Lawrence National Centre for Policy and Management

Lawrence Centre
Ivey Business School
Western University
1255 Western Rd
London, ON N6G 0N1 Canada

TEL 519-661-4253
FAX 519-661-4297
www.ivey.uwo.ca

LONDON | TORONTO | HONG KONG

Remarks to the Standing Senate Committee on Agriculture and Forestry

Good morning. Thank you for allowing me the opportunity to meet with the Standing Senate Committee on Agriculture and Forestry. It is an honour to be invited and I sincerely hope that the information that Professor Rivers and I provide assists the Committee as it prepares its report into the effects of climate change on the agriculture, agri-food and forestry sectors.

The Committee's Order of Reference emphasizes three dimensions:

a) The adaptability and resilience of the agriculture, agri-food and forestry sectors to a changing climate;
b) The repercussions of carbon pricing mechanisms on the competitiveness of stakeholders in the agriculture, agri-food and forestry sectors; and
c) The role of the federal, provincial and territorial governments in meeting targets for greenhouse gas emission reductions.

I hope to speak to each of these dimensions by discussing three studies. The first study examines the effect of climate change on agricultural productivity of land, and as a consequence its influence on land values, in the province of Saskatchewan. The second study looks at the implications of carbon pricing, specifically British Columbia's carbon tax, on the international trade in selected agricultural commodities. Finally, I will present some results on the effect of carbon pricing on the competitiveness of the Albertan beef cattle sector.

There is no simple summary of these research results. For some Canadian farmers, climate change implies higher yields and longer growing seasons. For others, extreme heat will dramatically reduce productivity. Likewise the burden of carbon taxes could be quite high if provincial policies adopt broad base approaches that cover farm fuels and emissions from enteric fermentation. Conversely the exemptions granted under Alberta's carbon tax policy, for example, imply very small changes in costs for most producers.

The current consensus is that the implications of climate change on the agricultural sector will have what is known as "nonlinear effects". The term nonlinear means that a small change in inputs – for example, small changes in temperature or precipitation or the global price of a commodity – will lead to disproportionate changes in output – whether that's measured in bushels per acre or producer surplus per head of cattle.

Yields and Land Values in Saskatchewan

Nowhere is this disproportional change more apparent than in the study on Saskatchewan agricultural productivity that Professor Rivers and I are undertaking.

As part of this study, we developed a model to forecast the expected change in yield per acre of different rural municipalities in Saskatchewan as a function of temperature. This is done via a two-step procedure. First, we look at the historical relationship between temperature and yield. The first graph illustrates this vital agronomic relationship between temperature and yield.

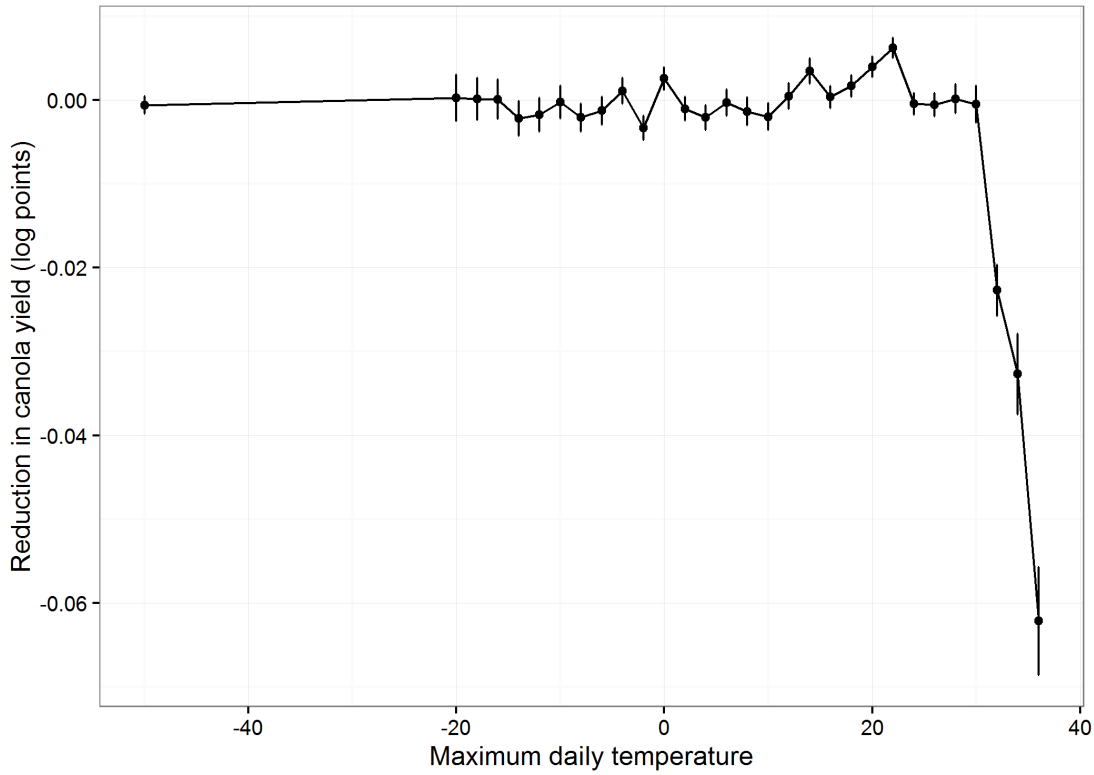

Figure 1

This figure is for canola and the important feature is the sharp decline that occurs once maximum daily temperatures exceed 30C. This means is that even a few really hot hours in a day, where hot hours are defined as being warmer than 30C, leads to dramatically lower productivity. The second step then uses these estimates in conjunction with Environment and Climate Change Canada's climate change scenarios to forecast the change in yields that we would expect in each rural municipality. The second graph that I've given you depicts the results from this step.

Areas shaded with lighter, green colours will experience an increase in yields due to warmer temperatures. The dark red regions will see a decrease in yields. The immediate takeaway from this analysis is that some regions of Saskatchewan, such as Porcupine in the Northeast, are advantaged by warming temperatures, while others, such as Maple Creek in the Southwest, are disadvantaged.

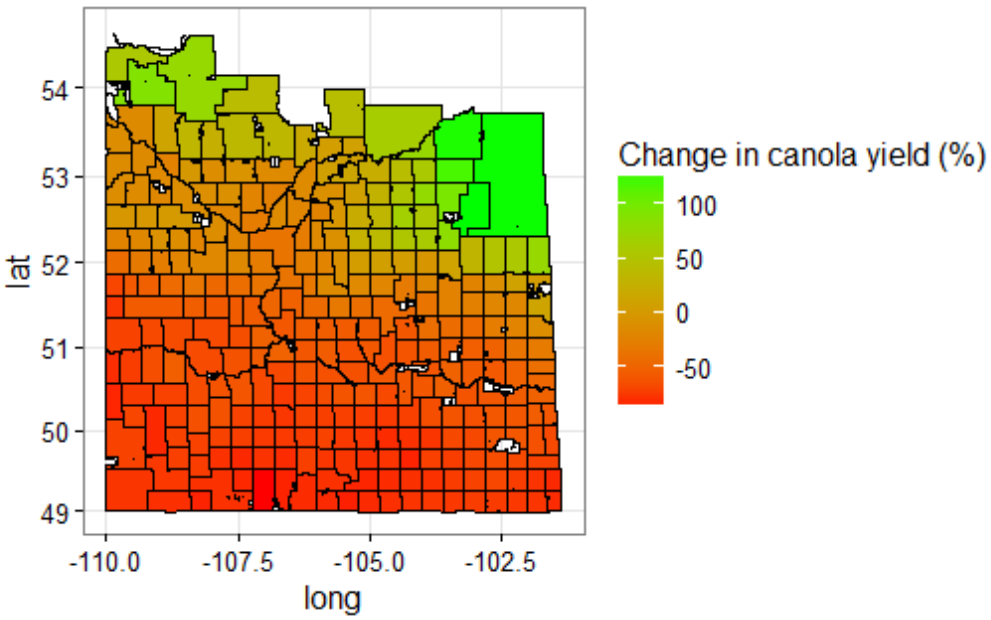

Figure 2

There are two additional points to make with respect to this analysis. First, across all rural municipalities in Saskatchewan, we estimate a modest net loss to the sector of $256M. Second, land values in the province appear to have capitalized in a business as usual forecast of climate change.

Carbon Taxes and Agricultural Trade

Next allow me to discuss the relationship between carbon pricing and agricultural trade. A major concern for many trade-exposed industries, such as agriculture, is the potential for carbon leakage. Leakage is the idea that, say, putting a price on carbon emissions in Canada will shrink domestic industries, thus reducing global emissions. But, because global trade is so vital for these sectors, firms in other jurisdictions are able to grow in response to the smaller Canadian output and fill the gap. Ultimately, this offshore growth will emit more carbon dioxide, offsetting some or all of the emissions reductions that occurred in Canada. The net effect then is no change in global emissions, just foregone Canadian output.

Leakage is a major concern when jurisdictions unilaterally implement carbon pricing. One place where we would expect to detect leakage is in the trade statistics. As a result, Professor Rivers and I conducted an empirical investigation into whether British Columbia's unilaterally implemented carbon tax had any effect on that province's net agricultural trade flows.

Our conclusion was that it didn't. British Columbia's carbon tax had no detectable effect on the province's agricultural trade flows. This is depicted in the third graph. The circles reflect the average estimated effect, while the bars provide a 95% confidence interval.

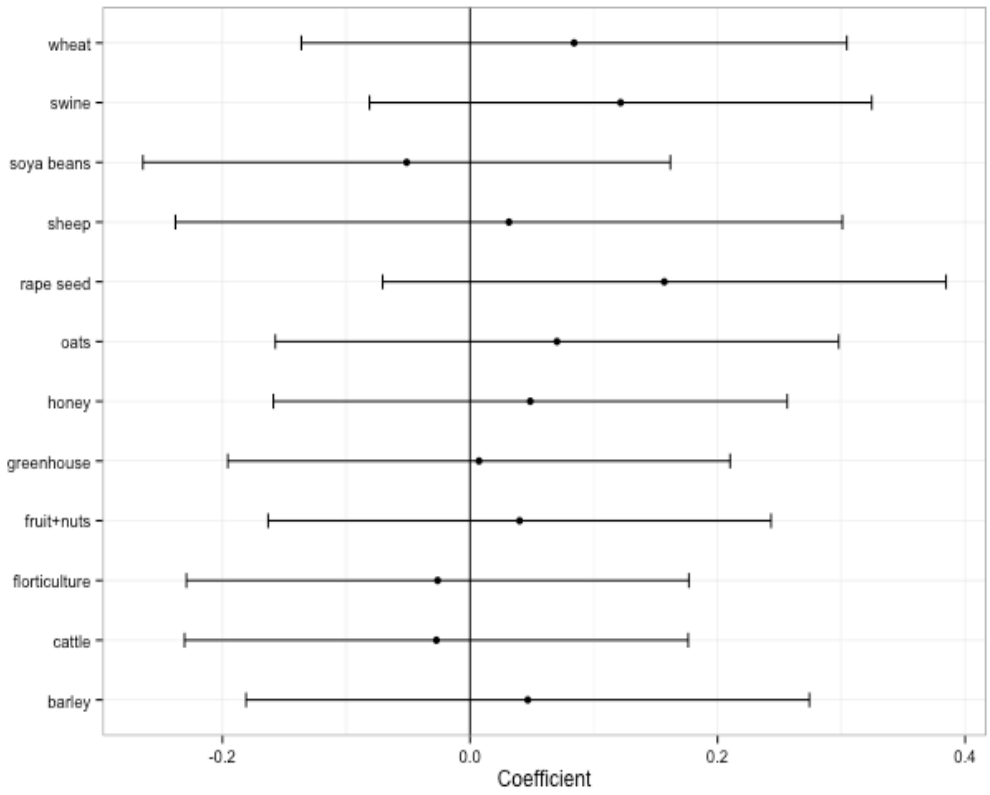

Figure 3

There are two additional points on this study. First, it is important to emphasize that a lack of evidence of an effect is not the same thing as there being no effect. Our estimates are statistically imprecise. It may be the case that with better data leakage would be observed. This leads to my second point. Recently, I replicated this analysis for cattle using a different dataset and a longer time span. These new results suggest that British Columbia's carbon tax did adversely affect cattle trade, but that the farm fuel exemption introduced in 2012 reversed almost all of the leakage.

Carbon Taxes and Cattle in Alberta

This brings me to the final study, which focuses on the Canadian cattle sector. For highly traded commodities such as cattle, prices are set on a global market. This means that domestic producers have very limited ability to pass through additional costs of any sort to consumers. As with the trade study, higher costs due to carbon taxation implies a smaller domestic cattle industry. This is the fundamental concern over competitiveness. Like with the other studies however, reality is more nuanced than the simple model.

When economists measure the economic costs of a tax, we look at quantities called deadweight losses or excess burdens. It turns out that the economic cost, or excess burden, to the Canadian cattle sector from a carbon tax depends on the state of the industry. When cattle prices are low, carbon taxes amplify the downturn for the sector, and the excess burden, or economic costs of the tax, is high. In contrast, when prices are high, the economic costs of carbon taxes are small. This phenomenon arises because of the sideways s-shape in last graph.

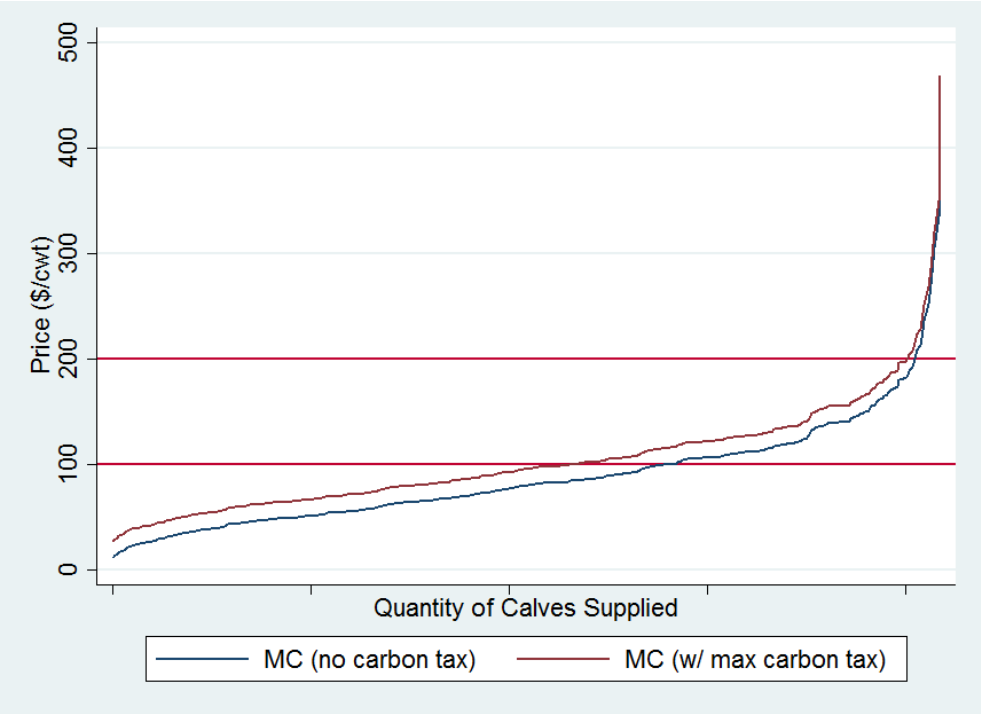

Figure 4

This figure illustrates the industry supply function for Albertan cow-calf producers. A supply function reflects how many calves will be supplied at a given price – both with and without a carbon tax. The red line illustrates the implications of a maximum carbon tax, not the one that Alberta actually implemented. Once the farm fuel exemptions and output based rebates for electricity are considered, the actual cost of the carbon taxes to most agricultural sectors, not just cattle, is less than 1% of current costs.

Thank you again for this opportunity to meet with you. I look forward to your questions.

Brandon Schaufele

Lawrence Centre Fellow and Assistant Professor
Business, Economics and Public Policy
Ivey Business School, Western University

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