural Input Price Index (Ag Index), 1970 - 1989, by Country

Year	Consumer Price					Agricultural Input Price Index				
	Western Canada	United States	United Kingdom	Germany	France	Western Canada	United States	United Kingdom	Germany	France
1970	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1971	104.5	104.0	109.0	105.0	106.0	104.5	104.5	110.2	104.1	107.1
1972	107.9	108.0	117.0	111.0	112.0	107.9	110.9	115.8	108.6	112.3
1973	111.1	114.0	128.0	119.0	120.0	111.1	132.7	150.0	122.6	124.6
1974	116.8	127.0	148.0	127.0	137.0	118.6	156.4	193.5	130.7	154.6
1975	125.3	139.0	184.0	135.0	153.0	138.1	170.7	216.6	137.6	173.5
1976	138.9	147.0	215.0	141.0	168.0	160.2	180.6	259.5	147.7	183.2
1977	153.9	156.0	249.0	146.0	183.0	181.0	190.1	301.0	151.1	197.9
1978	165.5	167.8	269.7	149.9	199.9	194.2	207.2	307.9	146.2	208.6
1979	178.7	186.9	305.8	156.4	221.3	199.3	237.6	343.3	154.1	228.8
1980	194.5	212.4	359.8	164.6	251.3	225.4	264.2	384.4	164.2	261.8
1981	212.4	233.6	402.9	174.5	284.0	264.2	287.0	422.9	180.3	295.3
1982	233.9	248.5	435.3	184.3	319.2	290.6	302.2	452.8	186.9	330.4
1983	263.2	257.0	456.9	190.9	349.3	336.7	302.2	484.4	188.2	362.6
1984	291.6	267.6	478.5	195.9	374.5	348.2	307.9	503.2	193.5	389.5
1985	308.4	278.2	510.9	199.1	397.1	348.8	298.4	462.2	189.0	385.9
1986	321.8	282.5	525.3	199.1	407.1	357.6	287.0	422.4	174.4	384.3
1987	334.7	293.1	546.9	199.1	419.7	359.6	297.8	422.6	164.6	382.5
1988	348.4	305.8	575.6	202.4	432.3	364.3	314.4	444.7	166.9	412.0
1989	363.7	329.6	620.5	208.0	482.0	369.0	338.9	469.4	171.7	404.4

Source: Statistics Canada. Consumer Price Index and Agricultural Input Price Index. Publication 62-004. Various Years, Ottawa: Canada.
Eurostat, 1971 - 1990, E.C. Index of Consumer Prices and Producer Prices of Agricultural Inputs, Statistical Office of the European Communities, Rue de la Loi 200, Bruxelles, Belgium.