

# Factors Driving the Competitiveness of Canadian Agriculture: A Case Study of the Wheat, Beef and Pork Sectors

Rakhal Sarker and Shashini Ratnasena

CATPRN Workshop 2012  
Westin Harbour Castle Hotel  
Toronto, Ontario  
September 29, 2012

# Introduction

- Competitiveness is a widely used concept/term in agri-food policy arena
- It is a “fuzzy” concept.
  - Too many alternative definitions and no general agreement
  - Too precise way to measure and open to wide range of interpretations
- Debates, analysis and predictions related to the competitiveness of agri-food sector acquired the centre stage

# Highlights.....



## *New Study Suggests Canada's Beef Industry at a Tipping Point*

OTTAWA, Sept. 10, 2012 –

**FARMFORUM.CA**

Search:  Entire site   
Home | Technology | Business | Production | Farm Life | Blog | Video | Contact



## Get ready for open grain markets

July 2012 | Business



Canadian Pork Council  
Conseil canadien du porc



CANADIAN MEAT COUNCIL  
CONSEIL DES VIANDES DU CANADA



CANADA PORK INTERNATIONAL  
CANADA PORC INTERNATIONAL

**FOR IMMEDIATE RELEASE**

**The Canadian Pork Industry is calling on the Government of Canada to urgently resume Free Trade Talks with South Korea**

Ottawa, Ont. [January 12, 2011]

# Empirical Questions

- How competitive is the agri-food sector in Canada?
- Has the competitiveness of Canadian agri-food sector being compromised by high and volatile commodity prices?
- Has the Competitiveness of Canadian Agriculture being adversely affected by rising energy prices?

# Choice of Commodities

- Focus on three important sectors of Canadian agriculture
  - Wheat, beef and pork
  - Why?

# Choice of Competitiveness Indicator

- Considerable diversity exists in the measurement indicators
- Competitiveness can be domestic or international
- Competitiveness is perceived as:
  - Performance
  - Potential
  - Process
- **Performance:** how well a sector has done relative to its rivals?
- **Potential:** what inputs/technology can enhance competitiveness?
- **Process:** how management converts potentials into competitive performance?

# Measurement of Competitiveness

- Indicators used to measure Competitive Performance:
  - Profitability
  - Growth
  - Balance of Trade
  - Domestic Resource Costs
  - Market Share/Constant Market Share
  - Revealed Comparative Advantage

# Measurement of Competitiveness

- Revealed Comparative Advantage
  - Balassa (1965, 1977)
  - Modified by Vollrath (1991)
- What is RCA?
- Why did we make this choice?
- How did we measure RCA?



# Data

## Annual trade data (1961-2011) - FAO & Global Trade Atlas

- Total value of wheat, beef and pork exports from Canada to all destinations ( in US \$)
- Total value of wheat, beef and pork exports from the United States to all destinations ( in US \$)
- Total value of wheat, beef and pork exports from all countries ( in US \$)
- Total value of agricultural exports from Canada, the United States and from all countries (in US \$)

# Data

## Annual input price data (1971-2011) –CANSIM

- Wheat: Western Canada input price indices and crop production farm input price index for fertilizer, pesticides, seed, energy and hired labour
  - Beef: Total operating expenses, cost of feed, energy and, hired labour for beef cattle ranching and feedlots
  - Hogs: Total operating expenses, cost of feed, energy and hired labour on hog and pig farming
- A number of creative steps were taken to generate some missing input expenses data for each sector.

## Real Exchange Rates (1971-2011)-USDA

- For Canada, Brazil, Argentina, Australia, China, France and EU (local currency per US \$)

# Econometric Approach

- International competitiveness can be driven by domestic as well as external factors
  - Changes in input costs and productivity could have a significant impact on RCA
  - Changes in exchange rates between Canadian dollar and the currencies of major competitors in commodity-specific export markets
  - Changes in trade environment (due to PTAs) could also influence RCA
- Used available literature to identify major inputs used in wheat, cattle and hog production in Canada
- How do these covariates influence RCAs?
  - Not enough help from the existing literature

# Econometric Approach

- To avoid functional form misspecification, we employed Box-Cox transformation (Zarembka, 1974; Spitzer 1982)
  - Scale invariance of t-ratios were ensured by employing a scaling procedure suggested by Spitzer (1984)
- How did the rising commodity and energy prices influence RCAs for wheat, beef and pork sectors?
- Used elasticities/estimated elasticity values from our regression analysis and data for each sector to determine these effects

# Empirical Results

# Results

Figure 1. Revealed Comparative Advantage of Wheat Exported from Canada and USA

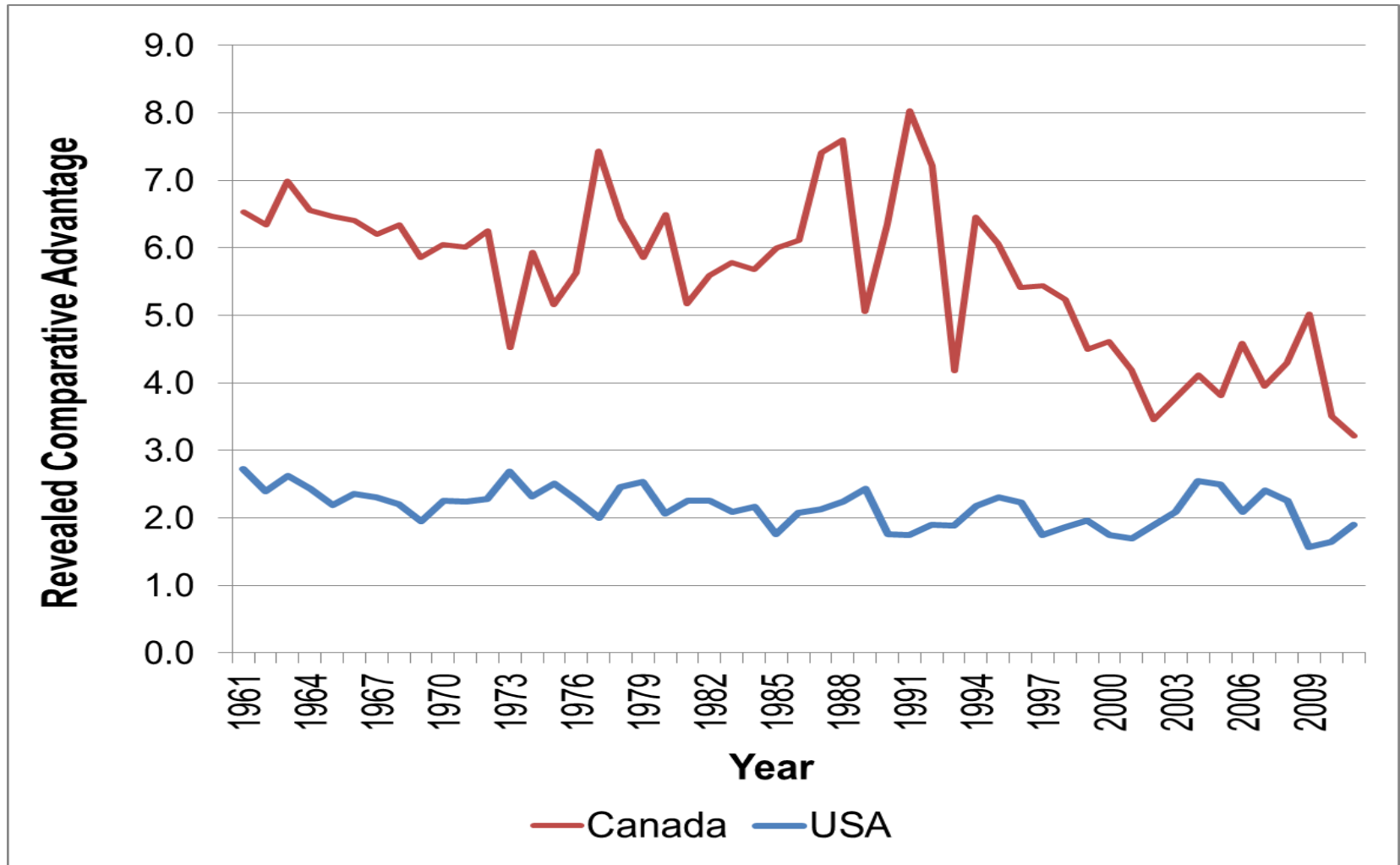


Figure 2. Revealed Comparative Advantage of Beef Exported from Canada and USA

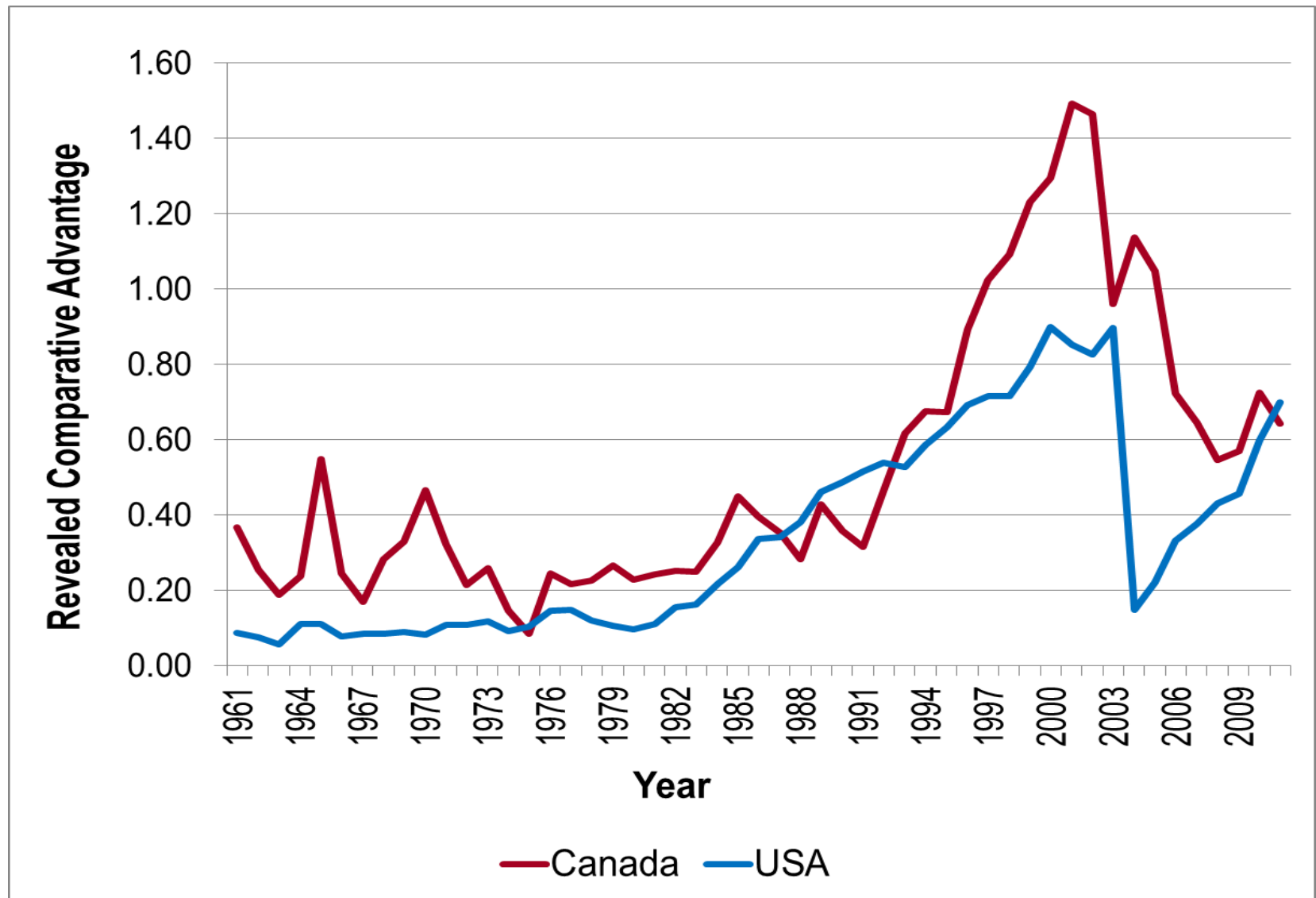
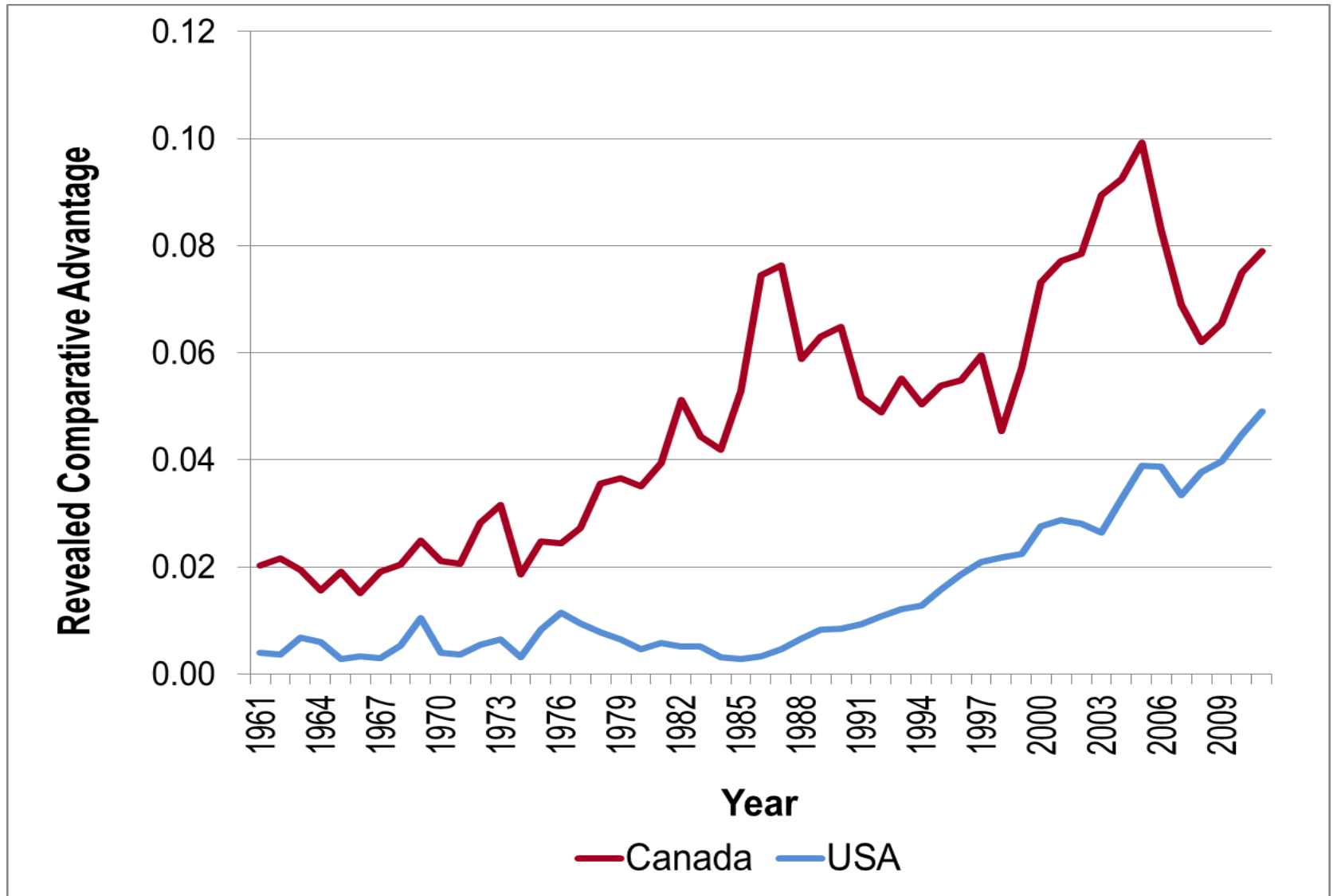


Figure 3. Revealed Comparative Advantage of Pork Exported from Canada and USA





**Table 1. Results of Functional Form Tests:  
RCAs of Wheat, Beef and Pork in Canada**

Model	Unrestricted Log- Likelihood	Restricted Log-Likelihood			
		Log-Linear		Linear	
	$L(\hat{\lambda})$	LLV ( $\lambda=0$ )	LRT	LLV ( $\lambda=1$ )	LRT
RCA Wheat Canada Model	24.69	24.68	0.02	23.52	2.35
RCA Beef Canada Model	6.09	3.41	5.35	-2.40	16.98**
RCA Pork Canada Model	10.64	6.98	7.29**	10.21	0.86

LLV= Log-Likelihood Value, LRT=Log- Likelihood Ratio Test, The critical value of Chi-squared distribution [ $\chi^2_{(1)}$ ] at 1 percent significance level is 6.635

## Table 2. Drivers of Revealed Comparative Advantage of Wheat in Canada

Factor	Estimated Coefficient
Price of Fertilizer	0.166
Price of Pesticides	1.140**
Price of Hired Labour	-0.574
Price of Seeds	-0.598**
Price of Energy	-0.259
Exchange Rate-Canada-USA	0.830*
Exchange Rate-Canada-Argentina	-0.112
Exchange Rate-Canada-France	-0.181
Exchange Rate-Canada-Australia	0.326
Dummy_NAFTA	-0.079
Constant	0.035
Box-Cox Parameter ( $\lambda$ )	0.000
R <sup>2</sup> -Adjusted	0.553
F -Value	5.948
Number of Observations	41

\*\* and \* indicate statistical significance at 5 % and 10 % levels of error probability

## Table 3. Drivers of Revealed Comparative Advantage of Beef in Canada

Factor	Estimated Coefficient
Feed Cost	0.719**
Energy Cost	0.047
Hired Labour Cost	-0.346
Exchange Rate-Canada-USA	-1.885***
Exchange Rate-Canada-Brazil	0.198
Exchange Rate-Canada-France	0.344
Exchange Rate-Canada-Australia	0.574
Dummy_NAFTA	0.672***
Constant	-0.151
Box-Cox Parameter ( $\lambda$ )	0.000
R <sup>2</sup> -Adjusted	0.867
F -Value	33.611
Number of Observations	41

\*\* \*and \*\* indicate statistical significance at 1 % and 5% levels of error probability

Table 4. Drivers of Revealed Comparative Advantage of Pork in Canada

Factor	Estimated
Cost of Feed	0.621***
Cost of Energy	-0.043
Cost of Labour	-0.452*
Exchange Rate-Canada-USA	0.207
Exchange Rate-Canada-Brazil	0.323
Exchange Rate-Canada-EU	0.385
Exchange Rate-Canada-China	0.089
Dummy_NAFTA	0.098
Constant	-0.117
Box-Cox Parameter ( $\hat{\lambda}$ )	1.000
R <sup>2</sup> -Adjusted	0.725
F-Value	14.230
Number of Observations	41

\*\* \*and \* indicate statistical significance at 1 % and 10% levels of error probability

# Main Results

- The functional form test results suggest:
  - a log-linear functional form is appropriate for wheat and beef models
  - a linear functional form is suitable for pork model
- The RCA of the Canadian Wheat sector is driven by:
  - The cost of pesticides
  - The cost of seeds
  - The Canada-US exchange rate
- The RCA of the Canadian Beef sector is significantly influenced by:
  - Feed costs
  - Canada-US Exchange rate
  - NAFTA
- The RCA of the Canadian Pork sector is significantly influenced by:
  - Feed costs
  - The cost of labour

**Table 5. Factors Influencing RCAs of Wheat in Canada between 2007-2011**

Factor	2007	2008	2009	2010	2011
Price of Fertilizer	0.069	0.045	0.071	0.060	0.043
Price of Pesticides	0.503	0.494	0.614	0.466	0.398
Price of Hired Labour	-0.235	-0.247	-0.306	-0.232	-0.199
Price of Seeds	-0.253	-0.271	-0.300	-0.225	-0.199
Price of Energy	-0.081	-0.069	-0.119	-0.074	-0.054
Exchange Rate-Canada-USA	0.573	0.629	0.782	0.492	0.434
Exchange Rate-Canada-Argentina	-0.043	-0.049	-0.055	-0.036	-0.032
Exchange Rate-Canada-France	-0.136	-0.158	-0.188	-0.112	-0.103
Exchange Rate-Canada-Australia	0.249	0.275	0.325	0.243	0.242
NAFTA	-5.692	-6.194	-7.243	-5.062	-4.628

Table 6. Factors Influencing RCAs of Beef and Pork in Canada between 2007-2011

Factor	Beef					Pork				
	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Feed Cost	0.76	0.70	0.60	0.76	0.90	0.49	0.43	0.30	0.38	0.71
Energy Cost	0.09	0.09	0.06	0.09	0.11	-0.06	-0.06	-0.03	-0.04	-0.06
Hired Labour Cost	-0.34	-0.28	-0.32	-0.34	-0.32	-0.36	-0.33	-0.22	-0.23	-0.55
Exchange Rates-										
Canada-USA	-2.42	-2.05	-2.30	-2.62	-2.24	0.26	0.23	0.26	0.27	0.27
Canada-Brazil	0.20	0.19	0.20	0.27	0.25	0.35	0.32	0.35	0.47	0.53
Canada-France	0.48	0.43	0.46	0.50	0.44					
Canada-Australia	0.81	0.69	0.73	1.00	0.97					
Canada-EU						0.48	0.43	0.50	0.50	0.52
Canada-China						0.08	0.07	0.09	0.09	0.37
NAFTA	133.2	112.4	117.5	149.6	132.5	13.95	12.54	13.22	15.16	15.94

# Main Results

- During last five years, the competitiveness of the wheat sector in Canada has been:
  - Positively influenced by costs of fertilizer, pesticides and the Canada-US Ex. rate
  - Negatively influenced by costs of labour, seeds and energy
  - NAFTA had a negative impact
- The competitiveness of beef sector has been:
  - Positively influenced by feed and energy costs and by NAFTA
  - Negatively impacted by labour costs and by the Canada-US Exchange rate
- The competitiveness of pork sector has been:
  - Positively influenced by feed costs, Canada-US Exchange rate and NAFTA
  - Negatively influenced by labour and energy costs



# Policy Implications

- Results relevant for a meaningful policy dialogue?
- Lower costs of seeds, energy and labour would enhance competitiveness of the wheat sector
- Lower costs of labour will enhance beef sector's competitiveness
- Lower costs of labour and energy will enhance the competitiveness of the pork sector
  - How to provide labour and energy to these sectors at lower costs?

# Concluding Remarks

- Survival and continued success in a turbulent world economy depends on Competitiveness
- An attempt is made in this paper to measure international competitiveness of wheat, beef and pork sectors in Canada using RCA as an indicator
  - Canada enjoyed competitive advantage in wheat but not in beef or pork exports
  - Since the early 1990s, Canada's competitiveness in beef and pork exports increased in a sustained manner until the BSE incident in 2004. The same is not true for the wheat sector

# Concluding Remarks

- Different factors drive the competitiveness of wheat, beef and pork exports from Canada
- Providing labour and energy at lower costs will enhance international competitiveness of Canadian agriculture
- Enhancing NAFTA is also likely to enhance the competitiveness of beef and pork sectors in Canada

# Survival



# Thank You.

## Happy to answer any questions!

# APPENDIX

# Summary Statistics of the Variables Used in the Revealed Comparative Advantage of Wheat, Beef and Pork in Canada Models

Variables	Units of Measurement	Wheat				Beef				Pork															
		Mean	St Dev	Min	Max	Mean	St Dev	Min	Max	Mean	St Dev	Min	Max												
Revealed Comparative Advantage	Unit Free	5.40	1.21	3.20	8.031	0.579	0.385	0.084	1.492	0.055	0.021	0.019	0.099												
Price of Fertilizer	Price Index*	93.91	45.61	25.14	250.60																				
Price of Pesticides	Price Index*	74.26	29.97	15.45	124.40																				
Price of Hired Labour	Price Index*	74.98	30.57	18.32	127.85																				
Price of Seeds	Price Index*	84.44	33.44	23.33	146.95																				
Price of Energy	Price Index*	94.64	54.72	21.31	244.88																				
Cost of Feed	Cd \$/Head					0.004	0.001	0.002	0.006	0.136	0.062	0.058	0.326												
Cost of Energy	Cd \$/Head					0.003	0.001	0.002	0.005	0.006	0.003	0.003	0.015												
Cost of Hired Labour	Cd \$/Head					0.001	0.001	0.001	0.002	0.015	0.007	0.006	0.037												
Exchange Rate:																									
Canada-Brazil	Unit Free																	0.600	0.189	0.357	1.062	0.473	0.194	0.257	1.000
Canada-France	Unit Free	1.03	0.15	0.789	1.393													1.038	0.153	0.789	1.393				
Canada-Australia	Unit Free	0.94	0.09	0.773	1.150													0.944	0.090	0.773	1.150				
Canada-USA	Unit Free	1.31	0.15	0.999	1.565													1.312	0.155	0.999	1.565	1.312	0.155	0.999	1.565
Canada-EU	Unit Free									0.936	0.146	0.641	1.261												
Canada-China	Unit Free									0.925	0.328	0.318	1.457												
Canada-Argentina	Unit Free									0.62	0.33	0.166	1.58												
Dummy Variable-Implementation of NAFTA	0=before 1994 and 1=on/after 1994									0.43	0.50	0.000	1.000					0.439	0.502	0.000	1.000	0.439	0.502	0.000	1.000

\*Base Year : 2002=100