Contracting Strategies for EU Traceability Requirements To the Eurofins International Seminar Paris

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Feb 21, 2008

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Organization

Background

- International Issues
- Review of Literature
- Non-GM grains and Traceability Approach

Costs and Risks Management Strategy Conforming EU Requirements

- Summary of work from Wilson, Henry and Dahl
- *Costs and Risks of Conforming to EU Traceability Requirements: The Case of Hard Red Spring Wheat*
- forthcoming *AgriBusiness*

Contracting for EU Traceability

- Definition and Objectives
- Simulation and Equilibrium
- Base Case Results and Sensitivities

Conclusion and Implications

Background

GM Wheat: Status and Evolution of Traits

- Roundup Ready:
  - Monsanto
  - Approved in US but not submitted in Canada;
  - withdrawn from further consideration
  - Want greater acceptance; focus on other crops; value of traits greater for other crops
- Fusarium Resistance
  - Syngenta
  - Field trials complete
  - Not submitted for deregulation
  - Anticipated available (potentially) in 2013
  - In interim: Improved resistance from conventional breeding; and better chemical treatments (fungicides)
- Varying forms of other traits
  - Drought tolerance
    - Land grant efforts on trait developed at/by OSU
    - Also work in Australia (Victoria)
  - End-use improvement
  - All relatively modest efforts and no plan for commercialization

European Requirements

- 18th April, 2004:
  - End of the moratorium (came in force in 1999).
  - EU allows grain from countries using GM seed under restrictive conditions:
    - Labeling of product containing more than 0.9% of approved GM material.
    - Maintaining high level of traceability

- 1st January, 2005:
  - Traceability becomes obligatory for all food and ingredients.

Applications for Non-GM Grains

- Traceability:
  - One step back and one step forward: system to identify to whom and from whom products are made available.
  - Transmission of specified information concerning the identity of a product to the next agent: certification record, test records,…
  - 5 years period of recordkeeping.
- Labeling:
  - “this product contains genetically modified organisms” if upper the 0.9% threshold.

Recommendations

- On-Farm:
  - Certified seed
  - Isolation between GM and Non-GM fields,
  - Buffer strips,
  - Cleaning, Storage adapted,
  - Auditing, Certification, Testing, Traceability,…
- Others agents:
  - Maintain segregation (transport, storage), Testing, Traceability,…

European regulation announces expected results but not means

Costs and Risks Management Strategy Conforming EU Requirements

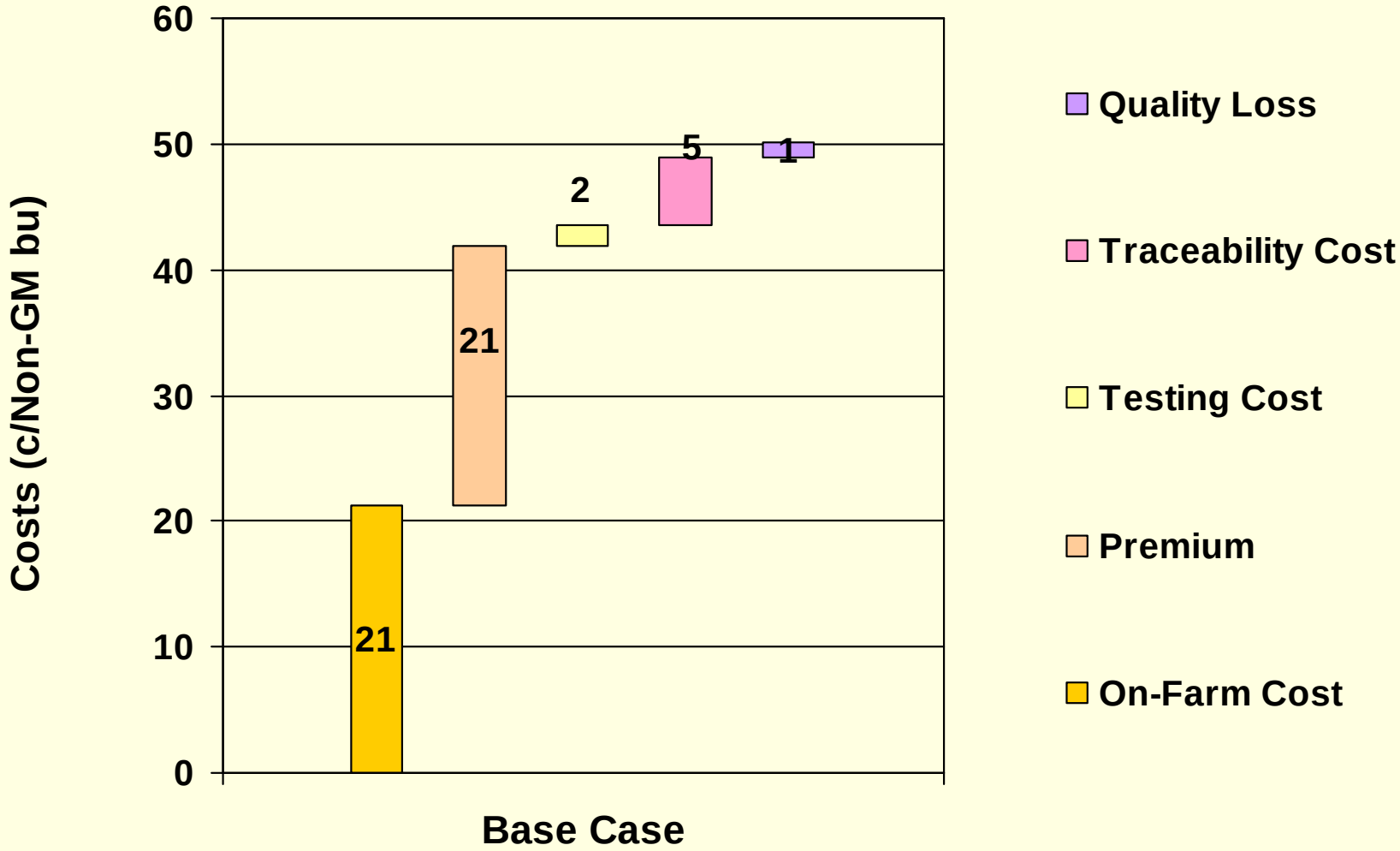
Costs and Risks: Model and Data

- Stochastic optimization model to determine optimal intensity and location of testing to conform to EU traceability requirements
  - Model determines
    - Costs
    - Optimal testing strategy
    - Buyer and seller risk of non-conforming

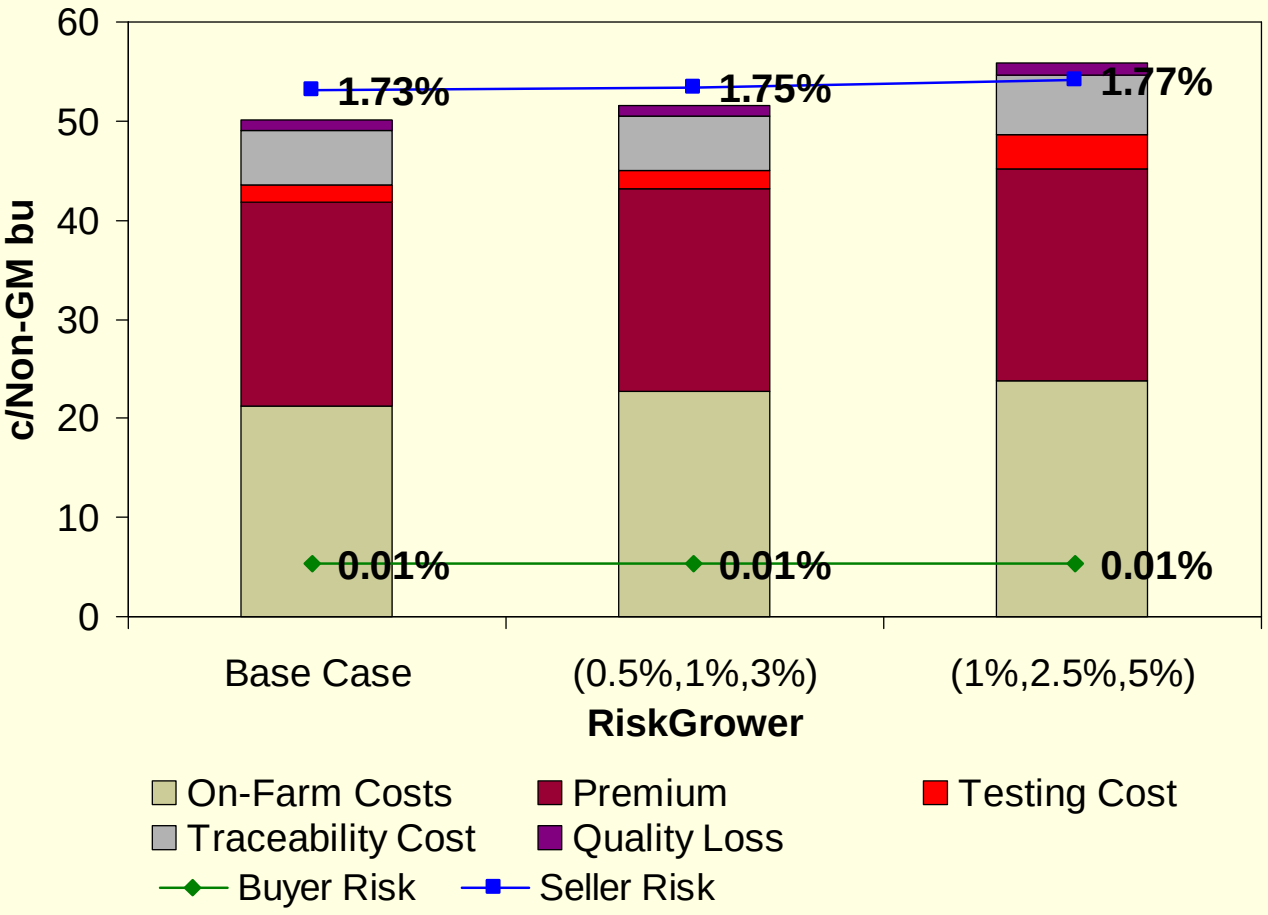
Base Case Results (1)

- Disutility = 1.0373
- Optimal testing strategy (tests per ___ samples):
  - On farm: 1-5 (e.g., 1 test per 5 loads)
  - Country Elevator receiving: 1-5
  - Country Elevator loading: 1-5
  - Export Elevator receiving: 0-NA
  - Export Elevator lading: 1-1
- Risks:
  - Buyer Risk: 0.01%
  - Seller Risk: 1.73%
- Premium/Non-GM bu = 20.56 c/bu $7.70/mt

Base Case Results (2)



Adventitious Commingling Sensitivities



Int. Contamination:

- Less Non-GM grain
- Costs ↑

High Contamination:

- Costs ↑
- Different Testing Strategy
- Testing cost ↑
- Seller risk ↑

Premium increase

Contracting for EU Traceability

Objectives and Definition

- To determine ‘strategic/incentive premium’ to induce participation of US supply chain agent to EU traceability requirements.
- Problem posed as an extensive form game (P-A).
- 4 Players each seeking to maximize profits:
  - Buyer
  - Supplier
  - Farmer, and
  - Nature-- represents uncertainty.

Principal-Agent Problem

- Principal offers contract to the supplier;
  - Supplier accepts or rejects the contract;
    - If accepted: offers or not a contract to the farmer;
      - farmer accepts or rejects the contract.
- All players have outside options.
- Nature represents GM detection in the grain flow is modeled at the end of the tree.

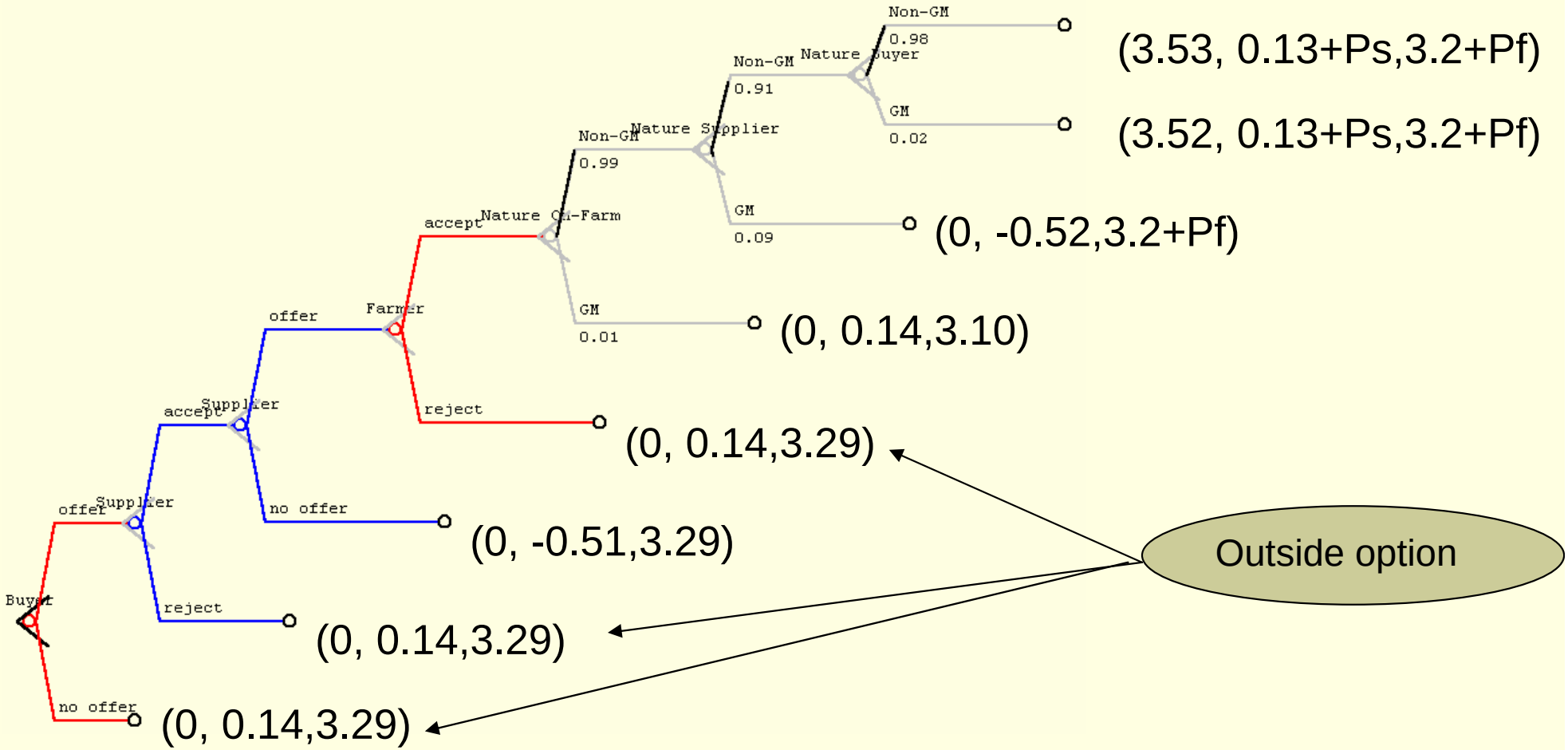
Base Case Data and Assumptions

	Items	Source	Value
Farmer	System Cost	Results of *Risk Optimizer* Base Case	19 c/Non-GM bu
	Testing Cost	Results of *Risk Optimizer* Base Case	0.01 c/Non-GM bu
	Market Price	Assumed from Swenson (2003) and Maxwell (2003)	340 c/Non-GM bu
	Outside Payoff	Swenson et al. 2003	329 c/bu
	Failure Cost	System cost and Testing cost	20 c/bu
	Nature	Results of *Risk Optimizer* Base Case	99.13%
Supplier	System Cost	Results of *Risk Optimizer* Base Case	0.11 c/Non-GM bu
	Testing Cost	Results of *Risk Optimizer* Base Case	0.74 c/Non-GM bu
	Net Margin	Wilson, Johnson and Dahl, 1995	14 c/bu
	Failure Cost	Wilson, Jabs and Dahl, 2002 (penalties)	65c/bu
	Nature	Results of *Risk Optimizer* Base Case	90.54%
Buyer	System Cost	Results of *Risk Optimizer* Base Case	0.1 c/Non-GM bu
	Testing Cost	Results of *Risk Optimizer* Base Case	0.62 c/Non-GM bu
	Market Price	Summation of supplier and farmer market prices	354 c/bu
	Outside Payoff	Summation of supplier and farmer outside payoffs	0 c/bu
	Failure cost	Results of *Risk Optimizer* Base Case (Quality loss)	0.92 c/bu
	Nature	Results of *Risk Optimizer* Base Case	98.19%

Simulation and Equilibrium

- Sequential Equilibrium
- Premium adjustment until contracting strategy achieved
- Costs and nature probabilities are specified and conformed to stochastic optimization:
  - Direct costs included in the model,
  - Nature probabilities are defined from the Non-GM flow of the stochastic simulation.
    - Derived from stochastic simulation

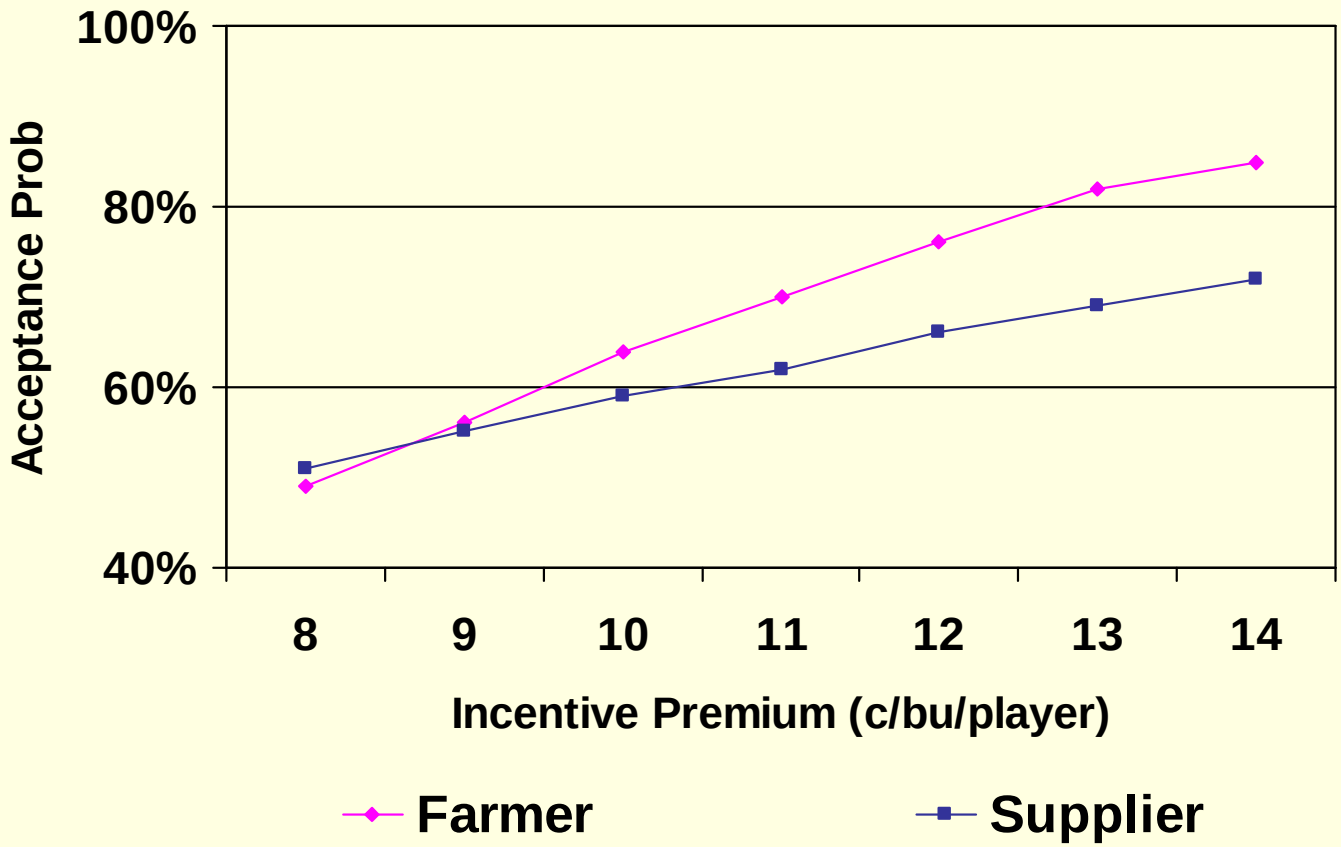
Base Case Tree and Theoretical Payoffs



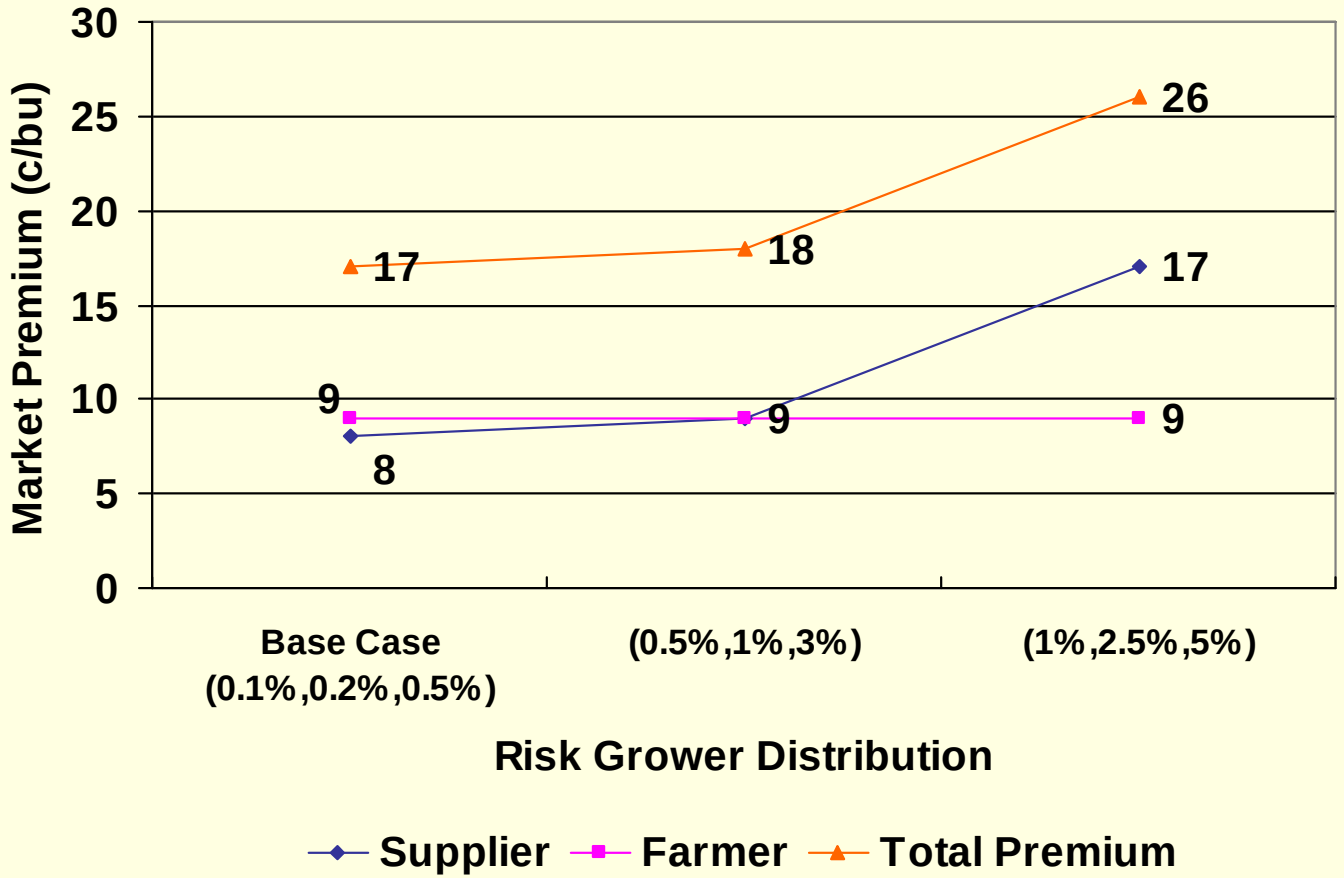
Base Case Results (1)

- Without premium
  - Equilibrium: No contract
- Premiums necessary to induce acceptance (participation)
  - 2.93 $/mt/Non-GM for the supplier:
    - the supplier requires an incentive premium equal to $2.93/mt to participate
  - 3.93$ /Non-GM mt for the farmer:
    - the farmer requires an incentive premium equal 3.93/mt to participate
  - Total premium equal to $6.24/mt/Non-GM
- Mixed strategy equilibrium results:
  - 51% acceptance for the supplier:
    - the supplier accepts contract with prob=51%
  - 56% acceptance for the farmer:
    - the farmer accepts contract with prob=56%
  - Principal and supplier offer 100% of the time a contract.

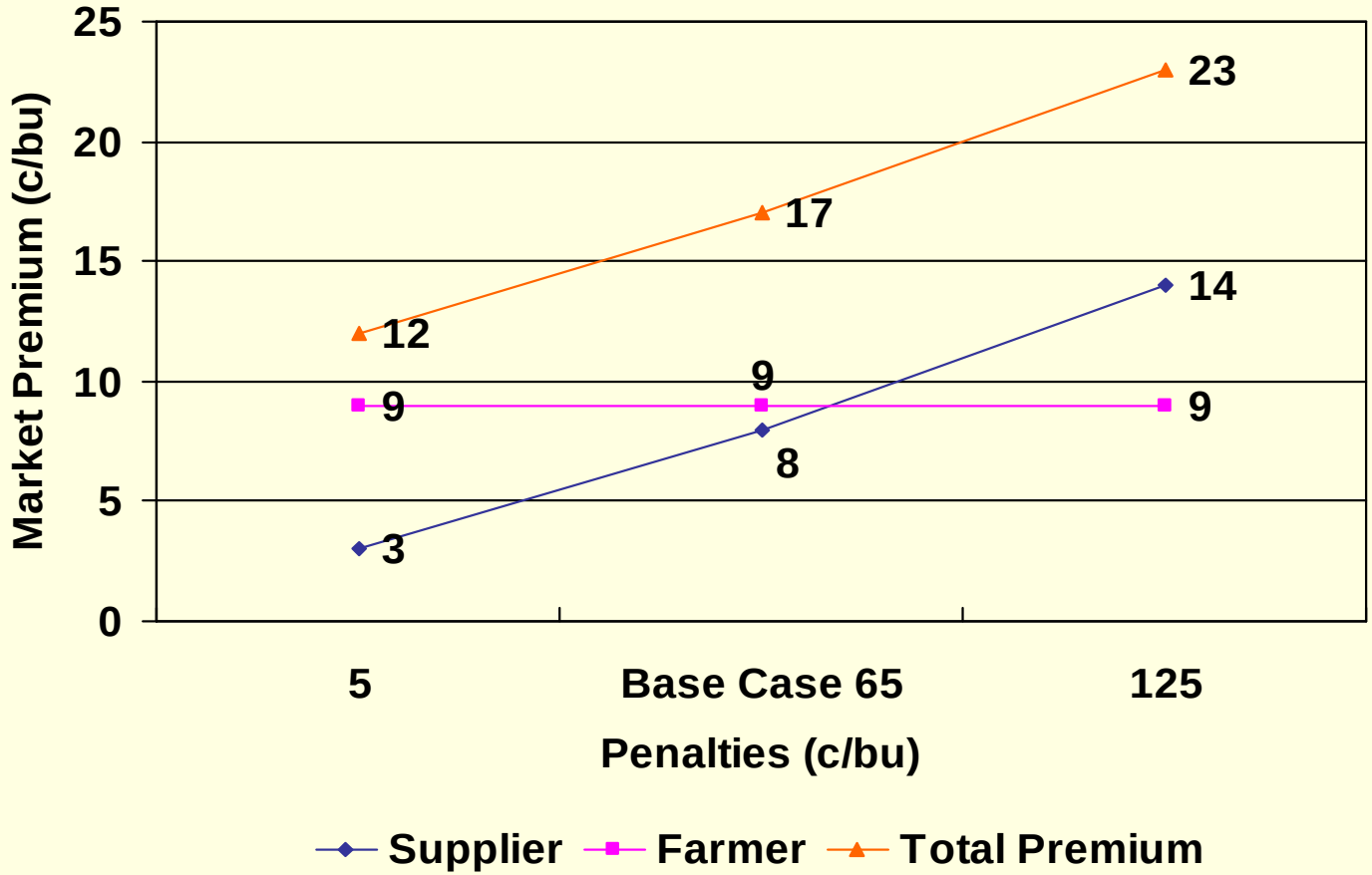
Impacts of Incentive Premium on Prob of Acceptance



Adventitious Commingling (on-farm AP risks) on Premiums



Sensitivities on Penalties



Conclusion and Implications

- Segregation and traceability
  - Are costly practices
  - Costs are not homogeneous between supply chain agents
  - Part of cost is the differential in productivity between GM and non-GM productions
- Contracting
  - Necessary to induce traceability and segregation to conform to EU requirements
  - Not-traditional

Strategic Simulation Conclusion

- Contracts can be developed to induce participation by growers and handlers
  - P-A model of contracting
  - Inclusion of risk and mixed game sequential equilibrium
- Strategic premiums:
  - $2.93/mt (farmer) and $3.30/mt (supplier) to induce participation.
- Farmer incentive premium is sensitive to:
    - Premiums
    - Adoption rate (not shown)
- Supplier incentive premium is sensitive to:
    - Adoption rate (more GM, more risk, greater premium),
    - Penalties for non-conformance
    - On-farm Risks
- Such contracts are more easily implementable in private grain trading industries
  - More difficulty, though not impossible, in STE's due in part to tradition of pooling

Questions and Discussions

Sensitivities on Non-GM Adoption Rate