

ECONOMIC IMPACTS OF LIVESTOCK PRODUCTION IN CANADA – A REGIONAL MULTIPLIER ANALYSIS

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**Report Prepared For
Canfax Research Services
Canadian Cattlemen's Association**

**DEPARTMENT OF BIORESOURCE POLICY, BUSINESS
AND ECONOMICS
UNIVERSITY OF SASKATCHEWAN
SASKATOON, SK, S7N 5A8**

RESEARCH REPORT

SEPTEMBER 2012

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S.K.

EXECUTIVE SUMMARY

Economic systems are getting increasingly complex over time. Decisions taken by one individual or firm affect many other individuals or agencies than what is obvious through casual observation. The Canadian cattle sector operates under such a complex economic system. Here, actions taken by producers and other economic agents impact other members of society. This is because of the nature of the economic system, where one economic agent depends on other economic agents to execute its own production decisions.

Every economic activity that takes place in a region involves certain amount of monetary expenditures. Such expenditures create some economic repercussions felt elsewhere in the economy, some of which are within the same region, while others are felt in other parts of the national (or even international) economy. On a national scale, these repercussions have been identified in Keynesian economics as the multiplier effect. Although for the aggregate economy such multipliers are useful, their major limitation is that they do not differentiate among sectors¹. In reality, every economic activity is different in terms of its multiplier effect. Knowledge of these differences is therefore considered important for national and regional economic development planning and related policy making.

Cattle production is a major industry in Canada. To most observers, its economic contribution is mainly seen in terms of initial monetary expenditures incurred by various producers and processors in the industry. Since the repercussions of this activity are not always that obvious, the usual practice is to ignore them. These impacts are commonly known as secondary impacts and are created through the multiplier effect of a sector. Ignoring these impacts leads to serious underestimation of the sector's importance to the regional and national (or provincial) economies. To understand the total economic impacts of an industry, one needs to look 'under the hood' and see how the regional / national economy functions and develops.

The main feature of a regional multiplier activity is the recognition of interdependencies among sectors along with intra-regional and interregional trade. Trade flows, particularly the imports of various products, act as a leakage (or drain) on the economy. Secondary impacts are produced only through the activities that occur within the regional boundaries. To capture the true contribution to regional development from a selected development alternative, one needs to know not only the outlays associated with that alternative but

¹ A sector is an aggregate of similar industries.

also where they lead to – local economy or elsewhere. If the expenditures are retained within the regional economy, they create multiplier activity.

Secondary impacts are generated through two types of changes in the economy: one, indirect impacts created through purchase of inputs from other industries in the region. These are also called backward linkages; two, induced impacts created through re-spending of income of workers and other human resources on consumer goods and services. In addition to the backward linkages, some industries contribute to the regional / national economy in another manner. These industries purchase live cattle and process them further, thereby adding more value to the product, and thus, adding to the regional / national economic growth and prosperity. These industries are called forward linked industries. Total secondary impacts of a sector are thus a sum of three major types of impacts – (1) direct impacts of the Canadian cattle sector (or its components); (2) direct, indirect and induced impacts of the backward-linked industries associated with the sector; and (3) direct, indirect and induced impacts through forward-linked industries associated with the sector. An input-output model is a useful method of estimating secondary impacts of any economic activity. In this study this approach was used by developing an input-output model of the Canadian and regional economies using 2008 as the base year.

This study was designed to estimate total economic impacts (direct and secondary impacts from backward and forward linkages) of farm level cattle production related economic activities. This was accomplished through the creation of a cattle sector. This sector was defined as those industries that have both farm level and forward linkages with cattle production. The sector consisted of three sub-farm level activities: Cow-calf production, Backgrounding operations, and Feeder or feedlot operations. The forward linkage industry was the slaughtering and meat processing. The analysis was undertaken for Canada as a whole and for its three regions – Western Canada, Eastern Canada, and province of Alberta.

The study model was a modification of Statistics Canada's provincial input-output transactions table. This model contained four sub-models one each for Canada and its three regions (as noted above). Economic impact results were measured through four economic criteria: Value of goods and services sold; gross domestic product generated; household (personal) incomes, and employment.

Results of these study scenarios in terms of gross domestic product (in market prices) and employment are shown in Table A below. Based on the results presented above, the following conclusions can be drawn:

Table A: Summary of Economic Impacts of Net Aggregate Cattle Sector on National / Regional Economy, by Regions

Region	GDP in Million \$		Employment in Person-Years	
	Direct	Total (Type II)	Direct	Total (Type II)
Canada	\$4,112	\$13,200	78,510	228,811
Western Canada	\$3,309	\$8,858	44,995	127,677
Eastern Canada	\$804	\$2,552	33,515	63,907
Alberta	1,816	5,875	26,158	62,612

1. The major conclusion of this study is that cattle production in Canada (and its various regions) is intimately tied to other economic activities, including slaughtering and meat production industries. Each of these live cattle production farms contributes to the economy not only through direct impacts on the national / regional economy, but they also generate additional impacts through secondary mechanisms – indirect and induced. For Canada as a whole, the cattle sector contributes \$13.2 billion to the national gross domestic product, and is directly or indirectly associated with creation of 228,811 full-time equivalent jobs.
2. There is a significant difference between the direct contributions of the sector and its total impacts. Overall, direct impacts constitute about a one-quarter to a half of the total economic impacts, while indirect impacts, contributed mainly by industry-support provided by other non-agricultural sectors, constitute the next largest.
3. Based on the results of this study, if relative contributions of a sector are estimated using direct impacts only, it will lead to serious underestimation. One of the inferences that can be drawn from the results of the study is that the cattle sector makes a much higher contribution to the economy than what is obvious from traditional measures related to direct contribution.
4. In terms of multipliers of cattle production, individual types of economic activities within the sector provide different level for various locations (region). For comparison purposes, output based multipliers (called pseudo multipliers) for various activities are shown in the Table B below.

Table B: Summary of Ratio-form Multipliers of Net Aggregate Cattle Sector on National / Regional Economy, by Regions

Region	GDP		Employment	
	Type I	Type II	Type I	Type II
Canada	1.343	1.912	1.798	2.914
Western Canada	1.731	2.677	1.755	2.838
Eastern Canada	1.976	3.174	1.419	1.907
Alberta	1.392	2.031	1.568	2.394

The study suffers through several limitations, the most significant being the available farm level cost of production and margins data. Lack of comparability between various regions and comprehensiveness of farm level regional data is a major limitation of the estimated value of multipliers. The second limitation of the study is that data used for processing activities was for Canada as a whole and not for individual regions. Furthermore, the data collected by Statistics Canada is for all meat production, which does not separate beef and veal production from other meat production. In addition, veal production is a product of both beef farms and dairy farms. A major data collection effort to sort these issues is needed to improve future economic impact analysis for this sector.

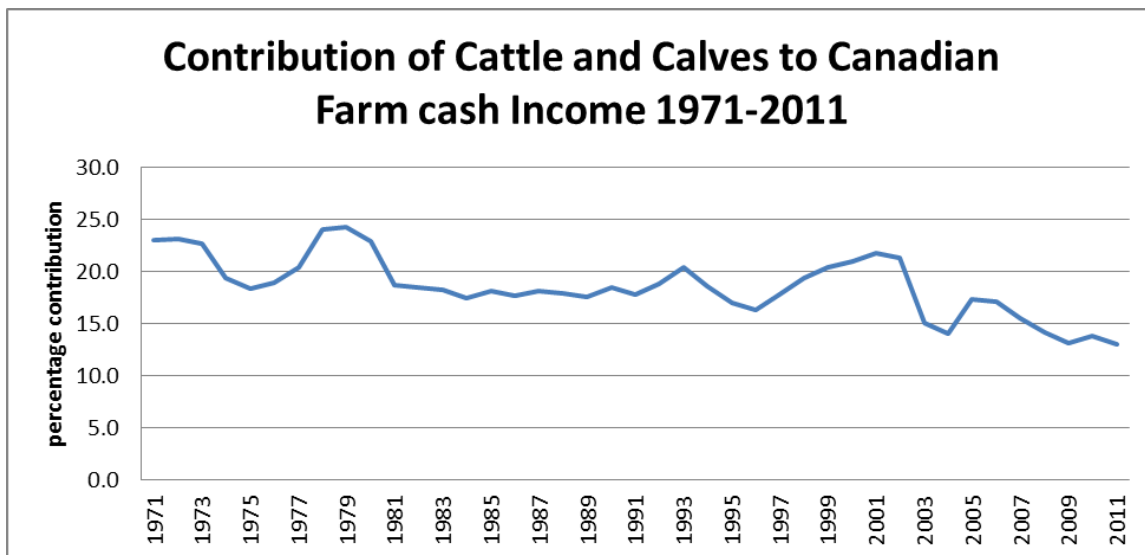
Chapter 1

INTRODUCTION

1.1 Background

Economic change is a complex process. It may consist of changes that may occur instantaneously / or perhaps in some cases in a sequential manner until the economic system reaches a new equilibrium. The degree of the complexity in this process is dependent upon the nature of the economy and the interdependencies that exist. Development of a new industry or expansion of an existing one could create a significant impact on the economic engine of a region or a nation.

The Canadian cattle sector is the highest component of the total farm cash income. During the past decade, it contributed an average of 15.4% of total Canadian farm cash income (Figure 1.1). The highest contribution was recorded for 1977 at 24% of the total farm cash income in Canada. As shown in Figure 1.1, over the last half century, its contribution has been decreasing slightly.



Source: Statistics Canada (2010)

Figure 1.1: Contribution of Cattle to Canadian Cash Farm Income, 1951-2010

The cattle sector in Canada is concentrated in a few select provinces. As shown in Table 1.1, in Eastern Canada, the cattle sector is more important in the provinces of Ontario and Quebec. In Western Canada, this activity is highly concentrated in the province of

Alberta for cattle and in Saskatchewan for calves. In fact, for Canada as a whole, Alberta produces slightly over half of the farm cash income from sales of cattle and calves.

Table 1.1: Share of Cattle Sector to Total Farm Cash Income by Provinces, Canada, 2011

Province	Level of Farm Cash Income from Cattle and Calves in Million \$	% of Total Canadian Cash Farm Income
Newfoundland and Labrador	3.0	0.05%
Prince Edward Island	21.6	0.33%
Nova Scotia	23.7	0.37%
New Brunswick	24.3	0.38%
Quebec	514.2	7.97%
Ontario	1,028.3	15.95%
Manitoba	421.4	6.53%
Saskatchewan	1,039.2	16.11%
Alberta	3,167.3	49.11%
British Columbia	206.0	3.19%
Canada	6,449.0	100.00%

Source: Statistics Canada (2012b).

In terms of Canada as a whole, Ontario and Alberta are the two provinces with a relatively higher share of the sector (as measured through farm cash income). These two provinces claim about 65% of the total Canadian cattle sector.

1.2 Need for the Study

Although it is conventional to measure importance of an industry (sector) by the contribution it makes directly to a given economic criteria (sales, income, gross domestic product, or employment). However, such comparisons rarely reveal the true importance of the sector in question.

Economic activities of an industry cannot be undertaken without the support of other industries in the region as well as those located outside the region, and the cattle sector is no exception. Frequently, the production of a sector spurs economic activities in other sectors within the region where it is located as well as outside the region and sometimes even in the rest of the world.

Canadian agricultural activities are undertaken in a relatively open-trading environment. Entrepreneurs make the best decision in terms of optimal place of purchase under this environment. The net result of these economic activities is that one sector affects another sector within a region, and economic activities in one province affect those in other provinces and even in other countries around the world (although more limited to the North American continent). Therefore, it is contended that if contributions of an industry are measured only in terms of direct impacts, this may not provide a realistic picture of total contributions of the industry to the province/region or nation. This is because many of the economic impacts are not that obvious intuitively; only those that are directly related to the industry are obvious. In addition to direct impacts, many other impacts are associated with the economic activities of an economic sector, such as agricultural production.

To illustrate the above point, let us take an example of producers using feed grains for livestock production. Let us further assume that these feed grains are supplied from an adjoining crop farm. Let us pursue the chain of reaction that would take place as a result of this single decision of the livestock producer.

Seeing higher expected demand for feed grains, the crop producer would likely add more area to these crops. In addition, the producer may decide to apply some fertilizer to a crop on his/her farm. The fertilizer is locally purchased, thereby putting additional money in the hands of the dealer. The dealer, in turn, must order this from the distributor, which would eventually be met by the manufacturer. During this process, money is generated through transportation of the product (going to various modes of transportation – railways or trucks), to government coffers through payment of taxes at various levels, and of course, in the hands of workers who work for the dealer and the distributor.

New demand at the manufacturer's level has to be met through new production. This may require some expansion in plant capacity through investment in machinery and equipment, or simply expansion of the production level with given capacity of the plant. In either situations, inputs required for production of fertilizer will increase, which would increase demand for mining products (such as natural gas). The mining sector, having received new orders, would gear up to higher production levels and would demand more inputs required for its own production. Workers in the manufacturing and mining concerns would have to be compensated, thereby generating new incomes in the region. This new income would find its way to new purchases of various consumer goods and services. Each of these actions would add further to the economic growth of the region, although some of the goods and services may be imported from other parts of Canada or the world.

The above type of new regional economic growth cannot be seen through perusal of direct contributions of the cattle sector. Mathematical models have been developed to measure such impacts of a sector. Economic models provide a relatively inexpensive means of generating impact of policy decisions, bringing or fostering new economic activities in a region, or of changing policies. From a policy maker's perspective, a model offers a means of projecting results of policy and of implementing a given policy.

In this regard, a number of questions need answering. These include, but not limited to, the following: What industries are affected by activities associated with cattle production in various regions of Canada? What would the regional economy look like if there were no cattle production units? In other words, major issues relate to information on the total contribution made by cattle production in Canada, which are at this time somewhat unknown. This study was undertaken to fill this void.

1.3 Objective of the Study

The major objective of this study is to estimate the total economic impact of the Canadian cattle sector on the national and regional economies. These contributions are made by taking into account its various linkages of the cattle sector with other economic activities in the region where this production takes place. In addition, both backward and forward linkages are assumed to exist. Estimated impacts include those through various types of changes that are created by various activities undertaken by the cattle producers.

1.4 Scope of the Study

In this study, estimation of economic impacts of the cattle sector are done both at the national and regional (including selected provincial) levels. These impacts were estimated for the following geographical jurisdictions: (1) Canada; (2) Eastern Canada; (3) Western Canada; and (4) Province of Alberta.

Analysis of economic impacts of the sector was done in a disaggregate manner: Different types of production processes included in the sector were analyzed separately. In addition, forward linkages of this sector (livestock slaughtering and meat processing) were estimated as well. Two types of economic impacts were estimated: gross impacts of a given type of production activity, and marginal impacts. The latter was estimated by avoiding all double-counting of inputs of one type of production process purchased from other production processes whose impacts have already been estimated.

Estimation of impacts in this study was limited to economic and employment impacts. No attempt was made to reflect social impacts resulting from them. Similarly all environmental impacts of the sector were also excluded. Furthermore, economic impacts that are realized in other parts of Canada or the world were also excluded (except the direct impact on these regions).

1.5 Organization of the Report

The rest of this report is divided into nine chapters. Chapter 2 provides an introduction to the cattle sector in various regions of Canada. Discussion on the nature of economic impacts through production activities, such as those from the cattle sector, is provided in Chapter 3, which is followed by a description of the study model in Chapter 4. The scenarios used for the impact analysis are presented in Chapter 5. The respective results of the analysis for the three levels of aggregations are presented in Chapters 6 to 9 for Canada, Western Canada, Eastern Canada, and Alberta. A summary of results and areas for further research are the topics for discussion in Chapter 10.

Chapter 2

CANADIAN CATTLE SECTOR: A BRIEF REVIEW

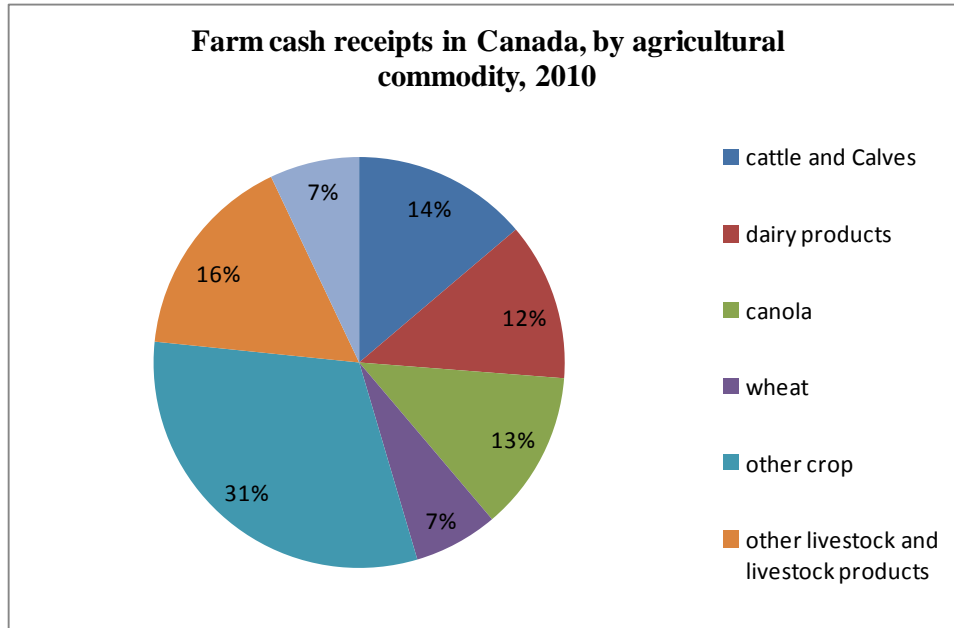
The cattle sector, in this study, is defined as a composite of all activities directly related to cattle production and processing. Thus, it is composed of two separate sub-sectors – Farm level beef cattle production sub-sector, and beef cattle slaughtering and meat processing sub-sector. These two sub-sectors are intimately related and depend on each other for their economic survival. This dependence is in terms of sale of raw materials produced by the farm sub-sector to the slaughtering sub-sector. In this chapter, various production activities that are related to the cattle sector are described.

2.1 Canadian Cattle Production Sector

Canada is among the top 20 beef producing countries in the world, coming 10th in 2010 (CME Group, 2010). Beef production is very significant to the national and provincial economies. The industry contributes to the economy through various stages of the supply chain (including backward and forward linkages) from the inputs at the farm level to the final product at the retail stores.

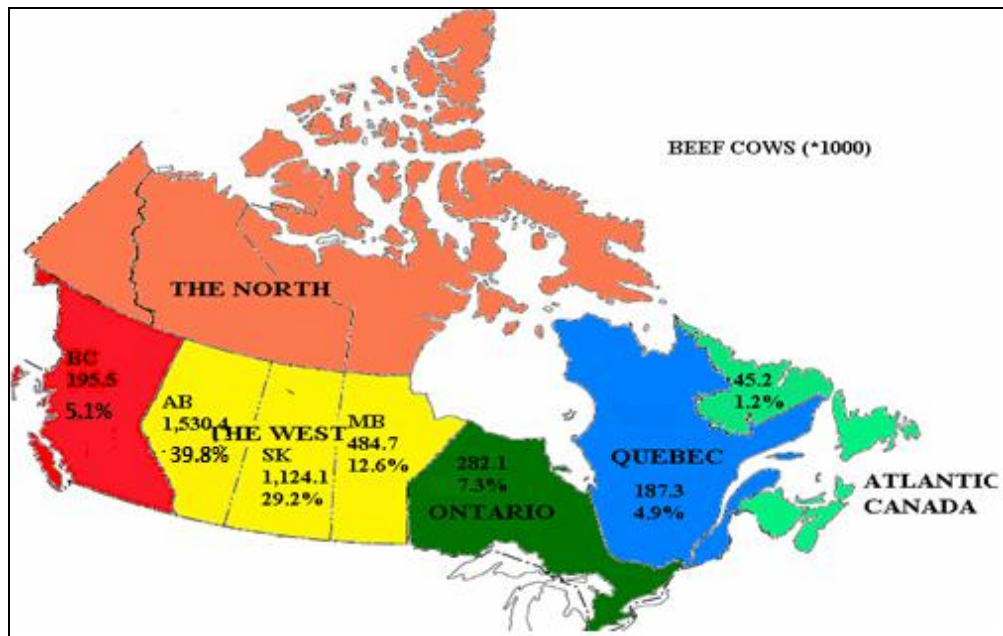
Canada's beef industry is the largest single source of farm cash income in Canada, contributing \$6.16 billion in 2010, up 5.4% from 2009 ,and contributed a total of \$24.6 billion to the Canadian economy in 2010 (Canadian Beef Inc., 2010). As shown in Figure 2.1, the cattle sector contributed the most farm cash receipts compared to other agricultural commodities. Similarly the red meat processing industry (consisting of beef, veal, pork, lamb and horse-meat) is the largest sector of the food manufacturing industry in Canada with annual revenues valued at over \$16.3 billion and total employment of over 46,000 people (CAFTA, 2007). As shown in Figure 2.2, based on number of beef cows on farms, this sector is highly concentrated in western Canada.

Total beef production in Canada was at 3.5 billion pounds, of which 50% was sold to the international market (Statistics Canada, 2012c). Canadians consumed 44.5 lbs. of beef per person in 2010, a 3.3 percent decrease from the year earlier. Over the past two decades, there has been a consistent decline in consumption of beef and veal in Canada from 38.8 kg per capita in late eighties to 20.2 kg by 2010 (Figure 2.3).



Source: Statistics Canada (2012)

Figure 2.1: Farm Cash Receipt in Canada, by Agricultural Commodities, 2010



Source: Statistics Canada (2011)

Figure 2.2: Provincial Distribution of Beef Cows in Canada, 2011

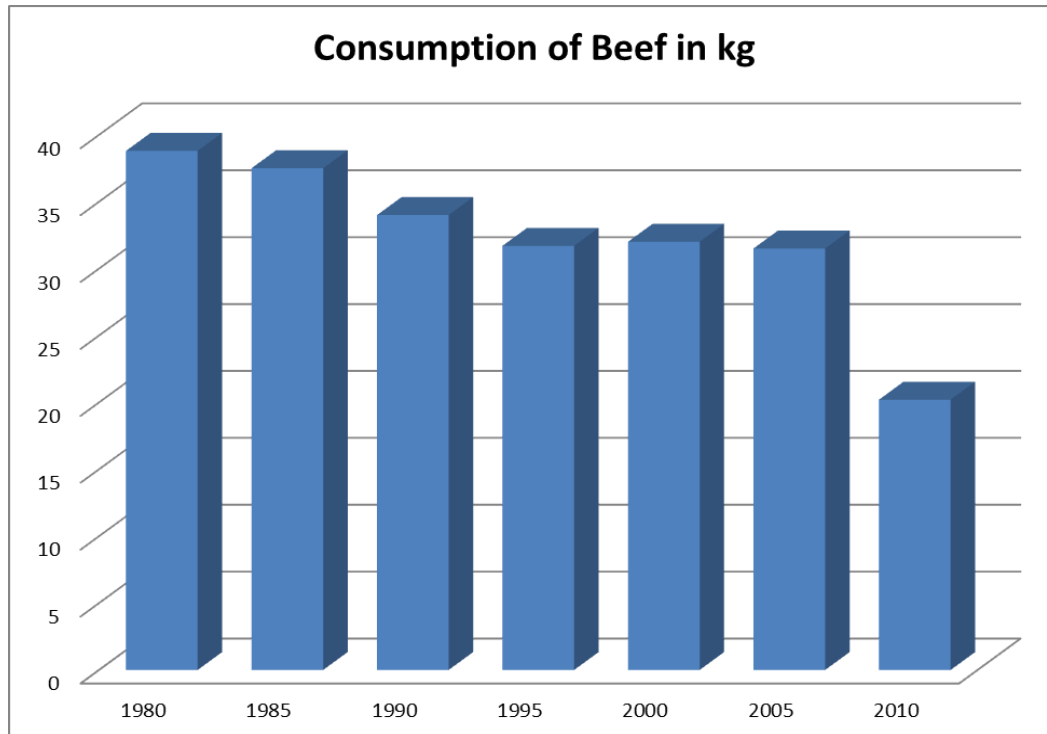


Figure 2.3: Trend in Consumption of Beef in Canada, Selected Years during 1980 and 2010

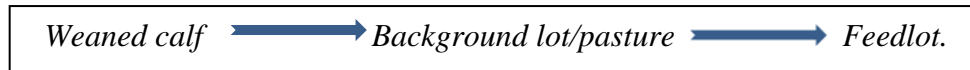
2.2 Farm Level Beef Cattle Production Sub-Sector

The farm level production sub-sector for cattle is a complex system with a significant amount of interregional and inter-firm dependencies. Another factor that adds complexity to the sub-sector is some overlapping in the numbers reported for the production of calves between beef and dairy herds.

There are three main stages of producing beef cows in Canada: cow/calf operation, backgrounding, and finishing. In the **cow calf phase**, cows are selected for their desirable traits, mated in the summer and birth occurs the following spring. Most of the cow calf process takes place outside in the pasture where calves are nursed to about a weight of 500 to 600 lbs., when they are then weaned into the **backgrounding** farm. In the backgrounding farm, calves are fed a slow growth diet to gain about 1.5 lb. or less a day. Keeping animals comfortable and protected is very important in this phase because backgrounding occurs mostly through the harsh Canadian winter. This process goes on to about a weight of 900 lb., where then animals are taken to the final stage of the process, **finishing**. Backgrounding can be used to delay cattle into entering the market, in case of low expected returns. In the **finishing farm** the animals are fed a carefully formulated diet for fast weight gain. Diet begins with forages and progressively moves to about 90% grains. Grains produce a tender and marbled beef.

2.2.1 Marketing Channels

The Canadian beef industry has two principal marketing channels (1) Feeder cattle markets and marketing, and (2) Finished (or fed) cattle markets and marketing (Grier, 2005). Feeder cattle follow the basic marketing pattern shown below:



Feeder cattle marketing are largely a domestic endeavor, with relatively fewer exports. Alberta and Ontario have a large concentration of feedlots, western feeder cattle are marketed to feedlots in Alberta. Based on Ontario's relatively large share of cattle on feed relative to its cow numbers, it can be concluded that some western feeders are also marketed in Ontario as well (Grier, 2005). Feeder cattle are marketed either direct or via auction. The sellers are typically the cow-calf or ranch operators while the buyers are the feedlots or their agents.

Finished cattle marketing involves the sale of slaughter cattle marketed to either federal inspected plants or exported to other countries, mainly the United States. International trade is an important component of the Canadian beef industry. Canadians consumes only about 50% of the total beef produced, and the other 50% is exported. The major consumption centers in Canada (Montreal and Toronto) are located closer to U.S. beef production centers than Alberta, which is Canada's major beef producing region. Conversely, Alberta is close to U.S. west coast and central beef consuming centers than the U.S. producing centers are. The introduction of Canadian and U.S. Trade Agreement (CUSTA) and the North American Free Trade Agreement (NAFTA) has resulted in an open and competitive North American beef market.

Because of the heavy exports (75.2% of all exports in 2010) to the United States, Canadian cattle prices are very closely related to the beef prices in the United States, subject to transport and local demand/supply situation. The exception to the functioning of these markets was in mid-2003, when the US closed its borders to Canadian beef and cattle after the breakout of bovine spongiform encephalopathy (BSE). This resulted in Canadian fed cattle prices declining 65 percent from \$108/cwt. in April 2003 to \$38/cwt. in July 2003 (Canfax Research Services, 2009). Two factors that affect the relationship between the price in Canada and that in the US are: (1) The purchasing power of the Canadian dollar against the American dollar (FCC, 2011); and (2) Emergence of the biofuel industry, which affect the cost of producing beef through higher feed grains prices (FCC, 2011).

2.2.2 Structure of Farm Level Beef Cattle Production Sub- Sector

Most of the Canadian beef farms are cow-calf operations. On Jan 1st 2011 there were a total of 67,300 cow-calf operations, 11,525 backgrounding operations, and 2,775 finishing operations. The number of beef farms has been decreasing, but the average farm size has been increasing over the years. In the 2006 census, there were 83,000 beef farms in Canada, but only 61,425 were reported having beef cattle in 2011 (See Table A.1 in Appendix A).

Although the beef production industry at the farm level has been shrinking, its average size of operation is increasing. According to Statistics Canada (2011), the average beef herd per farm in 2011 was 132, up from the 2006 census average of 61 head. The trend in the 2006 and 2011 census data shows that there is a decrease in the number of farms with less than \$500,000 in gross farm receipts. As shown by Table 2.1, farms making at least \$500,000 have seen a positive growth between the two census years.

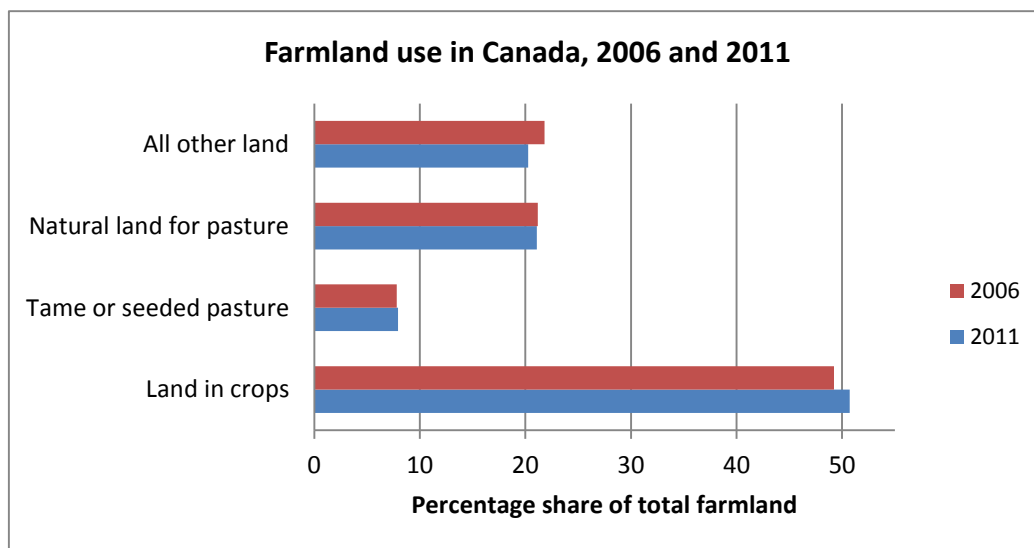
Table 2.1: Number of farms by gross farm receipts (at 2010 constant prices), Canada, 2006 and 2011

Gross Farm Receipts	Number of Farms		Percent change, 2006 to 2011
	2011	2006	
Less than \$10,000	43,954	45,749	-3.9
\$10,000-\$24,999	32,853	36,971	-11.1
\$25,000-\$49,999	25,764	30,227	-14.8
\$50,000-\$99,999	25,455	31,119	-18.2
\$100,000-\$249,999	31,670	40,382	-21.6
\$250,000-\$499,999	22,455	25,108	-10.6
\$500,000-\$999,999	13,977	12,499	11.8
\$1,000,000-\$1,999,999	6,304	4,614	36.6
\$2,000,000 and over	3,298	2,704	22
Total	205,730	229,373	-10.3

Source: Statistics Canada (2006 and 2011)

Cow-calf operations hold more than 90 percent of total Canadian beef inventories. The feed requirements of these operations are met either from their own farms or from purchases locally. In the western provinces, farmers grow barley and wheat, while Eastern Canada grows significant amounts of corn, for these purposes. As a result, Canada can supply beef produced from cattle fed diets of barley and wheat, as well as producing corn-fed beef (Canada Beef Inc., 2012).

Because of the dominance of cow-calf operations, the need for open pastureland is very critical in Canadian beef production. According to the 2011 agriculture census, of the total of 172.23 million acres of farmland, 21.1% was in natural pasture, and 7.9% seeded to tame hay (Figure 2.4).



Source: Statistics Canada (2006, 2011)

Figure 2.4: Land Use in Canada, by Type of Use, 2006 and 2011

2.3 Regional Structure of Farm Level Beef Cattle Production

Beef production is differently spread across Canadian regions, with more concentration in western provinces than in the eastern provinces. The two most beef cow populated provinces are Alberta and Saskatchewan, which carry more than 50% of total Canadian beef cows (as previously shown in Figure 2.2). In Eastern Canada, cattle numbers include dairy cattle (although separated) but such is not the case with processing of these cattle. Although there is some dairy production in Western Canada, the scale of such production is lower than that in Eastern Canada.

2.3.1 Western Canada

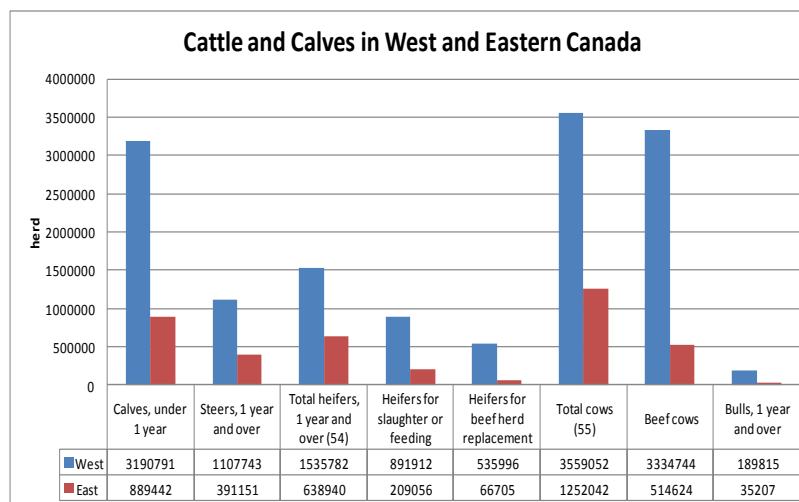
Beef cattle production in Canada is mostly concentrated in Western Canada, and within that in the province of Alberta. About 86.6% of all beef cows in Canada are in this region. Similarly for other categories of beef animal, proportion is almost three-quarters of the total (Table 2.2). The availability of pastureland and meat processing plants makes it easier to raise and process cattle in the region. The cost of producing beef is relatively cheaper than Eastern Canada, although comparable data are hard to find. Keeping the costs of production low is very important to Canadian beef producers since they are price takers for their final product. The costs of producing beef cattle are different, depending on the farmer's operation. Feeds are an integral part of the costs, including other costs

like transportation, labor, veterinary and medicine costs, utilities, marketing, among others. Total farm cash receipts² amounted to \$4.83 billion in 2011 (Statistics Canada, 2012b). This constitutes approximately 75% of the total Canadian farm cash income in 2011.

Table 2.2: Share of Western Canada of Total Canadian Livestock Numbers, 2011

Type of Livestock	% of Total Canadian Number
Calves under one year	78.2
Steers	73.9
Heifer for Slaughter or Feeding	81.0
Total Beef Cows	86.6

Beef cattle herd is higher in Western Canada relative to the eastern provinces, as shown in Figure 2.5. The costs of production differ across regions, making it favorable for some regions to be more competitively advantaged than the others in particular production systems. This difference has enhanced interprovincial trade in beef cattle.



Source: Statistics Canada (2011)

Figure 2.5: Cattle in Cattle Operations, Western and Eastern Canada, 2011

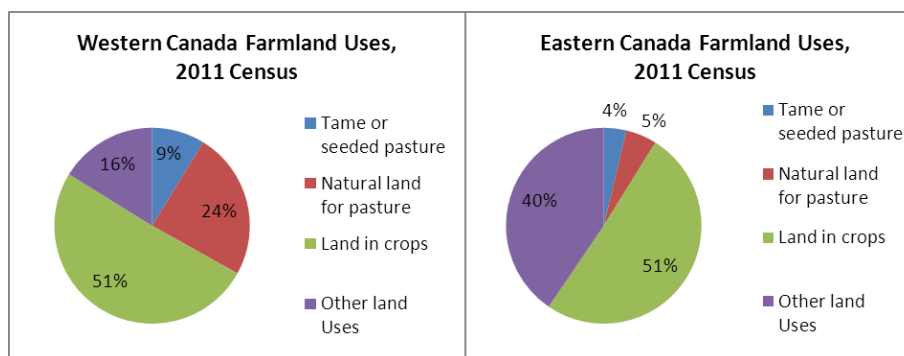
² One should note a possible bias in these estimates. Statistics Canada reports income from the sale of cattle, but does not distinguish them whether they originate from beef operations or dairy operations. Further investigation of this issue would improve future economic impact analysis. In this study, an approximation was made using beef vs. dairy cow numbers. In western Canada, the beef cows were 93.7% of total number of cows, as against 41.1% for eastern Canada. These numbers were used to estimate income from the sale of calves from beef herds.

The average number of cattle per farm in Western Canada stood at 161 head on January 2012. The herd size in this region is estimated to be 8.8 million head (as shown in Table 2.3). The cow-calf operations rely on the abundance of native pasture, and tame hay in the region. The total land that is pasture is 47.4 million acres across the western region, compared to only 2.5 million acres in Eastern Canada. In terms of land use, in Western Canada 31% of total farm land is pasture (native and cultivated), against only 9% in Eastern Canada (Figure 2.6). These differences in pastureland might be one of the factors that may explain higher beef cattle numbers in the western region than the east.

Table 2.3: Number of Beef Cattle by Type of Operations, Western Canada, 2006-2012

Year	Number of Beef Cattle in Thousand Head on			
	Total	Cow-Calf Operations	Feeder and Stocker Operation	Feeding Operations
On January 1				
2006	10,550	7,868	1,526	1,156
2007	10,165	7,519	1,522	1,124
2008	9,929	7,329	1,580	1,020
2009	9,427	7,032	1,218	1,177
2010	9,120	6,744	1,269	1,107
2011	8,746	6,328	1,314	1,104
2012	8,835	6,349	1,317	1,169
On July 1				
2006	11,814	8,235	2,418	1,162
2007	11,722	7,879	2,584	1,260
2008	11,118	7,498	2,532	1,087
2009	10,591	6,973	2,310	1,308
2010	10,124	6,847	2,145	1,132
2011	10,069	6,703	2,049	1,317

Source: Statistics Canada (2012d)



Total Area: West = 143.38 million acres; East = 28.87 million acres)

Data source: Statistics Canada (2011)

Figure 2.6: Farmland Use in Western and Eastern Canada, 2011

2.3.2 Eastern Canada

Eastern Canada is made up of the Atlantic Provinces (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick), Quebec, and Ontario. Most of the cattle production in Eastern Canada is in dairy operations, with only 18 percent of the 3,214,000 cattle in beef production. As of January 2012, Ontario accounts for 54 percent of the total beef numbers, Quebec for 37 percent, and the Atlantic province for only 9 percent. Cash receipts to the region from cattle are \$1.62 billion dollars, and that is only 7 percent of the total farm cash receipts. Ontario being the largest producer of beef in the region has seen a decrease of beef processing over the years, with the most recent closure of the June 2nd, 2012 Quebec's lone cull cattle slaughterhouse and the largest packing plant in Eastern Canada ([Grainnews](#), 2012). Eastern Canada boast the largest number of processing plants, but total slaughter of beef is lower than Western Canada.

In Eastern Canada, the number of farms reporting cattle has decreased tremendously over the years, as of January 2012 there are 37,245, down from a total of 46,935 the same period in 2004 (Table 2.4).

Table 2.4: Number of Beef Cattle by Type of Operations in Eastern Canada, 2005-2011, January and July

Year	Total	Cow-calf Operations	Feeder and Stocker Operation	Feeding Operations
Beef cattle numbers in Thousand Head on January 1				
2005	2,048	1,239	384	425
2006	2,011	1,202	396	413
2007	1,945	1,155	344	446
2008	1,923	1,187	319	418
2009	1,800	1,124	334	342
2010	1,820	1,099	354	368
2011	1,750	1,065	324	360
Beef cattle numbers in Thousand Head on July 1				
2005	2,230	1,245	545	441
2006	2,125	1,196	449	480
2007	2,083	1,179	447	458
2008	2,008	1,154	435	419
2009	1,997	1,126	429	442
2010	1,899	1,102	388	409

Source: Statistics Canada (2012d)

2.4 Beef Cattle Slaughtering and Meat Processing Sub-Sector

2.4.1 Canada

Most of the farm level production is destined for two major channels: (1) Exported out of the province (or outside Canada), without any further value-added within the Canadian economy, and (2) Agricultural products used as raw materials to be used for further processing by food processing operations within Canada. The latter leads to further value-added and generates additional employment and gross domestic product (GDP) at the regional or provincial levels.

Canadian meat processors produce a variety of meat products including fresh, frozen, processed, smoked and canned meat. In 2010 a total of 3.75 million cattle were slaughtered in Canadian slaughtering plants. The industry faced major challenges from 2003 to 2005 when the outbreak of BSE restricted the number of live cattle exports. Local slaughtering plants had to deal with a larger number of cattle in the market. The dark black arrow in Figure 2.7 shows the extreme point when Canadian slaughter plants had to deal with all the cattle in the market because there were no cattle exported in 2004. There were over 400 establishments in the red meat processing industry in 2008 (CAFTA, 2008). This number has been declining since then. In 2010, Maple Leaf Foods announced a major reorganization to reduce costs and improve profit, resulting in 23 planned plant closures over the next five years (FCC, 2011).

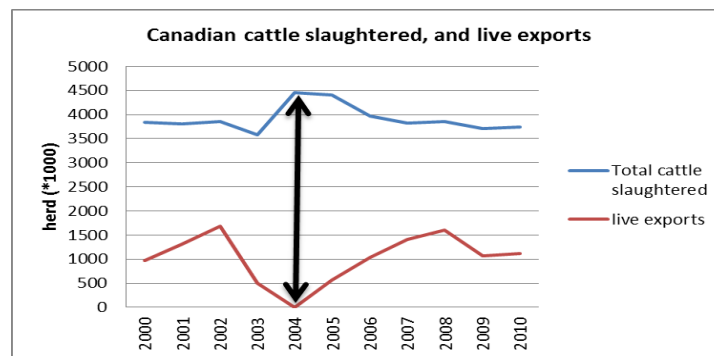


Figure 2.7: Total Head of Cattle Slaughtered, and Live Exports, Canada, 2000-2010

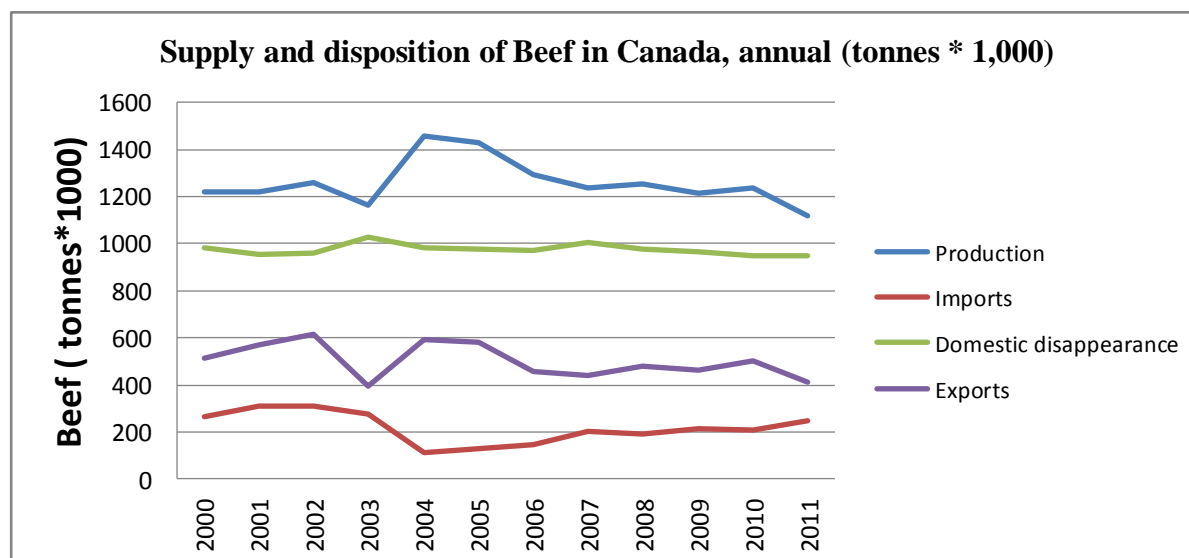
The introduction of the U.S's Country of Origin Labeling and the appreciation of the Canadian dollar do not help Canadian live cattle exports, Canadian slaughtering capacity might have to be reconsidered. Before the BSE outbreak Canada averaged 3.8 million head per year slaughtered per year. As shown in Table 2.5, these levels are declining since 2007.

Table 2.5: Cattle, farm and meat production, Canada, 2007-2011

Particulars	Livestock	2007	2008	2009	2010	2011
Total slaughtering, farm and meat production (x 1,000) ²	Cattle	3,490.20	3,527.10	3,406.20	3,451.30	3,098.20
	Calves	330.2	322.1	299	294.3	292.7
Estimated output of farm production (x 1,000)	Cattle	4,783.20	4,967.60	4,390.40	4,441.60	3,695.40
	Calves	395.2	430.2	327.2	312.7	317.1
Live imports for slaughter of farm production (x 1,000)	Cattle	30.6	28.3	30.4	36	73.4
	Calves	22.8	21	23.8	19.8	0
Live exports of farm production (x 1,000)	Cattle	1,323.60	1,468.80	1,014.60	1,026.30	670.6
	Calves	87.8	129.1	52	38.2	24.4
Average cold dressed weight of meat production (kilograms)	Cattle	355	355	357.3	358.6	360.8
	Calves	116.9	115.9	117.4	119.3	124.2
Meat production (tonnes)	Beef	1,855,274	1,802,847	1,812,588	1,758,811	1,792,316

Source: Statistics Canada (2012c)

About 68% of the total supply is consumed within the country. The rest of the beef and veal is exported to other countries, as shown in Figure 2.8.

**Figure 2.8: Total Supply and Disposition of Beef in Canada, 2000 - 2011**

The Canadian Federal and Provincial food inspection agencies (such as the Canadian Food Inspection Agency) work to protect Canadian beef consumers by contributing to food safety and the health of animals. The food safety program follows the Hazard analysis and critical control points (HACCP) principles. Before exporting beef to the U.S,

CFIA must certify that each load meets the USDA requirements before it is transported to the border. A large volume of beef is sold to the international markets annually, mostly to the United States and Mexico being the second highest destination of Canadian beef.

2.4.2 Regional Structure of Slaughtering and Meat Processing and Related Activities

The processing of beef cattle happens in provincial and federal inspected plants, with most of the slaughtering done in federal inspected plants. The industry is dominated by companies with large slaughtering capacity. The number of slaughtering plants has been decreasing over the years, with the exception of Ontario that shows a steady growth (Table 2.6).

Table 2.6: Number of Federally Inspected Livestock Slaughtering Plants in Canada, by Provinces*, 2003-2011

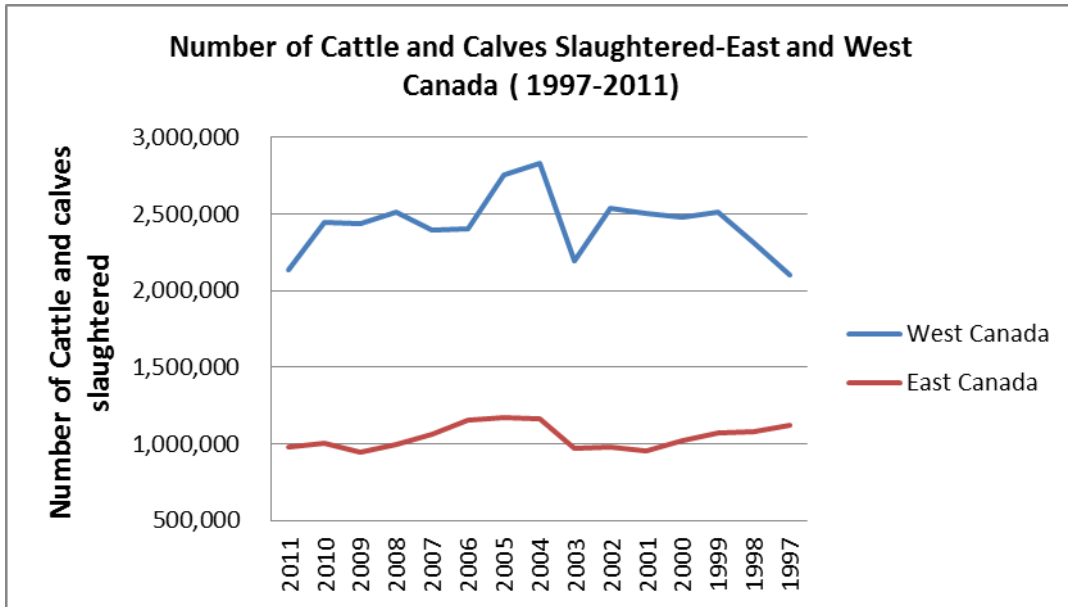
Location	2003	2004	2005	2006	2007	2008	2009	2010	2011
British Columbia / Alberta	9	10	10	11	11	9	8	8	6
Saskatchewan / Manitoba	2	2	2	3	3	2	2	1	0
Ontario	5	7	7	8	7	7	7	8	9
Quebec	8	9	8	8	7	5	5	8	6
Western Canada	11	12	12	14	14	11	10	9	6
Eastern Canada	13	16	15	16	14	12	12	16	15
Canada	26	29	28	31	29	24	23	26	22

* These plants use all live animals including poultry birds. Exact number of those for beef and veal production is not known / reported.

Source: Agriculture and Agri-Food Canada (2012).

Despite the decrease in the number of slaughtering plants, there are a stable number of cattle slaughtered yearly (Figure 2.9), except in 2003 through 2005 when plants had to raise slaughtering capacity to deal with all Canadian cattle in the market after the U.S boarder closed to Canadian cattle due to the outbreak of BSE.

The west region is dominated by Alberta that slaughters at least 80 % of all cattle, while the east is dominated by Ontario that slaughters at least 60% of all cattle annually. Size of these plants can be measured in terms of number of employees. However, since these plants process various types of animals, it is difficult to know what size plants are for beef cattle only. In spite of this difficulty, a regional distribution of slaughtering and meat processing activity is shown in Figure 2.10.



Source: Agriculture and Agri-Food Canada (2012)

Figure 2.9: Number of Cattle Slaughtered in Eastern and Western Canada, 1997-2011

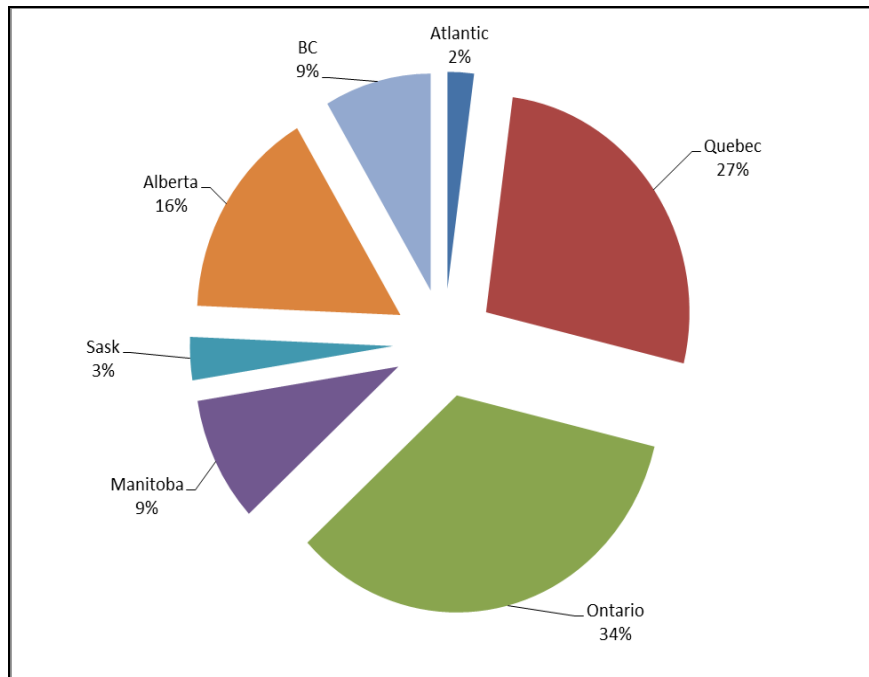


Figure 2.10: Distribution of Employment in Animal Slaughtering and Meat Processing Plants Canada by Region, 2010

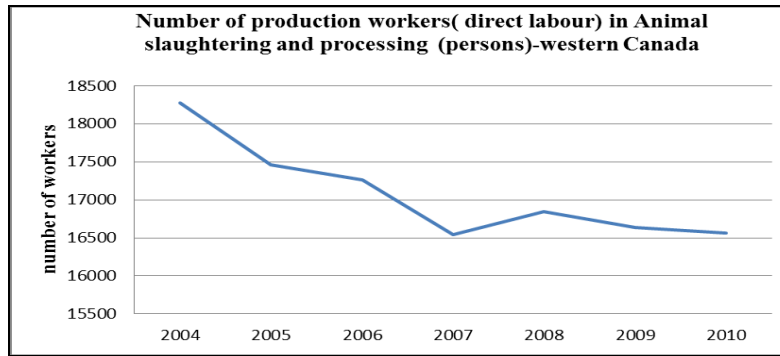


Figure 2.11: Number of Workers in Slaughtering and Processing Plants in Western Canada, 2004-2010

In spite of having a large beef herd, processing of live animals and meats is located more in Eastern Canada, where, based on number of employees, 63% of the capacity is present. In Western Canada, much of this processing is located in Alberta. As a matter of fact, some provinces in the west, such as Saskatchewan, have no processing facilities. This province has the second highest number of beef operations in the country, but since it has no slaughtering plants, most of the calves are sold to Alberta for finishing before being slaughtered or exported to international markets. In addition, in Western Canada, not only has the number of slaughtering plants been decreasing over the years, from a high of 14 in 2006 to a low of 6 in 2011, but also employment in these plants has shown a decreasing trend (Figure 2.11). Despite the decrease in the number of plants, cattle slaughtered remained high with the rise in slaughter capacity of the existing plants.

Chapter 3

NATURE OF ECONOMIC LINKAGES BETWEEN THE CATTLE SECTOR AND REGIONAL / NATIONAL ECONOMY

Economic impacts of a new project or set of activities are dependent on the complexity of the economic system where such activities occur. In a system where there is no production, and all goods and services are obtained from outside the region, the level of impact of any change would be zero. However, in a more mature economic system, an exogenous change would trigger an interrelated set of changes throughout the economy that require some formal method of modeling to determine the magnitude of these changes. One of the methods used is an input-output model based analysis, which results in estimated total impact in the economy resulting from activities of a given sector. The description of the model is deferred to the next chapter, but the concept of economic impacts is discussed in this chapter.

3.1 Concept of Economic Impacts

Economic interdependencies among various economic good producing industries exist in all regions, and Canada is no exception to it. An exogenous change in a region can result in a variety of changes, each one of which, if economic in nature, can be monetized to become economic impacts.

A simple model of an economy is shown in Figure 3.1. Six types of economic changes are noted here: (1) *Input Change Effects*, which result from the combination of various inputs used in the production process of a given sector; (2) *Labor Income Expenditures Effects*, which result from the re-spending of wages, salaries, and profits from unincorporated business on consumer goods and services; (3) *Capital Expenditures Effects*, which are a result of new investments in durable and semi-durable goods required to undertake new production of goods and services; (4) *Output Effects*, which result from a change in the demand for various goods and services either within a region or from outside the region; (5) *Downstream Effects*, which result from the marketing, transportation and primary processing³ and secondary processing activities triggered by production of various firms in the region; and (6) *Forward Linkages Effects*, which result when a part of the output of a sector is purchased by other sector(s) and additional value-

³ For further discussion of impact components, see Powell (1991).

added activities are generated. An exogenous change can either effect production of a sector or its final demand (such as exports). Combined together, these effects would lead to economic impacts on the region.

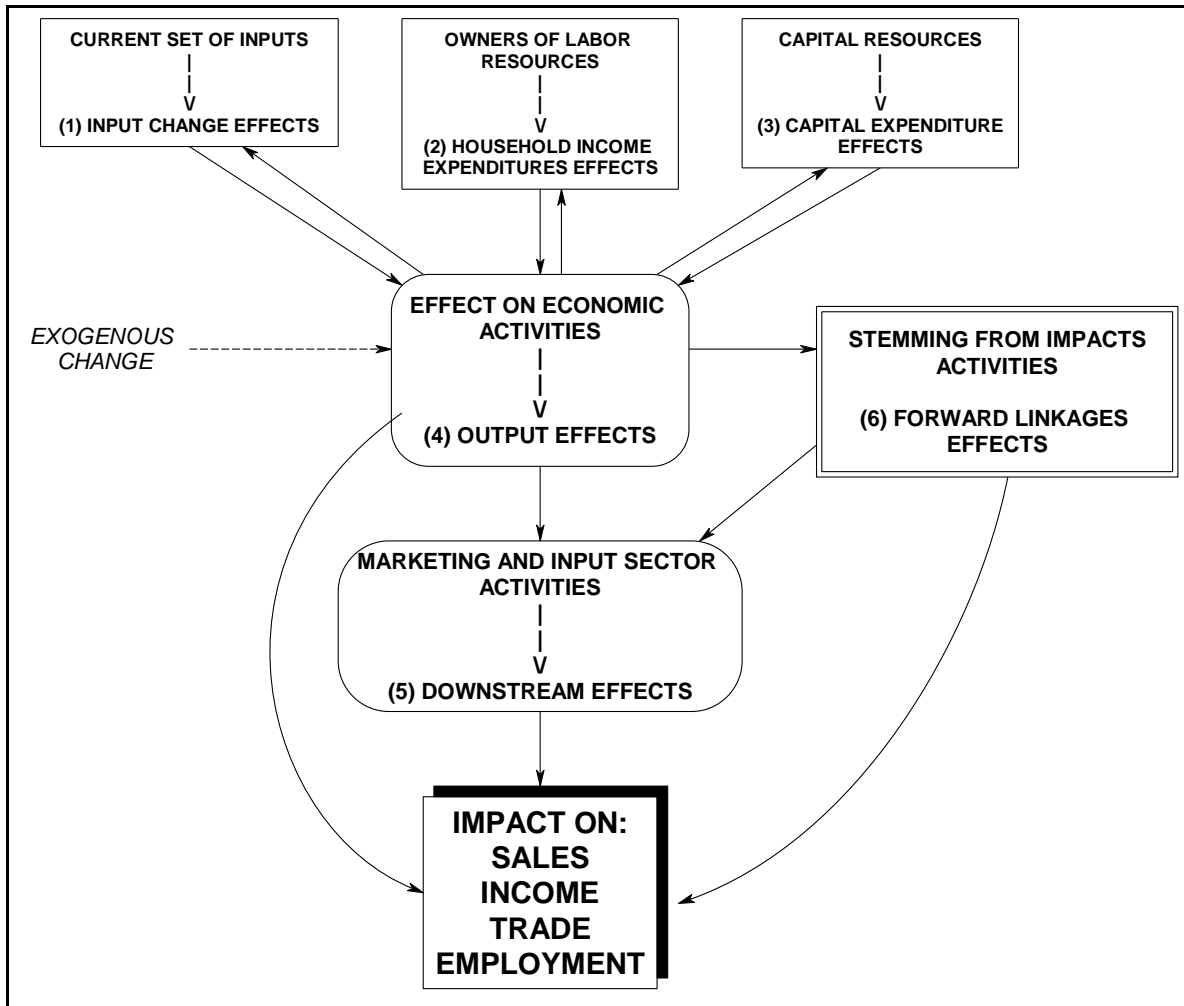


Figure 3.1: A Simple Model of an Economy Showing Various Types of Economic Effects

The nature of interdependencies that currently exist between a regional economy and the cattle sector could be illustrated by the recent experience with the outbreak of BSE in Canada. This incidence caused the U.S. to close the border to Canadian cattle over a certain age. This substantially reduced the demand for Canadian cattle, since the U.S. has been a major destination for Canadian feeder and slaughter animals. The lack of buyers affected many stockyards, trucking companies, and brokers. Reduced demand brought about more market pressures on price (particularly for the slaughter animals), which started falling soon after the announcement of the border closure. A lack of sales of these animals meant that they were kept on farms longer than they would have been without BSE. This led to higher feed demand. Lack of markets, lower price, and higher feeding

costs resulted in lower net income for cattle producers. This decreased family expenditures of these producers resulted in lower demand for consumer goods. This also results in lesser transportation, wholesaling, and retailing activities. Government coffers were also affected since the tax revenue generated is also reduced. On account of the reduced export demand and lower live cattle prices, packing plants were able to process these animals at a higher margin. Any excess capacity was used up subject to the level of market demand. Overall, various economic sectors in Canada were affected either directly or indirectly. This briefly illustrates the intricate relationships that exist in a mature and complex economic system.

3.1.1 Mechanism of Impact Generation

All the interdependencies shown in Figure 3.1 lead to economic impacts in a region. Generally speaking, these impacts are generated by producers through their production decisions, or by the consumers, investors, and governments through changes in their expenditure patterns. Any action taken by producers or consumers (or other agencies such as governments) in this reference, when measured in monetary units, is called the 'direct impacts'. These direct impacts become the starting point for a series of other impacts within the economy, called 'secondary economic impacts'. They are created through two types of changes in the economy, resulting in two different types of economic impacts, as described below.

1. *Indirect impacts:* These impacts are generated through the purchases of various goods and services (non-human resources) produced by other industries. The purchase of these goods creates additional demand for the goods produced by other industries. In order to produce them, these industries are assumed to increase production and purchase additional goods and services within the region. The cattle sector purchases inputs from other industries. Examples of these would include feed grains, processed feeds, forages, fuel, machinery and equipment, and other services. In economic impact literature, these interdependencies are called 'backward linkages' of a sector.
2. *Induced impacts:* These impacts are generated by the actions of owners of human resources (such as workers and owners of unincorporated non-farm businesses) who receive compensation for their services. The wages and salaries and return to management earned by these agents are subsequently spent within the region, triggering another round of increase in the demand for various goods. As with the indirect impacts, industries facing an increase in the demand for their goods increase their respective production levels, thereby resulting in another round of economic impacts.

In addition, to direct impacts and its impact on other sectors, a second line of impact generation comes through 'stemming from' effects. The cattle sector sells its goods to animal slaughtering and meat processing industries for further processing. These relationships are called 'forward linkages' of a sector in the economic impact assessment literature. The assumption is that if cattle production did not exist, the activities undertaken by these firms would not be economical, and may cease to exist. Although in some instances it can be argued that these forward-linked firms may decide to import the needed input requirements, this, however, would be more of a short run measure. In the long run, the firms may decide to relocate the plant in a region or a country more conducive to yield economic returns.

3.1.2 Impact Identification for the Cattle Sector

Total impacts of a sector's activities are generated through a combination of direct cattle production and its forward linkages. Each of these produces further impacts on the economy through indirect impacts and induced impacts. By applying the conceptual impact typology presented in Section 3.1.1, total economic impacts of agriculture can be represented as a sum of the following six impacts:

1. Direct impacts of cattle farm level production;
2. Indirect impacts from farm level beef cattle production (through backward-linked industries);
3. Induced impacts from farm level beef cattle production (through payments to workers and producers, and their re-spending within the economy);
4. Direct impacts of forward-linked industries with farm level beef cattle production;
5. Indirect impacts from forward-linked industries with farm level beef cattle production; and
6. Induced impacts from forward-linked industries with farm level beef cattle production.

Provided that due consideration is made for any double-counting, a sum of the above six types of impacts would constitute the total economic impact of cattle production sector.

3.2 Source of Economic Impacts in a Regional Setting

If the region is an isolated one, and all economic activities are fuelled by local production, the above sum of economic impacts would apply to any decision leading to direct impacts. However, in Canada, like many other economies, regions trade with each other, as well as with countries outside Canada. Thus, cattle producers (as well as consumers) decisions have an economic impact not only on the economy of the region (where they are located), but also on other provinces in Canada that trade with the region, and other parts of the world where these operations import goods and services. These impacts are called the 'Trade-related' impacts associated with a direct and / or forward linked sector.

3.3 Accounting for Total Economic Impacts of the Cattle Sector

The direct effects of any economic activity can be seen relatively easily. For the cattle sector some of the contributions were shown in Chapter 2. However, direct contributions are not the same as total economic contribution of a sector. In order to estimate the total contribution, one needs a tool for estimating the spin-off effects of the sector.

There are a number of methods that can be used for such an assessment. These methods include the following: the Export-Base Model, the Income-Expenditures Model, and the Input-Output Model. The first model is appropriate if one lives in a region with a single industry that is totally export oriented. Economic impact assessment for this economy will be rather simple, and for these situations, an Export-Base model is adequate. This model relates the total growth in the region to the export sales. The higher the export levels, the higher the values of economic performance indicators for the region are. If the only driving force in the region is the export market, on which the region has no control; it is decided by forces outside the region. However, this type of model would only be appropriate for a single industry region. An example of this type of a region would be a mining town, where the ore is sent elsewhere for processing or processed alongside, or a town totally dependent on tourism. Unfortunately or fortunately in the twenty-first century, not too many regions in Canada resemble this type of a simple region.

The assumption of a single export sector is removed from the Income-Expenditures Model. The focus of the analysis here is on the income (regardless of how many sectors generate it) and the manner in which it is spent. The impact of the direct income on the total income generated in the region can then be calculated. The region is assumed to

contain a single homogenous set of consumers. Trade patterns are allowed but added together for the estimation of the total income generation.

The above two models do not offer a good basis for policy analysis since they are both very aggregate and their assumptions are somewhat restrictive. Most economic activities in a region are undertaken by a number of industries. These industries trade with each other. Each industry can produce a number of products. For this type of an economy, the best way to undertake an economic impact assessment is through the use of an input-output model.

An input-output model is a useful method of estimating secondary impacts of economic development projects. Secondary impacts in this context refer to any other changes beyond those experienced by the firms that are affected by a given initial change (called direct impacts above). An input-output based economic impact analysis is preferred for the following reasons:

1. Every industry's impact is treated to be unique, allowing its specific economic impacts to be estimated.
2. Different types of economic stimulus can be applied to undertake economic impact analysis. Thus, economic impacts of consumer spending, exports, or purchases by other firms, for example, could be estimated uniquely.
3. Development of the model can also be region specific, thereby allowing regional differences in the production processes, technology, and trade patterns.

The input-output model was used in this study. More details on this model are presented in the next chapter.

Chapter 4

METHOD OF ECONOMIC IMPACTS ESTIMATION USING INPUT-OUTPUT MODEL

This chapter is devoted to a description of economic impact analysis tools and methodology. The chapter is divided into six sections. Section 5.1 described a brief history of input-output analysis, followed by its basic framework in Section 4.2. Section 4.3 is a description of the study input-output model and steps taken to make it operational. Final model is described in Section 4.4, followed by a discussion on the term 'multiplier'. Distinction between gross impact and net impact of a given economic activity is drawn in Section 4.6.

4.1 History and Concept of Input-Output Analysis

Input-output analysis is a name given to a framework developed by Leontieff (1936) based on the inter-industry flow of goods and services within an economy. An alternative name for this analysis is also *inter-industry analysis*, since all relationships among various economic agents are captured in this framework.

Roots of input-output analysis can be traced back to Quesney; he published the famous *Tableau Economique* in 1758. Quesney stressed the notion of interdependence of economic activities and depicted the successive rounds of wealth being created through additional output generated by the economy – a concept later called the multiplier effect. It was not until later that Walras (1874) took these ideas and extended the partial equilibrium theory to a general equilibrium framework. Using Walras's general equilibrium framework, Leontieff prepared input-output tables for the U.S. economy for the years 1919 and 1929. Many other developments were added to the initial framework by Leontieff and by other authors.

The availability of high-speed computers made the input-output analysis a very useful, and more popular, method. Today, input-output analysis is routinely applied for national economic analysis including forecasting of regional and national economic performance, and by various provinces within Canada (although its use is highly variable from province to province). A national input-output model for Canada is published annually by Statistics Canada (2012a)⁴.

⁴ In addition, Statistics Canada maintains an inter-provincial input-output model that is available for use on a user fee basis.

An input-output model can be constructed for any level of aggregation. It could be constructed for the world as a whole, for a specific nation, for a province/region within a nation, for a number of regions together trading with each other, as well as for a specific firm. An input-output model has been used in many other areas besides economic impact analysis. Impact of new industries on a region has been investigated by Czamanski (1972) using Nova Scotia as the case study. Klassen (1967) has used it for selecting industries for depressed areas. Government of Canada has combined the input-output model along with an economic model for testing policies for simulating regional economic performance both in the short-run and long-run. In recent years, input-output analysis has been extended to deal with environmental issues such as greenhouse gas emissions, energy consumption, resource use, environmental pollution, and employment and migration issues. More recent applications have included the development of physical flows, price input-output models, and physical and economic life cycle analysis models.

4.2 Basic Input-Output Framework

The basic input-output model is based on actual observations on sales and purchases by many economic agents in a given regional economy. These actions are termed 'economic transactions' in the input-output context. The heart of the model is a *Transactions Table*, which denotes the interdependence (in terms of sales and purchases of goods and services) among three types of economic agents: producers of various goods and services (called economic sectors); owners of resources (land, labor and capital, and management); and final users agencies (to include consumers, governments, businesses, and trade agencies). The fundamental information contained in the model is the flow of goods from producers of these goods to the users of these goods. Producers of goods and services are basically firms. All firms that produce similar products are grouped under a single 'sector'. The goods and services are called 'commodities'. The final users are called 'final demand agencies', and their use of commodities is called 'final demand'.

Final demand refers to those commodities that do not enter into the region again. Examples of these would include consumer demand, export sales, and government expenditures. These transactions are different from other sales (from one sector to the other) since they enter into the production process for producing final demand goods and services. Typically, the rows in the transactions tables refer to the producing sectors and the columns to users of various commodities.

Various goods and services that are used in the production process of economic sectors are divided into two types: Intermediate inputs/commodities, and Primary

inputs/commodities. Intermediate inputs refer to those commodities that re-enter the production process for further value-added activities. These goods are traded between one economic sector and another. Primary inputs are those that refer to the owner of land, labor, capital, and management resources. These inputs receive compensation/payment, which can be aggregated to reflect the Gross Domestic Product (Income based) for a region.

Two types of accounting systems have been used in developing input-output models. These are square accounting systems, where every sector produces one and only one commodity, and the rectangular accounting system, where a sector can produce one or more of the commodities. Canadian input-output models are based on the rectangular accounting system.

In a rectangular accounting system, a transactions table is divided into three matrices: Use matrix, Make matrix, and Final Demand matrix. The Use Matrix displays the purchases of various economic sectors of intermediate and primary inputs. The Make Matrix is a display of various intermediate inputs produced by various economic sectors. The Final Demand matrix is the account of transactions among various economic sectors and final demand agencies.

The system of equations that are developed for impact analysis is linear in nature. Furthermore, non-linearities are not allowed in the system. In fact, the technology of production and consumption, as expressed in terms of the relationships, is assumed to be fixed in proportion. Similarly, in a rectangular system, the market share of each sector in producing a commodity cannot be altered and thus remains fixed.

The input-output analysis is a demand driven process. If the commodity is demanded, either by other sectors or by final demand agencies, its production will increase accordingly. It should be noted that capacity constraints are not considered to be a limiting factor in the model. It is, in fact, assumed that all sectors have excess capacity and would be able to adjust to the new increased level of production. However, in some situations this may be an unrealistic assumption. Under those situations, additional investigation of results is done to ensure that the economy is capable of producing the new level of commodities demanded.

4.3 Study Input-Output Model

The study input-output model was based on the rectangular input-output model accounting system. It is called by the acronym CRECSIO (Canadian REgional Cattle

Sector Input-Output) model for the year 2008. In this section, an overview of this model and steps undertaken to develop the model are described. The major features of this model include the following:

1. Model contains disaggregated account of the Canadian and regional economies.
2. Non-survey techniques were used to develop coefficients for various study regions sectors.
3. The input-output model was appended with an employment module to estimate the effect on number of jobs under a given study scenario⁵.
4. For estimation of induced impacts, consumer behavior was incorporated.

Each of these features is described in more detail in the following sections.

4.3.1 Preparation of the Study Model

The starting point of the preparation of the CRECSIO model was Statistics Canada's Canadian and provincial transactions table at aggregation small or 'S'. At this level of aggregation, the number of economic sectors in the economy and the number of commodities is the smallest one⁶. Although transactions table are produced in two alternative formats – Aggregation 'M' (for Medium) or 'L' (for Large), they are not released for public use⁷.

In this study model CRESCIO, four separate input-output sub-models were developed: (1) Canadian economy; (2) Eastern Canadian economy; (3) Western Canadian economy; and (4) Province of Alberta. All these regions are programmed into a single model. Thus, analysis for each of the four regions can be done using the same model. Each sub-model has the same economic structure, but its own coefficients.

The study model contained 25 economic sectors and a total of 58 commodities (distributed as 48 intermediate and 10 primary commodities). A detailed list of sectors

⁵ Scenarios are described in Chapter 5 of this report.

⁶ It should be noted that this is the only form in which Statistics Canada would release a transactions table to a non-government public agency. Even here, rules for preserving confidentiality are observed; therefore some of the entries for some economic sectors are blanked out.

⁷ The provincial governments can obtain a model which is somewhere between the M or L aggregation merely for their own use. In addition, Statistics Canada maintains the inter-provincial input-output model. This model is maintained and run by the agency itself. It is available to private agencies for a fee.

and commodities for this level of aggregation is shown in Appendix B (Table B.1 for sectors and Table B.2 for commodities). The final demand agencies included Consumers, Investment, Governments and Exports. Development of the model involved obtaining the transactions tables for 10 provinces and for Canada as a whole. In order to operationalize the model, the transaction table data were checked for any confidential entries. If such items were found, their value was imputed using a neighbouring region. The next step was to check balancing of the model. Each commodity's supply (total output) should be equal to its disposition (sales to other sectors or to final demand agencies). If the entries did not balance, values were imputed. The third step undertaken was to aggregate provincial transactions tables to form two regional models: (1) Western Canada, which included provinces of Manitoba, Saskatchewan, Alberta and British Columbia; and (2) Eastern Canada, which included Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, Quebec, and Ontario. This resulted in three balanced transaction tables, one each for Canada, Eastern Canada, and Western Canada. In addition, a model was also developed using a similar approach for the province of Alberta.

There were four major limitations of these transactions tables in the context of this study: One, there were no coefficients available for aggregated regions, such as Western Canada and Eastern Canada; Two, there was no process for estimating employment for the regional (or national) economy as it gears up to produce more goods services to meet increasing demands by the cattle sector; Three, in order to estimate induced impacts, consumer behaviour need to be modelled; and Four, since various firms are allowed to import goods and services from other parts of Canada or from the rest of the world, these need to be accounted in the model. To improve on these limitations, additional activity was required. The following steps were undertaken to complete the development of the CRESCIO model:

- One, Estimation aggregate regional input-output coefficients for various sectors;
- Two, Development of employment coefficients for various modeled;
- Three, Estimation of consumer behavior relationship; and,
- Four, Estimation of leakages from the regional economies.

Each of these is described further in the following sections.

4.3.2 Development of Regional Input-output Coefficients

Based on a review of past economic studies two types of methods have been used for creating regional technical coefficients for an input-output model: (1) Survey Approach; and (2) Non-Survey Approach.

The first approach requires primary data collection for various sectors on their purchase of inputs and disposal of their final product(s). This approach is time consuming and resource intensive. This approach is followed in building Canadian and provincial input-output models by Statistics Canada. Since for the study model, the starting point was Statistics Canada's transactions tables, this approach was not needed.

The second approach provides a short-cut to the primary data collection. It is based on the knowledge of a location quotient (LQ). A LQ is a measure of a region's self-sufficiency in meeting its requirement for various goods and services. If a region is self-sufficient it would first meet its own requirements and export the rest to other parts of Canada or rest of the world. It is calculated as follows:

$$LQ_{rc} = \frac{\text{Share of the commodity } c \text{ in region } r}{\text{Share of commodity } c \text{ in Nation}} \quad (4.1)$$

If the $LQ \geq 1$, the region is a surplus region and can meet all its requirements for that commodity. Thus, its technical coefficients are similar to that for the nation. If $LQ < 1$, it is a deficit region for that commodity and new set of coefficients are created. The estimation involves the use of the following equation:

$$A_{cr} = A_{cn} * LQ_{rc} \quad (4.2)$$

Where, A_{cr} is the technical coefficient for the commodity c in region r , and A_{cn} is the technical coefficient for that commodity for the nation.

This procedure was applied to both the regional models (Western Canadian and Eastern Canadian) of the CRECSIO.

4.3.3 Estimation of Employment Coefficients

In order to estimate employment coefficients for various sectors in the CRECSIO model, Statistics Canada's data on employment by major sectors were obtained. Corresponding levels of output were obtained from the output matrix of the transactions table for the model. Dividing the number of workers employed by a certain sector by its output in thousands of dollars provided the employment coefficient in terms of number of persons per \$1,000 worth output (value of goods and services sold). Results are shown in Table 4.1.

For some sectors, separate employment data were not available. A case in point was the agriculture (crop and animal production), forestry and logging, fishing, hunting and trapping. These sectors were assigned similar coefficients for each of these sectors.

Table 4.1: Employment Coefficients for the CRECSIO Model, by Regions

Sector	Employment Coefficients Workers per 1000 \$ Output for			
	Alberta	Canada	West	East
Crop and Animal Production	0.004641	0.007615	0.007530	0.0096139
Forestry and Logging	0.016500	0.007615	0.007530	0.0096139
Fishing, Hunting and Trapping	0.016500	0.007615	0.007530	0.0096139
Support Activities for Agriculture and forestry	0.016500	0.007615	0.007530	0.0096139
Mining and Oil and Gas Extraction	0.001090	0.001141	0.001045	0.0015645
Utilities	0.003088	0.002751	0.002981	0.0026592
Construction	0.002447	0.004120	0.003169	0.0050114
Manufacturing	0.001915	0.003196	0.002863	0.0032972
Wholesale Trade	0.004610	0.005473	0.005034	0.0056833
Retail Trade	0.011493	0.014589	0.013023	0.0153872
Transportation and Warehousing	0.004931	0.006344	0.005263	0.0070670
Information and Cultural Industries	0.003995	0.004821	0.005100	0.0047177
Finance, Insurance, Real Estate and Rental and Leasing	0.001873	0.002434	0.002198	0.0025470
Professional, Scientific and Technical Services	0.001887	0.009382	0.001720	0.0014872
Administrative and Support, Waste Management and Remediation Services	0.010101	0.013364	0.012805	0.0130712
Educational Services	0.232953	0.271776	0.248437	0.2839583
Health Care and Social Assistance	0.030111	0.033240	0.031973	0.0338267
Arts, Entertainment and Recreation	0.015577	0.016321	0.015390	0.0167837
Accommodation and Food Services	0.012841	0.017180	0.015092	0.0184915
Other Services (Except Public Administration)	0.016315	0.021213	0.019421	0.0221800
Operating, Office, Cafeteria and Laboratory Supplies	0.012841	0.021213	0.019421	0.0221800
Travel, Entertainment, Advertising and Promotion	0.016315	0.021213	0.019421	0.0221800
Transportation Margins	0.004931	0.021213	0.019421	0.0221800
Non-Profit Institutions Serving Households	0.003657	0.021213	0.019421	0.0221800
Government Sector	0.002141	0.002642	0.002437	0.0027300

4.3.4 Modeling Consumer Behavior

In order to estimate induced impacts under a given scenario, it is important to make assumptions regarding the propensity to consume. As income of consumers increases, a portion of this increase is spent on consumer goods and other personal expenditures. In the case of smaller changes, an appropriate indicator is the marginal propensity to consume (MPC). The MPC is the proportion of changed income being spent on personal expenditures. These values are typically estimated using regression analysis. In order to estimate the MPC for various regions, a regression equation for personal expenditures (PEX) and income (INC) for Canada was estimated using 1991-2012 data. The estimated

results showed the MPC to be greater than one. Since it is a situation that cannot be sustained in the long-run, average propensity to consume were estimated.

As a substitute, an attempt was made to estimate the average propensity to consume (APC). The APC is simply a ratio of average personal expenditures to average income. According to past estimates, the APC for most regions was around one, and has been increasing in the recent time periods. In this model, this coefficient was set equal to 0.9752. It should be noted that this estimate is an assumption and can easily be changed if so required.

4.3.5 Inter-provincial and International Trade

As noted above, a part of the region's demand for goods and services (commodities) is met through imports from other regions. Similarly, a region's output of a sector can be exported. These imports/exports for various commodities take place within Canada (from other Canadian regions) as well as from outside the country. The former is called inter-regional imports/exports, and the latter one as foreign imports/exports. Both of these types of imports / export activities were included in the model. In the CRECSIO model, imports were treated as a source of supply for the commodity and not shown as explicit demand activity. In other words, imports were treated as negative demand. In addition, these imports are a leakages and do not contribute to the local economic growth.

4.4 Estimation of Economic Impacts of a Change in Economic Activity

As noted above, total economic impacts, based on an input-output model, are demand driven. The demand for the commodities could be through expansion of production of a sector, by enhanced exports, or purchases by investors or consumers. Each of these situations can be analyzed using the CRESCIO model.

To estimate the above total impacts the output and inputs of various sectors are further manipulated using input-output model mathematics. The final result is an "Economic Impact Analyzer" that contains these steps and has the capability of presenting the total impacts under a given direct change. The direct change is called a 'scenario'. These scenarios are presented in Chapter 5.

The Analyzer presents matrices showing direct change under a scenario. These matrices are used to estimate direct plus indirect impacts, and total impacts (direct, indirect and induced impacts) resulting from the scenario. The first type of changes (direct and

indirect) is called Type I impacts, whereas second type (direct, indirect and induced) are called Type II impacts.

In the model, Impacts are presented in two formats: the Long format contains all individual items of GDP and trade with various regions, along with employment generated; the short format provides impacts in terms of the following indicators: Output (or sales of goods and services by various sectors), GDP at factor cost, GDP at market prices, Labor income (excluding transfer payments), Imports from various regions, and Employment.

4.5 Concept of an Economic Multiplier

From the results of the Analyzer, one can estimate various types of multipliers for the scenario. A multiplier is simply a ratio of total impacts to direct impacts under a given scenario. Mainly these multipliers are either Type I (total impacts include direct and indirect impacts only) or Type II (where total impacts include induced impacts in addition to Type I impacts). Depending on the choice of direct impact, one can calculate three types of multipliers: Final demand multipliers, Pseudo multiplier, and Ratio-form multipliers.

4.5.1 Final Demand Multiplier

A final demand multiplier is a result of change in either consumer expenditures, higher exports, or higher expenditure by government or investors. The final demand multiplier shows the change in the economy for every one dollar increase in a given type of final demand for that commodity. Thus, if the final demand is in terms of exports sales abroad, and if the output multiplier is 1.75, it suggests that one dollar increase in exports creates change in production (sales of all goods and services) in the region of 1.75 dollars. Similar interpretations can be made to imports multiplier, income multiplier, or GDP multiplier. Needless to say these multipliers would vary from one sector to another.

4.5.2 Pseudo Multiplier

If a scenario involves a change in the production of a sector (which could be triggered by some exogenous change), a final demand multiplier is not suitable. Here one needs information based on output of the sector being impacted on. This multiplier is called a pseudo multiplier. Thus, if a pseudo output multiplier for manufacturing sector is 1.35, this suggests that if the production of this sector increases by one dollar, output of all goods and services in the regional economy would increase by 1.35 dollars.

4.5.3 Ratio-Form Multiplier

The ratio-multiplier takes a different form than the above two types of multiplier. Let us take an example of income in cattle production. Let us further assume that the ratio-form income multiplier is estimated at 2.25. This suggests that for every dollar of income earned by cattle producers, the rest of the economy makes an additional 1.25 dollars, making it a total income change in the region of 2.25 dollars.

4.6 Gross Multiplier Effects vs. Net Multiplier Effect

Estimation of economic impacts of a change in final demand for a commodity or production of a sector requires one caution. If the change involves a final demand, and since that commodity transaction does not enter the regional economic system, estimation of economic impacts does not require any change in the calculation of multipliers. However, if the change involves level of production, and if the sector has forward linkages, estimation of these impacts, if done for each of the individual sub-sectors, would overstate the total economic impact of the sector. This is called the gross impacts of the sector and any multipliers based on such estimates would be gross multipliers. These multipliers would overstate the impact of the sector.

The degree of overstatement in the total economic impacts arises from the double-counting of inputs for economic impact analysis. This double-counting occurs because of the fact that some of the inputs purchased by the forward linked sub-sectors are already produced and their impacts are already included. Including them again creates inflated level of impacts. Thus, for the cattle sector in Canada double-counting is a result of inputs from other sectors, as shown in Table 4.2.

Table 4.2: Source of Double-Counting in the Cattle Sector in Canada

Producing Sector	Purchasing Sector	Input
Cow-calf Operations	Backgrounding Operations	Calves
	Animal Slaughtering and Meat Production Sector	Calves
Backgrounding Operations	Feeder Operations / Feedlots	Feeder Animals
Feeder Operations / Feedlots	Animal Slaughtering and Meat Production Sector	Finished Animals

If the above set of inputs is removed from subsequent (sequential) economic impact analyses, and if all these impacts are added together, the result would be net total economic impacts of the sector.

Chapter 5

STUDY SCENARIOS

The total economic impacts of the cattle sector on the Canadian and regional economies (including provincial economy of Alberta) were estimated by using two approaches:

One, each of the sub-sectors was assumed to be an independent scenario and total impacts were estimated using their respective expenditures. These included the three types of farm level production firms plus the processing sub-sector. In total there were four individual scenarios. These impacts, as noted in Chapter 4, would be gross impacts.

Two, aggregate scenario, where both sub-sectors were combined. This was based on following a net direct impact approach, where commodities already produced were not included again. Using this approach showed the net total impact of the cattle sector.

Economic impacts of a given scenario were estimated using a 'with' and 'without' situation. In other words, the situation depicts the changes in the Canadian or regional economy if that production sub-sector included in the scenario did not exist.

The model was run for four individual scenarios plus the aggregate scenario for the three regions and Canada as a whole. These three regions were: Western Canada, Eastern Canada, and province of Alberta. The four study scenario included three scenarios for farm level production of cattle, namely cow-calf production, backgrounding, and feeding/feedlots operations. The fourth scenario was that of animal slaughtering and meat processing.

5.1 Farm Level Cattle Production Scenarios

In this study, impacts of each of these scenarios were estimated as an independent set of activities. All the inputs purchased by that production unit were included in impact analysis. The results of these scenarios reflect a situation as if these were the only changes that have occurred in the economy. No effort was made here to avoid the possible double-counting.

Each scenario was estimated as value of production as measured by cash farm income. Since Statistics Canada reports this income as a total, an approximation to divide it among the three scenarios was developed. It involved taking into account the number of beef cows in a given region by three types of production sub-sector. Each of these sub-

sectors was weighted by its relative value using the typical weight of the animal leaving that sector and the respective price. In all cases, a one-one relationship between beef cows number and the final product being sold by that sub-sector was assumed⁸. Resulting value of production for the three scenario and four spatial regions are shown in Table 5.1.

Table 5.1: Direct Demand (Change) Associated with Study Scenarios, 2011

Scenario	Value of Production in Thousand Dollars			
	Canada	Eastern Canada	Western Canada	Alberta
Cow-calf Operations	\$544,157	\$111,965	\$432,222	\$18,069
Backgrounding Operations	\$2,632,977	\$443,802	\$2,189,175	\$353,039
Feeding Operations including feedlots	\$3,082,300	\$898,944	\$2,183,356	\$1,625,649
Total Farm Cash Income	\$6,259,434	\$1,454,711	\$4,804,753	\$1,996,757
Slaughtering and Meat processing	\$10,860,405	\$2,801,984	\$8,058,420	\$6,849,657
Total Direct Value of Production	\$17,119,839	\$4,256,695	\$12,863,173	\$8,846,414

Total farm cash income in Canada for 2011 was reported at \$6.3 billion. Its distribution by Eastern and Western Canada suggests that Western Canada has a slightly higher proportion of total than Eastern Canada. Similarly, share of Alberta to Canadian cash farm income from cattle production was almost half of the Canadian cattle sector. In fact as shown in Figure 5.1 (Left Panel), farm level production is more concentrated in Western Canada than in Eastern Canada.

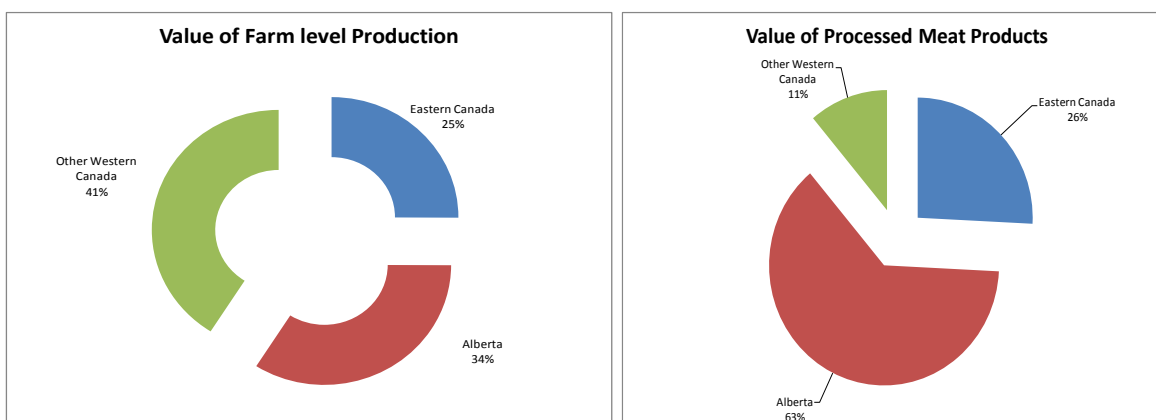


Figure 5.1: Regional Distribution of Canadian Beef Cattle Sector. (Left Panel – Farm Level Production; Right Panel – Agri-Processing)

⁸ It is recognized that this approach might generate somewhat unrealistic data. Given that such data are not reported, this issue needs further scrutiny.

Farm level beef cattle production is destined either for live export market or purchased by other local buyers for further processing. One could argue that in a narrow sense forward linkages do exist between farm level sub-sectors (as calves raised by the cow-calf operations are purchased by the backgrounding operations, whose products are purchased by finishing (feedlots)), in this scenario only the aggregate farm level production of cattle was included as having forward linkages. Thus the cattle sold to the animal slaughtering and meat production sub-sector is the forward linkage scenario used in this study.

5.2 Beef Cattle Slaughtering and Meat Processing Scenario

The forward linkages of farm level cattle production is with the animal slaughtering and meat production industry. This adds further value added to the regional economy. Unfortunately all the data reported for this industry is for all live animals slaughtered for meat production (to include beef, veal, pork, chicken meat, turkey meat, mutton and lamb, and other meats). To estimate the value of beef and veal and other related products, some imputation was required.

To estimate the Canadian beef and veal output, Statistics Canada's 2007 data for the Canadian Animal Slaughtering and Meat production sector was obtained from their input-output model. Using the proportion of value of cattle to other live animals / birds used as input, total output for beef and veal⁹ production was estimated. This assumes that processing of beef cattle required similar inputs as other live animal / birds.

The second issue in this scenario was related to estimation of regional production. Using the data¹⁰ on regional slaughter of beef animals, 74.2% of the total Canadian slaughter was allocated to Western Canada, and the remaining 25.8% to Eastern Canada. The distribution is shown in Figure 5.1 (Right panel). This resulted in a value of meat production by the cattle sector in Western Canada at \$8.06 billion and that in Eastern Canada at \$2.8 billion.

If one assumes that the processing of these cattle is totally dependent on local supply¹¹ of cattle, the sector could be defined as inclusive of farm level and agri-processing level economic activities. Using this extended sector definition, the cattle sector in Canada is a

⁹ It is recognized that some of the veal may have been produced from dairy calves. However, the distribution of total calves by beef or dairy was not available.

¹⁰ These data were provided by Ms. Brenna Grant of the Canadian Cattleman's Association.

¹¹ In reality, a firm processing a product has two options: One, use local goods, or Two, Import them from other regions of Canada or the world. The second option is viable in the short-run. However, in the long run for the firm to continue in the region, local inputs must be available. Lack of meeting this condition would indicate closure of the firm's business.

\$17 billion industry¹². Thus, both farm level production and meat processing is located mostly in Western Canada. One should note that this is the gross value of their output and does include some double-counting.

5.3 Aggregate Scenario

The aggregate scenario created in this study was based on the premise that individual scenarios would overestimate total impact of the cattle sector due to double-counting. This is because at each stage of production and processing purchases are made from another sector whose impacts have already been included. To avoid this double-counting, a method of triangulation was followed. Animals purchased by the backgrounding, feeding operations / feedlots, and processing firms were excluded in the estimation of total economic impacts.

5.4 Data Sources

The starting point in economic impact analysis is the direct inputs purchased by a given sector from other goods producing sectors. For example, a cow-calf producer would need, among other items, bedding, feed, fencing, as inputs. The quality of estimated economic impacts is governed by the quality of this information.

Unfortunately comparable regional data for various stages of production in the sector were not available. A list of studies and sources reviewed is provided in Table 5.2. Available data pertained to different time periods, or used different accounting system (in terms of items reported or detailed). In some cases, estimates were provided for the cost of production but not on the revenue side. In spite of these limitations, best set of cost of production were selected from those available. However, quality of these estimates can be improved significantly. This aspect needs to be taken into account while interpreting the multipliers reported later on in this study.

Farm level cost of production data were obtained as follows: For the cow-calf operations in Western Canada, data provided by Manitoba Agriculture, Food and Rural Initiatives (2008a) were used. Data for the backgrounding operations in Western Canada were obtained from MAFRI (2008a). Feedlot data for Western Canada were based on budgets and past year summary of returns by Ms. Brenna Grant of the Canadian Cattlemen's Association. These budgets were reviewed, and average of past ten years was used.

¹² Another approximation that was not taken into account was the regional variability in type of animal slaughtered.

Table 5.2: Sources Consulted for Data Collection for the Farm Sub-Sector

	Cow-Calf	Backgrounding	Feeder
Manitoba	MAFRI-Policy Analysis Branch-booklet	MAFRI-Policy Analysis Branch-booklet	MAFRI-Policy Analysis Branch-booklet
Saskatchewan	Kathy Larson, Western Beef Development Centre, Lanigan, SK Fact Sheet #2010-1	Dr. Bart Lardner, WBDC; Ravinder Kumar, Dept. of Animal & Poultry Science; and Dr. John McKinnon, Dept. of Animal & Poultry Science Fact Sheet #2008-02.1	Tim Highmoor, WBDC Economist Fact Sheet #2005-09 WBDC
Alberta	Canfax, Updated: 07/06/2012 Correspondence	n/a	Dale A. Kaliel. Production Economics & Competitiveness Division. Agriprofits technical Bulletin
Eastern Canada / Ontario	Ontario Ministry of agriculture, Food and Rural Affairs. Budgeting tools, available online http://www.omafr.gov.on.ca/english/busdev/bear2000/Budgets/budgettools.htm	Ontario Ministry of agriculture, Food and Rural Affairs. Budgeting tools, available online http://www.omafr.gov.on.ca/english/busdev/bear2000/Budgets/budgettools.htm	Ontario Ministry of agriculture, Food and Rural Affairs. Budgeting tools, available online http://www.omafr.gov.on.ca/english/busdev/bear2000/Budgets/budgettools.htm

Since data are not collected in a form enabling a direct use for economic impact analysis, some imputations were done. These imputations included direct impact of three farm level cattle production sub-sectors, and value of beef cattle processing. For Eastern Canada data were obtained from various Ontario sources listed in Table 5.2.

For the processing sector, the only coefficients that were available were for Canada as a whole. These coefficients were obtained from the Canadian input-output model (See Statistics Canada, 2012d). Two adjustments were made in these data: One, they were converted into coefficients for beef cattle using share of total live animal purchases. Two, proportion of total revenue thus estimated was used to calculate the input-output coefficients. These coefficients were used for both Eastern, Western Canada and for the province of Alberta.

5.5 Estimation of Economic Impacts

The procedure for the estimation of economic impacts involved three steps:

- One, Collection of direct requirements for the production activity being analyzed;
- Two, Classification of above set of data by input-output model commodity system. A list of these commodities is provided in Table B.2 (Appendix B).
- Three, Estimation of Type I and Type II economic impact of the selected activity using the CRECSIO model; and,
- Four, Estimation of various types of multipliers using the results in Step 3 above.

This study reports both gross and net impacts of the cattle sector in three regions of Canada. The net impacts were estimated by excluding the goods already produced by other types of farms or sub-sector.

5.6 Reporting of Results

The economic impact results and multipliers are reported in the next four chapters. They are arranged as: Canada (in Chapter 6); Western Canada (in Chapter 7), Eastern Canada (in Chapter 8), and Alberta (in Chapter 9). In all regions, both gross and net impacts of the sector are presented. Also, each chapter includes details on each of the sub-sectors, including direct impacts of the sector, secondary impacts, and multipliers.

Chapter 6

ECONOMIC IMPACTS OF THE CANADIAN CATTLE SECTOR ON CANADIAN ECONOMY

This chapter presents the total impact of the Canadian cattle sector on the Canadian economy. All farms associated with cattle production are included here¹³. On account of Canada as a whole, no interregional trade is permitted; however, international trade is possible and was included.

The chapter is divided into four sections: Section 6.1 described the multiplier effect of the three farm level cattle production individually. This is followed that for the processing sector. Since there is double counting among the farm level producing units and between farm level and processing level, in Section 6.3 a net multiplier for the entire cattle sector is computed. The last section provides a brief summary.

6.1 Economic Impacts of Farm Level Cattle Production Sub-Sector

6.1.1 Direct Impact of the Sub-Sector

As described in Chapter 2, farm production in Western Canada takes place in three types of production units: Cow-calf operations, Backgrounding operations, and Feeding operations and / or feedlots. Direct impacts of an economic activity are traditionally measured through five indicators: (1) Level of sales, also called output of a sector; (2) Contributions to the income of workers and other members of the society associated with that activity, called Labor Income; (3) Contributions to the gross domestic product for the region in market prices; (4) Contributions to employment generating activities; and (5) Imports from other regions within Canada and from rest of the world. Since the last indicator provides little information on the contribution to the Canadian (or regional) economy, this study presents results only for the first four indicators.

Direct impacts of the farm level sub-sector of cattle production are shown in Table 6.1. These farms, as already noted above, sell \$6.3 billion worth of cattle¹⁴. This total value of production was imputed for the three types of farms using the value of output and number of beef cows. The total cash farm income from the sale of calves was attributed to the

¹³ Readers should note that some of the income may have been derived from the sale of dairy calves. From the Statistics Canada estimates, it is not clear, and therefore, further investigation of this issue is needed.

¹⁴ The inventory of cattle on farms is not included in this estimate.

cow-calf operations. These enterprises make a contribution to Canada's gross domestic product (GDP) of \$1.5 billion, included within it is the personal income of \$1.4 billion¹⁵. Using employment coefficients, the farm level sub-sector is estimated to have employed 50,165 workers (on a full time equivalent basis)¹⁶.

Table 6.1: Direct Impacts of the Canadian Farm Level Sub-Sector, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total
Sales of Goods and Services*	Million Dollars	\$544	\$2,633	\$3,082	\$6,259
GDP at Market Prices	Million Dollars	\$170	\$399	\$934	\$1,466
Labor Income	Million Dollars	\$130	\$348	\$878	\$1,355
Employment	Person-Years	4,331	20,753	25,082	50,165

* Total farm cash receipts for the region were obtained from Statistics Canada (2012). Total farm cash income for each of the three sub-sectors was imputed.

The farm level production is a large generator of employment in the region. It was estimated to have generated a total of 50,165 person years of employment in the region. Larger contribution to employment is provided by backgrounding operations and feedlots¹⁷.

6.1.2 Total Economic Impact of the Sub-Sector

Total economic impacts of a sector include indirect and induced impacts in addition to direct impact (contributions made) of the sector. Indirect impacts are created through the purchase of various inputs that are required for the production of various commodities. For the Canadian cattle farm sub-sector, inputs required for production were obtained from the cost of production budgets. This information reflected the type of goods and

¹⁵ One of the reasons for the close values of GDP and labor income is that some of the budgets used for the analysis did not include depreciation and taxes.

¹⁶ It should be noted that this is an estimate and is not based on actual employment numbers since these data are not reported by Statistics Canada at this level of disaggregation.

¹⁷ Please note that these employment estimates are based on sales. If sales do not relate to employment, these estimates could be over or under-estimated for each of the three types of cattle farm level production farms.

services that are required for the production and some of which are purchased from other goods producing sectors. Results are shown in Table 6.2 (Top panel of the table). These production activities would impact each of the goods producing sectors differently. However, these can be aggregated for the economy as a whole. A direct value of production of the sector of \$6.3 billion creates additional demand for various economic goods (Type I impacts), eventually resulting in an aggregate value of goods and services produced by Canada of \$13.8 billion. If the re-spending of the income earned by various members of the labor force considered (Type II impacts), value of total goods and services would increase to \$19.8 billion (Bottom panel of Table 6.2).

Table 6.2: Total Economic Impacts of the Canadian Farm Level Sub-Sector, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total*
Type I Impacts (Direct and Indirect)					
Sales of Goods and Services	Million Dollars	\$1,156	\$6,029	\$6,614	\$13,799
GDP at Market Prices	Million Dollars	\$424	\$1,821	\$2,384	\$4,629
Labor Income	Million Dollars	\$271	\$1,144	\$1,663	\$3,078
Employment	Person-Years	9,483	48,163	53,375	111,021
Type II Impacts (Direct, Indirect and Induced)					
Sales of Goods and Services	Million Dollars	\$1,686	\$8,255	\$9,868	\$19,809
GDP at Market Prices	Million Dollars	\$714	\$3,039	\$4,164	\$7,917
Labor Income	Million Dollars	\$440	\$1,853	\$2,699	\$4,992
Employment	Person-Years	14,259	68,218	82,687	165,164

* As noted above, the total of the three production types should be interpreted with caution. Because of double-counting this total is an overestimate.

Contributions to the GDP at market prices¹⁸ were estimated at \$7.9 billion, which includes labor income of almost \$5 billion. In total, some 165,164 person-years of employment are generated either directly or indirectly from farm level cattle production in Canada.

6.1.3 Economic Multipliers for the Sub-Sector

The results of the total economic impacts can be translated into multipliers for the sub-sector. As noted earlier, two types of multipliers are commonly used for sectoral analysis. They are: Pseudo Multipliers and Ratio-form multipliers.

The Pseudo multiplier provided the magnitude of change per dollar of the sector (or sub-sector) is the level of output (production of goods and services). These multipliers indicate the change in the selected indicator from one unit (dollar) change in the output of the sub-sector. These multipliers can be of Type I (include only direct and indirect economic impacts) or of Type II (include direct, indirect and induced economic impacts). Multiplier estimates are shown in Table 6.3.

Table 6.3: Economic Pseudo Multipliers for the Farm Level Production of Cattle, Canada, Type I and Type II

Indicator	Unit	Value		
		Cow-Calf	Back-grounding	Feeder / Feedlots
		Type I Impacts (Direct and Indirect)		
GDP at Market Prices	Dollars	0.779	0.692	0.773
Labor Income	Dollars	0.499	0.435	0.540
Employment	Person-Years per Mill. \$ of Sales	17.4	18.3	17.3
		Type II Impacts (Direct, Indirect and Induced)		
GDP at Market Prices	Dollars	1.312	1.154	1.351
Labor Income	Dollars	0.809	0.704	0.878
Employment	Person-Years per Mill. \$ of Sales	26.2	25.9	26.8

¹⁸ GDP at market prices includes indirect taxes and subsidies in addition to labor income and other operating surplus (which includes depreciation). If these items are excluded, the GDP is measured at factor cost.

Results indicate that for every dollar of output generated by the farm level sub-sector, considering all impacts (indirect and induced) the total GDP at market prices would increase by 1.312 for the cow-calf operations, 1.154 for the backgrounding operations and by 1.351 for the feedlots (when all indirect and induced impacts are included). Employment per million dollar worth of output generated by the sub-sector is estimated to be 26 and 27 person-years. This means that for every million dollar sold of cattle by these farms, 26 to 27 workers are employed in the Canadian economy.

One should keep in mind that these impacts and multipliers reflect gross changes in the economy, and are slightly over-estimated. This is because both backgrounding and feedlot operations purchase cattle from other farms. Since we are counting them twice, economic impact for these two types of farm level cattle production is an overestimate.

A ratio-form multiplier relates the activity of the sub-sector to the level of changes in the entire economy. In other words, these multipliers indicate the change in the entire economy (for a given criterion) per unit of change in the sub-sector. These multipliers are shown in Table 6.4.

Table 6.4: Economic Ratio-form Multipliers for the Canadian Farm Level Production of Cattle, Type I and Type II

Indicator	Value		
	Cow-Calf	Back-grounding	Feeder / Feedlots
	Type I Impacts (Direct and Indirect)		
Sales of Goods and Services	2.125	2.290	2.146
GDP at Market Prices	2.492	4.672	2.553
Labor Income	2.082	3.293	1.895
Employment	2.190	2.321	2.128
	Type II Impacts (Direct, Indirect and Induced)		
Sales of Goods and Services	3.099	3.135	3.201
GDP at Market Prices	4.196	7.796	4.459
Labor Income	3.377	5.332	3.076
Employment	3.293	3.287	3.297

* Lower direct income in these sub-sectors is responsible for these large multipliers.

A perusal of estimates in Table 6.4 suggests that for one unit of change in the beef cattle sub-sector there is slightly more than double impact on the economy. For example, for every dollar of income received by workers and farm owners in the feedlot operations, another 2.08 dollars are created elsewhere – resulting in a multiplier of 3.08. Some multipliers in the table are somewhat large. This is in part due to the type of data used for

direct impact in this analysis. For example, the GDP multiplier for backgrounding operations is 7.8. This is a result of the fact that a very small part of the total expenditures were recorded for depreciation, land taxes, and personal incomes. Given the small denominator, the ratio-form multiplier would be rather large¹⁹. However, caution is advised in interpreting and use of these estimates.

6.2 Canadian Beef Cattle Slaughtering and Meat Processing Sub-Sector

Some of the cattle on various types of farms are destined for exports while others are purchased by local slaughtering and meat processing establishments. These establishments through their own activities would add further value to the economy and result in further economic growth. In this section, economic impacts of these activities are reported, first with the direct economic impacts, then total economic impacts, and the finally in terms of multipliers.

6.2.1 Direct Impact of the Sub-Sector

As noted above, actual data for beef cattle slaughtering and meat processing operations in various regions of Canada were not available²⁰. Therefore, imputations were made to estimate these. Based on these impacts, the sub-sector produced about \$10.9 billion worth of goods, which contributes \$2.6 billion to Canada's GDP (which is the contribution made by the sub-sector itself), including \$1.5 billion as wages and salaries and profits of unincorporated non-farm businesses. It is estimated to have employed 28,345 workers in 2008 (Table 6.5).

Table 6.5: Direct Economic Impacts of Canadian Slaughtering and Meat Processing Sub-Sector, 2008

Particulars	Unit	Value
Production of Goods and Services	Mill. \$	\$10,860
Gross Domestic Product at Market Prices	Mill. \$	\$2,645
Labor Income	Mill. \$	\$1,484
Employment	Person-Years	28,345

6.2.2 Total Economic Impacts of the Sub-Sector

Using the direct economic impacts of beef cattle slaughtering and meat production in Table 6.6, total (Type I and Type II) impacts were estimated. These results are presented

¹⁹ This issue is a result of type of cost of production budgets that were available at the time of conducting this study. Further investigation is required.

²⁰ Readers are advised that these data are estimates based on certain assumptions. Caution is advised in their interpretation and application.

in Table 6.6. In terms of increasing the production of goods and services, the sub-sector contributed a total of \$23 billion through direct and indirect impacts, and almost \$32 billion through all impacts. Similarly additions to the Canada's GDP were estimated at \$12 billion, including \$7 billion through direct labor income (wages of workers and profits of unincorporated non-farm businesses). In addition, 196,690 jobs in Canada are directly or indirectly related to beef cattle slaughtering and meat processing. One must note that since this sub-sector purchases some raw materials from the farm level sub-sector, these estimates are larger than those of the sub-sector by itself²¹.

Table 6.6: Total Economic Impacts of Canadian Cattle Slaughtering and Meat Processing Sector, 2008

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	Mill. \$	\$23,214	\$31,759
Gross Domestic Product at Market Prices	Mill. \$	\$7,760	\$12,434
Labor Income	Mill. \$	\$4,388	\$7,108
Employment	Person-Years	119,726	196,690

6.2.3 Economic Multipliers for the Sub-Sector

Estimated total impacts of the beef cattle slaughtering and meat processing sub-sector were converted into two types of multipliers – Pseudo multipliers and Ratio-form multipliers. In terms of pseudo multipliers, as shown in Table 6.7, for every dollar worth of goods produced by this sub-sector, Canadian GDP increases by 71.5 cents, including personal income of 40.4 cents, based on direct and indirect impacts. For a million dollar worth of output of the sub-sector, 11 workers are employed in Canada. Type II multipliers, as expected, are even larger, as shown in Table 6.8. One should also remember that this sector is also counting impacts for the farm level production of beef cattle.

Interpretation of ratio-form multipliers can also be done in a similar manner as for the farm production sub-sector. These are shown in Table 6.8. For every dollar contributed by the sector to the Canadian GDP, another 1.93 dollars are generated by other sectors, for a total change of 2.93 through indirect impacts and by 3.7 by including all impacts. Similarly every worker employed by the sub-sector 4.2 workers are employed in Canada (counting only direct and indirect impacts) and almost seven workers are employed, if all impacts are included.

²¹ These impacts, called net impacts, are presented in Section 6.4.

Table 6.7: Pseudo Economic Multipliers for the Canadian Cattle Slaughtering and Meat Processing Sub-Sector, 2008

Particulars	Unit	Type I Impact Level	Type II Impact Level
Gross Domestic Product at Market Prices	\$	0.715	1.145
Labor Income	\$	0.404	0.654
Employment	Person-Years per Mill. \$ of Sales	11.0	18.1

Table 6.8: Ratio-form Economic Impacts Multipliers for Canadian Beef Cattle Processing Sector, 2008

Particulars	Type I Impact Level	Type II Impact Level
Production of Goods and Services	2.138	2.924
Gross Domestic Product at Market Prices	2.934	4.701
Labor Income	2.957	4.790
Employment	4.224	6.939

6.3 Net Impacts of Canadian Cattle Sector

The above impacts are accurate if each sector's contribution is considered in isolation (just by itself with no trading with any other sub-sector of the cattle sector). However, to obtain the aggregate impact of cattle production and processing, all double-counting has to be removed. This was done in order to estimate the net impacts of the sector. Since value of processed meat is for a different time period, the results are a mismatch²².

Using the net direct impacts, each of the farm level and processing level sub-sectors were combined, and economic impacts of all activities (farm level units and processing activities) were estimated. These results are presented in this section.

6.3.1 Net Direct Impacts of the Canadian Cattle Sector

Since there is no double-counting in the direct impact estimates, total direct impact of the sector is sum of individual sub-sectors. As shown in Table 6.10, the sector produced a total of \$17 billion dollar worth of goods, contributed \$4.1 billion to the Canadian GDP (including \$2.8 million to personal incomes). It employed a total of 78,510 workers (on a full-time equivalent basis).

²² It is expected that the nature of beef cattle processing has not undergone drastic change over the 2008 to 2011 period. However, this remains to be an assumption and needs further scrutiny.

Table 6.9: Net Direct Economic Impacts of Canadian Cattle Sector

Particulars	Unit	Value		
		Farm Level	Processing Level	Total
Production of Goods and Services	Mill. \$	\$6,259	\$10,860	\$17,119
Gross Domestic Product at Market Prices	Mill. \$	\$1,466	\$2,646	\$4,112
Labor Income	Mill. \$	\$1,355	\$1,494	\$2,849
Employment	Person Years	50,165	28,345	78,510

6.3.2 Total Net Economic Impacts of the Canadian Cattle Sector

Using the total direct purchases of the combined farm level and processing level sub-sectors, economic impacts were estimated. These results are presented in Table 6.11. If only direct and indirect impacts are included (Type I impacts), the sector contributed \$33 billion to the Canadian level of sales of goods and services, \$13.2 billion to the Canadian GDP at market prices, including \$8 billion to personal income. A total of 141,165 jobs are related to this sector either directly and indirectly. When induced impacts are added to these values, employment generation increases to 228,811 jobs (on a full-time equivalent basis).

Table 6.10: Total Net Economic Impacts of Canadian Cattle and Calves Sector

Particulars	Unit	Total Impacts
		Type I Impacts
Production of Goods and Services	Mill. \$	\$22,993
Gross Domestic Product at Market Prices	Mill. \$	\$7,879
Labor Income	Mill. \$	\$4,967
Employment	Person-Years	141,165
		Type II Impacts
Production of Goods and Services	Mill. \$	\$32,724
Gross Domestic Product at Market Prices	Mill. \$	\$13,200
Labor Income	Mill. \$	\$8,065
Employment	Person-Years	228,811

6.3.3 Net Economic Multipliers for Canadian Cattle Sector

Results of total impacts were translated into multipliers. These multipliers were estimated at two level of direct production – aggregated farm level and processing level, and farm level cattle production level. The first type is called Net Aggregate Multiplier, and the

second one as the Farm Production-Based Multiplier. These results are shown in Table 6.11.

Table 6.11: Pseudo and Ratio-form Net Economic Multipliers for the Canadian Cattle Sector

Particulars	Unit	Pseudo Net Aggregate Multiplier		Pseudo Net Farm Production Based Multiplier	
		Type I	Type II	Type I	Type II
Production of Goods and Services	\$	1.343	1.912	3.674	5.228
Gross Domestic Product at Market Prices	\$	0.460	0.771	1.259	2.109
Labor Income	\$	0.290	0.471	0.794	1.289
Employment	Person-Years per Mill. \$ of Sales	8.246	13.366	22.554	36.557
		Ratio-Form Net Aggregate Multiplier		Ratio-Form Net Farm Production Based Multiplier*	
Production of Goods and Services	\$	1.343	1.912	3.674	5.228
Gross Domestic Product at Market Prices	\$	1.916	3.210	5.374	9.004
Labor Income	\$	1.743	2.831	3.666	5.952
Employment	Person-Years	1.798	2.914	2.814	4.561

* Since the farm level direct impacts are low during the study period, these multipliers are somewhat larger. Caution is advised in their interpretation and use.

These multipliers can be used to answer various types of questions. For example, one question might be “How much contribution does the cattle sector makes to the Canadian GDP for every dollar contributed by it directly? As shown in Table 6.11, the Type I ratio-form GDP multiplier is 1.916 and Type II multiplier is 3.21. Thus, with the contribution by the cattle sector of one dollar, another 91 cents are generated by other non-cattle sectors through purchase of goods and services, or another \$2.21 through re-spending of received incomes within the Canadian economy in addition to purchase of goods and services, for a total change of \$3.21.

Another question that could be asked is: “How many jobs in total are created by the farm level production of cattle in Canada?” This question can be answered using the pseudo net aggregate farm production based employment multiplier. In this case, the answer would be that for every \$1,000 worth of production sold, there would be 22.5 person-

years of employment generated through direct and indirect changes, and 36.6 person-years of employment created if all three types of impacts are included (direct, indirect and induced).

6.4 Summary

From the results presented in this chapter, cattle sector is an important economic activity. It is responsible for \$33 billion worth of sales of goods and services in Canada. These sales contribute \$13 billion to the country's GDP, which includes \$8 billion through personal incomes. Directly or indirectly through induced income effects, the sector generates 228,811 jobs in the country.

Chapter 7

ECONOMIC IMPACTS OF WESTERN CANADIAN CATTLE SECTOR

In this chapter, the estimated economic impacts of the cattle sector in Western Canada are reported. As noted earlier in this report, this sector was defined to include two major sub-sectors of economic activities: Farm level beef cattle production sub-sector, and Beef cattle slaughtering and meat processing sub-sector. The chapter is divided into four sections, starting with, in Section 7.1, direct economic impacts of farm level production, followed by the same for the processing sub-sector in Section 7.2. Net impacts of the sector are presented in Section 7.3, with a summary of the whole sector in Section 7.4.

7.1 Farm Level Production of Cattle

7.1.1 Direct Impact of the Farm Level Production

As described in Chapter 2, farm production in Western Canada takes place in three types of production units: Cow-calf operations, Backgrounding operations, and Feeding operations and / or feedlots. Similar to that for Canada, direct impacts were measured in terms of gross value of goods and services sold (called output), gross domestic product (in market prices), labor income, and employment.

For farm level sub-sector of the cattle production, these impacts are shown in Table 7.1. These farms sell \$4.8 billion worth of cattle. Some of these are destined for exports and others are purchased by other local industries (particularly for further processing). Combined together they contribute \$591 million to the regional GDP, including \$471 million to the labor income in the region. It is estimated to employ some 23,964 workers estimated on a full-time equivalent basis.

7.1.2 Total Economic Impact of Farm Level Production

All expenditures incurred by a goods producing sector generate secondary impacts, which include indirect impacts (which are created through the purchase of various inputs that are required for the production of various commodities) and induced impacts (which are created through consumer demand generated by additional income in the hands of consumers). These impacts are shown in Table 7.2.

Through purchases of goods and services for cattle production, there is additional expansion in the level of goods produce by other sectors. These sectors then require more inputs for meeting this additional demand. The result is a larger level of economic activity in Western Canada, as shown in Table 7.2.

Table 7.1: Direct Impacts of the Western Canadian Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total*
Sales of Goods and Services	Million \$	\$432	\$2,189	\$2,183	\$4,804
GDP at Market Prices	Million \$	\$151	\$360	\$80	\$591
Labor Income	Million \$	\$115	\$324	\$32	\$471
Employment	Person-Years	3,255	4,269	16,440	23,964

* Total farm cash receipts for the region were obtained from Statistics Canada (2012). Total farm cash income for each of the three sub-sectors was imputed.

Table 7.2: Total Economic Impacts of the Western Canadian Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total*
Type I Impacts (Direct and Indirect)					
Sales of Goods and Services	Million \$	\$837	\$4,756	\$4,245	\$9,838
GDP at Market Prices	Million \$	\$327	\$1,486	\$1,734	\$3,547
Labor Income	Million \$	\$212	\$930	\$1,271	\$2,413
Employment	Person-Years	6,514	23,403	31,804	61,721
Type II Impacts (Direct, Indirect and Induced)					
Sales of Goods and Services	Million \$	\$1,168	\$6,199	\$6,239	\$13,606
GDP at Market Prices	Million \$	\$514	\$2,303	\$2,865	\$5,682
Labor Income	Million \$	\$322	\$1,412	\$1,938	\$3,672
Employment	Person-Years	9,341	35,745	48,863	93,949

* As noted above, the total of the three production types should be interpreted with caution. Because of double-counting this total is an overestimate.

By producing \$4.8 billion of sales to other economic agents, the sub-sector generates a total economic activity for sale of \$13.6 billion. This level of total sales contributes to the regional GDP in the tune of \$5.7 billion, which includes \$3.7 billion worth of income to people (called labor income). An estimated 93,949 jobs in Western Canada depend on the activities of the sub-sector either directly or indirectly.

7.1.3 Economic Multipliers for Farm Level Production

Direct impact of cattle production and its total impacts are used to calculate multiplier effect of the sub-sector. These results are shown in Table 7.3 for the pseudo multipliers and in Table 7.4 for the ratio-form multipliers.

Table 7.3: Economic Pseudo Multipliers for the Farm Level Production of Cattle, Western Canada, Type I and Type II

Indicator	Unit	Value		
		Cow-Calf	Back-grounding	Feeder / Feedlots
		Type I Impacts (Direct and Indirect)		
GDP at Market Prices	Dollars	0.756	0.679	0.794
Labor Income	Dollars	0.490	0.425	0.582
Employment	Person-Years per Mill. \$ of Sales	15.1	10.7	14.6
		Type II Impacts (Direct, Indirect and Induced)*		
GDP at Market Prices	Dollars	1.189	1.052	1.312
Labor Income	Dollars	0.745	0.645	0.888
Employment	Person-Years per Mill. \$ of Sales	21.6	16.3	22.4

* Since the farm level direct impacts are low during the study period, these multipliers are somewhat larger. Caution is advised in their interpretation and use.

For every dollar worth of cattle produced by a cow-calf farm, almost 76 cents are added to the GDP (including 49 cents or higher to labor income) by either other non-cattle sectors within agriculture or by other non-agricultural sectors. The Type II impacts suggest a change of \$1.19 per dollar value of farm output. Every million dollar worth of cattle produced in Western Canada generates up to 22 jobs²³. Of course different types of farms differ in terms of their impact on the region.

In terms of ratio-form multiplier, interpretation is similar to that provided in Chapter 6. Every dollar of GDP generated by the sub-sector farms results in an increase in the regional GDP level by 2 and 4 times. Some of these multipliers are rather large, in part due to smaller level of direct impact of these types of farms.

²³ Due to lower cattle prices, value of sales is low. Since the employment coefficient is based on sales of a sector, this resulted in lower level of employment.

Table 7.4: Economic Ratio-form Multipliers for the Farm Level Production of Cattle, Western Canada, Type I and Type II

Indicator	Value		
	Cow-Calf	Back-grounding	Feeder / Feedlots
	Type I Impacts (Direct and Indirect)		
Sales of Goods and Services	1.937	2.173	1.944
GDP at Market Prices	2.169	4.122	2.032
Labor Income	1.844	2.868	1.560
Employment	2.002	5.483	1.935
	Type II Impacts (Direct, Indirect and Induced)		
Sales of Goods and Services	2.701	2.832	2.855
GDP at Market Prices	3.412*	6.391*	3.356*
Labor Income	2.806*	4.356*	2.378*
Employment	2.870	8.374*	2.972

* Lower direct income in these sub-sectors is responsible for these somewhat larger multipliers.

7.2 Western Canadian Beef Cattle Processing Sub-Sector

A portion of the farm level output of the farm level sub-sector is sold for further processing. The processing industries add further value to the goods and create economic growth in the region. These results are described in this Section.

7.2.1 Direct Impact of Processing Sub-Sector

The processing sub-sector in Western Canada produced (and sold) a total of \$8 billion worth of goods to other economic agents in Canada and in the rest of the world (Table 7.5). This generated almost two billion dollar worth of GDP in Western Canada (including slightly over one billion dollars in terms of labor income). Employment in this sub-sector was estimated at 21,032 workers on a full-time equivalent basis.

7.2.2 Total Economic Impacts of Processing Sub-Sector

The direct economic activity by the processing sub-sector in Western Canada resulted in more economic activities. Combining all direct, indirect and induced impacts, it contributed \$7.8 billion to the regional GDP and employed 109,988 workers (Table 7.6).

Table 7.5: Direct Economic Impacts of Western Canadian Cattle Processing Sector, 2008

Particulars	Unit	Value
Production of Goods and Services	Mill. \$	\$8,058
Gross Domestic Product at Market Prices	Mill. \$	\$1,964
Labor Income	Mill. \$	\$1,101
Employment	Person Years	21,032

Table 7.6: Total Economic Impacts of Western Canadian Cattle Processing Sector

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	Mill. \$	\$16,173	\$20,591
Gross Domestic Product at Market Prices	Mill. \$	\$5,299	\$7,803
Labor Income	Mill. \$	\$2,837	\$4,315
Employment	Person Years	72,198	109,988

7.2.3 Economic Multipliers for Processing Sub-Sector

Converting the total economic impacts on a per dollar worth of output results in a development of pseudo multipliers. These multipliers are shown in Table 7.7. On the basis of including only direct and indirect impacts (Type I impacts), one dollar of goods sold by the sub-sector results in \$2.7 in terms of GDP in the region. This also generates 9 person-years of employment per million dollars of sales of goods. If all impacts (Type II) are considered, the total employment increases to 13.7 workers per million dollars of sales.

Table 7.7: Pseudo Economic Multipliers for the Western Canadian Cattle Processing Sector

Particulars	Unit	Type I Impact Level	Type II Impact Level
Gross Domestic Product at Market Prices	\$	0.658	0.968
Labor Income	\$	0.351	0.535
Employment	Person-Years per Million \$ of Sales	9.0	13.7

Ratio-form multipliers for the processing sub-sector are shown in Table 7.8. The sub-sector has a high multiplier activity. If all impacts are included, output of the Western Canadian region increases 2.6 times the level of output of the sub-sector. The GDP of the

region increases by almost four times, and employment by a little under four-times. One should note that since the sub-sector is purchasing inputs from the farm level production sub-sector, these multipliers reflect more than processing level impacts.

Table 7.8: Ratio-form Economic Impacts Multipliers for Western Canadian Cattle Processing Sector

Particulars	Type I Impact Level	Type II Impact Level
Production of Goods and Services	2.007	2.555
Gross Domestic Product at Market Prices	2.698	3.974
Labor Income	2.577	3.919
Employment	3.433	5.230

7.3 Net Impacts of Aggregate Western Canadian Cattle Sector

To avoid the double-counting through the purchases of inputs from other sectors whose impacts are already accounted for, impacts were re-estimated on a net purchases basis. The sector is now called 'net aggregate cattle sector' or simply aggregate sector. These results are described in this section.

7.3.1 Net Direct Impacts of the Aggregate Western Cattle Sector

Direct impacts of the aggregate sector are presented in Table 7.9. The sector produces \$12.8 billion worth of goods and services, contributes \$3.3 billion to the regional GDP (including \$2.3 billion as labor income), and employs 44,995 workers at both farm level production and off-farm level processing activities.

Table 7.9: Net Direct Economic Impacts of Aggregate Western Canadian Cattle Sector

Particulars	Unit	Value		
		Farm Level	Processing Level	Total
Production of Goods and Services	Mill. \$	\$4,805	\$8,058	\$12,863
Gross Domestic Product at Market Prices	Mill. \$	\$1,345	\$1,964	\$3,309
Labor Income	Mill. \$	\$1,254	\$1,101	\$2,355
Employment	Person-Years	23,963	21,032	44,995

7.3.2 Total Net Economic Impacts of Aggregate Western Cattle Sector

The direct expenditures by the aggregate sector generate several rounds of secondary impacts. The aggregate sector generates goods and services worth \$18.4 billion in Western Canada region through direct and indirect impacts and \$24.1 billion through direct, indirect and induced impacts (Table 7.10). It generates \$8.9 billion worth of GDP including \$5.5 billion as labor income. Directly and indirectly it is responsible for employment of 127,677 workers (full-time equivalent basis).

Table 7.10: Total Net Economic Impacts of Aggregate Western Canadian Cattle Sector

Particulars	Unit	Total
		Type I Impacts
Production of Goods and Services	Mill. \$	\$18,444
Gross Domestic Product at Market Prices	Mill. \$	\$5,729
Labor Income	Mill. \$	\$3,625
Employment	Person Years	78,956
		Type II Impacts
Production of Goods and Services	Mill. \$	\$24,138
Gross Domestic Product at Market Prices	Mill. \$	\$8,858
Labor Income	Mill. \$	\$5,529
Employment	Person Years	127,677

7.3.3 Net Economic Multipliers for the Western Cattle Sector

Total impacts of the aggregate sector were converted into per unit change, called multipliers. For every dollar worth of production of the aggregate sector, the rest of the economy produces another 43 cents through indirect changes, and 88 cents through indirect and induced changes, for a Type I multiplier of 1.43 and Type II multiplier of 1.87 (Table 7.11). Similarly for every dollar of goods sold by the aggregate sector, 69 cents are generated as labor income in the Western Canadian economy. The aggregate sector creates employment of 6 or 10 person-years through Type I changes and Type II changes, respectively.

Multiplier effect of farm level production can also be estimated from the above level of impacts. These are shown in the last two columns of Table 7.11. Total impact of farm level production of cattle on the regional production level is 5 times the level of goods produced by the sub-sector. Impact on GDP and labor income is even higher than these levels. This is on account of lower direct incomes and GDP.

Table 7.11: Pseudo and Ratio-form Net Economic Multipliers for the Aggregate Western Canadian Cattle Sector

Particulars	Unit	Pseudo Net Aggregate Multiplier		Pseudo Net Farm Production Based Multiplier	
		Type I	Type II	Type I	Type II
Production of Goods and Services	\$	1.434	1.877	3.839	5.024
Gross Domestic Product at Market Prices	\$	0.445	0.689	1.192	1.843
Labor Income	\$	0.282	0.430	0.754	1.151
Employment	Person-Years per Mill. \$ Sales	6.138	9.926	16.432	26.572
		Ratio-Form Net Aggregate Multiplier		Ratio-Form Net Farm Production Based Multiplier*	
Production of Goods and Services	\$	1.434	1.877	3.839	5.024
Gross Domestic Product at Market Prices	\$	1.731	2.677	4.259	6.586*
Labor Income	\$	1.539	2.348	2.891	4.409*
Employment	Person-Years	1.755	2.838	3.295	5.328

* These multipliers are high perhaps as a result of lower value of production and other direct impacts of the farm level cattle production.

7.4 Summary of Impacts

Cattle production in Western Canada and its subsequent processing activities make a significant contribution to the Western Canadian regional economy. A total of \$24 billion dollar worth of goods sold, and a net contribution of the regional GDP of \$8.8 billion are indicative of this importance. Directly or indirectly employment of over 127 thousand workers is related to the farm level production and processing activities in this region.

Chapter 8

ECONOMIC IMPACTS OF THE EASTERN CANADIAN CATTLE SECTOR

In this chapter, economic impacts of the Eastern Canadian cattle sector are presented. The method of analysis and presentation follows the same line as used for Canada and Western Canadian cattle production. Both farm level as well as processing sub-sector activities are included.

8.1 Farm Level Production of Cattle

8.1.1 Direct Economic Impacts of the Farm Level Production

In Eastern Canada, cattle production comprises of beef herds and dairy herds. Although data for beef cows is separated from dairy cows, such is not the case with sales of calves. Slaughtered or exported calves may be a product of either type of farm. However, in this study, it is assumed that all calves reported by Statistics Canada can be divided into those from beef or dairy herds in proportion to the number of cows of each category²⁴. Similar to Western Canada, farm production in Eastern Canada takes place in three types of production units: Cow-calf operations, Backgrounding operations, and Feeding operations. Their impacts are measured through four economic indicators: Level of sales (also called output of a sector); Labor Income; Gross Domestic Product in market prices; and Employment generating activities. For farm level sub-sector of the cattle production, these impacts are shown in Table 8.1.

Table 8.1: Direct Impacts of the Eastern Canadian Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder	Total*
Sales of Goods and Services	Mill. \$	\$112	\$444	\$899	\$1,455
GDP at Market Prices	Mill. \$	\$19	\$29	\$80	\$128
Labor Income	Mill. \$	\$16	\$23	\$62	\$101
Employment	Person Years	1,076	16,484	8,642	26,202

* Total farm cash receipts for the region were obtained from Statistics Canada (2012). Total farm cash income for each of the three sub-sectors was imputed.

²⁴ In Eastern Canada, proportion of beef cows is 41.1% of the total number of cows in the region.

These farms in 2011 sold \$1.5 billion worth of cattle. Some of these are destined for exports and others are purchased by other local industries (particularly for further processing). The farm level production is a large generator of employment in the region. It was estimated to have generated a total of 26,202 person years of employment in the region. In addition, these activities contributed to the regional gross domestic product (GDP). Together they contributed a total of \$128 million worth of GDP to the region, including \$101 million dollars as income to the people engaged in these operations.

8.1.2 Total Economic Impact of Farm Level Production

Total impacts of a production activity include in addition to direct impacts, secondary impacts. The secondary impacts are generated through purchases of inputs (called indirect impacts) and through re-spending of income earned by workers and profits of unincorporated non-farm businesses. For the farm level beef cattle production sub-sector in Eastern Canada, total economic impacts for various selected indicators are presented in Table 8.2.

Table 8.2: Total Economic Impacts of the Eastern Canadian Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder	Total*
		Type I Impacts (Direct and Indirect)			
Sales of Goods and Services	Mill. \$	\$220	\$1,001	\$2,001	\$3,222
GDP at Market Prices	Mill. \$	\$61	\$249	\$508	\$818
Labor Income	Mill. \$	\$39	\$155	\$316	\$510
Employment	Person Years	2,057	21,431	18,390	41,878
		Type II Impacts (Direct, Indirect and Induced)			
Sales of Goods and Services	Mill. \$	\$292	\$1,286	\$2,583	\$4,161
GDP at Market Prices	Mill. \$	\$100	\$404	\$824	\$1,328
Labor Income	Mill. \$	\$63	\$246	\$503	\$812
Employment	Person Years	2,730	24,059	23,766	50,555

* As noted above, the total of the three production types should be interpreted with caution. Because of double-counting this total is an overestimate.

All the three types of cattle farms combined together are related either directly or indirectly to \$4.2 billion worth of goods and services in the region. In terms of net contribution, these farms are responsible for \$1.3 billion in terms of regional GDP, including \$812 million as labor income. If all indirect and induced impacts are counted, total employment related to these farms is estimated at 50,555 person-years. If induced impacts are excluded, total impacts are slightly lower.

8.1.3 Economic Multipliers for Farm Level Production

Total economic impacts of the farm sub-sector were converted into multipliers. Both pseudo and ratio-form multipliers for the Eastern Canadian farm level beef cattle production sub-sector are shown in Table 8.3 and 8.4, respectively.

Table 8.3: Economic Pseudo Multipliers for the Farm Level Production of Cattle, Eastern Canada, Type I and Type II

Indicator	Unit	Value		
		Cow-Calf	Back-grounding	Feeder / Feedlots
		Type I Impacts (Direct and Indirect)		
GDP at Market Prices	Dollars	0.542	0.562	0.565
Labor Income	Dollars	0.352	0.349	0.352
Employment	Person-Years per Mill. \$ of Sales	18.4	18.3	20.5
		Type II Impacts (Direct, Indirect and Induced)		
GDP at Market Prices	Dollars	0.896	0.911	0.917
Labor Income	Dollars	0.561	0.554	0.559
Employment	Person-Years per Mill.\$ of Sales	24.4	24.2	26.4

According to the level of pseudo multipliers, every dollar of production of these farms yields a regional GDP between 54 and 57 cents with indirect impacts included, or 90 to 92 cents if all impacts are included. In terms of employment generation, sales of one million dollar worth of cattle in the region results in employment of 18 to 21 person years

through indirect linkages, and 24 to 26 person-years through all (direct, indirect and induced) impacts.

Table 8.4: Economic Ratio-form Multipliers for the Farm Level Production of Cattle, Eastern Canada, Type I and Type II

Indicator	Value		
	Cow-Calf	Back-grounding	Feeder / Feedlots
	Type I Impacts (Direct and Indirect)		
Sales of Goods and Services	1.968	2.255	2.226
GDP at Market Prices*	3.117	8.464	6.330
Labor Income*	2.537	6.626	5.061
Employment	1.912	1.300	2.128
	Type II Impacts (Direct, Indirect and Induced)		
Sales of Goods and Services	2.620	2.897	2.874
GDP at Market Prices*	5.152	13.717	10.278
Labor Income*	4.039	10.534	8.046
Employment	2.537	1.460	2.750

* Lower direct income in these sub-sectors is responsible for these large multipliers.

The ratio-form multipliers in Table 8.4 indicate how many times one unit of a given indicator for a sub-sector turns over to create the total economic change of that sub-sector. Let us take an example of a Type II multiplier. For GDP, one unit of GDP generated by, say a feeder/feedlot operation, results in a total GDP in the region of 6.3. This number is unusually large because the farms have not had a good return over the past few years, and some of the budget data did not account for some GDP items. Caution is advised in their use.

8.2 Eastern Canadian Beef Cattle Processing Sub-Sector

Eastern Canada has a larger slaughtering and meat processing sector than Western Canada, but the slaughter of beef cattle is larger in Western Canada. Since data are reported for all live animal processing, it is somewhat unclear whether the value estimated in this study is net of other types of animals. Several assumptions were made in this estimation, including:

1. Identical labor productivity across Canada, and
2. Number of employees in a region reflects the gross output of the plant.

The estimation involved total output of the Canadian slaughtering and meat processing industry and the use of above assumption. This yielded the total output of the sub-sector in Eastern Canada. Given the nature of assumptions made, however, the accuracy of this number requires further scrutiny.

8.2.1 Direct Impact of Processing Sub-Sector

Eastern Canada's processing sub-sector produced a total value of goods and services worth \$2.8 billion, which generated a regional GDP of \$683 million, including \$383 million dollars as labor income. It is estimated to have employed 7,313 workers on a full-time basis, as shown in Table 8.5.

Table 8.5: Direct Economic Impacts of the Eastern Canadian Cattle Processing Sector, 2008

Particulars	Unit	Value
Production of Goods and Services	Mill. \$	\$2,802
Gross Domestic Product at Market Prices	Mill. \$	\$683
Labor Income	Mill. \$	\$383
Employment	Person Years	7,313

8.2.2 Total Economic Impacts of Processing Sub-Sector

Total economic impacts of the processing sub-sector in Eastern Canada were estimated and are presented in Table 8.6. Through direct, indirect and induced changes in the regional economy, the sub-sector generated a total GDP of \$2.7 billion, which included \$1.6 billion as labor income. The sub-sector was also responsible directly or indirectly for creating 45,151 person-years of employment.

Table 8.6: Total Economic Impacts of Eastern Canadian Cattle Processing Sector, 2008

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	Mill. \$	\$5,665	\$7,515
Gross Domestic Product at Market Prices	Mill. \$	\$1,729	\$2,734
Labor Income	Mill. \$	\$1,001	\$1,594
Employment	Person- Years	28,079	45,151

8.2.3 Economic Multipliers for Processing Sub-Sector

The total impacts as reported above were converted into multipliers – pseudo and ratio-form. They are shown in Tables 8.7 and 8.8, respectively.

Table 8.7: Pseudo Economic Multipliers for the Eastern Canadian Cattle Processing Sector

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	\$	2.022	2.682
Gross Domestic Product at Market Prices	\$	0.617	0.976
Labor Income	\$	0.357	0.569
Employment	Person-Years per Mill. \$	10.0	16.1

Table 8.8: Ratio-form Economic Impacts Multipliers for the Eastern Canadian Cattle Processing Sector

Particulars	Type I Impact Level	Type II Impact Level
Gross Domestic Product at Market Prices	2.532	4.004
Labor Income	2.616	4.163
Employment	3.840	6.174

In terms of level of production of goods of the sub-sector, one dollar worth of production leads to a total regional level production of 2.68 dollars with both indirect and induced changes included. The GDP increase is 97.6 cents including 57 cents as labor income. Every one million dollar worth of goods sold by the sub-sector generates 10 person-years of employment through direct and indirect impacts, and 16 person-years through all impacts.

Ratio-form GDP multiplier of this sub-sector suggest that every dollar of direct GDP generated by it results in a total GDP creation of 4 dollars, if all impacts are considered. Similarly, every worker employed by this sub-sector results in total employment of 6.17 person-years in the region. It should be noted that since part of the inputs for this sub-sector are procured from the farm level production, these multipliers are an over-estimate and should be used with caution. To remove this bias, estimation of net impacts is needed, which is shown in Section 8.3.

8.3 Net Impacts of the Aggregate Eastern Canadian Cattle Sector

8.3.1 Net Direct Impacts of the Western Cattle Sector

Since there is no double-counting in the direct contributions, these values remain the same as for each of the sub-sectors. Under the assumption that the processing sector has not undergone any major change, the farm level and processing level values are added to create the direct contribution of the cattle sector in eastern Canada. Details are shown in Table 8.9. On account of lower return in the industry, the regional farm level sub-sector values are low. Total production of the sector is estimated at \$4.3 billion with a total labor force of 33,515 workers on a full-time equivalent basis.

Table 8.9: Net Direct Economic Impacts of the Aggregate Eastern Canadian Cattle Sector

Particulars	Unit	Value		
		Farm Level	Processing Level	Total
Production of Goods and Services	Mill. \$	\$1,455	\$2,802	\$4,257
Gross Domestic Product at Market Prices	Mill. \$	\$121	\$683	\$804
Labor Income	Mill. \$	\$101	\$383	\$484
Employment	Person Years	26,202	7,313	33,515

8.3.2 Total Net Economic Impacts of the Eastern Canadian Cattle Sector

The direct expenditures of the sector create several rounds of impacts, some through purchase of input from other sectors (industries) while others through household (families of workers and self-employed members of labor force) spending the money received as wages or profits within the region. In total, the sector produced goods and services worth \$8 billion (counting all direct, indirect and induced impacts), which translated into generation of \$2.6 billion GDP (including \$1.5 billion labor income). About 63,907 person-years of employment were also associated with the sector through its direct and secondary economic impacts (Table 8.10).

8.3.3 Net Economic Multipliers for the Aggregate Eastern Canadian Cattle Sector

As shown in Table 8.11, the sector was responsible for sales of \$1.9 for every dollar of output sold by it directly. These sales created a GDP of 60 cents per dollar of output sold, including 36 cents as labor income. For every million dollar output sold, the sector created 15 person-years of employment.

Table 8.10: Total Net Economic Impacts of the Aggregate Eastern Canadian Cattle Sector

Particulars	Unit	Total
Type I Impacts		
Production of Goods and Services	Mill. \$	\$6,324
Gross Domestic Product at Market Prices	Mill. \$	\$1,589
Labor Income	Mill. \$	\$957
Employment	Person Years	47,545
Type II Impacts		
Production of Goods and Services	Mill. \$	\$8,096
Gross Domestic Product at Market Prices	Mill. \$	\$2,552
Labor Income	Mill. \$	\$1,524
Employment	Person Years	63,907

Table 8.11: Pseudo and Ratio-form Net Economic Multipliers for the Aggregate Eastern Canadian Cattle Sector

Particulars	Unit	Pseudo Net Aggregate Multiplier		Pseudo Net Farm Production Based Multiplier	
		Type I	Type II	Type I	Type II
Production of Goods and Services	\$	1.486	1.902	2.257	2.889
Gross Domestic Product at Market Prices	\$	0.373	0.599	0.567	0.911
Labor Income	\$	0.225	0.358	0.342	0.544
Employment	Person Years per Mill. \$ of Sales	11.169	15.012	16.968	22.808
		Ratio-Form Net Aggregate Multiplier		Ratio-Form Net Farm Production Based Multiplier	
Production of Goods and Services	\$	1.486	1.902	2.257	2.889
Gross Domestic Product at Market Prices	\$	1.976	3.174	2.327	3.736
Labor Income	\$	1.977	3.149	2.499	3.979
Employment	Person-Years	1.419	1.907	6.501	8.739

Ratio-form multipliers indicate the magnitude of unit direct expenditures of the sector creating total economic impacts. Thus, for the labor income, one dollar of income generated by the sector would result in another \$0.90 generated elsewhere for a total multiplier of 1.902. Similar interpretation can be attached to other multipliers.

If one is interested in estimating the impact of the farm level production sub-sector on the total economy, one can use the multipliers in the last two columns of Table 8.11. Taking the example of employment multiplier (Type II), estimated value is 8.739. Thus for every job created by farm level production sub-sector, another 7.7 person-years of employment is generated elsewhere in the economy, for a total impact of 8.7 person-years.

8.4 Summary

The Eastern Canadian farm level cattle sub-sector produces a total value of output of \$1.5 billion, which through processing activities adds another \$2.8 value to the production of the region, for a total of \$4.3 billion. Directly the sector contributes \$0.8 billion to the regional GDP, including almost one-half billion dollars as labor income. It employs about 33,515 workers either as paid workers or owners of unincorporated non-farm businesses.

When all the direct indirect and induced impacts of the sector are counted, its contribution to regional sales of goods and service is estimated at \$8 billion, contributing \$2.6 billion to the regional GDP. In total, 63,907 workers (paid and owners of unincorporated business) are associated with this sector.

Chapter 9

ECONOMIC IMPACTS OF THE ALBERTA CATTLE SECTOR

This chapter is a summary of result of impact of the Alberta beef cattle sector on the Alberta economy. It included farm level as well as processing sub-sector. Economic impacts are presented in terms of direct and secondary impacts of these activities.

9.1 Alberta beef system

Alberta is the golden province of beef production in Canada, boasting the largest beef processing capacity in the country. This allows for fed cattle from other provinces to be slaughtered and processed in Alberta. In 2011, 780,000 tonnes of beef were processed in Western Canada: about 85 per cent or 664,000 tonnes of this was processed in Alberta (Alberta Beef Producers, 2012). Beef production is the largest agricultural sector in Alberta, providing \$3.2 billion in farm cash receipts in 2011.

According to Statistics Canada (2011a), Alberta had 4.87 million head of beef cattle, supported by the vast availability of pastures. The overall land use for the 20.4 million ha of farm in the province includes 31 percent of farmland under natural pasture and another 12 percent under tame or seeded pasture.

Because of the slaughtering capacity of the province, most cattle are fed to finish in the province; about 90 percent of all last year's 2.1 million head of feedlot cattle finished in Western Canada were finished in Alberta. Alberta exports both live beef cattle and beef to the United States, Mexico, Hong Kong, Japan, Russia, and other countries. The majority of the exports are destined to the United States, with a total of 178,000 tonnes or 68 percent of the total beef exports in 2011.

9.2 Farm Level Production of Cattle

9.2.1 Direct Impact of the Farm Level Production

As described in Chapter 2, farm production in Western Canada takes place in three types of production units: Cow-calf operations, Backgrounding operations, and Feeding operations and / or feedlots. Since sales of goods and services by various types of farms are not reported, imputations were made using value of products and number of beef cows on various types of beef farms in the province. Similar to other regions reported in previous chapters, economic impacts were measured through four indicators: (1) Level of sales (output of a sector); (2) Labor Income; (3) Gross domestic product in market prices; and (4) Employment.

For farm level sub-sector of the cattle production, these impacts are shown in Table 9.1. These farms, as already noted above, sold \$3.5 billion worth of cattle. Some of these are destined for exports and others are purchased by other local industries (particularly for further processing). In these activities, a total GDP of \$957 million was generated. The total employment in the sub-sector was estimated at 16,914 full-time workers, who received a total income of \$904 million.

Table 9.1: Direct Impacts of the Alberta Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total*
Sales of Goods and Services	Million Dollars	\$198	\$1,679	\$1,614	\$3,491
GDP at Market Prices	Million Dollars	\$68	\$263	\$626	\$957
Labor Income	Million Dollars	\$53	\$249	\$602	\$904
Employment	Person-Years	1,491	3,274	12,149	16,914

* Total farm cash receipts for the region were obtained from Statistics Canada (2012). Total farm cash income for each of the three sub-sectors was imputed.

It should be noted that the provincial cattle sector has been under financial stress over the last decade. Profit margins have been low, in part due to the outbreak of the BSE. Although the industry is slowly recovering, the labor income and GDP values are lower than under normal production and trade conditions.

9.2.2 Total Economic Impact of Farm Level Production

Indirect impacts are created through the purchase of various inputs that are required for the production of various commodities. For the Alberta cattle farm level sub-sector, as noted earlier, input requirements create a series of repercussions in the economy. When added together these reflect the total economic impacts of the production activity in question. Although it is realized that various economic sectors in the province would be affected differently, indicators presented in this chapter are more aggregate in nature.

Through direct, indirect and impact impacts, Alberta's cattle farm level production sub-sector contributed \$8.4 billion to the sales of various goods and services. This level of output contributed \$3.2 billion to the provincial GDP. The sub-sector was directly or

indirectly responsible for employment of 45,144 full-time equivalent workers (paid workers and owners of unincorporated non-farm businesses), as shown in Table 9.2.

Table 9.2: Total Economic Impacts of the Alberta Farm Level Cattle Production, 2011

Indicator	Unit	Value			
		Cow-Calf	Back-grounding	Feeder / Feedlots	Total*
		Type I Impacts (Direct and Indirect)			
Sales of Goods and Services	Million Dollars	\$354	\$3,345	\$2,870	\$6,569
GDP at Market Prices	Million Dollars	\$134	\$926	\$1,108	\$2,168
Labor Income	Million Dollars	\$88	\$578	\$830	\$1,496
Employment	Person-Years	1,491	11,948	18,490	31,929
		Type II Impacts (Direct, Indirect and Induced)			
Sales of Goods and Services	Million Dollars	\$461	\$4,020	\$3,907	\$8,388
GDP at Market Prices	Million Dollars	\$196	\$1,316	\$1,706	\$3,218
Labor Income	Million Dollars	\$124	\$804	\$1,177	\$2,105
Employment	Person-Years	3,158	16,502	25,484	45,144

* As noted above, the total of the three production types should be interpreted with caution. Because of double-counting this total is an overestimate.

9.2.3 Economic Multipliers for Farm Level Production

Conversion of the total impact to unit impacts resulted in two types of multipliers for the sub-sector: Impact per unit of production, called pseudo multiplier, and Impact per unit of direct contribution of the sub-sector, called a ratio-form multiplier. These multipliers are shown in Table 9.3 for the pseudo multipliers and in Table 9.4 for the ratio-form multipliers.

Table 9.3: Economic Pseudo Multipliers for the Farm Level Production of Cattle, Alberta, Type I and Type II

Indicator	Unit	Value		
		Cow-Calf	Back-grounding	Feeder / Feedlots
		Type I Impacts (Direct and Indirect)		
GDP at Market Prices	Dollars	0.678	0.552	0.686
Labor Income	Dollars	0.444	0.344	0.514
Employment	Person-Years per Mill. \$	12.3	7.12	11.5
		Type II Impacts (Direct, Indirect and Induced)		
GDP at Market Prices	Dollars	0.989	0.784	1.057
Labor Income	Dollars	0.624	0.479	0.729
Employment	Person-Years per Mill. \$	15.9	9.8	15.8

Table 9.4: Economic Ratio-form Multipliers for the Farm Level Production of Cattle, Alberta, Type I and Type II

Indicator	Unit	Value		
		Cow-Calf	Back-grounding	Feeder / Feedlots
		Type I Impacts (Direct and Indirect)		
Sales of Goods and Services	Dollars	1.789	1.992	1.779
GDP at Market Prices	Dollars	1.956	3.517	1.768
Labor Income	Dollars	1.672	2.326	1.378
Employment	Person-Years	1.636	3.649	1.522
		Type II Impacts (Direct, Indirect and Induced)		
Sales of Goods and Services	Dollars	2.328	2.394	2.421
GDP at Market Prices	Dollars	2.855	4.997*	2.724
Labor Income	Dollars	2.352	3.234*	1.954
Employment	Person-Years	2.119	5.040*	2.098

* Lower direct income in these sub-sectors is responsible for these large multipliers.

Considering total impact (direct, indirect and induced) pseudo multiplier, on a per dollar basis of output, the sub-sector is responsible for generating almost equal amount of GDP to the province. For employment, on a one million dollar basis, the sub-sector provided 1.5 to 3.6 workers.

The ratio-form output multiplier is between 2.3 to 2.4, suggesting that each dollar of production results in more than twice the value of provincial goods and services sold. For every job in the sub-sector, two to five jobs²⁵ are created in the economy.

9.3 Alberta Beef Cattle Processing Sub-Sector

9.3.1 Direct Impact of Processing Sub-Sector

The processing of provincially produced beef cattle results in another round of economic impact on the provincial economy. It is estimated that the value of processed products sold was \$6.8 billion, generating \$1.7 billion as GDP, and creating additional employment of 9,244 workers (Table 9.5).

Table 9.5: Direct Economic Impacts of the Alberta Cattle Processing Sector

Particulars	Unit	Value
Production of Goods and Services	Mill. \$	\$6,850
Gross Domestic Product at Market Prices	Mill. \$	\$1,669
Labor Income	Mill. \$	\$935
Employment	Person Years	9,244

9.3.2 Total Economic Impacts of Processing Sub-Sector

The processing sector through purchase of inputs and providing income to workers creates another round of economic impacts on the Alberta economy. These results are shown in Table 9.6.

Table 9.6: Total Economic Impacts of the Alberta Cattle Processing Sector

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	Mill. \$	\$9,306	\$11,086
Gross Domestic Product at Market Prices	Mill. \$	\$2,672	\$3,700
Labor Income	Mill. \$	\$2,048	\$2,048
Employment	Person Years	19,103	31,116

Total impact of the processing sub-sector on the Alberta economy is estimated at \$11 billion in terms of goods produced, \$2.7 billion as GDP, and employment of 31,116 workers in the province.

²⁵ Interpretation of these values should be done with caution. These values are higher as a result of lower value of farm level direct contribution.

9.3.3 Economic Multipliers for the Processing Sub-Sector

Processing of cattle produces a high rate of multiplier activity, in part due to the fact that it includes part²⁶ of the farm level sub-sector impacts. Every dollar of output of this sector generates \$0.55 as GDP. About 4.5 workers are associated directly or indirectly with the production every one million dollars (Table 9.7). In terms of ratio-form multipliers, a GDP multiplier of 2.22 suggests that for every dollar of GDP contributed by the processing sub-sector another \$1.22 are generated elsewhere.

Table 9.7: Pseudo Economic Multipliers for the Alberta Cattle Processing Sector, 2008

Particulars	Unit	Type I Impact Level	Type II Impact Level
Gross Domestic Product at Market Prices	\$	0.390	0.540
Labor Income	\$	0.212	0.299
Employment	Person-Years per Mill. \$	2.8	4.5

Table 9.8: Ratio-form Economic Impacts Multipliers for the Alberta Cattle Processing Sector, 2008

Particulars	Unit	Type I Impact Level	Type II Impact Level
Production of Goods and Services	\$	1.359	1.619
Gross Domestic Product at Market Prices	\$	1.601	2.217
Labor Income	\$	1.551	2.180
Employment	Person- Years	2.066	3.366

9.4 Net Impacts of the Alberta Cattle Sector

As noted previously since part of the input requirements of the processing sub-sector is met through farm level production sub-sector, and furthermore, since there is some double-counting among the farm level production activities, impacts were re-estimated by excluding these transactions. The result was a net aggregate cattle sector, which was further subjected to economic impact analysis.

9.4.1 Direct Impacts of the Net Aggregate Alberta Cattle Sector

The net aggregate cattle sector in Alberta produces a total of \$10.3 billion as goods and services, which results in a contribution to the provincial GDP of \$2.9 billion, Some 26,158 person-years of employment is associated with these activities.

²⁶ This part is those cattle that are not destined for exports.

Table 9.9: Net Direct Economic Impacts of Alberta Cattle Sector

Particulars	Unit	Value		
		Farm Level	Processing Level	Total
Production of Goods and Services	Mill. \$	\$3,491	\$6,850	\$10,341
Gross Domestic Product at Market Prices	Mill. \$	\$953	\$1,940	\$2,893
Labor Income	Mill. \$	\$903	\$936	\$1,839
Employment	Person Years	16,914	9,244	26,158

9.4.2 Total Economic Impacts of the Net Aggregate Alberta Cattle Sector

The net aggregate sector generates a total value of production of \$16.9 billion. This results in a provincial level GDP of almost \$6 billion, including \$3.6 billion labor income. Through direct, indirect and induced effects, the sector is responsible for generating 62,612 jobs on a full-time equivalent basis (Table 9.10).

Table 9.10: Total Net Economic Impacts of the Alberta Cattle Sector

Particulars	Unit	Total Impacts
		Type I
Production of Goods and Services	Mill. \$	\$13,742
Gross Domestic Product at Market Prices	Mill. \$	\$4,027
Labor Income	Mill. \$	\$2,568
Employment	Person-Years	41,019
		Type II
Production of Goods and Services	Mill. \$	\$16,942
Gross Domestic Product at Market Prices	Mill. \$	\$5,875
Labor Income	Mill. \$	\$3,640
Employment	Person-Years	62,612

9.4.3 Economic Multipliers for the Net Aggregate Alberta Cattle Sector

Interpretation of multipliers for the net aggregate cattle sector are similar to those provided in other regions. Results are shown in Table 9.11. In terms of farm level net

activity, the effect on the provincial economy is high. Every dollar contributed by the sector to the GDP, the provincial GDP increases by another \$5.16, for a multiplier of 6.16. Similarly every job in the sector yields another 2.7 jobs elsewhere in the economy, resulting in an employment multiplier of 3.7 person-years.

Table 9.11 Pseudo and Ratio-form Net Economic Multipliers for the Alberta Cattle Sector

Particulars	Unit	Pseudo Net Aggregate Multiplier		Pseudo Net Farm Production Based Multiplier	
		Type I	Type II	Type I	Type II
Production of Goods and Services	Mill. \$	1.329	1.638	3.938*	4.854*
Gross Domestic Product at Market Prices	Mill. \$	0.389	0.568	1.154	1.683
Labor Income	Mill. \$	0.248	0.352	0.736	1.043
Employment	Person Years per Mill. \$	3.967	6.055	11.753	17.940
		Ratio-Form Net Aggregate Multiplier		Ratio-Form Net Farm Production Based Multiplier*	
Production of Goods and Services	Mill. \$	1.329	1.638	3.938	4.854
Gross Domestic Product at Market Prices	Mill. \$	1.392	2.031	4.226	6.165
Labor Income	Mill. \$	1.396	1.978	2.841	4.027
Employment	Person-Years	1.568	2.394	2.425	3.702

* These values are higher on account of lower direct impact of the farm level production of cattle sub-sector.

Chapter 10

SUMMARY AND CONCLUSIONS

10.1 Summary of Methodology

National and regional governments are concerned about the allocation of resources among various economic sectors and in various regions. The problem of how to plan and quantify for regional economic development and growth is frequently faced by local and regional planners. At many jurisdictions, knowledge of local/regional level economic activities that would arise from certain public/private decisions is required. Sufficient information has to be developed so that alternative regional development strategies can be compared and those meeting the objective most can be selected.

Every economic activity that takes place in a region leads to some monetary expenditures. Such expenditures create some repercussions in terms of economic changes felt elsewhere in the economy, some of which are within the same region, while others are felt in other parts of the national (or even international) economy. On a national scale, these repercussions have been identified in Keynesian economics as the multiplier effect. Every economic activity is different in terms of this multiplier effect. Knowledge of these is, therefore, considered important for regional economic development planning and policy making.

Although national multiplier activity related to changes in the income level of individuals can be accomplished by using the original Keynesian multiplier, at the regional level the analysis needs some major modifications. Regional and sectoral multipliers are typically created through an input-output model. The basic difference between national and regional multiplier activity is the existence of additional leakages through interregional trade. To capture the true level of regional development from a development alternative, one needs to know not only the outlays associated with the alternative but also its secondary impacts on the regional economy. This is required since comparison of initial expenditure on an alternative may lead to somewhat misguided allocation of resources.

Cattle production is a major industry in Canada. Its economic contribution is mainly seen in terms of initial monetary expenditures incurred by the industry or sales of their product. Since the repercussions of this activity are not always that obvious, the current practice of ignoring the multiplier effect of this sector may lead to serious underestimation of its importance to the national, regional or provincial economy. To understand the total economic impacts of an industry, one needs to look 'under the hood' to see how the regional economy functions and develops.

This study was designed to estimate the total economic impacts of cattle production (those associated with the sector directly and including all the regional level repercussions). Since many industries in Canada depend, for their own economic existence, on this sector, it was considered appropriate to undertake analysis of economic repercussions by identifying various types of production units and its linkages with the non-agriculture sectors. This led to the creation of a cattle sector which included two sub-sectors, one each for the farm level production, and processing sector. On account of interdependencies that exist between these two sub-sectors, a new net aggregate sector was also created.

An input-output model is a useful method of estimating economic effects of any economic activity. The major merits of this methodology include the following: one, various types of industries can be identified separately in terms of their secondary impacts; and two, models can be developed for a level of spatial scale. In this study, this approach was used to estimate the total economic impacts of the Agriculture and Food Cluster.

To estimate the total economic impact of the cattle sector, one national, two regional and one provincial input-output model were developed using the 2008 transactions data provided by Statistics Canada. The initial transactions table provided by Statistics Canada contained only 25 sectors, and 58 goods and services, called commodities.

10.2 Summary of Results

For each of the four regions of this study (Canada, Western Canada, eastern Canada, and Alberta), six scenarios were developed: Three scenarios for the farm level production sub-sector, one each for the three types of farms – cow-calf operations, Backgrounding operations, and feeding / feedlots operations; One scenario for the processing sub-sector; Two scenarios for the net aggregate sector – one for the farm level and the other for the processing level.

A summary of impacts in terms of gross domestic product and employment are summarized in Table 10.1. On account of double counting issues, only the results of the net aggregate (combined farm and processing level) scenario are presented. Impacts are shown in terms of gross domestic product and employment – two indicators typically used for regional economic planning. Total contribution to the Canadian GDP suggests that the sector contributes \$5.4 billion annually either directly or through its secondary impacts. Similarly, in terms of employment, the sector is associated with 196,478 person-

years of employment. In terms of the total regional level impacts, the sector is more predominant in Western Canada with a total employment of 86,315 person-years than in Eastern Canada. Within Western Canada, the province of Alberta has a lion share of the total impact as it has almost half of the total employment in the region.

Table 10.1: Summary of Economic Impacts of Net Aggregate Cattle Sector on National / Regional Economy, by Regions

Region	GDP in Million \$		Employment in Person-Years	
	Direct	Total (Type II)	Direct	Total (Type II)
Canada	\$4,112	\$13,200	78,510	228,811
Western Canada	\$3,309	\$8,858	44,995	127,677
Eastern Canada	\$804	\$2,552	33,515	63,907
Alberta	1,816	5,875	26,158	62,612

Multiplier activity associated with the sector is shown in Table 10.2. Most GDP multipliers are in the range of 1.3 to 1.98 for Type I (Direct and indirect changes included) whereas Type II (Direct, indirect and induced changes included) multipliers were found to be in the range of 1.9 to 3.2. Higher multiplier level for Canada is a result of lack of leakages which happens on a regional economy. Employment multipliers were also in the same range. Higher multipliers are a result of a mature economy with fewer imports from other parts of Canada or the world.

Table 10.2: Summary of Ratio-form Multipliers of Net Aggregate Cattle Sector on National / Regional Economy, by Regions

Region	GDP		Employment	
	Type I	Type II	Type I	Type II
Canada	1.343	1.912	1.798	2.914
Western Canada	1.731	2.677	1.755	2.838
Eastern Canada	1.976	3.174	1.419	1.907
Alberta	1.392	2.031	1.568	2.394

The major conclusion of this study is that cattle production in Canada is a significant economic activity that leads to other changes in the economic fabric of the nation. Each of these regions enjoys not only direct impact, but also those generated through secondary mechanisms – indirect and induced.

There is a significant difference between the direct contributions of the sector and its total impacts. Overall, direct impacts constitute about a third to a half of the total economic impacts.

Based on the results of this study, if relative contributions of a sector are estimated using direct impacts only, it will lead to serious underestimation. The obvious inference that can be drawn from the above data is that the Canadian cattle sector makes a much higher contribution to the national and regional (as well as to provincial) economy than what is obvious from traditional measures related to direct contribution.

10.3 Areas for Future Research

Regional economies are in a constant flux of development. Economic conditions change from time to time. This suggests the need for future studies in the area. Some of these are described below:

1. Statistics Canada revises the regional transactions tables periodically. It is advised that a newer set of data be used to test the robustness of the conclusions drawn from the analysis undertaken for this study.
2. In the present study, data for cost of production budget for various regions was not comparable. This makes the results somewhat non-comparable. In future, a common set of cost accounting needs to be used to produce results that would bring forth more accurate economic impacts for the sector. The same comment applies to the processing sector.
3. Development of details of direct contributions made by the disaggregated farm level production units based on some simplifying assumptions. These included the restriction of a farm producing a single product. An alternative manner to model these farms could be to allow multiple products. This may provide a more realistic picture of agriculture's total contributions.
4. Induced economic impacts are highly sensitive to the assumption of average or marginal propensity to consume. In this study, the coefficients used were assumed. Future studies can improve on this assumption.
5. Total economic impacts of a sector are generated in two separate phases: one, the investment phase, and two, the operations phase. In this study,

the total economic impacts of the cattle sector were estimated only for the operations phase. A significant level of impacts could be generated by new investment activity that is undertaken by agricultural producers, as well as those by food processing firms.

Hopefully, an extension of the present study on lines suggested above would lead to a better appreciation of the economic importance of the cattle sector.

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Appendix A

Regional Distribution of Beef Cattle Numbers

Table A.1: Number of Beef Cows and Farms Reporting, Canada, 2006 and 2011

Region	Number of Farms Reporting Beef Cows		Number of Beef Cows		% of Total Canada in 2011
	2011	2006	2011	2006	
Canada	61,425	83,000	3,849,368	5,081,596	100.00
Newfoundland and Labrador	42	70	382	761	0.01
Prince Edward Island	386	550	10,207	16,107	0.27
Nova Scotia	944	1,132	18,329	25,925	0.48
New Brunswick	712	909	16,312	22,248	0.42
Quebec	4,575	5,699	187,332	226,236	4.87
Ontario	11,567	15,017	282,062	377,354	7.33
Manitoba	6,668	9,216	484,727	655,587	12.59
Saskatchewan	14,074	19,738	1,124,149	1,444,640	29.20
Alberta	18,618	25,665	1,530,391	2,035,841	39.76
British Columbia	3,839	5,004	195,477	276,897	5.08

Source: Statistics Canada (2006, 2011)

Table A.2: Disposition of Farm Level Cattle, and Production of Meat, Canada, 1981-2010

Cattle production - Canada								
	Farm production				Meat production			
	Total slaughter 1	Exported alive	Imported alive	Farm production	Total slaughter 1	Average cold dressed weight 2	Total cold dressed weight 2	Edible offal
	thousands of head					kilograms	thousands of tonnes	tonnes
1981	3,691.30	184.6	80.3	3,795.60	3,691.30	265	978.15	34,657
1982	3,788.10	317.3	71.5	4,033.90	3,788.10	260.4	986.49	35,579
1983	3,708.80	265.9	77.5	3,897.20	3,708.80	267.7	992.75	34,851
1984	3,565.90	294.2	29.9	3,830.20	3,565.90	266	948.41	33,508
1985	3,603.00	334.8	51.5	3,886.30	3,603.00	273.5	985.25	33,867
1986	3,511.40	221	60.9	3,671.50	3,511.40	280.6	985.15	33,047
1987	3,194.50	234	66	3,362.50	3,194.50	285.8	912.97	30,108
1988	3,086.30	461.1	31.8	3,515.60	3,086.30	293.8	906.87	29,079
1989	3,121.00	444.9	39.6	3,526.30	3,121.00	291.1	908.4	29,421
1990	2,892.00	822.5	13.4	3,701.10	2,892.00	296.7	857.93	27,236
1991	2,726.10	840.9	43.2	3,523.80	2,726.10	301.8	822.78	25,657
1992	2,834.80	1,240.40	33.2	4,042.00	2,834.80	302.2	856.66	26,717
1993	2,685.00	1,188.10	48	3,825.10	2,685.00	306.3	822.31	25,310
1994	2,727.40	982.6	95.1	3,614.90	2,727.40	316	861.86	26,860
1995	2,791.30	1,108.80	78.6	3,821.50	2,791.30	318.1	887.91	28,741
1996	3,143.20	1,481.10	46.8	4,577.50	3,143.20	310.5	976.11	33,102
1997	3,257.70	1,331.80	34.7	4,554.80	3,257.70	321.5	1,047.34	35,103
1998	3,405.50	1,288.70	62.4	4,631.80	3,405.50	334.9	1,140.49	36,710
1999	3,587.90	957.5	182	4,363.40	3,587.90	340.7	1,222.42	38,721
2000	3,496.80	938.1	260.1	4,174.80	3,496.80	349.6	1,222.63	39,215
2001	3,461.20	1,251.40	223.3	4,489.30	3,461.20	352.8	1,221.01	38,795
2002	3,529.90	1,542.70	60.6	5,012.00	3,529.90	356.8	1,259.44	39,606
2003	3,224.90	479.2	22.6	3,681.50	3,224.90	360.4	1,162.15	26,057
2004	4,072.50	0	7.8	4,064.70	4,072.50	357.7	1,456.68	32,921
2005	4,043.10	545	4.9	4,583.20	4,043.10	353.7	1,429.90	44,275
2006	3,643.20	1,011.90	19.1	4,636.00	3,643.20	354.6	1,291.73	32,458
2007	3,490.20	1,323.60	30.6	4,783.20	3,490.20	355	1,239.03	39,842
2008	3,527.10	1,468.80	28.3	4,967.60	3,527.10	355	1,252.14	41,833
2009	3,406.20	1,014.60	30.4	4,390.40	3,406.20	357.3	1,216.83	38,959
2010	3,447.20	1,079.00	34	4,492.20	3,447.20	358.6	1,236.09	39,580

Appendix B

List of Sectors and Commodities in the Canadian Regional Cattle Sector Input-Output Model -- CRECSIO

Table B.1 List of Sectors in the Study Input-Output Model -- CRECSIO

Sectors
1 Crop and Animal Production
2 Forestry and Logging
3 Fishing, Hunting and Trapping
4 Support Activities for Agriculture and forestry
5 Mining and Oil and Gas Extraction
6 Utilities
7 Construction
8 Manufacturing
9 Wholesale Trade
10 Retail Trade
11 Transportation and Warehousing
12 Information and Cultural Industries
13 Finance, Insurance, Real Estate and Rental and Leasing
14 Professional, Scientific and Technical Services
15 Administrative and Support, Waste Management and Remediation Services
16 Educational Services
17 Health Care and Social Assistance
18 Arts, Entertainment and Recreation
19 Accommodation and Food Services
20 Other Services (Except Public Administration)
21 Operating, Office, Cafeteria and Laboratory Supplies
22 Travel, Entertainment, Advertising and Promotion
23 Transportation Margins
24 Non-Profit Institutions Serving Households
25 Government Sector

**Table B.2: List of Commodities in the Study
Input-Output Model -- CRECSIO**

Commodity
<i>Intermediate Commodities</i>
1 Grains
2 Other agricultural products
3 Forestry products
4 Fish and seafood and hunting and trapping products
5 Metal ores and concentrates
6 Mineral fuels
7 Non-metallic minerals
8 Services incidental to mining
9 Meat, fish and dairy products
10 Fruit, vegetable and other food products and feeds
11 Soft drinks and alcoholic beverages
12 Tobacco and tobacco products
13 Leather, rubber, and plastic products
14 Textile products
15 Hosiery, clothing and accessories
16 Lumber and wood products
17 Furniture and fixtures
18 Wood pulp, paper and paper products
19 Printing and publishing
20 Primary metal products
21 Fabricated metal products
22 Machinery
23 Motor vehicles, other transportation equipment and parts
24 Electrical, electronic and communication products
25 Non-metallic mineral products
26 Petroleum and coal products
27 Chemicals, pharmaceuticals and chemical products
28 Miscellaneous manufactured products
29 Residential building construction
30 Non-residential construction
31 Repair construction
32 Transportation and storage
33 Communications services
34 Other utilities
35 Wholesaling margins
36 Retailing margins and services
37 Gross imputed rent
38 Finance, insurance, and real estate services
39 Business and computer services
40 Education, tuition and other fees services
41 Health and social services

42 Accommodation services and meals
43 Other services
44 Transportation margins
45 Operating, office, cafeteria and laboratory supplies
46 Travel, entertainment, advertising and promotion
47 Services provided by non-profit institutions serving households
48 Government sector services
<i>Primary Inputs</i>
49 Non-competing imports
50 Unallocated imports and exports
51 Sales of other government services
52 Indirect taxes
53 Subsidies
54 Labor Income
55 Other operating surplus
56 Imports Interprovincial
57 Imports Foreign
58 Other Leakages

