

Challenges Facing Modelers of the Biofuels Industry in Canada

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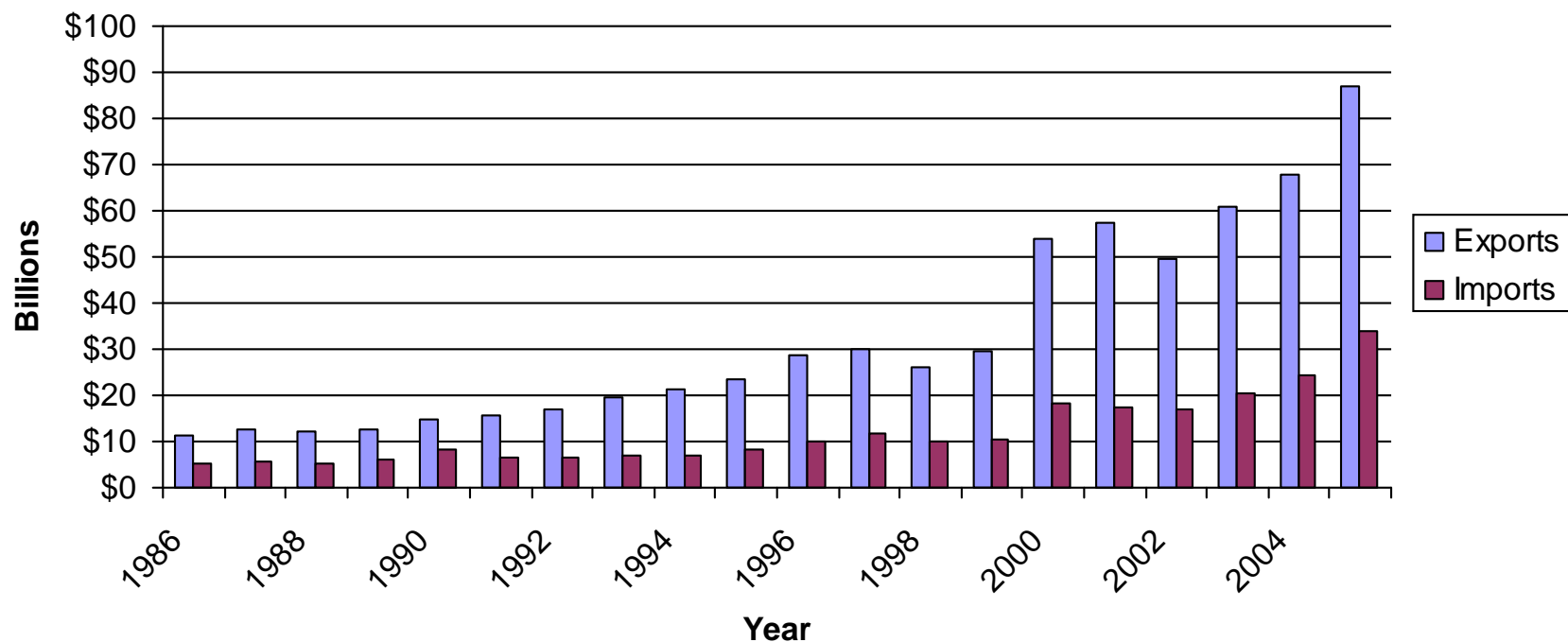
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Outline

- Context:
 - Policy
 - Outcomes
 - Economic Research Questions
- Modeling challenges:
 - Understanding the informational needs of model users.
 - How best modify existing models.

Biofuel Policy in Canada - 1

- Primary motivation is not energy security.
 - Producers in Canada are net exporters:
 - Oil, Natural gas, Uranium, Hydro-electricity, Coal etc.



Biofuel Policy in Canada - 2

■ Motivation:

- Environmental concerns.
- The desire to improve rural development.
- The desire to enhance and stabilize farm incomes.



Biofuel Policy in Canada - 3



Ethanol

Biodiesel



Biogas

Biofuel Policy in Canada - 4

■ Production mandates:



– Average renewable content

- Gasoline: 5% by 2010.
- Diesel: 2% by 2012.

Biofuel Policy in Canada - 5

■ Implications:

	Projected Demand Created by Mandate	2006 Production Capacity	Required Increase in Capacity
Ethanol (by 2010)	3.1 billion litres (819 million US gallons)	605 million litres (160 million US gallons)	2.5 billion litres (659 million US gallons) (413%)
Biodiesel (by 2012)	600 million litres (158 million US gallons)	56 million litres (15 million US gallons)	544 million litres (143 million US gallons) (971%)

Outcomes - 1

- The renewable fuels lobby has been very effective.
- Widespread government support of the biofuel industry in Canada will have:
 - Intentional and desirable effects
 - Inevitable and undesirable effects



Outcomes - 2

The ethanol frenzy in the US will have a larger impact in Canada than federal and provincial government programs for biofuels.



Outcomes – 3

■ Higher input costs for:

- Beef
- Dairy
- Hogs
- Poultry



Cereal Grains and Oilseeds	Mar 1, 2007 Price	Mar 1, 2006 Price
Corn , CBOT future, next-nearest month, US\$ per bushel	US\$4.36 (86%)	US\$2.35
Soybeans , CBOT future, next-nearest month, US\$ per bushel	US\$7.81 (32%)	US\$5.91
Oats , CBOT future, next-nearest month, US\$ per bushel	US\$2.59 (39%)	US\$1.86
Feed Barley , WCE future, next-nearest month, C\$ per tonne	C\$186.50 (54%)	C\$120.80
Feed Wheat , WCE future, next-nearest month, C\$ per tonne	C\$165.00 (59%)	C\$103.50

Research Questions - 1

With the increase in demand for grains and oilseeds as biofuel feedstocks, how will the pattern of crop production be affected?



Research Questions - 2

With the increase in demand for grains and oilseeds as biofuel feedstocks, what will be the impact on the level and pattern of livestock production?



Research Questions - 3

What are the impacts of the increase in the supply of DDGs on the composition of feed rations, logistics and enterprise profitability?



Research Questions - 4

How might commodity markets adjust as cellulosic ethanol becomes economic?



Modeling Challenges - 1

- There is a need in Canada to develop a **systems model** to help answer these types of research questions.
 - i.e., one that deals with the production, distribution and consumption of goods within and across sectors
 - ... with linkages to foreign sources of demand and supply.

Criteria For a Systems Model

1. Consumer driven.
2. Spatial distribution of production.
3. Clear separation of stages of production.
4. Stages of production occur **in time**.
5. Price and product risk.
6. Capacity to change crop types.
7. Linkages to horizontal markets.
8. Linkages to foreign markets.
9. Capacity to analyze market interventions.



An Obvious Choice...



■ CRAM

- Mathematical programming model
- Used many times to assess many policy alternatives:
 - Statutory freight rates on prairie grains and oilseeds
 - Feed Freight Assistance program
 - Effects of trade agreements (CUSTA and NAFTA)
 - Effects of agricultural program changes (direct assistance to beef and hogs, WGTA)
 - Impacts of possible technological change (rBST)
 - Effectiveness of crop insurance
 - Returns generated through publicly funded research on several agricultural commodities
- Recently updated !!

Another Obvious Choice

■ FARM

- Structural econometric model.
- Used by Agriculture and Agri-Food Canada to generate medium term outlook forecasts.
- 11 key components:
 - Beef, pork, poultry and eggs (3)
 - Milk and dairy products (1)
 - Crops (excl. horticulture) (1)
 - Consumer prices for food and retail food (1)
 - Farm input prices and quantities (2)
 - Farm income, agri-food trade, and manufacturing shipments (3)



Suitability Comparison - 1

Criteria	CRAM	FARM
1. Consumer driven.	LIMITED But it does capture changes in demand and supply	NO Trade is calculated as a residual.
2. Spatial distribution of production.	YES BC (8); Prairies (22); ON (10); QC (11); Maritimes (4)	LIMITED East-West for the supplies of beef, hogs and crops.
3. Clear separation of stages of production.	NO Lower order products (cattle) are sinks for higher order products (feed grains)	YES Linking equations.

Suitability Comparison - 2

Criteria	CRAM	FARM
4. Stages of production occur in time.	NO Static single time period	NO Static single time period
5. Price and product risk.	NO Deterministic, not stochastic	NO Deterministic, not stochastic
6. Capacity to change crop types.	YES But this is a complex process	LIMITED Requires econometric estimation dependant on price, quantity and technical data that may be unavailable.

Suitability Comparison - 3

Criteria	CRAM	FARM
7. Linkages to horizontal markets.	<p>YES</p> <p>Livestock (cattle, hogs, etc) Grains (wheat, barley etc) Oilseeds (canola, soybeans) Special crops, forages, etc</p>	<p>YES</p> <p>Wheat, canola, beef, pork and feed.</p>
8. Linkages to foreign markets.	<p>YES</p> <p>Exogenous linkages</p>	<p>YES</p> <p>Foreign demand and supply equations for wheat, canola, beef, pork and feed.</p>
9. Capacity to analyze market interventions.	<p>YES</p>	<p>YES</p>

Modeling Challenges - 2

- Both CRAM and FARM have advantages and disadvantages.
 - But for most questions, the spatial advantages of CRAM make it a preferable means of analysis.

Model Modifications - 1

- With the increase in demand for grains and oilseeds as biofuel feedstocks, how will the pattern of crop production be affected?
- Requires: Specific biofuels be included as a competing end use for identified crops.
 - quantities demanded of biofuel, location of plants
 - crop varieties, methods.
 - biofuel prices
 - technical coefficients

Model Modifications - 2

- With the increase in demand for grains and oilseeds as biofuel feedstocks, what will be the impact on the level and pattern of livestock production?
- Requires: Important modifications to the livestock component in CRAM, esp. cattle
 - two period model
 - endogenously determined size and location of industry
 - DDGs pose a very complex modelling problem....

Model Modifications - 3

- What are the impacts of the increase in the supply of DDGs on the composition of feed rations, logistics and enterprise profitability?
- Requires: the composition of rations be determined endogenously within CRAM.
 - This plays a big role in the pattern of resource allocation and location of livestock production.
 - Involves several dimensions which are not scientifically well understood.

Model Modifications - 4

■ Physical challenges of DDGs

- Moisture content for shipping
- Consistent nutritive content
 - Levels of fat, protein, amino acids
 - How to incorporate in rations for:
 - Ruminants
 - Dairy and beef, by sex, age, stage of growth
 - Monogastrics
 - Hogs and poultry, by sex and age
- Price elasticities of demand and supply
- Elasticities of substitution within rations and across livestock types.



Model Modifications - 5

- How might commodity markets adjust as cellulosic ethanol becomes economic?
- Requires: Specific biofuels be included as a competing end use for identified crops.
 - quantities demanded of biofuel, location of plants
 - feedstock varieties, methods
 - biofuel prices
 - technical coefficients

Concluding Remarks

- Need a suitable economic systems model for major agricultural industries, particularly those that are vulnerable to rapidly changing supply and demand conditions.
 - This would allow rapid analysis of major policy, production and investment options.