COVID-19 and the Canadian Cattle/Beef Sector: Some Preliminary Analysis

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Abstract: Canada's cattle/beef sector has already weathered a shock after a 2003 case of BSE resulted in closed borders and industry restructuring. Now the sector has to adjust to similar shocks due to COVID-19. This paper examines the supply chain from the consumer up to the cow-calf producer by considering consumer reactions, labour market constraints, and supply response. A quarterly market model of North American cattle and beef markets is used to examine price and revenue impacts associated with the market disruptions. Depending on the scenario, there is considerable price and revenue suppression at all levels of the market.

Résumé: Le secteur canadien du bœuf a déjà subi un choc après qu'un cas d'ESB en 2003 eut entraîné la fermeture des frontières et la restructuration de l'industrie. Maintenant, le secteur doit s'adapter à des chocs similaires dus au COVID-19. Cet article examine la chaîne d'approvisionnement du consommateur au producteur de vache-veau en tenant compte des réactions des consommateurs, des contraintes du marché du travail et de la réponse de l'offre. Un modèle de marché trimestriel des marchés nord-américains du bœuf est utilisé pour examiner les effets sur les prix et les revenus associés aux perturbations du marché. Selon le scénario, il y a une compression considérable des prix et des revenus à tous les niveaux du marché.

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Introduction

While markets and individuals are reeling from COVID-19, there is a sense of *déjà vu* in Canadian cattle markets. Thicker borders, limited hook space in packing plants, and uncertainty about consumer reactions were all aspects of the 2003 BSE event. In each case, the market shock resulted in a rapid onset of the impacts. The difference is that COVID-19 is truly a health crisis. Moreover, it is the health of ranchers, feedlot staff, packing plant workers, transport drivers, grocery and distribution workers, and, finally, the population of consumers and their income status that is driving the impacts in the cattle and beef sector. As a result, the impact will be largely driven by logistics and negative income effects for consumer demand and not by traditional supply side drivers.

I will discuss the impacts of the pandemic on the cattle beef supply chain starting from the retail sector and working backwards to the primary producer. Most of the discussion will be descriptive, but, at the end of the article, I will employ a North American cattle/beef model to consider some possible broad-brush outcomes. Of course, any analysis of the impacts of COVID-19 on the Canadian cattle industry is at this time purely speculative and should only be used to help outline the potential boundaries of the economic impact and suggest potential avenues for further study.

Retail Behaviour

Some of the impacts on the consumer are already partially known. *Social distancing* has drastically changed consumer behaviour. Consumer food purchases have dramatically shifted from "food consumed away from home" to retail grocery sales. This creates logistical problems for wholesalers and retailers as they relocate products between sectors. Several trends have been identified for beef consumption as grocery shelves are being emptied by consumers in the anticipation of being quarantined in the future. "(A)ll the beef was gone

(except for a bit of ground beef), about half the pork was gone, and chicken was plentiful"
and, further, that new plant-based burgers are not being purchased (Lusk, 2020).

Certainly, this is an initial reaction and there is no particular reason for the trend to
continue. Current stock-outs occur because consumers are "forward buying" in anticipation
of future restricted mobility. The shortages have more to do with problems with in-store
logistics and not with shortages in the rest of the supply chain.[1] However, this behaviour has
resulted in rising retail beef prices while farm-level fed cattle cash prices are declining (16%
decline from the beginning of this year and a 9% decline year-over-year (McMillin, 2020)).
Part of this can be explained with a simple vertical two-level supply-demand fixed-unit
marketing margin graph (see Tomek & Robinson, 1990) where the retailer supply curve shifts
upward and to the left (because of increased logistics costs), retail prices increase, quantity
demanded and farm-level output decline, and so must farm-level prices. As a result, the
margin between retail and farm-level prices increases. However, this is only part of the story
and it is the other part that, in a slowing economy, does not bode well for beef. The Economic
Research Service (USDA) forecasts this year's U.S. beef production to be a record of 12.6
million tonnes (ERS, 2020). Total red meat and poultry production is also expected to set a
record at 49.6 million tonnes. This abundant supply has been built into CME Group Inc. live
cattle future prices. Cattle futures responded first to the fundamentals of declining global beef
demand relative to increasing production. Managed money that previously held long
positions for cattle futures exited those positions, adding momentum to the downturn trend in
fed cattle prices.

In the longer term, how much beef is consumed relative to other meats and how big
the retail-farm price margin is depends on the workings of the market. With lower incomes,

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[1] A hoarding response makes in-store logistics more challenging and shifts the composition of cuts to those that are more amenable to freezing.

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all prices in the beef supply chain will decline, farm/retail margins will return closer to long-run spreads, and beef consumption will decline because beef is the highest price protein available on a market where consumers are uncertain about their incomes. This adjustment is something that I will examine with model-based results, but first I have to consider an overview of potential supply chain adjustments in the the processing, feedlot, cow-calf, and international trade sectors.

Processing Sector

While the processing sector is not responsible for the current state of the beef and cattle sector, there is potential for future disruptions driven by this sector. First, the sector is labour intensive and, as such, is vulnerable to labour disruptions from COVID-19. The U.S. sector has a work environment where sick leave is rare (Sanker & Mulvany, 2020). Therefore, there is potential for transmission of the virus among workers, leading to packing plant processing interruptions. Second, Canada does not have enough packing capacity to accommodate all of the domestically produced slaughter cattle. Interruptions of shipments at the U.S. border, whether border thickening or a closure, present the same problems faced by the sector in 2003 when producers had nowhere to sell their cattle and faced suppressed prices.

Beef packing has already been hit by several recent shocks. Last summer, a fire at a Tyson meat packing plant destroyed about 5 to 6% of the U.S.'s beef processing capacity (Lusk, 2019). Beef packers in Canada and the U.S. face continual labour shortages. The U.S. Administration has discontinued new applications for the H2A guest worker program. Various producer groups across the U.S. are currently lobbying to reduce these restrictions. In Canada, temporary foreign workers have been used to help staff our two major beef packing plants. In 2014, changes to the *Temporary Foreign Workers* program made it more difficult for packing plants to find potential employees in Canada. Many questions remain: will travel

restrictions affect Canada's *Temporary Foreign Workers* program and the U.S. H2A guest worker program? Will livestock transport and other support services continue to operate as usual? Will lower petroleum prices reduce transport cost enough to offset other logistical problems? Will a weaker dollar affect imported inputs?

In order to attract and retain labour, North American meat processors have committed to pay extra money to farmers and slaughterhouse workers. Until May 3, Cargill has committed to pay U.S. and Canadian slaughterhouse workers a premium of $2 an hour, with a bonus of $500 to those who complete eight consecutive weekly shifts (Polansek, 2020). Maple Leaf Foods and Olymel have also said that they will give employees temporary pay increases or bonuses. Another positive consideration is that beef packing and processing plants are stringently regulated, continually inspected, and have numerous protocols which protect not only food safety but human health as well. It is unlikely that the sector will get through the next few months without any packing plant disruptions.[2] However, the disruptions are unlikely to be sustained because of built-in controls (e.g., sanitation protocols for meat and employees, health monitoring, etc.) in the industry and what appears to be a desire by the industry to be flexible and responsible.

Feedlot Sector

The feedlot sector is less likely to be disrupted by labour shortages, but there are potential ways that social distancing and labour shortages can affect the sector. First, feedlots procure feeder cattle and can market their fed cattle through auction barns. Second, feedlots depend on truckers to deliver their feed and ship their animals. To date, these disruptions have not

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[2] The Alberta beef packer, Harmony Beef, halted cattle slaughter on March 27 due to a positive test for COVID-19 by a Harmony worker (Johnson & Nickel, 2020). The halt in production is expected to be very short-term.

occurred. At the end of March, sales through public stockyards were proceeding, although feeder volumes have been lighter (Duckworth, 2020).

For the first quarter of 2020, live fed-cattle prices have taken the biggest hit relative to declines for feeder-calf prices or cull cattle prices. For instance, in March, feeder cattle prices declined by 9% while fed cattle prices fell by 16% relative to prices at the beginning of the year (McMillin, 2020). So far, the concern is the divergence between increasing boxed beef prices and declining fed cattle prices. It is much too soon to see a supply response. In the short-run, fed cattle can be held on feed somewhat longer. Over time, that trend has been for heavier carcass weights and there is some evidence that weights are even heavier this year, although there is a price discount[3] for both heavier fed and feeder cattle (Nalivka, 2020). Feedlot operators hope to buy feeder calves at a lower price and that the market will return to normal in six months.

If markets continue to be depressed into the second half of this year, feedlots will take actions and dramatically reduce placements. This will largely result in depressed prices for feeder calves, and the burden of adjustment will be passed further up the supply chain.

Cow-Calf Sector

Producers who graze backgrounders will also be negatively affected in the short term because they are normally selling weaned calves at this time of year, which go to a feedlot or to grass. Backlogs in feedlots will hold back placements of feeder calves in feedlots. Cow-calf producers are at the end of the supply chain, with a lag of two years before calves are marketed as slaughter cattle. Currently, their worries are six months away when spring calves will be taken to market.

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[3] See Canfax (2019) for a discussion of price slides where increasingly heavy cattle receive progressively lower prices.

Non-fed cattle prices in Canada have fared much better than the other classes of beef cattle in recent weeks. In mid-March, the D1-D2 cow average price was 1% higher than the same week a year ago, and cow slaughter was down 11% (McMillin, 2020). The impact on the cow-calf sector depends on how long the market disruptions continue. If the disruptions and a major recession continue into the fall, then ranchers will have to make a culling decision, as calves are weaned and breeding decisions are made for the following year. If problems persist at that time, cull cow and bull prices will start to rapidly decline. While in the first quarter increased hamburger sales helped to stabilize the price of culled animals, a prolonged recession and frozen stocks of lower quality cuts of meat will add to the downward pressure in cull cow and bull prices. Even with low cull animal prices, ranchers will decide to reduce their herds unless future prospects improve over the coming two years.

International Trade

On March 18, 2020, the Government of Canada announced that the U.S.-Canada border would be closed to non-essential travel (tourism and recreation). At the same time, assurances were given that travel restrictions and closures will not impact the flow of trade. Borders closed to the flow of live animals was the biggest obstacle associated with the BSE event. The U.S. border was closed to animals aged under thirty months of age for 26 months after May 20, 2003, and the U.S. border was closed to older cattle for 53 months (Western Producer, 2013). Between the second and third quarters of 2003, Canadian fed cattle prices fell 47%, feeder prices fell 20%, and cull cow prices fell 64% (AAFC, 2016). The situation at that time was more dire because shackle space in packing plants was more limited and there was simply nowhere for the cattle to be slaughtered. This situation was particularly dire for cull cattle, whereas today ground beef appears to be more in demand than more expensive cuts and, therefore, cull animals are in demand.

Early in 2020, the potential for offshore exports of beef was particularly promising because *African Swine Fever* had decimated hog herds in China, and world markets for animal proteins were becoming very tight. As markets begin to stabilize after the initial shock of COVID-19, offshore beef and other meat demand should help the Canadian beef cattle sector to recover from the initial shock.

Border thickening involves regulations and costs which result in slowdowns and difficulties for moving people and goods. A lack of inspectors, truck drivers, and customs officials can lead to thicker borders. Border thickening can also result from political uncertainties increase the risk of further border disruptions.

The worst case trade scenario would involve a U.S. border closure to exports of live animals and beef to the U.S. This is unlikely to happen for cattle and beef and not for other sectors. A more likely outcome involves border thickening. One particularly worrying prospect for border thickening involves calls for the U.S. to re-introduce mandatory *country of origin labelling* (Kelloway, 2020). At this time, lobbying to re-introduce mandatory country of origin labelling is likely to be drowned out by other concerns. So logistical frictions, labour shortages for inspectors and customs agents, and interruptions for trucking will be the largest contributors to border thickening. A weaker Canadian dollar will make our exports more competitive and this should off-set some of the costs of border thickening.

Model Set-up

This study uses a model developed by Rude and Goddard (2016), who constructed a quarterly econometric simulation model (1990 Q1-2017 Q4) that mimics North American beef and cattle markets.[4] Three scenarios are considered: a *best guess* case (BGS), a pessimistic case,

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[4] The modelling approach explicitly accounts for the impact of COVID-19 on market prices and on quantities produced, traded, and consumed. The model provides a broad array of information that describes the North

and a more optimistic case. These scenarios are not chosen to provide a forecast because there are simply too many unknowns. Rather, the scenarios are intended to illustrate and flesh out some of the issues raised in the descriptive analysis above. Each scenario involves an income shock, a wage increase in beef packing plants, and an autonomous decrease in packer demand for slaughter cattle because of operation disruptions.

Table 1 describes percentage changes of shocked results relative to the baseline. The shocks are applied to the model's exogenous variables over a two-year simulation period, which corresponds to the 2016Q1-2017Q4 baseline data. In each case, no distinction is made between the U.S. and Canadian markets or processers, and the shocks are applied equally. The derivation of the shocks is briefly described in table footnotes. The income and packing plant wage shocks are applied as percentage changes from baseline exogenous variables. In the case of slaughter demand, it is unlikely that the North American meat packing will get through the simulation period without any packing plant disruptions. Shanker and Mulvany (2020) report that some companies are already slowing their processing lines by 20% to 30% as employees stay home to recover from illness or take care of family members. In the *BGS* and pessimistic scenarios, I apply an autonomous reduction in packer demand (i.e., an intercept shifter). In the *BGS*, the slowdowns are averaged and spread over two quarters, while they are doubled and applied over the simulation period in the pessimistic case.

Model Results

The three scenarios are presented below with the *best guess* scenario considered first. Given the large volume of possible results, I will only consider the percentage change in retail beef,

American cattle/beef market. The model estimates farm prices and quantities produced, traded, and consumed. The model provides a broad array of information that describes the North American cattle/beef market. The model estimates farm- level and wholesale prices for live cattle and beef; breeding inventories, the supply of fed and non-fed cattle that are marketed; packer demand for cattle; final consumer demand for beef; and net trade in cattle and beef. The model is first solved to create a baseline for the 2016 Q1-2017 Q4 period. This baseline is then used as the basis of comparison against the different "what- if" scenarios

fed steer, and feeder prices. Supply responses are aggregated into an overall all-revenue estimate for the marketing of feed, feeder, and cull cattle. Table 2 presents the *best guess* impacts.

The first quarter *BGS* simulation results are roughly similar to actual market behaviour. Although I show virtually no change in retail prices, actual prices have increased due to hoarding behaviour. The impact on fed steer prices is large and negative, but not as large as the decline in the CME futures price which has already accounted for built-in expectations for mid-year economic impacts. As expected, the effect on feeder prices is more muted and lags the impact on fed cattle prices. Supply responds to lower prices but with a lag, and, consequently, the negative revenue effects linger into 2021 and only start a weak recovery in the third quarter.

Second quarter and third quarter negative impacts dominate the other results, with markets starting to improve in the last quarter of 2020 and into 2021. Feeder cattle and revenues are slower to recover, and the negative effects push the sector recovery into 2021.

Table 3 shows a rough confidence interval for the COVID-19 impacts. The pessimistic scenario shows the most interesting results, where lingering effects are spread further into 2021 and cattle prices start to weaken again in the second quarter. These impacts are driven by declining packer demand associated with operational problems. In fact, these operational problems offset improving macroeconomic conditions as GDP returns to baseline levels. The other factor driving the negative impacts results from lagged supply responses.

Implications

Certainly, the longer the recession lingers, the more adverse the impacts are for the beef sector. A V-shaped recovery for the economy will help as long as there are no other disruptive labour market effects in the processing industry. Currently, *timing* is driving most of the impacts in the cattle beef sectors. In the short-run, there is little connection between what is happening in the live cattle markets versus retail meat markets. It is difficult to determine what may happen to consumer demand after the COVID-19 recession. Consumer tastes and buying patterns may return to normal, but this period of profound adjustment may change buying patterns as consumers face a more uncertain future with the prospect of future pandemics. Logistical problems across the cattle and beef supply chain should decline as agents become accustomed to social distancing and other mobility/quarantine regulations. Eventually the effects of the pandemic will pass.

Canadian cattle inventories peaked in 2005 and have since declined by 25%. U.S. cattle inventories appear to have peaked after five years of expansion and are currently at the highest level since 2008. The Canadian cattle sector would have faced downward price pressures in any event. The long-run question is: which direction will the Canadian beef herd move in? In the pessimistic scenario, by the end of the simulation period, the herd declines a further 7% relative to the baseline. Even the optimistic scenario results in a 1% decline relative to the baseline at the end of the simulation period. This is a crucial juncture for the Canadian cattle/beef sector. Will the cattle sector continue to contract because of the COVID-19 shock or will it expand in response to growing global demand for animal protein?

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Table 1. Assumptions for exogenous shocks

	Income			Wage			Slaughter Demand Intercept		
	BGS[a]	Optimism[b]	Pessimism[c]	BGS[d]	Optimism	Pessimism[e]	BGS[f]	Optimism	Pessimism[g]
Y1:Q1	-4%	-2%	-6%	0%	0%	10%	0%	0%	0%
Y1:Q2	-14%	-7%	-24%	2%	0%	10%	-2%	0%	-5%
Y1:Q3	-5%	-2%	-6%	2%	0%	10%	-2%	0%	-5%
Y1:Q4	-1%	0%	-1%	0%	0%	10%	0%	0%	-5%
Y2-all	0%	0%	0%	0%	0%	10%	0%	0%	-5%

[a] Derived from J.P. Morgan (2020) projections & recession extended to Q3 to Q4 rather than JPMorgan Q3 recovery
[b] Half of the BGS (*best guess* scenario) income projection
[c] Derived from Goldman Sachs (2020) projection with extended Q3 and Q4 recession
[d] One month Cargill 10% wage increase allocated across Q2 and Q4 and applied to entire industry
[e] Cargill wage increase applied across all periods and applied to entire industry
[f] A reported 20-30% slowing of processing lines (Shanker & Mulvany, 2020) is evenly spread over Q3 and Q4
[g] Double of the BGS (*best guess* scenario) disruption projection is spread over entire simulation

Table 2. Best Guess Scenario (BGS)

Year	%Δretail price	%Δsteer price	%Δfeeder Price	%Δrevenue Overall
Y1 Q1	-0.06%	-5.23%	-2.50%	-5.21%
Y1 Q2	-12.33%	-26.07%	-12.78%	-26.93%
Y1 Q3	-9.03%	-19.32%	-15.78%	-22.48%
Y1 Q4	-6.24%	-1.44%	-11.35%	-10.66%
Y2 Q1	-3.99%	3.15%	-6.05%	-3.83%
Y2 Q2	-2.68%	1.87%	-3.05%	0.37%
Y2 Q3	-2.10%	0.98%	-1.72%	1.06%
Y2 Q4	-1.68%	0.67%	-1.02%	0.51%

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Table 3. Optimistic and Pessimistic Scenarios

Year	Optimistic				Pessimistic			
	%Δretail price	%Δsteer Price	%Δfeeder price	%Δrevenue overall	%Δretail price	%Δsteer Price	%Δfeeder price	%Δrevenue Overall
Y1 Q1	0.17%	-2.62%	-1.26%	-2.61%	-1.01%	-7.76%	-3.72%	-7.75%
Y1 Q2	-1.65%	-10.05%	-5.11%	-10.58%	-35.42%	-41.21%	-25.86%	-43.61%
Y1 Q3	-2.10%	-4.83%	-5.20%	-6.45%	-15.90%	-30.57%	-28.65%	-34.82%
Y1 Q4	-2.25%	-0.59%	-3.78%	-4.26%	-11.74%	-13.13%	-24.50%	-25.24%
Y2 Q1	-1.76%	1.11%	-1.99%	-0.94%	-10.65%	-8.01%	-19.12%	-17.53%
Y2 Q2	-1.28%	0.84%	-0.91%	0.20%	-9.73%	-9.10%	-15.77%	-13.94%
Y2 Q3	-1.01%	0.52%	-0.43%	0.48%	-9.37%	-11.55%	-14.79%	-14.97%
Y2 Q4	-0.81%	0.36%	-0.19%	0.27%	-10.22%	-13.71%	-15.35%	-15.93%