The Cost of Producing Wheat in Five Wheat Growing Regions:
- The Brown Soil Zone of Saskatchewan,
- North Dakota, U.S.A.,
- East Anglia, England,
- The Paris Basin, France,
- The Borde Region, South East of Hannover, Germany

by

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Abstract

The paper compiles the on-farm costs associated with producing a tonne of wheat between 1970 and 1989 for five wheat growing regions, namely; the brown soil zone of Saskatchewan, north western North Dakota, 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 such as; property taxes, overhead, depreciation, opportunity interest cost on all capital, both equity and debt, invested in the farm, and an opportunity cost for operator and family labour. 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 droughts in Saskatchewan and North Dakota.

Introduction

Canada is a major exporter of wheat in the world accounting for as much as one third of the trade in the 1930s and around twenty percent in the last two decades (Phillips). Canadians, especially Western Canadians, have long thought of their prairies as the breadbasket of the world. It was naturally assumed that the Canadian prairies produced the best bread wheat at the lowest price in a world that was in desperate need of more bread. World events of the last fifteen years have brought into question at least part of this assumption.

The high quality of Canadian bread wheat and the increasing demand for wheat is still not in doubt. The question arises as to whether Canadian wheat can still be produced at a competitive cost with other wheat producing regions in the world. If the cost of producing wheat on the Canadian prairies is significantly higher than other wheat producing countries, Canadian wheat farmers will have to shift out of wheat production eventually even if the subsidy and trade war is resolved and prices rise.

Comparing the costs of producing wheat between Canada, the USA, and Europe can give incites 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. It is more likely the data reflect a production technology that is more suited to wheat production and more consistent between 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 between 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 affects of droughts, diseases, technological changes, and competitiveness from other crops to be absorbed in averages and for trends to emerge. Standard deviations (Std Dev) and coefficients of variation (CV) can also be calculated and give incites into the relative conditions of production and the risks faced by the farmers in a particular region of a country.

The 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.). However, despite the above argument, it is still important to know the average cost of producing a commodity in various countries.

The remainder of the paper is divided into four sections. 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 source of the data used in the study. The results of the study are presented in the next section and include the average real cost of producing a tonne of wheat in Canadian dollars from 1970 to 1989 for each of the five regions analyzed. Conclusions and implications derived from the results will complete the paper.

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 anyone source must be supplied from a comparable source or 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 cost 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. 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. The CPI and Ag Index were used in separate calculations as they differed substantially in all countries and thereby influenced 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.

Finally, it is important to make sure the entire data set is adjusted for inflation and converted to Canadian dollars in order to make cost comparisons over time and between countries. As stated above, it was found that there were major differences between the CPI and the Ag Index in each country (Table 1). The differences occurred in the mid to late 1970s where

the Ag Index, in all but Germany, surged ahead of the CPI and then again in the latter half of the 1980s where the Ag Index slowed down and was even negative in Germany. The rate of inflation from 1970 to 1989 as measured by the CPI was almost the same as that measured by the Ag Index in Saskatchewan and North Dakota but significantly greater than that measured by the Ag Index in the UK, Germany and France. Average annual exchange rates were used to convert the data to Canadian dollars and these fluctuated a great deal during the time in question (Table 2).

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). 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 the Bismarck State College and is based on averages from a sample of farm accounts (North Dakota State Board of Vocational Education). 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 in very similar to the conditions from which the Saskatchewan data is derived. Data for the Northern Plains 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.). 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). 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). The French data is based on a sample of mainly cereal farms in the Beauce-Gatinais area in the Paris Basin region (Carles). 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).

All the European data is based on the costs associated with winter wheat production while the North American data is based on spring wheat production. There are obvious differences in the quality of the product produced between the North American and European regions with hard red spring wheat usually demanding a higher price than the soft winter wheats.

In addition there are yield differences with the soft winter wheats usually out yielding the hard red spring wheats under similar conditions (Table 3). It would appear the North American regions could lower their costs per tonne by growing the higher yielding 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. Until these changes are made the comparisons will have to be between hard red spring wheat in North America and soft winter wheat in Europe.

Results

The resulting cost of production per tonne are presented in Figures 1 to 4 and include data for the period from 1970 to 1989 adjusted to real terms by the Ag Index and converted to Canadian dollars by the average annual exchange rate. Average costs per tonne, Std Dev and CV for each of the regions are included in Table 4.

Wheat Yields

Wheat yields from the brown soil zone of Saskatchewan are the lowest of the five regions analyzed and also have almost the largest CV (Table 3). The Saskatchewan yields average 92.1%, 30.4%, 29.4%, and 27.0% of the North Dakota, East Anglia, the Borde Region of Germany, 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 averaged lower in the drought prone 1980s than the 1970s whereas the European yields have consistently moved upward.

Cost of Production in Canadian Dollars

In order to compare the costs of producing wheat between various countries the domestic costs have to be converted to a common currency. The Canadian dollar was chosen as the common currency and the results of the conversion by the average annual conversion rates are presented in Figures 1 to 4 and Table 4.

Average real costs in Canadian dollars from 1970 to 1989 in all countries were calculated to be significantly lower using the Ag Index rather than the CPI. It is for this reason that the remainder of the discussion will concentrate on the Ag Index results expressed in Canadian dollars. North Dakota has the lowest average real cost for producing wheat between 1970 to

1989 at $204.30/Tn using annual exchange rates and $202.78/Tn using the average exchange rate. The costs average significantly lower in the 1970s than they do in the 1980s and the trend indicates a slight increase. The average real cost of producing wheat in the brown soil zone of Saskatchewan at $207.23/Tn is only slightly higher than that of North Dakota. The real costs averaged significantly higher in the 1980s than in the 1970s and a rather consistent upward trend is evident. East Anglia is the third lowest cost producer in the sample of five and is not significantly behind the two North American regions with 1970 to 1989 average real costs at $216.65/Tn using annual exchange rates. The Paris Basin costs come in at $221.11/Tn with the 1980s cost lower than the 1970s. It appears the main reason for the above phenomena is the high exchange rates in the late 1970s and early 1980s. Finally, the Borde region of Germany shows costs at $254.34/Tn. These are by far the highest costs but are directly related to Germany's high currency exchange rate. The Borde region's real cost in Marks were also the most downward moving of all the region analyzed. If the German Mark losses value against the other currencies in the future, Germany could develop a very competitive cost of wheat production.

Another perusal of Table 4 will show that the trend in wheat production costs is moving to favour the European regions. The average costs in the 1970s were; $171.25/Tn for the brown soil zone of Saskatchewan, $177.40/Tn for North Dakota, $216.33/Tn for East Anglia, $225.48/Tn for the Paris Basin, and $248.25/Tn for the Borde region of Germany, thereby demonstrating a distinct advantage for the North American regions. Costs per tonne in the 1980s were; $243.21/Tn for the brown soil zone of Saskatchewan, $231.20/Tn for North Dakota, $216.98/Tn for East Anglia, $216.74/Tn for the Paris Basin, and $260.43/Tn for the Borde region of Germany, thereby demonstrating a distinct advantage for at least East Anglia 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 high 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. New yield increasing production technologies have been adopted very rapidly 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. Land legislation in various parts of Europe restricting the development of agricultural land would keep the land price down and thereby lower the relative cost structure of European farms.

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 1980s 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 1980s is much higher than in East Anglia and the Paris Basin. In addition Saskatchewan farmers have not had the price incentive to efficiently increase production 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.

The future competitiveness of the North American regions and the brown soil zone of Saskatchewan in particular 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 opportunity cost nature of many of the factors of production. However, the costs have been greater than returns for at least ten years, savings have been depleted and off farm employment is more difficult to find within commuting distance and is very disruptive to the family and farm business if the farmer has to leave the farm to find work. It is also 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. This means that the structure of agriculture, at least in the brown soil zone of Saskatchewan will change dramatically in the future.

It is extremely difficult to predict the future structure of agriculture in a region but the developments of the recent past would indicate the following changes. 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. However, these fewer commercial wheat farms will produce a higher percentage of the wheat than they have in the past, probably in the area of 85 to 95 percent. The total number of farms may not drop significantly, and in fact may increase, but the bulk of them will be part time in the sense that the operator will supplement income with as much off farm income as possible. Hard red spring wheat will still be produced in significant quantities but only by the most efficient producers. Higher yielding wheats and other crops, perhaps those that can be used as sources of renewable energy for industrial purposes, will have to be developed, adopted, and produced as efficiently as possible in order for Saskatchewan agriculture to compete on the international market place.

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Table 1: Consumer Price Index (CPI) and Agricultural Input Price Index (Ag Index), 1970 - 1989, by Country

	**********Consumer Price**********					*******Agricultural Input Price Index********				
Year	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

Table 2: Currency Exchange Rates, 1970-1989, 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
Coef.Var.	0.11	0.13	0.27	0.17

Table 3: Wheat Yields by Region

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	2.019	2.024	4.01	3.84	5.50
1971	1.919	2.024	4.55	5.32	5.71
1972	1.455	1.997	4.39	4.77	6.70
1973	1.413	2.031	4.21	4.92	6.62
1974	1.344	1.816	5.13	4.71	6.76
1975	1.680	1.607	4.35	5.45	5.68
1976	2.085	2.145	3.83	5.02	5.57
1977	1.951	1.607	5.10	5.49	5.50
1978	1.882	2.071	5.10	5.83	5.80
1979	1.633	1.916	5.70	5.57	5.60
1980	1.591	1.029	5.30	5.89	6.10
1981	1.746	1.930	6.39	5.66	5.65
1982	2.151	2.239	6.36	6.20	6.29
1983	2.085	1.822	6.85	6.67	6.34
1984	1.210	2.105	8.29	6.68	8.13
1985	1.412	2.448	6.56	7.09	7.32
1986	2.085	2.004	7.43	7.45	6.03
1987	2.255	1.990	5.60	7.29	6.30
1988	0.748	0.888	6.24	7.34	7.58
1989	1.675	1.580	7.39	5.80	8.30
Mean	1.717	1.864	5.64	5.85	6.37
Std Dev	0.368	0.365	1.23	0.97	0.84
Coef Var	0.21	0.20	0.22	0.16	0.13
Averages					
1970-79	1.738	1.924	4.64	5.09	5.94
1980-89	1.696	1.803	6.64	6.61	6.80

Table 4: Average Costs, Std. Dev. and CV Per Tonne by Region					
	Ag Index Real Total Cost Can$/Tn Saskatchewan	Ag Index Real Total Cost Can$/Tn North Dakota	Ag Index Real Total Cost Can$/Tn England	Ag Index Real Total Cost Can$/Tn Germany	Ag Index Real Total Cost Can$/Tn France
Mean	$207.23	$204.30	$216.65	$254.34	$221.11
Std. Dev.	$71.13	$62.28	$37.81	$50.06	$48.76
Coef. Var	0.34	0.30	0.17	0.20	0.22
Averages					
1970-79	$171.25	$177.40	$216.33	$248.25	$225.48
1980-89	$243.21	$231.20	$216.98	$260.43	$216.74

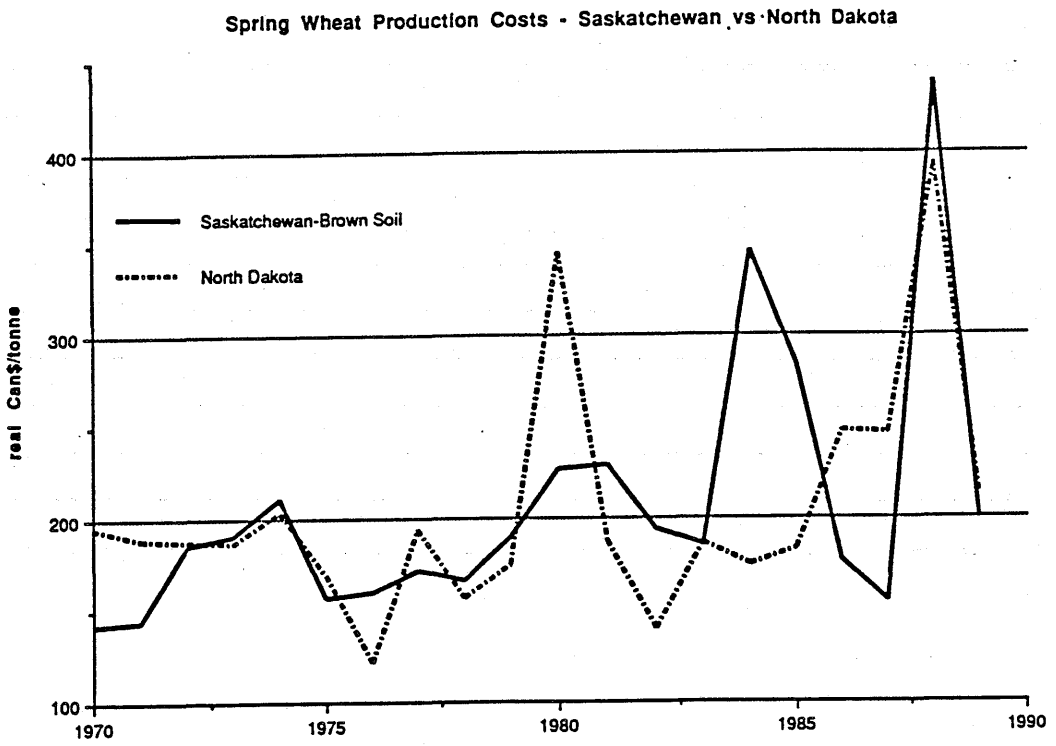

Figure 1

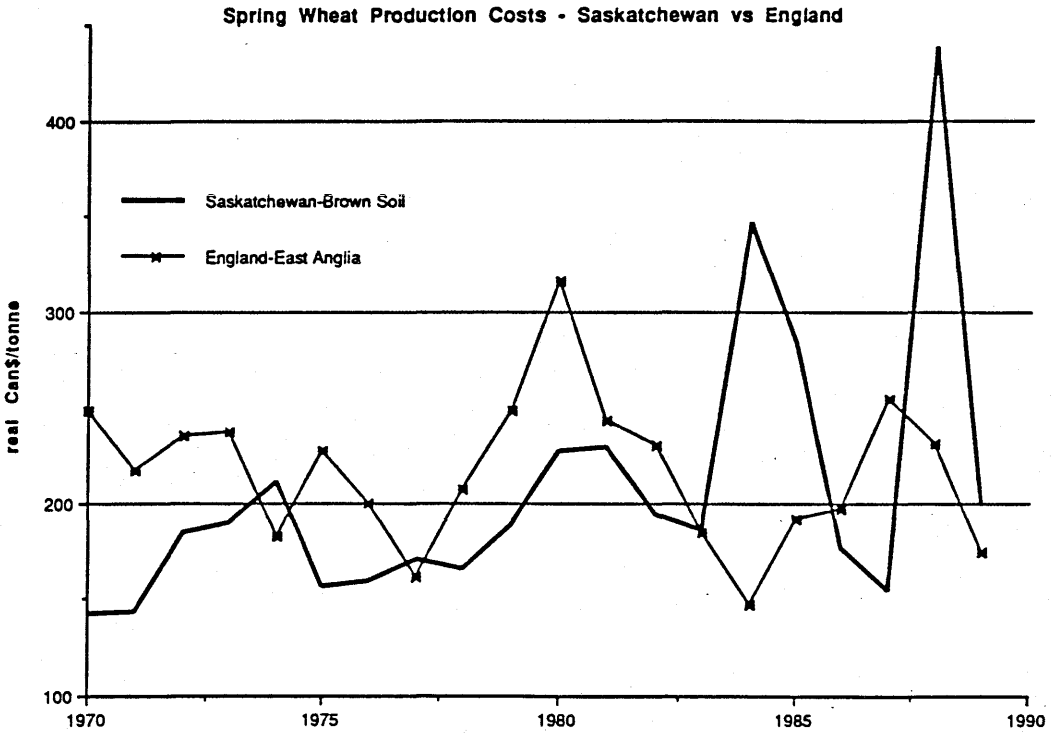

Figure 2

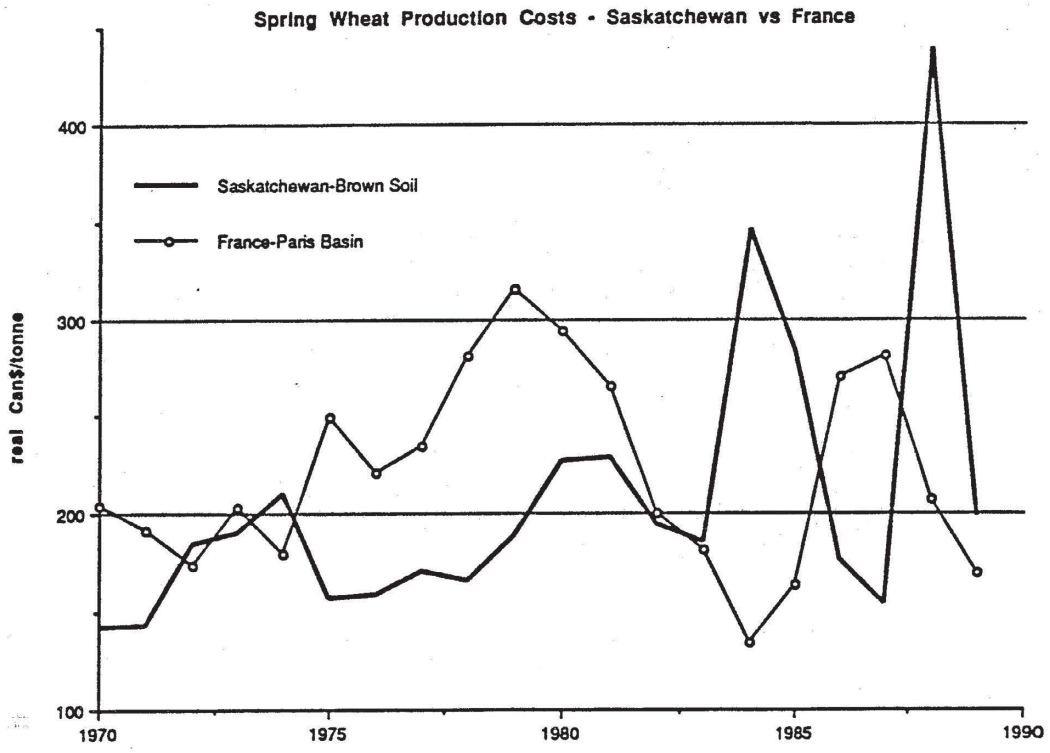

Figure 3

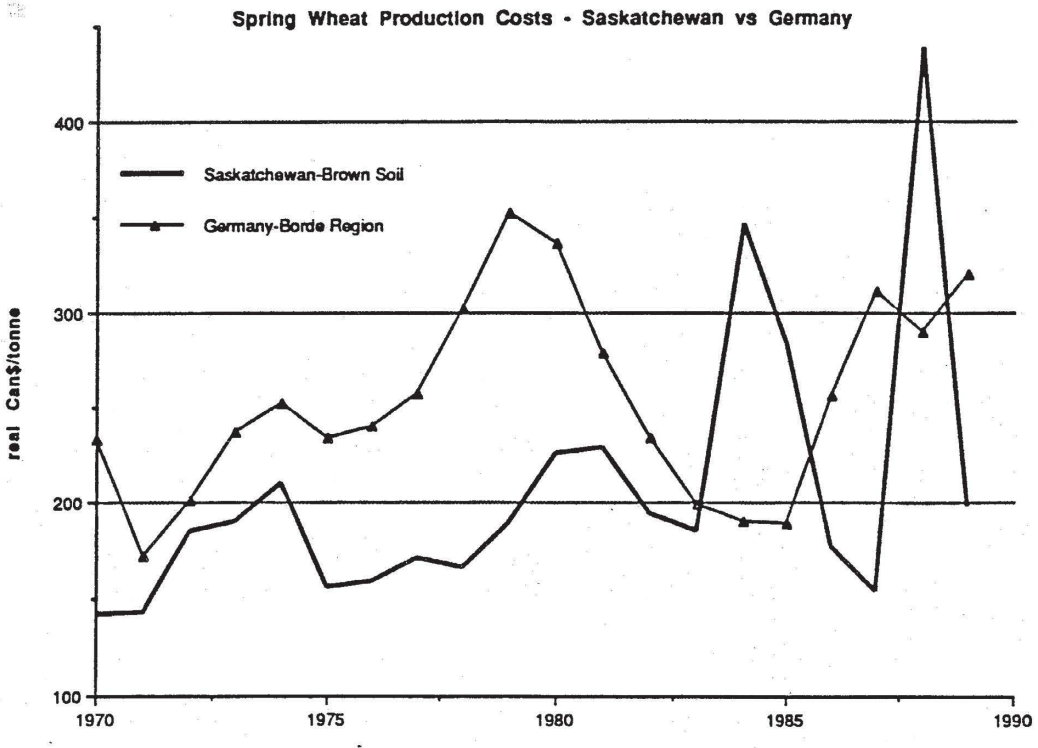

Figure 4