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Carbon Pricing and the Canadian Beef Sector

This summary is taken from the report “Carbon Pricing and the Canadian Beef Sector” by Brandon Schaufele, Assistant Professor Graburn Economics and Ivey Business School, Western University. Special Thanks to the funders: British Columbia Cattlemen’s Association, Alberta Beef Producers, Saskatchewan Cattlemen’s Association, Manitoba Beef Producers, and the Beef Farmers of Ontario.

INTRODUCTION

Canada has committed to pricing carbon dioxide emissions. These prices may be explicit taxes as in Alberta and British Columbia or they may be determined via cap-and-trade systems like the one linking Ontario and Quebec to California. There are concerns about the implications of Canada’s commitment to carbon pricing, especially because the policy is being unilaterally implemented. **Unilateral implementation** means that Canada is proceeding with carbon pricing even as the other major cattle producers do not. Cattle markets are globally integrated, so the fear is that even a small increase in costs, due to a carbon levy, may jeopardize the sector’s international competitiveness.

With 45% of Canadian beef production exported, the beef sector is susceptible to both domestic and international pressures that are challenging to avoid. Leakage, due to this international integration, is a key concern for both the sector and for policy-makers. The term leakage refers to an unintended consequence of carbon pricing. Producers in highly traded sectors face perfectly elastic demand at world prices. The fear is the carbon price will lead Canadian producers to decrease their output – indeed, the purpose of carbon pricing in sectors such as cattle is to decrease output. Decreased output means fewer calves are sold and less profit for the sector. But because Canada is acting alone on carbon pricing, other cattle producing regions will respond to Canada’s reduced production by increasing their output.

In a pessimistic scenario, all the carbon price accomplishes is an off-shoring of emissions (with little net improvement in global emissions), in conjunction with a smaller Canadian beef cattle industry. **Leakage** yields a reduction in domestic competitiveness with minimal environmental benefit. Of course, whether leakage is

meaningful in a real-world context is an empirical question.

The Government of Canada will implement its Backstop Carbon Pricing Policy on January 1, 2018. Mandated carbon prices start at \$10 per tonne carbon dioxide-equivalent (tCO₂e), increasing by an additional \$10/tCO₂e each year for five years, reaching \$50/tCO₂e in 2022¹. The overwhelming consensus is that market based programs, are the most effective policies available to governments to reduce CO₂ emissions while allowing industry to find the least cost method to improve environmental performance². Given this progression in carbon prices, scenarios are calculated at \$20/tCO₂e and \$40/tCO₂e, with and without a farm fuel exemption, to provide an estimate of the costs across the spectrum that the provinces will face over the coming years.

Energy consumption is a small share of the overall costs of most cattle operations, typically accounting for less than 5% of a feedlot’s or cow-calf enterprise’s net-of-cattle costs. But it must be remembered that carbon prices interact with other features of the cattle market and even small increases in costs can have large implications as they influence decision making. Increasing the price of fuels, for instance, leads to increased energy costs that could result in: decreased profits, reduction in herd sizes, or more firms exiting the industry.

EXISTING CARBON POLICIES

Canada does not have a uniform carbon pricing policy. Each province and territory is expected to implement its own system. The Federal Government has committed to a “Federal Carbon Pricing Backstop”, a policy that sets the minimum stringency for the provincial programs. To date, Alberta and British Columbia have implemented carbon taxes, while Ontario and Quebec have cap-and-trade programs. Basic economic theory illustrates that these

¹ Canada’s existing carbon pricing policies focus on emissions from the combustion of fossil fuels, covering approximately 70% of total emissions. Fugitive emissions from manure and soils and methane from enteric fermentation are not included in the tax base. Dyed fuels intended for on-farm use are also exempted in British Columbia, Alberta, and the federal backstop policy.

² Rather than forcing businesses to use potentially inefficient technologies.

two policies are equivalent in an ideal setting. However, key differences emerge in practice - particularly around exemptions³. The cost of a carbon pricing policy is determined by two factors, the price/rate and the tax base covered. The tax base covered is extremely important for the agricultural sector. For example, whether a provincial or territorial government includes a farm fuel exemption will be determined on a case-by-case basis. Currently, both British Columbia and Alberta exempt dyed fuels, while Ontario and Quebec do not.

British Columbia and Quebec have pre-existing carbon pricing policies that started in 2008 and 2007/13⁴ respectively. This makes it possible to observe the actual ramifications of carbon pricing on the cattle sectors there compared to other provinces (Alberta and Ontario) as a control group. However, the results should be viewed with caution as (1) they both have relatively small production and therefore are not ideal case studies; (2) Quebec had a notable pre-trend in its sector due to prior policy changes; and (3) the BC policy coincided with the 2008 global financial crisis which impacted all sectors. Therefore, these estimates are likely overstating the true impact of the carbon pricing on the cattle sector.

The econometric evidence suggests that a \$25/tCO₂e carbon price resulted in a 100,000 head reduction in the provincial herds. However, the farm fuel exemption granted by British Columbia in 2012 reverses the majority of this negative effect. By exempting dyed fuels used on-farm 80,000 head are restored to the provincial herd, implying that the farm fuel exemptions do provide meaningful, but not complete, relief to the sector. Hence, ***carbon pricing led to large reductions in herd sizes, but farm fuel exemptions greatly reduced the impact.***

The results on head slaughtered are not statistically significant. Which is not surprising as neither provinces have a packer sector of notable size.

Pass-through of Carbon Pricing

Agriculture is trade dependent and subject to international competition. Therefore, it is generally thought that producers are unable to pass on higher costs to consumers as prices are set in the larger global marketplace. However, there is little evidence supporting this position as regional shocks are needed to prove it. Generally, shocks, such as increases in fertilizer or oil

prices, are global in nature. Increases in oil prices affect the cattle industry not only in Canada, but also elsewhere in the world. The important characteristic of Canada's carbon pricing policy, however, is that it is unilateral. This means that it will only change the cost structure of Canadian enterprises while leaving producers in the rest of the world unaffected.

Separate econometric analysis investigates the prospect for passing-along a share of the carbon pricing-related costs to consumers or to other levels of the market. Historical changes in fuel excise taxes, in both Alberta and Ontario, are used to demonstrate that it is extremely unlikely that producers will be able to pass-through any unilaterally implemented carbon price at any stage of the supply chain (feedlot or cow-calf). Rather, each will bear the majority of the carbon price independent of the effects at other stages of the supply chain. This suggests that competitive international markets play a role for both weaned calf prices and for fed cattle prices.

COW-CALF SECTOR

Carbon pricing has two costs for producers. First, there is a technical cost effect, which reflects the carbon price's direct and indirect increases in input costs. This is the "bottom-line" effect for producers that is seen over the short-term. Second, there is an output effect, which measures the contraction in industry size that results from a carbon price over the long-term. The consequences of the output effect, can be nearly as important as the cost effect. This larger output response results from the absence of a demand response⁵ and farmers bear the full burden of the carbon price. Both of these effects must be summed to obtain the total private⁶ cost of carbon pricing for cow-calf producers.

Technical Costs

Technical costs reflect the direct and indirect increases in input costs. Energy costs will increase as will the cost of other inputs via the carbon prices indirect effects. For example, the cost of feed for Alberta cow-calf operations is estimated to increase by \$8.56 per calf with a \$40/tCO₂e carbon price.

Under Alberta's current system at \$20/tCO₂e, with a farm fuel exemption, the cost of production is estimated to increase 1.3% (\$1.55/cwt) compared to the five-year

³ All Canadian carbon pricing policies also exempt emissions from enteric fermentation. Enteric fermentation is the largest unpriced source of greenhouse gas emissions in many countries, including Canada. (Globally, no country levies a fee on enteric fermentation.)

⁴ Quebec had a small carbon tax of approximately \$3/t CO₂e, but formally launched their cap and trade system in January 2013.

⁵ As cattle prices are set in a global market, Canada is too small to influence global prices.

⁶ Private costs (as opposed to social costs) as measured as the change in producer surplus (that is the producer's contribution to fixed costs and net margins). This requires establishing a counterfactual scenario.

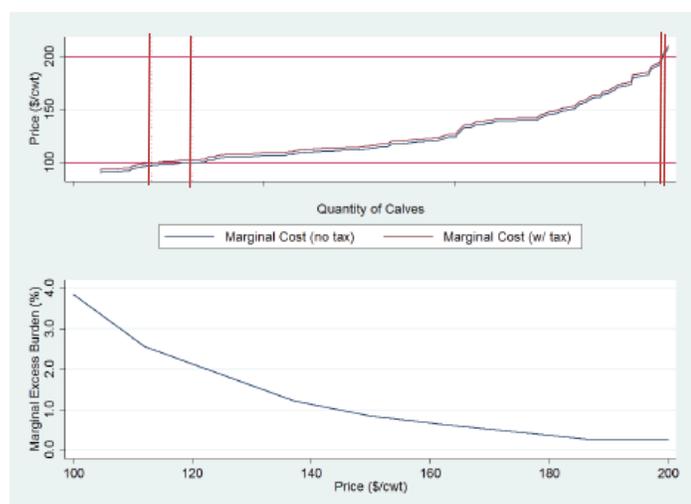
average and at \$40/tCO₂e increase 1.4% (\$1.87/cwt). In Ontario, with no farm fuel exemption, the cost of production is estimated to increase 0.6% (\$1.19/cwt) and 1.2% (\$2.37/cwt) at \$20 and \$40/tCO₂e respectively. The dollar impact in Ontario is higher than Alberta at \$40/tCO₂e despite a lower percentage impact due to the higher cost of production in Ontario.

Output Costs

A unique farm-level dataset and leading-edge econometric methods enabled especially detailed analysis of the output effect for cow-calf producers. It was possible to reconstruct a full supply function for the market and estimate different supply elasticities at different price levels.

Figure 1 shows when calf prices are high, as shown by the horizontal line at \$200/cwt, the marginal cost function is nearly vertical and output responses are negligible with a marginal excess burden (bottom panel) equally 0.26%. As prices decline however, the supply curve becomes increasingly elastic (flatter) and the output response grows rapidly and nonlinearly⁷. At \$100/cwt, the marginal excess burden in this scenario is 3.85%. So, even though prices only fell by 50%, the marginal burden increased nearly 15 fold.

Figure 1. Implications of a \$40/tCO₂e Carbon price on Alberta’s cow-calf industry



This nonlinear supply curve results in a larger negative impact when calf prices are lower. Hence, the output effect can be large, even for small changes in costs. This is because not only is there a lower calf price that pressures margins; but at these lower calf prices the impact of the carbon price is proportionately larger – combined these

both impact the output response and decisions made by producers. Therefore, when the calf price is low, the implications of even a small carbon price can be substantial.

The size of the output effect in Alberta ranges from a low of \$0.16 at \$20/tCO₂e and \$200/cwt calf price to a high of \$1.22/cwt at \$40/tCO₂e and \$100/cwt calf price. The estimates for Ontario are similar although with a slightly wider range at \$0.12 to \$1.74/cwt.

Total Producer Costs

Table 1 summarizes the estimated total costs of carbon pricing for Alberta and Ontario cow-calf producers. In Alberta, fuels used on-farm are exempted from the carbon price, while in Ontario they are not. Using average baseline pre-carbon pricing operating costs of \$119.05/cwt for Alberta and \$198.00/cwt for Ontario, the increased percent of operating costs range from 0.66% in Ontario with high calf prices to 2.41% of operating costs in Alberta with a \$40/tCO₂e carbon price and low calf prices.

Carbon Price	\$20/tCO ₂ e		\$40/tCO ₂ e	
	\$100/cwt	\$200/cwt	\$100/cwt	\$200/cwt
Alberta (<i>with farm fuel exemption</i>)	2.70	1.71	3.61	2.04
Ontario (<i>No farm fuel exemption</i>)	2.07	1.32	4.11	2.61

Over the period analyzed, Alberta’s AgriProfit\$ model reports gross margins of \$5.80/cwt. After adjusting for unpaid labour, these decline to \$4.60/cwt. These estimates are based on an average price of \$182/cwt of weaned calf. This means that **even with the farm fuel exemption a \$40/tCO₂e carbon price will reduce gross margins by approximately 1/4 to 1/3**. Moreover, this could increase rapidly if calf prices fall.

Caution is needed in interpreting these numbers. The entire point of the output response is that marginal, and hence average, costs will change⁸. But it is not obvious how the total operating costs will change with an evolving industry structure.

FEEDLOT SECTOR

The feedlot analysis had three steps. First, the long-run relationship between feeder cattle, fed cattle and oil prices is estimated in a pass-through analysis. Second, the technical cost increase for feedlots is estimated. Third, the total costs (technical and output) of the carbon price are calculated.

⁷ This increased elasticity is driven by the sector’s underlying technology, which is highly dependent on land quality and weather.

⁸ See page 20 of the full report for a discussion on the different impacts of marginal vs. average cost analysis.

Pass-Through Analysis

Over short periods of time cattle prices and, say, oil prices might appear random, but over longer periods they are connected, because fuel is an essential input into the feedlot sector. Changes in the commodity costs of fuel will eventually lead to changes in fed calf production and in turn changes in fed calf prices. Of course, the same reasoning applies to the relationship between feeder and fed cattle prices.

In Alberta, every \$1 increase in oil prices leads to an \$0.85 increase in fed cattle prices in the long-run. For Ontario, the pass-through rate is slightly smaller at \$0.79. Interestingly, the short-run dynamics of oil price shocks indicate that initially fed cattle prices decrease slightly before eventually incorporating the higher oil prices. The relationship between prices at different levels of supply chain follows a similar pattern, but the magnitudes of the pass-through effects are distinct. The long-run pass-through rate from feeder to fed cattle prices is actually smaller than the oil to fed cattle pass-through rate. The price pass-through coefficient is 0.71 in Alberta and 0.52 in Ontario. At the same time the short-run response is negative and larger for both provinces, equaling -0.18 and -0.22 in Alberta and Ontario, respectively.

Alberta	Oil Prices	Feeder Cattle
Short-Run	-0.04**	-0.18***
Long-Run	0.85***	0.71***
Ontario	Oil Prices	Feeder Cattle
Short-Run	-0.04***	-0.22***
Long-Run	0.79***	0.52***

The average cost estimates from the Canfax TRENDS model closely match the implied marginal costs from the pass-through analysis. Hence, it is likely that the average and marginal cost curves are relatively flat.

Technical Costs

These direct and indirect input cost increases were determined by using the computable general equilibrium model, the crop enterprise budgets and Canfax's TRENDS model. Average projected costs for the 2016 model, based on a steer entering at 550 lb and exiting at 1375 lbs, is used as the benchmark. A key assumption, is that feedlots are not able to squeeze cow-calf margins by reducing the price paid for weaned calves. Likewise, feedlots do not face higher calf prices due to the carbon tax. Instead, this analysis considers only those direct and indirect costs incurred at the feedlot level of the market.

Table 3 shows that a \$20/tCO_{2e} carbon price in Alberta, with a farm fuel exemption, will yield a \$0.81/cwt cost increase, representing 0.55% of total operating costs. In Ontario and Quebec, without the exemption, it will yield a \$1.11/cwt cost increase, representing 0.76% of total operating costs. At \$40/tCO_{2e}, the costs increase to \$1.35/cwt, or 0.92% of costs, with the farm fuel exemption and \$1.87/cwt, or 1.28% of costs, without it.

Table 3. Technical costs increase on feedlots (\$/cwt)

Carbon Price	\$20/tCO _{2e}	\$40/tCO _{2e}
No farm fuel exemption	\$1.11/cwt	\$1.87/cwt
With farm fuel exemption	\$0.81/cwt	\$1.35/cwt

A key point on these cost increases is that they assume that there is no change in feeding practices. In the crop enterprise budgets, the percent increase in the cost of barley is greater than that for silage. Firms are able to substitute across different inputs. Substitution possibilities are perceived to be small in the feedlot (and cow-calf) industries, yet they do exist⁹. Hence, these numbers can be considered an upper bound and potentially over-estimate of the true effect.

Total Producer Costs

Similar to the cow-calf sector, feedlots have both technical and output costs from carbon pricing. However in the feedlot analysis, data limitations prevented calculating the output effect at different price levels. Instead, a single "average" elasticity of supply was estimated.¹⁰ Table 4 presents the total estimated producer costs for Canadian feedlots. At \$20/tCO_{2e}, feedlots will see a 0.75% and 1.03% increase in operating costs with and without the fuel exemption. At \$40/tCO_{2e} the corresponding values are 1.25% and 1.73%.

Carbon Price	\$20/tCO _{2e}	\$40/tCO _{2e}
No farm fuel exemption	1.50	2.53
With farm fuel exemption	1.10	1.83

CONCLUSIONS

The output effect can be large, even for small changes in costs. This larger output response results from the absence of a demand response. So, farms bear the full burden of the tax. In addition, a nonlinear supply curve results in greater impact at lower prices.

In a global carbon pricing scenario, it is possible to pass through increased costs to consumers. This would eliminate the competitiveness concerns and enable the global industry to share the burden with consumers.

Finally, given the unique characteristics of the agricultural sector, limited input-specific exemptions, such as those on dyed fuels used for on-farm activities, or price-contingent exemptions are recommended as practical safety valve mechanisms to offset potential leakage and competitiveness problems.

⁹ For example, as Ontario's electricity prices increased in 2016-17, feedlot operators were more judicious with their water heaters during the winter months. Anecdotally several opted to actively managed their equipment, rather than treat the heaters as always-run. This implies substitution between (potentially uncompensated) labour and energy. An increase in labour hours – active management – took the place of energy-usage - electricity in this context.

¹⁰ The elasticities in this report (0.74 and 0.67) were similar to the literature (0.84 and 0.71). A midpoint of 0.71 was used in the analysis.