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Prospects for Hog Production and Processing in Canada

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March 1999

Foreword to the First Edition (March 1998)

Over the past year or so the George Morris Centre has published a number of reports on the actual or potential competitiveness of the Canadian hog and pork industry. Last Fall, the group of organizations that commissioned this report approached us, asking us first to have an objective look at Canada's cost competitiveness in hog production and then to put that into a competitiveness context with other factors in the pork industry. As will be seen in the body of the report, our approach was to take a standard cost model and attempt to obtain cost estimates for several points in Canada, the United States, South America and Europe. The focus is on the effects of "external" factors in each country and region, i.e. grain markets, financial markets and labor markets, on the cost of raising hogs. We do not claim that the cost estimates here are ones that would be the basis for an investment prospectus. However, our intent is to obtain an estimate of the cost differences among various countries and regions.

We are very grateful to the organizations that sponsored the report. They include: Agriculture and Agri-Food Canada, The Landmark Group, Manitoba Pork, Canadian Imperial Bank of Commerce, the Royal Bank, Manitoba Agriculture, Manitoba's Credit Unions, and FeedRite. While their input was valuable and quite helpful for the final report, we of course take responsibility for any errors of omission or co-mission.

Dr. Larry Martin Dr. Zana Kruja John Alexiou

Foreword to the Second Edition (March 1999)

Several readers have expressed interest in receiving an updated edition of this study, which would reflect developments in the world and domestic markets. Those developments are clearly important in the short term be cause of their implications for farm profits. The fundamental question is whether the longer term situation has changed. To examine this, we undertook an update of the 1998 analysis. It is reflected in this edition.

Executive Summary

This research project is an assessment of potential competitiveness of the Canadian hog/pork industry.

Domestic and world market potential for pork is analysed in terms of current consumer preferences and potential changes in consumer perception of health and dietary issues related to pork consumption. Evidence shows that, on a per capita basis, domestic pork demand declined despite considerable growth in real per capita income. The business literature often refers to products with demand like that of pork as a "mature" market, one that is regarded essentially as a commodity in which there is little growth potential. If this is true then the export market will be the major source of future growth.

The evidence shows that international demand for pork grew very rapidly until 1997, especially in Asia. The past two years have seen a reduction in Asian imports, a fact that is consistent with the economic recession that is taking place there. Indications are that imports will recover with the economy in that part of the world. In fact, the USDA anticipates fairly substantial growth in 1999. The growth trend is expected to continue in the future because of substantial reductions in Asian trade barriers and the limited productive resources which characterize some Asian countries. The fact that the most important growth is in Asia means that Canada has good market access. Moreover, three of Canada's major historic competitors in the export market have recently faced major competitive pressures: Holland and Taiwan because of disease; Holland and Denmark because production growth has not kept up with import demand. In fact, Canada is the only major exporting country which has had steady growth in hog production over the past several years.

Using standard budgets for three and single-site hog production facilities, production costs were compared for five regions in Canada, four in the US, Argentina, Chile, Holland and Denmark. All five Canadian regions compared favourably in the cost estimates. But Western Canada shows the lowest overall cost. Its major advantage is in the cost of feedgrains. In fact the advantage conferred by feedgrain prices in the Prairies is quite substantial. A second advantage is Canada's interest rates.

Holland and Denmark are shown to have the highest production costs for hogs, by a substantial margin. Their sources of cost disadvantage are several, including labour, interest, building costs and feed. South American costs are surprisingly high in the estimates. The South American a countries have an advantage in labour costs. Their feedgrains are priced comparably to Eastern Canada and the US. Building and depreciation costs are somewhat greater, especially in Argentina. The most significant disadvantage is for Argentina whose high rate of inflation has contributed to extremely high interest rates.

The non-traditional US production regions in the southeast and west appear to have few cost advantages. Feed and labour are higher than the mid-west and remaining costs are comparable. As a result, these regions do not appear to have the competitive advantage that were found for Western Canada.

Along with the already existing advantage Canada enjoys in hog production costs, the structural changes taking place in the processing industry mean that Canada's total costs will become increasingly competitive. This means that Canada has the opportunity to reduce the flow of live hogs moving into the US and increase Canada's share of world pork export markets.

Putting this information together, it would appear that Canada is on the brink of being one of, if not the most cost competitive pork producers in the world. It already has competitive production costs. It is in the process of enhancing the competitiveness of the processing industry. Some competitors face major problems in maintaining their position. The Canadian industry has the natural and human resources that can provide the means to produce pork safely with environmental responsibility. In fact, if the appropriate processes are developed, it is likely that these factors could be a source of price premium from those target markets which value these characteristics, a part of the market that is growing. In a larger sense, Canada is poised to take advantage of these factors at the very time world demand is growing because of falling trade barriers and rising prosperity in some parts of the world.

However, competitiveness is not just about cost, so there are some qualifiers that need to be acknowledged in this scenario.

Most obvious is the fact that if the Asian economies sustain a prolonged period of recession, the opportunities will be smaller for Canada and its competitors, and it will be difficult for all producing areas to sustain production. This is particularly true because so much capital has been invested in hog production over the past few years. The current capital base is large and very efficient, and was geared for continued growth in the Asian market. If that growth is not sustained, then resources invested in hog production will not likely earn profits based just on domestic demand. While there is little likelihood of a prolonged period of low prices like those of November and December of 1998, neither is there likely to be a prolonged period like 1996/97 unless international markets regain their buoyancy.

Second, clearly Western Canada's advantage results from feedgrain prices, but the magnitude of its cost advantage suggests that the feedgrain market in Western Canada may not arbitrage efficiently. When viewed in the context of the other regions, feedgrain costs appear to be lower than what would be consistent with a market characterized by economic efficiency. If the Canadian feedgrain market becomes more efficient, this advantage may be reduced.

Third, if the Canadian industry fails to undertake the hard work and complexity required to develop HACCP and environmental processes that allow it to differentiate its product in world markets (ie make it a Lexus or Mercedes), then all Canada will have is a cost advantage. If Canada is willing to make the effort to develop identity preserved product that responds to what many customers want with respect to food safety, the natural environment, as well as product quality characteristics, then it will likely gain a much larger competitive advantage than that conferred by its cost advantage.

Prospects for Hog Production and Processing in Canada

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Prospects for Hog Production and Processing in Canada

1.0. Introduction

Much has been said and written about the prospects for the hog/pork complex in Canada over the past couple of years, especially Western Canada because of the removal of the grain transportation subsidy in 1995. Lately, there has been increasing discussion about the possibility that some pork exporting countries such as Holland, Denmark and Taiwan are at or near their capacity to export. At the same time, discussion has begun to surface about the potential cost competitiveness of countries in southern South America. These discussions are all in the context that import barriers for pork are declining because of the WTO agreement in 1995.

This changing situation raises a number of questions that are relevant to this report. What are the likely market prospects for pork in the world market? What is the situation in competitor countries? How do the various regions of Canada stack up in terms of production cost against each other, against the US and other competitor countries? What are the implications for Canada's competitiveness of the changes that are occurring and are likely to occur in pork processing?

The report's general objective is to assess Canada's potential competitiveness in the future. Its specific objectives are:

- 1. To assess the international market potential for pork
- 2. To compare production costs for pork in Canada to other countries
- 3. To assess the potential effects of the changing structure of Canada's pork processing industry on the relative competitiveness of the pork industry
- 4. To address the potential impacts on Canada's competitiveness of issues such as environment and food safety.

Assessment of market potential begins in section 2.0 by examining the domestic market and Asian import trends for pork. Underlying the trends are the major factors affecting them - changes in trade policies and economic growth in the importing countries. These are also examined for selected countries. The section then turns to an assessment of trends in competitor countries, and ends with an analysis of production trends in Canada and the US.

The assessment of competitiveness continues in section 3.0 with the comparison of costs in various countries or regions of potential production costs based on budgets for standardized production systems.

Section 4.0 brings together the factors from the previous two with additional information about actual

and potential competitiveness of the processing industry to assess the overall competitiveness of the Canadian pork industry.

2.0. Assessing Market Potential¹

The first task of this study is to assess the potential market for pork. We begin with a brief analysis of the domestic market. Then the Asian market and some of its determinants are addressed. Finally, the competitiveness of competing countries is analysed.

2.1. The Domestic Market

Figure 2.1 contains annual per capita domestic disappearance of pork and retail prices of pork in Canada over the past 15 years². By linking the related sets of points, one gets a rough representation of the demand relationships in the 1980's and 1990's. It is clear that, on a per capita basis, demand declined despite considerable growth in real per capita income. This is based on the fact that the line representing the 1990's is inside the one representing the 1980's. In economic terms this means that in the 1990's the only way to induce consumers to purchase a given quantity of pork was to offer it at a lower real price than in the 1980's. Another way to look at the relationship is that the average consumer was willing to buy less at a given price in the 1990's than in the 1980's, the industry must accept lower prices. In turn, this translates to continuous pressure on all parts of the industry to reduce costs.

¹Parts of this section draw on an earlier report done for the Royal Bank, <u>Assessing the Risk of Expanding</u> the Canadian Hog Industry, June 1997.

² Per capita consumption in 1998 is an estimation based on USDA information on domestic pork consumption in Canada (carcass weight) and the historical relationship between this number and per capita consumption (retail weight) reported by Statistics Canada.





Another clear implication of the demand information is that the only source of growth in domestic demand has been population growth. If we had a similar set of data for fresh vegetables, chicken or pasta, we would likely see that the demand line shifted **outward** from the 1980's to the 1990's. This means that demand for these products grew because of population **and** because preferences changed to favour pasta and vegetables: as the average consumer had more income she/he was willing to pay more of it to buy fresh vegetables and pasta. This made it much easier to expand domestic markets for these products.

The business literature often refers to products with demand like that of pork as a "mature" market, one that is regarded essentially as a commodity in which there is little growth potential. If this is true then the export market will be the major source of future growth, as will be revealed below. However, there are several examples of mature markets in which someone came along and developed new products or services and/or changed the product's image in ways that caused substantial growth. The bottled water market was considered to be mature with soda water and various upscale products such as Perrier. Then along came Clearly Canadian and changed the rules by putting flavours in attractively designed bottles, followed by a number of companies that added flavours to iced tea. The coffee market was considered mature with ground coffee, grind-your own beans and instant coffee as the base. Then along came Starbucks' introduction of flavoured and fancy coffees in an easy access format. The market has been revolutionized first through food service and now through the second set of products offered through retail chains, airlines, etc.

Despite considerable promotion by producer organizations and others, pork is widely regarded as fat, hard to fit into a modern life style, and utilitarian. As a result of unfavourable press coverage of questionable practices, it is linked negatively by some to poor environmental performance, and is

unpopular with some because it has negative connotations as a red meat. While the chicken and fish industries have benefited from positive press about their "healthfulness" and from some very creative product development, the pork industry has not: think about how many further-processed chicken and fish products are in a Loblaw/Superstore President's Choice display today vs 20 years ago. Then think about the pork section. When/if an entrepreneur develops and markets the right pork products, this so-called mature domestic market may experience a considerable growth spurt.

2.2. Import Patterns in Selected Countries

The export market to Asia shows a very different picture than the domestic market. An important factor for the pork industry is the implementation of the 1995 WTO agreement which reduces tariff and other non-tariff barriers quite significantly. With the exception of Japan, Asian tariffs for pork are set to decline by 30 to 60 percent during the agreement's phase-in period, which continues into the next century³. This will provide significantly more market access than exporting nations enjoyed in the past⁴.

The effects of these changes in market access are already becoming evident. Figure 2.2 contains the imports of pork by selected countries over the past 20 years. Focussing on the data for the Phillippines and Korea, one can see a very significant increase in imports during 1995 and 1996. These increases are consistent with the phase-in of the WTO in 1995. However the past two years registered a sharp decline in Asian imports as a result of the recent economic crisis in that area of the world.

³See Appendix Table 2.1 for details.

⁴While Japan's tariffs in Appendix Table 2.1 appear to be relatively small both before and after the phasein period, its non-tariff barriers are far more significant. Essentially, Japan creates an extremely high internal reference price and the tariffs only apply to product whose landed value is at or above the reference price. If it is below, then there is levy equal to the difference between the landed price and the reference price. It is always significantly below. Therefore, it is a more significant barrier than the tariff. Japan is lowering the internal reference price quite significantly and some traders believe this reference reduction could be speeded up.



Figure 2.2 Pork Imports in Selected Asian Countries ('000 tonnes)

Total Asian imports (Figure 2.3) show the cumulative trend. Note that the rate of increase in imports increased over time until 1997. In fact, imports increased by 50 percent from 1990 to 1996. This reflects globalization, the lowering of border protection and the fact that many Asian countries had rapid real income growth over the past few years, spurring demand for favoured products such as pork. The decline in 1997 reflects a disease problem in Taiwan and the economic problems suffered by some Asian countries during the second half of the year. The observation for 1999 is USDA's forecast, which is up significantly.⁵

⁵ It should be noted that, during the Asian economic crisis, USDA forecasts have been somewhat optimistic and the agency found it necessary to reduce them as each of the past two years unfolded. This may occur again in 1999, but the forecast growth in imports is less optimistic than the past two years, and early signs are that economic conditions are improving.

Figure 2.3 Asia Pork Imports



Appendix Table 2.2 contains data on real incomes in various Asian countries. They show that growth has been very rapid and has contributed to marked increases in domestic demand in these countries. Obviously, recent problems in Asia put these import growth rates in question for the short-term, but the underlying trends are extremely strong. Japan is the major importer of pork. In 1996 Japan represented 44 percent of world pork imports (excluding intra-European Union trade). However, in 1998 this share went down to 36 percent. The question is whether Japan will maintain this position given the Asian financial crisis. The IMF projections of GDP growth rates seem to be optimistic for Japan in 1999 (the projected rate for 1999 is 0.5 percent⁶). What is important is that this rate is no longer negative and this is an improvement from the performance in 1998. We cross checked these rates with USDA forecasts. The USDA forecast of Japan's real GDP growth rate is higher than the IMF forecast (1.5 percent). If these forecasts are accurate, it should bode well for North American exports of pork and other food products.

In addition, tariffs and non-tariff barriers will continue to decline. From an inflation and economic stimulus perspective, removing trade barriers is a positive factor for an importing nation; prices then fall within the importing country and there is a positive income effect because consumers have more money to spend on other products.

Combining these factors on the demand side with the fact that many Asian countries have a relative shortage of natural resources means that import demand is growing rapidly and will likely continue in the future. When Asian imports are shown as a percentage of world imports (Figure 2.4) one can see Asia's growing importance. Again, 1999 numbers are USDA projections. According to these projections, Asian pork imports in 1999 will recover the share of world imports lost as a result of the

⁶ Source: "Agricultural Outlook", Economic Research Service/USDA, September 1998.

recent crisis.



Figure 2.4 Asian Pork Imports as Percent of World Imports

Russia is another important pork importing country. As shown in Figure 2.5, in 1995 Russian imports represented 9 percent of total world imports with 454 thousand tonnes. However, Russian imports are unstable, and since 1995 they have been declining. In 1998 Russian imports declined by 23 percent compared to 1997 and the USDA projections for 1999 indicate that further decline of Russian pork imports is expected.





It is of interest to consider the rate at which imports might grow in the future. Figure 2.6 contains historic world import levels and projections into the next decade assuming three levels of growth. The three growth rates were determined from data on Asian and world import demand. We estimated trend lines for the Asian and world import series starting with 1980 through 1998, then 1985 through 1998 and finally 1990 through 1998. We then calculated the growth rates of each trend and selected a low, medium and high growth rate from the set. These growth rates were then applied to the 1998 world import levels and compounded until the end of the projection period.

The results are shown in Figure 2.6 and Appendix Table 2.3. At the lowest rate of growth, imports project to 7 percent more in 2005 than in 1998, while at the highest level they project to a 61 percent increase.



Figure 2.6 World Import Projections

2.3. Assessing the Competitors

In this section, an overview and assessment of the competitor countries is undertaken. Following it is an analysis of production trends in the US and Canada.

2.3.1. The Pork Industry in Denmark and the Netherlands

The Danish pork industry is one of the most successful in the world. Almost 80 percent of Danish pork production is exported - mainly to other countries in the EU. The number of hog farms declined about 70 percent during the past two decades, while the number of pigs on farms increased about 12 percent.

According to Agriculture and Agrifood Canada⁷, Denmark has no natural advantage in hog and pork production. It has a significant cost disadvantage because of: scarcity of land and high land prices, environmental regulations related to manure disposal, high wage rates, the high feed costs characteristic of the EU, and relatively long distances from the emerging markets in East Asia.

However, these disadvantages have not impeded Denmark from exporting most of its pork production. The strategy of the Danish hog and pork industry is to focus on product competitiveness. One of its main strengths is the vertical coordination of its industry, through its cooperative structure which enables efficient transmission of market signals from consumers to farmers through identity preservation. Also, Denmark focusses on training and has a highly trained agricultural and processing work force.

In spite of Denmark's past success, it is reaching the environmental limits of its ability to produce hogs because of its limited land base and high production density. As a result pork production in Denmark flattened between 1992 and 1996 (Figure 2.7). During 1997 and 1998 Danish pork production increased at a moderate rate and the projection for 1999 at a similar growth rate.



Figure 2.7 Pork Production in Denmark and the Netherlands

Holland's pork industry developed rapidly between 1970 and 1990. Similar to Denmark, but even smaller geographically, Holland is also undergoing concentration of its hog farms. The number declined by about 45 percent during the past two decades, while the average pigs per farm increased

⁷"The hog and pork industries of Denmark and the Netherlands" Agriculture and Agrifood Canada, 1997.

by 34 percent. Most of Holland's pork production (75 percent) is exported, mainly to other EU countries (95 percent of exports). Recently, the Dutch industry suffered a major outbreak of Swine Fever that caused it in 1997 to markedly reduce the size of its swine herd. However, as shown in Figure 2.6 pork production in the Netherlands recovered in 1998, and USDA projections for 1999 are even more optimistic.

Agriculture and Agrifood Canada also indicates that the Netherlands has no natural advantage in pork production. As with Denmark, the main cost disadvantages are land scarcity, high land prices, environmental problems and the resulting environmental regulations governing manure disposal, and high wage rates. However, the Netherlands' strengths are location, transportation infrastructure, production oriented research, vertical coordination, and access to protected EU markets.

2.3.2. <u>The Pork Industry in Latin America</u>

Latin America is the new kid on the block in pork production. However, Brazil's production is growing, Argentina may soon see major investment and investment is occurring in Chile. The following gives some perspective to the industries in these three countries.

Brazil has the fourth largest swine herd in the world and is the sixth largest exporter of pork. Currently, most hog production is in the Southern states of Rio Grande Do Sul and Santa Catarina. Most new investment in this region is being made in state of the art technology and design.

New investment is also occurring in the Central-West region, close to surplus grain and oilseed production. The western states provide financial incentives to pork processors, through rebates and preferential tax structures. The effectiveness of these policies will depend on how well the Brazilian government can control inflation and bring interest rates to attractive levels.

Argentina's swine herd was estimated at 5 million head in 1993 and about 21 percent of domestic corn consumption is for swine. While expansion would seem appealing, the fiscal situation and inflation have been a drag on investment. Further long-term growth in hog production will need to be financed either by domestic or foreign firms who will likely do so only if there is a stable investment climate. The recent decline in inflation has brought discussion that Spanish investors may build a new processing plant and expand hog production to service the specific needs of the Spanish market.

In Chile, Super Pollo, a major poultry company, is investing in world class hog production facilities. The firm is investing in state of the art housing and equipment, contracts with North American specialists in feed and genetics, and is rumoured to be looking for managers in the US and Canada. However, long-term cost competitiveness of the industry may be limited by the small amount of grain grown in the country, a very limited land base and environmental sensitivity.

2.3.3. <u>The Pork Industry in China</u>

China is the world's largest producer of hogs/pork accounting for 53 percent of world pork production in 1998. No country in the world can produce all the meat China requires. With 22 percent of the world's population, but only 7 percent of the world's arable land, China has a huge challenge to feed its growing population. Currently, the seventh largest economy in the world in GDP terms, China is emerging as the economic motor of Asia Pacific. It is predicted by some to become the world's largest economic centre by the Year 2020.

Over the next 5-10 years, Chinese pork imports are estimated to increase at an average annual rate of over 10 to 20 percent. Imports of meat have been restricted, but are being slowly liberalized. China reduced import tariffs on agricultural products last October. The tariff reduction for pork was quite substantial; frozen/fresh/chilled pork and offal decreased from 45 percent to 20 percent, processed pork products decreased to 30 percent from 55 percent.

One of the most significant issues that will affect China during the coming years is whether membership in the World Trade Organization is accepted. China's application to join has had little success although some progress has been made. As soon as membership becomes effective, the liberalization of import regimes will increase imports dramatically and create an enormous impact in meat trading opportunities. Canadian pork exports have increased substantially from \$7.9 million in 1994 to \$31 million in 1997. However, estimates of Canadian pork exports to China in 1998 show a decline of 9.5 percent from 1997. Pork consumption in China has increased by 12 million tonnes from 1994 to 1998 as urban Chinese are becoming richer and eating more meat.

2.4. Trends in North American Production

There have been significant structural changes in the Canadian hog industry over the past few years. Figure 2.7 contains the total annual production of hogs in Canada since 1987. It is presented in two levels; domestic slaughter and exports of live hogs. Especially in the past three years, exports to the U.S. of hogs for both slaughter and for finishing have increased very rapidly from Alberta, Manitoba and Ontario. The slaughter portion of Figure 2.8 can be thought of as those hogs that were born, finished and processed in Canada. The remainder are those that were born in Canada and either exported for finishing or exported for processing.



Figure 2.8Total Canadian Hog Production (1980-1998)

To further understand the structure of the industry, Figure 2.9 contains regional production in western Canada, Quebec and Ontario. The figure shows evidence of the structural changes that are occurring. As one can see, Ontario's production declined from 1986/7 until 1997before recovering in 1998. Quebec's production increased moderately and Western Canada's increased quite substantially. The reasons for these changes in market share are discussed below.



Figure 2.9 Canadian Hog Production by Region (1987-1998*)

Quebec's hog production has been increasing for a number of reasons. The most important is that there are limited investment opportunities in agriculture outside the hog industry in Quebec. The climate is too inhospitable for expanded soybean production, as is occurring in Ontario; short season varieties are still too long for the number of heat units available in many parts of Quebec. Supply management programs in dairy, in which Quebec likely has a natural advantage, and in poultry limit growth for those industries. Therefore, hog production has been the only source of growth for primary producers as well as the processing and feed companies in that province.

Many people perceive that a second reason for Quebec's steady growth is its provincial support program, known as ASRA. ASRA has made substantial contributions to cash flow for hog producers because of the level of its financial support. People we talked to for this project indicate that the level of support reached as high as \$24 per hog during a recent year of depressed operating margins. However, the level was reduced to \$2 per hog in 1996, and indications are that the program will be phased out shortly. Therefore, it should not have the same effect in the future as it had in the past. Experience during the low price period in 1998, however, suggests that significant government support remains committed to the hog industry.

The third factor that contributes to the industry's growth is that it organizes itself in an efficient supply chain within which all parties have cooperated, as much as possible, to ensure that each is viable. One aspect of this is that packers have been able to operate their plants with a degree of assurance about capacity utilization, with no competition from packers in Ontario or the United States for Quebec hogs. Estimates in 1997 by people who work in the industry in Quebec were that this results in at least \$3 per hog additional revenue relative to Ontario.

The trend in Ontario production and market share was downward until 1998. Again, several factors have contributed to the downward trend. Perhaps one of the most important is that the Ontario industry has been moving through a period of capital replacement. Much of the industry's capital base, as late as 1994, was made up of hog barns built during the late 1970's. These barns were becoming tired and technologically antiquated, as well as depreciated. During the past few years, there has been considerable investment in new capital, much of it the type that fits into loops and networks, consistent with multi-site production. However, it would appear that many of the new barns were built to replace old barns that were being withdrawn from production. The net effect was little net growth in hog production. However, it is clear that this situation turned around in 1998.

A second factor is that Ontario farmers have a number of opportunity costs. Much of the hog industry is based on land that can grow corn and soybeans. Soybean prices have been extremely high during the past several years, especially for farmers who are able to produce soybeans for human consumption. The investment and risk in growing soybeans relative to the investment in producing corn and hogs is small. The net effect has been to draw acreage out of corn production for hog feed and into soybean production. Recent price movements in the oilseed complex made soybeans less attractive and resources were invested in other areas, including hog production.

Western Canada's trend is notably different from the others for two reasons. First, the Western Grain Transportation subsidy ended effective August 1, 1995. This resulted in an increase of the highest transport rate off the prairies to \$40 per tonne (in 1997) in western Manitoba compared to a previous peak rate of \$15 per tonne in eastern Saskatchewan. This in turn results in lower feedgrain prices and lower hog production costs in the prairie region.

The second reason for the change is a changed attitude in western Canada toward value-adding and, especially, toward the export market. Removal of the grain transportation subsidy and substantial curtailment of other grain subsidies has given farmers the clear signal that there is a high payoff from farming the market. This attitude has shifted, therefore, from being essentially a wheat/barley production culture to one that responds to the most profitable alternatives. This has carried over into attempts to do value-adding in its broadest sense including hog production.

The intent of the foregoing is to indicate that the expansion in western Canada is fuelled both by real economic change in the form of the removal of the grain transportation subsidy, but also by a change in perceptions and attitudes about the appropriate incentives and how to respond to them. This fundamental change in structure appears to be permanent. The consequence is that investment decisions are being made that will move western Canada toward a much more intensive agriculture, including ongoing expansion in the pork industry.

This structural change in hog production has led to structural change in exports. Figure 2.10 shows Canada's exports of pork. They follow a pattern similar to the overall trend in production with a flattening off in the early 1990's and growth between 1995 and 1997. Last year's decline in Canadian pork exports seems to be related to the Asian crisis as well as the increase in the volume of production in the US which represent more than 50 percent of Canadian pork exports. During this decade, exports of live hogs increased (Figure 2.11 which is again made up of both hogs exported

as market hogs or as weanling pigs).



Figure 2.10Canadian Pork Exports (1980-1998)

Figure 2.11 Total Canadian Exports of Live Hogs



Increased exports of live animals point to the question of the competitiveness of the packing industry which will be addressed in Section 4.0. For the present, however, it is important to establish that growth in hog production has provided an increased pool of hogs for potential pork exports. By adding together exports of live hogs and exports of pork, we can establish the size of that pool and can use the export data to make projections at the end of this section.

To do so (Figure 2.12), we make the following assumptions to convert live hog exports to pork exports. First, assume live hogs are marketed at a weight of 235 lb⁸. Second, assume that the conversion factor from live hogs to product weight (ie., carcasses that are broken into sub-primal cuts but not deboned) is 57 percent. With these assumptions, we can add together the potential pork from live hogs that were exported to the United States, with the actual pork that was exported.

The pattern of U.S. hog slaughter (Figure 2.13) contrasts, especially during 1996 and 1997, with Canada's. This is especially notable because an increasing share of U.S. slaughter is from exports of Canadian live hogs. When Canadian-origin hogs are deducted from U.S. slaughter, U.S. slaughter actually fell by about 6 percent in 1996 from 1995. Comparing this to, especially the western Canadian pattern, underlines the structural change that is taking place in western Canada. This is the only time in this century that western Canada increased its hog production when U.S. production in these circumstances and reduced hog production.



Figure 2.12 Total Canadian Exports of Pork and Hogs as Pork (1980-1998)

⁸As indicated, live hog exports include weanlings as well as market hogs. The point of the exercise here is to estimate the potential amount of pork that could have been produced in Canada (the pool mentioned above) that is available for domestic consumption and/or export. In other words, this is a representation of the amount of pork that could have been produced in Canada if all the hogs born here were raised and slaughtered here.

Figure 2.13 US Hog Slaughter (1980-1998)



The U.S. appears to be continuing its consistent 3 1/2 to 4 year hog cycle. However, within this ongoing cyclical structure, structural changes are occurring. These changes have resulted in more hogs being produced in capital intensive operations and in former fringe areas: Virginia, North Carolina, Texas, Oklahoma, Colorado and Utah, while traditional concentrations of production in Iowa, Illinois and Ohio have declined. This is in part because the mid-west has alternatives, such as soybeans, as is the case for Ontario. On the other hand, the fringe areas have fewer alternatives, integrators are able to focus on quality control, some have relatively low labour costs, some have few environmental restrictions. Labour costs may or may not continue to be an advantage in some of the fringe areas, but it is becoming clear that environment is an issue with which hog industries everywhere need to come to grips.

2.5. Canada's Contribution to Market Risk

Adding Canada's live hog exports to its domestic slaughter gives a sense of Canada's share of North American production. This represents an important fact in putting the Canadian hog industry into an appropriate perspective to analyse market risk. For example, a 20 percent increase in the number of hogs produced in Canada for a given year would represent only a 3.6 percent increase in North American production. Before going further, it is important to put a 20 percent increase into perspective. Since most of the hog expansion is occurring in Western Canada, and Western Canada represents about 45 percent of total Canadian production, a 20 percent Canadian increase is equivalent to a 44 percent increase in the West. On a sustained basis, this rate of expansion means that Western Canada would double its output every two years and two months. This is a rate that is unlikely to occur.

To turn to the estimation of price effects, most estimates of demand for pork suggest that the price elasticity of demand is between -0.5 and -1.0. This means that a 20 percent increase in Canadian hog production would lower North American prices by between 3.6 percent and 7.2 percent if all of the additional pork was sold in the North American market. Thus, if hog prices were at \$180/ckg, the maximum effect of a 20 percent per year increase in Canadian production would be to reduce them to around \$168/ckg. This is not an effect that should threaten the economic viability of efficient hog producers.

Even that level of price depression would result only if all the additional pork stayed in North America. As shown above, this is far from the case because of the growing importance of the off-shore export market. Therefore, it is easy to conclude that a substantial increase in Canadian production by itself would have little impact on hog prices.

This, of course, takes into account only one small factor - Canadian production - that can affect hog prices. As the past few months have shown, many other factors affect prices, not the least of which is the level of US production, demand in Asia and demand in North America. In fact, all of these factors may affect prices more than Canadian production. Witness the effect of the expansion in US production of over 8% in 1998. This represents almost 10 million hogs, or about 1.85 billion lbs of pork on a carcass basis. It is a major factor that drove down North American hog prices. It and the reduction in Asian imports are the major sources of risk in this industry. Moreover, this analysis treats the market as a "commodity" market and does not take into account the possibility of product differentiation based on quality, service or consistency characteristics. If it is possible to differentiate Canadian product, then the effects of additional Canadian supply on prices will be even less than are estimated here.

3.0. Comparing Costs of Producing Hogs

The previous section showed that there is a growing export demand for pork, that Canada, at least at the farm production level, has had some of the fastest production growth in recent years and that some competitor countries have had increasing problems maintaining their competitiveness. Will Canada continue to be competitive in the future? In this section, this question is addressed from a production cost perspective, by comparing costs in Holland, Denmark, Chile, Argentina, the US, and Canada. This comparison is based on standardized budgets for specific production systems, not on costs from a sample of farms⁹. The intent is not to develop an investment prospectus but rather to show systemic cost differences across regions.

This approach and its assumptions has a number of implications for the results which should be clearly understood by the reader:

1. The assumptions about the performance of the various production systems drive the results on relative total costs of production among the systems. Thus because we assume that larger operations are able to wean more pigs per sow per year, this contributes to a lower cost for larger systems. Whether, in reality, larger operations have better weaning performance is a matter that needs to be investigated..

2. What makes the difference in costs across countries and regions is their relative factor prices. In other words, since we assume that the same production system is used in each jurisdiction, differences in prices of feed, labour, capital and building materials are what cause one jurisdiction's costs to be different from another's. What the standardized production models do for the analysis is to provide a method of weighting factor prices in ways that make them germane to hog production.

3. Only major categories of cost are included. The categories include: labour, capital, buildings and feed. A number of costs such as marketing, manure disposal, veterinary and medical costs, which are unique (often within the control of the manager) to the individual farm, are not included. Therefore, the totals are less than for actual operations. This is because our primary focus is on the factors that make regions different. If one is considering investing in the industry in a specific region, the other costs need to be investigated. A particularly complex issue is environmental management, which is addressed in the next section.

The cost analysis begins below with a description of the production systems that formed its basis.

⁹The budgets are based on work done by Hurt, Boehlje and Hale at Purdue University

3.1. Production Systems

As indicated above, the same production systems are assumed to be implemented in all countries in this study, namely: three site farrow to finish (TSFF) operations for operations of 600 sows or more. A 180 sow farrow to finish operation with a single site is also included. Defining a standard set of productions processes was considered important in order to make the data comparable across jurisdictions. The system is varied using five different sizes of operation: 180 Sow, 600 Sow, 1200 Sow, and 3000 Sow. Details on the characteristic of the production system and on the technical coefficients related to herd composition and productivity, are based on the studies by Hurt, Boehlje and Hale, and Hurt and Zering published by the Purdue Cooperative Extension Service in 1995.

The operations are designed as high investment, totally confined farrow-to-finish swine units. General technologies include:

- all-in/all-out production
- less than 21 day weaning with two week age variation
- split-sex and phase feeding
- physical separation of pigs by room and age group and separation by building phase for greater bio-security
- high quality genetics, and
- artificial insemination

Appendix 3 details the assumptions and data used, as well as the results of the cost analysis.

3.2. Cost Comparisons

In this section, interregional comparisons are made of total cost and its various components on a per market hog basis . Again, we point out that the "total" is the total of the components included. They do not include marketing costs, veterinary and medicine or manure disposal cost. All of these are largely unique to the farm operation and not to the jurisdiction. Manure disposal is sometimes seen as a cost and sometimes as a return depending upon the situation. While more will be said about this in section 4.0, the most important point is that operations that are set up in a sustainable fashion (where the operation produces enough feed for the hogs to produce enough manure to provide nutrients for the feed) would likely see manure as a valuable asset. Those that are not set up this way likely see manure disposal as a cost. Again, this is a local issue, not one of jurisdiction.

In order to avoid political boundaries, where possible economic regions form the basis for the comparisons. Thus for Western Canada and the US, costs are reported on a regional basis that make sense from an economic (climate, grain price) perspective. For Eastern Canada, costs are calculated for Ontario, Quebec and the Atlantic provinces because political boundaries are roughly consistent with economic differences.

3.2.1. Comparing Labour Costs

As indicated in the appendix, the assumptions about labour employed by each size of production unit has a major impact on unit (ie. per market hog) labour costs (Appendix Table 3.17 and Figure 3.1).

In general, the larger the size of operation the lower the labour cost. This is a result of the assumed improvement in labour productivity in the model operations. The largest operation employs 11 people compared to 1.5 for the smallest, a ratio of about 7.5:1, while the number of market hogs produced by the largest operation is more than 20 greater than the smallest. In general, the estimated labour cost per market hog of the smallest operation is between three and four times greater than the largest operation.



Figure 3.1 Labour Costs

Wage costs clearly make a difference. As expected, the European countries have the highest labour costs. In fact, European labour costs are about twice those of North America, and North American costs are about twice those for South America. Within North America, labour costs in the Maritimes are estimated to be the lowest, while the Western Prairies and the Western States are the highest.

3.2.2. Comparing Feed Costs

Feed costs per hog are not highly correlated to the size of operation. However, they are highly correlated with feed prices. Western Canada enjoys a very significant advantage in feed costs over all the competitor regions. This is consistent with the argument that removing Canada's former Western Grain Transportation subsidy conferred a significant livestock cost advantage for the Prairie provinces. Ontario, Argentina and the US Western Corn Belt are next at \$15-20/hog higher cost. It is interesting to note that, while feed costs in Quebec and the Maritimes are higher than the Prairies, Ontario and the US corn belt, they compare quite favourably to the US Southeast and the Mountain

states. Denmark and Netherlands have the highest feed cost per pig. This is, of course a result of the European Union's Common Agricultural Policy, which results in artificially high feed prices within the EU.

Finally, it is of note that because of Chile's relatively high feed prices, it loses the advantage of low labour costs, mentioned above.





3.2.3. Depreciation and Interest Costs

Depreciation costs include both facilities and equipment. Construction costs (and, therefore, depreciation) are very similar in each of the Canadian regions, somewhat lower (but similar across regions) in the US, a little higher in South America, and much higher in Holland and Denmark (Appendix Table 3.19 and Figure 3.3).





After addressing depreciation costs, it is interesting to see the pattern of interest costs. Several things are apparent (Appendix Table 3.20 and Figure 3.4). First, interest costs are highest in Argentina, followed by the two European countries. This is not surprising given the interest rates used in the analysis. As a result, the advantage Argentina enjoyed in labour costs is substantially over-shadowed by interest costs. This is at least partially reflective of the risk inherent in investing in what has been an unstable economy. Second, much of the difference that occurred in depreciation between the US and Canada is made up in interest cost; Canada's lower interest rate largely offsets its slightly higher building costs. Fundamentally, there is not much difference in interest costs in North America because of this.



Figure 3.4 Interest Costs

3.2.4. Comparing Total Costs

Appendix Table 3.15 and Figure 3.5 contain estimated total costs per market hog for each jurisdiction. Note again that "totals" are for only the categories of cost that are included in the analysis. They do not include marketing expenses, breeding stock, veterinary and medical costs, or manure disposal.



Figure 3.5 Total Costs per Market Hog

When all the costs are totalled, there is a clear cost advantage for the Canadian Prairies. As we

have seen, this is mainly because of Western Canada's advantage in feedgrain prices. Ontario and the US Corn Belt are next lowest, followed by the "new" production areas in the US, the Maritimes and Argentina.

It is interesting to note that much of the current US expansion of hog production is in the Mountain states and recently was in the South East. According to our analysis, neither has a particular cost advantage in hog production. This underlines the suspicion of many people that the main attraction of these areas is space and lax environmental controls. But the experience to date in North Carolina, growing concerns everywhere about the environmental impacts of hog production, and growing concerns about food safety suggest quite strongly the folly of producing a product where it should not be produced.

On the other hand, the major reason for Argentina's ranking in these estimates is its high cost of capital. If it can continue to manage its economy with stability so its interest rates fall, it can be a force to reckon with in the future. Unfortunately, we were unable to obtain comparable costs for Brazil for this study. However, from the information we were able to obtain, it would appear that Brazil is currently a lower cost producer than Argentina. Expansion in the Central-West part of the country will likely bring costs there even lower, but not as low as the Canadian Prairies.

An issue with which the Canadian industry needs to come to grips is the size of its hogs. For reasons that no one seems to be able to explain, the Canadian grading system discounts heavy carcasses and Canadian carcasses average about 8 kg less than US carcasses. This means that the fixed costs of sow feed, capital, and labour, are spread over fewer kilograms of production in Canada than in the US. To this point, we have calculated costs per market hog. In Appendix Table 3.16 and Figure 3.6, total costs are reported again, but per 100 kg of live weight. The Purdue models are structured on the assumption that hogs are marketed at 245lbs live weight. This was used to convert costs in every jurisdiction except Canada. For the Canadian regions, we assumed hogs are marketed at 235 lb., and this is used to convert the unit cost. This assumption is **very** conservative; the difference in average live weights is more than 20 lb per hog. However, the budgets are based on fairly strict assumptions and it was felt that they should not be "pushed" too hard in going outside their base parameters.



Figure 3.6 Total Costs per 100 kg Live Weight

Even with this conservative assumption, there is a difference of about \$5 per 100 kg of live hog. The best way to see the difference this makes is to compare the Maritimes, the US South East and US Mountain States in Figures 3.5 and 3.6. In Figure 3.5, the Maritimes' cost is lower than the Mountain states and about the same as the South East on a per hog basis. But when costs are expressed on the basis of weight, then the Mountain states are about the same as the Maritimes and the South East is quite a bit lower. Realistically, the difference is higher and, when added to the higher cost of processing in Canadian packing plants because there are fewer kilograms over which to spread the fixed costs of processing, it would appear that this historical aberration results in a substantial dilution of Canada's cost advantages.

4.0. Additional Considerations and Conclusions

The foregoing sections identified that there is strong potential for growth in export demand for pork and that Canada is well positioned to take advantage of it because Canada's hog production costs are favourable. But there are two additional factors that will affect the competitiveness of Canada's pork industry. One is the competitiveness of the processing industry: the second major component of the hog/pork complex has major implications for overall cost competitiveness as does farm production. The second factor has been alluded to several to at several points in the study - that is the relationship among hog production, pork processing, environmental protection, and food safety. Both of these factors will be vitally important in the future and both deserve separate attention in this study.

4.1. Competitiveness of the Processing Industry

In a recent George Morris Centre publication, the cost competitiveness of the Canadian pork processing industry was analysed and found to be lacking. Table 4.1 is the summary table from that analysis. To explain it, four factors were analysed to estimate their effects on the manufacturing cost (cost not including the cost of hogs): plant size; number of shifts; wage costs and size of carcass. The numbers in the table show the effect of each factor relative to the manufacturing cost of a plant with capacity of 20,000 per week, working one shift with estimated Canadian wage costs and Canadian carcass weights. The last column of the table can be interpreted as follows:

- increasing scale from 20,000 to 45,000 per week per shift would reduce manufacturing cost by \$8.74/100 kg of carcass.
- moving from one to two shifts would reduce cost by an additional \$3.57/100 kg.
- reducing wage costs to the level estimated for the US would reduce manufacturing costs by an additional \$7.26/100 kg.
- increasing the average size of hog carcass in Canada to the same as the US would reduce cost by an additional \$2.91/kg.

	Cost Savings (Increases) from Base /100 kg				
Factor	20,000/wk	30,000/wk	45,000/wk		
Plant Size		\$7.50	\$8.74		
Two Shifts	\$6.14	\$4.55	\$3.57		
40 % Wage Cost	\$8.10	\$6.90	\$7.26		
Size of Carcass	\$3.74	\$3.06	\$2.91		

Table 4.1. Effects on Total Manufacturing Costs of Several Differences in Structure

The largest Canadian processing plant at the time the report was written was 32,000 per week on a single shift and most were closer to 20,000. However, a number of changes in the structure of the industry have been announced since. New or expanded plants that will eventually have scale approaching 45,000 per week and/or operate on two shifts have been announced for Lethbridge and Moose Jaw. Intercontinental Packers announced a significant expansion of their plant in Saskatoon to move to efficient scale. Fletchers in Red Deer are in the midst of a multi-million dollar expansion that will move it to world standard capacity, and has already moved to a double shift. Maple Leaf Foods announced a new plant to be built in Brandon, and a prospective \$30 million investment in their Burlington plant to move it to second shift capacity.

If all or most of these investments are completed, the Canadian industry will be much stronger and

more efficient than it was in the past and should be competitive with the US industry. This will depend in part on the final outcome of the dispute between Maple Leaf and the UFCW on their labour contract. However, there should be no question that the injection of capital and capacity represented by these developments should reduce manufacturing costs per unit of pork and if better labour contracts can be developed, this will have a similar effect. If Canadian processors have lower manufacturing costs, it follows that they will be able to bid more effectively against their US competitors for hogs that would otherwise have been sold to the US. Alternatively, lower processing costs in Canada will assist in making the sector more cost competitive.

There is no information on the processing industry in South America, but it is clearly not as industrialized as North America's. It will have a labour cost advantage, but as we saw in the previous section, it has a disadvantage in the cost of capital.

There is to date no publically available analysis of processing costs in Europe. However, it is generally known that European plants have lower capacity and slower line speeds than North American plants. Conversations with US researchers who are investigating European processing cost comparisons indicate that European processing costs are significantly higher than those in North America.

This then suggests that both the cost of raising hogs and processing them is much higher in Europe than in the Americas. This leads in turn to the question of why Denmark and Holland have been major exporters of pork. The answer is the combination of excellent supply chain management discussed in section 2.0, European protection and export subsidies that simultaneously inflate European feed costs, keep North American product out of the European Union and provide the impetus for European exports to third party countries. This was well documented in a 1995 study by Jensen, Voight and Hayes which estimated that if Denmark's protection was removed, it would be a net **importer** of pork from Canada and the US.

As the world moves toward freer trade, especially with its growing environmental problems, we believe Holland and Denmark will be a declining factor in the world pork market.

4.2. Environmental and Food Safety Issues

Hogs and the environment are an increasingly controversial subject. This results in part from the smell of manure, but more substantively from concerns about manure leeching into ground or surface water systems and affecting the health of humans and other species. At a superficial level environmental concerns should give an added advantage to Western Canada because of the space available in Western Canada. But this begs most of the important issues; even Western Canada has problems with manure disposal and its environmental impacts.

The most basic aspect of this issue, as was mentioned in Section 3.0, is whether hog production can be sustainable. To be sustainable, the industry needs to be land based - ie the manure from the animals is used to provide the nutrients for the land that feeds the animals. From this perspective, any of the Canadian regions can be sustainable because of the amount of land that is available. Western

Canada, for example, has 86 million acres of land available for crops - the total of the area under crops and summer fallow. Only 540 thousand acres are currently being fertilized with hog manure. This gives some idea of the size of the opportunity for sustainable production.

But the processes for doing this right are complex, still under development in most places, and the costs of doing them depend on the individual situation. For example, an extremely large operation located on relatively small acreage faces a high costs of manure storage and disposal because it may need to move it over long distances. A more moderate size operation located on the land used to produce feed could have a low or net negative cost if the manure is used to replace chemical fertilizer. Moreover, as the conflict over environmental issues heats up, there may well be entirely new processes developed (perhaps similar to the HACCP¹⁰ processes now being developed for food safety). These will inevitably be different in different places because different soil and ecological systems present different risks: there is clearly no single set of processes that will ensure minimization of negative effects on the environment. The Canadian industry has the advantage over several existing competitors that it has created few environmental problems to date and can take a leadership position by devising appropriate processes for various soils and eco-systems.

There are similar considerations about the broader issue of human health. As the hog population grows, does the risk of disease that can be transmitted to humans also grow, and how much risk is there that Canada could have a serious outbreak of disease as has occurred in Holland and Taiwan? By definition disease risk grows with the size of population. Moreover, a basic paradox in disease prevention is that the more successful a nation is at eradicating a disease from an animal population, the less resistance the population has if an outbreak of the disease occurs. But all of the animal health professionals we talked to pointed out that the fact that the paradox is relevant is a sign of the success of Canada's disease prevention program. So, the relevant question is, how large is the risk? One answer is that Canadian regulators work to maintain probabilities at less than one in 250 in establishing protocols. There is a clear understanding in Canada about the importance of being free of animal diseases in accessing world markets and in assuring consumer safety. Canada is internationally recognized as a leader in developing and implementing international food safety and animal health standards, devoting substantial resources to monitoring and testing for animal diseases. We also contribute leadership to international bodies which take the lead in attempting to eradicate diseases world wide. This is important because of the growing scope of international trade and the fact that, if a country is free of a disease, usually the only way it can be contracted is to bring it in from elsewhere. So, world wide eradication is in Canada's long term interest. For example, and despite the recent outbreak in Taiwan, Canadian animal health personnel have been working closely with Latin American countries to eradicate Hoof and Mouth, and it has nearly been accomplished in several countries. Similarly, Canada has assisted the US in attempting to eradicate pseudo-rabies, again with growing success.

¹⁰ **Hazard Analysis Critical Control Points** (HACCP) is a performance based production control system used by the food industry. It is a process which identifies where potential contamination can occur (critical control points) and strictly manages and monitors these points to ensure that the process is in control, and that the safest product possible is being produced for the market.

Canada's animal health professionals are extremely competent in preventing the entry of disease. For example, while the US has achieved regional eradication of pseudo-rabies, Canada was extremely cautious in developing a protocol for imports of live slaughter hog. In fact, that protocol, as already indicated, has yet to be acted upon despite very considerable internal and external pressure. Similarly, upon learning that Britain reduced its rendering standards a few years ago, thereby introducing the risk of BSE, Canada immediately tracked down all breeding stock imported from Britain. Along with any progeny, these animals were immediately slaughtered to take away any possibility of introducing BSE into Canadian herds. This was done in spite of very substantial criticism and somewhat negative press coverage at the time. The result is that there is no hint of an outbreak in Canada.

In addition to some of the world's most stringent import regulations in the inspection of animals and meat, Canada has a sophisticated monitoring system through out the country. This incorporates local animal health care providers in monitoring and reporting on heard health as well as mechanisms that utilize rapid reporting of diseases and condemnations by both federal and provincial meat inspectors. In Ontario, for example, part of the weekly responsibility of all regional managers and the provincial administrator in the meat inspection branch is to carefully review all health information for the week. The inspection branch veterinarians are also involved in monitoring information from veterinary practitioners so the branch can quickly relate health problems in meat inspection to those in herds.

Canada has at least two advantages in addition to its management systems that keep disease risk at very low levels. First is the size of the country, which has the advantage that a disease outbreak in one area can be confined to that area and not spread to others. This helps prevent the spread of disease and would allow, in most cases, for regional protocols to be invoked by importing countries in the event of an outbreak. Second, Canada is bordered on three sides by oceans and on the fourth by a nation that has very few disease problems. International trade with other countries enters Canada at a defined set of points that have strong customs processes. This assists in pinpointing and managing the risks. All of the foregoing contrasts to countries such as Holland, Taiwan and even Denmark, which are small with extremely concentrated hog populations and more potential for entry of diseases.

It would be the height of folly to conclude that there is no risk associated with disease in an expanding Canadian hog population. However, by any standards, any foreseeable expansion would leave Canada with much less concentration of population than most other countries and, therefore, proportionately lower risk. Moreover, the system in place and the growing pressure by local communities to assure that the industry conduct itself in an environmentally responsible way can lead only to the conclusion that, while disease is a risk, it is so much less in Canada than in most competitor countries that it probably becomes an opportunity for Canada.

Canada has a real opportunity in this area if some or all of the industry focus on how environment and food safety can be used as the basis for differentiating some of our pork. This likely means that the Canadian industry should consider the development of HACCP programs for food safety and HACCP-like programs for environmental protection. These need to be implemented throughout the supply chain and used in conjunction with Canada's favourable image around the world to command a premium because our pork is produced with the appropriate processes.

4.3. Conclusions

The study began with four objectives around which the evidence and analysis was organized. Conclusions are developed around each of the objectives below.

• To assess the international market potential for pork

The evidence shows that international demand for pork grew very rapidly until 1997, especially in Asia. The past two years have seen a reduction in Asian imports, a fact that is consistent with the economic recession that is taking place there. Indications are that imports will recover with the economy in that part of the world. In fact, the USDA anticipates fairly substantial growth in 1999. The growth trend is expected to continue in the future because of substantial reductions in Asian trade barriers and the limited productive resources which characterize some Asian countries. The fact that the most important growth is in Asia means that Canada has good market access. Moreover, three of Canada's major historic competitors in the export market have recently faced major competitive pressures: Holland and Taiwan because of disease; Holland and Denmark because production growth has not kept up with import demand. In fact, Canada is the only major exporting country which has had steady growth in hog production over the past several years.

• To compare production costs for pork in Canada to other countries

Using standard budgets for three- and single-site hog production facilities, production costs were compared for five regions in Canada, four in the US, Argentina, Chile, Holland and Denmark. All five Canadian regions compared favourably in the cost estimates. But Western Canada shows the lowest overall cost. Its major advantage is in the cost of feedgrains. In fact the advantage conferred by feedgrain prices in the Prairies is quite substantial. A second advantage is Canada's interest rates.

Holland and Denmark are shown to have the highest production costs for hogs, by a substantial margin. Their sources of cost disadvantage are several, including labour, interest, building costs and feed.

South American costs are surprisingly high in the estimates. The South American a countries have an advantage in labour costs. Their feedgrains are priced comparably to Eastern Canada and the US. Building and depreciation costs are somewhat greater, especially in Argentina. The most significant disadvantage is for Argentina whose high rate of inflation has contributed to extremely high interest rates.

The non-traditional US production regions in the southeast and west appear to have few cost

advantages. Feed and labour are higher than the mid-west and remaining costs are comparable. As a result, these regions do not appear to have the competitive advantage that were found for Western Canada.

• To assess the potential effects of the changing structure of Canada's pork processing industry on the relative competitiveness of the pork industry

The past year saw the largest influx of capital into the Canadian pork processing industry in at least recent history. At least five new plants or expansions have been announce or started that will put the industry at a very different level of cost efficiency. As shown in a 1997 George Morris Centre publication, the Canadian industry was at a significant cost disadvantage before these changes. The disadvantages arose from plants with insufficient scale, single shifts, high total labour costs, and smaller Canadian carcasses. The new plants have the potential to remove or reduce the disadvantage from plants, and even to enjoy a cost advantage over US plants. The industry is moving rapidly to reduce the difference in carcass weights.

Along with the already existing advantage Canada enjoys in hog production costs, the structural changes taking place in the processing industry mean that Canada's total costs will become increasingly competitive. This means that Canada has the opportunity to reduce the flow of live hogs moving into the US and increase Canada's share of world pork export markets.

• To address the potential impacts on Canada's competitiveness of issues such as environment and food safety.

Consumers around the world place increasing value on product that is produced with processes that are friendly to the environment and that provide safe food. Canada has several potential advantages in these areas. They include:

- relatively new production facilities that have to date avoided the negative consequences of Europe, Taiwan and the US southeast.
- an extremely large land base that allows outstanding management of production practices and that minimizes the risk of spreading disease or other sources of human health risk.
- geography that contributes to ease of disease protection.
- one of the best disease prevention and monitoring systems in the world.
- industry participants who are already advanced in thinking about development of HACCP and similar processes that can provide the opportunity for differentiating Canadian pork in world markets on its environmental and health characteristics.

To date, all of this is opportunity that has yet to be exploited for Canada. What is required is for concerted efforts by Canadian supply chains to take advantage of the opportunity. But to put Canada in perspective, several of its competitors have clearly pushed their pork industries to or toward apparent limits in environmental and safety terms. The US industry appears to be mainly avoiding the issues by expanding production in areas that are relatively high in cost. South America has the same opportunity as Canada, but is far behind in developing a basic infrastructure.

4.4. Canada's Overall Competitiveness

Putting this information together, it would appear that Canada is on the brink of being one of, if not the most cost competitive pork producers in the world. It already has competitive production costs. It is in the process of enhancing the competitiveness of the processing industry. Some competitors face major problems in maintaining their position. The Canadian industry has the natural and human resources that can provide the means to produce pork safely with environmental responsibility. In fact, if the appropriate processes are developed, it is likely that these factors could be a source of price premium from those target markets which value these characteristics, a part of the market that is growing. In a larger sense, Canada is poised to take advantage of these factors at the very time world demand is growing because of falling trade barriers and rising prosperity in some parts of the world.

However, competitiveness is not just about cost - if so no one would drive a Lexus or Mercedes. So there are some qualifiers that need to be acknowledged in this scenario. Most obvious is the fact that if the Asian economies sustain a prolonged period of recession, the opportunities will be smaller for Canada and its competitors, and it will be difficult for all producing areas to sustain production. This is particularly true because so much capital has been invested in hog production over the past few years. The current capital base is large and very efficient, and was geared for continued growth in the Asian market. If that growth is not sustained, then resources invested in hog production will not likely earn profits based just on domestic demand. While there is little likelihood of a prolonged period of low prices like those of November and December of 1998, neither is there likely to be a prolonged period like 1996/97 unless international markets regain their buoyancy.

Second, clearly Western Canada's advantage results from feedgrain prices, but the magnitude of its cost advantage suggests that the feedgrain market in Western Canada may not arbitrage efficiently. When viewed in the context of the other regions, feedgrain costs appear to be lower than what would be consistent with a market characterized by economic efficiency. If the Canadian feedgrain market becomes more efficient, this advantage may be reduced.

Third, if the Canadian industry fails to undertake the hard work and complexity required to develop HACCP and environmental processes that allow it to differentiate its product in world markets (ie make it a Lexus or Mercedes), then all Canada will have is a cost advantage. If Canada is willing to make the effort to develop identity preserved product that responds to what many customers want with respect to food safety, the natural environment, as well as product quality characteristics, then it will likely gain a much larger competitive advantage than that conferred by its cost advantage.

Appendix to Section 2.0 Asian Market Profile and World Import Trends

	1995	2004	Rate of Reduction
Japan			
fresh and chilled	5.0 %	4.3 %	14 %
frozen	5.0 %	4.3 %	14 %
cured	10.0 %	8.5 %	15 %
Korea			
fresh and chilled	29.6 %	22.5 %	24 %
frozen	37.0 %	25.0 %	32 %
Philippines			
fresh and chilled	100.0 %	40.0 %	60 %
frozen	100.0 %	40.0 %	60 %
Thailand			
all pork	60 %	40 %	33 %

Table 2.1.Changes in Committed Tariff Equivalents for Pork.

Source: GATT/WTO

Table 2.2Real GDP	Rates in J	apan and Korea
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Country	Percentage change from previous period						
Country	1993	1994	1995	1996	1997	1998	
Japan	0.3	0.6	1.5	3.9	0.9	-2.5	
Korea	5.8	8.6	8.9	7.1	5.5	-1.5	

Source: IMF World Economic Outlook, 1998.

Table 2.3Projections of World Pork Imports

	World Pork Import Projections ('000 tons)				
	1%	4%	7%		
1999*	5,303	5,460	5,618		
2000*	5,356	5,678	6,011		
2001*	5,409	5,906	6,431		
2002*	5,463	6,142	6,882		
2003*	5,518	6,387	7,363		
2004*	5,573	6,643	7,879		
2005*	5,629	6,909	8,430		

Source: USDA(1980-1998), George Morris Centre Projections (1999*-2005*)

Appendix to Section 3 (Detailed Cost Calculations)

Herd Assumptions:

		Size of Operations					
	180 Sow	600 Sow	1200 Sow	3000			
Pigs Marketed per Litter	8.51	9.025	9.025	9.2			
Litters / Sow / yr	2.35	2.67	2.66	2.66			
Pigs marketed per Sow	20	24.05	24.04	24.47			
Market pigs	3600	14431	28853	73416			
Sows	197	706	1412	3540			
Boars	10	18	35	71			

Table 3.1.Herd Assumptions

Hurt, et al did not include the 3000 sow operation, so herd assumptions for this size are based on additional calculations using the relevant literature on existing operations of this size, and also details of other sizes given in the Purdue study.

Rations:

The base rations used in each of these operations are taken from the Purdue Study and are given in average form in Table 3.2. These rations are used to calculate feed costs in the US and Eastern Canada. Conversations with people in the hog industry in Latin America confirmed that they represent rations actually fed in that region. Thus they are also used in the Latin American analysis.

Feed type	Unit	Size of Operation			
		180 Sow	600 Sow	1200 Sow	3000 Sow
Corn	bu / litter	95.4	95.18	95.18	95.18
Soybean Meal	ton / litter	0.73	0.72	0.72	0.72
Other Feed	cwt. / litter	2.51	2.5	2.5	2.5

 Table 3.2.
 Rations Used in the US and Eastern Canada

Rations in Europe present a particular problem because of what is fed. As a result of the Common Agricultural Policy (CAP), grain and soybean price relationships within the EU are distorted.. Farmers in these countries rarely use grains in their feed. Rather, they use commercial feed mixes that contain high levels of products such as tapioca. Ration contents change from time to time as relative

ingredient prices change. It is not relevant, therefore, in this study to use a corn or barley and soybean meal based ration. Rather we use an average feed cost for various rations based on 1995 data. This may have two offsetting impacts for the comparisons. First, it may inflate them slightly because it is a "retail" price compared to the implicit 'wholesale' prices used in other regions based on market prices for corn and soybean meal. On the other hand, we were unable to find comparable feed cost data for 1996 in Europe, while for the other countries feed prices are based on the average of 1995 and 1996. Since 1996 included record high corn prices in world markets, this may <u>underestimate</u> the feed price for Europe. Table 3.3 contains the average feed intake for the European models, as quoted by the EuroporC study.

A					
	Denmark	Netherlands			
Feed intake kg / sow / year	1071	1042.86			
Feed intake piglets kg/sow/year	626.25	835.04			
Feed intake finishing pigs kg/sow/year	4998.23	3642.23			

Table 3. 3.Ration used in Europe

Since Western Canada uses barley instead of corn, barley is substituted for corn in the base ration. The ration used for Western Canadian production models is 85 percent barley and 13 percent soymeal. This is considered equivalent to the corn ration used in the US and in Eastern Canada.

The main components of production costs are analysed in order to determine the cost competitiveness of different countries. These elements include: labour costs, feed costs, facilities and equipment depreciation costs, and interest costs. All costs are reported in Canadian dollars. The average exchange rate during 1996 is used for the conversion. A series of assumptions are used to make the costs comparable.

Labour Assumptions:

Estimated labour requirements are based on the assumption that operations use the same technology in all countries, as defined in the Purdue Study. The resulting person equivalents for each size operation are shown in Table 3.4.

		Size of Operation					
	180 Sow	3000 Sow					
Manager		1	1	1			
Assistant Manager	1	1	1	1			
Production Assistant I			2	4			
Production Assistant II	0.5	2	2	5			
Total	1.5	4	6	11			

 Table 3.4.
 Use of Labour (person equivalents)

In calculating labour costs, it is necessary to estimate both salaries and benefits. The data used to estimate them do not account for benefits separately. Hence the assumption was made that the proportion of salaries and wages are the same as the Purdue Study. Its basic labour cost structure and the proportions are shown in Table 3.5.

	Salary	Benefits	% of Benefit
Manager	40,500.00	6,075.00	15
Assistant Manager	20,250.00	3,037.00	15
Production Assistant I	19,125.00	4,781.00	25
Production Assistant II	14,625.00	3656	25

 Table 3.5.
 Assumptions About Labour Cost Proportions

The Purdue study includes data only for Indiana. For our purposes, we need data on several regions. The US Department of Commerce reported average <u>agricultural wage rates for livestock workers</u> for various states in 1990. To update them, we used information contained in a USDA/ERS study (1995) on the rate of increase of agricultural wage rates from 1990 to 1994. Further, the inflation rate was used as a proxy for the rate of increase until 1996. This gave the resulting labour costs reported in Table 3.6. Note that to double check the validity of the procedure, we reproduced the wage costs for 1996 from Hurt, et al. Our numbers are virtually identical to what they reported. Hence we conclude that the procedure fairly represents US labour costs.

Table 3. 6.Labour Costs in the US (US \$, 1996)

(Sulaites & Denents)						
	Indiana & Ohio	Missouri & Iowa	N.Carolina	Utah	Michigan & Minnesota	
Manager	46,575.00	46,360.04	42,490.73	46,431.69	42,132.46	
Assistant Manager	23,287.00	23,180.02	21,245.37	23,215.85	21,066.23	
Production Assistant I	23,906.00	23,795.91	21,809.86	23,832.69	21,625.96	
Production Assistant II	18,281.00	18,196.88	16,678.13	18,225.00	16,537.50	

(Salaries & Benefits)

Labour costs in Canada were calculated by using information received from industry sources in each province on minimum wage per hour for livestock workers, as well as benefits. The minimum was used to calculate the wage for Production Assistant II, and the salaries for the other positions were then calculated based on the respective proportions in the Purdue Study (as given in Table 3.5).

Table 3.7.Labour Costs in Canada (C\$)(Salaries & Benefits)

	Ontario	Manitoba	Alberta	Quebec	Nova Scotia
Manager	57,821.54	58,977.97	62,307.69	59,192.31	52,615.38

	Ontario	Manitoba	Alberta	Quebec	Nova Scotia
Assistant Manager	28,910.77	29,488.98	34,269.23	29,596.15	26,307.69
Production Assistant I	27,304.62	27,850.71	32,365.38	27,951.92	24,846.15
Production Assistant II	20,880.00	21,297.60	24,750.00	21,375.00	19,000.00

Labour cost information on Chile was obtained through Gonzalo Castro, President of Progen Ltda (Chile). The labour cost in Argentina, on a per sow basis, was calculated based on a 50 sow farrow-to-finish operation, using modern herd and resource management techniques. This labour cost was later adjusted to derive a yearly salary and then an hourly rate which could be used in the current study framework.

For the European countries, data from the EuroporC study were used, combined with the proportions from the Purdue Study. The resulting labour costs are shown in Table 3.8.

(Salaries	& Benefits)			
	Netherlands	Denmark	Argentina	Chile
Manager	75,000.00	85,500.00	28,339.40	23841.94
Assistant Manager	49,820.00	56,794.80	14,169.70	11920.97
Production Assistant I	47,000.00	53,580.00	13,367.64	11258.69
Production Assistant II	35,720.00	40,720.80	10,127.00	8609.59

Table 3.8.Labour Costs in Europe and Latin America (C\$)(Salarias & Banefits)

Feed Price Assumptions:

As indicated above, the ration is based on the Purdue Study, where a 76% corn ration is used. North America and Argentina are assumed to have the same rations for Corn and Soybean meal, except for Western Canada where barley is substituted for corn. It is assumed that an 85% barley ration is equivalent to the 76% corn ration.

US feed costs by State were obtained through the NASS 1996 Annual Agricultural Price Report (July 1997). In this publication was found the annual cash grain prices in each State. Soymeal prices were for a 44 % protein meal, while the Canadian prices were for a 48 % protein meal. To correct for the difference, we looked at the historical relationship between the two soymeal prices at Decatur in the US, and adjusted the 44% protein price according to our findings. We increased the 1996 price of the 44% meal by 5% to bring it to a comparable level with the 48% meal. Table 3.9 gives the average prices for 1996 and 1995.

Table 3.9.Feed Prices in the US

	Corn Price (per bushel)	Soymeal Price (per cwt)
Ohio	3.21	13.36

Indiana	3.19	13.36
Missouri	3.22	13.52
Iowa	2.99	13.36
N.Carolina	3.52	15.52
Utah	3.25	19.97
Kansas	3.27	13.52
Nebraska	3.10	13.52
Michigan	3.11	12.93
Minnesota	2.81	12.93

Prices for the Western Prairies are represented by the average price for 1995-1996 in Calgary, Alberta. Eastern Prairie prices are represented by the average prices for 1995-1996 in Brandon, Manitoba. Prices for Ontario are taken from OMAFRA's Ontario hog production budget. Quebec prices are represented by average 1995-96 Quebec City prices, and Nova Scotia prices are represented by average 1995-1996 Truro prices. Results are summarized in Table 3.10.

Table 5.10. Free Frees in Canada (C\$)		
	Barley Price (per tonne)	Soymeal Price (per tonne)
Western Prairies	151.00	340.00
Eastern Prairies	143.00	312.00

Table 3.10. Feed Prices in Canada (C)

	Corn Price (per tonne)	Soymeal Price (per tonne)
Ontario	178.50	316.61
Quebec	201.97	315.71
Nova Scotia	226.00	336.57

As indicated above, average feed prices for Denmark and the Netherlands are taken from EuroporC's estimates of total feed costs instead of grain and soybean meal prices. Feed prices are shown in Table 3.11.

Table 3.11. Feed Thees in Europe (C\$/100kg)		
	Netherlands	Denmark
Sow feed	31.93	36.21
Feeder pigs feed	49.23	47.77
Finishing pigs feed	33.86	34.88

 Table 3.11.
 Feed Prices in Europe (C\$/100kg)

Our data sources in Chile also provided feed prices on the basis of complete feed prices instead of for corn and soybean meal prices (Table 3.12). The complete feeds are based on the same corn and soybean meal components that were used in North America.

Table 3.12.Feed Prices in Chile (C\$/100kg, average 1995-1996)

	Chile
Sow feed	31.57
Feeder pigs feed	37.53
Finishing pigs feed	34.79

Feed prices for Argentina are reported for the actual ingredients (Table 3.13)

Table 3.13. Feed Prices in Argentina (C\$)

	Corn Price (per tonne)	Soymeal Price (per tonne)
Argentina	142	247

Depreciation Cost Assumptions:

Construction and equipment costs were calculated for each country. Based on the total amount of investment and using the linear depreciation method, the amount of depreciation per market pig was calculated. A period of ten years was assumed in all countries.

Sources of data used for construction costs are very different and various assumptions were made to include this information in the analysis. For instance, when the construction cost was given as a range of dollar amounts per head, the minimum was assigned to the largest size of operations, and the maximum cost was assigned to the smallest size of operations. The other sizes of operation were assigned proportionately to cost levels in the given range. This was based on the assumption that larger sizes of operation are more efficient, which is the underlying assumption in the model used in the Purdue Study also. Construction data were obtained only for four US states. For the purpose of the study, an average of these costs was calculated, in order to be used in a later stage, when the total costs per pig are calculated for each state. While the depreciation costs will not differ among these states, the total calculated in this way will be a more accurate estimate of total costs per pig, and a comparison can be made.

Argentina represented a particularly difficult case. Conversations with hog producers in each of Argentina, Chile and Brazil indicated that Argentina has the highest construction costs in Latin America. However, we were unable to find anyone who is using the kind of technology in production that is assumed in this study - largely because the industry there remains small and fragmented. Since there was general agreement that construction costs were higher, the rather arbitrary decision was made to increase the Chilean construction costs by 15% as a proxy for the Argentinian costs.

Interest Costs:

The study implicitly assumes that each operation in each jurisdiction is new. The question then is to estimate the cost of capital. There are various assumptions that can be made about whether capital is financed with debt or equity, and what interest rate is used. The argument has been made in the literature that equity capital has a **lower** cost than debt capital in the case of family farm operations. Frankly, with the current generation of farmers, this argument is hard to accept because most are as astute with business management skills as the rest of the population. We doubt that the long run expectation of earnings from owner's equity is below recent short term interest rates. Similarly, the argument can be made that equity capital, especially institutional equity providers want a higher rate than interest rates because of the risk that is entailed. The problem is to arrive at an interest premium that is widely representative of investors' expectations.

To address this issue, we assumed that the model operations are financed 60 percent by debt and 40 percent by equity. However, the same interest rate of prime plus two percent was used for both the debt and equity portions.¹¹ Also, the average interest charges for the life of the loan were calculated only on 50 percent of the amount of initial investment. This is to represent the fact that the principal on loans is paid down over time and that the asset becomes depreciated.

This cost element is also calculated on a per pig basis. The differences between countries and states/provinces are reflected by the long term interest rates used. The interest rates for the European countries were taken by EuroporC, whereas the prime rate (during 1996) plus two percent was used for the US, Canada and Argentina. For Chile, an average of the 12 year loans during 1996 was used.

¹¹ Based on earlier discussions with the client, we estimated capital costs in one run of the spread sheet model at prime plus two for the debt portion, and prime plus 10 for the equity portion (the difference in interest rates reflects the different cost of debt and equity financing). This procedure clearly raised capital costs over the one shown in the study, and raised them most for Argentina, but it did not affect the relative standing. Since our intent here is to represent relative costs, and especially since it is likely that each investor's actual or imputed cost is unique, we chose to adopt a standard of prime plus two for each country.

Country	Long Term Interest Rate
US	10.5 %
Canada	7.5 %
Argentina	20 %
Chile	6.7 %
Netherlands	7.2 %
Denmark	8.3 %

Table 3.14.Interest Rates by Country

Table 2.15	Total Costs by	magiana	non montrat has
1 able 5.15.	Total Costs Dy	regions (per market nog

	Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow
US West Corn Belt	110.74	101.30	98.62	93.93
US East Corn Belt	112.75	103.15	100.10	94.85
US South East	123.27	112.00	109.40	104.31
US Mountain	130.62	118.68	115.85	110.39
Maritimes	123.44	113.56	111.24	106.77
Quebec	120.65	110.60	107.99	103.30
Ontario	111.99	102.95	98.96	93.48
Eastern Prairies	97.76	87.43	85.26	80.58
Western Prairies	101.37	92.04	89.70	84.61
Argentina	128.97	117.63	116.39	112.95
Chile	137.38	121.10	120.08	116.90
Netherlands	181.75	162.82	159.33	152.57
Denmark	182.42	162.99	159.00	151.69

Table 3.16. Total Costs by regions per 100 kg live weight

		Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow	
West Corn Belt	99.56	91.07	88.67	84.44	
East Corn Belt	101.37	92.74	89.99	85.27	
South East	110.82	100.69	98.36	93.78	
Mountain	117.43	106.69	104.15	99.24	
Maritimes	115.7	106.44	104.26	100.08	
Quebec	113.08	103.67	101.22	96.82	
Ontario	104.97	96.49	92.75	87.56	
Eastern Prairies	91.63	81.95	79.91	75.53	
Western Prairies	95.01	86.27	84.08	79.30	
Argentina	115.95	105.75	104.64	101.55	
Chile	123.51	108.88	107.96	105.10	
Netherlands	163.40	146.38	143.24	137.16	
Denmark	164.00	146.54	142.95	136.37	

	Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow
US West Corn Belt	11.91	9.75	7.07	4.08
US East Corn Belt	12.34	10.10	7.32	4.23
US South East	11.26	9.22	6.68	3.86
US Mountain	12.30	10.07	7.30	4.22
Maritimes	9.95	8.10	5.77	3.28
Quebec	11.19	9.11	6.50	3.70
Ontario	10.93	8.90	6.35	3.61
Eastern Prairies	11.15	9.08	6.47	3.68
Western Prairies	12.96	10.12	7.31	4.20
Argentina	5.34	4.35	3.10	1.76
Chile	4.51	3.67	2.62	1.49
Netherlands	18.80	13.60	10.06	5.91
Denmark	21.43	15.50	11.47	6.73

Table 3.17. Labour Costs (per market hog)

 Table 3.18.
 Feed Costs (per market hog)

	Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow
US West Corn Belt	77.36	72.44	72.44	71.06
US East Corn Belt	80.54	75.43	75.43	74.00
US South East	90.53	84.78	84.78	83.16
US Mountain	96.84	90.60	90.60	88.88
Maritimes	90.43	84.77	84.77	83.16
Quebec	82.06	76.92	76.92	75.46
Ontario	75.79	71.01	71.01	69.66
Eastern Prairies	59.11	55.48	55.91	54.42
Western Prairies	62.91	59.05	59.52	57.93
Argentina	81.72	76.60	76.60	75.14
Chile	115.62	96.14	96.17	94.49
Netherlands	117.13	97.40	97.43	95.72
Denmark	121.52	101.05	101.08	99.32

	Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow
US West Corn Belt	13.56	12.53	12.53	12.31
US East Corn Belt	12.97	11.52	11.47	10.70
US South East	13.49	11.86	11.83	11.24
US Mountain	13.49	11.86	11.83	11.24
Maritimes	16.28	15.04	15.05	14.78
Quebec	19.34	17.87	17.87	17.56
Ontario	18.38	16.75	15.71	14.13
Eastern Prairies	16.65	15.38	15.39	15.12
Western Prairies	18.00	16.63	16.64	16.35
Argentina	19.85	18.34	18.35	18.02
Chile	17.26	15.95	15.95	15.67
Netherlands	45.83	38.11	38.12	37.45
Denmark	39.47	32.82	32.83	32.25

 Table 3.19.
 Depreciation Costs (per market hog)

 Table 3.20.
 Interest Costs (per market hog)

	Production Systems			
	180 Sow	600 Sow	1200 Sow	3000 Sow
US West Corn Belt	7.91	6.58	6.58	6.47
US East Corn Belt	6.90	6.09	5.87	5.92
US South East	7.99	6.15	6.12	6.06
US Mountain	7.99	6.15	6.12	6.06
Maritimes	6.78	5.64	5.64	5.54
Quebec	8.06	6.70	6.70	6.58
Ontario	6.89	6.28	5.89	6.01
Eastern Prairies	6.94	5.77	5.77	5.67
Western Prairies	7.50	6.24	6.24	6.13
Argentina	22.05	18.34	18.35	18.02
Chile	6.42	5.34	5.34	5.25
Netherlands	16.50	13.72	13.72	13.48
Denmark	16.38	13.62	13.62	13.39

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