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**IMPACTS FROM GOVERNMENT REGULATIONS ON THE CANADIAN-U.S. BASIS
FOR FED CATTLE**

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Impacts from Government Regulations on the Canadian-U.S. Basis for Fed Cattle

Abstract

Price differences between fed cattle prices in the U.S. and Canada (fed cattle basis) are important for Canadian cattle feeders. Discovery of BSE in Canada in 2003 and changes in exchange rates have made predicting basis difficult. An autoregressive model was estimated to determine factors affecting the basis and effects of governmental policies which addressed issues related to the fed cattle and beef trade. Resumption of beef and live cattle exports improved the basis but implementation of mandatory country of origin labeling in the U.S. adversely affected the basis.

Key Words:

Canada, fed cattle, government policy, international trade, prices, U.S.

JEL Codes:

Q13, Q17, Q18

Introduction

Canadian exports of fed cattle and beef to the U.S. increased sharply prior to 2003 (Klein, McGivern, and Grier 2006). In May 2003, Canadian-U.S. trade and trade relations changed immensely when the first case of BSE (bovine spongiform encephalopathy) was found in Canada and the U.S. government closed the Canadian-U.S. border to all cattle and beef movement.

Prior to the BSE case, the two countries' cattle feeding and meat packing industries were highly integrated. Following the border closing, that degree of close integration eroded sharply (Rude, Carlberg, and Pellow 2007; Church and Gordon 2007). Still, research shows that marketing and pricing practices in the two countries by cattle feeders and meat packers both before and after the border closing are quite similar (Ward, Carlberg, and Brocklebank 2007). Similar, too, are the perceptions of cattle feeders toward several marketing and pricing practices

and proposed solutions to perceived or real marketing and pricing issues.

A key factor affecting trade in fed cattle is the cash market basis, or difference, between cash fed cattle prices in Canada and the U.S. (Schroeder and Ward 2006). Cattle feeders monitor the basis closely in evaluating competing bids from Canadian and U.S. packers. However, explaining basis, especially if the goal is forecasting basis *ex ante*, is even more difficult (Tomek 1997). Data collected by CanFax show the Alberta-Nebraska and Ontario-Nebraska fed cattle basis fell precipitously immediately after the U.S. border closed in May 2003 after the BSE discovery and fed cattle prices in Canada plummeted. This sharp price decline and subsequent increase in meat packing profits raised several questions regarding market power in the Canadian meat packing industry (Church and Gordon 2007). Since the border reopened, the basis gradually rebounded toward a level more characteristic of the period prior to the border closing.

Predicting basis, however, has become much more difficult in recent years than prior to the BSE event due also to other factors. Transportation costs have increased with rising diesel prices, and competition for trucks by other industries has heightened. The Canadian dollar strengthened significantly over the 2004-2008 period to a par level with the U.S. dollar before declining somewhat in 2009. Exchange rates significantly affect Canadian-U.S. cattle and beef price relationships and trade (Klein, McGivern, and Grier 2006). Canadian-U.S. fed cattle trade regulation changes increased export costs for Canadian cattle feeders. The U.S. government imposed import regulations and enhanced inspection requirements which added export costs for Canadian cattle feeders. Additional regulations associated with the Canadian government's enhanced feed ban and efforts to eliminate BSE cases in Canada have affected costs and

requirements for exporting UTM (under-thirty-month-old) cattle as well as OTM (over-thirty-month-old) cattle. The enhanced feed ban regulations increased slaughter costs in Canada, which combined with rising labor costs in Canada, adversely impacted packer margins and placed pressure on Canadian fed cattle prices. Lastly, the U.S. implemented mandatory country of origin labeling (MCOOL), limiting the harvest of Canadian fed cattle to just a few U.S. plants, further adversely affecting Canadian exports of fed cattle to the U.S.

The objective of this paper is two-fold. First is to determine factors affecting the historical Canadian-U.S. fed cattle basis. Second, is to determine the effect, if any, from governmental policy changes since the 2003 Canadian border closing on the Canadian-U.S. fed cattle basis.

Data and Procedures

Weekly data for the period January 1998 through June 2009 were used for this analysis. The fed cattle basis was calculated for Alberta and Ontario. Basis here is a cash-to-cash market calculation and is the Alberta or Ontario weekly average fed steer price in Canadian dollars (\$CAD) minus the Nebraska direct fed steer price converted to Canadian dollars. Alberta and Ontario fed cattle prices are available from CanFax at www.canfax.ca. Nebraska prices are weighted average prices for direct trade, 60-80% Choice, live weight steers reported by the U.S. Department of Agriculture (USDA) and available from the Livestock Marketing Information Center (LMIC) www.lmic.info. Canadian-U.S. dollar exchange rates are available at the CanFax website.

Additional data in our models include: nearby live cattle futures market prices available from the LMIC website; Rocky Mountain and East Coast diesel prices available from the Energy Information Center at <http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp>; regional Federally inspected steer and heifer slaughter in the U.S. reported by USDA and available from LMIC; regional steer and heifer slaughter in Canada from CanFax; and regional slaughter capacity in Canada from CanFax.

Summary statistics are presented in Table 1 for several key data series used in this analysis, by year and for 1998-2008. Year-to-year changes show how much market conditions have changed, especially the basis, exchange rates, and diesel prices over the 11-year period, and particularly beginning with the border closing in May 2003.

Figure 1 shows the weekly basis for Alberta (AbNe) and Ontario (OnNe) for the entire data period. The impact of the border closing on basis is evident. Viewing Figure 1, one could visually divide the data into three distinct periods. First is a “normal” market period prior to the border closing (January 1998 to May 2003), followed by the BSE-induced dramatic basis decline and period of recovery (May 2003 to August 2005), and ending with a period appearing to resemble a near-normal basis pattern similar to before the BSE discovery though possibly at a different level (August 2005 to June 2009).

Figure 2 provides a closer look at the basis for the period since the border closing in May 2003. At the top of the figure are markers for times when governmental policies changed conditions which are hypothesized to affect the fed cattle cash basis between Canada and the U.S. The six markers correspond to the following policy changes or events.

1. May 20, 2003 – BSE discovery in Canada and immediate Canadian-U.S. border closing to Canadian live cattle and beef trade
2. September 10, 2003 – First shipment to the U.S. of boneless beef exports from Canada processed from cattle UTM of age following the May 20 border closing
3. July 18, 2005 – First shipment of UTM live cattle exports from Canada to the U.S. after the border closure
4. July 12, 2007 – Announcement of the enhanced feed ban and SRM (specific risk materials) regulations in Canada
5. November 20, 2007 – Approval of Rule 2 in the U.S., which allowed resumption of all live cattle and beef exports to the U.S. from Canada
6. September 30, 2008 – Implementation of MCOOL in the U.S. which limited processing of Canadian fed cattle in some U.S. plants.

Initial Tests – Given the precipitous change in basis when the border closed and the subsequent recovery to a more stable basis pattern, identifying a model that can account for the abnormal periods is difficult. Normal fed cattle price relationships changed significantly when the border closed (Rude, Carlberg, and Pellow 2007). Therefore, as noted above from the graphical depiction of weekly basis over the data period, we hypothesized three distinct periods in the data. To determine whether or not separability existed, paired t-tests were conducted on the basis means, both for Alberta and Ontario, for the three time periods (pre border closing, recovery, and post recovery). Table 2 provides the t-test results which confirm significantly different basis

means for each pair of time periods at the 0.01 significance level. For example, Alberta-Nebraska fed cattle basis prior to the May 2003 BSE discovery averaged -\$7.58/cwt compared to an average basis of -\$10.04/cwt during the post-recovery (most recent) period. A similar basis weakening is observed for the Ontario market, from -\$2.72/cwt. to -\$5.95/cwt., respectively. This suggests that post-recovery basis levels have not returned to the same levels they were prior to the BSE discovery. These results are *ceteris paribus*, in that they could have occurred as a result of several market factors.

A key objective of this research was to identify effects on basis from government policy changes. We hypothesized that each incremental policy change would significantly change basis, some positively and some negatively. Paired t-tests were calculated for periods defined by the six policy change dates listed above. These are identified as resumption of boneless beef exports from Canada, resumption of UTM live cattle exports from Canada, the announced enhanced feed ban and SRM regulations in Canada, approving of Rule 2 by the U.S. and resumption of beef and live cattle exports from Canada, and implementation of MCOOL in the U.S. Each policy period is the period from when the policy was announced or took effect until the next policy was announced or took effect.

Table 3 provides t-test results. Most policy changes resulted in expected and significant differences in the basis means. The mean basis for both Alberta and Ontario narrowed significantly (i.e., increased in favor of Canada) when boneless beef exports resumed (AB \$21.69/cwt., ON \$13.12/cwt.). Similarly, the recovery continued when UTM live cattle exports resumed and the mean basis for both Alberta and Ontario again narrowed significantly (AB

\$21.61/cwt., ON \$27.96/cwt.).

The announced enhanced feed ban and SRM regulations had mixed effects. Based on the t-test of means, the change in regulations had no significant effect on the Alberta basis but significantly widened (i.e., worsened for Canadians) the Ontario basis (\$3.87/cwt.). Approval of Rule 2 had an opposite effect. The mean basis for Alberta following the Rule 2 announcement to resume all live cattle and beef exports to the U.S. narrowed or improved for the Alberta beef industry (\$4.62/cwt.) but had no significant effect on the Ontario basis. The Alberta basis widened significantly (\$4.82/cwt.) following implementation of MCOOL in the U.S. while the Ontario basis narrowed (\$3.39/cwt.).

Here also, t-tests are *ceteris paribus* in that t-tests fail to determine which of several market factors could explain the basis behavior, thus do not provide explanations of *why* basis changed. Therefore, a more definitive approach is required.

Model Development

Few previous livestock studies have modeled weekly price determinants, thus provide little guidance in how to model joint market dynamics, i.e., the fed cattle market both in Canada and the U.S. Modeling weekly market dynamics is difficult also because preferred weekly data series are often not available, making model estimation even more challenging.

Our approach was to specify and estimate a structural model as a first-order autoregressive process estimated by ordinary least squares with SAS (SAS Institute 2002-2003). Serial correlation was assumed and confirmed in the weekly time series data. Given t-test

results discussed earlier for periods (Table 2), each model was estimated for the entire data period and for three subperiods (prior to the border closing, recovery, and post recovery). Independent variables were those hypothesized to affect the weekly basis as well as zero-one dummy variables included to measure effects from incremental governmental policy changes.

The autoregressive model can be written as

$$(1) \quad y_t = \alpha + \sum_{i=1}^n \beta_i x_{it} + V_t$$

where the regression is augmented with an autoregressive model for the random error term.

Dependent variables y_t are, respectively, the Alberta minus Nebraska fed cattle price or the Ontario minus Nebraska fed cattle price, all in \$CAD. Independent variables x_{it} are the Nebraska fed cattle price adjusted for exchange rate, nearby live cattle futures market price adjusted for exchange rate, Rocky Mountain and East Coast diesel price, respectively for regional models, adjusted for exchange rate, difference between regional steer and heifer slaughter in Canada and regional slaughter in the U.S., regional slaughter capacity utilization in Canada, and dummy variables for government policy changes. Prices adjusted for exchange rate changes recognize the importance of exchange rates (Klein, McGivern, and Grier 2006) and the changes in the Canadian-U.S. exchange rate over the data period. Regional differences in steer and heifer slaughter in Canadian and the U.S. are for western Canada vs. northern plains plus mountain states in the U.S. and eastern Canada vs. eastern states in the U.S., respectively, in the Alberta-Nebraska and Ontario-Nebraska models.

Dummy variables for government policy changes are coded 0 before they take effect and 1 afterwards, thus coefficients on the policy dummy variables measure the incremental effect

from the change in policy. Policy changes are the border closing, resumption of boneless beef exports, resumption of UTM live cattle exports, announced enhanced feed ban and SRM regulations, approval of Rule 2 which allowed resumption of beef and live cattle exports, and implementation of MCOOL.

Estimation Results and Discussion

Results from the autoregressive model estimation are shown in Table 4. All results are discussed in term of Canadian dollars. Nebraska fed cattle prices were negative and statistically significant across the four time periods but coefficient magnitude varied considerably. Nebraska fed cattle prices were hypothesized to be highly significant as Canadian cattle feeders watch Nebraska prices closely as an indicator of the U.S. fed cattle market when making fed cattle marketing decisions. Coefficients varied across the three subperiods, suggesting considerably different market conditions existed in the subperiods than for the entire data period.

Canadian cattle feeders watch the live cattle futures market as an indicator of near-term market condition changes in the U.S. and use the futures market for hedging fed cattle prices. Live cattle futures market prices were positive and statistically significant for the entire period, but were not significant in the three subperiod estimations. Perhaps changing fundamental market conditions in the U.S. over time are being captured in our models largely by including the Nebraska fed cattle price.

Diesel prices were included in the model to proxy changes in transportation costs over time when exporting Canadian fed cattle to the U.S. Results suggest diesel prices were more

important for the Ontario-Nebraska basis than the Alberta-Nebraska basis. Increasing diesel prices adversely affected the Ontario-Nebraska basis in the overall period and for the post-recovery subperiod though impacts were small. A \$1/gallon increase in diesel price reduced the Ontario-Nebraska basis by \$0.04-\$0/05/cwt.

Differences in regional steer and heifer slaughter and regional slaughter capacity utilization were intended to capture near-term supply-demand condition differences in Canada and the U.S. Increased slaughter in the eastern U.S. relative to eastern Canada adversely affected the Ontario-Nebraska basis, while increased slaughter capacity utilization in western Canada adversely affected the Alberta-Nebraska basis, but only for the full data period in both cases, and impacts were small. Therefore, these variables may not be good indicators of relative, local competitive conditions in the two countries.

Dummy variables for policy change increments were mixed positive and negative and mixed significant and not significant. However, results were quite consistent between the entire period and subperiods.

As expected and consistent with Figures 1 and 2, basis declined sharply with the closing of the Canadian-U.S. border to live cattle and beef exports. During the initial border closing period, prior to any allowed resumption in cattle and beef movement across the border to the U.S., the Alberta-Nebraska basis dropped \$22.81/cwt. and the Ontario-Nebraska basis dropped \$13.84/cwt. The larger decline in western Canada likely reflects the larger fed cattle industry in Alberta and greater dependence on fed cattle exports from that area to the U.S.

The resumption of boneless beef exports from Canada to the U.S. processed from UTM

cattle enhanced basis recovery in Canada as is evidenced in results for the entire period and the recovery period. Average basis increased \$10.62/cwt. both in Alberta and Ontario in the full-period model when beef exports resumed. In the recovery period model, the increases were \$9.73/cwt. and \$11.00/cwt., respectively, for Alberta and Ontario. Resuming exports of live cattle UTM did not significantly increase the Canadian-U.S. basis.

Announcement and implementation of the Canadian feed ban was expected to adversely affect the Canadian-U.S. basis. Specifically, regulations requiring removal of specific risk materials (SRM) from carcasses in processing were expected to increase slaughter costs, making the Canadian processing industry less competitive relative to the U.S., thus translating into lower fed cattle bids from Canadian packers relative to U.S. packers. However, neither in the full period model nor the post-recovery model did the feed ban significantly affect the basis.

Full resumption of cattle and beef movement across the Canadian-U.S. border (Rule 2) positively and statistically significantly affected the Alberta basis but not the Ontario basis, both for the full data period and the post recovery period. Respectively, the increase was \$4.83/cwt. and \$4.05/cwt. Perhaps the market in eastern Canada already adjusted to the resumption of boneless beef exports and UTM fed cattle exports and full resumption of exports had little additional effect.

Implementation of MCOOL, reportedly adversely affected the Canadian-U.S. fed cattle basis (Kay 2008). Earlier t-test results seem to confirm the negative effect on the Alberta-Nebraska basis but indicated a positive effect on the Ontario-Nebraska basis. No significant effect was found either for Alberta or Ontario in the model for the entire data period. However,

for the post-recovery period, MCOOL was associated with a \$3.58/cwt. decline in basis for Ontario and \$1.91/cwt. for Alberta. The decline in Alberta was significant at a 0.10 significance level for a one-tailed test, which is appropriate given our hypothesis of a negative impact on basis.

Implications and Conclusions

Determining factors affecting the Canadian-U.S. fed cattle basis is important in predicting the basis, which in turn affects Canadian cattle feeders' decision to market fed cattle domestically or export them to the U.S. Predicting basis became more difficult after the first BSE case was found in Canada, which was followed by the immediate closing of the Canadian-U.S. border to beef and cattle trade.

Two basis series, one for western Canada and one for eastern Canada were analyzed in this study. First, paired t-tests showed basis means differed for subperiods of the entire 11½-year data period compared with the entire period. Second, paired t-tests showed governmental policy changes resulted in nearly all cases in differences in the mean basis compared with the immediately preceding period prior to the changed policy. Resumption of exports from Canada to the U.S., both of beef and cattle, resulted in an improvement in the basis for Canadian cattle feeders. Implementing the feed ban in Canada and putting restrictions on specific risk materials (SRMs) in beef carcasses significantly hurt the basis in Ontario but not Alberta. The announcement by the U.S. of the border being reopened to all cattle and beef trade (Rule 2) significantly improved the basis in Alberta but not in Ontario. Finally, mandatory country of

origin labeling (MCOOL) in the U.S. caused a significant decline in the basis based on mean differences in the basis before and after implementing the labeling rule in the U.S.

Mean comparisons do not account for market factors affecting the fed cattle basis. Therefore, a first order, autoregressive model was developed and estimated to determine factors affecting the fed cattle basis and to measure the effects from governmental policy changes independent of other market factors which affect the basis following the BSE discovery in Canada. The Nebraska fed cattle price was the most important variable affecting the fed cattle basis in Alberta and Ontario. Other structural variables were of lesser importance and less consistent in explaining the variation in basis across periods.

Several policy changes significantly affected the basis as was hypothesized. The border closing to beef and live cattle exports from Canada to the U.S. had a large negative effect on the basis. Reopening the border to boneless beef exports from Canada to the U.S. significantly improved the fed cattle basis and moved the basis toward a more “pre-BSE” level. Implementing the feed ban and placing restrictions on carcass SRMs did not affect the basis adversely as was anticipated. Complete reopening of the border to all cattle and beef trade (Rule 2) further improved the basis for Alberta, but not Ontario. Lastly, U.S. implementation of MCOOL had a negative effect on basis as expected, with a greater impact on Ontario than Alberta.

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Figure 1. Weekly Alberta-Nebraska and Ontario-Nebraska fed cattle basis, 1998-2009

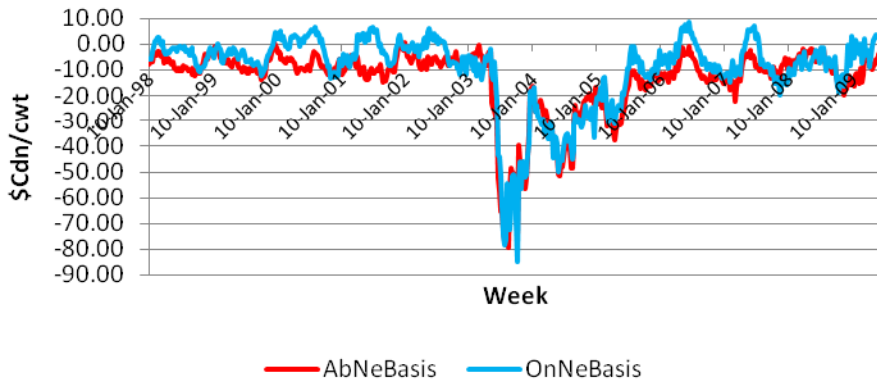


Figure 2. Weekly Alberta-Nebraska and Ontario-Nebraska fed cattle basis, since May 2003

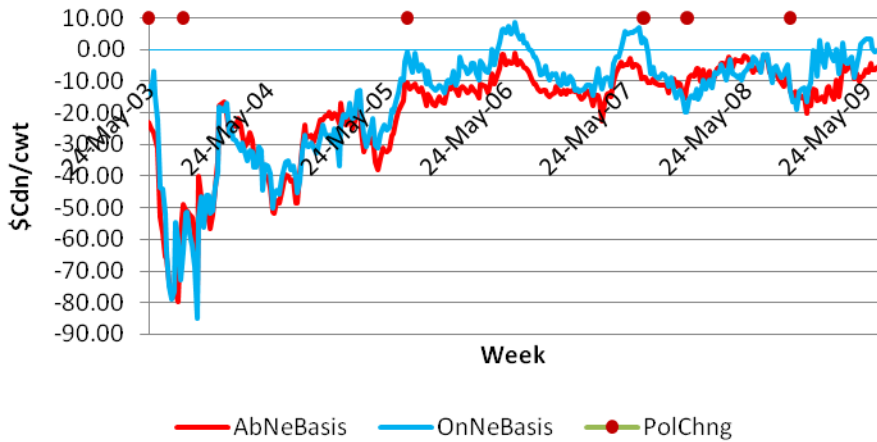


Table 1. Mean and Standard Deviation for Selected Variables, by Year and Total, 1998-2008^{ab}

| Variable | Year | | | | | | | | | | | |
|--|------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 1998-2008 |
| Alberta minus Nebraska fed cattle basis ^c | -7.75 (-2.72) | -7.59 (-3.45) | -7.89 (-2.67) | -9.25 (-3.48) | -6.50 (-2.11) | -33.66 (-26.6) | -31.31 (9.96) | -20.06 (7.82) | -10.16 (4.10) | -10.49 (4.21) | -8.27 (4.69) | -13.92 (13.28) |
| Ontario minus Nebraska fed cattle basis ^b | -3.20 (3.26) | -4.60 (3.31) | -0.42 (5.78) | -1.40 (4.86) | -2.22 (4.46) | -33.27 (26.15) | -33.02 (7.02) | -14.82 (8.38) | -3.71 (6.01) | -7.16 (7.47) | -8.08 (4.26) | -10.20 (14.92) |
| Alberta fed cattle price | 83.64 (3.35) | 89.76 (4.16) | 95.34 (5.31) | 103.06 (8.12) | 98.82 (6.91) | 84.34 (26.7) | 78.73 (6.35) | 85.58 (5.04) | 86.76 (2.99) | 88.46 (7.72) | 90.01 (5.20) | 89.49 (11.8) |
| Ontario fed cattle price | 88.19 (2.12) | 92.75 (3.84) | 102.82 (4.22) | 110.91 (8.35) | 103.10 (6.01) | 84.72 (24.53) | 77.02 (4.75) | 90.82 (4.83) | 93.21 (3.87) | 91.79 (11.52) | 90.20 (7.14) | 93.21 (12.98) |
| Nebraska fed cattle price | 61.61 (2.48) | 65.56 (2.80) | 69.48 (3.46) | 72.61 (5.63) | 67.09 (3.70) | 84.50 (10.36) | 84.63 (3.72) | 87.24 (4.66) | 85.45 (4.15) | 92.06 (3.77) | 92.35 (4.66) | 78.46 (11.82) |
| Live cattle futures market price | 63.38 (2.65) | 66.39 (2.65) | 70.23 (2.99) | 73.03 (5.09) | 68.56 (4.30) | 82.07 (8.78) | 83.80 (3.98) | 87.32 (4.53) | 86.20 (5.28) | 93.89 (2.82) | 93.72 (5.39) | 79.00 (11.52) |
| Canadian to U.S. dollar exchange rate | 0.67 (0.02) | 0.67 (0.01) | 0.67 (0.01) | 0.65 (0.01) | 0.64 (0.01) | 0.72 (0.04) | 0.77 (0.03) | 0.83 (0.02) | 0.88 (0.01) | 0.93 (0.06) | 0.94 (0.07) | 0.76 (0.12) |

^a Numbers in parentheses are standard deviation

^b Complete data years, i.e., 52 weeks

^c Basis is exchange-rate adjusted

Table 2. Paired t-tests for Mean Differences by Period

| Variable | Comparison Period | | | | | | | | |
|---|---------------------------------|--------------------------|-----|--------------------------------|--------------------------|-----|-----------------------------|--------------------------|-----|
| | Prior vs. Recovery ^a | | | Recovery vs. Post ^a | | | Prior vs. Post ^a | | |
| | Mean | t Statistic ^b | N | Mean | t Statistic ^b | N | Mean | t Statistic ^b | N |
| Alberta minus Nebraska fed cattle basis | | | | | | | | | |
| First period | -7.58 | 18.68*** ^c | 277 | -35.77 | 16.82*** | 111 | -7.58 | 6.78*** | 277 |
| Later period | -35.77 | | 111 | -10.04 | | 201 | -10.04 | | 201 |
| Ontario minus Nebraska fed cattle basis | | | | | | | | | |
| First period | -2.72 | 20.50*** | 277 | -34.79 | 18.05*** | 111 | -2.72 | 6.25*** | 277 |
| Later period | -34.79 | | 111 | -5.95 | | 201 | -5.95 | | 201 |

^a Prior is before the border closing; Recovery is from the border closing to resumption of live cattle exports, Post is resumption of "normal" market conditions

^b Given unequal variances

^c Asterisks indicated significance; *=0.10, **=0.05, ***=0.01

Table 3. Paired t-tests for Mean Differences by Policy Dates Following the Border Closing^a

| Variable | Comparison period | | | | | | | | | | | | | | |
|---|---|--------------------------|----|---|--------------------------|-----|---------------------------------------|--------------------------|-----|----------------------------------|-------------------------|----|-------------------------------|--------------------------|----|
| | Closing vs. Initial Beef Exports ^a | | | Initial Beef Exports vs. UTM Exports ^a | | | UTM Exports vs. Feed Ban ^a | | | Feed Ban vs. Rule 2 ^a | | | Rule 2 vs. MCOOL ^a | | |
| | Mean | t Statistic ^b | N | Mean | t Statistic ^b | N | Mean | t Statistic ^d | N | Mean | tStatistic ^b | N | Mean | t Statistic ^c | N |
| Alberta minus Nebraska fed cattle basis | | | | | | | | | | | | | | | |
| First period | -54.44 | 3.74*** ^c | 15 | -32.75 | 16.25*** | 97 | -11.14 | 0.03 | 103 | -10.94 | 7.90*** | 19 | -6.32 | 5.86*** | 45 |
| Later period | -32.75 | | 97 | -11.14 | | 103 | -10.94 | | 19 | -6.32 | | 45 | -11.14 | | 39 |
| Ontario minus Nebraska fed cattle basis | | | | | | | | | | | | | | | |
| First period | -45.95 | 1.91* | 15 | -32.83 | 18.50*** | 97 | -4.87 | 2.49** | 103 | -8.74 | 0.45 | 19 | -8.06 | 2.80** | 45 |
| Later period | -32.83 | | 97 | -4.87 | | 103 | -8.74 | | 19 | -8.06 | | 45 | -4.67 | | 39 |

^a Closing is closing the border to beef and live cattle exports; Initial beef exports is allowing boneless beef exports; UTM is allowing exports of live cattle under 30 months of age; Feed ban is implementation of the enhanced feed ban in Canada; Rule 2 is the resumption of beef and live cattle exports, MCOOL is the implementation of mandatory country of origin labeling in the U.S.

^b Given unequal variances

^c Given equal variances

^d Given equal variances for Alberta-Nebraska; unequal for Ontario-Nebraska

^e Asterisks indicated significance; *=0.10, **=0.05, ***=0.01

Table 4. Regression Results Including Estimates for Policy Changes, by Period, 1998-2009

| Independent Variable | Data Period | | | | | | | |
|--|---------------------------|----------------------|--------------------------------|---------------------|------------------------|---------------------|-----------------------------|---------------------|
| | Dependent Variable: Basis | | | | | | | |
| | <u>Entire Period</u> | | <u>Prior to Border Closing</u> | | <u>Recovery Period</u> | | <u>Post-Recovery Period</u> | |
| | Ab-Ne | On-Ne | Ab-Ne | On-Ne | Ab-Ne | On-Ne | Ab-Ne | On-Ne |
| Intercept | 55.636*** (9.81) | 69.994*** (9.57) | 22.021*** (4.06) | 45.419*** (6.25) | 43.849** (2.11) | 40.407 (1.55) | 48.299*** (8.14) | 77.754*** (9.50) |
| Nebraska fed cattle price (\$CAD) | -0.836*** (17.60) | -0.895*** (15.73) | -0.250*** (3.86) | -0.442*** (5.77) | -1.020*** (8.98) | -1.005*** (7.01) | -0.717*** (9.17) | -0.880*** (8.52) |
| Live cattle futures price (\$CAD) | 0.234*** (4.41) | 0.195*** (3.07) | 0.028 (0.48) | 0.016 (0.23) | 0.201 (1.35) | 0.138 (0.74) | 0.137 (1.63) | 0.141 (1.27) |
| Diesel price (\$CAD) | -0.001 (0.04) | -0.043** (2.33) | -0.024 (1.19) | -0.030 (1.13) | 0.054 (0.76) | 0.053 (0.65) | -0.007 (0.59) | -0.045*** (2.72) |
| Regional Canadian-US steer and heifer slaughter difference | 0.000 (0.44) | -0.000*** (2.90) | -0.000 (0.83) | 0.000 (0.90) | -0.000 (0.62) | -0.000 (1.28) | 0.000 (0.09) | -0.000 (1.44) |
| Regional Canadian slaughter capacity utilization | -0.027* (1.79) | 0.030 (0.48) | -0.014 (1.05) | 0.016 (0.32) | -0.071 (1.29) | -0.131 (0.48) | -0.006 (0.26) | 0.147 (1.56) |
| Border closing | -22.810*** (10.01) | -13.837*** (4.90) | NA | NA | NA | NA | NA | NA |
| Boneless beef exports | 10.618*** (4.66) | 10.622*** (3.80) | NA | NA | 9.729** (2.12) | 10.999** (2.12) | NA | NA |
| Under 30 months live cattle exports | 0.880 (0.39) | 2.573 (0.92) | NA | NA | NA | NA | NA | NA |
| Canadian feed ban | 1.563 (0.67) | 1.514 (0.53) | NA | NA | NA | NA | 0.234 (0.16) | 0.950 (0.47) |
| Beef and live cattle exports (Rule 2) | 4.835** (2.08) | 2.272 (0.79) | NA | NA | NA | NA | 4.046*** (2.76) | 1.768 (0.88) |
| Mandatory COOL | -1.375 | -3.505 | NA | NA | NA | NA | -1.904 | -3.582* |

Table 4. Regression Results Including Estimates for Policy Changes, by Period, 1998-2009

| Independent Variable | Data Period | | | | | | | |
|----------------------|---------------------------|--------|--------------------------------|-------|------------------------|-------|-----------------------------|--------|
| | Dependent Variable: Basis | | | | | | | |
| | <u>Entire Period</u> | | <u>Prior to Border Closing</u> | | <u>Recovery Period</u> | | <u>Post-Recovery Period</u> | |
| | Ab-Ne | On-Ne | Ab-Ne | On-Ne | Ab-Ne | On-Ne | Ab-Ne | On-Ne |
| | (0.58) | (1.21) | | | | | (1.26) | (1.73) |
| n | 596 | 596 | 277 | 277 | 111 | 111 | 201 | 201 |
| Regression R2 | 0.484 | 0.431 | 0.124 | 0.226 | 0.549 | 0.450 | 0.538 | 0.556 |
| Total R2 | 0.966 | 0.961 | 0.766 | 0.862 | 0.928 | 0.892 | 0.882 | 0.891 |

a Asterisks indicate significance, where *=0.10, **=0.05, ***=0.01. Numbers in parentheses are absolute values of calculated t statistics.