Exchange Rate Impacts on the Canadian Beef Industry

For the National Beef Industry Development Fund

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The purpose of this project is to examine the implications of an appreciating Canadian dollar on the Canadian beef industry at the primary production and processing levels. The expected outcome of the project is a study, which provides industry with a quantitative analysis that determines the effects (short term and long term) of changes in the exchange rate. It will also demonstrate how changes in the exchange rate affect prices, trade, and overall industry structure.

Fundamentally, the objectives for this project concern measuring and examining the impact of the exchange rate on the cattle and beef industry. Specific objectives therefore involve measuring and examining the impact of the exchange rate on key areas of the cattle and beef packing sectors. Specific areas of examination include factors such as prices, costs, asset values as well as general consequences such as productivity, profitability and trade.

This executive summary provides the summary and conclusions of each section of the report.

Exchange Rate Impacts on Commodity Prices and Input Factors

A starting point for any discussion on exchange rate impacts is to note its role in the price discovery process. In that regard, the most important point is to note that from feeder cattle through to beef cuts, as well as grain, Canadian prices are determined by US prices due to the ability to arbitrage in an open North American market. The second point is to note the direct role that the exchange rate plays in commodity pricing in Canada. There is a direct, highly correlated inverse relationship between the exchange rate and cattle/beef prices. The exchange rate plays a direct and simple arithmetic role in pricing cattle and beef.

Conversely, the analysis suggests that there is very little relationship between the exchange rate and most agricultural inputs (other than grain in livestock rations). Exchange rates appear to have very little impact on the prices or values of land and farm labour and a small impact on the prices of fertilizer, electricity and diesel. The exception is the relatively stronger relationship between the exchange rate and the prices of capital assets. In that regard, it must be concluded that the exchange rate plays a minor role in the price determination or discovery process of cattle industry inputs, with the exception of capital assets.

Exchange Rate Impacts and Industry Productivity and Competitiveness

There is sufficient evidence to suggest that declining productivity in the overall Canadian economy was the primary cause of the depreciation of the currency relative to the US during the 1990's. Furthermore, declining productivity relative to the US may have resulted from declining investment relative to the US. In addition, the depreciation of the currency during the 1990's may have helped to increase the cost of capital, which would have accelerated the decline in the capital-labour ratio. Furthermore, given the integral relationship between competitiveness and productivity, it is clear that the depreciation of the Canadian dollar was largely a result of the lack of competitiveness of Canadian industries in aggregate in comparison to the US and other nations. This research has not resolved whether the lack of Canadian industrial competitiveness was the sole reason for the depreciation. There were likely other factors such as political uncertainty in Quebec for example. Nevertheless, the exceptional correlation indicates that a lack of competitiveness of the Canadian economy was a driving force.

Furthermore, while the C$ has appreciated notably since mid 2003, there is not yet sufficient evidence to suggest that there has been a corresponding increase in productivity. In this instance, the evidence suggests that higher relative interest rates in Canada and surging oil revenues were the key drivers of the appreciation.

Finally, the strong correlation between productivity and the exchange rate is a major reason why it is misleading to state that a declining currency helps Canada's competitiveness. That is, declining productivity indicates a lack of competitiveness of the Canadian economy and declining productivity is linked to the depreciation of the Canadian dollar. As such, the depreciating currency is a measure of Canada's lack of competitiveness.

As such, with regard to the cattle and beef industry, the recent appreciation of the currency should be considered a benefit or a positive development. This is due to the probable positive impacts on investment and the resulting productivity improvements.

Cost and Revenue Structures in Each Component of the Value Chain

This section assessed the consequence of an appreciation in the Canadian dollar relative to the US dollar on thirteen typical cattle enterprises across Canada. A partial budget analysis revealed that an appreciating Canadian dollar had an adverse impact, sometimes quite severe, for every cattle enterprise in every region. This result reflects, in part, the extent to which livestock enterprises in Canada are exposed to exchange rate risk.

Although it is apparent that both the cow-calf and feedlot operations incur significant short-term losses, it is important to point out that the greatest negative impact of the exchange rate change is borne by the cow-calf operations. In the long-run, it is expected that the full burden of the exchange rate appreciation will be borne by the cow-calf operators as the loss in value will be incorporated into the value of fixed assets, namely land. The feedlot operations will in the long-run return to acceptable margins by simply paying less for feeder cattle (this long-run aspect however, is beyond the scope of this analysis).

The results also are a product of the initial assumptions regarding the responsiveness of the price of some products, but not others, to changes in the exchange rate. All other things the same, the initial shock from a change in the exchange rate is temporary phenomena. The changes occur first only for some groups of individuals slowly spread over the whole economic system. Over time market processes ensure the prices of every good and service in every region will change to restore the balance between supply and demand. This long-term response was not incorporated in the analysis in this section.

In addition, Canadian packers are also negatively impacted by an appreciation of the C$. The appreciating dollar forces packers to more closely align their operating costs, particularly labour with the US. During the 1990's packers were very low cost relative to the US, largely due to the cheap dollar. As of 2006, this low cost, dollar-shield advantage has largely eroded. Conversely, as the dollar appreciated, the simple arithmetic of the appreciation caused the spread between the beef revenue and the cattle costs to narrow. Clearly the appreciation is causing and will force Canadian packers to improve their competitive position, or risk failure in the market.

Canadian Cattle and Beef Industry Production and Structural Trends

The analysis in this section argued that the depreciation during the 1990's caused a disproportionate growth in the cowherd. It did not, however, result in a disproportionate growth in beef production in Canada relative to the United States. The structural impact of the Canadian dollar can be easily seen in the cowherd, but much less so in the volume of production and packer capacity in Canada. With that noted, Canadian beef production did increase faster than US production during the 1990's. While that cannot be directly related to the currency depreciation, there is an indirect relationship. That is, without the expanded cowherd, conditions would not have been as conducive to expanded beef production in Canada.

Impact of the Exchange Rate on Canadian Cattle and Beef Industry Trade Trends

The analysis undertaken in this section was designed to assess whether there is an identifiable relationship between live and product trade and the exchange rate. Long term annual and monthly datasets were used to assess the possibility of a potential relationship between trade and exchange rate.

Essentially the results of the long term annual and the shorter-term monthly data have shown that there is no confident statistical relationship between cattle imports and cattle exports. There was a reasonable relationship between annual imports from the US and the exchange rate but the fact that there was no monthly relationship suggests that the annual relationship was coincidental. The coincidental relationship was more likely caused by changing production levels in Canada as opposed to the direct exchange rate impact. Beef exports and the exchange rate on the other hand have shown a strong relationship on both an annual and monthly basis. That is, as the exchange rate depreciated, exports increased.

Based on the fact that there was no similar strength on the cattle trade or beef import relationship, however, it raises the question of whether there was in fact a causal relationship with exports. That is, why would the exchange rate not impact cattle trade or beef imports, but

have an influence on beef exports. The logical conclusion of this research is that the exchange rate does not impact beef exports.

As such, the conclusion of this section of the report is that the exchange rate does not have a direct impact on trade. This is contrary to much of the conventional wisdom, which argues that a depreciating currency results in greater exports and an appreciating currency results in less exports. The fact is however, that not only is there no statistical proof of this but there is also much statistical evidence to the contrary. The continued strength in live cattle exports since the border opened, despite the appreciated dollar is just one example. Record hog exports in 2004 and near record numbers in 2005 are another example of the lack of the expected relationship.

The fact is that in commodity markets, changing exchange rates become directly reflected in prices in the domestic market. So while the depreciated (appreciated) dollar may result in higher (lower) Canadian cattle and beef prices, it does not necessarily mean that more (less) product will trade to the US.

Managing Exchange Rate Risk

There are a number of financial instruments available to manage exchange rate risk in the beef business. They all have pro's and con's, which suggests that which to use is partially a function of the hedger's objective. Producers need to understand or have knowledge of the risk that can be involved in using hedging instruments such as futures, options, etc. Hedging oneself in futures may be the lowest cost, but the hedger needs to know a lot about futures trading to be effective in doing in doing it. Similarly, hedging with options is appealing if the premium is not out of line and if the producer can absorb a little risk. Options are also useful if the producer wants to protect against disaster and yet take advantage of the rate moving back in his favor. In all cases the net cost needs to be evaluated for each alternative.

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Introduction

Alberta Agriculture Food and Rural Development completed a comprehensive review of the implications of the appreciation of the Canadian dollar on agriculture. While the paper effectively identifies the effects an appreciating Canadian dollar has on agriculture, it does not quantitatively determine the net impact it has on the beef industry and other agriculture sectors. In fact, very little work has been done that quantitatively examines the impacts a strengthening Canadian dollar has on the beef industry in Canada. This is an important area of research given the beef industry in Canada is an export-oriented industry, whose competitiveness is highly dependent on the value of the Canadian dollar in international markets.

Purpose

The purpose of this project is to examine the implications of an appreciating Canadian dollar on the Canadian beef industry at the primary production and processing levels. The expected outcome of the project is a study, which provides industry with a quantitative analysis that determines the effects (short term and long term) of changes in the exchange rate. It will also demonstrate how changes in the exchange rate affect prices, trade, and overall industry structure.

Objectives

Fundamentally, the objectives for this project concern measuring and examining the impact of the exchange rate on the cattle and beef industry. Specific objectives therefore involve measuring and examining the impact of the exchange rate on the following areas of the cattle and beef packing sectors:

1. Revenues and prices
2. Commodity input costs (particularly grain)
3. Industry production factors such as labour, energy, interest rates, equipment, land and materials
4. Investment and capital expenditures
5. Asset valuations
6. Trade patterns
7. Production

8. Costs of production, margins and profitability
9. Industry structure (size and number of operations)

In addition to those specific exchange-impact objectives, the study also will explore alternative mechanisms to manage exchange rate risk, identifying both the positive and negatives aspects of different mechanisms.

1. Exchange Rate Impacts on Commodity Prices and Input Factors

The purpose of this section of the report will be to establish the link between the exchange rate and key production, productivity, investment and pricing variables in the beef and cattle industry. Examining the long-term trends in these key variables and determining the degree that they are related to the exchange rate addresses this purpose.[1]

1.1 Commodity Price Determination and Discovery Process in Canada

This section of the report examines how agricultural commodity prices are determined and discovered in Canada. The purpose of this section is to demonstrate the central role played by the exchange rate in the Canadian commodity pricing process.

Price Determination and Discovery Defined

The term *price determination* is typically used to illustrate how prices are derived from a macro perspective while the term *price discovery* is used to explain how prices are derived from a micro perspective. As a starting point in the pricing process, any commodity that can be freely traded between countries is priced based on global supply and demand for that commodity.

Ward and Schroeder have noted that price determination is the interaction of the broad forces of supply and demand, which in turn determine the overall market price level. Ward and Schroeder go on to note that price discovery is the process of buyers and sellers arriving at a transaction price for a given quality and quantity of a product at a given time and place. Price discovery involves several interrelated concepts, among them market structure (number, size, location, and competitiveness of buyers and sellers); market behavior (buyer procurement and pricing methods); market information and price reporting (amount, timeliness, and reliability of information); and futures markets and risk management alternatives. Price discovery begins with the market price level that is determined by the broad forces of global supply and demand.

[1] Note that the exchange rate can either be expressed as C$/US$ or vice versa. Either manner is acceptable and both are widely and interchangeably used by the industry. In this paper both methods are used. The exchange rate is typically noted as US$/C$ (eg., US$0.85/C$) when discussing cattle prices and the C$/US$ is used when discussing input prices.

Buyers and sellers discover prices on the basis of uncertain expectations and as a result, transaction prices fluctuate around that market price level.[2]

Price Determination and Discovery in Canada

Fundamentally, Canada is a relatively small country, which relies on the world market to determine and discover prices of most agricultural commodities: i.e. the Canadian economy has marginal impacts on world prices. In general, Canada's supply and demand situation determines whether Canada is an exporter of the commodity, with prices at "freight under" the world price, or an importer, with prices at "freight over."

North American-based commodity prices are typically determined based on prevailing North American and global supply and demand conditions for the particular commodity. The overall North American domestic and foreign export demand for the commodity, coupled with the total supply of the commodity, determines the prevailing Canadian price level at any time. This provides direction, guidance or a reference to the relative price range for which the commodity will trade either domestically or internationally. In Canada regardless of the commodity, if it is largely produced in North America, the market price level is almost always a US-based reference. In other words the starting price level for determination will be a US price such as a futures price or a major geographic production region. This is due to the fact that Canadian and US producers can freely trade most agricultural commodities. This ability results in a price arbitrage, which keeps prices closely correlated.[3]

From that basic starting point prices are then discovered or transacted at any given time based on the prevailing US or global price level guide. The discovery process typically begins with the US reference price converted to Canadian dollars by the exchange rate. This conversion provides the Canadian traders with the Canadian dollar (C$) value that the commodity would trade for in that US reference market. All the exchange rate does is translate the US or world price into Canadian currency. So, if a US grain commodity is trading at US$2.50/bu, this translates to C$3.85 when the loon is at US$.65, but is only C$3.33 when the loon flies up to US$.75 (in both cases, plus or minus freight). Similarly, if US packers are bidding hog prices at US$50/cwt, this translates to C$157/ckg[4] when the loon is at US$.65, but only C$136/ckg when the loon is at US$.75.

From that Canadian dollar value of the US reference, a price spread or basis is added or subtracted. This spread or basis is a reflection of the local supply and demand conditions coupled with the cost of transport to or from the nearest US market. Most often the spread is subtracted from the US reference price because for most commodities, Canada is typically on an export basis.

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[2] Ward and Schroeder, Understanding Livestock Pricing Issues, Oklahoma State University, 2001

[3] In economics, arbitrage is the practice of taking advantage of a state of imbalance between two (or possibly more) markets: a combination of matching deals are struck that exploit the imbalance. (http://en.wikipedia.org/wiki/Arbitrage)

[4] Pounds are used in the US but kilograms are used in the Canadian hog industry. The calculation from US$/lb to C$/ckg also involves adjusting for differences in measuring carcass weights between Canada and the US. The calculation is as follows US$/lb * .74 US carcass yield / .80 Cdn carcass yield / exchange rate * metric conversion 2.20462

Cattle and Beef Price Determination and Discovery

As with most agricultural commodities, the Canadian cattle price will follow the US price because of the ability of Canadian cattle producers to sell to US buyers. As with most commodities, this ability results in a price arbitrage, which keeps prices closely correlated. This price arbitrage has historically been a fixture of the North American live cattle pricing structure. For Canada this arbitrage exists only if there is free and open trade in cattle in both directions, which of course came to a temporary end on May 20, 2003.

The following graph shows the monthly average price of fed steers in Alberta versus the price of fed steers in the Texas Panhandle in US dollars and the Texas price in Canadian dollars over the ten years from 1993 to 2002[5].

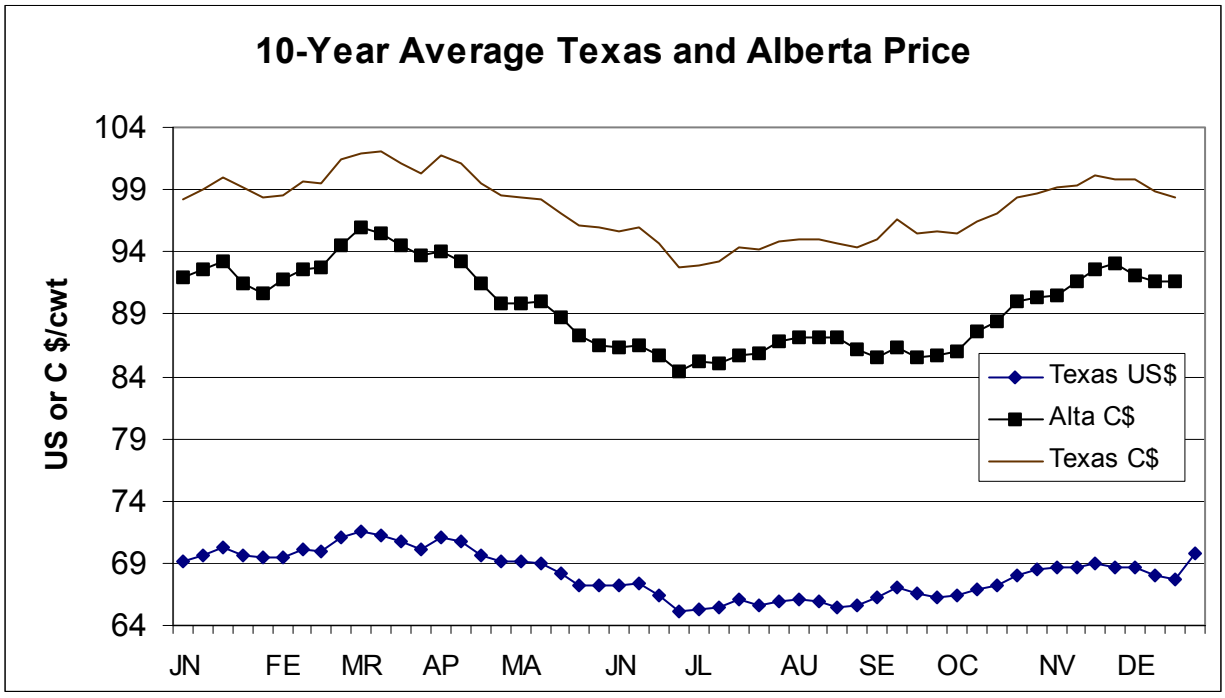


Figure 1 Source Texas Cattle Feeders Association and Canfax

As can be seen from the graph, there is an exceptionally close relationship between US prices and Alberta prices. There is over 95% correlation between the ten-year average Texas and Alberta prices in Canadian dollars[6]. There is also over 95% correlation between Texas prices in US dollars and Alberta prices in Canadian dollars.

After the US price, the next step in the Canadian cattle price discovery process is the exchange rate. If the exchange rate appreciates, the Canadian price will decline, and vice versa. As a basic

[5] The Texas Panhandle is the largest marketing region in the US. Texas prices are representative of prices across the United States.
[6] The statistical correlation measures the relationship between two properties. Statistical concepts are discussed in greater detail in footnote 8 below.

rule of thumb in the past, prior to BSE, for every 1% change in the exchange rate, cattle prices in Canada will move by a little over 1% in the opposite direction.

For example, if Texas steer prices are $80 and the exchange rate is US$0.79 (1C$=US$0.79), then the Canadian reference price is C$101.27. The following graph shows the impact of changes in the exchange rate on changes in Canadian cattle reference prices when the Texas price is fixed at $80. The correlation coefficient of the Canadian reference price and changes in the exchange rate is 100% and for every 0.97% change in the exchange rate, it leads to a 1% change in Canadian prices. From an arithmetic perspective the results are self-evident but from an economic perspective it is purely important to recognize that this direct relationship exists in actual cattle markets. This direct, arithmetic relationship simply means that changes in the exchange rate are immediately reflected in cattle prices. It means that if the US cattle price is unchanged and the exchange rate changes, the change in the exchange rate will be fully reflected in the cattle price. This direct relationship exists in cattle markets due to the ability to sell cattle freely in both Canada and the US. This relatively obvious arithmetic exercise provides an important demonstration of the impact of the exchange rate on cattle prices.

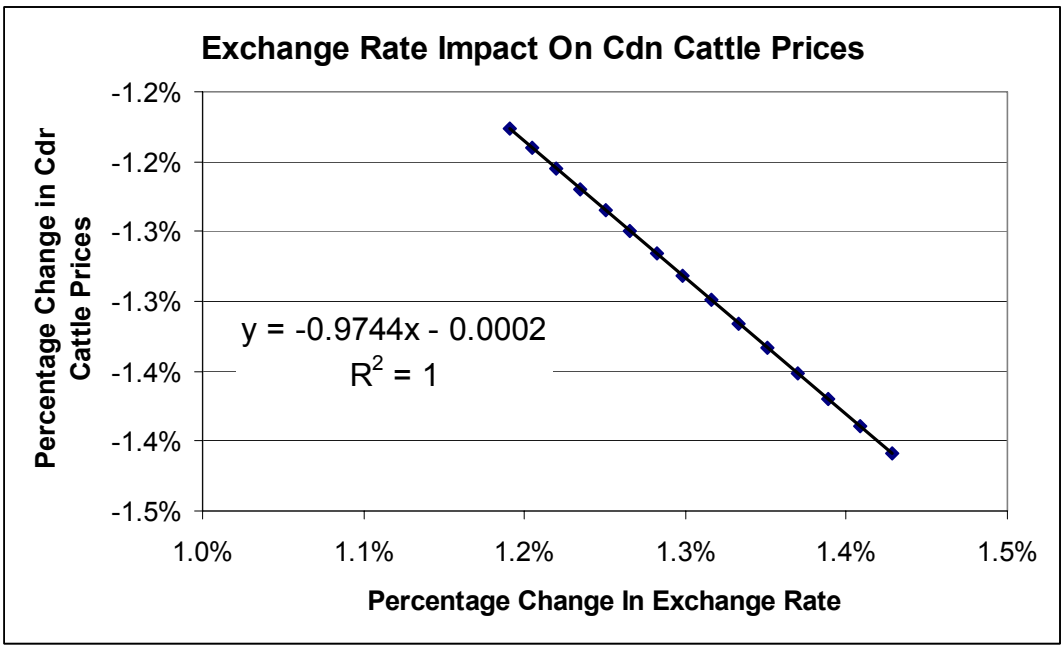


Figure 2 Source: George Morris Centre data files

The final part of price discovery is the spread, or basis. The most important component of the spread or basis[7], is the cost of transportation to an alternative market or packer outside of the Canadian producing region, such as Alberta. Those alternative markets for Alberta include the states of Washington, Colorado, Utah and Nebraska, among others.

The discussion above asserts that for every change in the exchange rate, there is a corresponding, almost equal change in the cattle price. This is the case when the other factors such as the US

[7] Spread refers to the price relationship between different markets while basis refers to the difference between a particular cash price and the Chicago Mercantile Exchange futures contract

cattle price and the spread are constant. Of course this is rarely the case. As noted above, there are three main variables that cause changes in the Canadian cattle price, of which the exchange rate is only one. The following graph shows the direct relationship between the exchange rate and actual cattle prices in Alberta from 1990 through 2002 (pre-BSE).

As can be seen, there is the expected direct and negative relationship between the exchange rate and cattle prices. With that said, the exchange rate cannot explain all or even half of the total change in annual cattle prices over the course of the 12 years prior to BSE.[8]

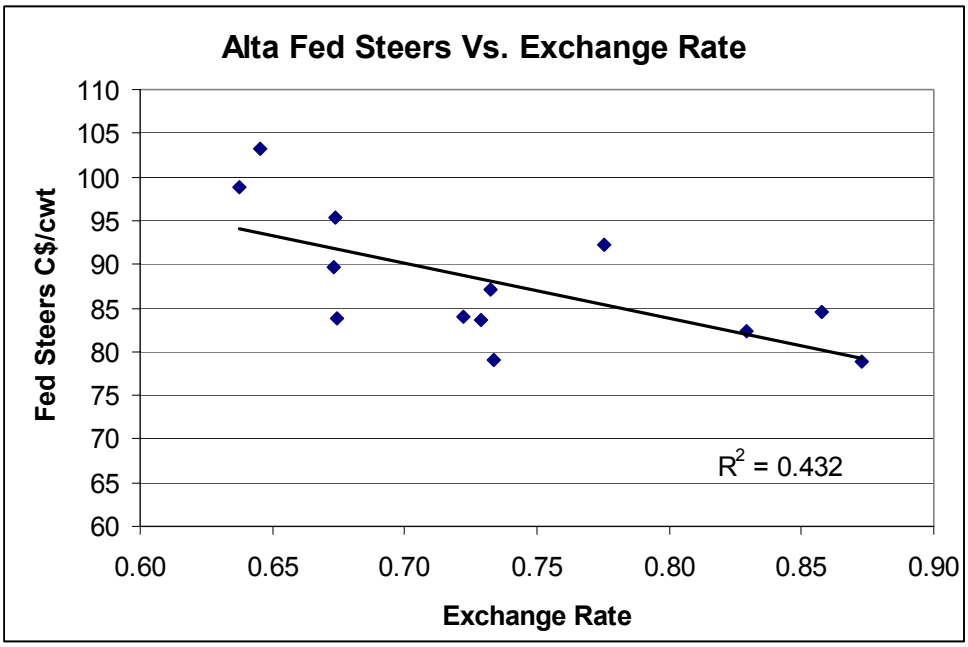


Figure 3 Source: Canfax

Feeder cattle pricing forces are subtly different from those of fed cattle. The price of feeder cattle is almost entirely a price derived from the interaction of other prices and markets. That is, the price of feeder cattle is largely dependent upon the price or expected price of fed cattle and the price of grain. The higher the price of grain, the higher the cost of gain of the animal and the

[8] Linear regression is used as a technique to assess whether there is a relationship between two variables. In essence, linear regression can establish the amount of variance accounted for by one variable in predicting another variable. In this case (Figure 3), the Alberta fed steer price is the variable to be estimated (the dependent variable) based upon the level of the exchange rate (the variable used as the predictor is called the independent variable). R-squared, also termed the coefficient of determination, is a measure of the closeness of the two variables and provides a guide to the "goodness of fit". R-squared can describe how well the line in the figure fits with the observed data, determining the proportion of the variance that is explained by the model (equation). An r-squared of 1.0 would indicate a perfect correlation and perfect fit between Alberta fed cattle price and the exchange rate. All of the observed data would be on the line in the figure. In this case, the r-squared of 0.432 means that only 43 percent of the variance can be explained by the use of the exchange rate as a predictor of Alberta fed cattle price. Besides the exchange rate, other variables are affecting the price of Alberta fed cattle. The lower the r-squared, the wider the spread of data around the predicted line.

lower the price that the cattle feeding sector can afford to pay for cattle, and vice versa. Conversely if fed cattle prices increase, or are expected to increase, feeder cattle prices will increase. Of course in addition to those demand side factors, the overall supply of feeder cattle also plays a key role.

As with fed or slaughter cattle, the US price of feeder cattle is a prime determinant as is the exchange rate. If US feeder cattle prices increase, it implies strong US feedlot demand, which in turn will draw Canadian feeder cattle to those higher prices. That ability to trade in turn results in higher prices in Canada and vice versa when US prices decline. Separately, the exchange rate has the same impact on feeder prices as on fed prices. That is, appreciation of the exchange rate results in lower feeder prices and vice versa.

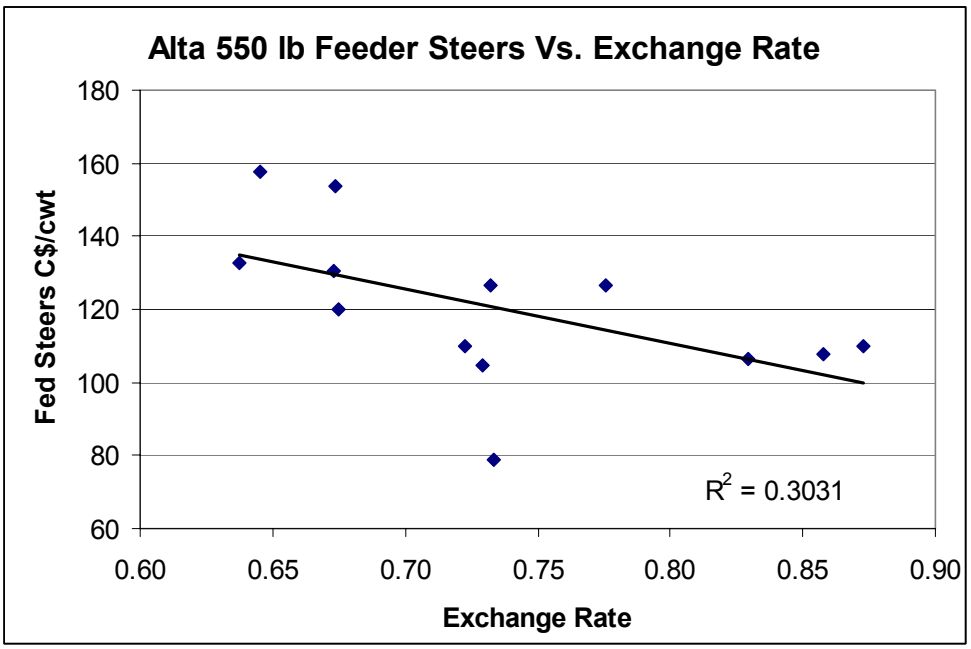
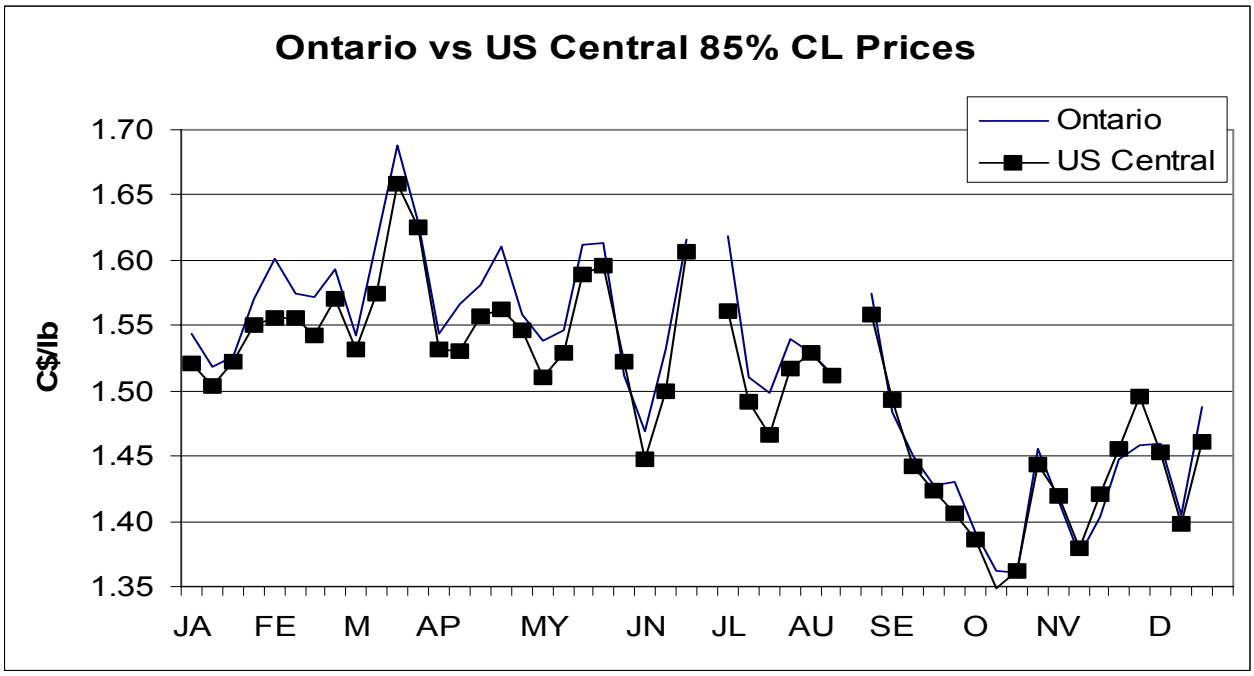


Figure 4 Source: Canfax

Finally, beef prices are determined in a very similar manner to cattle prices. That is, the US market determines the overall price level. Canadian prices are the US price for the particular beef cut, converted by the exchange rate and then adjusted for the transport factor. In addition to the exchange rate and transport, there are other market oriented factors at work but in essence, the beef pricing scenario is almost identical to the cattle pricing methodology. As an example of this fact, it is noted that one of the benchmark beef prices is the price of lean grinding beef. This price is widely noted and is reported in the US by the USDA and by Canfax in Ontario. The following two graphs show the pricing relationship between Ontario and the central US for 85% chemical lean (CL) beef through the five-year weekly average prices for the period prior to BSE and the border closure. The graphs show how closely the prices move together over time and how well the two prices are correlated. The graphs demonstrate again, the near complete interconnection between the US and Canadian markets.



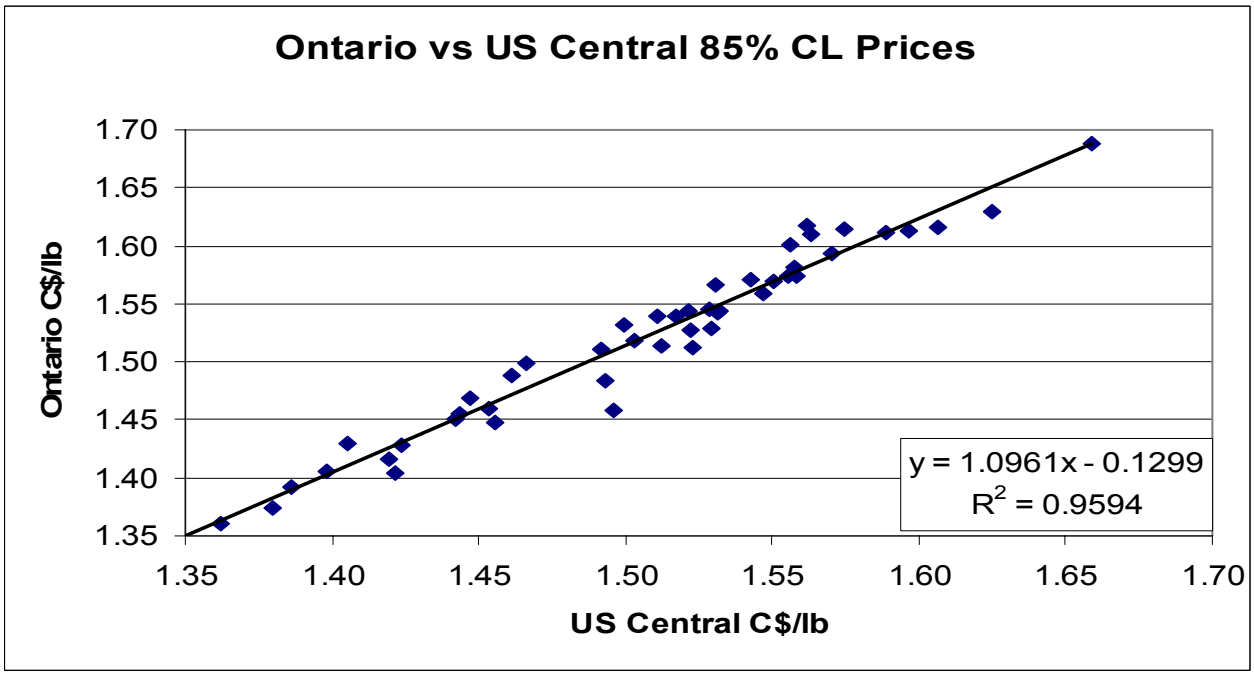


Figure 5 Source: Canfax

Canadian Grain Pricing

One of the most important production inputs in the cattle industry is grain. It comprises about 70% of the costs of finishing cattle in feedlots. As with cattle and beef prices in Canada, as well as all freely traded North American-based commodities, grain prices in Canada are determined by US grain prices. As with cattle prices, and all freely traded North American-based commodities, grain prices are essentially the US price, converted by the exchange rate and then adjusted for a spread based on transport or local market conditions. The following graph shows the monthly pricing relationship between western Canadian barley prices and US corn prices from 2000 through May of 2005.

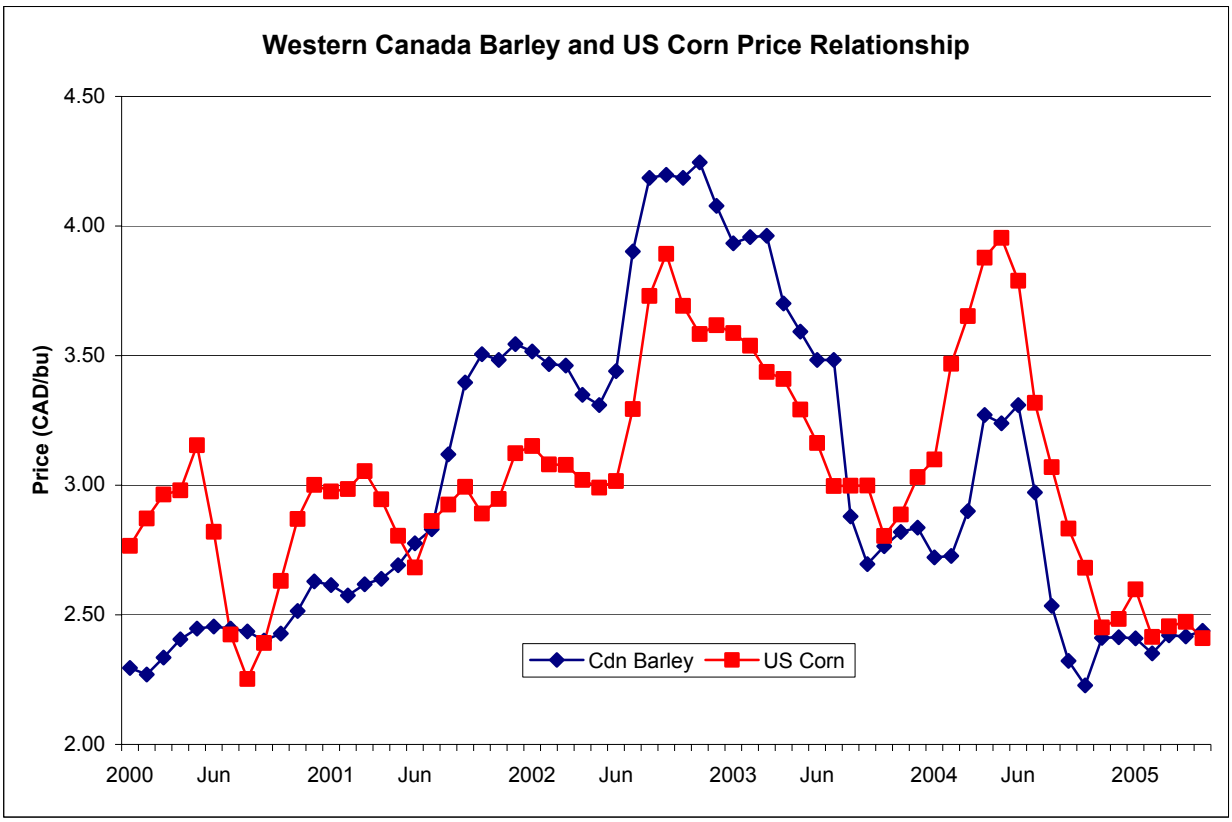


Figure 6 Source: George Morris Centre data files

The correlation coefficient between the two prices is .73, which is a statistically significant relationship. Once again, as with cattle and beef, the point to be made is that the US market is the determining factor for grain prices in Canada.

With regard to the exchange rate, the following graph shows the relationship between the exchange rate and western barely prices over the same 2000 to June 2005 timeframe.[9]

[9] As noted previously in this paper, the exchange rate can either be expressed as C$/US$ or vice versa. Either manner is acceptable and both ways are widely and interchangeably used by the industry. The Canfax Weekly Report reports the exchange rate as US$/C$ (eg., US$0.85/C$). The Bank of Canada

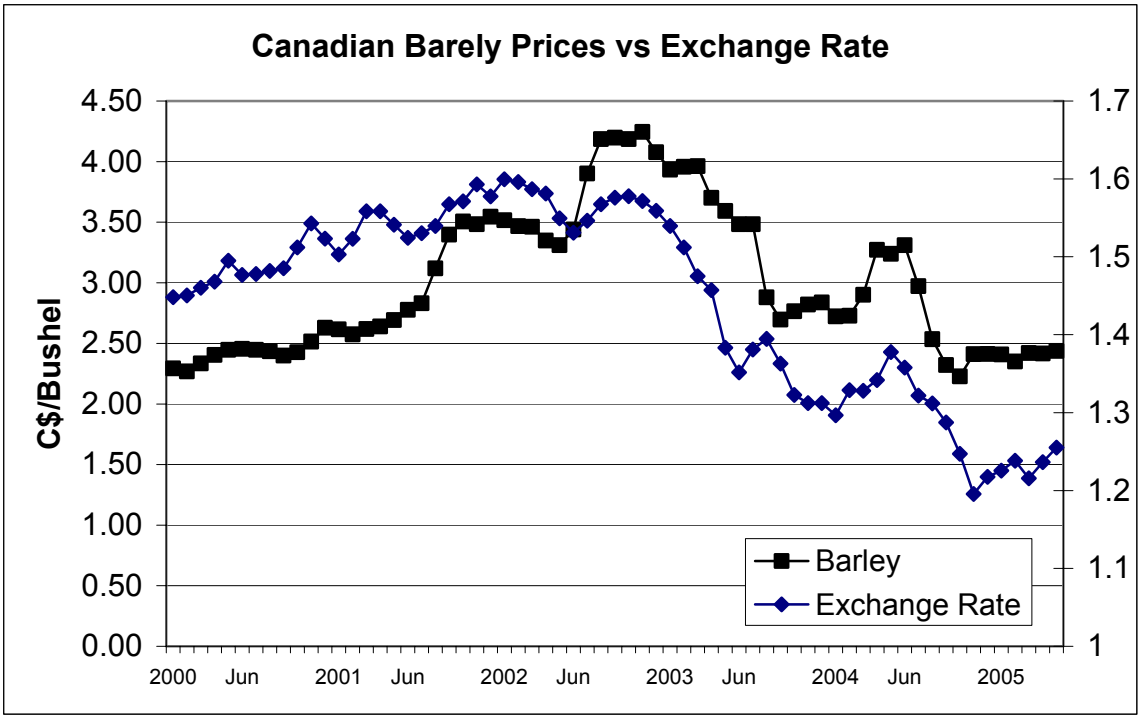


Figure 7 Source: George Morris Centre data files

The graph above shows that as the exchange rate depreciated and then appreciated, there was a corresponding increase and then decrease in the price of barley. However, this relationship is not as strong as it is with cattle prices. The correlation coefficient is just .51 which is not significant as an explanatory variable. This simply indicates that the exchange rate influence exists but is not as dominant in western barley pricing as it is in cattle pricing.

Price Determination and Discovery Summary and Discussion

There are two important points to take from this section. The first is to note that from feeder cattle through to beef cuts, as well as grain, Canadian prices are determined by US prices due to the ability to arbitrage in an open North American market. The second point is to note the direct role that the exchange rate plays in commodity pricing in Canada. There is a direct, highly correlated inverse relationship between the exchange rate and cattle/beef prices. The exchange rate plays a direct and simple arithmetic role in pricing cattle and beef.

provides both Can/US and US/Can. As noted earlier, in this paper both methods are used, given the pervasive use of both methods by the industry.

1.2 The Exchange Rate and Cattle Industry Production Factors

The previous section examined how commodity prices and in particular cattle prices are discovered and determined in Canada. It discussed the role of the exchange rate in the pricing process. This section of the report outlines the key cattle industry production input variables (excluding grain as that has already been discussed in the section above) as well as the pricing process of those variables. Key input variables include energy, interest rates, labour, capital assets (equipment/machinery) and land. Due to the nature of these production inputs, (ie. capital asset base) this analysis takes a longer-term perspective. The purpose of the section is to demonstrate the role, if any, of the exchange rate in the pricing of industry inputs.

Agricultural Industry Inputs

The graphs and discussion on the following pages show the trends in key agricultural input variables from 1980 through 2003.[10] The graphs show the unit costs or overall costs. Also included in the graphs is the trend in the Canadian exchange rate expressed as the value of one US dollar in Canadian dollars. Each of the graphs is paired with another graph showing the statistical relationships between the input and the exchange rate.

As a starting point on the discussion above, the exchange rate generally depreciated over the longer-term trend from 1980 through 2003. This depreciating trend line was interrupted during the late 1980's and early 1990's. Another point to note, within that context is that even if there is a meaningful statistical relationship between the exchange rate and the production variable in question, it does not necessarily mean that there is a cause and effect at work between the two factors. In other words, it can be shown that there are statistical relationships between many occurrences but that in itself does not mean that one occurrence led to the other. With that caveat noted, the discussion below does help to illuminate if there is a relationship in existence, why it might exist and what it might mean for the industry.

[10] The source of the data is Statistics Canada Cansim series'. 2003 is the latest available data for most of the inputs. The data reflect annual farm expenses and asset values as tabulated by Statistics Canada, Agriculture Unit.

Land

The following graphs show Canadian agricultural land prices per acre coupled with the exchange rate from 1980 through 2003.

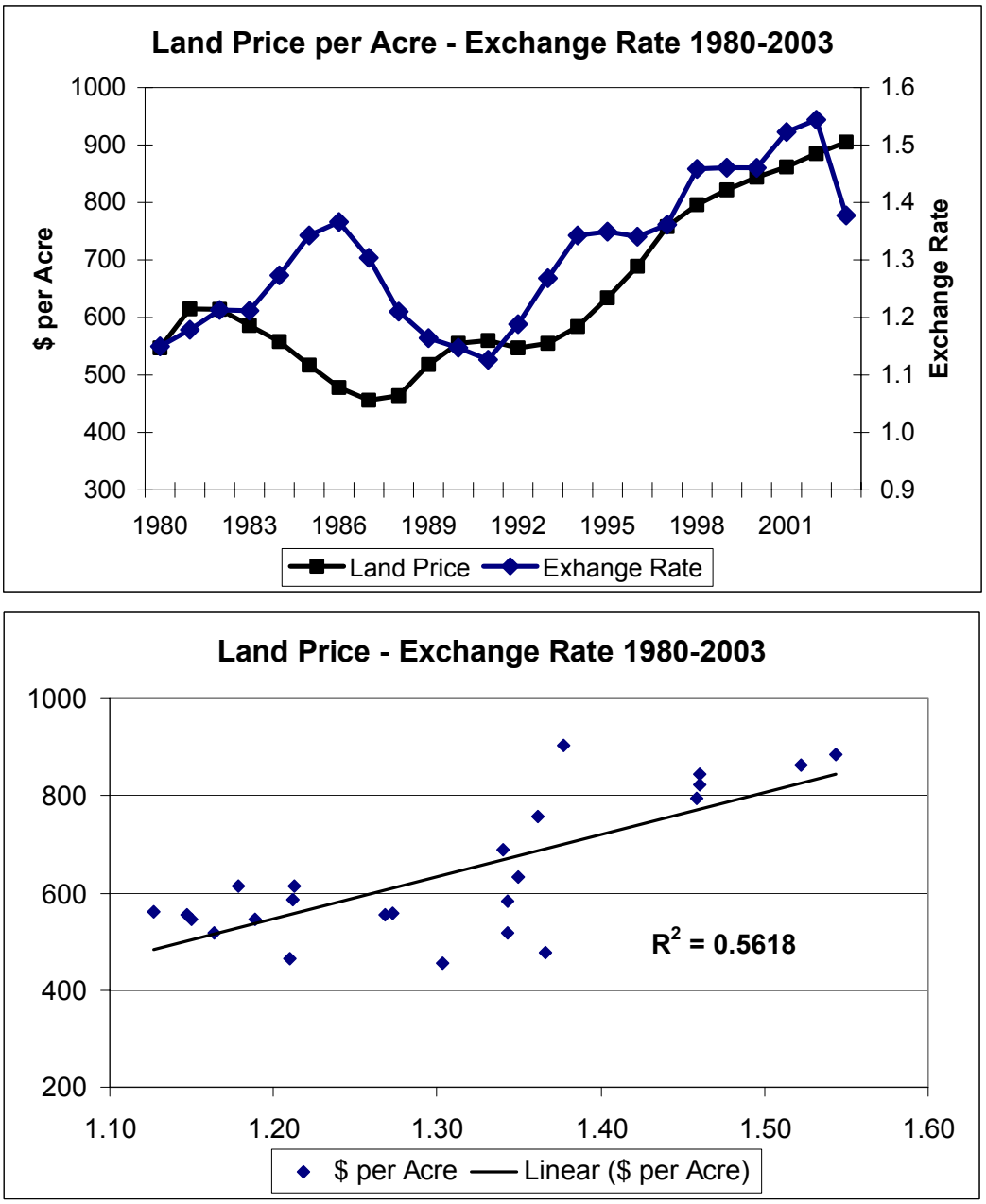


Figure 8 Source: Cansim

As can be seen, there is a reasonably strong longer-term relationship between the exchange rate and agricultural land values. From a statistical perspective the relationship is significant and therefore there is reason to assert that the exchange rate has an impact on land values. While that

is statistically true, however, land values are typically influenced by factors such as the following[11]:

- Farm incomes
- Urban encroachment/access
- Yields/usage
- Interest rates
- Availability

There is a positive relationship between land values and yields, farm incomes and urban sprawl and a negative relationship between land values and interest rates. Furthermore, as a general long-term trend, all real estate, urban and rural, has tended higher over time in all areas.[12] As noted by the Farm Credit Corporation, "Rising land values generally indicate strength in the agricultural industry."[13] This overall rising land values trend has occurred as the exchange rate trended toward depreciation. However, during the late 1980's as the exchange rate appreciated, acreage values continued to increase. This indicates that the relationship is relatively weak.

Statistics Canada[14] tabulates an index of farm input costs, including farm rent. Additional evidence of the lack of a linkage between land values and the exchange rate is the relationship between farm rent and the exchange rate. There is essentially no statistical relationship between the Canadian farm rent index and the exchange rate. As such, despite the statistical relationship between the exchange rate and land values, there is not necessarily a causal relationship between exchange rates and land values. Therefore, the linkage between the exchange rate and land values from a direct, causal perspective is not strong and should not be considered important.

A comparison was made between pastureland values in Canada, using Alberta data, and those in the US. After steady growth in the 1970's, the annual average pastureland price in Alberta[15] denominated in Canadian dollars leveled-off though most of the 1980's and early 1990's, before resuming an upward trend through 2002.

[11] 2004 Farmland Value Survey Iowa State University, Michael D. Duffy, extension economist, Darnell Smith, research economist, http://www.extension.iastate.edu/agdm/wholefarm/html/c2-70.html
[12] Credit as a Factor Influencing Farmland Values: What Does the Evidence Show? http://www.ers.usda.gov/Briefing/FinancialMarkets/AIS56a.pdf
[13] Spring 2005 Farmland Values, Farm Credit Corp, http://www.fcc-fac.ca/en/Products/Property/FLV/Spring2005/index.asp?main=2&sub1=property&sub2=farmlandvalues
[14] CANSIM II TABLE 3280014
[15] The annual average pastureland value in Alberta is the average of CLI 4 and CLI 5 agricultural land sales for each year as reported by the Government of Alberta. CLI 4 land is defined as, "Soils in this class have severe limitations that restrict the range of crops or require special conservation practices." CLI 5 land is defined as "Soils in this class have very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible."

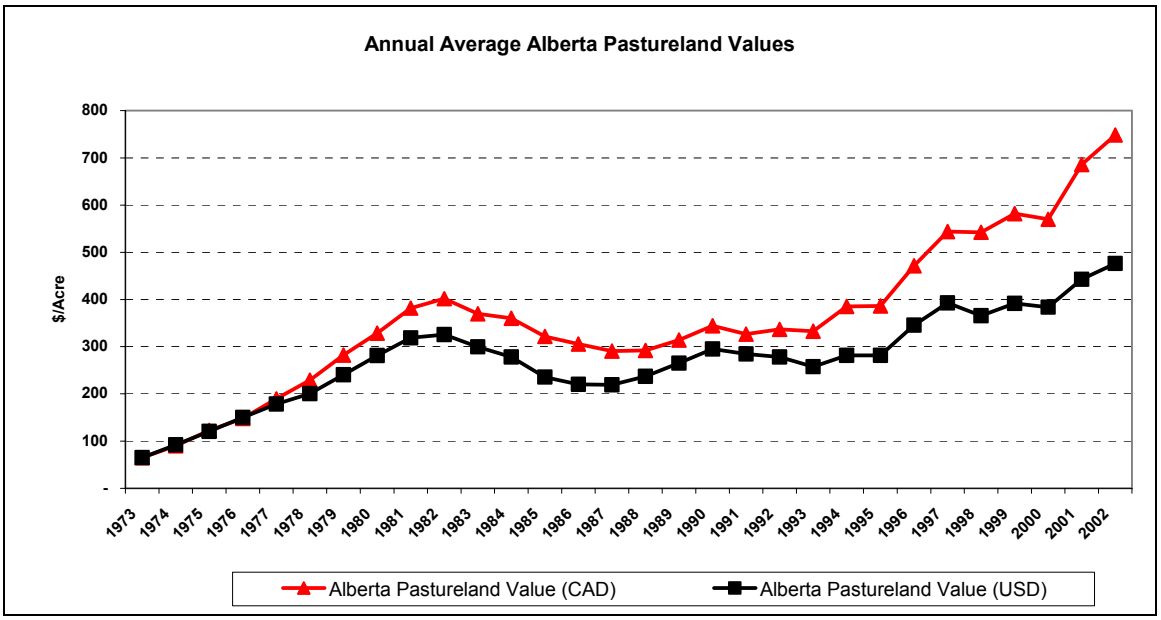


Figure 9 Source: Government of Alberta

A weakening of the Canadian dollar versus the US dollar resulted in a flatter trend throughout the late 1990's in US dollar denominated pastureland values. The average Alberta pastureland value (USD) has exhibited a strong relationship with US pastureland values as reported by the USDA[16], with an R-squared of 0.84 from 1973 to 2002. The average US pastureland value used in this comparison consists of pastureland values of the top ten states for beef cow inventories excluding Montana and Kentucky due to missing data.

[16] Prior to 1998, pastureland values are available from the Economic Research Service of the USDA Cash Rents for US Farmland publication. Data from 1998 onward is available in the National Agricultural Statistics Service (NASS) Agricultural Land Values and Cash Rents publication.

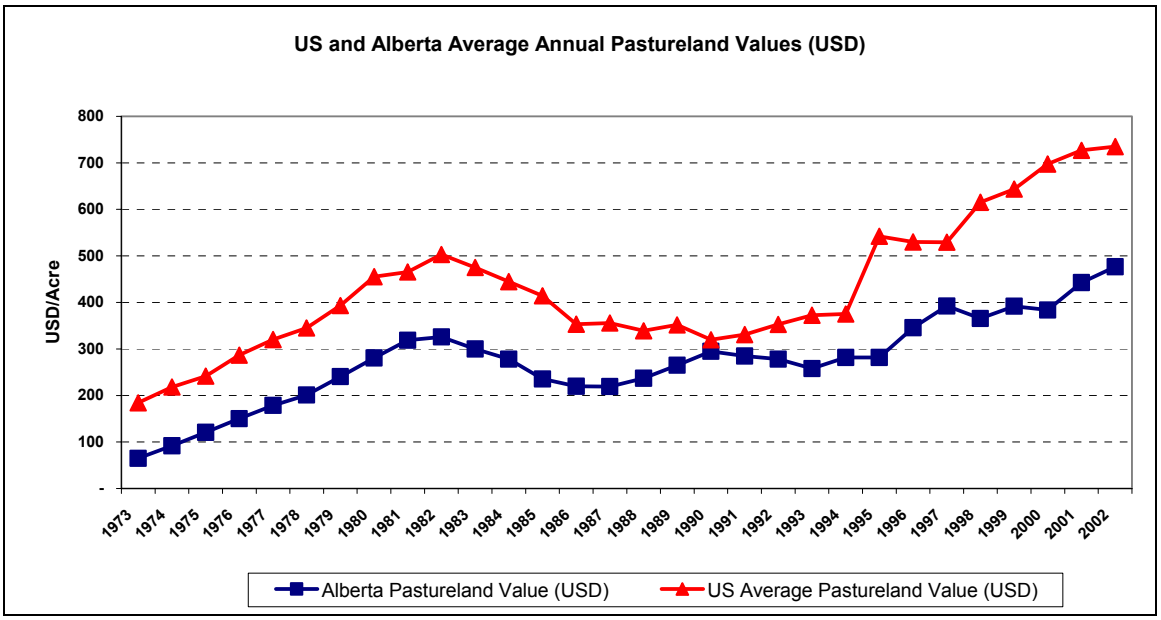


Figure 10

Both the US and Canadian pastureland values should be closely related to the income that is earned by the landholder from grazing cattle on that land. Thus, to the extent that the prices of feeder steer calves are indicative of income levels, US and Canadian pastureland prices should be well correlated when US and Canadian feeder steer calf prices are well correlated. The average 500-600 pound Alberta cash feeder steer price, a proxy for income to the pastureland owner, demonstrated a moderately strong relationship with the Alberta pastureland value from 1973 to 2002 with an R-squared of 0.61.

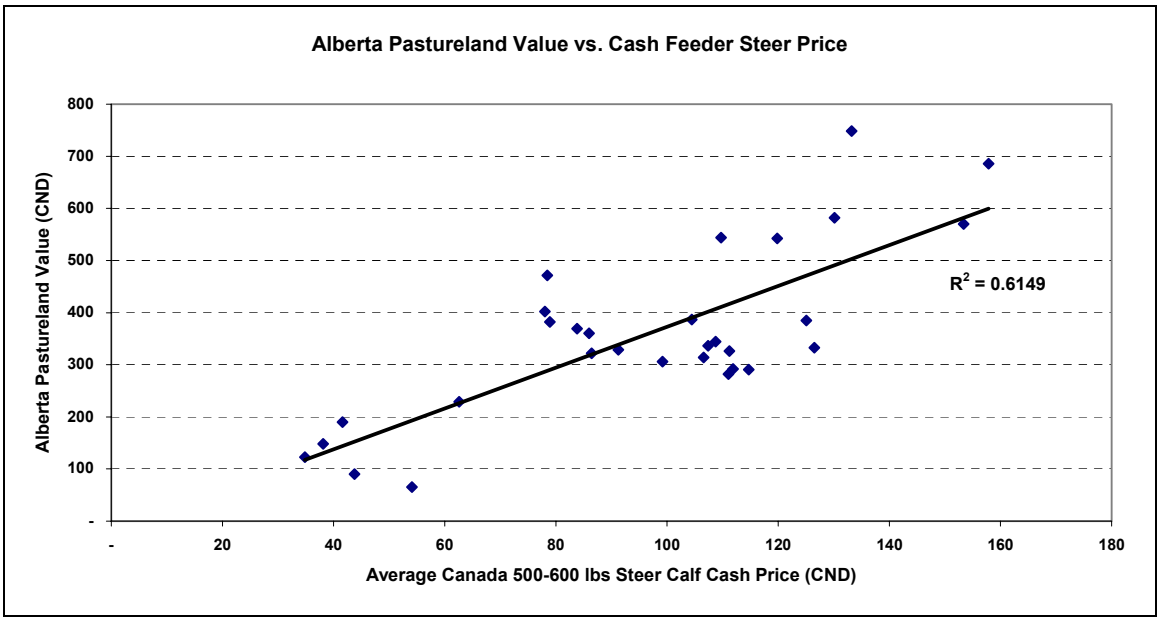


Figure 11

Capital Assets

The following graph shows the relationship between the exchange rate and the aggregate value of capital assets on Canadian cattle farms per 1000 head of cattle. Capital assets include machinery and buildings involved in the production of cattle in the farming or feeding operation. Examples would include barns, silos, feedmills and tractors. The capital asset base will fluctuate over time based on a number of factors. Firstly, individual capital assets will depreciate over time depending on generally expected useful life spans. The asset base on any farm or in Canadian cattle farms as a whole will increase over time when more assets are accumulated or when asset prices increase. The aggregate value of the asset base can increase or decrease depending on the circumstances at work in the industry.

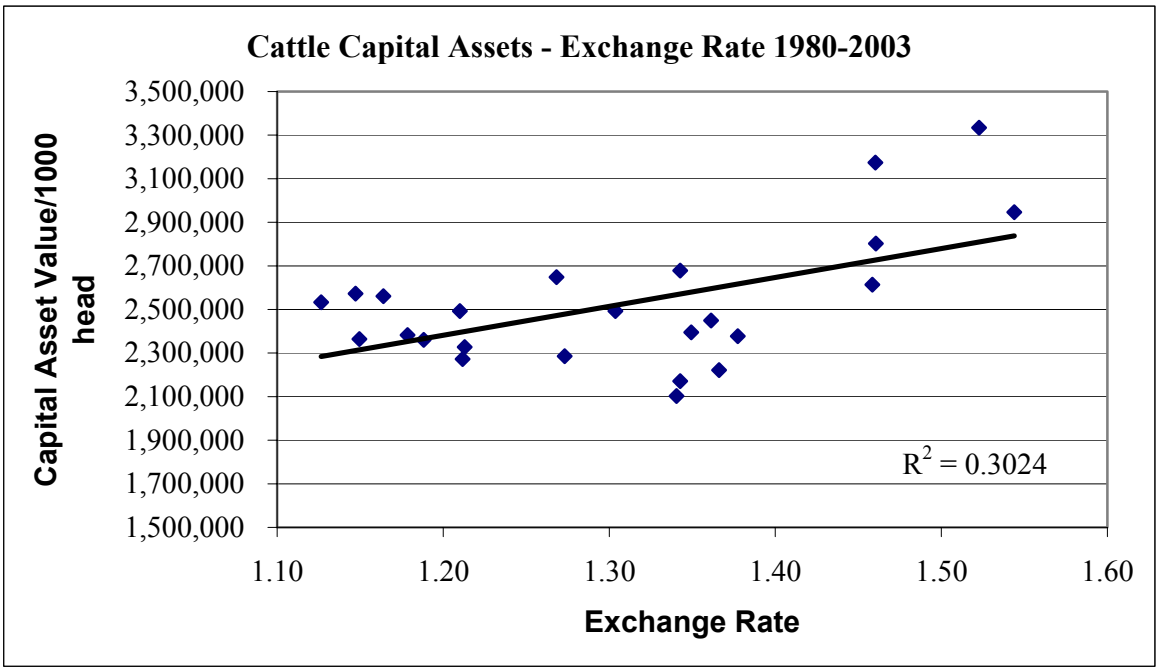


Figure 12 Source: Cansim

As can be seen, there is little or no statistical relationship between the exchange rate and the value of capital assets on cattle farms in Canada. This does not mean that the exchange rate does not in some way influence or impact the accumulation of capital assets on cattle farms. In fact this concept is discussed in greater detail later in this paper. With that said, however, there is no statistical evidence to suggest that there is a meaningful direct relationship between the exchange rate and the value of capital assets on cattle farms.

Further examination of the capital asset and exchange rate relationship can involve capital asset pricing. Farm machinery is a good proxy for farm capital assets. The Statistics Canada farm price index series, which was noted above, also measures the changes in farm machinery prices. The following graph shows the farm machinery price index compared to the exchange rate.

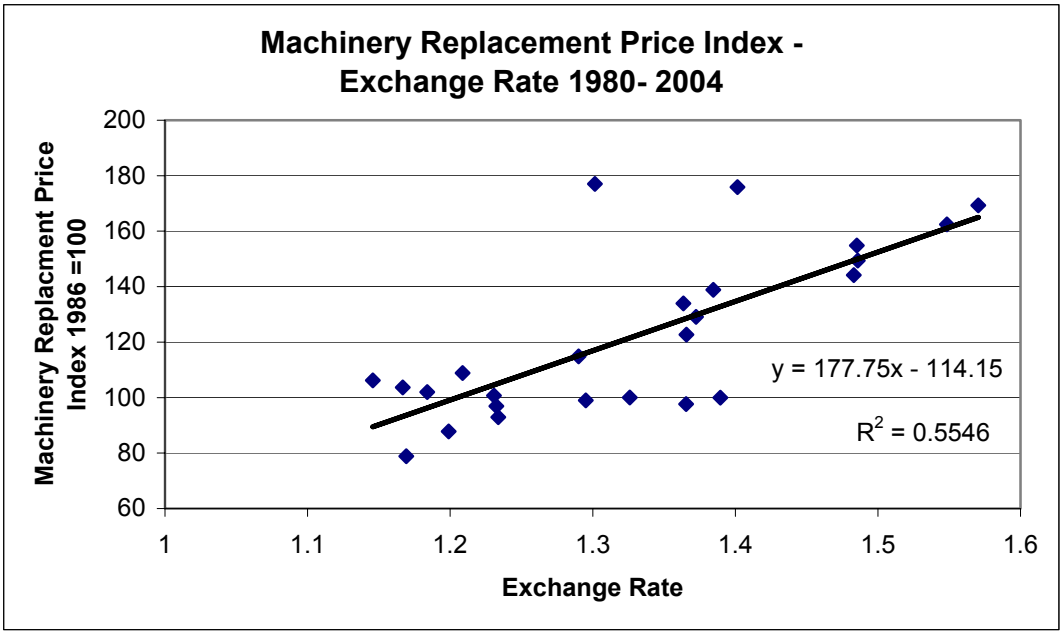


Figure 13 Source: Cansim

There is a reasonably significant relationship between the exchange rate and changes in farm machinery prices. By inference, that suggests that there is a relationship between the exchange rate and capital asset value prices. That is, as the exchange rate depreciates, capital assets increase in price. This relationship is reasonable given that capital assets can be traded freely between Canada and the United States. As a result, as the exchange rate depreciates, it should be expected that capital assets will become more expensive. As a basic point of guidance, over the last two decades, every 1% change in the exchange rate has lead to a 2% change in farm machinery values.

In summary, with regard to capital assets, there does not appear to be a relationship between the exchange rate and the value of capital assets on cattle farms. There does, however, appear to be a reasonable relationship between the exchange rate and the price of capital assets.

Labor Expense

The following graph shows the relationship between the exchange rate and the index of hired farm labour rates. The graph and the data used to compile the graph shows that there is no meaningful statistical relationship between the exchange rate and changes in wage rates. This is not surprising given the fact that labour is far less mobile than commodities and labour does not arbitrage like commodities.

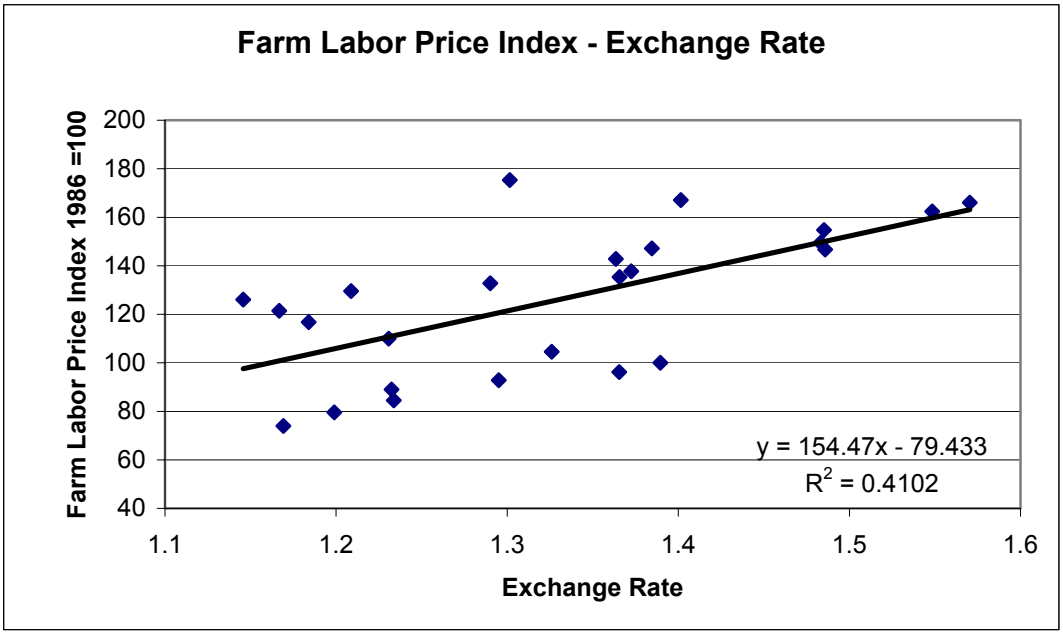


Figure 14 Source: Cansim

Interest Rates

The following graph shows the relationship between the exchange rate and prime interest rates in Canada.

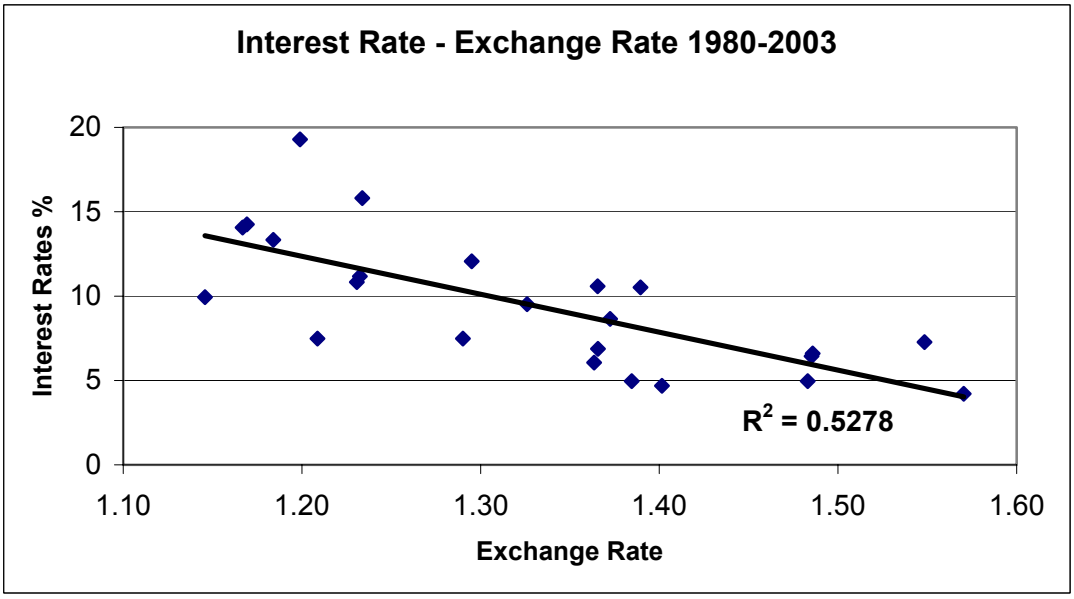


Figure 15 Source: Cansim

The graph shows a relatively weak relationship between exchange rates and the interest rate level in Canada. Basically the relationship shows that the lower the interest rate, the weaker the currency.

Other Inputs

Other key agricultural inputs include electricity, fertilizer and diesel fuel. As with labour rates, Statistics Canada calculates an index of these farm inputs. These input indices can be graphed relative to the exchange rate to determine relationships, if any. As an example the following graph shows the statistical relationship between fertilizer and the exchange rate.

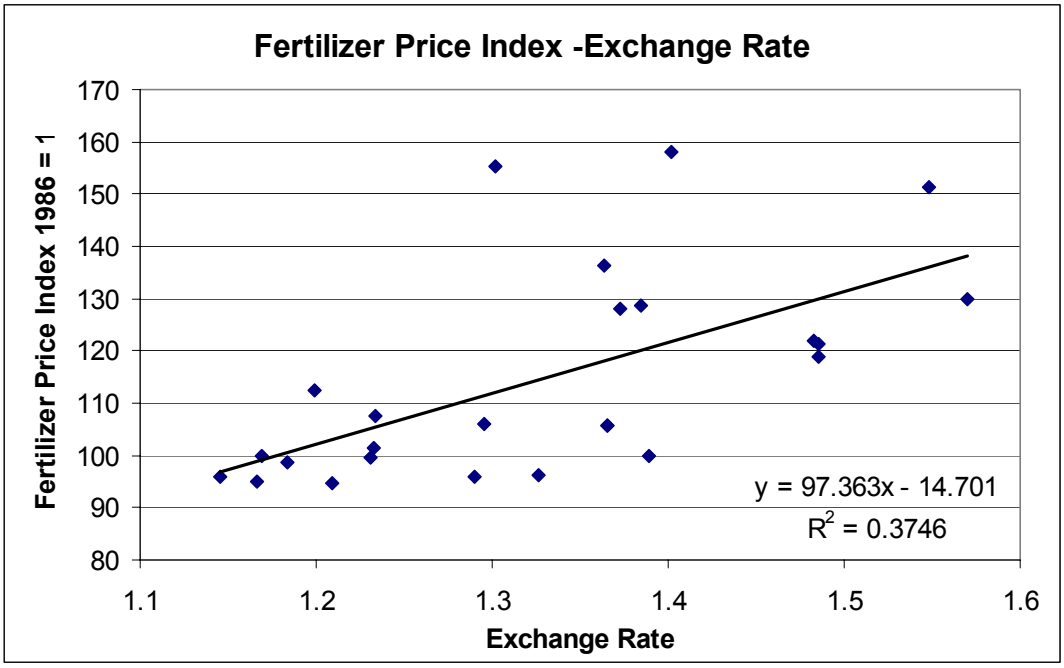


Figure 16 Source: Statistics Canada, Cansim

This graph is reasonably indicative of the other inputs such as diesel fuel and electricity. That is, the exchange rate appears to have some, minor impact on the changes in the price of the input. The graphs and statistical relationships suggest that as the exchange rate depreciates (appreciates), the price of the good increases (decreases). This relationship is not surprising given that these types of goods can be freely traded across borders. Of course the fact that the exchange rate has a minor impact on the values is also not surprising given all the other factors that go into pricing items such as fertilizer, electricity or fuel.

Indirect Impacts

A secondary point that should be addressed with regard to inputs, which was not addressed in this section, relates to indirect effects of the exchange rate. That is, the impact of the exchange rate on industry profitability and hence on the price of industry inputs. Section two of this report provides a detailed examination of the impact of exchange rates on industry margins. To the extent that the exchange rate impacts margins, as discussed in section 2, it will also have an indirect impact on the industry's purchasing power, and hence the prices of inputs. It is likely impossible to state with certainty the magnitude of this indirect affect. Furthermore this indirect affect or impact is most certainly very small even when compared to the relatively small direct

impacts. Nevertheless, as long as the exchange rate impacts margins, as noted below, then there will be an impact on input purchases and therefore it needs to be noted.

Agricultural Industry Inputs and the Exchange Rate Discussion

The foregoing analysis suggests that there is very little relationship between the exchange rate and most agricultural inputs. Exchange rates appear to have very little impact on the prices or values of land and farm labour and a small impact on the prices of fertilizer, electricity and diesel. The exception is the relatively stronger relationship between the exchange rate and the prices of capital assets. The purpose of this section of the report was to demonstrate the role, if any, of the exchange rate in the pricing of industry inputs. In that regard, it must be concluded that the exchange rate plays a minor role in the price determination or discovery process of cattle industry inputs, with the exception of capital assets.

1.3 Industry Productivity and the Exchange Rate

The previous section examined relationships between the exchange rate and industry input costs. Possible relationships between these measures and the exchange rate were also reviewed. This section provides an overview of some of the key measures in overall industry productivity. The purpose of this section is to determine overall industry productivity trends and to determine whether there is an exchange rate factor behind these trends. This section does not look particularly at the cattle and beef industry productivity measures. The premise is that if there are overall industry productivity links to the exchange rate, then it is reasonable to assume that the cattle and beef industry are similarly affected.

Short Term and Long Term Causes of Exchange Rate Change

This section examines the drivers behind the short and long term trends in the exchange rate. That is, this section seeks to determine the causes of change in the exchange rate.

A common question during the last two years of the C$'s appreciation is whether the Canadian dollar is rising or whether the US dollar falling? The following graph shows the US dollar value of the Australian dollar, the Euro, the Pound and Yen (100 units) and the C$ from 2002 to January 2005.

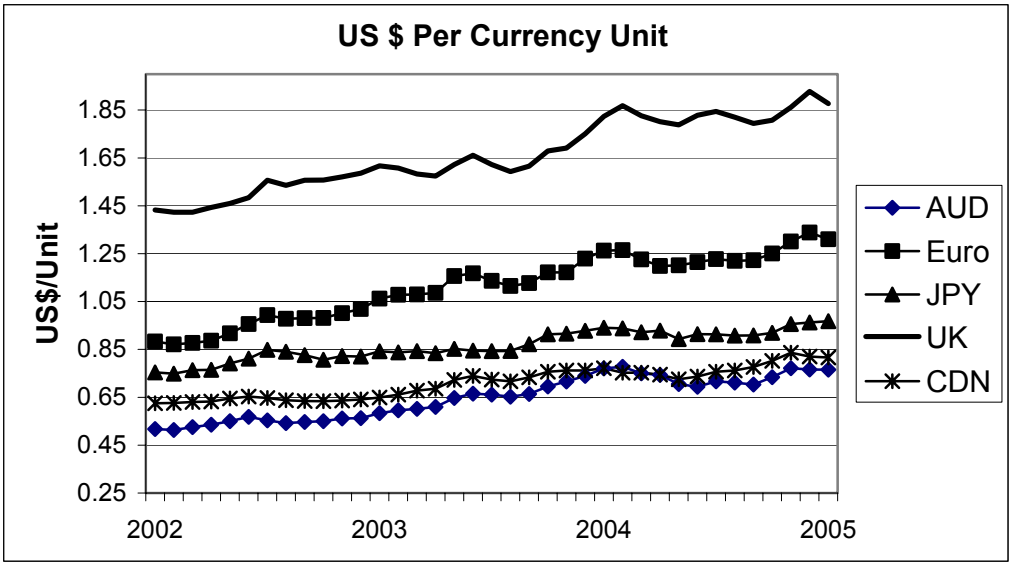


Figure 17 Source: Bank of Canada

All of the currencies have been rising in value relative to the US dollar Prevailing economic analysis states that the reason for this development is because the US Federal Reserve Board has dropped US interest rates very low relative to other international interest rates, and because of sluggish growth in the US economy. Low interest rates cause short-term capital to try to find higher-returning places to invest. The sluggish economy discourages long-term capital investment because the expected payoff is too low.

A second question is; what is driving the value of the Canadian dollar in the long term? The George Morris Centre has asserted in previous research that productivity is a major factor in currency valuation.[17] The hypothesis is that there is a direct link between the relative productivity between Canada and the US and the exchange rate between the two currencies. This is demonstrated on the graph below. The graph shows the exchange rate as well as a productivity measure. The productivity measure is the Gross Domestic Product in the two countries divided by the total number of people employed in all industries and sectors[18]. This gives the total number of dollars produced by the economy per worker. Then in order to compare to the US, the Canadian productivity is shown as a percentage of the US.

The graph shows that in 1981, Canada's productivity ratio was about 85% of the US. During the 1980's the ratio declined and then rose to over 90% in the early 1990's. By 2002, it was down to just over 60%. During the last two years, however, Canadian productivity increased relative to the US. The increase in productivity over the last two years is a reflection of stronger economic growth in Canada than the US during the last two years, as well as the strength added by high-energy prices. What is noteworthy is that there is a strong and direct correlation between this productivity measure and the second line on the graph – Canada's exchange rate. The correlation between productivity and the exchange rate is over 95%.

[17] A Comparative Analysis of Productivity and Competitiveness in Agri-Food Processing in Canada and the United States: An UPDATE, Stiefelmeyer, November, 2005

[18] Exchange rate effects are taken out by adjusting the GDP data by the annual exchange rate.

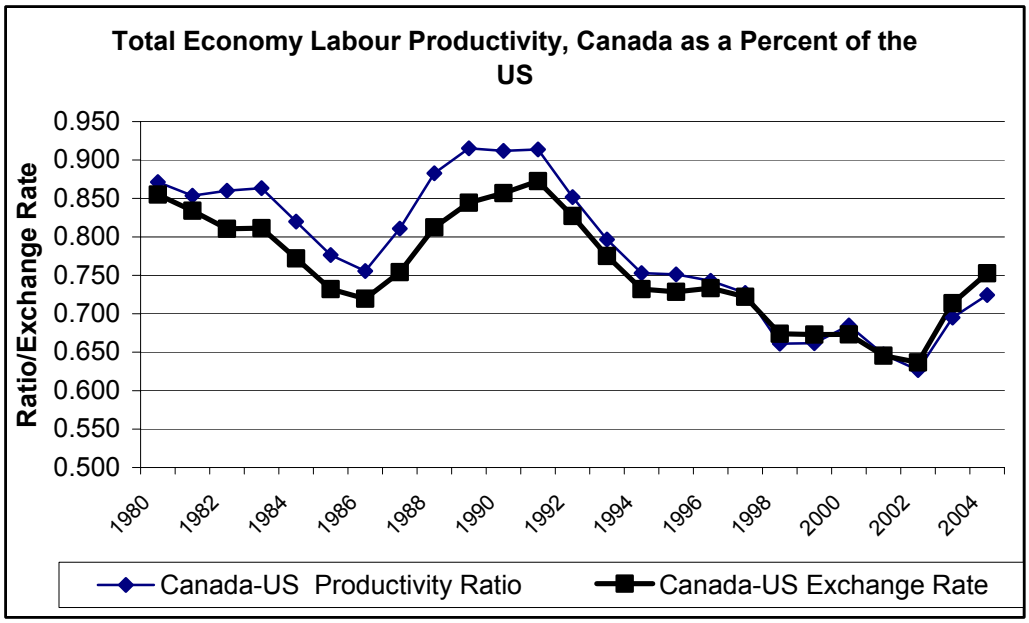


Figure 18 Source: George Morris Centre data files

During the last two years, as shown on the graph, the implication is that Canadian productivity is rising and hence the exchange rate is appreciating. The comparison in the graph raises the question: is the dollar rising because Canada's relative productivity is rising, or does it appear that relative productivity is rising because the loon is rising?

To overcome this measurement problem, the productivity measure can be changed to use value added per dollar of expenditure on wages and salaries rather than per employee. This adjustment is helpful because value added per dollar of expenditure is a ratio that uses two value measures. Therefore there are no exchange rate effects when industries in both countries are compared using one rate of exchange, in this case the Canadian dollar. This calculation puts dollars in both the numerator and denominator. The results are shown in Figure 19, which has the original information from Figure 18, as well as the new productivity ratio using GDP value added/dollar of wage expenditure. Clearly, this series is not as directly correlated with the other two. Most importantly though this more independent productivity measure is steady to only slightly higher in 2003 while the dollar in turn rose sharply.

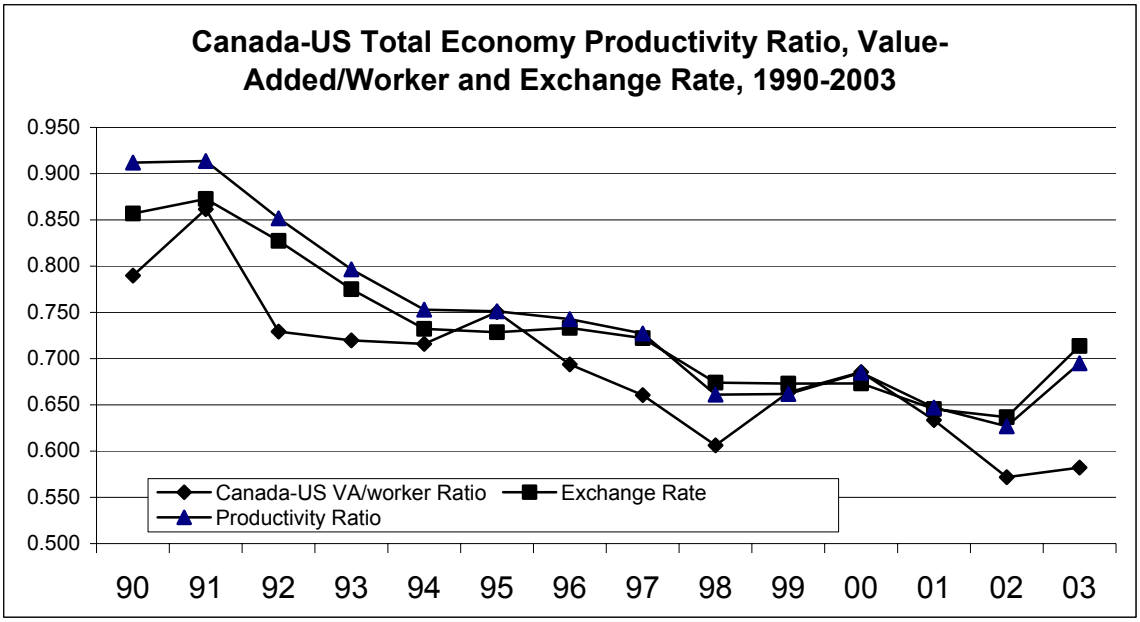


Figure 19 Source: George Morris Centre data files

This suggests that something other than productivity in Canada is responsible for the recent rise in the Canadian dollar. Figure 20 shows the differences between Canadian and US prime interest rates since 2000 plotted against the C$. Note that the Bank of Canada started raising Canadian rates in 2001. After a lag, the C$ started to rise. The interest rate spread peaked in mid-2004, and then started to decline. The spread declined because the Bank of Canada let the US Federal Reserve lead the rate hikes for a while since Canada was not experiencing much inflation, and Canadian exporters were complaining about the currency appreciation. Note that the C$ dropped in late 2004 and early 2005 following the decline in the interest rate spread. The fall 2005 rally in the exchange rate appears to result from two factors. First, the price of oil continuing to rise, which is perceived to be a net positive for Canada. Second, the ongoing threat of a relative rise in Canadian interest rates. The Bank of Canada has said on several occasions that rates will need to rise.

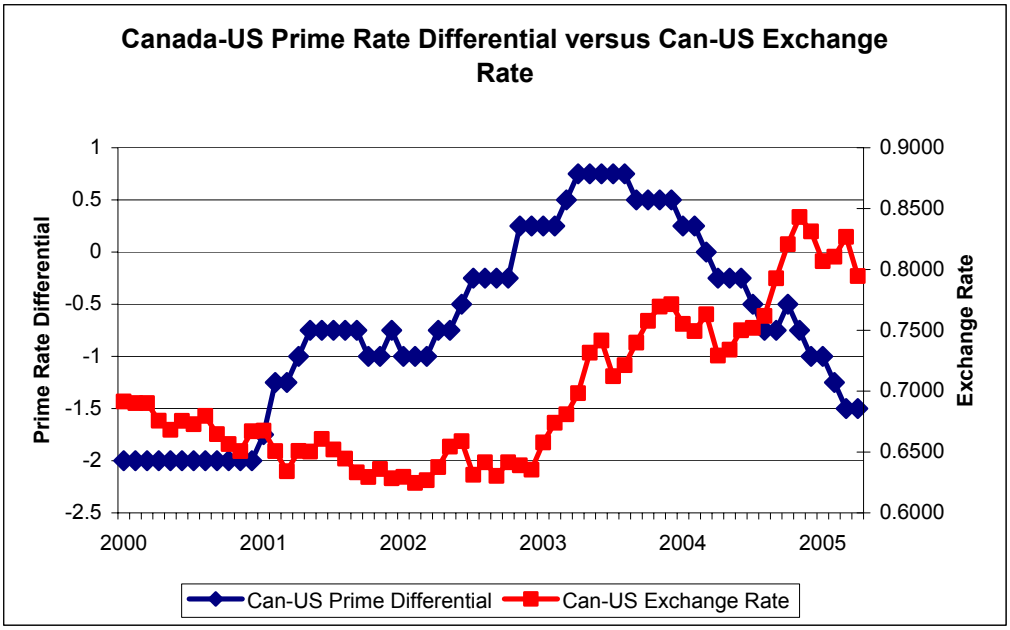


Figure 20

Causes of Declining Productivity

The key challenge therefore is to determine why Canada's productivity and hence its competitiveness is falling relative to the US. As a starting point, it is noted that labour productivity is greatly influenced by capital investment. If a company buys new equipment with new technology that allows more output per person, productivity rises. If a company builds a new plant with economies of size, then output increases per worker. The implication therefore is that Canada is not investing as rapidly in technology, plant and equipment.

When examining capital expenditures in the two countries, the data show that Canadian investment does lag that of the US. The following graph shows total Canadian capital investment from 1992 though 2003 as a percentage of US capital investment in US dollars.

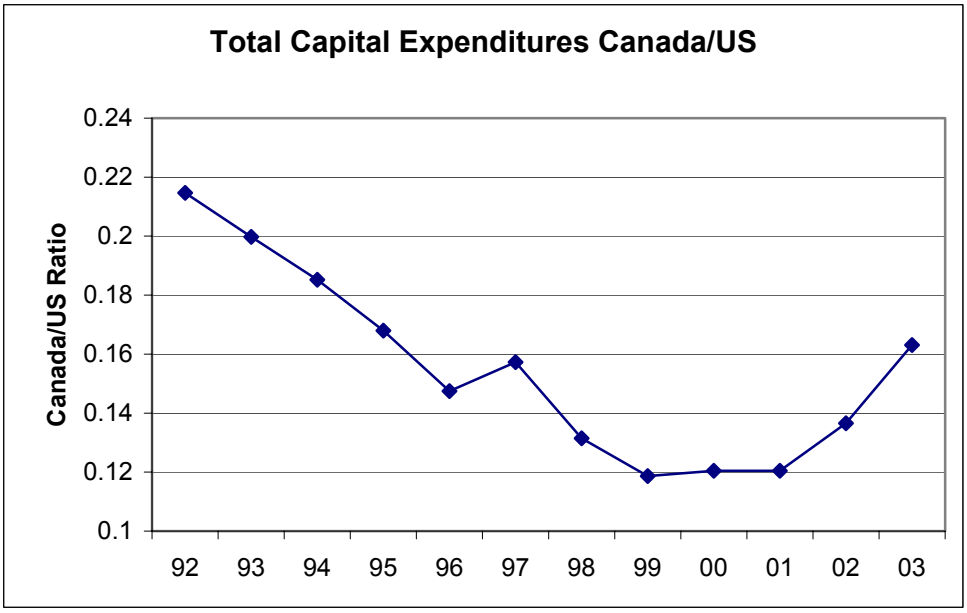


Figure 21 Source: Statistics Canada and the US Census Bureau

Canadian investment relative to the US lost ground continually through the 1990's. Only in 2002 did the investment begin to improve relative to the US. This improved investment is consistent with the modest increase in productivity indicated during the early part of this decade as noted in the previous section.

Interestingly, the converse of output per unit of labour is labour cost per unit of output: the lower the relative productivity, the higher the relative labour cost. When Canada's underlying relative productivity is falling, it means that underlying relative costs are rising. In turn, this means that, if Canada is to export goods and services while Canada's costs are rising relative to competitors, the only way to make it is to lower the exchange rate. In other words, the declining currency provided helped to conceal Canada's declining productivity.

Furthermore, the effect of a depreciating currency may also play a role in decreasing productivity. In other words, the relationship may be circular. An April 2005 research report for the Bank of Canada provides support for that assertion[19]. Using industry-level data for Canadian manufacturing industries from 1981 to 1997, the authors found empirical evidence of a negative relationship between the capital-labour ratio and the user cost of capital relative to the price of labour. A 10 per cent increase in the user cost of the machinery and equipment (M&E) relative to the price of labour results in a 3.3 per cent decrease in the M&E-labour ratio in the long run. Assuming complete exchange rate pass-through into imported M&E prices, the maximum effect of a permanent 10 per cent depreciation in the exchange rate is a 5.2 per cent increase in the user cost of M&E, and a 1.7 per cent decline in the M&E-labour ratio. This result implies that the cumulative growth of the M&E-labour ratio during the 1991–97 period would have been 2.3 percentage points higher had the dollar not depreciated. In other words, the depreciation helped to lower the capital acquisition rate in Canada. The authors go on to say that the exchange rate

[19] Do Exchange Rates Affect the Capital-Labour Ratio? Panel Evidence from Canadian Manufacturing Industries by Danny Leung and Terence Yuen, Bank of Canada Working Paper 2005-12

effect on total labour productivity is small. Nevertheless the paper is evidence of the negative and self-re-enforcing relationship between declining productivity and the depreciating Canadian dollar.

The depreciation likely impacts productivity through its impact on the cost of capital. The Bank of Canada study says that the exchange rate and the relative price of capital (user cost of capital over the price of labour) move together for much of the 1991-97 period. When the exchange rate depreciated during the 1981–86 and 1991–95 periods, the relative price was generally rising. When the exchange rate appreciated during the 1987–90 period, the relative price fell. The magnitude of the fluctuations in the relative price, however, is much greater than that of the exchange rate. This suggests that there are other important factors driving the relative price. Once again, there is evidence for the negative, self-re-enforcing relationship.

Industry Competitiveness and The Exchange Rate

In 1990, Canada's Agri-Food Competitiveness Task Force defined competitiveness as '*the sustained ability to profitably gain or maintain market share*'. The Task Force said that the definition could be applied to an individual company, an industry, an industrial sector or a national economy.

Harvard University's Michael Porter, defined productivity as the value of the output produced by a unit of labour or capital. It depends on both the quality of the products and the efficiency with which they are produced. Porter flatly states that "the only meaningful concept of competitiveness at the national level is national productivity.[20] Most economists would agree that country or industry productivity relative to other countries is arguably the best single measure of competitiveness. For example a 2000 Industry Canada research report entitled "An Assessment of Competitiveness and Productivity Levels," simply states, "Our analysis indicates that Canadian manufacturing industries with high relative productivity compared to their U.S. counterparts tend to be more competitive.[21]

There is a direct linkage between productivity, which was discussed in the previous section and industry competitiveness. The strong correlation between productivity and the exchange rate demonstrated in the previous section is a major reason why it is misleading to state that a declining currency helps Canada's competitiveness. That is, declining productivity indicates a lack of competitiveness and declining productivity is linked to the depreciation of the Canadian dollar. As such, the depreciating currency is a measure of Canada's lack of competitiveness.

Exchange Rate and Productivity Summary and Discussion

The key point is that there is sufficient evidence to suggest that declining productivity is the primary cause of the depreciation of the currency relative to the US during the 1990's. Furthermore, declining productivity relative to the US may have resulted from declining

[20] The Competitive Advantage of Nations, Porter, 1990

[21] An Assessment of Competitiveness and Productivity Levels – Canadian and U.S. Manufacturing Industries Frank Lee, Industry Canada, Jianmian Tang Industry Canada, 2000 (http://www.csls.ca/events/jan2000/Lee&Tang.pdf)

investment relative to the US. In addition, the depreciation of the currency during the 1990's may have helped to increase the cost of capital, which would have accelerated the decline in the capital labour ratio. Furthermore, given the integral relationship between competitiveness and productivity, it is clear that the depreciation of the Canadian dollar was largely a result of Canada's lack of competitiveness. This research has not resolved whether the lack of competitiveness was the sole reason for the depreciation. There were likely other factors such as political uncertainty in Quebec for example. Nevertheless, the exceptional correlation indicates that a lack of competitiveness was a driving force.

Furthermore, while the C$ has appreciated notably since mid 2003, there is not yet sufficient evidence to suggest that there has been a corresponding increase in productivity. In this instance, the evidence suggests that higher relative interest rates in Canada and surging oil revenues were the key drivers of the appreciation.

1.4 Red Meat Industry Competitive Position[22]

The previous section has stated the case that the depreciation in the Canadian currency was a result of declining productivity and competitiveness in Canada. This section of the report specifically examines competitive measures for the red meat processing industry. The red meat sector is used as opposed to the beef sector due to data limitations. With that said, the general red meat sector evaluation is expected to be applicable to the beef sector. The purpose of this section is to evaluate the sector's competitive position relative to the United States.

Measuring Competitiveness

As noted above, competitiveness is the ability to profitably maintain or enhance market share. There are a variety of data challenges with regard to attaining profitability measures. As such, at the industry level, value added can be used as a proxy of profits. By definition, value added is the difference between an industry's total revenue (value of shipments, as reported by Statistics Canada and the US Commerce Department) and its cost of raw materials.

Following from the above discussion, this study uses value added as a first approximation for profitability of processing industries because it represents the revenue that is excess to that required to pay for raw materials. To undertake inter-industry comparisons with other industries in Canada, or the same industries in the US, two sets of ratios are developed for each:

- Value added per dollar of sales: This indicates the gross margin of the subject industry relative to the comparators. An increase in the ratio indicates that margins are rising and, in industries with a competitive structure, suggest that the industry's product mix is changing toward being less of a commodity. A decline in the ratio may indicate that the industry's products are being commoditized, that non-raw material costs are declining, and/or that competitive pressure from others in the supply chain are increasing.

[22] Stiefelmeyer, November 2005

- Value added per dollar of expenditure on wages and salaries: This is the second approximation for profitability. If this ratio is rising, the industry is generating additional revenue after paying for , management and raw materials to pay for capital and knowledge.

In order to implement the other aspect of competitiveness, an appropriate measure for market share was required. There are many ways to calculate market share, including market share of domestic consumption or percentage of production sold internationally. One variant of the two is called the Net Export Orientation Ratio.

Net Export Orientation Ratio (NEOR) = (Value of Exports – Value of Imports) / Total Value of Sales

Therefore, if an industry's NEOR is positive, then the value of its exports are greater than the imports into its domestic market. Conversely, if an industry has a negative NEOR, then the value of imports into the domestic market outweighs the value of its exports.

Red Meat Industry Competitiveness

Sales in the red meat processing industry in the United States are roughly 10 times that of sales in Canada. Total Canadian red meat sales have been in the C$14-15 billion range from 2000-2003, while US sales are about C$135 billion. Growth in the two industries has been averaging nearly the same, with 4% per year in the United States and a 3.9% growth in Canada. In fact, the graph below, illustrates that similar trend line in sales between the two industries.

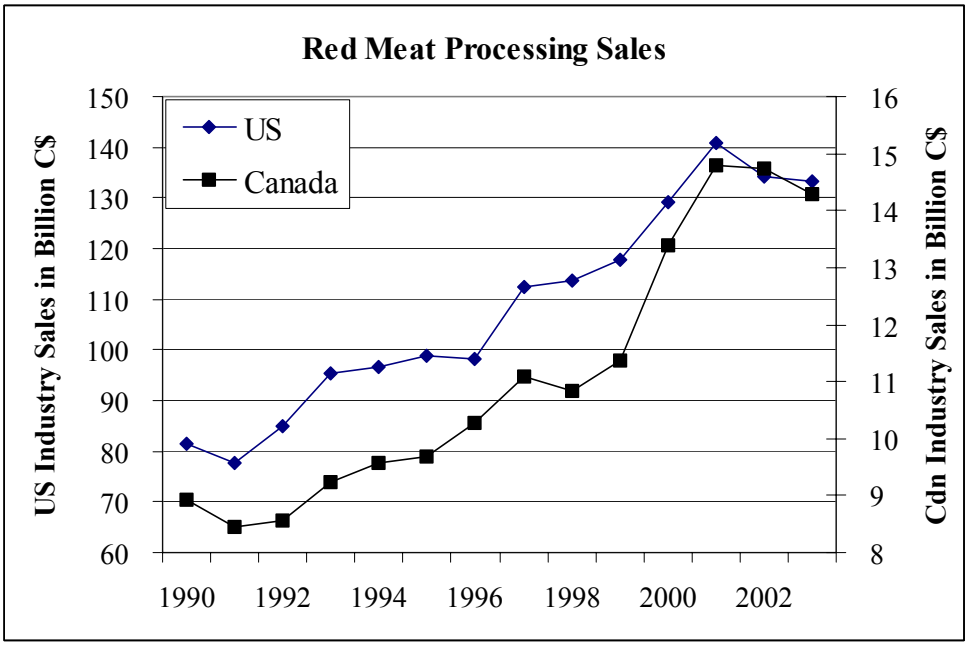


Figure 22 Source: Statistics Canada and US Bureau of Statistics

Total employment in red meat processing in the United States grew from just over 200,000 employees in 1990 to just over 262,500 in 2003, an average growth rate of 2.2% per year.

Canada's industry averaged 2.9% growth per year and reached just over 46,000 in 2003, up from 32,500 in 1990. Due to the large difference in the sizes of the two industries, there is also a large difference in total expenditure on wages and salaries. The United States' red meat processing industry has grown on average by 6.6% since 1990, whereas Canada's expenditure has only grown by half of that at 3.2% per year.

From 1990 through 2003 Canada's value added per dollar of sales has averaged 21.7 cents, which is slightly higher than the United States' at 21.5 cents. Since 1997, however, the United States surpassed Canada in value added per dollar of sales. On average, the United States' value added per dollar of sales has grown by 3% per year since 1990 whereas Canada's growth has averaged only 1.4% per year.

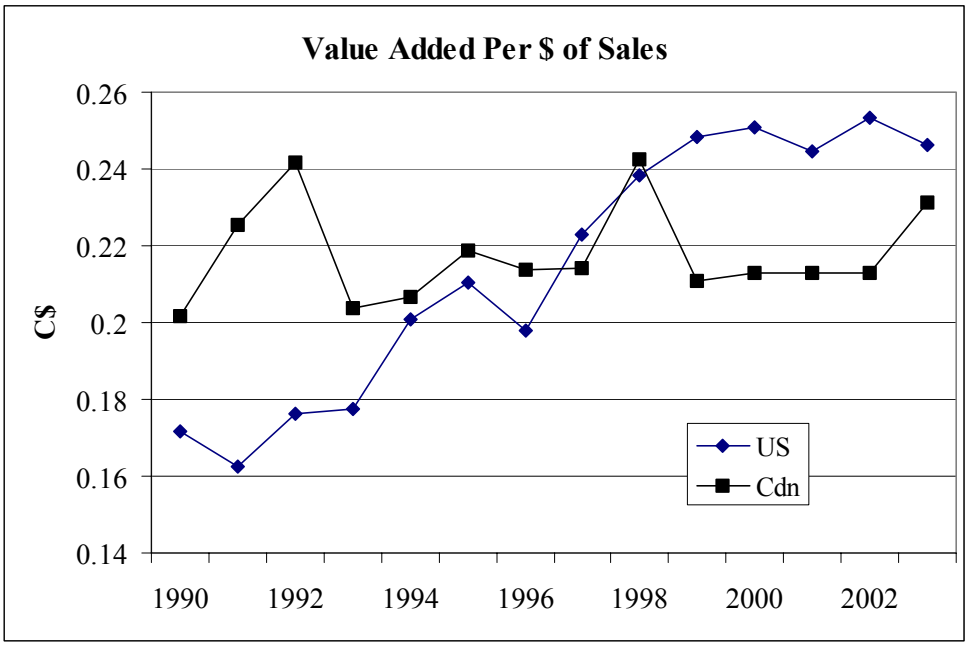


Figure 23 Source: Statistics Canada and US Bureau of Statistics

With respect to value added per dollar spent on wages and salaries, Canada has consistently fallen short of the United States. Between 1990 and 2003, Canada averaged $2.09 in value added per dollar of wage, 40% below the average of $2.93 in the United States. However, Canada's average growth rate in value added per dollar spent on wages and salaries is more than triple that of the United States, at 1.8% compared to 0.5% per year. The steady growth in labour productivity in Canada since 1999 is likely a result of the major investments that were made in the beef processing sectors a few years prior.

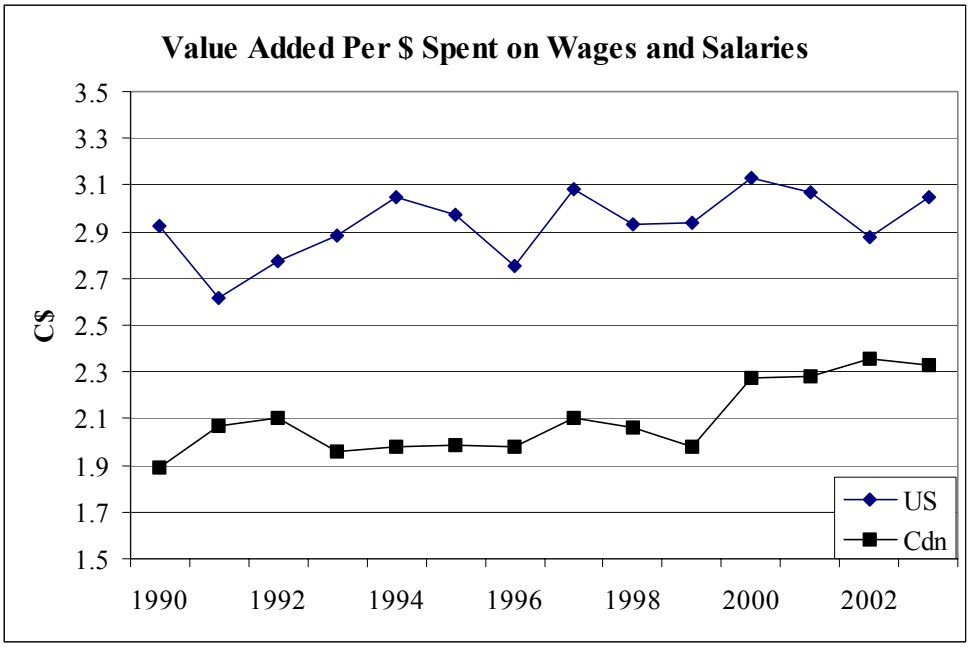


Figure 24 Source: Statistics Canada and US Bureau of Statistics

Overall, since the early 1990s, the United States has gained markedly in labour productivity and value added per dollar spent on wages and salaries.

With regard to market share, recall that the net export orientation ratio is the difference between exports and imports as a ratio of value of sales in a particular industry. Therefore, if there is a positive net export orientation ratio (NEOR), it shows that the particular industry exports a larger percentage of its product than is imported into its country. And the opposite is true for a negative NEOR, it shows that a larger percentage of its product is imported from other countries than it is exporting.

The following graph compares the NEOR's of the Canadian and U.S. red meat industries.[23]

The graph shows that exports by the Canadian red meat industry have consistently been much larger than imports relative to production. Since 1994, Canada's export orientation has shown strong growth compared to the United States, which has grown at a much slower pace. This strong export orientation relative to domestic production is not surprising given the large production base and relatively small domestic market. Conversely the US domestic market is very large relative to its production base. Of course the dramatic decline in the net exports in Canada in 2003 was a result of the BSE driven decline in beef exports.

[23] US import and export data from the United States International Trade Commission Dataweb is only available back to 1997, while Canadian Strategis Trade Data On-line is available to 1992.

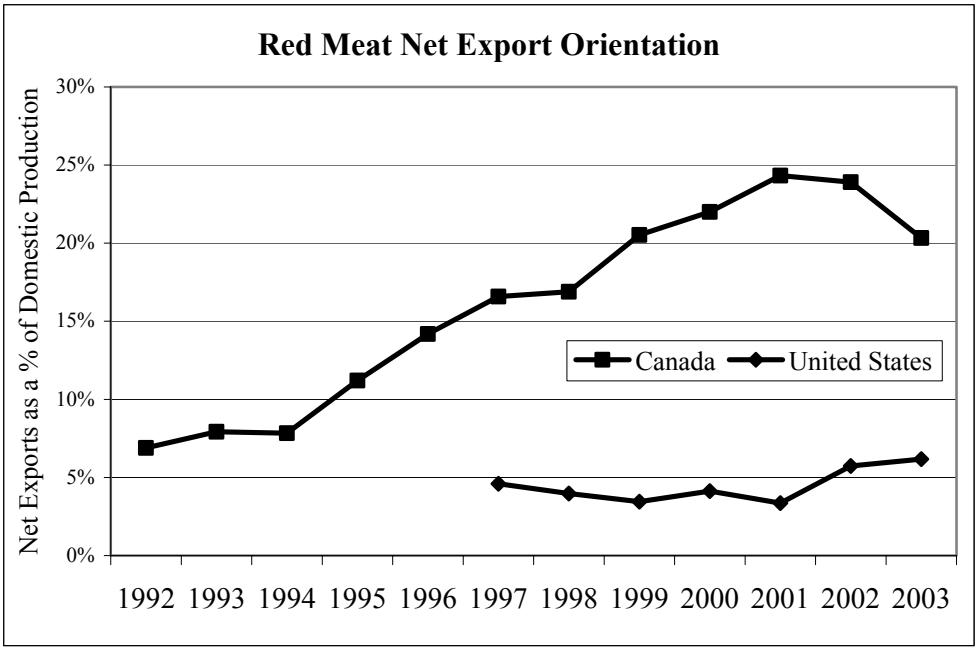


Figure 25 Source: Statistics Canada and USDA

Red Meat Industry Competitiveness Summary and Discussion

The analysis in this section regarding the red meat processing industries' competitive position provides a portrait of an industry that is lagging the US in most important competitive indicators. It is unfortunate that data limitations do not allow a more detailed comparison of the Canadian and US beef processing industry. In fact it could be argued that the Canadian pork industry is largely accountable for the relatively poor performance of the Canadian red meat industry. That is, in comparison to the Canadian beef industry, the Canadian pork industry typically operates smaller plants and on single shifts. The two largest beef plants in Canada, Cargill, in High River and Lakeside, in Brooks, which represent about 60% of the Canadian industry, both operate very large, double shift plants. Furthermore, Cargill's Better Beef unit, which represents another 10% of industry capacity, while not double shifted, has undergone extensive investment and modernization in recent years. Anecdotal information indicates that the larger beef plants in Canada, including XL and Better Beef, are very competitive relative to their US counterparts.

1.5 Summary and Conclusions

The purpose of this paper is to examine the implications of an appreciating Canadian dollar on the Canadian beef industry at the primary production and processing levels. The purpose of this specific section of the report is to establish the link between the exchange rate and key production, productivity, investment and pricing variables in the beef and cattle industry. Examining the long-term trends in these key variables and determining the degree that they are related to the exchange rate addresses this purpose.

To that end, this section of the report has addressed and analyzed those key variables in the beef and cattle industry relative to the exchange rate and came to the following conclusions:

1. The exchange rate is an important component of the cattle and beef price discovery process in Canada. The exchange rate helps to explain a significant portion (30-40%) of the change in cattle prices. Essentially, if other factors are held constant, a one percent change in the exchange rate leads to a one percent change in the price of cattle and beef. This is due to the industry's ability to trade cattle and beef openly across borders, which results in a very strong, pricing arbitrage.
2. The exchange rate has a varying influence on cattle and beef industry production factors. For example, there was no relationship found in the relationship between the exchange rate and land, but a reasonably strong relationship between the exchange rate and farm machinery. Farm labour rates on the other hand were not closely related to changes in the exchange rate. As a guide, it is realistic to suggest that if the input is mobile or can be readily traded across borders, then the exchange rate will have an impact on the price of the input.
3. Contrary to conventional wisdom, the exchange rate does not make Canada more competitive. Instead this paper argues and demonstrates that the depreciation of the exchange rate during the 1990's and early 2000's was a symptom of the lack of competitiveness in Canada. This paper has shown that as Canada's productivity and competitiveness declined, the exchange rate declined. The paper shows in particular that Canada's red meat sector is relatively uncompetitive compared to the United States, although much of that is likely due to the pork sector, not the beef sector.
4. The cause of declining productivity and hence declining competitiveness is a relative lack of investment compared to the United States. In fact, the depreciation of the currency only served to make investment more prohibitive and therefore exacerbating the problem.
5. The recent appreciation of the currency was likely the result of a gradual increase in investment during 2002 and 2003 as well as surging oil industry growth and the widening of the interest rate spread over the US.

In summary, then, this section concludes that the exchange rate is an integral component of the pricing process for those factors and goods that are mobile or tradable between Canada and the US.

The section also concludes that the depreciation of the exchange rate was attributable to the lack of productivity and competitiveness in Canada. As such, with regard to the cattle and beef industry, the recent appreciation of the currency should be considered a benefit or a positive development. This is due to the probable positive impacts on investment and the resulting productivity improvements.

2. Cost and Revenue Structures in Each Component of the Value Chain

2.1 Introduction

The purpose of this section is to assess the effect of changes in the C$/US$ exchange rate on thirteen representative cattle enterprises in Canada. Partial budget models are developed to quantify the impact of exchange rate changes on cattle farms of various types, sizes and locations. Since costs, methods of production and output prices vary across the country, it is important to include farms of various sizes and enterprise combinations in the different regions.

Six of the partial budget models characterize small and large cow-calf enterprises in Alberta, Manitoba, and Ontario. It is assumed that small farms have sufficient land base to provide all forage and cereal feed requirements to maintain a cow-calf enterprise of average size, provincially, without buying additional feed. Large cow-calf operations have sufficient land base to meet the grazing requirements, but endowed with the same cereal and hay production capacity of the smaller (i.e. average) cow-calf enterprise.

The separation and characterization of small and large enterprises applies to feedlots as well. Partial budget models for small feedlot operations in Alberta, Saskatchewan, and Ontario are developed to represent family-based operations with cow-calf and feedlot enterprises on the same farm, along with growing enough feed for all of their animals (cow-calf and feedlot). These small operations do not purchase additional feeder animals. It is assumed that calving occurs early in the year and that calves remain on pasture until they reach 700-800 lbs. in late fall. At this time, they enter the feedlot and given a typical fattening ration. In addition to the small feedlot operations, partial budget models of three larger feedlot operations in each of the same provinces are developed. As with the cow-calf enterprises, the large feedlot operations have the same cow-calf and feed component as the small feedlots, but they purchase additional animals and feed for the feedlot component.

The final partial budget model is of a very large, specialized feedlot located in Alberta. For this enterprise it is assumed that all feed and feeders are purchased.

This section is organized in four parts. The next part describes the size, enterprise combinations and resource availabilities in each partial budget model along with the data sources. The third part assesses the impact of an increase in the exchange rate on each of the thirteen livestock enterprises. The last part provides a summary and some concluding comments. Finally, as a result of the size and nature of the tables, they have been placed at the end of this section as opposed to within the relevant paragraphs.

2.2 Description of Enterprise Activities and Data Sources

Cow-Calf Enterprises

Individual partial budget models are developed to represent small and large cow-calf operations in Alberta, Manitoba, and Ontario. The number of cows on the small operations is set equal to the provincial averages and they have a sufficient land base to provide all of the forage and cereal feed requirements.

According to Agriculture and Agri-food Canada (2005), cow-calf operations in Alberta, Manitoba and Ontario average 140, 100 and 50 head respectively. For the purpose of this study, it is assumed that these averages reflect the size of small cow-calf enterprises in these regions. The number of animals on large cow-calf operations in Alberta and Manitoba are set equal to 190 head based on a report by Western Beef Development Centre (Highmoor & Monchuk, 2004) that categorized large cow-calf operations to be 190 head and larger. The large operation in Ontario is assumed to have 100 head.

For both small and large cow-calf enterprises, it is assumed that 12 percent of animals would be replacements heifers, 4 percent would be bulls and that the calving rate is 90 percent. Table 1 reveals the resulting number of replacement heifers and bulls by cow-calf enterprise (small and large) by region (Alberta, Manitoba and Ontario).

Information on feed requirements for cow-calf enterprises were obtained from the CRAM Livestock Update (AAFC, 2004b). Table 2 lists the feed requirements for different classes of bovine animals across regions. Given information contained in Table 2, crop and pasture acreages for cow-calf enterprises were set so that feed requirements on small operations in each province could be met without purchasing feed. Large cow-calf operations are assumed to have sufficient grazing capacity but with only the same grain and hay acreages as the small operations. The additional grain and hay required for these operations are purchased at the average provincial prices in 2001 (Canadian Cattlemen, 2005; Internet Hay Exchange, 2005).[24] Table 1 shows the resulting number of hectares of crop and pasture for cow-calf operations across Alberta, Manitoba and Ontario. In Alberta, it is estimated that 7 ha (about 17 acres) of barley, 32 ha (about 80 acres) alfalfa, 130 ha (1/2 section) other hay, and 195 ha (about 3/4 section) pasture is required to meet the feed requirements for a small operation (Note: 65 ha pasture and 780 ha (3 sections) of unimproved grazing lease would also meet the pasture demands). For the small cow-calf operation in Manitoba, 3, 32, 15 and 105 hectares are required for cereal crops, alfalfa, other hay and pasture respectively. In Ontario, 1, 4, 6, and 24 hectares are required for corn grain, alfalfa, other hay, and pasture respectively.

Costs are incurred on cow calf enterprises from cropping activities (for feed) and livestock feeding activities. Costs per hectare for crops by region are listed in Table 3 and were calculated

[24] It should be noted that land requirements are set so that small cow-calf operations are feed self-sufficient. In reality cow-calf producers often grow and market additional cereal crops. However, given that we wish to look at the cow-calf operation in isolation, we have chosen to model only the land and crops required to provide feed for the operation.

using Statistics Canada Agricultural Regions averages and obtained from the CRAM Crops Update (AAFC, 2004a). No rental rate on pasture is assessed, but the costs associated with pasture upkeep and improvements are included in the partial budgets.

The costs per head from the non-crop component of the cow-calf operation are presented in the bottom half of Table 1. The Alberta figures were obtained from *AgriProfit$: Benchmarks for Alberta Cattlemen* (Alberta Agriculture, Food and Rural Development, 2002) which provided costs per head for the most profitable 20 percent of enterprises, the lowest cost 20 percent, and the provincial average. For our purposes, we use the provincial averages for the small cow-calf operations and the lowest cost values for the large cow-calf operations. The Ministries of Agriculture in other provinces only publish budgets containing average costs. Therefore, the Alberta values were used to obtain proportional costs between the large and small operations. The proportions in Alberta are applied to Manitoba and Ontario to estimate costs for the large operations in those provinces.[25]

Feedlot Enterprises

The feedlot sector is characterized by seven different farm structures: three small and three large family-based operations with cow-calf/feedlot enterprises on the same farm and one very large commercial feedlot. Feedlots are located in Alberta, Saskatchewan, and Ontario.

Table 4 reveals the size of feedlot enterprises across regions. The size of the small feedlots is set just large enough to accommodate the weaned calves from the cow-calf operation. Consequently, it is assumed that there are 66 head fed on small operations in Alberta, 59 in Saskatchewan and 22 in Ontario. In contrast, large feedlot sizes are set to 1300, 300, and 130 head in Alberta, Saskatchewan, and Ontario respectively (Agriculture and Agri-Food Canada, 2005). It is assumed the very large feedlot was located in Alberta on a quarter section lot with a one time capacity of 30,000 head. The death loss for each enterprise is assumed to be 3%.

Setting the size of large feedlots equal to provincial averages has an important implication in this study for the sources of feeder cattle. Large feedlots feed their own weaned calves in addition to a large number of calves sourced from elsewhere. For example, of the 1300 head on a large feedlot in Alberta, 139 head are weaned calves from the internal cow/calf activity while 1,161 head are purchased from external suppliers. In the large feedlot in Saskatchewan, 139 head are weaned calves from the internal cow/calf activity and 161 are purchased. Finally, for a 130 head feedlot in Ontario, 73 feeders are weaned calves from the internal cow/calf activity and 57 feeders are purchased.

Feed requirements in all cases are obtained from the CRAM Livestock Update (AAFC, 2004b). It is assumed that forage requirements for the feedlot component of the operations in Western Canada are met with a 50-50 silage-hay combination except for the commercial feedlot where the forage was assumed to be 100% silage. All of the Ontario feedlots are assumed to feed 100% silage to meet the forage requirements.

[25] The feed costs provided in *AgriProfit$: Benchmarks for Alberta Cattlemen* (Alberta Agriculture, Food and Rural Development, 2002) are not used in our analyses. Instead, per head feed costs were obtained from the crop production costs shown in Table 3.

The small feedlots are specified with enough land to grow feed for both the cow-calf and feedlot components. Large feedlots have the same feed resources as the small enterprises. This means that large feedlots must purchase additional feed for the larger number of feeder animals. It is assumed the very large commercial feedlot neither raises its own feeder cattle nor does it grow any of its own feed. It therefore must purchase all its feed and feeder cattle.

Small feedlot operations have sufficient land base to meet all of the forage and cereal feed requirements. The estimated crop and grazing land requirements for these operations are listed in Table 4. It is estimated that, on average, 110 ha of cereal crops, 250 ha hayland, and 275 ha of pasture are required for the small cow-calf and feedlot operation of 90 head (66 feeders) in Alberta. In Saskatchewan, the average Saskatchewan cow-calf and feedlot operation of 65 head (59 feeders) requires, 105 ha for cereals, 180 ha for hay, and 305 hectares of pasture. The average Ontario cow-calf and feedlot operation of 30 head (22 feeders), needs 11 ha for cereal crops, 16 ha for hay, and 37 ha of pasture. Large enterprises have the same cereal, hay, and pasture resource availabilities as the small operations. Again, it is assumed large feedlots purchase additional feed and feeder cattle to bring the feedlot operation to a size (number of head) equal to the provincial averages.

Costs are incurred on feedlot enterprises from cropping activities (for feed) and livestock feeding activities. As was the case with cow-calf enterprises, no rental rate on pasture is assessed but costs associated with pasture upkeep and improvements are included. Cropping costs per hectare were set equal to those used for the cow-calf operations and which are summarized in Table 3.

Non-cropping costs for the cow-calf component of the cow-calf/feedlot operations are the same as those specified above and are presented in Table 4. The costs in Saskatchewan are estimated using yardage information obtained from Western Beef Development Centre (Highmoor & Monchuk, 2004). However, the remaining cost components (other than feed which are determined based upon the provincial prices and costs) were not available. As a result, costs in Saskatchewan are set to those obtained from Manitoba Agriculture, Food and Rural Initiatives (2001). Non-cropping costs in Alberta feedlot costs are obtained using sources from Alberta Agriculture, Food and Rural Development, and Kaliel (2005). The commercial feedlot costs were obtained from an anonymous client of the Royal Bank (2005).

2.3 Assessment of a Change in the Exchange Rate

Background

The exchange rate is the amount of foreign currency per unit of local currency. It reflects the supply of and the demand for both foreign and local currencies. This is an important point and it merits further explanation.

The supply and demand for Canadian dollars determines its price, or its purchasing power. For a given supply of Canadian dollars, an increase in the production of goods implies that producers demand more Canadian dollars since more goods must now be exchanged for money. As a

result, the exchange value or the purchasing power of the Canadian dollar will increase. Every Canadian dollar will now command more goods. If the supply of Canadian dollars increases for a given stock of goods, its purchasing power falls since now there are fewer goods per dollar. The prices of goods at any point in time are a manifestation of a given state of supply and demand for Canadian dollars.

Likewise, the supply and demand for US dollars determines its price or purchasing power. For a given supply of US dollars, an increase in the production of goods implies that producers demand more US dollars and the purchasing power of each US dollar will increase. If the supply of US dollars increases for a given stock of goods, its purchasing power falls since now there are fewer goods per dollar.

Therefore, just like any other good, both supply and demand determine the price, or rate at which currency is exchanged for goods and services. When more than one kind of money is used as a medium of exchange, the mutual exchange rate between them is determined by their purchasing power. The final prices of the various commodities, as expressed in each of the two or several kinds of money, are in proportion to each other. The exchange rate between the various kinds of money reflects their purchasing power with regard to the commodities.

The changes in currency exchange rates do not affect all commodities and services at the same time or to the same extent. The prices of goods traded across regions with different currencies respond swiftly to changes in exchange rates. In contrast, the prices of products traded only in local markets are not very responsive, and respond slowly to changes in the exchange rate. This applies not only to activities related to livestock and crop production, but for all goods and services. Monetary changes occur first only for some groups of individuals and then slowly spread over the whole economic system to the extent that the additional demand of those first benefited reaches other groups of individuals. This insight is necessary to assess the effect of changes in the exchange rate on livestock enterprises in Canada.

Method

In the analysis which follows, it is assumed that the demand and the supply of Canadian and United States dollars has changed, all other things held constant. In particular, the exchange rate changes from C$1.548=US$1 to C$1.204=US$1. This reflects how the relative purchasing power of the Canadian dollar increased relative to the United States dollar from 2001 to 2005.

The extent to which a change in the C$/US$ exchange rate affects revenues and costs on livestock operations depends upon whether output and factor markets are local or international in scope. Budget items such as bedding, pasture costs, veterinary, breeding fees, repairs to equipment, corrals and buildings, custom work, trucking and marketing charges, operating interest, paid labour, insurance, and depreciation are typically priced in local markets and thus respond only very slowly over a long period to changes in the exchange rate. To simplify the analysis, these costs were assumed to be unresponsive to exchange rate changes as were the value of cull cows, open heifers, bulls, bred cows and bred heifers. In contrast, weaned calves, feeders and slaughter cattle and feed are traded across national geo-political jurisdictions and therefore the prices of these products respond quickly to exchange rate changes.

The gross margin is calculated for each of the thirteen representative cattle enterprises in Canada given information on the value of production and variable costs.[26] Then we calculate the impact of the appreciation in the Canadian dollar relative to the US dollar on the value of production, variable costs and the gross margin. An appreciation of the Canadian dollar to the US dollar implies that for products traded across the Canada-United States border, producers exchange fewer Canadian dollars for inputs purchased, but they also receive fewer Canadian dollars for outputs sold.

Results

Table 5 shows the per head gross margin for cow-calf and feedlot enterprises across regions with an exchange rate of C$1.548=US$1. This exchange rate reflects the mean rate at which Canadian dollars where exchanged for United States dollars in 2001.

The gross margins for large cow-calf enterprises exceeded that of the smaller enterprises in every region and by as much as $96/head. The gross margins in Western Canada ranged from $597/head in Alberta to $619/head in Manitoba. In Ontario, the gross margin for a large cow-calf enterprise was $532/head. For small cow-calf enterprises, the gross margin was highest in Saskatchewan ($602/head) and lowest in Ontario ($490/head).

Gross margins on feedlots also were larger for the large enterprises. Feeding activities on large feedlots in Ontario generated the largest gross margins ($185/head), while in Western Canada the gross margin ranged from $134/head in Alberta to $150/head in Manitoba. The gross margin associated with the very large commercial feedlot was $160/head, which compared to the gross returns on large feedlots, is intermediate between Ontario and Western Canada. Finally, the range in gross margins on small feedlots was between $53/head in Saskatchewan and $113/head in Alberta.

Table 6 indicates the per head gross margin for cow-calf and feedlot enterprises across regions with an exchange rate of C$1.204=US$1. This exchange rate reflects the mean rate at which Canadian dollars where exchanged for United States dollars in 2005, and is a 28.5% increase over the exchange rate in 2001.

Table 6 shows how gross margins are squeezed as the Canadian dollar appreciated relative to the United States dollar, all other things held constant. While the gross margins for large cow-calf enterprises exceed that of the smaller enterprises in every region, the gross margins are reduced by 35% and more. The gross margins in Western Canada range from $369/head in Alberta to $394/head in Manitoba. In Ontario, the gross margin for a large cow-calf enterprise is $338/head. For small cow-calf enterprises, gross margins also fall by 35% or more. The gross margin remains highest in Saskatchewan ($395/head) and lowest in Ontario ($310/head).

[26] The variable cost of internally transferred feeder animals in small and large feedlots are set equal to the price weaned calves would have fetched in the open market. The resulting per head gross margins therefore correctly reflects opportunity costs, regardless of the scale of the enterprise.

The impact on feedlots are perhaps more devastating, especially with regard to small enterprises. Feeding activities on large feedlots in Ontario generated the smallest gross margins ($7/head), while in Western Canada the gross margin ranged from $24/head in Saskatchewan to $40/head in Alberta. The gross margin associated with the very large commercial feedlot was $41/head, greater that any of gross returns on large feedlots. While feeding activities on small feedlots generate positive gross margins in Alberta and Manitoba, gross margins are negative in Saskatchewan (-$22/head) and in Ontario (-$56/head).

The consequences of the change in the exchange rate can be disaggregated between cow-calf activities and feeding activities on feedlots. Table 7 reveals that on small cow-calf/feedlots the effects of appreciation of the Canadian dollar manifests themselves at each stage of production. In Alberta for example, the gross margin falls $210/head from cow-calf activities and by $76/head from feeding activities, for a total decrease of $287/head. The largest total decrease occurs in Ontario ($324/head) where the gross margin falls by $180/head from cow-calf activities and by $143/head from feeding activities.

The magnitude of the decrease is amplified on the large cow-calf/feedlot enterprises. The smallest impact occurs in Alberta where the gross margin falls by $228/head from cow-calf activities and by $93/head for feeding activities. In sum, the total decrease in gross margin in Alberta is $321/head. In comparison, the total decreases in gross margins are $342 in Saskatchewan, $362 in Manitoba and $372 in Ontario. The gross margin associated with the very large commercial feedlot falls by $118/head.

Although it is apparent that both the cow-calf and feedlot operations incur significant short-term losses, it is important to point out that the greatest negative impact of the exchange rate change is borne by the cow-calf operations. In the long-run, we expect the full burden to be borne by the cow-calf operators as the loss in value will be incorporated into the value of fixed assets, namely land. The feedlot operations will in the long-run return to acceptable margins by simply paying less for feeder cattle (this long-run aspect however, is beyond the scope of this analysis).

2.4 Beef Packing and the Exchange Rate

The purpose of this section of the report is to access the impact of changes in the exchange rate on the Canadian beef-packing sector. This will be addressed by examining how the exchange rate could impact the various components of the packer's cost structure. As such, the first part will provide a framework and broad breakdown for the overall cost structure of a representative beef packer. The second part assesses how the dollar could impact that structure.

As a starting point, the cost structure of the beef packer can be broken down into two basic components: raw material (cattle costs) and operating costs (fixed and variable). Total costs therefore are the cost of cattle plus the operating costs. In that regard the cost structure is similar to the cattle feeder's budget, which accounts for the cost of the feeder cattle and the total cost of gain.

With regard to operating costs, it is important to note that that the beef-packing sector in Canada is either privately owned or are components of larger US operations. As such, there is very little detailed financial information available regarding the costs of operations. With that noted, as part of the research for this project, discussions regarding costs of operations were held with industry personnel. While these discussions were not specific to individual companies, a basic cost framework did evolve. Furthermore, the November 2005 Report of the Standing Committee on Agriculture and Agri-Food did help to shed further light on the basic costs of operations by the industry.[27]

Finally, when discussing costs of operations, it is also of value to utilize revenues as a point of reference. In that regard, beef packer revenues are comprised of the sales from the beef products (carcass cuts) and the allied products such as the hide and inedible products. Canadian beef packers have been reporting the prices of the cuts for over a year and the allied product values have been reported by Canfax for several years.

With that information and the sources noted, it is also important to note that this section of the report does not profess to be a definitive statement on packer costs. Instead, this section simply seeks to provide a reasonable cost structure in order to evaluate in general terms, the impact of exchange rate fluctuations.

Packer Operating Costs

As noted above, the main source of these cost estimates are interviews and the report of the Standing Committee. Based on those sources, it is within reason to assume that a large, efficient beef packing plant operating on the Canadian prairies would have a total cost structure of over $200/head. This would include all costs of slaughter, fabrication (boxing) and allied products. These costs include all variable and fixed costs including administration and packaging, but excluding transportation, taxes and depreciation.

Of that $200+/head, approximately 60-65% or over $125 would be direct and indirect labour (line workers as well as support but not management). The remaining $75 (+/-) would include other variable and fixed costs such as packaging, administration, energy and other supplies. As a generalization, it is expected that the total variable and fixed cost breakdown for a packing plant might amount to 70% variable (e.g. labour and packaging mostly) and 30% fixed (e.g. administration and utilities).

Cattle Costs

The packer's cattle costs obviously vary on an hourly, daily, weekly, and yearly basis. Therefore, caution must be noted when trying to generalize about cattle costs as a share of total revenues or total costs. Nevertheless, it is apparent that cattle costs comprise the overwhelming share of either revenues or total costs. Based on George Morris Centre historic data in

[27] FINAL REPORT: FINANCIAL ANALYSIS RELATIVE TO MEAT PACKING COMPANIES IN THE CONTEXT OF THE BSE CRISIS OF 2003, November 2005 Report of the Standing Committee on Agriculture and Agri-Food.

combination with the above noted operating costs, it is estimated that cattle costs typically can comprise about 87-90% of total packer revenues or likewise about 87-90% of total costs.

Exchange Rate Impacts

As discussed in detail in section 1, changes in the exchange rate directly impact the prices and hence the costs of cattle and beef. That is, when the exchange rate changes in one direction, the Canadian value price or costs of cattle and beef change almost instantly in the opposite direction. For example, if the exchange rate is US$.75 and cattle prices are $80/cwt in the US, the Canadian equivalent is C$106.67/cwt live or $181/cwt dressed. If at the same time, the US boxed beef cutout value is trading around US$150/cwt, the Canadian equivalent would amount to C$200/cwt.

If the exchange rate were to appreciate to US$.80 and other conditions were the same, the Canadian equivalent cattle price would be equal to C$100/cwt live or $169.50 dressed. The difference amounts to a reduction in cattle costs to the packer of $11.50/cwt on a dressed basis. On the beef side of the equation, the appreciation would make the Canadian dollar equivalent cutout amount to $187.5/cwt. That amounts to reduced revenue of $12.50 due to the appreciation.

The following graph (Fig. 26) shows the arithmetic of the changing exchange rate on both cattle costs and beef revenues for exchange rates ranging from .70 through .85 with US cattle prices equal to $80 and the boxed beef cutout at $150. On the left vertical axis, it shows the total values of cattle costs and beef cutout prices. On the right vertical axis it shows the differential between the beef cutout and the cattle costs.

As can be seen, as the exchange rate appreciates, the values of both the cattle and the boxed beef decrease. The decrease in values, however, does not occur in equal measure. Due to the simple fact that beef prices are greater than cattle prices, the impact of the exchange rate has a greater impact on beef prices than on cattle prices. Therefore when the dollar appreciates, beef prices decline faster than cattle costs and vice versa. As such, when the exchange rate is at .75, as noted above, the differential between revenues and costs is about C$19/cwt. At the .80 exchange rate, the difference is about C$18/cwt, a decline of $1/cwt or about $13/head. At an exchange rate of .85, the difference is less than $17, a decline of more than $2 or up to $30/head compared to when the exchange rate was at .75.

The bottom line is that the appreciation in the exchange rate does have the effect of eroding packer gross margins (revenue less cattle costs), all other factors being constant.

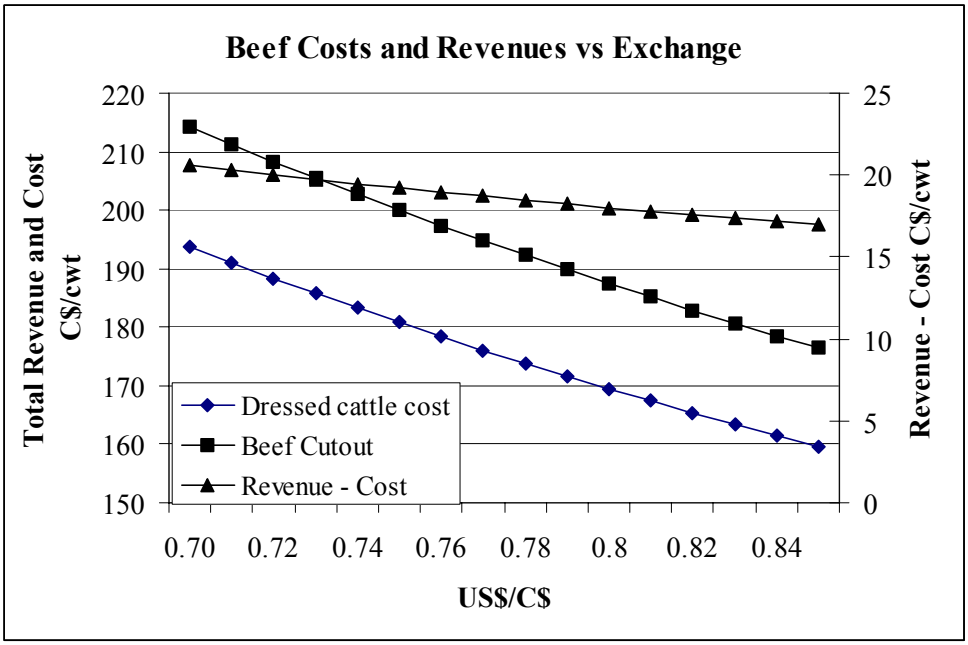


Figure 26 Source: George Morris Centre

As noted earlier, cattle costs comprise 87 to 90% of total costs, as such, the beef revenue and cattle costs are clearly the most important factors for consideration. Nevertheless, beef packing is a very narrow margin business. Packers over the long term tend to bring back net profit returns of about 1% of total revenues[28]. Therefore, while the $200/head operating cost might represent just 10 to 13% of total costs, the impact is very important. Furthermore, unlike the cattle costs and beef costs which are largely controlled by overall forces of supply and demand, the operating costs are more directly under the control of the packer management.

From another perspective, unlike cattle and beef prices and costs, the starting point for the discussion is Canadian dollars. That is, when referencing cattle costs and beef prices, the starting point is the US dollar converted to Canadian dollars. With regard to operating costs, the starting point is Canadian dollars. Further to that point, as noted in the previous section, there is very little linkage between changes in the exchange rate and most operating input costs of on the farm. That is particularly true of farm labour. The same therefore could be said of those same inputs for the packing plant, particularly plant labour. Changes in the exchange rate are not going to directly impact on plant labour costs.

This does not mean that the exchange rate is not important. When the Canadian packer must compete with a US packer either at home or abroad, or when a US head office is evaluating its Alberta operation, the Canadian dollar is converted to a US basis. Changes in the exchange rate impact the operating cost structure. For example as noted earlier, direct and indirect plant labour likely amount to about C$125/head. When the exchange rate is at .75 cents, the US equivalent

[28] Based on George Morris Centre data sets.

cost is US$94/head. When the exchange rage appreciates to .85 cents, the US equivalent cost is US$106/head, an increase of US$12/head or 13% on the 13% appreciation in the currency.

The message is that the C$ value of labour will remain at roughly $125/head regardless of whether the exchange rate is .75 or .85. That is, based on the evidence, there is no immediate impact on labour rates or most other operating inputs. Nevertheless, on a competitive basis, relative to their US counterparts, the Canadian packer cost structure erodes as the exchange rate appreciates.

What is important here is the fact that the $125 doesn't adjust to the exchange rate. If it did adjust, there would be less of a challenge. That is, the Canadian packer would be largely indifferent to the level of the exchange rate, were it not for the fact that the $125 is a Canadian dollar figure.

Exchange Rates and the Beef Packing Sector Summary

The above discussion demonstrated that regardless of whether the focus is in Canadian or US dollars or both, Canadian packers are negatively impacted by an appreciation of the C$. The appreciating dollar forces packers to more closely align their operating costs, particularly labour with the US. During the 1990's packers were very low cost relative to the US, largely due to the cheap dollar. As of 2006, this low cost, dollar-shield advantage has largely eroded. Conversely, as the dollar appreciated, the simple arithmetic of the appreciation caused the spread between the beef revenue and the cattle costs to narrow. Clearly the appreciation is causing and will force Canadian packers to improve their competitive position, or risk failure in the market.

2.5 Concluding Comments

This section assessed the consequence of an appreciation in the Canadian dollar relative to the US dollar on thirteen typical cattle enterprises across Canada. A partial budget analysis revealed that an appreciating Canadian dollar had an adverse impact, sometimes quite severe, for every cattle enterprise in every region. This result reflects, in part, the extent to which livestock enterprises in Canada are exposed to exchange rate risk. By hedging the Canadian dollar, cattle producers can protect themselves against this risk (see section 5).

The results also are a product of the initial assumptions regarding the responsiveness of the price of some products, but not others, to changes in the exchange rate. All other things the same, the initial shock from a change in the exchange rate is temporary phenomena. The changes occur first only for some groups of individuals slowly spread over the whole economic system. Over time market processes ensure the prices of every good and service in every region will change to restore the balance between supply and demand. This long-term response was not incorporated in the analysis in this section.

Table 1. Estimated Land Requirements and Expected Cow-Calf Expenses (2001)

	Alberta		Manitoba		Ontario	
	Small	Large	Small	Large	Small	Large
Size (Total # head)	90	190	65	190	30	100
Cows	75	160	54	160	25	84
Replacement Heifers	11	22	8	22	4	12
Bulls	4	8	3	7	1	4
Land Requirements (ha)						
Cropland (cereals)	7	7 [a]	3	3 [a]	1	1 [a]
Hayland (alfalfa/other)	162	162 [a]	47	47 [a]	10	10 [a]
Pasture	195	370	105	295	24	73
Costs ($/head)						
Bedding/straw	18.46	14.30	20.00	15.49		
Veterinary & Medicine	20.80	17.38	19.37	16.19	25.00	20.89
Breeding Fees/Bull Rental	0.21	0.14	26.84	17.89	30.00	20.00
Trucking & Marketing Charges	12.73	9.33	25.55	18.73	30.00	21.99
Fuel	16.21	15.57	26.67	25.62	[b]	[b]
Repairs -- Machine	15.26	11.77	11.84	9.13	[b]	[b]
Repairs -- Corrals and Building	7.76	7.41	5.09	4.86	[b]	[b]
Utilities and Misc.	20.16	15.80	14.33	11.23	53.00	50.84
Custom Work & Specialized Labour	14.81	19.63	10.00	13.25	[b]	[b]
Operating Interest Paid	4.72	2.58	15.62	8.54	10.00	5.47
Insurance	6.64	6.90	11.27	11.71	[b]	[b]
Subtotal	**137.76**	**120.81**	**186.58**	**152.64**	**148.00**	**119.18**
Equipment & Building Depreciation	30.31	26.22	52.19	45.15	52.19	45.15
Lease Payments	3.77	1.82	[c]	[c]	[c]	[c]
Paid Capital Interest	12.82	11.41	[c]	[c]	[c]	[c]

Notes:

[a] The hectares for the large operations were set equal to those of the small operations; feed shortfalls required additional feed to be purchased at the market price (pasture is the only exception).

[b] For Ontario, these values are included within the value for 'Utilities and Misc'.

[c] For Manitoba and Ontario, these values are included within the value for 'Equipment & Building Depreciation'

Sources: See Appendix.

Table 2. Feed Requirements for Different Classes of Animals Across Regions (Tonnes DM)

	Alberta & Saskatchewan			Manitoba			Ontario			
	Barley	Forage	Pasture	Barley	Forage	Pasture	Corn	Forage	Pasture	Soymeal
Cows	0.20	2.63	2.87	0.09	3.32	2.36	0.07	2.06	2.44	0.01
Heifers	0.36	1.37	1.21	0.36	1.37	1.21	0.16	1.52	1.26	0.01
Bulls	0.20	3.29	3.19	0.50	3.83	3.19	0.10	2.37	1.68	0.01
Calf/Stocker			1.05			1.05			1.05	
Feedlot	1.80	0.53					1.31	0.53		0.25

Note: Feed requirements for cows, heifers and bulls are annual; feed requirements for calves/stockers is for the period they remain on the cow-calf operation; and feedlot requirements are for the period an animal is expected to be in the feedlot.

Sources:

Gibb, Darryl. 2004. Research Scientist and Beef Production Specialist, Sustainable Production Systems Section, Agriculture and Agri-Food Canada. Personal Communication on Cattle Feed Requirements in the Prairies, February 2.

McLaughlin, B. 2003. Livestock feed requirements Study. Statistics Canada Catalogue No. 23-510-XIE.

Table 3. Crop Expenses, $/ha (2001)

	ALBERTA				MANITOBA				ONTARIO			
	Barley	Silage	Alfalfa	Other Hay	Barley	Silage	Alfalfa	Other Hay	Corn	Silage	Alfalfa	Other Hay
Seed	11.20	12.35	9.24	12.35	16.00	19.75	27.18	27.18	90.64	81.75	25.30	25.30
Fertilizer												
N	45.81	45.81	0.00	16.20	34.37	34.37	0.00	33.98	73.53	70.88	1.31	28.49
P	16.20	16.20	17.26	13.97	22.43	22.43	42.73	21.30	14.43	14.11	20.88	20.88
K	1.42	1.42	3.95	3.95	14.70	14.70	41.72	23.83	10.65	10.40	25.97	25.97
Fuel	8.17	8.17	8.17	8.17	9.19	9.19	9.19	9.19	25.94	37.20	18.60	17.62
Chemicals	48.75	17.90	0.00	0.00	49.35	17.88	0.00		138.18	138.18	34.55	38.28
Repairs	25.40	10.25	25.61	25.80	29.57	10.24	29.57	29.57	41.95	51.82	32.08	51.82
Other	35.57	23.80	19.41	19.41	37.28	23.78	19.77	19.82	392.34	251.69	251.69	251.69
Total	192.52	135.9	83.64	99.85	212.89	152.34	170.16	49.39	787.66	656.03	410.38	460.05

Sources: See Appendix.

Table 4. Estimated Land Requirements and Expected Feedlot Expenses(2001)

	Alberta			**Saskatchewan**		**Ontario**	
	Small	**Large**	**Very Large**	**Small**	**Large**	**Small**	**Large**
Size (# of head)	66	1,300	30,000	59	300	22	130
# of head transferred internally from cow/calf activities	66	139	0	59	139	22	73
# of head sourced from elsewhere	0	1,161	30,000	0	161	0	57
Land Required (ha)							
Cropland (cereals)	59	59 [a]	0	58	58 [a]	6	6 [a]
Cropland (silage)	5	5 [a]	0	3	3 [a]	1	1 [a]
Hayland (alf/other)	162	162 [a]	0	112	112 [a]	10	10 [a]
Pasture	195	195 [a]	0	205	205 [a]	24	24 [a]
Operating Costs ($/head)							
Yardage [b]	75.00	50.00	40.50	57.25	57.25	70.00	70.00
Veterinary & Medicine	22.50	22.50	1.08	17.62	17.62	20.00	20.00
Trucking & Marketing	35.64	35.64	17.82	63.98	63.98	30.00	30.00
Operating Interest Paid	25.75	25.75	27.81	62.27	62.27	33.00	33.00

Notes:

[a] The hectares for the large operations were set equal to those of the small operations; feed shortfalls required additional feed to be purchased at the market price.

[b] Includes bedding/straw, fuel, repairs, manure removal, custom work, utilities, taxes, and insurance.

Sources: See Appendix.

Table 5. Gross Margin for Cow-Calf and Feedlot Enterprises (C$1.548 = US$1), $/head[a]

	Cow-Calf Enterprise		Feedlot Enterprise	
Province	**Small**	**Large**	**Small**	**Large**
Alberta	553	597	113	134
Saskatchewan	602	615	53	145
Manitoba	523	619	100	150
Ontario	490	532	87	185
Commercial (AB)	n/a	n/a	n/a	160

Note:

a Calculations do not include fixed costs or the returns to labour.

Table 6. Gross Margin for Cow-Calf and Feedlot Enterprises (C$1.204 = US$1), $/head[a]

	Cow-Calf Enterprise		Feedlot Enterprise	
Province	**Small**	**Large**	**Small**	**Large**
Alberta	343	369	36	40
Saskatchewan	395	386	-22	24
Manitoba	321	394	17	38
Ontario	310	338	-56	7
Commercial (AB)	n/a	n/a	n/a	41

Note:

a Calculations do not include fixed costs or the returns to labour.

Table 7. Change in Gross Margins of Cow-Calf and Feedlot Enterprises from the 28.5% Increase in the CDN$/US$ Exchange Rate, $/head.

	Small Cow-Calf and Feedlot Enterprises			Large Cow-Calf and Feedlot Enterprises		
Province	**Cow-Calf**	**Feedlot**	**Total**	**Cow-Calf**	**Feedlot**	**Total**
Alberta	↓ 210	↓ 76	↓287	↓ 228	↓ 93	↓ 321
Saskatchewan	↓207	↓75	↓ 282	↓ 229	↓ 113	↓ 342
Manitoba	? 202	↓ 111	↓ 284	↓ 225	↓ 137	↓ 362
Ontario	↓ 180	↓ 143	↓ 324	↓194	↓ 178	↓ 372
Commercial (AB)	n/a			n/a	↓ 118	n/a

Note:

a Calculations do not include fixed costs or the returns to labour.

3. Canadian Cattle and Beef Industry Production and Structural Trends

The first section of the report examined price discovery and the role of the exchange rate in the price discovery process. The previous section evaluated the role of the exchange rate in the cost of production of each of the sectors of the beef industry. This section evaluates production and structural issues within the context of the Canada-US exchange rate.

3.1 Canadian Cattle Inventory and Production

The Cowherd

The Canadian beef cowherd is a basic starting point in evaluating the growth and general direction of the cattle and beef industry. By 2004 the beef cowherd grew by over five times its total of less than one million head in 1950. By comparison, the US herd grew by just under two times its size in 1950. In 1980 the Canadian herd was 9% of the US herd. In 2005, the Canadian herd was 16% of the US herd. From its recent history low of 3.2 million head in 1986, the Canadian heard grew by 1.66 times. As another point of reference, the Canadian sow herd grew by 1.6 times over that same 1986-2004. Further perspective on the growth of the Canadian herd is provided by the following graph. Figure 27 shows the Canadian beef cowherd relative to the US herd.

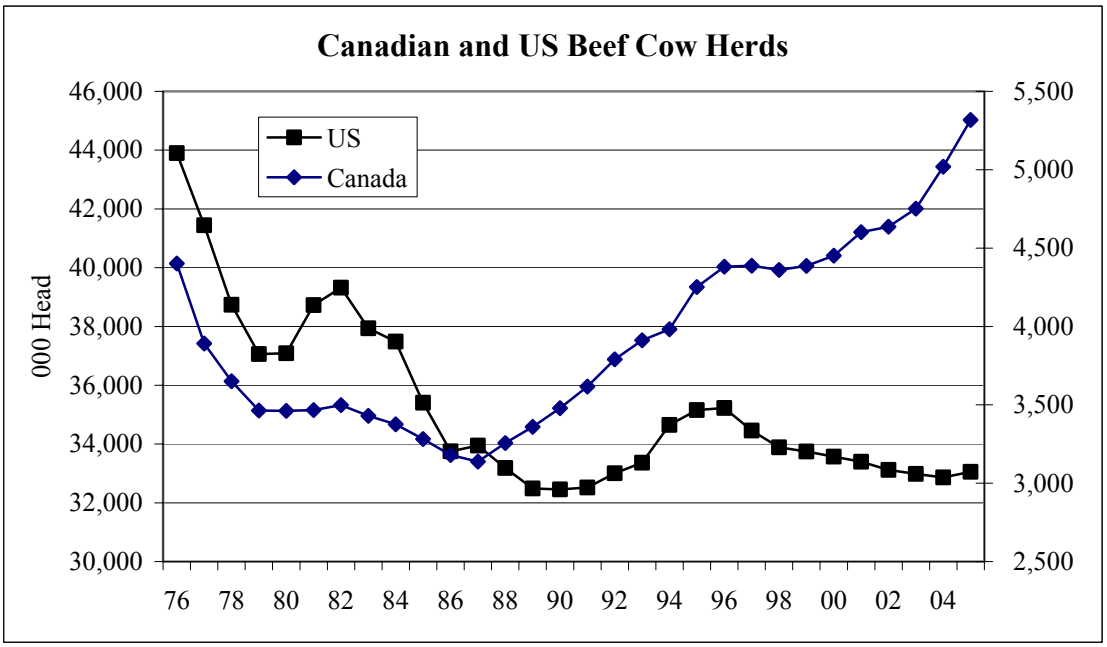


Figure 27 Source: Statistics Canada and USDA

Of course looking at 2003-2005 cowherd totals is a little misleading given the fact that Canada has been unable to export cows since 2003. That has had the effect of significantly increasing the cowherd totals relative to the US. As such, for the purposes of this analysis pertaining to the industry structure and the exchange rate, comparisons up to 2002 are the most relevant.

The graph above shows that from 1976 through 1996, the Canadian and US cowherds moved in a close tandem. The R-squared over that period of time was over .86. From 1976 through 1989, the Canadian herd's size relative to the US was fairly constant at around 9-10%. This is not surprising given that both countries are a part of the North American industry and each herd responds to the same economic signals. These economic signals are essentially the profitability of the industry. The profitability measures come to fruition through the cattle cycle, which is a phenomenon of industry expansion and contraction. After 1996, however, the two herds began to move in opposite directions. As the US herd declined, the Canadian herd increased. This means that the industries in the two countries were experiencing different profitability signals and therefore different signals regarding expansion and contraction.

As noted, the sharp depreciation in the currency began to occur in 1992. This depreciation continued through 2002. It is also of note that the sharp divergence in the herds began to take place after 1996. The following graph shows the ratio of the Canadian herd to the US herd as well as the exchange rate from 1992 through 2002.

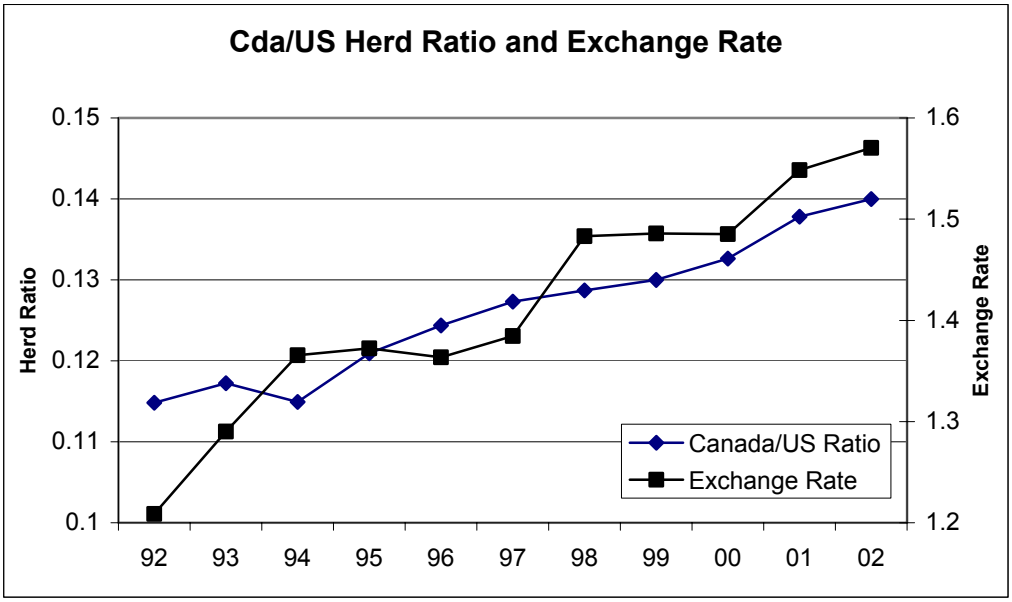


Figure 28 Source: George Morris Centre data files

The R-Squared of the exchange rate and the ratio of the two herds over that time frame is .85. In contrast, during the 1980's there was virtually no relationship between the exchange rage that the relative size of the Canadian and US herds. This suggests that the exchange rate depreciation during the 1990's is a very strong explanatory variable for the growth of the Canadian herd relative to the US herd.

The rationale for how the exchange rate can be an explanatory variable for the growth of the Canadian herd relative to the US herd can be found in the preceding chapter of this paper. As noted, the depreciating exchange rate during the 1990's simply resulted in higher priced calves for cow calf and ranching operations. Cow calf operators, unlike feedlots, do not purchase a large proportion of exchange rate sensitive inputs, such as grain and feeder cattle. As such, cow calf operators avoided the negative impacts of the depreciation on input prices. Only the profitable impacts of depreciation were directly experienced. This depreciation helped to mute much of the possible negative pricing impacts that were being experienced by the US cow calf

operator. Essentially the depreciating currency resulted in a direct profit to ranchers as a result of higher calf prices. Higher profits lead to greater incentive for Canadian ranchers to expand relative to their US counterparts.

Beef Production

For the purposes of this discussion, beef production is defined as the amount of beef produced in Canadian and US plants. The following graph shows Canadian beef production in comparison to US beef production from 1970 through 2004 (again note that BSE related distortions occurred post 2003).

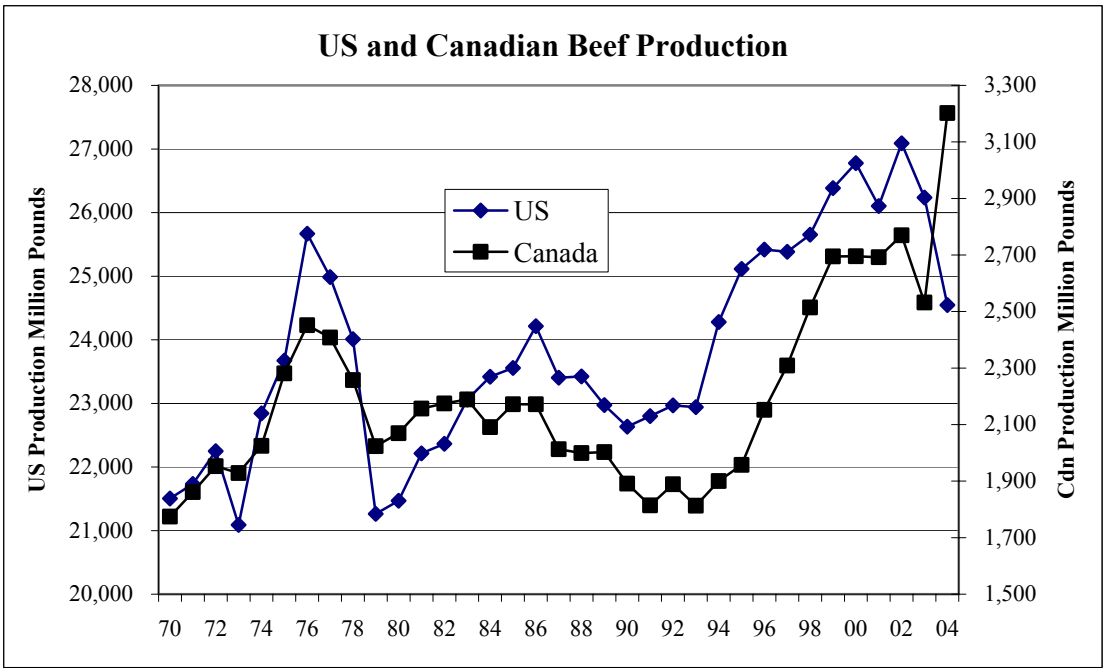


Figure 29 Source: Statistics Canada and USDA

Over the years from 1970 through 2002, there was an 81% correlation between the production levels in the two countries. Over that time, Canadian production has averaged mostly between 8-10% of US production. Canada's production started declining from the 10% level during the late 1980's and dipped to the 8% level during the early to mid 1990's. This production decline relative to the US occurred as live exports to the US surged. This surge in live exports at that time coincided with the exceptional growth in the beef cowherd relative to the US cowherd, as noted above. This means that the growth in the cow "factory" outpaced the slaughter or production capacity of the actual beef plants. During that time from the late 1980's to the early 1990's, slaughter capacity declined in Canada as older less efficient plants left the business. In fact in 1989, estimated slaughter capacity in Canada was 62-64,000 head per week[29]. Capacity dropped to about 55,000 head by 1995, a decline of 14%. The gradual growth of capacity and production at Cargill during the early 1990s helped to reverse the trend. That and the expansion at Lakeside during the latter half of the 1990's helped to push Canadian capacity up to around 74,000 head in 2002, an increase of over 30% (see graph below). That helped push Canadian production ratio relative to the US moved back up to just over 10%.

[29] Based on maximum weekly slaughter as reported by Canfax.

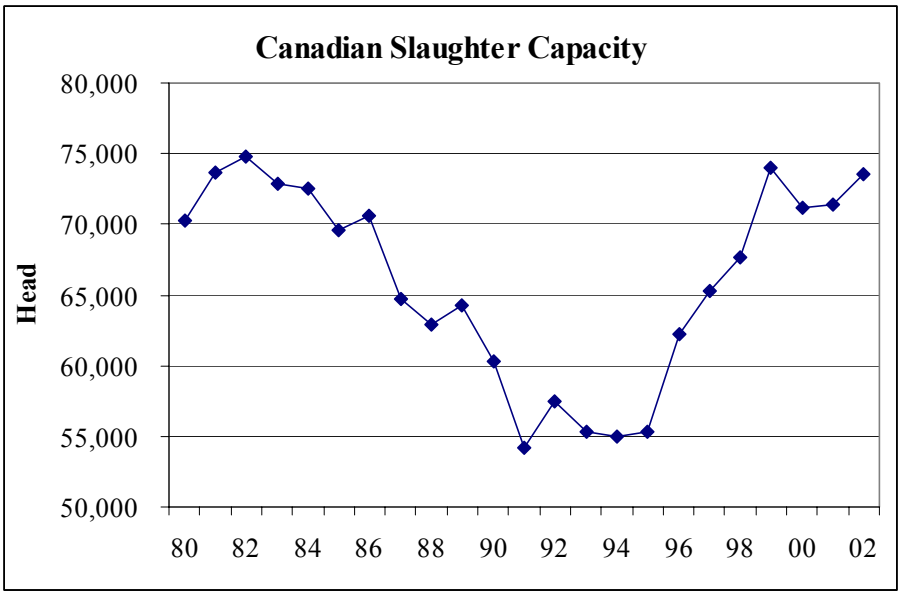


Figure 30 Source: Canfax

It was argued in section 2 that there was a profit link between the exchange rate and the cowherd. It was also argued in section 2 that there was little profit link between the exchange rate and beef slaughter operations. As such, while there looks to be a link between packer expansion and the exchange rate depreciation during the latter half of the 1990's, there is no profit related rationale for packers to expand due to the depreciation. In fact, as argued in section 1, the depreciation of the exchange rate is a much stronger argument for a lack of investment and hence a lack of expansion in the packing sector. As a further point towards that, when Cargill and Lakeside completed their expansions in the late 1990's, production relative to the US leveled back to 1970/80 levels, while the exchange rate continued to depreciate through 2002.

As noted, while production grew in the late 1990's, it did not grow out of historic 1970/80 level proportional relationships with the US. As such, this longer term 8-10% linkage in relative production in the two countries stands in contrast to the growth in the cowherd in Canada relative to the US during the 1990's. The following graph shows the relative size of the Canadian and US beef cowherds and Canadian and US beef production. The steady to modest increase in beef production relationship despite the relative growth in the cowherd can of course be explained by the growth in live exports to the US. To be fair, however, looking at the relative relationship can be misleading given the size of the US production compared to Canadian. That is, the US size tends to mute some of the statistic change occurring in Canada. For example, it needs to be noted that from 1990 to 2002, Canadian production volumes grew by 46% compared to 20% in the US. While Canadian production may not have gained materially on its historic share, it was clearly growing much more rapidly in the 1990's than the US industry.

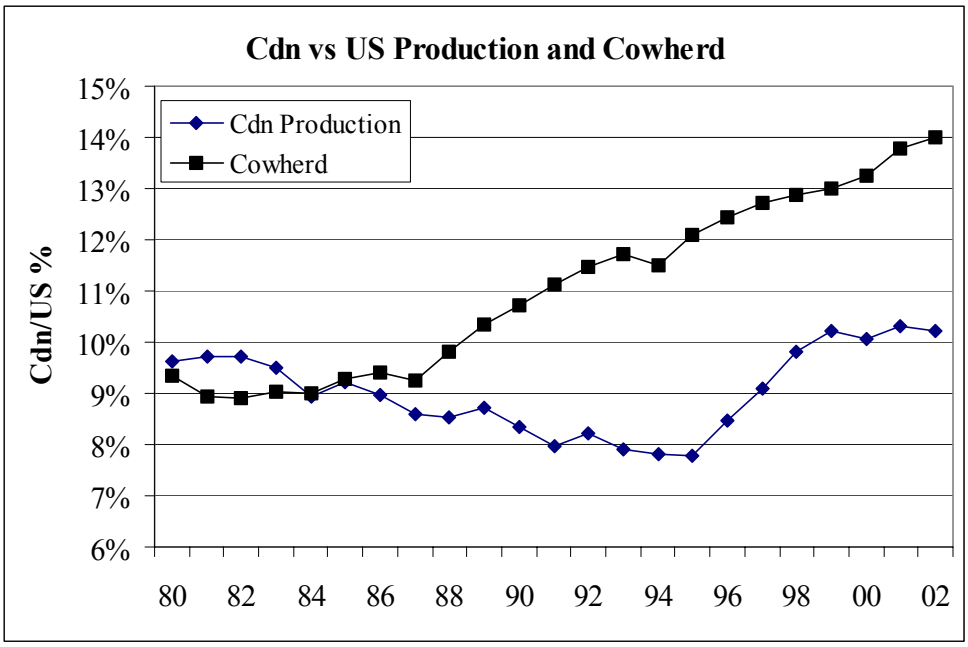


Figure 31 Source: Statistics Canada (Cansim) and USDA

3.2 Summary and Conclusions

Therefore, while it has been argued above that the depreciation during the 1990's caused a disproportionate growth in the cowherd, it did not result in a disproportionate growth in beef production in Canada relative to the United States. The structural impact of the Canadian dollar can be easily seen in the cowherd, but much less so in the volume of production and packer capacity in Canada. With that noted, Canadian beef production did increase faster than US production during the 1990's. While that cannot be directly related to the currency depreciation, there is an indirect relationship. That is, without the expanded cowherd, conditions would not have been as conducive to expanded beef production in Canada.

This is not meant to argue that the exchange rate was the only factor behind the divergence between the Canadian and US cowherds beginning in the late 1980's and early 1990's. The end of the Western Grain Transportation Act (WGTA) was also important to the expansion. (It was repealed in 1995 but with expectations before that, especially created by the crow-offset subsidies that were offered beef producers in Alberta, Saskatchewan and Manitoba). That stimulated more feeding in Western Canada, which increased the demand for feeder cattle. The increased demand for feeder cattle resulted in an increase in the cowherd.

4. Impact of the Exchange Rate on Canadian Cattle and Beef Industry Trade Trends

The purpose of this section is to assess whether there is an identifiable relationship between the cattle and beef trade and the exchange rate. This analysis includes Canadian imports and exports.

This section takes two approaches to this analysis. The first presents the results of a statistical analysis about the relationship between long-term cattle and beef trade and the exchange rate. This longer-term view incorporates annual exchange and trade data from 1971 to 2002. During the 1971 to 2002 period the value of the Canadian currency compared to the US currency fluctuated between 0.60 and 1.05. The second approach focuses on a shorter time frame but utilizes monthly data. The period covered in this approach is from 1989 to 2003, a period in which the beef trade strongly increased. It is also a period of time in which the exchange rate depreciated on a near continual basis. The longer-term view allows for possible lags and adjustments while the monthly basis can capture the effect of smaller variations in the exchange rate on trade.

This section is particularly focused on statistical analysis, utilizing a standard linear regression model to test relationships. The linear regression model allows indicating if there is a direct relation between trade and exchange rate. Furthermore this type of model quantifies the direct relationship in terms of magnitude and probability.[30] Each component of the analysis is presented graphically to provide a visual reference to the relationship as well as in statistical summation form.

[30] The linear model use is the following: $Qt.Trade = \alpha + \beta * X\text{-rate}$
Where:
- Qt.Trade: is the quantity trade (Cattle imports or exports and beef imports or exports)
- α: is the intercept or the quantity trade when exchange rate is zero
- β: is the parameter or the slope of the relation
- X-rate: Exchange rate as $CDN/ $US

The quantity trade is measure in thousand head for cattle and in millions of pounds for beef. The parameter (β) or the slope of the relation indicates the direct impact of the exchange rate movement on trade. The regression analysis is mainly undertaken to estimate the value of the parameter (β) and his level of signification. The regression analysis allows identifying if the parameter has a significant impact on the trade. This is determined with the p-value statistic which indicates if the β value is statistically different from zero. If the β value is not statistically different from zero this is means that there no relation between the two variables. The closer to zero is the p-value the higher is the signification level. For the purpose of this analysis the p-value would have to be under the level of 0.05. The 0.05 means that there is only five percent of probability that the parameter (β) would not be significant or equal to zero. The idea is to have the lowest p-value in order to minimise the likelihood of having a parameter that is not different from zero. The other statistic use to estimate the relation between exchange rate and trade is the R^2. The R^2 statistic can be defined as the proportion, or percentage, of variation of the dependant variable (trade) explained by the independent variable (exchange rate). The R^2 ranges from 0 to 1 which can be interpreted as a range from 0% to 100%. The closer that R^2 is to one the more that the independent variables can explain the variance of the dependant variable.

4.1 Long Term Cattle and Beef Trade

Live Cattle Imports for Slaughter

The following graph presents the annual live cattle imports in Canada and exchange rate from 1971 to 2002. The cattle imports are characterized by major fluctuations from year to year. By comparison, the annual exchange rate fluctuations are smoother and less volatile. The other main difference between these two variables is in terms of the direction of the trend line. As has been documented many times in this paper, the exchange rate presents a strong downward or depreciating trend over time, at least from the 1970's through the 1990's. In particular, the Canadian dollar has been depreciated by around 30 percent from 1971 to 2002. That trend is in comparison to the cattle imports that fluctuate within a sideways pattern, neither increasing nor decreasing. Visually it appears that there is no discernable relationship between these variables.

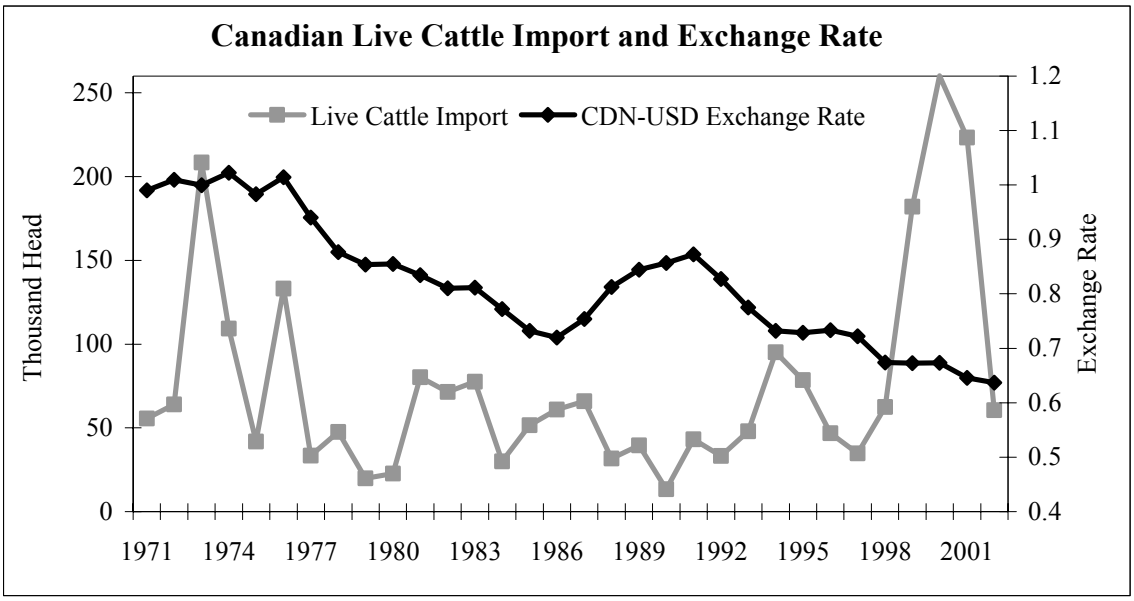


Figure 32 Source: Agriculture and Agri-Food Canada

To determine whether or not there is a relation between cattle imports and the exchange rate, the following linear regression has been conducted:

Regression analysis
R^2: 0.027
Parameter value (β): -86.68
p-value: 0.370

The R^2 statistic indicates in this case 0.027. This means that exchange rate explains less than two percent of the variation of cattle imports. The parameter value, which is the slope of the relation, was estimated at -86.68. The fact that the parameter is negative is inconsistent with the prevailing wisdom, which states that when the Canadian dollar depreciates in relation to the US dollar, that imports are supposed to decrease. Instead, this regression model estimates that when the Canadian dollar depreciates imports increase. With that said, the value of the parameter was 0.370, which is not significant at a level of $p<0.05$. This means that this parameter is not statistically different from zero. From these results we can concluded that there is no long-term

relation between the live cattle imports and the exchange rate. In other words, the exchange rate has not had any impact on the volume of cattle imported from a longer-term perspective.

Live Cattle Export

The following graph presents the exports of live cattle by Canada and the exchange rate. As with the import situation, the exchange rate presents much smaller fluctuations than the cattle exports. As noted above, Canadian dollar has been depreciated by around 30 percent from 1971 to 2002. On the other hand, the live cattle exports have increased by more than 1,300 percent during this period. As can be seen from the graph, however, most of that increase occurred after 1986. These two curves seem to present an inverse relationship, meaning exports increase as the exchange rate trends lower.

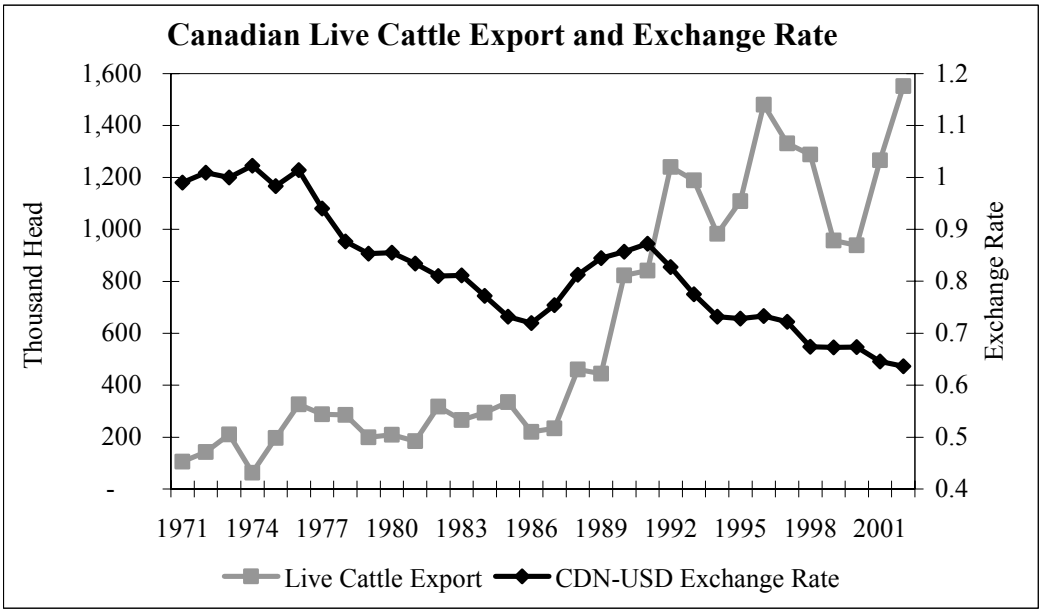


Figure 33 Source: USDA and GMC data files

A linear regression has been conducted to test the potential relation between the exchange rate and the beef exports. These are the main results obtained from the linear regression analysis:

Regression analysis
R^2: 0.466
Parameter value (β): -2826.34
p-value < 0.01

The regression analysis identified that there is a significant relation between these two variables. The R^2 statistic indicates that 46.6 percent of the variations in live cattle exports from Canada are attributable to the exchange rate fluctuations. The linear model estimates that a reduction of one point of Canadian dollar compared to the US dollar increases by 28,263 the number of live cattle exported. The *p*-value or level of significance of the parameter is $p < 0.001$. This means that there is less that 0.1 percent of chance that the parameter is not different from zero. In other words, the value of the parameter is significant at a level that is over 99.9 percent.

On the surface therefore, the graph and the regression analysis point to a relatively good relationship between the depreciation of the exchange rate and the growth of cattle exports over

time. This seems consistent with the prevailing viewpoint that a lower Canadian dollar would increase exports of live cattle from Canada. That view, however, is inconsistent with the lack of any relationship between the exchange rate and cattle imports. It is also possible that the upward trend of cattle exports is just randomly associated with the downward trend of the exchange rate. It is important to take into account that the relation is potentially explainable by the fact that these two variables were in transition during in the long term. In support of that assertion, it is noted that the strongest growth of the cattle exports occurred between 1987 and 1993. During this 6-year period the exchange rate was actually continuously appreciating. This is highlighting that the relationship between exports and the exchange rate is potentially weaker than what was estimated with the linear model over the 31-year period. In other words it should call into question the viewpoint that cattle export growth is due to exchange rate.

Beef Imports

The following graph shows the Canadian beef imports and the exchange rate from 1971 to 2002. The graph indicates that the imports of beef have increased by over 250 percent during these 31 years. These two curves present an inverse relation, which is inconsistent with the belief that a depreciated Canadian dollar would reduce beef imports. The beef import relationship is clouded, however, by a number of factors. Not the least of these is the fact that unlike beef and cattle exports as well as cattle imports, which are dominated by the US, beef imports come from a variety of countries. Most notable of those countries are Australia and New Zealand. Furthermore, beef import volumes from non-US sources are regulated by a tariff and import control scheme. As a result, the simple Canada/US exchange rate relationship may not provide sound point of reference.

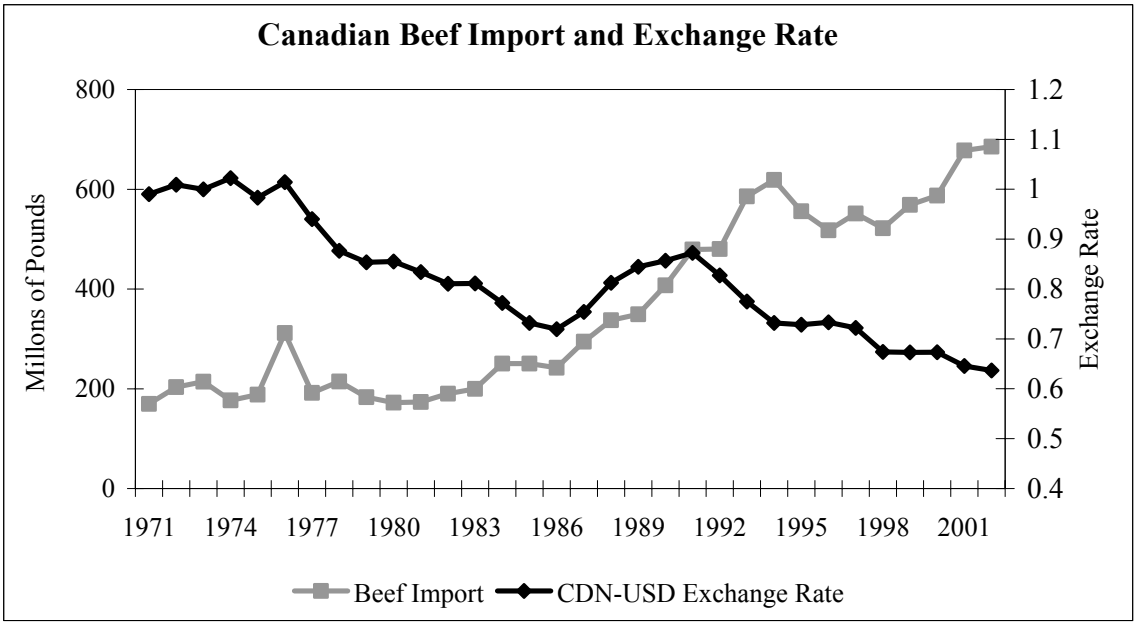


Figure 34 Source: Agriculture and Agri-Food Canada

Effectively, when discussing volumes of non-US or non-NAFTA beef, the reference is towards Australia, New Zealand and to a lesser extent, Uruguay. Australia has approximately half of the non-US exports, followed by New Zealand with between 35-40%. Together, the two countries represent nearly 90% of the non-US exports to Canada. These two countries and Uruguay are

effectively designated as the lead exporters to Canada and are allocated quota under the previous Uruguay General Agreement on Tariffs and Trade (GATT) round. These volumes and the associated schemes are part of the tariff rate quota regime under the WTO.

Regression analysis
R^2 Value: 0.500
Parameter value (β): -1081.30
p-value < 0.001

The regression analysis identified that there is a significant relation between these two variables. The R^2 statistic indicates that 50 percent of the variations in beef imports are attributable to the exchange rate fluctuations. The model states that a reduction of one point of the exchange rate increases by 11.1 million of pounds the quantity of beef imported. The p-value or level of signification of the parameter is lower than 0.1 percent ($p < 0.001$). This regression means that a lower Canadian dollar appears to be a significant variable that can explain the growing beef imports over time. This relation is totally inconsistent with the economic theory. In fact, it would have been expected to observe that a lower Canadian dollar would have reduced the quantity of beef imported.

Obviously in the case of imports as noted above, it is necessary to take into consideration both the US and non-US import factors. The following graph shows Canadian imports of US beef and the exchange rate from the mid 1980's to 2002. Statistically there is very little relationship that can be observed over that timeframe. With that noted, however, during the latter part of the 1990's through 2002, there was a very strong, logical relationship between the exchange rate and imports of US beef. That is, the weaker the exchange rate become, the less US beef was imported. In addition, during the mid-1980's to early 1990's, the stronger the C$ the more US beef was imported. So overall, while there are anomalies, mostly associated with the 1993 to 1996 period, the exchange rate/ US beef import relationship is a reasonably consistent with prevailing wisdom of exchange rate impacts.

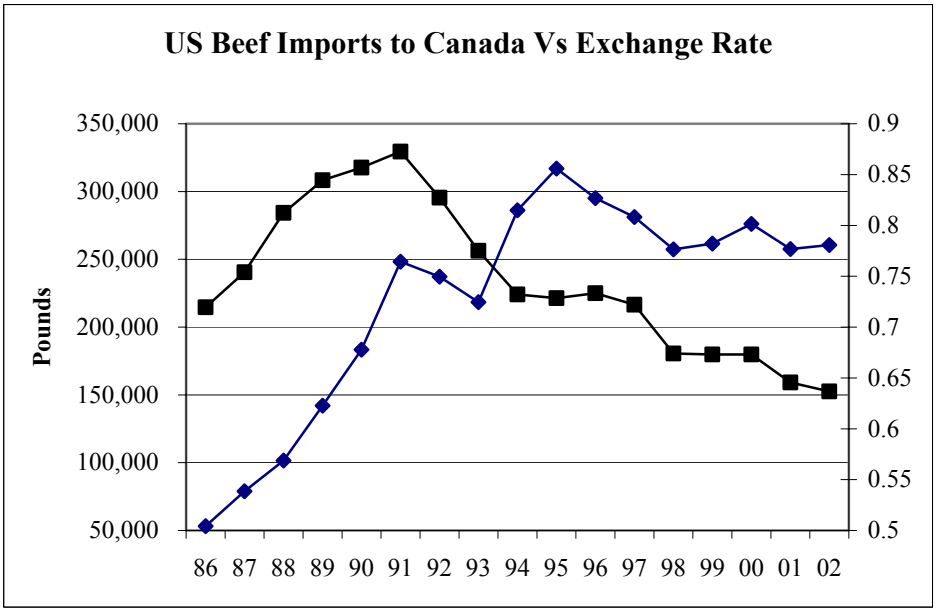


Figure 35 Source: Statistics Canada

While there is a reasonable matching of exchange rate and import performance, it is also entirely possible that the exchange rate was not the key driver. For example, it is equally plausible that the decline in imports during the 1990's was simply the result of the massive increase in Canadian production during the 1990's as shown in section 3 above. Conversely, the increase in imports during the 1980s may simply be attributable to the declines in production during that period.

Beef Exports

The Canadian beef exports and the exchange rate are illustrated in the graph below. These two variables show that from 1971 to 2002 the exchange rate was depreciating almost continuously and during that period the beef exports were growing almost continuously. Beef exports have increased by more than 1100 percent from 1971 to 2002. Beef exports during that time period were dominated by shipments to the United States. During the 1970's and 1980's the US share of beef exports was typically in the 90% range. During the 1990's the US share declined, but still remained in the 70-80% range.

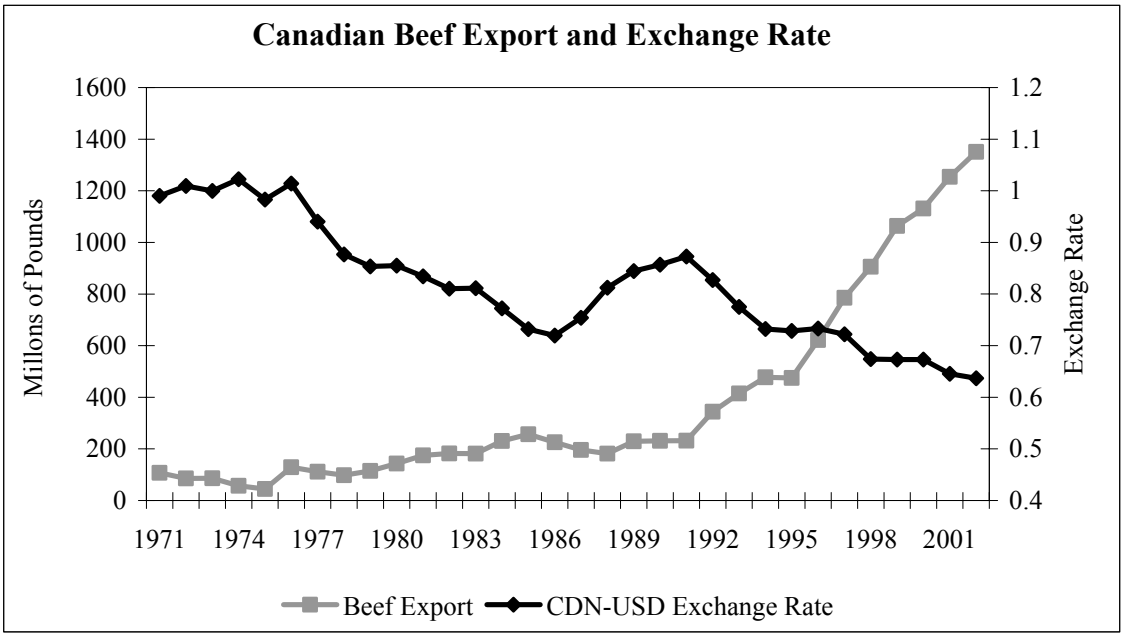


Figure 36 Source: Statistics Canada (Cansim)

Regression analysis
R^2 Value: 0.612
Parameter value (β): -2540.83
p-value < 0.001

The regression analysis identified that there is a significant relation between these two variables. The R^2 statistic indicates that 61.2 percent of the variations of beef exports from Canada are attributable to the exchange rate fluctuations. The linear model estimates that a reduction of 1 percent of Canadian dollar compared to the US dollar increase by 25.4 million of pounds the quantity of beef exported. The *p*-value or level of signification of the parameter is $p < 0.001$.

This means that there is less than 0.1 percent of chance that the parameter is not different from zero.

Again, it is possible that this relation could be explained by the fact that these two variables were in transition during that long period. As with the decline in imports, the increase in exports could easily be explained by the surge in production during the 1990's.

4.2 Monthly Analysis of Cattle and Beef Trade and the Exchange Rate

This sub section undertakes a statistical and economic analysis of cattle and beef exported to the US and beef imported from the US on a monthly basis. The previous long term analysis already showed that there is no relation between cattle imports and exchange rate. The previous section could not, however, categorically conclude that there was no relationship between cattle exports and the exchange rate. There are also questions regarding the exchange rate's impact on beef exports and beef imports. The period of monthly analysis in this section is from January 1989 to April 2003, which is the period where the exports have grown the most over the last three decades. This allows capturing the effect of smaller variations in exchange rate on trade. Therefore, it will provide another measure of the sensitivity of trade to the exchange rate.

Monthly Cattle Exports

The following graph presents the monthly cattle exports to the US and the exchange rate from 1989 to 2003. These two curves indicate that there is not a strong relation between cattle exports and exchange rate. The exchange rate decreased relatively consistently from 1989 to early 2003. The exports are characterized by strong fluctuations from month to month. The regression analysis of this relationship will allow measuring if the strong fluctuations of cattle export are related to the exchange rate variations.

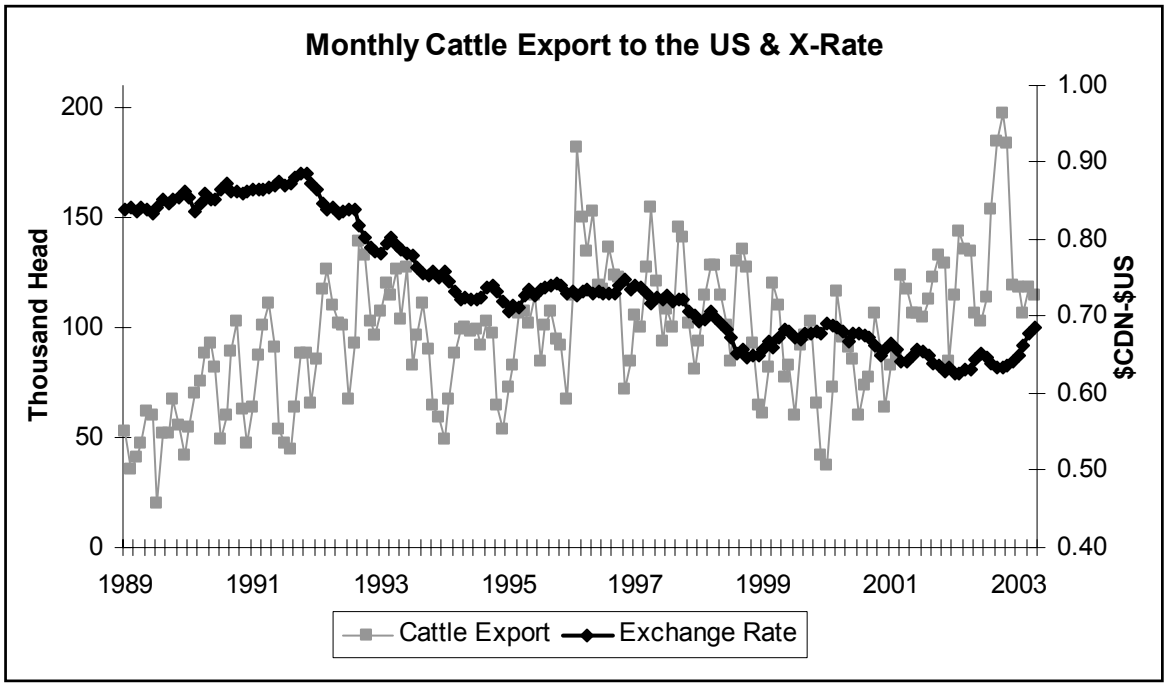


Figure 37 Source: Agriculture and Agri-food Canada

Regression analysis
R^2 Value: 19.1
Parameter value (β): -172.6
p-value < 0.001

The regression analysis indicates that the exchange rate can explain 19.1 percent of the variation of cattle export to the US. That basically means that on a monthly basis, the exchange rate has little influence on cattle exports. That is interesting because while the annual data suggests there may be a relationship, the monthly data does not. The prevailing logic of the link between the exchange rate and trade in live cattle should hold true on a monthly basis if there is merit in the argument. One month should give cattle market participants more than enough time to adopt their marketing focus. In fact, changes to cattle marketing and sales can occur in less than one day. As such, if there was a link between the exchange rate and cattle exports, it should be clearly visible through monthly data. The fact that it does not hold true, statistically, suggests that there is no real strength to the linkage assertions.

Monthly Beef Imports

The following graph shows monthly beef imports from the United States in combination with the monthly exchange rate. The monthly import of beef from the US fluctuates widely over time compared to the exchange rate.

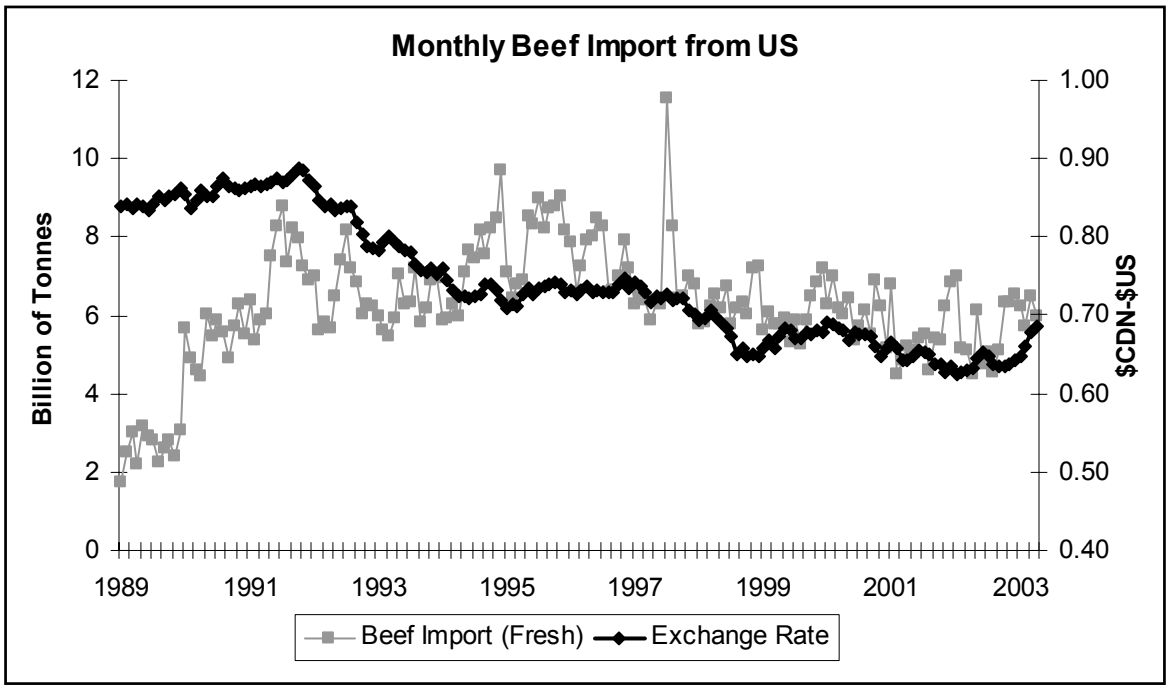


Figure 38 Source: Agriculture and Agri-Food Canada

Regression analysis
R^2 Value: 0.015
Parameter value (β): -2.298
p-value = 0.112

The R^2 statistic indicates that only 1.5 percent of the fluctuations of the quantity of beef imported from the US can be attributed to the variation in exchange rate. This indicates that there is no significant relation between the beef imports and the exchange rate. Furthermore, the *p*-value is 0.112, which indicates that the β parameter is not significant at a level under 0.05. This means that the parameter is not significantly different from zero. In other words, this indicates that there is not direct relation between the exchange rate and the beef imports.

Monthly Beef Exports

The following graph shows monthly beef exports to the US in combination with monthly exchange rate fluctuations. The regression analysis presented under the graph below assesses if the monthly exchange rate variations are impacting the beef exported to the US.

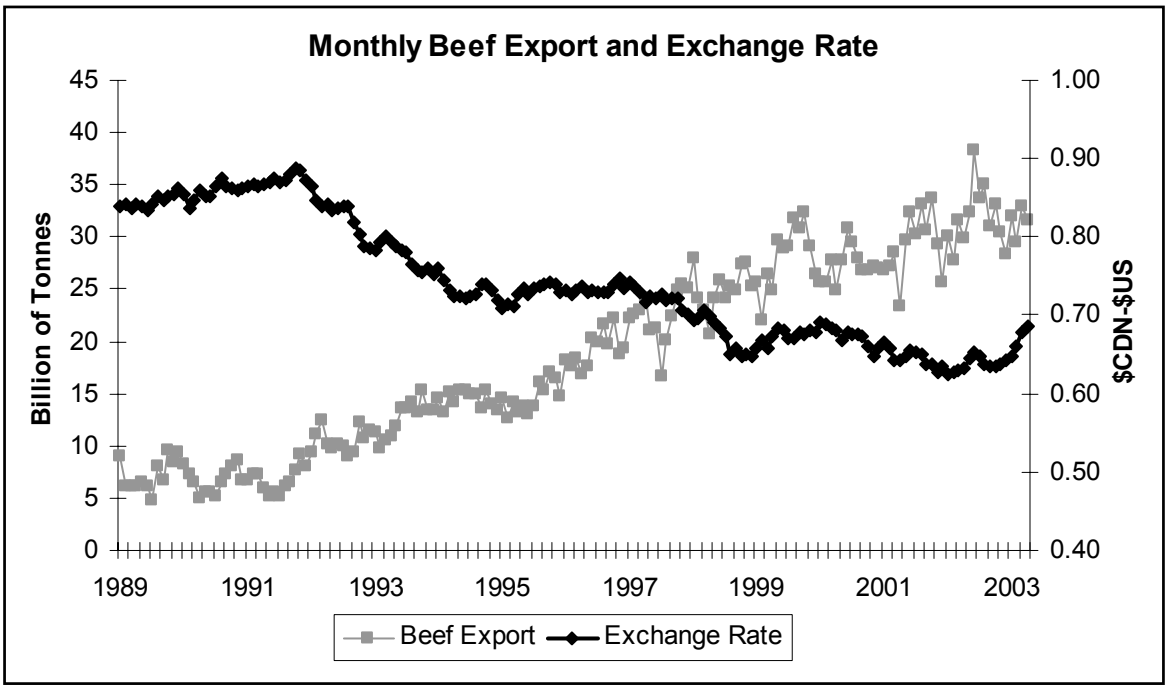


Figure 39 Source: Agriculture and Agri-Food Canada

Regression analysis
R^2 Value: 0.859
Parameter value (β): -106.28
p-value < 0.001

The R^2 statistic indicates that 85.9 percent of the variations of the beef exports appears to be explained by the variation in the exchange rate. The linear regression analysis estimates that an increase of one point of the exchange rate reduced the quantity of beef exported by 1.06 tonne. According to the *p*-value that is less than 0.1 percent (< 0.001) this relation is significant 99.9 percent of the time.

As with the annual data, there is evidence to indicate a link between the exchange rate and exports to the United States.

4.3 Summary and Conclusion

The analysis undertaken in this section was designed to assess whether there is an identifiable relationship between live and product trade and the exchange rate. A long term (32 years) and a monthly (13 years) datasets have been used to assess the possibility of a potential relationship between trade and exchange rate. The regression analysis was a statistical process used to test if whether the exchange rate had an impact on imports and exports of cattle and beef.
Essentially the results of the long term annual and the shorter-term monthly data have shown that there is no confident statistical relationship between cattle imports and cattle exports. There was a reasonable relationship between annual imports from the US and the exchange rate but the fact that there was no monthly relationship suggests that the annual relationship was coincidental. The coincidental relationship was more likely caused by changing production levels in Canada as opposed to the direct exchange rate impact. Beef exports and the exchange rate on the other hand have shown a strong relationship on both an annual and monthly basis. That is, as the exchange rate depreciated, exports increased.

Based on the fact that there was no similar strength on the cattle trade or beef import relationship, however, it raises the question of whether there was in fact a causal relationship with exports. That is, why would the exchange rate not impact cattle trade or beef imports, but have an influence on beef exports. The logical conclusion of this research is that the exchange rate does not impact beef exports.

As such, the conclusion of this section of the report is that the exchange rate does not have a direct impact on trade. This is contrary to much of the conventional wisdom, which argues that a depreciating currency results in greater exports and an appreciating currency results in less exports. The fact is however, that not only is there no statistical proof of this but there is also much statistical evidence to the contrary. The continued strength in live cattle exports since the border opened, despite the appreciated dollar is just one example. Record hog exports in 2004 are another example of the lack of the expected relationship.

The fact is that in commodity markets, changing exchange rates become directly reflected in prices in the domestic market. This was discussed in detail in section 1. So while the depreciated (appreciated) dollar may result in higher (lower) Canadian cattle and beef prices, it does not mean that more (less) product will trade to the US.

5.0 Managing Exchange Rate Risk

Exchange rate risk is essentially the effect that changes in the exchange rate can have on transaction values and ultimately the value of the firm. Currency fluctuations can impact cash flow, as well as the value of assets and liabilities. With the bulk of cattle and beef export sales being made into the US, most of these transactions occur in US dollars. Even the majority of international beef sales (non US) are transacted in US dollars.

Many cattle producers market their cattle to the US with a very short timeline between the time of sale and the time of delivery, perhaps as little as one week. Most producers may feel that such a short time line negates the need to mitigate the risk of changes in the exchange rate or the week-to-week change is usually too small in comparison to the cost of a formal risk management program. But consider that over the past two years, the week-to-week change in the Canada/US exchange rate has averaged one percent up or down. The extremes have been from a 2.3% gain to a 3.2% decline. Even in the short run, the impact of these levels of changes in the exchange rate could translate into differences in the value of cattle (final value versus expected value at time of sale) by as much as $20 to $30 per head.

Producers and processors who enter into contracts for forward delivery of slaughter or feeder cattle, or beef with US or international entities have additional risk because of the extended timeline involved in such transactions. Here the need to look at some type of risk management program regarding changes in exchange rate is more necessary as the potential impact on the final value of the sale is much greater than with the shorter-term transactions. This section provides a description and investigation of the various risk management tools that can be used to reduce the risk of unanticipated exchange rate changes. The following instruments will be examined and explained as to their effectiveness on exchange rate risk management and potential relevance and use by cattle producers:

- Foreign exchange forward contracts
- Futures contracts
- Foreign currency options
- Foreign currency swaps

Before proceeding further with a discussion of these items, it is important to note that the concepts, tactics and examples addressed in this section provide a basic overview of exchange rate risk management. That is, this section would need to be expanded in multiples of its current size in order to address the full intricacies of Canadian exchange rate risk management. Instead this section is merely meant to outline the concepts, possibilities and tools available. It is not intended to be an exhaustive exchange rate risk management strategy. In addition, producers need to understand or have knowledge of the risk that can be involved in using hedging instruments such as futures, options, etc.

5.1 Exchange Forward Contracts

This is probably the most widely used approach to the management of short-term exchange rate fluctuations. It is simply a forward contract with a financial institution (FI) for a fixed number of dollars at a fixed exchange rate.

Assume that a producer has a contract with a US packer to deliver 100 head of 1200 pound cattle in two months at a price of $US.90/cwt. This is a total value of US$108,000. At an (assumed current) exchange rate of $.84, this would be about C$128,500. However, if the exchange rate rises to $.89, the producer would receive only about C$121,348, a C$7151 "loss" because of the increase in exchange rate.

With a forward contract, the producer simply contracts ahead with a financial institution for C$128,500. When the cattle are delivered, the producer receives C$128,500 of which C$7,151 is topped up by the financial institution because of the exchange rate movement. In turn, the FI either hedged the currency forward contract with Canadian dollar futures or options or entered into an offsetting contract with another FI. Of course, if the C$ falls against the US$ before the cattle are delivered, the producer also gets $128,500 because s/he does not receive the speculative gain of $7,151.

The producer pays the FI a fee for this service and the FI has a buy/sell spread.

There are two or three potential advantages of this instrument over futures and options. One is that it can be set up in any amount, while the futures contracts are for C$100,000 (C$50,000) on the mini contract. The other is that there is considerable liquidity even if the forward contract is made for six to nine months forward. This is often not the case with futures, where most of the trading is done in the first two futures contracts. The second is probably of dubious value since trading in the nearby futures contracts is quite liquid and positions can be rolled (see the next section). A third potential advantage is that the FI bears the responsibility for managing the risk by trading futures, options or swaps. Once the rate is set in a forward contract, the cattle producer can neither gain nor lose from exchange rate fluctuations.

The potential disadvantage of forward contracts is the cost. The FI charges a fee for the service and may add to it in the buy/sell spread. The magnitude of this is an empirical question that needs to be investigated because the fee and the spread is likely negotiable.

5.2 Hedging With Futures

The producer can also hedge the exchange rate with futures, which would be done by buying one C$100,000 futures contract (or three C$50,000 mini contracts). Assuming they trade at the initial exchange rate of US$.84, the producer would buy at $.84 when the cattle contract is made and sell at $.89 when the cattle are delivered. By doing this the producer makes a profit of US$.05, US$5,000 on the contract (US$7500 on three minis) before brokerage fees. At the current rate of $.89, this is a profit of C$5,618 on a futures contract (C$8,427 on three minis). Recall that the loss on the cattle contract was C$7,151. So, hedging with one futures contract covers most of the exchange rate loss. Hedging with three minis covers more than the loss.

Now, what happens if the Canadian dollar declined to $.79? In this case, the producer would have enjoyed a speculative gain of C$7,151on the cattle contract and would have lost C$5,618 on a futures contract or C$8,427 on three minis.

The potential advantages of hedging the risk with futures are that it may cost less over time, as mentioned above, and that the producer has more flexibility. This means that the trader may be able to liquidate the futures position if the C$ is declining and reduce the loss on futures. This will reduce the cost. To make this advantage real requires a disciplined trading strategy.

Two disadvantages are clear from the example. First, futures contracts are lumpy – they only come in two sizes, but the size of the amount at risk is much more variable. Therefore, it is very difficult to match the size of the risk position to the size of the contracts.

The second is the opposite of one of the potential advantages. While the flexibility to trade in and out is a potential advantage, it is also a potential disadvantage because hedgers are tempted to turn into speculators without discipline, which often leads to costly or even disastrous results.

Another potential disadvantage is that futures contracts more than four to six months forward are not heavily traded. Therefore, liquidity is an apparent problem for anyone who wants to trade forward. As noted earlier, however, this is a serious issue because volume is very large in the nearby contracts, and it is easy to roll contracts forward. This means if a hedger has bought March futures as a hedge, the hedger can sell them and roll the position to the June or September contract. The spreads in exchange rate futures are relatively small and depend in large part on relative interest rates between Canada and the US. While rolling can result in loss of the spread, it is relatively small compared to the impact of the $.05 to $.10 changes in exchange rate that have occurred in less than six months over the past several years.

Simulation Model with use of Canadian Dollar Futures

To look at the effects of utilizing currency futures contracts in conjunction with a cattle feeding program that involved the marketing of cattle to a US packer, a simulation model was developed. According to the cattle on feed surveys performed by Canfax, 45 percent of cattle placed on feed in Alberta and Saskatchewan feedlots are in the weight category of 800 pounds or more[31]. Adding in the category of feeder cattle between 700 and 799 pounds brings the proportion up to 68 percent. The patterns were consistent between steers and heifers. The simulation model was based on the placement of 850 pound feeder steers as a proxy for cattle feeding activity in Western Canada. Using Canfax TRENDS parameters, the cattle would be marketed 114 days after the time of placement. The producer would contract the cattle to a US packer at the time of placement on feed. For ease of calculation, placements and marketings were set in one month periods, with placements occurring from January 1998 through December 2002 and marketings taking place from May 1998 through April 2003. Thus the model takes into account the five-year period prior to the first case of BSE in Canada. All cash and futures price data is based on monthly averages. The model is based on contracting for the delivery of 100 head of 1200 pound fed cattle in each month.

Over the simulation period, the Canadian dollar was generally trending downward from the US$0.70/C$ area in early 1998 to a low under US$0.63 in late 2001 and early 2002. This was a deterioration of more than 10 percent. The Canadian dollar then strengthened into mid 2002, reaching above US$0.65 in June before falling back into the low US$0.63 in the fall. The Canadian dollar rebounded once again in late 2002, reaching the US$0.67-0.68 area in March/April 2003. The turn in the Canadian dollar to higher values in relation to the US dollar has continued, reaching above US$0.85 in late 2005.

Live cattle futures contracts are traded on a bi-monthly basis (February, April, June, August, October and December) on the CME[32]. Currency futures contracts are set up on a basis of four times per year (March, June, September and December). The hedging program would be set to

[31] Average 2000-2005
[32] Chicago Mercantile Exchange, http://www.cme.com/

utilize the nearest relevant contract month after the expected month of marketing the animals. A feeder steer weighing 850 pounds and placed in a feedlot during January would be marketed in May of the same year. The June live cattle contract would be used to determine the contract price of the cattle in US dollar terms. For the exchange rate, the feedlot operator would use the June Canadian dollar contract.

For animals placed on feed in August, the expected marketing month is December. In this case, the live cattle futures contract for February of the following year would be used to set the contract price of the cattle in US dollar terms. The Canadian dollar contract for March of the following year would be used for the exchange rate aspect of the transaction. A listing of placement months and corresponding marketing months and contract months is shown below:

Placed	**Marketed**	**Live Cattle Futures**	**CDN Dollar Futures**
January$_{(t)}$	May$_{(t)}$	June$_{(t)}$	June$_{(t)}$
February$_{(t)}$	June$_{(t)}$	August$_{(t)}$	September$_{(t)}$
March$_{(t)}$	July$_{(t)}$	August$_{(t)}$	September$_{(t)}$
April$_{(t)}$	August$_{(t)}$	October$_{(t)}$	September$_{(t)}$
May$_{(t)}$	September$_{(t)}$	October$_{(t)}$	December$_{(t)}$
June$_{(t)}$	October$_{(t)}$	December$_{(t)}$	December$_{(t)}$
July$_{(t)}$	November$_{(t)}$	December$_{(t)}$	December$_{(t)}$
August$_{(t)}$	December$_{(t)}$	February$_{(t+1)}$	March$_{(t+1)}$
September$_{(t)}$	January$_{(t+1)}$	February$_{(t+1)}$	March$_{(t+1)}$
October$_{(t)}$	February$_{(t+1)}$	April$_{(t+1)}$	March$_{(t+1)}$
November$_{(t)}$	March$_{(t+1)}$	April$_{(t+1)}$	June$_{(t+1)}$
December$_{(t)}$	April$_{(t+1)}$	June$_{(t+1)}$	June$_{(t+1)}$

Fed cattle in Alberta tend to sell (FOB the feedlot) at a discount to US cash cattle prices and live cattle futures prices in equivalent US dollar terms. This is mainly due to Alberta being a surplus area in terms of cattle numbers and the need to ship a certain proportion of cattle production to packing plants in various US states (mostly Washington, Utah, Nebraska and Colorado). The basis is the difference between the cash price for the cattle FOB the feedlot and the live cattle futures price (both in US dollars). Over time, the basis normally averages close to the cost of transporting the cattle to US packing plant destinations. In the 1998 through 2002 time period, the basis averaged minus US$6. This average basis level was used to determine the contract price that a US packer would offer for Alberta fed cattle to be delivered at a future date.

During January 1998, the average price for the June live cattle futures was US$68.30/cwt. Adjusting by the basis (-US$6.00) would put the contract price at US$62.80/cwt for delivery of 100 head of fed cattle in May. The expected value would be US$74,762. The spot Canadian dollar averaged US$0.6947/C$ in January 1998, making the value of the cattle amount to C$107,622. By May 1998, the spot Canadian dollar had declined to US$0.6919/C$. Thus at time of delivery, the cattle are now worth C$108,057. The value of the contracted cattle has risen by C$435 due to the change in the exchange rate from January to May.

Now assume that the feedlot operator hedged the Canadian dollar to protect against adverse moves in the exchange rate that could lower the value of the contracted cattle. This would be the

case if the value of the Canadian dollar rose in US dollar terms over the life of the contract. To cover this transaction, the producer would buy (go long) one Canadian dollar contract (C$100,000). The June Canadian dollar contract averaged US$0.6962/C$ in January 1998. By May 1998, the June Canadian dollar contract had declined to US$0.6947/C$. This would lead to a loss on the Canadian dollar futures trade in the amount of US$150. Using the spot Canadian dollar value in May of US$0.6919/C$, the loss on the futures trade amounts to C$217. Thus the net change in value of the contracted cattle has now been reduced to a net gain of C$218 (435-217).

The results of the contracting and hedging activity and differences are shown in ledger form below:

a) Contract fed cattle using live cattle futures

June live cattle futures in Jan/98	US$68.30/cwt
Basis	-US$6.00/cwt
Contract price for May/98 delivery	US$62.30/cwt
Spot Canadian dollar in Jan/98	US$0.6947/C$
Value of contract cattle in Jan (62.30/0.6947*1200 cwt)	C$107,622
Spot Canadian dollar in May/98	US$0.6919/C$
Value of contract cattle in May (62.30/0.6919*1200 cwt)	C$108,057
Gain (loss) in value of contract cattle (108,057-107,622)	C$435

b) Contract fed cattle using live cattle futures and hedge Canadian dollar

June live cattle futures in Jan/98	US$68.30/cwt
Basis	-US$6.00/cwt
Contract price for May/98 delivery	US$62.30/cwt
Spot Canadian dollar in Jan/98	US$0.6947/C$
Value of contract cattle in Jan (62.30/0.6947*1200 cwt)	C$107,622
Spot Canadian dollar in May/98	US$0.6919/C$
Value of contract cattle in May (62.30/0.6919*1200 cwt)	C$108,057
Hedge (long) June Canadian dollar futures in Jan/98	US$0.6962/C$
Liquidate June Canadian dollar futures in May/98	US$0.6947/C$
Gain (loss) in futures trade ((0.6947-0.6962)*100,000)	(US$150)
Gain (loss) in C$ terms (150/0.6947)	(C$217)
Value of contract cattle including futures trade (108,057-217)	C$107,840
Gain (loss) in value of contract cattle (107,840-107,622)	C$218

In the above example, the potential gain in the value of the cattle from the change in the exchange rate between the time of placement of the cattle on feed and the time of delivery to the

US packing plant is reduced by the hedging loss on the Canadian dollar futures, but not totally wiped out. This was due to two factors. Firstly, the cattle transaction was "under-hedged", in that the value of the Canadian dollar futures contract (C$100,000) was less than the Canadian equivalent value of cattle contract (C$107,622). Secondly, the spot Canadian dollar declined to a further degree (0.6947-0.6919=0.0028) than did the price of the Canadian dollar futures contract (0.6962-0.6947=0.0015). The net gain in the value of the contract cattle amounts to C$0.18/cwt.

Next, we will look at an example where the Canadian dollar was increasing over the time of the contract. Cattle placed on feed in March 2002 would be targeted for marketing in July 2002. The cattle would be contracted according to the value of the August 2002 live cattle futures in March 2002 (US$67.93/cwt). Adjusting for the basis (-US6.00/cwt), the expected value of the cattle at the time of contracting would be US$74,316. The spot Canadian dollar averaged US$0.6299/C$ in March 2002, making the expected value amount to C$117,981. By July 2002, the spot Canadian dollar had increased to US$0.6451. This puts the value of the cattle at the time of delivery at C$115,201. The value of the contracted cattle has declined by C$2,780 due to the change in the exchange rate from March to July.

To cover this cattle transaction, the producer would hedge the September 2002 Canadian dollar futures in March 2002 (US$0.6178.C$). By July 2002, the September Canadian dollar futures contract had risen to US$0.6425/C$. This hedging activity would have resulted in a gain of US$2,470. Using the spot Canadian dollar value in July of US$0.6451/C$, the gain on the futures trade amounts to C$3,829. In this case, the decline in the cash value of the contracted cattle (C$2,780) has been offset by the gain in the futures trade (C$3,829), resulting in a net gain of C$1,049.

The results of the contracting and hedging activity and differences are shown in ledger form below:

a) Contract fed cattle using live cattle futures

August live cattle futures in Mar/02	US$67.93/cwt
Basis	-US$6.00/cwt
Contract price for Jul/02 delivery	US$61.93/cwt
Spot Canadian dollar in Mar/02	US$0.6299/C$
Value of contract cattle in Mar (61.93/0.6299*1200 cwt)	C$117,981
Spot Canadian dollar in Jul/02	US$0.6451/C$
Value of contract cattle in May (61.93/0.6451*1200 cwt)	C$115,201
Gain (loss) in value of contract cattle (115,201-117,981)	(C$2,780)

b) Contract fed cattle using live cattle futures and hedge Canadian dollar

August live cattle futures in Mar/02	US$67.93/cwt
Basis	-US$6.00/cwt
Contract price for Jul/02 delivery	US$61.93/cwt
Spot Canadian dollar in Mar/02	US$0.6299/C$
Value of contract cattle in Mar (61.93/0.6299*1200 cwt)	C$117,981

Spot Canadian dollar in Jul/02	US$0.6451/C$
Value of contract cattle in May (61.93/0.6451*1200 cwt)	C$115,201
Hedge (long) September Canadian dollar futures in Mar/02	US$0.6178/C$
Liquidate September Canadian dollar futures in Jul/02	US$0.6425/C$
Gain (loss) in futures trade ((0.6425-0.6178)*100,000)	US$2,470
Gain (loss) in C$ terms (2470/0.6451)	C$3,829
Value of contract cattle including futures trade (115,201+3,829)	C$119,030
Gain (loss) in value of contract cattle (119,030-117,981)	C$1,049

In this particular case, the scenario changed from a C$2,780 decline in the value of the cattle due to the change in the exchange rate, to a gain of C$1,049 due to the use of the Canadian dollar futures. Again, the transaction was "under-hedged", in that the value of the Canadian dollar futures contract (C$100,000) was less than the Canadian equivalent value of the cattle contract (C$117,981). However, the increase in the Canadian dollar futures contract (0.6425-0.6178=0.0247) was much greater than the increase in the spot Canadian dollar (0.6451-0.6299=0.0152). This was enough to more than offset the decline in the cash value of the cattle during the contract period. The net gain in the value of the contract cattle amounts to C$0.87/cwt

Other examples can be shown where the loss on the Canadian dollar futures contract was greater than the gain in the contract value of the cattle due to the change in the spot Canadian dollar. This leads to a net decline in the value of the cattle over the contract period. Conversely there are examples where the gain on the Canadian dollar futures contract did not fully cover the decline in the contract value of the cattle due to the change in the spot Canadian dollar. There would still remain a net decline in the value of the cattle over the contract period, but less so than leaving the dollar unhedged.

Over the simulation run from 1998 through 2002 (marketings from May/98 through Apr/03), the difference in contract value of the cattle from the time of placement (contracting) to time of marketing (delivery) averaged C$371 per group of 100 head of cattle (or C$0.31/cwt). However, hedging the Canadian dollar resulted in an average loss of C$360 per contract (equivalent to C$0.30/cwt of cattle). For this time period, the use of Canadian dollar futures pretty much negated the gains in the value of the cattle due to the generally declining Canadian dollar.

As previously mentioned, the use of one Canadian dollar futures contract per month of hedging activity resulted in the futures contract covering, on average, only 86 percent of the value of the cattle in Canadian dollar terms. Expanding the model to the contracting of 1000 head of fed cattle per month incorporated the use of between 10 and 13 Canadian dollar futures contracts at a time, depending upon the contracted price of the cattle. Here, the use of the Canadian dollar futures contracts would cover, on average, 99.9 percent of the value of the cattle in Canadian dollar terms. There would still be times when the currency would be "under hedged" but also times when the currency would be slightly "over hedged". The ending results were not significantly different in comparison to the model with 100 head of cattle per month. The difference in contract value of the cattle from the time of placement to time of marketing averaged C$3705 per group of 1000 head of cattle (or C$0.31/cwt). The hedging of the Canadian dollar resulted in an average loss of C$4010 per month (equivalent to C$0.33/cwt of

cattle). Again, the use of Canadian dollar futures negates the gains in the value of cattle due to the generally declining Canadian dollar over the simulation period. In both cases, there would also be costs associated with the hedging transactions, as well as opportunity costs associated with the need for margin maintenance on the hedging account.

As can be seen in the following chart, the Canadian dollar was mostly declining against the US dollar over the simulation period. Intuitively, this imputes a bias into the model. To include a time period when the Canadian dollar was in a general uptrend in comparison to the US dollar, the model was extended through August 2005 (last marketing month being December 2005). Of course, this is purely hypothetical, as the border was closed to exports of live cattle to the US from late May 2003 through early July 2005. The cattle markets in Canada and the US, in essence, became disconnected in comparison to their past relationships. Even with the re-opening of the US border to trade in live cattle under 30 months of age, the basis has widened considerably from what was the case prior to May 2003.

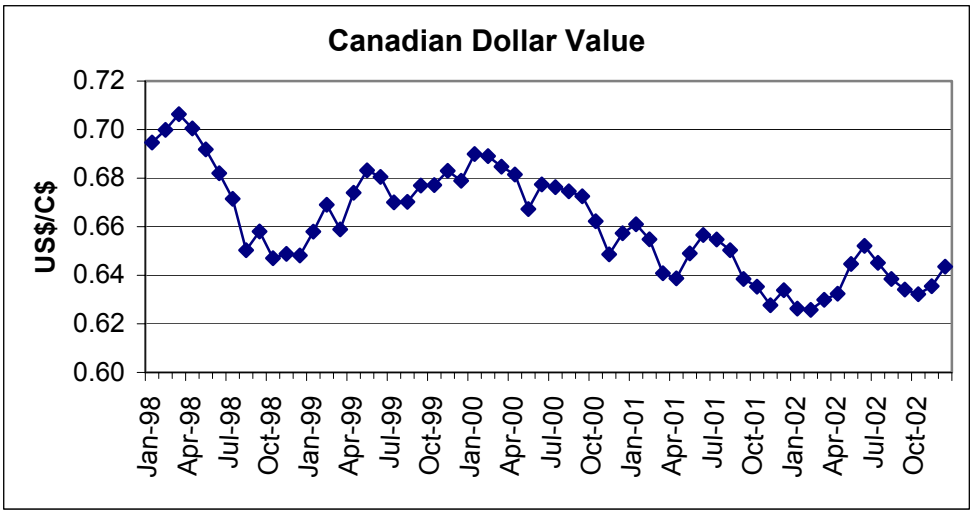


Figure 40 Source: Informa Economics data files

For the purpose of the theoretical model, the assumptions were made that cattle contracting could continue from 2003 through 2005 and the basis would remain at the previous level of – US$6.00/cwt. The modified model now encompasses 92 months of data. From late 2002, the Canadian dollar rose from the US$0.63-0.64 area toward US$0.75 by mid 2003. Despite some setbacks in early 2004 and early 2005, the uptrend has mostly continued, with the Canadian dollar breaking above US$0.80 in October 2004 and averaging nearly US$0.86 in December 2005. The upswing in the Canadian dollar has been more dramatic and quicker (shorter time from 2003 through 2005) than the declining trend in the Canadian dollar from 1998 through 2002. Again, the level of contracting was for 100 head of cattle per month.

Over the new simulation run from January 1998 through August 2005 (marketings from May/98 through Dec/05), the difference in contract value of the cattle from the time of placement to the time of marketing averaged a decline of C$1009 per group of 100 head of cattle (or C$0.84/cwt). The hedging of the Canadian dollar resulted in average gains of C$870 per contract (equivalent to C$0.73/cwt of cattle). Over the 92 month period, the hedging of the Canadian dollar mostly, but not entirely, offset the declines in the value of the cattle due to the changes in the exchange

rate. Again, the use of one Canadian dollar futures contract per month results in "under hedging" the currency.

Separating out the time period from 2003 to 2005 (the period of an uptrending Canadian dollar), the average decline in the value of the cattle over each four month contract period is C$3594 per group of 100 head of cattle (or C$3.00/cwt). Hedging the Canadian dollar over this time period results in an average gain of $3176 per futures contract (equivalent to C$2.65/cwt of cattle). Thus the use of Canadian dollar futures offsets more than 88 percent of decline in the value of the cattle due to changes in the exchange rate. Expanding the model to 1000 head per month results in the dollar hedge completely offsetting the declines in the value of the cattle due to exchange rate changes.

The following table summarizes the effects of hedging the Canadian dollar on the changes in the value of cattle in Canadian dollar terms. The results have been broken out by year to show how the results can change over time, depending upon whether the Canadian dollar is in an uptrend or downtrend in comparison to the US dollar.

Influence of Changes in Exchange Rate on Value of Canadian Cattle

	Gain (loss) in Value of Cattle (no C$ hedge) C$/cwt	Gain (loss) in Value of Cattle (including C$ hedge) C$/cwt	Effect of C$ Hedge on Value of Cattle C$/cwt
1998	1.60	0.07	(1.52)
1999	(0.94)	0.11	1.05
2000	1.85	0.33	(1.52)
2001	1.14	0.11	(1.03)
2002	(2.10)	(0.58)	1.52
2003	(3.74)	(0.21)	3.53
2004	(2.62)	(0.34)	2.28
2005 through August	(2.45)	(0.57)	1.87

5.3 Hedging with Options

Options are derivatives of futures. They are called options because they give the buyer of an option the right, but not the obligation to take an underlying futures position. Call options give the buyer the right, but not the obligation to be long futures. Put options give the buyer the right, but not the obligation to be short futures.

Buying options is like buying insurance. If a producer's risk is that the C$ will rise, then the producer can buy Calls. They will be *written* by a risk taker – like the underwriter of insurance. The buyer pays the writer a premium when the Call is bought. If the C$ rises, the Call option's premium rises and/or the buyer can exercise the option thereby forcing the writer to provide the underlying futures position. If the C$ falls, the option's premium falls, the buyer loses some or all of the premium and the writer keeps the original premium. Again, the comparison to insurance should be clear: if I buy life insurance I pay a premium. If I die, my beneficiary cashes the insurance policy. If I don't die, the insurer keeps the premium.

Someone else may have the risk that the C$ will fall. To hedge with options, that person would buy Puts. If the C$ falls, the hedger buys Puts. If the C$ falls, the Put premium rises. If the currency rises, the Put premium falls.

We can apply this to the foregoing example where the C$ rose from US$.84 to US$.89. Rather than buying futures, a hedger might buy an $.85 Call (chosen because the premium for an $.84 or $.845 will be relatively high) at a premium of approximately $1,000. When the cattle contract is completed and the C$ has moved to $.89, the $.85 Call will have an *intrinsic* value of $.04, or $4,000. It may also have remaining *time value* – i.e. the risk premium. Time value depends on the amount of time left until the option stops trading, and the volatility of the underlying futures contract. Let's assume that the Call has a time value of $300, so the total premium is US$4300, the total of the intrinsic and time values. To complete the hedge, the Call option would be sold when the cattle are delivered for a profit of US$3,300. At a rate of $.89 this is a profit of C$3,708.

Comparing the hedge with the Call option to the hedge with futures, we see that the Call option results in about C$1,900 less profit to contribute to the loss resulting from the C$'s rise. This is because it was "out of the money" by one cent (i.e. an $.85 Call in an $.84 market) and because of the loss of time value.

But conversely if the C$ had fallen to $.79, the cattle producer would receive the speculative gain of C$7,151 from the drop in the exchange rate less the loss of US$700 on the Call premium.

Futures Versus Options Discussion

The advantages and disadvantages of hedging with options compared to futures are apparent in the example. The main advantage is that the hedger retains the opportunity to profit from a positive move in the exchange rate because the loss on the option is limited to the loss of time value. The corollary of this is that the hedger never receives margin calls: the maximum loss is the initial premium on the Call.

The disadvantage of options is that the hedger will always lose time value – when the C$ rises hedging with futures gets all the profit. But the options premium will rise more slowly because the time value will decline.

Another disadvantage is that time values are very high for options that are traded very far forward. So, it costs far more to buy an option against a futures contract that will mature a year forward than against one that will mature two to four months forward. For this reason most options are traded against the first two futures contracts.

5.4 Currency Swaps

Swaps are usually used for relatively long-lived and complex obligations. For example, a producer might take a loan in the US for US$1,000,000 at 5% interest. It is repayable over four years in US$ 250,000 increments. The producer would convert and invest the US funds into Canadian and invest it in the business. But the risk is that the C$ may fall so that the producer needs to pay back more than the current million dollar equivalent in Canadian funds and that the Canadian dollar value of the interest payments would also rise. For example, if the loan was made when the C$ is worth $.85, then the loan converts to C$1.765 mil, and the $250,000 annual payment is C$294,117. The producer wants to pay back the principal of the loan at a rate of C$294,117/yr. But if the C$ goes to $.75, then the US$250,000 annual obligation becomes C$333,333. Of course, the C$ value of the interest payment would also rise.

A financial institution or intermediary would provide a swap to the producer, which would guarantee the principal payments at C$294,117. The swap aspect is that this position would be offset by the financial intermediary with another customer or customers who have the opposite exchange rate risk. That way the additional cost to the intermediary of the guarantee to the beef producer is offset by again on the guarantee to the other party.

As the example suggests, swaps have and advantage in long term and/or complex transactions where futures don't trade far enough into the future, aren't liquid, or are too lumpy to match the obligation.

As with the other instruments, the attraction will depend on the cost.

5.5 Summary

The foregoing suggests that a number of financial instruments are available to use to manage exchange rate risk in the beef business. They all have pro's and con's, which suggests that which to use is partially a function of the hedger's objective. Hedging oneself in futures may be the lowest cost, but the hedger needs to know a lot about futures trading to be effective in doing in doing it. Similarly, hedging with options is appealing if the premium is not out of line and if the producer can absorb a little risk. Options are also useful if the producer wants to protect against disaster and yet take advantage of the rate moving back in his favor. In all cases the net cost needs to be evaluated for each alternative.

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