Will Country-of-Origin Labeling (COOL) be "Cool" for the U.S. Meat Industry?*

by

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Will Country-of-Origin Labeling (COOL) be "Cool" for the U.S. Meat Industry?

The 2002 Farm Bill (PL 107-171) contains a Country of Origin Labeling (COOL) provision that requires retailers to label the country of origin of the covered commodity from September 30, 2004. The covered commodities in this provision include whole muscle and ground product of beef, lamb, and pork, seafood (wild and farm-raised fish and shell fish), fresh and frozen fruits and vegetables, and peanuts. Although the implementation of this provision is expected to affect U.S. agriculture and food industries as well as trade relations with neighboring countries significantly, there is still a great deal of uncertainty regarding the COOL effect. Proponents of COOL claim that the new provision would increase the demand for U.S. beef by promoting beef born, raised, and processed in the United States. However, some producer groups such as National Cattlemen's Beef Association (NCBA) and National Pork Producers Council (NPPC) do not support the mandatory COOL expecting the cost would outweigh the benefit. Packers and retailers are also concerned about the increased labor and infrastructure cost due to the COOL requirements.

This paper provides an economic analysis of the COOL effect in the U.S. meat industry. Specifically we estimate the net producer benefit from COOL after taking into account the potential cost of the COOL program. Unlike previous studies in the literature the present study considers substitution effects in both demand and supply sides of the market. Under the proposed COOL program consumers will have substitution opportunities between two clearly differentiated products, domestic and foreign products, in addition to conventional substitutability among meat products. Decision making from producers (processors and farmers)

is also affected by prices of foreign products due to the substitution in the market. Another unique contribution of this study is to incorporate imperfectly competitive nature of processing sector in the model. It is well known that the U.S. food industry becomes more concentrated and imperfectly competitive. For example, the four-firm concentration ratio for the beef packing industry increased from 0.30 in 1978 to 0.86 in 2000 (Sexton, 2000). Finally, unlike previous studies the current study provide a detailed analysis of COOL impact on each stage of beef supply chain. The newly developed model in this study is a three sector model for the U.S. beef, pork and chicken industries with four production stages (retail, processing, feedlot, and backgrounding) for the beef industry, three production stages (retail, processing, and farm) for the pork industry, and two production stages (retail and farm) for the poultry industry. The model focuses on beef and pork industries because COOL will be implemented in these two industries but not in the poultry industry.

The outline of this paper is the following. First, based on previous studies, we discuss how the COOL provision would be implemented, what the estimated COOL cost would be, and how much consumers would pay more for the COOL product. Then, an equilibrium displacement model is developed to assess potential impacts of the COOL provision on the multi-stages of the U.S. beef production. The newly developed framework is simulated with various estimates of the COOL cost and willingness-to-pay from consumers and simulation results are reported. The final section presents summary and conclusions.

What is COOL and how will it be implemented?

The legal basis for COOL is the Farm Security and Rural Investment Act of 2002 (Public Law 107-171) which amends the Agricultural Marketing Act of 1946. Subtitle D of the Act states: "a retailer of a covered commodity shall inform consumers, at the final point of sale of the covered commodity to consumers, of the country of origin of the covered commodity." COOL is expected to be administered by the Agricultural Marketing Service of the U.S. Department of Agriculture (USDA) beginning September 30, 2004. The USDA has issued voluntary COOL guidelines, but no retailers have implemented them.[1]

In case of beef, lamb, and pork products, the law states that as retailer may use a "United States Country of Origin" label only if the product is from an animal that was exclusively born, raised, and slaughtered in the United States. However, in case of beef, this definition also includes cattle exclusively born and raised in Alaska or Hawaii and transported for a period not to exceed 60 days through Canada to the United States and slaughtered in the United States (AMS, USDA). In case that a product has U.S. and mixed origins, the product must provide detail with respect to production stages including where the animal was born, country or countries in which the animal was raised and the country in which the animal was processed. For example, a product may have the label, "from animals born and raised in Mexico and processed in the USA" or "from animals born in Canada, raised and processed in the USA."[2] Imported product must be labeled at the point of importation regarding the country from which the product is imported (e.g., "Product of Mexico"). Ground or commingled product must identify product as above for each source and must list each source in descending order of prominence by weight. However, the law does not require the label to list the actual percentage

of weight for each constituent ingredient (e.g., 50 percent from United States, 40 percent from Mexico and 10 percent from Canada).

COOL does not apply to foodservice establishments (e.g., restaurants, hotels, convention centers, hospitals, nursing homes, etc.), and butcher shops and retailers with annual sales less than $230,000. For supermarkets, COOL will apply to fresh or frozen whole muscle and ground meats but will not apply to deli foods, canned or cooked products, and fresh or frozen processed products. Under current USDA guidelines, processed products are taken to be combinations of raw products that produce a materially different product or a commodity that is altered by the addition of other ingredients or by further processing (e.g., cooking, curing, or restructuring) to produce a different product. However, covered commodities that retain their identity when combined with other ingredients, such as water enhanced case ready steaks, are not considered to be "processed food items." Grinding a product to produce ground beef, pork or lamb is also not sufficient to exclude it from COOL provisions.

Under the COOL, retailers must provide information about the country of origin for all covered commodities. This is information that retailers would not normally have and must be provided by suppliers. Records must be maintained on all sales for two years. USDA may require " A verifiable record-keeping audit trail" to ensure compliance. Retailers may be subject to a $10,000 fine "per violation" for willful violation of COOL.

What are the responsibilities of suppliers? Subtitle D states, "Any person engaged in the business of supplying a covered commodity to a retailers shall provide information to the retailer regarding country of origin of the covered commodity." In other words, records will be required at every stage of production and processing to verify country of origin. Because liability starts at

the retail level and moves upstream in the marketing chain (back to animal producers), each step of the marketing system will logically shift the risk of information provided by suppliers to suppliers. Retailers, processors and others in the marketing chain have already indicated the intention of requiring contract provisions to ensure that records are in place. Additionally, buyers at all levels may require indemnity clauses (also known as "hold harmless" clauses), which will transfer the liability of incorrect or unverifiable labeling information to the supplier. Third party record-keeping may be required by buyers.

Precise record-keeping requirements are unclear at this time. The Act specifically forbids the USDA from mandating an animal identification system to meet COOL provisions. However, depending on how retailers, processors and others in the marketing system interpret the liability of COOL violations, individual animal ID may be required to meet contractual terms for suppliers. While individual animal ID may not be required to meet COOL requirement, current USDA guidelines indicate that a product labeled as "Product of USA" must be traceable from birth to one or more U.S. producers. Under current USDA voluntary guidelines, self-certification at any stage of production or processing is not sufficient to verify country of origin. Self-certification is simply a supplier telling a buyer (or signing a statement) that the livestock or product was born, raised and processed in the U.S. without accompanying records to verify or certify that the statement is true. However, it is not clear at this time that third party verification of records would be required or who would provide such verification. Under the model of other existing (not related to COOL), USDA provides advisory audits to verify compliance with certification requirements. These audits are performed on a user-fee basis.

Although it is not clear what records producers should maintain, packers are increasingly asking producers to keep various records. Producers at every level of production are asked to maintain clear records on all animal purchases and sales that identify dates, animal number and description, birth place, and names of all suppliers and buyers. Cow-calf producers are also asked to maintain cowherd and calf birth records, sales records including dates, animal number and description, and names of all animal buyers.

Current USDA guidelines indicate that domestic retail product labels must clearly identify the location of production (birth and raised) and processing facilities of covered products. Retailers will ask packers to sticker or stamp all covered commodities with country of origin information that fully complies with the federal standards set forth in the statute as interpreted by the USDA. They will require a sufficient number of signs to ensure one for each retail-sized package; records and a verifiable audit trail to establish the accuracy of the country of origin information for all covered commodities; to indemnification of themselves for any fines and other costs that may incur as a result of the country of origin information that packers provide or fail to provide; segregation of all covered commodities by country of origin throughout the production chain until they are delivered, and documentation verifying the efficacy of the segregation plan; and results of any audit conducted by the USDA or other independent third party to ensure the accuracy of the country of origin information that packers provide.

What would be the estimated COOL cost?

COOL will increase marketing costs in industries where COOL should be implemented. The amount of additional cost has been hotly debated and may depend on decisions about the implementation details yet to be decided (e.g., mandatory vs. voluntary, self-certification vs. third party certification). However, there is every indication that the costs will be significant. For example, Ernie Davis at Texas A&M University estimated $9 billion of total start-up costs for beef industry (*Feedstuffs,* April 7, 2003) while Sparks Companies, Inc. and Cattle Buyers Weekly reported about $1.5 to $1.7 billion (Sparks Companies, Inc., 2003). The estimate from Sparks Companies, Inc. and Cattle Buyers Weekly is close to the USDA's estimate, $2 billion (*Feedstuffs,* April 7, 2003). This section summarizes a joint report from Sparks Companies, Inc. and Cattle Buyers Weekly for estimated COOL costs in the beef industry.

Table 1 provides a summary of estimated COOL costs at each stage of the beef production. Costs for the beef industry are about $50 per head. The cost burden is primarily due to the likelihood that individual animal identification will need to be implemented due to significant commingling of Canadian and Mexican feeder cattle ands calves with U.S. origin animals at the lower end of supply chain, as well as integration of Canadian fed cattle at the slaughter stage and imported beef (primarily from Canada, Australia and New Zealand) at the processing stage of the supply chain. For the industry total, the estimated annual cost to meet the COOL requirements ranges from $1.5 billion to $1.7 billion. Cow-calf producers and backgrounders are expected to bear $198 million while cost at the feedlot level ranges between $109 million and $167 million. Costs at the packer/processor level would exceed those of live animal producers because packers will incur huge costs for segregating beef products during

slaughtering and fabrication stage of production. Costs at the retail level are the biggest among those of supply chains estimated at $23 per head or about $800 million annually.

How would consumers respond to COOL?

A mandatory COOL would be successful if the following conditions are met: there is asymmetric information, COOL increases demand for the product, and the disclosure of possible negative quality attributes does not exceed the benefits (Golan et al.). However, it is not easy to measure the existence of asymmetric information empirically, and it is yet uncertain that COOL will increase demand for "American" product. More specifically it is not clear whether consumers prefer a product guaranteed to be born, raised and processed in United States, and whether they are willing to pay more for a product with a U.S. country-of origin.

Numerous studies have examined consumers' preferences and willingness to pay (WTP) for various credence attributes such as organic, eco-friendly, no use of growth hormones, non-genetically-modified, and shade-grown. While the results of these studies have varied, the general consensus has been that consumers are becoming increasingly concerned about food safety and the origin of their food, and certain segments of the population are willing to pay more for the food guaranteed in food safety and origin (Loureiro, McCluskey and Mittlehammer; Lusk and Fox; Baker and Burnham).

Schupp and Gillespie (2001a and 2001b) surveyed Louisiana consumers, meat processors, wholesalers, retailers and restaurants to determine their attitudes toward mandatory labeling of country-of-origin labeling of beef. The majority of consumers surveyed, 93%, supported mandatory labeling of fresh and frozen beef in retail stores. About 86% of the

consumers rated U.S. beef superior to imported beef based on their expectations of higher quality, and concerns with the safety of imported beef (Schupp and Gillespie, 2001a). The majority of the meat handlers surveyed, 82%, supported mandatory COOL of beef as well. Beef handlers were more likely to favor the labeling requirement if they believed that their customers would benefit from the increased information provided by COOL. However, restaurants that were already using imported beef were less likely to support a mandatory COOL.

Wimberley et al. conducted a national survey of 819 adult consumers to examine American's views on global food sources, who they trust for knowledge of food safety, and the impact of the 9/11 attack on feelings about food safety. About 92 % of respondents say that they would eat meat produced in the United States while only 21 % say yes to eating South American meat, just 14% would eat meat from England, and merely 10% would eat meat from other European countries. The bottom line is that Americans do trust U.S-grown meat. However, they do not trust meat from the other countries very much. Another interesting finding of this survey is the impact of 9/11 attack in 2001 on the American consumer's concern on their food safety. Whereas 46% say they had thought some (28%) or a lot (17%) about the security of our food supply prior to the 9/11 attack, 91 % were somewhat (36%) or very concerned after the attack. While both Schupp and Gillespie's and Wimberley et al.'s studies indicate that American consumers would support mandatory COOL, these studies did not determine if consumers would be willing to pay a premium for the product with a guaranteed COOL.

Several recent studies have estimated U.S. consumers' willingness to pay for a mandatory COOL program. Loureiro and Umberger conducted a survey of 243 consumers in Colorado (Boulder, Denver, and Fort Collins) grocery stores during spring 2002. They found that

Colorado consumers are willing to pay an average of $184 per household annually for a mandatory COOL program. The same respondents were also willing to pay an average of 38% and 58% more for steak and hamburger labeled as "U.S. Certified Steak" and "U.S. Certified Hamburger," respectively, over the initial given prices. Another survey was conducted by Umberger et al. for consumers in Chicago and Denver and found that 73% of consumers surveyed were willing to pay an 11% and 24% premium for steak and hamburger labeled with U.S. country-of-origin, respectively. The most commonly cited reasons by consumers for preferring COOL were: food safety concerns about imported beef, a preference for labeling source and origin information, a strong desire to support to support U.S. producers, and beliefs that U.S. beef was of higher quality. In a separate experiment, consumers participated in an auction and bid on two steaks, one steak was labeled as "Guaranteed USA: Born and raised in the United States" and the other steak carried no label. On average, consumers were willing to pay a 19% premium for the steak labeled "Guaranteed USA: Born and raised in the United States." Similarly, Dickinson and Bailey conducted a laboratory auction to examine meat traceability as well as other credence attributes such as no use of growth hormone, humane animal treatment, and food safety assurance. The auction results indicated that consumers would be willing to pay an 8%, 17%, and 21% more for a roasted beef sandwich ($3.00 initially) that assures basic traceability, humane animal treatment, and food safety, respectively. When the beef sandwich guarantees all three attributes, the premium increased to 35%.

Review of previous studies on market-level effects of COOL

A simple analysis of cost estimates may be misleading because costs can be passed through the marketing channel and trade relations should also affect the welfare effects. A few studies have estimated market-level welfare effects of COOL. Hayes and Meyers estimated the impact of COOL on the pork industry. The study reports that based on an own-price elasticity of pork of –0.7, their projected $10 per head increase in costs would result in a 7% decrease in retail pork demand, and U.S. export could be reduced by 50% as a result of COOL regulation by 2010. Van Sickle et al.'s estimates are more optimistic. They present estimates of $3 billion of consumers' aggregate willingness to pay for the beef industry based on Umberger et al. They also claim that there will be an increased consumer confidence in the labeled products. Derrell examined the impact of COOL on the Mexican beef cattle industry and U.S/Mexican cattle and beef trade. Mexico has exported significant numbers of feeder cattle to the U.S. for many years, and the study reports on an analysis of the impact on Mexican and U.S. cattle and beef markets if the COOL should result in no cattle imports into the U.S. from Mexico. The resulting increased availability of animals and increased fed beef production in Mexico results in a decrease in Mexican fed beef imports of 56,248 metric tons (12.2 % decrease from the current imports) annually, which lowers U.S. calf prices of $1.13 per cwt., decreased feeder cattle prices of $0.56 per cwt., and fed cattle prices reduced by $0.35 per cwt. This long run effects indicates that COOL will potentially hurt U.S. beef producers due to the deteriorated U.S./Mexican cattle and beef trade. Lusk and Anderson considered horizontally linked beef, pork, and poultry demands at the retail level as well as the vertical linkage of farm, wholesale, and retail sectors in their analysis of COOL impact. An equilibrium displacement model was used for the analysis of four possible cases: all of the cost increase is imposed on producers, the increase is split equally

between producers and marketers, one-fourth of the increase is borne by producers and three-fourths by marketers, and all of the cost increase is borne by marketers. Three different cost increases considered in the market include 0.5%, 3%, and 6.5%, where 6.5% increase is equivalent to $1.62 billion of cost increase estimated by Sparks Company Inc. Under the assumption of "no demand change," producers are worse off under COOL if they have to pay any more than about one-fourth of the cost increase. If COOL increases beef demand by 5%, beef producers are always better off except only in the case where costs are at the high end of estimates (6.5% increase) and borne completely by producers.

Although several studies have reported economic impacts on the meat industry, it is still unclear who will bear the most cost and whether benefits will outweigh costs of each participant in the supply chain (e.g., cow-calf producing, backgrounding, feedlot, packing, and retailing in the beef industry). Due to the complexity of meat supply chain, further research is needed with consideration of market power (in particular for processors), substitution effects in both demand and supply, and derived demand and supply relations in the vertically linked multi-production system. The next section presents an analytical framework that addresses the limitations from previous studies.

Model

Consider a three industry model where two inputs, a farm input and a composite marketing input, are used in variable proportions under the constant return to scale technology to produce two differentiated retail products, domestic and foreign products. The model represents beef, pork, and poultry industries horizontally while it also reflects multiple stages of vertical supply chain

for each industry. The presence of market power at the processing level is also considered in this model in both downstream and upstream markets. The COOL is expected to raise producer cost and consumer's willingness to pay for the domestic beef and pork products.

With these considerations initial equilibrium of the model is given by:

Retail (Demand)

Beef

(1) $Q_{BD}^{R} = Q_{BD}^{R}(P_{BD}^{R}, P_{PD}^{R}, P_{C}^{R}, P_{BF}^{R}, P_{PF}^{R})$

(2) $Q_{BF}^{R} = Q_{BF}^{R}(P_{BD}^{R}, P_{PD}^{R}, P_{C}^{R}, P_{BF}^{R}, P_{PF}^{R})$

Pork

(3) $Q_{PD}^{R} = Q_{PD}^{R}(P_{BD}^{R}, P_{PD}^{R}, P_{C}^{R}, P_{BF}^{R}, P_{PF}^{R})$

(4) $Q_{PF}^{R} = Q_{PF}^{R}(P_{BD}^{R}, P_{PD}^{R}, P_{C}^{R}, P_{BF}^{R}, P_{PF}^{R})$

Poultry

(5) $Q_{C}^{R} = Q_{BD}^{R}(P_{BD}^{R}, P_{PD}^{R}, P_{C}^{R}, P_{BF}^{R}, P_{PF}^{R})$

Retail-level derived supply

Beef

(6) $Q_{BD}^{R} = f^{B}(Q_{BD}^{F}, Q_{MD})$

(7) $Q_{BF}^{R} = g^{B}(Q_{BF}^{F}, Q_{MF})$

Pork

(8) $Q_{PD}^{R} = f^{P}(Q_{PD}^{F}, Q_{MD})$

(9) $Q_{PF}^{R} = g^{P}(Q_{PF}^{F}, Q_{MF})$

Poultry

(10) $Q_{C}^{R} = f^{C}(Q_{C}^{F}, Q_{MD})$

Farm-level derived demand

Beef

(11) $P_{BD}^{F}(1+\Omega_{B}) = P_{BD}^{R} f_{Q_{BD}^{R}}^{B}(1-\psi_{B})$

(12) $P_{BF}^{F} = P_{BD}^{R} g_{Q_{BF}^{F}}^{B}(1-\psi_{B})$

(13) $P_{MD} = P_{BD}^{R} f_{Q_{MD}}^{B}(1-\psi_{B})$

(14) $P_{MF} = P_{BF}^{R} g_{Q_{MF}}^{B}$

Pork

(15) $P_{PD}^{F}(1+\Omega_{P})=P_{PD}^{R}\ f_{Q_{PD}^{F}}^{P}(1-\psi_{P})$

(16) $P_{PF}^{F}=P_{PD}^{R}\ g_{Q_{PF}^{F}}^{P}\ (1-\psi_{P})$

(17) $\mathrm{E}\,P_{MD}=\mathrm{E}\,P_{PD}^{R}-\delta_{PD}+\frac{\kappa_{PD}}{\sigma_{PD}}\ (\mathrm{E}\,Q_{PD}^{F}-\gamma_{FPD})-\frac{\kappa_{PD}}{\sigma_{PD}}\ (\mathrm{E}\,Q_{MD}-\gamma_{MD})-\varepsilon_{P\psi}\,\mathrm{E}\,\psi_{P}$

(18) $\mathrm{E}\,P_{MF}=\mathrm{E}\,P_{PF}^{R}-\delta_{PF}+\frac{\kappa_{PF}}{\sigma_{PF}}\ (\mathrm{E}\,Q_{PF}^{F}-\gamma_{FPF})-\frac{\kappa_{PF}}{\sigma_{PF}}\ (\mathrm{E}\,Q_{MF}-\mu_{(MF,MF)})$

Poultry

(19) $P_{C}^{F}\ (1+\Omega_{C})=P_{C}^{R}\ f_{Q_{C}^{F}}^{C}\ (1-\psi_{C})$

(20) $P_{MD}=P_{C}^{R}\ f_{Q_{MD}}^{P}\ (1-\psi_{C})$

<u>Farm-level supply</u>

Beef

(21) $Q_{BD}^{F}=Q_{BD}^{F}\ (P_{BD}^{F},P_{BF}^{F},P_{PD}^{F},P_{PF}^{F},P_{C}^{F})$

(22) $Q_{BF}^{F}=Q_{BF}^{F}\ (P_{BD}^{F},P_{BF}^{F})$

Pork

(23) $Q_{PD}^{F}=Q_{PD}^{F}\ (P_{BD}^{F},P_{BF}^{F},P_{PD}^{F},P_{PF}^{F},P_{C}^{F})$

(24) $Q_{PF}^{F}=Q_{PF}^{F}\ (P_{PD}^{F},P_{PF}^{F})$

Poultry

(25) $Q_{C}^{F}=Q_{C}^{F}\ (P_{BD}^{F},P_{BF}^{F},P_{PD}^{F},P_{PF}^{F},P_{C}^{F})$

where f^{i}_{j} are marginal product of jth input for ith industry and $\Omega_{i}=\frac{\theta_{i}}{\varepsilon_{i}}$ and $\psi_{i}=\frac{\xi_{i}}{\eta_{i}}$ are Lerner indices to denote oligopsony and oligopoly power for the ith industry. Here θ and ξ are conjectural elasticities and η and ε are the absolute value of retail demand elasticity and farm-level supply elasticity, respectively. Note that the model allows substitution between domestic and foreign products as well as between alternative meat products in retail demand and farm-level supply. Definitions of variables are listed in table 2.

To derive an equilibrium displacement model, we need to express (1) to (25) in percentage changes. By totally differentiating these equations, we have:

Retail (Demand)

Beef

(1)' $$\mathrm{E}\,Q_{BD}^{R} = \eta_{(BD,BD)}(\mathrm{E}\,P_{BD}^{R} - \delta_{BD}) + \eta_{(BD,PD)}(\mathrm{E}\,P_{PD}^{R} - \delta_{PD}) + \eta_{(BD,C)}\,\mathrm{E}\,P_{C}^{R} + \eta_{(BD,BF)}\,\mathrm{E}\,P_{BF}^{R} + \eta_{(BD,PF)}\,\mathrm{E}\,P_{PF}^{R}$$

(2)' $$\mathrm{E}\,Q_{BF}^{R} = \eta_{(BF,BD)}(\mathrm{E}\,P_{BD}^{R} - \delta_{BD}) + \eta_{(BF,PD)}(\mathrm{E}\,P_{PD}^{R} - \delta_{PD}) + \eta_{(BF,C)}\,\mathrm{E}\,P_{C}^{R} + \eta_{(BF,BF)}\,\mathrm{E}\,P_{BF}^{R} + \eta_{(BF,PF)}\,\mathrm{E}\,P_{PF}^{R}$$

Pork

(3)' $$\mathrm{E}\,Q_{PD}^{R} = \eta_{(PD,BD)}(\mathrm{E}\,P_{BD}^{R} - \delta_{BD}) + \eta_{(PD,PD)}(\mathrm{E}\,P_{PD}^{R} - \delta_{PD}) + \eta_{(PD,C)}\,\mathrm{E}\,P_{C}^{R} + \eta_{(PD,BF)}\,\mathrm{E}\,P_{BF}^{R} + \eta_{(PD,PF)}\,\mathrm{E}\,P_{PF}^{R}$$

(4)' $$\mathrm{E}\,Q_{PF}^{R} = \eta_{(PF,BD)}(\mathrm{E}\,P_{BD}^{R} - \delta_{BD}) + \eta_{(PF,PD)}(\mathrm{E}\,P_{PD}^{R} - \delta_{PD}) + \eta_{(PF,C)}\,\mathrm{E}\,P_{C}^{R} + \eta_{(PF,BF)}\,\mathrm{E}\,P_{BF}^{R} + \eta_{(PF,PF)}\,\mathrm{E}\,P_{PF}^{R}$$

Poultry

(5)' $$\mathrm{E}\,Q_{C}^{R} = \eta_{(C,BD)}(\mathrm{E}\,P_{BD}^{R} - \delta_{BD}) + \eta_{(C,PD)}(\mathrm{E}\,P_{PD}^{R} - \delta_{(C,PD)}) + \eta_{(C,C)}\,\mathrm{E}\,P_{C}^{R} + \eta_{(C,BF)}\,\mathrm{E}\,P_{BF}^{R} + \eta_{(C,PF)}\,\mathrm{E}\,P_{PF}^{R}$$

Retail-level derived supply

Beef

(6)' $$\mathrm{E}\,Q_{BD}^{R} = \varepsilon_{BD,BD}^{R}\,(\mathrm{E}\,Q_{BD}^{F} - \gamma_{FBD}) + \varepsilon_{BD,MD}^{R}\,\mathrm{E}\,Q_{MD}$$

(7)' $$\mathrm{E}\,Q_{BF}^{R} = \varepsilon_{BF,BF}^{R}\,\mathrm{E}\,Q_{BF}^{F} + \varepsilon_{BF,MF}^{R}\,\mathrm{E}\,Q_{MF}$$

Pork

(8)' $$\mathrm{E}\,Q_{PD}^{R} = \varepsilon_{PD,PD}^{R}\,(\mathrm{E}\,Q_{PD}^{F} - \gamma_{FPD}) + \varepsilon_{PD,MD}^{R}\,\mathrm{E}\,Q_{MD}$$

(9)' $$\mathrm{E}\,Q_{PF}^{R} = \varepsilon_{PF,PF}^{R}\,\mathrm{E}\,Q_{PF}^{F} - \gamma_{FPF}) + \varepsilon_{PF,MF}^{R}\,\mathrm{E}\,Q_{MF}$$

Poultry

(10)' $$\mathrm{E}\,Q_{C}^{R} = \varepsilon_{C,C}^{R}\,\mathrm{E}\,Q_{C}^{F} + \varepsilon_{C,MD}^{R}\,\mathrm{E}\,Q_{MD}$$

Farm-level derived demand

Beef

(11)' $$\mathrm{E}\,P^F_{BD} = \mathrm{E}\,P^R_{BD} - \delta_{BD} - \frac{1-\kappa_{BD}}{\sigma_{BD}}\,(\mathrm{E}\,Q^F_{BD} - \gamma_{FBD}) + \frac{1-\kappa_{BD}}{\sigma_{BD}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{B\psi}\,\mathrm{E}\,\psi_B - \eta_{B\Omega}\,\mathrm{E}\,\Omega_B$$

Here, $\varepsilon_{B\psi} = \frac{\psi_B}{1-\psi_B}$, $\eta_{B\Omega} = \frac{\Omega_B}{1-\Omega_B}$

(12)' $$\mathrm{E}\,P^F_{BF} = \mathrm{E}\,P^R_{BD} - \delta_{BD} - \frac{1-\kappa_{BF}}{\sigma_{BF}}\,\mathrm{E}\,Q^F_{BF} + \frac{1-\kappa_{BF}}{\sigma_{BF}}\,\mathrm{E}\,Q_{MF} - \varepsilon_{B\psi}\,\mathrm{E}\,\psi_B$$

(13)' $$\mathrm{E}\,P_{MD} = \mathrm{E}\,P^R_{BD} - \delta_{BD} + \frac{\kappa_{BD}}{\sigma_{BD}}\,\mathrm{E}\,Q^F_{BD} - \gamma_{FBD}) - \frac{\kappa_{BD}}{\sigma_{BD}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{B\psi}\,\mathrm{E}\,\psi_B$$

(14)' $$\mathrm{E}\,P_{MF} = \mathrm{E}\,P^R_{BF} - \delta_{BF} + \frac{\kappa_{BF}}{\sigma_{BF}}\,\mathrm{E}\,Q^F_{BF} - \frac{\kappa_{BF}}{\sigma_{BF}}\,\mathrm{E}\,Q_{MF}$$

Pork

(15)' $$\mathrm{E}\,P^F_{PD} = \mathrm{E}\,P^R_{PD} - \delta_{PD} - \frac{1-\kappa_{PD}}{\sigma_{PD}}\,(\mathrm{E}\,Q^F_{PD} - \gamma_{FPD}) + \frac{1-\kappa_{PD}}{\sigma_{PD}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{P\psi}\,\mathrm{E}\,\psi_P - \eta_{P\Omega}\,\mathrm{E}\,\Omega_P$$

Here, $\varepsilon_{P\psi} = \frac{\psi_P}{1-\psi_P}$, $\eta_{P\Omega} = \frac{\Omega_P}{1-\Omega_P}$

(16)' $$\mathrm{E}\,P^F_{PF} = \mathrm{E}\,P^R_{PD} - \delta_{PD} - \frac{1-\kappa_{PF}}{\sigma_{PF}}\,\mathrm{E}\,Q^F_{PF} + \frac{1-\kappa_{PF}}{\sigma_{PF}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{P\psi}\,\mathrm{E}\,\psi_P$$

(17)' $$\mathrm{E}\,P_{MD} = \mathrm{E}\,P^R_{PD} - \delta_{PD} + \frac{\kappa_{PD}}{\sigma_{PD}}\,(\mathrm{E}\,Q^F_{PD} - \gamma_{FPD}) - \frac{\kappa_{PD}}{\sigma_{PD}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{P\psi}\,\mathrm{E}\,\psi_P$$

(18)' $$\mathrm{E}\,P_{MF} = \mathrm{E}\,P^R_{PF} - \delta_{PF} + \frac{\kappa_{PF}}{\sigma_{PF}}\,\mathrm{E}\,Q^F_{PF} - \frac{\kappa_{PF}}{\sigma_{PF}}\,\mathrm{E}\,Q_{MF}$$

Poultry

(19)' $$\mathrm{E}\,P^F_{C} = \mathrm{E}\,P^R_{C} - \delta_{C} - \frac{1-\kappa_{C}}{\sigma_{C}}\,\mathrm{E}\,Q^F_{C} + \frac{1-\kappa_{C}}{\sigma_{C}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{C\psi}\,\mathrm{E}\,\psi_C - \eta_{C\Omega}\,\mathrm{E}\,\Omega_C$$

Here, $\varepsilon_{C\psi} = \frac{\psi_C}{1-\psi_C}$, $\eta_{C\Omega} = \frac{\Omega_C}{1-\Omega_C}$

(20)' $$\mathrm{E}\,P_{MD} = \mathrm{E}\,P^R_{C} - \delta_{C} + \frac{\kappa_{C}}{\sigma_{C}}\,\mathrm{E}\,Q^F_{C} - \frac{\kappa_{C}}{\sigma_{C}}\,\mathrm{E}\,Q_{MD} - \varepsilon_{C\psi}\,\mathrm{E}\,\psi_C$$

<u>Farm-level supply</u>

Beef

(21)' $$\mathrm{E}\,Q^F_{BD} = \varepsilon^F_{BD,BD}(\mathrm{E}\,P^F_{BD} - \upsilon_{BD}) + \varepsilon^F_{BD,BF}\,\mathrm{E}\,P^F_{BF} + \varepsilon^F_{BD,PD}(\mathrm{E}\,P^F_{PD} - \upsilon_{PD}) + \varepsilon^F_{BD,PF}\,\mathrm{E}\,P^F_{PF} + \varepsilon^F_{BD,C}\,\mathrm{E}\,P^F_C$$

(22)' $$\mathrm{E}\,Q^F_{BF} = \varepsilon^F_{BF,BD}(\mathrm{E}\,P^F_{BD} - \upsilon_{BD}) + \varepsilon^F_{BF,BF}\,\mathrm{E}\,P^F_{BF}$$

Pork

(23)' $$\mathrm{E}\,Q^F_{PD} = \varepsilon^F_{PD,BD}(\mathrm{E}\,P^F_{BD} - \upsilon_{BD}) + \varepsilon^F_{PD,BF}\,\mathrm{E}\,P^F_{BF} + \varepsilon^F_{PD,PD}(\mathrm{E}\,P^F_{PD} - \upsilon_{PD}) + \varepsilon^F_{PD,PF}\,\mathrm{E}\,P^F_{PF} + \varepsilon^F_{PD,C}\,\mathrm{E}\,P^F_C$$

(24)' $$\mathrm{E}\,Q^F_{PF} = \varepsilon^F_{PF,PD}(\mathrm{E}\,P^F_{PD} - \upsilon_{(PF,PD)}) + \varepsilon^F_{PF,PF}\,\mathrm{E}\,P^F_{PF}$$

Poultry

(25)' $$\mathrm{E}\,Q^F_C = \varepsilon^F_{C,BD}(\mathrm{E}\,P^F_{BD} - \upsilon_{BD}) + \varepsilon^F_{C,BF}\,\mathrm{E}\,P^F_{BF} + \varepsilon^F_{C,PD}(\mathrm{E}\,P^F_{PD} - \upsilon_{PD}) + \varepsilon^F_{C,PF}\,\mathrm{E}\,P^F_{PF} + \varepsilon^F_{C,C}\,\mathrm{E}\,P^F_C$$

where EQ and EP denote relative change, i.e., EQ = dQ/Q and EP = dP/P. Equations need to be solved for 25 endogenous variables and simulated with values of parameters. The current model will be extended to a more comprehensive model that include more detailed production stages (i.e., 4 production stages for beef, 3 for pork and 2 for poultry industries) and simulation results will be presented at the meeting.

Discussions and conclusions

The mandatory COOL is expected to start from September 30, 2004 and the implementation of this provision is likely to affect U.S. meat and related food industries significantly. However, there is still uncertainty in the record-keeping requirements and their economic impacts on these industries. Although the provision does not mandate an animal identification system, it does require "traceability" from birth to retailers that should be verifiable. Although it is not clear at this time that the verification by a third party is required or not, under current USDA voluntary guidelines, self-certification is not sufficient. Since the cost of maintaining "traceability" for

individual animal is extremely high and is a primary source of high COOL cost, the economic analysis of COOL effects heavily relies on the interpretation of the record-keeping requirements. As estimated in Lusk and Anderson, if COOL cost is as high as increasing by 6.5% (as estimated by Sparks Company Inc. and USDA) and borne completely by producers, beef producers are likely to suffer from COOL. To avoid the high cost, many producer groups, packers, and retailers have suggested a voluntary COOL with a self-certification. So far, USDA is reluctant to go this direction because the voluntary program will significantly limit the effectiveness of the program. Conclusions of this paper will be presented based on simulation results.

References

Dickinson, D.L. and D. Bailey. "Meat Traceability: Are U.S. Consumers Willing to Pay for It?" *Journal of Agricultural and Resource Economics* 27(2002).

Golan, E., F. Kuchler, L. Michell, C. Greene, and A. Jessup. "Economics of Food Labeling." Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 793, 2000.

Hayes, D.J. and S.R. Meyer. "Impact of U.S. Country of Origin labeling on U.S. Pork Exports." 2003.

Krissoff, B, F. Kuchler, K. Nelson, J Perry, and A. Somwaru. "Country-of Origin Labeling: Theory and Observation." WRS-04-02, ERS, USDA, January 2004.

Loureiro, M.L., J.J. McCluskey, and R.C. Mittelhammer. "Assessing Consumers Preferences for Organic, Eco-labeled and regular Apples." *Journal of Agricultural and Resources Economics* 26(2)(2001): 404-416.

Loureiro, M.L. and W.J. Umberger. "Estimating Consumer Willingness-to-Pay for Country-of-Origin Labeling." *Journal of Agricultural and Resource Economics* (2003 forthcoming).

Lusk, J.L. and J.D. Anderson. "Modeling the Effects of Country of Origin Labeling on Meat Producers and Consumers." Staff Paper #03-07, Purdue University, June 2003.

Lusk, J.L. and J.A. Fox. "Consumer Demand for Mandatory Labeling of Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn." *Journal of Agricultural and Applied Economics* 34(1) (2002): 27-38.

Miller, J. "Producer Expectation for Country-of-Origin Labeling." Paper presented at the 2003 FAMPS Conference. March 2003.

Peel, D. "A Summary of the Impact of Country of Origin Labeling (COOL) on the Mexican Beef Cattle Industry and U.S./Mexican Cattle and Beef Trade." Livestock Marketing Information Center. Oklahoma State Extension Services in Cooperation with USDA. May 16, 2003.

Schupp, A and J. Gillespie. "Consumer Attitudes Toward Potential Country-of-Origin Labeling of Fresh or Frozen Beef." *Journal of Food Distribution Research* 33 (2001): 34-44.

Smith, R. "COOL start-up costs put at $9 billion; AMS issues listening dates, locations." *Feedstuffs*, April 7, 2003.

Sparks Companies, Inc. "COOL Cost Assessment." April 2003.

Umberger, W.J., D.M. Feuz, C.R. Calkins and B.M. Sitz. "Country-of-Origin Labeling of Beef Products: U.S. Consumers' Perceptions. Paper presented at the 2003 FAMPS Conference. March 2003.

U.S. Senators. *Cattle Buyers Weekly*, April 28, 2003.

VanSickle, J, R. McEowen, C.R. Taylor, N. Harl, and J. Conner. "Country-of-Origin Labeling: A legal and Economic Analysis." International Trade and Policy Center Paper PBTC 03-5, University of Florida, May 2003.

Wimberley, R.C. and multiple co-authors. "Food from Our Changing World: The Globalization of Food and How Americans Feel About It." http://sasw.chass.ncsu.edu/global-food, February 2003.

Footnotes

1. Because of the delayed preparation and growing opposition from the industry, Congress recently agreed to delay COOL for two years to revisit some of the legislative requirements. The two-year delay will apply to meats, produce, and peanuts, but not to farm-raised and wild fish (Krissoff et al.).

2. Although slaughter, fabrication, and grinding of meat does not constitute processing for purposes of the exclusion of processed products under COOL, USDA will permit the term processing instead of slaughter on COOL labels fearing negative consumer reaction to the term "slaughter."

Table 1. Beef Supply Chain COOL Cost Estimates

	$/Head	Segment Cost (Million $)	Calculation Process
Cow-Calf Producer, Backgrounders	$4.88	$198.00	38 Million Head Calf Crop 2.5 Million Head Imports
Feedlot	$3.75-5.75	$109-167	29 Million Head Sold
Packer/Processor	$15-18	$435-522	29 Million Head Steer/Heifer 6 Million Head Cows/Bulls
Retail Distribution and Retail Store	$23.00	$805.00	8 Billion lbs. Sold @ 10 cents/lb from 35 Million Cattle
TOTAL	$47.13-$51.63	$1571- $1716	

Source: Sparks Companies Inc.

Table 2. Definitions of variables

Symbol	Definition
Q_{BD}^{R}	Quantity of domestic beef at the retail level
Q_{BF}^{R}	Quantity of foreign beef at the retail level
Q_{BD}^{F}	Quantity of domestic beef at the farm level
Q_{BF}^{F}	Quantity of foreign beef at the farm level
Q_{MD}	Quantity of domestic market input
Q_{MF}	Quantity of foreign market input
P_{BD}^{R}	Retail price of domestic beef
P_{BF}^{R}	Retail price of foreign beef
P_{BD}^{F}	Farm price of domestic beef
P_{BF}^{F}	Farm price of foreign beef
P_{MD}	Price of domestic market input
P_{MF}	Price of foreign market input
Q_{PD}^{R}	Quantity of domestic pork at the retail level
Q_{PF}^{R}	Quantity of foreign pork at the retail level
Q_{PD}^{F}	Quantity of domestic pork at the farm level
Q_{PF}^{F}	Quantity of foreign pork at the farm level
P_{PD}^{R}	Retail price of domestic pork
P_{PF}^{R}	Retail price of foreign pork
P_{PD}^{F}	Farm price of domestic pork
P_{PF}^{F}	Farm price of foreign pork
Q_{C}^{R}	Quantity of domestic poultry at the retail level
Q_{C}^{F}	Quantity of domestic poultry at the farm level
P_{C}^{R}	Retail price of domestic poultry
P_{C}^{F}	Farm price of domestic poultry

Table 3. Definitions of parameters

Parameter	Definition
$\eta^{R}_{(BD,BD)}$	Retail level own-price demand elasticity for domestic beef
$\eta^{R}_{(BD,PD)}$	Retail level cross-price demand elasticity for domestic beef with respect to domestic pork
$\eta^{R}_{(BD,C)}$	Retail level cross-price demand elasticity for domestic beef with respect to poultry
$\eta^{R}_{(BD,BF)}$	Retail level cross-price demand elasticity for domestic beef with respect to foreign beef
$\eta^{R}_{(BD,PF)}$	Retail level cross-price demand elasticity for domestic beef with respect to foreign pork
$\eta^{R}_{(BF,BD)}$	Retail level cross-price demand elasticity for foreign beef with respect to domestic beef
$\eta^{R}_{(BF,PD)}$	Retail level cross-price demand elasticity for foreign beef with respect to domestic pork
$\eta^{R}_{(BF,C)}$	Retail level cross-price demand elasticity for foreign beef with respect to poultry
$\eta^{R}_{(BF,BF)}$	Retail level own-price demand elasticity for foreign beef
$\eta^{R}_{(BF,PF)}$	Retail level cross-price demand elasticity for foreign beef with respect to foreign pork
$\eta^{R}_{(PD,BD)}$	Retail level cross-price demand elasticity for domestic beef with respect to domestic beef
$\eta^{R}_{(PD,PD)}$	Retail level own-price demand elasticity for domestic pork
$\eta^{R}_{(PD,C)}$	Retail level cross-price demand elasticity for domestic pork with respect to poultry
$\eta^{R}_{(PD,BF)}$	Retail level cross-price demand elasticity for domestic pork with respect to foreign beef
$\eta^{R}_{(PD,PF)}$	Retail level cross-price demand elasticity for domestic pork with respect to foreign pork
$\eta^{R}_{(PF,BD)}$	Retail level cross-price demand elasticity for foreign pork with respect to domestic beef
$\eta^{R}_{(PF,PD)}$	Retail level cross-price demand elasticity for foreign pork with respect to domestic pork
$\eta^{R}_{(PF,C)}$	Retail level cross-price demand elasticity for foreign pork with respect to poultry
$\eta^{R}_{(PF,BF)}$	Retail level cross-price demand elasticity for foreign pork with respect to foreign beef
$\eta^{R}_{(PF,PF)}$	Retail level own-price demand elasticity for foreign pork
$\eta^{R}_{(C,BD)}$	Retail level cross-price demand elasticity for poultry respect to domestic beef
$\eta^{R}_{(C,PD)}$	Retail level cross-price demand elasticity for poultry with respect to domestic pork
$\eta^{R}_{(C,C)}$	Retail level own-price demand elasticity for poultry

$\eta^R_{(C,BF)}$ Retail level cross-price demand elasticity for poultry with respect to foreign beef

$\eta^R_{(C,PF)}$ Retail level cross-price demand elasticity for poultry with respect to foreign pork

$\varepsilon^R_{BD,BD}$ Retail level own-price derived supply elasticity for domestic beef

$\varepsilon^R_{BD,MD}$ Retail level cross-price supply elasticity for domestic beef with respect to domestic market input

$\varepsilon^R_{BF,BF}$ Retail level own-price derived supply elasticity for foreign beef

$\varepsilon^R_{BF,MF}$ Retail level cross-price supply elasticity for foreign beef with respect to foreign market input

$\varepsilon^R_{PD,PD}$ Retail level own-price derived supply elasticity for domestic pork

$\varepsilon^R_{PD,MD}$ Retail level cross-price supply elasticity for domestic pork with respect to domestic market input

$\varepsilon^R_{PF,PF}$ Retail level own-price derived supply elasticity for foreign pork

$\varepsilon^R_{PF,MF}$ Retail level cross-price supply elasticity for foreign pork with respect to foreign market input

$\varepsilon^R_{C,C}$ Retail level own-price derived supply elasticity for domestic poultry

$\varepsilon^R_{C,MD}$ Retail level cross-price supply elasticity for domestic poultry with respect to domestic market input

σ_{BD} Substitution elasticity between farm and marketing inputs for domestic beef production

κ_{BD} Farm level domestic beef input's cost share; $\kappa_{BD} = S_{BF}(1+\Omega_{BD})/(1-\psi_{BD})$

σ_{BF} Substitution elasticity between farm and marketing inputs for foreign beef production

κ_{BF} Farm level foreign beef input's cost share; $\kappa_{BF} = S_{BMD}/(1-\psi_{BD})$

σ_{PD} Substitution elasticity between farm and marketing inputs for domestic pork production

κ_{PD} Farm level domestic pork input's cost share

σ_{PF} Substitution elasticity between farm and marketing inputs for foreign pork production

κ_{PF} Farm level foreign pork input's cost share

σ_{C} Substitution elasticity between farm and marketing inputs for domestic poultry production

κ_{C} Farm level poultry input's cost share

$\varepsilon^{F}_{BD,BD}$ Farm level own-price supply elasticity for domestic beef

$\varepsilon^{F}_{BD,BF}$ Farm level cross-price supply elasticity for domestic beef with respect foreign beef

$\varepsilon^{F}_{BD,PD}$ Farm level cross-price supply elasticity for domestic beef with respect domestic pork

$\varepsilon^{F}_{BD,PF}$ Farm level cross-price supply elasticity for domestic beef with respect foreign pork

$\varepsilon^{F}_{BD,C}$ Farm level cross-price supply elasticity for domestic beef with respect poultry

$\varepsilon^{F}_{BF,BD}$ Farm level own-price supply elasticity for foreign beef with respect domestic beef

$\varepsilon^{F}_{BF,BF}$ Farm level own-price supply elasticity for foreign beef

$\varepsilon^{F}_{PD,BD}$ Farm level cross-price supply elasticity for domestic pork with respect domestic beef

$\varepsilon^{F}_{PD,BF}$ Farm level cross-price supply elasticity for domestic pork with respect foreign beef

$\varepsilon^{F}_{PD,PD}$ Farm level own-price supply elasticity for domestic pork

$\varepsilon^{F}_{PD,PF}$ Farm level cross-price supply elasticity for domestic pork with respect foreign pork

$\varepsilon^{F}_{PD,C}$ Farm level cross-price supply elasticity for domestic pork with respect poultry

$\varepsilon^{F}_{PF,PD}$ Farm level own-price supply elasticity for foreign pork with respect domestic pork

$\varepsilon^{F}_{PF,PF}$ Farm level own-price supply elasticity for foreign pork

$\varepsilon^{F}_{C,BD}$ Farm level cross-price supply elasticity for domestic pork with respect domestic beef

$\varepsilon^{F}_{C,BF}$ Farm level cross-price supply elasticity for poultry with respect foreign beef

$\varepsilon^{F}_{C,PD}$ Farm level own-price supply elasticity for poultry with respect domestic pork

$\varepsilon^{F}_{C,PF}$ Farm level cross-price supply elasticity for poultry with respect foreign pork

δ_{BD} Shifter of domestic beef price at retail level

δ_{PD} Shifter of domestic pork price at retail level

γ_{FBD} Shifter of domestic beef quantity at the farm level

γ_{FPD} Shifter of domestic pork quantity at the farm level

υ_{BD} Shifter of domestic beef price at farm level

υ_{PD} Shifter of domestic pork price at farm level