Impacts of Corn Price and Imported Beef Price on Domestic Beef Price in South Korea

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IMPACTS OF CORN PRICE AND IMPORTED BEEF PRICE ON DOMESTIC BEEF PRICE IN SOUTH KOREA

By

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International Agricultural Trade Research Consortium (IATRC)
Annual Meeting, Clearwater Beach, FL, December 13-15, 2015

INTRODUCTION

❑ South Korea is one of the largest beef import countries in the world and second largest market for U.S. beef exports.

❑ 1976 – 1st South Korean beef imports

❑ 2001 **Uruguay Round of Multinational Trade Negotiation**

   ❑ Domestic market fully opened

❑ 2012 Imported Beef Quantities

   ❑ Australia (52.1%)

   ❑ U.S. (35.4%)

   ❑ New Zealand (11.0%)

INTRODUCTION (CONT..)

❑ Bovine Spongiform Encephalopathy

   (BSE)

   ❑ Washington State dairy cow

   ❑ Dec. 2003 Korea banned beef

      imports from U.S.

❑ 2003 BSE outbreak

   ❑ Increased imports from Australia and New Zealand

LINKAGE BETWEEN FEED AND BEEF PRICES

❑ Corn is one of the important feedstock to produce cattle

❑ Proportion of amount of imported feed is more than 50% in total formula feed to domestic cattle
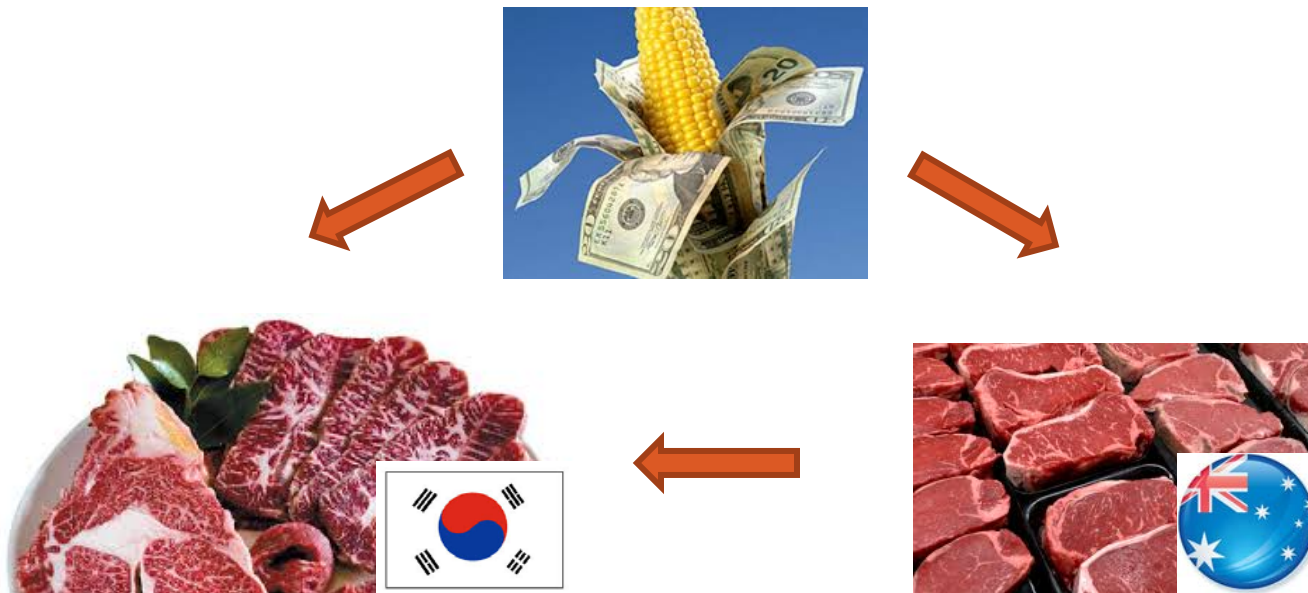
OBJECTIVES

1. What is the relationship between Korean beef price and Corn Price?

2. What impact does corn price have on imported beef prices?

3. What is the relationship between prices of Korean beef and imported beef?

4. Did BSE fundamentally change these relationships?

DATA

❑ 2000-2015 Monthly time series data

❑ Korean beef prices from Korea Institute for Animal
   Products Quality Evaluation

❑ Imported beef prices from Korea Customs Service

❑ Corn price data from World Bank

❑ Real exchange rate from Bank of Korea

SUMMARY STATISTICS

Summary and Descriptive Statistics						
Variable	Description	Obs	Mean	Std. Dev.	Min	Max
KORP	Price of Korean native cattle (won/kg)	178	13291.83	1905.46	8677.00	18625.00
CORNP	Imported Corn price (won/kg)	178	184.98	82.26	83.92	380.46
AUSP	Imported Australian beef price (won/kg)	178	4163.63	1147.44	2034.33	6118.35
DKORP	First differentiated KORP	177	17.75	1236.09	-3822.00	3951.00
DCORNP	First differentiated CORNP	177	0.38	13.35	-48.30	69.42
DAUSP	First differentiated AUSP	177	22.40	207.92	-569.21	704.49
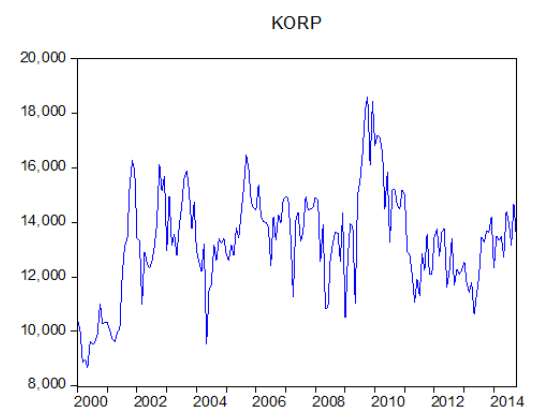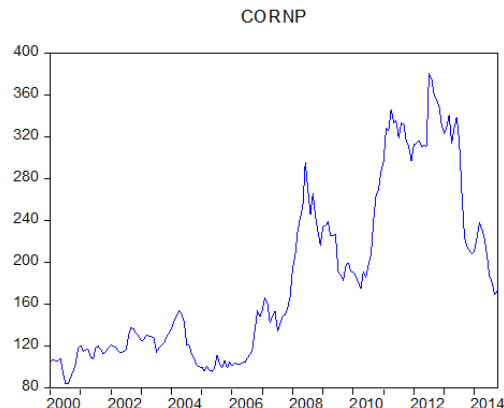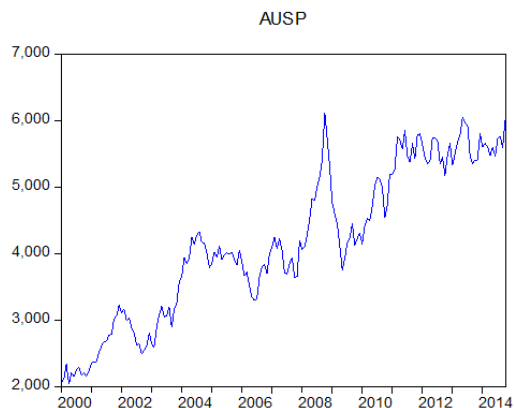
STRUCTURAL BREAK WITH UNIT-ROOT TEST

❑ Dickey-Fuller (DF), Phillips-Person (PP), and Dickey-Fuller using a Generalized Least Square (DFGLS) for the unit root may cause **bias** (Baum, 2001).

❑ The additive outlier **(AO)** is used when the change is assumed to affect instantaneously whereas the Innovational Outlier **(IO)** model for slowly change (Perron and Vogelsang, 1992).

❑ We assume the change by BSE affect instantaneously, and Clemente-Montanes-Ryes unit-root test with single mean shift (**also called AO**) model is used.

RESULT FROM THE CLEMENTE-MONTANES-RYES UNIT-ROOT TEST

	KORP	CORNP	AUSP
du1	**3821.87***	**133.683***	**1909.196***
	(9.331)	(17.984)	(15.039)
rho -1	-0.281	-0.117	-0.072
	(-3.088)	(-3.048)	(-2.878)
Optimal Break Point	**2001 April**	**2008 July**	**2010 August**
*** 1%, ** 5%, and * 10% significant level **Parenthesis indicates t-statistics** **du1 represents time structural break** **rho-1 represents the unit root**			

❑ The optimal structural break points for prices of Korean beef, imported corn and Australia beef are **April 2001**, **July 2008**, and **August 2010**.

⟹ Fail to reject the null hypothesis of a unit root in series of three variables despite the structural break.

DF-GLS UNIT ROOT TEST

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \gamma_1 \Delta y_{t-1} + \cdots + \gamma_p \Delta y_{t-p} + \varepsilon_t$$

❑ The testing null hypothesis is $H_0: \beta = 0$. The null hypothesis explains that y_t is a random walk or it possibly has drift. The alternative hypothesis is that y_t is either stationary with linear trend or non-zero mean with no trend.

The results from the DF-GLS Unit Root Test						
	Level			**First Difference**		
Variable	Constant w/o trend	Constant with trend	Decision	Constant w/o trend	Constant with trend	Decision
KORP	-1.8883	**-2.9562****	**I(1)/I(0)**	**-17.4795*****	**-18.5246*****	**I(0)**
CORNP	-1.0074	-1.7368	**I(1)**	**-10.7521*****	**-10.8671*****	**I(0)**
AUSP	0.3254	**-3.4392****	**I(1)/I(0)**	**-12.3592*****	**-12.5411*****	**I(0)**
Note: Estimates are statistically significant at *** 1%, ** 5%, and * 10% **I(0) indicates no unit root and I(1) indicates unit root**						

NUMBER OF LAG SELECTION

The results from Selecting Number of Lags			
Data	**AIC**	**BIC**	**HQ**
Original Data	2	1	1
Differentiated Data	1	1	1

❑ where AIC: Akaike Information Criterion, BIC: Bayesian Information Criterion, and HQ: Hannan-Quinn Information Criterion.

❑ BIC is consistent compared to AIC

➢ AIC overestimates with positive probability (Tsay, 1984, Potscher, 1989, and Cavaliere, et al., 2015).

THRESHOLD COINTEGRATION TEST

❑ Seo (2006) test for no cointegration vs. threshold cointegarion.

❑ The Seo test based on the BIC criteria shows:

    ➢ Cointegration between prices of Korean beef and Australian beef

    ➢ Cointegration between prices of Australian beef and corn

    ➢ No cointegration between prices of Korean beef and corn.

❑ Threshold Vector Auto Regression (**TVAR**) with first differentiated data is used.

TESTING THRESHOLD LINEARITY

❑ Threshold non-linearity by using Lo and Zivot test that was proposed by Hansen (1999) and developed by Lo and Zivot (2001).

Threshold Hypothesis	DAUSP	DCORNP	DKORP
1 vs 2	**35.295*****	16.691	19.405
1 vs 3	**62.303*****	28.863	42.406
2 vs 3	**27.008*****	12.172	23.001
Significant at * 1%, ** 5%, and * 10%** **Note: D indicates first difference**			

❑ We find that only differentiated Australian beef price has 2 thresholds at 1% significant level whereas other variables have no thresholds.

❑ Focus on only TVAR with 2 thresholds in first differentiated Australian beef price.

TVAR MODEL

Two regimes of TVAR model can be defined as following equation:

$$y_t = \begin{cases} \delta_1 + \rho_{1,1}y_{t-1} + \cdots + \rho_{1,p}y_{1-p1} + u_t & if \ x_{t-d} \geq \theta_L \\ \delta_2 + \rho_{2,1}y_{t-1} + \cdots + \rho_{2,p}y_{1-p1} + u_t & if \ \theta_H \geq x_{t-d} \geq \theta_L \\ \delta_3 + \rho_{3,1}y_{t-1} + \cdots + \rho_{3,p}y_{1-p1} + u_t & if \ \theta_H \geq x_{t-d} \end{cases}$$

where *y* is price vector of Korean beef, corn, and Australian beef, $\delta_1, \delta_2, \delta_3$ refer the intercepts in each regime, $\rho_{j,1}, \ldots, \rho_{j,m-1}$ are the number of lags in regime, θ_L, θ_H are the thresholds, *d* is the delay of transition variable, and x_{t-d} is the transition variable from one of three variables.

RESULT FROM TVAR

	REGIME	INTERCEPT	DAUSP(-1)	DCORNP(-1)	DKORP(-1)
DAUSP	1	-157.46	-0.84	3.17	0.03
(11.40%)	2	10.88	-0.05	-0.36	0.01
	3	33.26	-0.16	-1.80	-0.02
DCORNP	1	-14.89	-0.04	0.09	-0.001
(69.30%)	2	0.18	-0.001	**0.18******	**-0.003***
	3	-5.04	0.02	0.15	-0.001
DKORP	1	**1992.63******	**5.04******	**-39.99******	**-0.60*****
(19.30%)	2	130.93	**1.49******	1.43	**-0.30*****
	3	-335.07	0.07	**22.14******	**-0.40***
Threshold value: -278.15 and 198.29					
Significant levels: **, *** , **, and * at 0%, 1%, 5%, and 10% respectively**					
Note: (-1) indicates first lag					

SUMMARY AND CONCLUSION

❑ Positive impact on current Korean beef price by increasing in previous month of Australian beef price in first and second regimes

➤ Korean beef price is relatively higher than Australian beef price

➤ Shock in Australian beef price is buffered by price difference

❑ If corn price increased in previous month, there is incentive to increase current Korean beef price, but the incentive is canceled out (i.e., buffered) by low Australian beef price in first regime. However, the incentive is not buffered in third regime where increasing in previous Australian beef price is high.
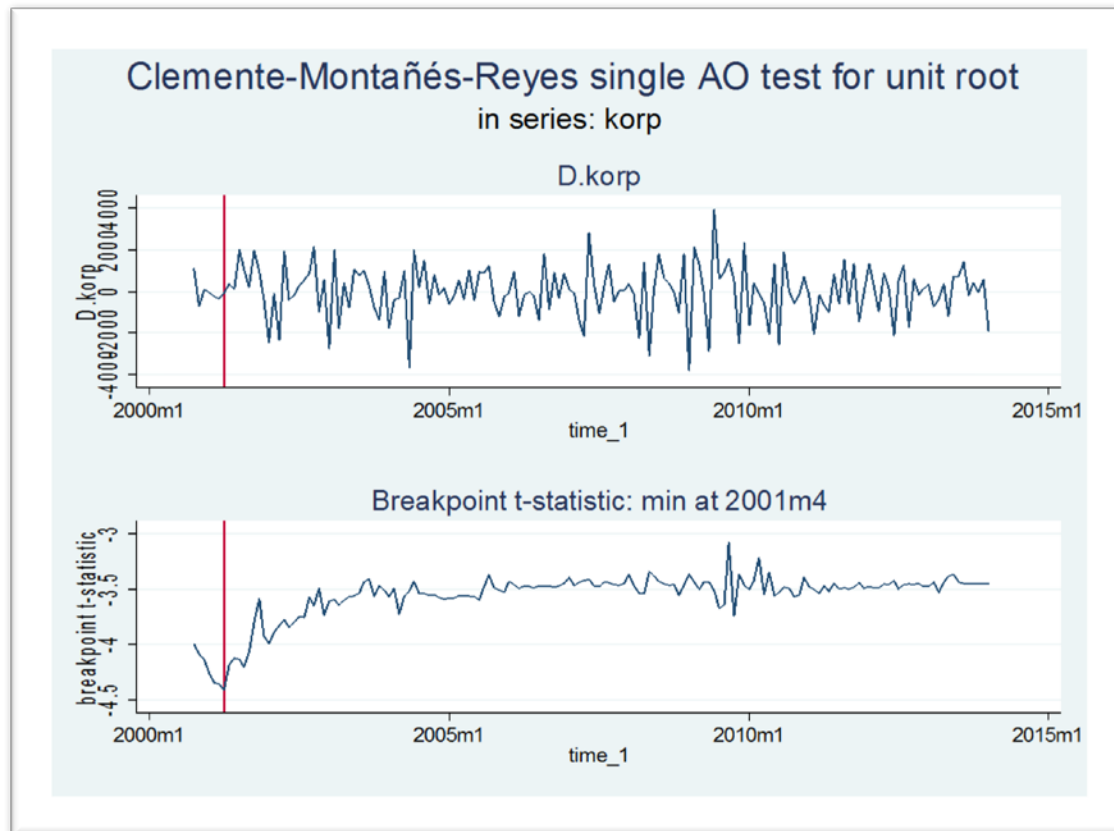
SUMMARY AND CONCLUSION (CONT..)

❑ Current Korean beef price is negatively affected by previous month of the Korean beef price regardless of the price change in imported Australian beef price.

➢ Due to market demand condition

❑ The main contributions of this paper

➢ Consideration of non-linearity

➢ Different impact of threshold points
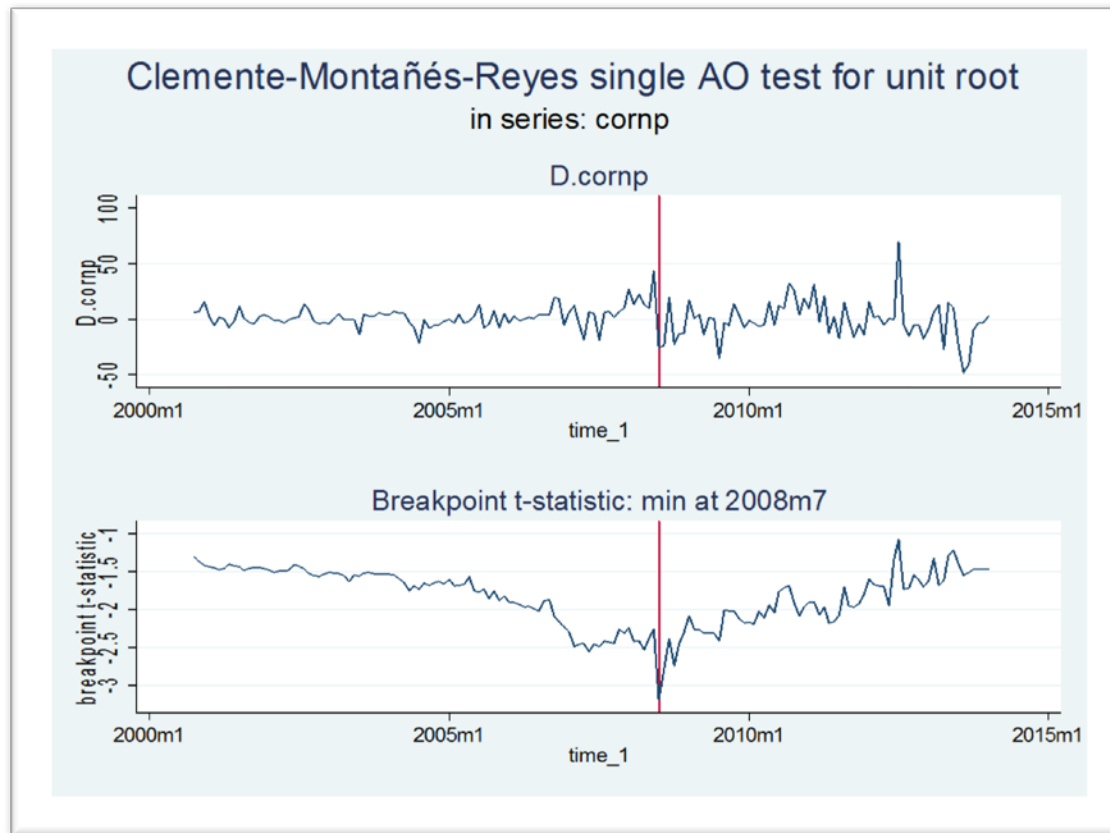
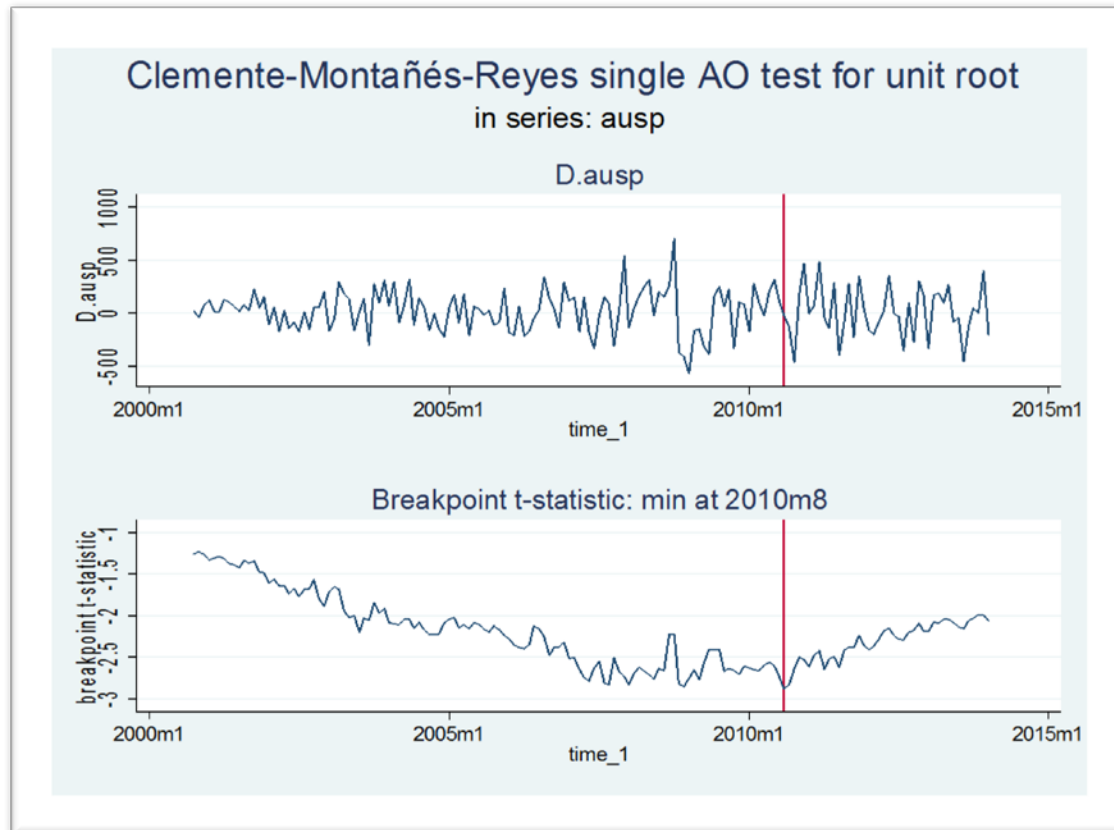➢ Price impact on domestic beef market in South Korea

THANK YOU!!

APPENDIX

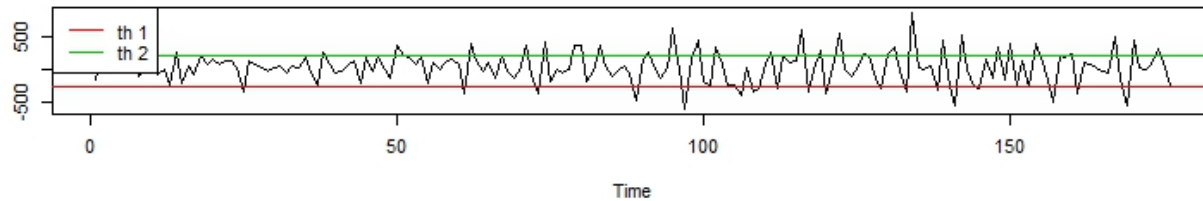Clemente-Montañés-Reyes single AO test for unit root
in series: korp

D.korp

Breakpoint t-statistic: min at 2001m4

APPENDIX (CONT..)

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