Estimating the Consumer Expenditure under COOL

Osei Yeboah
Professor
Department of Agribusiness, Applied Economics & Agriscience Education
North Carolina A & T State University
A-25 C.H. Moore Agricultural Research Facility
1601 E. Market St. Greensboro, NC 27411
Email: oyeboah@ncat.edu

Cephas B Naanwaab
Assistant Professor
Department of Economics
School of Business and Economics
North Carolina A & T State University
117 Merrick Hall
1601 E. Market St. Greensboro, NC 27411
Email: cbnaanwa@ncat.edu

Johnson Antwi
Graduate Research Assistant
Department of Agribusiness,
Applied Economics & Agriscience Education
North Carolina A & T State University
A-18 C.H. Moore Agricultural Research Facility
1601 E. Market St. Greensboro, NC 27411
Email: jantwi@aggies.ncat.edu

Selected paper prepared for presentation at the Southern Agricultural Economics Association's 2015 Annual Meeting, Atlanta, Georgia, January 31-February 3, 2015

Abstract

Country of Origin Labeling (COOL) is a labeling procedure, passed in the 2008 Farm Bill by the United States Congress requiring all food products to be labeled by their country of origin. According to Brester *et al*. (2005), COOL will generate an additional cost of 1.24% and 3.41% for US beef and pork consumers, respectively, which will affect their expenditure patterns. This paper seeks to analyze the effect of COOL induced expenditures on US beef and pork products. A system of linear expenditure functions are developed and used to estimate the own price and cross price elasticities as well as the income elasticities. Consumer expenditure (retail quantities and prices) on each product is regressed on per capita GDP and consumer expenditure on a related product such as chicken using quarterly data from 2004 to 2008 to represent pre COOL; and 2009 to 2013 constituting post COOL. The" pre'' and "post" COOL estimated elasticities are compared. The estimated coefficients were all statistically significant both before and after the implementation of COOL. Generally, consumer expenditure on beef and pork after the implementation of COOL decreased while the consumer expenditure on chicken increased.

Key words: beef, country of origin labeling, linear expenditure model, pork, chicken.

Introduction

Country of Origin Labeling (COOL) is a labeling law, passed in the 2008 Farm Bill by the United States Congress requiring meat, fruits and vegetables, and peanuts to be labeled as to their country of origin. Both the authorization and implementation of COOL by the USDA have been controversial, particularly for the labeling rules for meat and meat products. COOL regulations give retailers a number of options for marking commodities, including via placards, signs, labels, stickers, bands, twist ties, and pin tags. The regulations do not prescribe a specific font size, typeface, color, or location for country of origin markings, but declarations must be legible and must appear in a conspicuous location. Bulk containers used at the retail level may contain a covered commodity from more than one country of origin provided that all possible countries of origin are listed. The declaration of the country of origin of a product may take the form of a statement such as "Product of USA," "Produce of the USA," or "Grown in Mexico," or it may take the form of a check box provided it is in conformance with other federal labeling. The COOL regulations define the term ‘‘raised’’ as ‘‘the period of time from birth until slaughter or in the case of animals imported for immediate slaughter. Consumers are becoming increasingly concerned with the quality, safety and production attributes of their food (Caswell 1998). Consumers' concerns with the safety and origin of beef are especially true in light of recent European and Japanese BSE outbreaks and occurrences of *E-coli 0157:H7* in U.S. beef (Shiptsova, Thomsen, & Goodwin 2002).

Verification immediately became one of the most contentious issues, particularly for livestock producers, in part because of the potential complications and costs to affected industries of tracking animals and their products from birth through retail sale. The necessary documentation and verification for mandatory COOL is a complex issue. Regardless of the discussion, Dickinson & Bailey (2002) recently conducted research evaluating consumers' preferences for beef and pork products guaranteed to be traceable to the animal of origin, as well as for other credence attributes: humane animal treatment, no added growth hormones, and food-safety assurance. Although consumers in that study valued and were willing to pay for traceability, they placed a higher value on food-safety assurance and the other credence attributes which are only verifiable through a traceback system. Producers of plant-based commodities, as well as food retailers and others, also expressed concern about the cost and difficulty of maintaining records for commodities that are highly fungible and often widely sourced. USDA's Food Safety and

Inspection Service (FSIS) is responsible for labels on meat products. FSIS labeling policy allows fresh muscle cuts of beef and lamb to be identified as "U.S. beef" or "U.S. lamb" so long as the statement is truthful. USDA's Agricultural Marketing Service (AMS) offers a voluntary program to officially certify that livestock, meat, and meat products originate from the United States and are eligible to be labeled as "U.S. beef." The voluntary program certifies that livestock and meat products have been produced from livestock born, raised, slaughtered, and processed in the United States. In effect, USDA has offered to overcome the major stumbling block for labels: verification and certification. To certify U.S. origin, AMS audits production and processing records. FSIS noted that when its report was written, there were no participants in the program (FSIS, 2000).

Proponents of mandatory COOL have expressed concerns about the safety of imported food and have argued that "consumers have a right to know" where their food is coming from (Food Marketing Institute 2002). The latest U.S. labeling rules, put into effect in 2013, require meat sold in grocery stores to indicate the country, or countries, where the animal was born, raised and slaughtered. Additionally, supporters of mandatory labeling believe COOL would provide U.S. producers with a competitive advantage in the supermarket (Schupp & Gillespie 2001b). It is interesting to note that the most vocal proponents of COOL have been groups primarily representing feeder cattle producers. The strong support of COOL provided by some feeder cattle producers indicates that those producers expect COOL-induced beef demand increases to more than offset additional marketing costs. They may be unaware that the incidence of both COOL costs and benefits will largely be determined by relative supply and demand elasticities among meat industries and market levels. Among beef industry participants at all levels, arguments over COOL scarcely abated (and probably intensified) after the Farm Bill was passed. VanSickle et al. (2003) were decidedly more optimistic in their evaluation of the impacts of COOL. Extrapolating from willingness-to-pay estimates by Umberger et al. (2003), they calculated an "aggregate willingness to pay" in the beef industry alone of almost $3 billion. Production attributes that may be valued by consumers, such as country of origin, are considered *credence characteristics* (Darby & Karni 1973; Caswell & Mojduszka 1996). Truthful labeling of credence characteristics allows consumers to judge products before purchasing (Caswell 1998).Van Sickle et al. also noted other potential benefits such as increased consumer confidence in the labeled product. Predictably, much of the debate over COOL focused on how much it would cost and who would

have to pay for it. Firms will voluntarily label a food-product attribute if the private benefits from doing so exceed the costs (Caswell & Mojduszka 1996). The WTO's continued assault against commonsense food labels is just another example of how corporate-controlled trade policy undermines the basic protections that U.S. consumers deserve. The United States should appeal the ruling and continue to fight for sensible consumer safeguards at the supermarket (Food & Water Watch Executive Director, Wenonah Hauter).

Conversely, others argue that although some consumers may be willing to pay for country-of-origin labeling, they may not have to pay for any of it, given that the majority of beef and pork products are of domestic origin (Plain & Grimes, 2003). Thus, imported meat products could sell at a discount rather than domestic products commanding a premium. In August 2003, the U.S. General Accounting Office (GAO) concluded the USDA's initial cost estimates were too high and questioned many of the USDA's initial cost assumptions. In October 2003, the USDA released its "Proposed Rule on Mandatory County-of-Origin Labeling." In this document, the USDA estimated record-keeping costs of $582 million for the first year of development and ongoing costs of $458 million for maintenance and operation of record keeping. In addition to these direct record-keeping costs, the USDA projected additional capital costs could be as much as $3.9 billion. Other critics have argued that mandatory COOL would impose a trade barrier and instigate trade wars (see Schupp and Gillespie 2001a & Food Marketing Institute 2002).

USDA's mandatory COOL rule is not only onerous and burdensome on livestock producers and meat packers and processors, it does not bring the U.S. into compliance with its WTO obligations," the joint statement read. "By being out of compliance, the U.S. is subject to retaliation from Canada and Mexico that could cost the U.S. economy billions of dollars. According to the USDA's Economic Research Service (USDA/ERS, 2003), beef imports from all sources represented 16.9% of total U.S. beef supplies. Fifty-one percent of all beef imports were trimming and manufacturing grade beef which is subsequently ground into hamburger. Live cattle imports (on a carcass weight basis) from Canada represented approximately 28% of U.S. beef imports in 2002. The United States imported approximately 1.1 billion pounds of pork in 2002, which represented about 5.2% of total U.S. pork supplies. Over 80% of these imports originated in Canada. In addition, the United States imported 5.7 million head of hogs and feeder pigs, representing about 5.7% of U.S. hog slaughter. Almost all hog imports originated in Canada (USDA/ERS, 2003). The U.S. poultry industry is the world's largest producer and

exporter of poultry meat. In 2002, U.S. poultry meat (broilers, other chicken, and turkey) exports were about 14.5% of domestic poultry supplies. Imports amounted to 16 million pounds, or less than 0.5% of domestic production (USDA/ERS, 2003).

The Canadian cattle and hog industries say that COOL has cost them combined losses of more than $900 million USD. If the COOL rules persist, the Canadian government has threatened to place tariffs on U.S. meat imports, along with products such as wine, potatoes and orange juice. The U.S. beef industry has strongly opposed COOL, while organizations representing consumers say that grocery shoppers deserve to know where their meat originates. Eight groups representing the American and Canadian meat industries filed the lawsuit in the U.S. District Court for the District of Columbia to block implementation of a mandatory country-of-origin labeling (COOL) rule. The rule, finalized by the USDA in May 2013, requires origin declaration for three meat production steps: born, raised and slaughtered. It also eliminates the ability to commingle products, which requires segregation of livestock and products in the supply chain. Even if consumers do favor domestic over imported products, labeling costs may outweigh the benefits from increased demand. Part of the reason benefits are small is that imported muscle cuts are a small fraction of total domestic beef consumption (1-2 percent in recent years (FSIS, 2000)). If labels served to exclude a portion of imported beef, the realized price increase would be relatively small in the short run and most likely zero in the long run.

The World Trade Organization (WTO) has ruled in favor of Canada and Mexico in an ongoing dispute with the United States over country-of-origin labeling (COOL) on meat. COOL is a failed program that will soon cost not only the beef industry, but the entire U.S. economy, with no corresponding benefit to consumers or producers (Bob McCan, president of the National Cattlemen’s Beef Association). The USDA estimated that the "first-year incremental costs for growers, producers, processors, wholesalers and retailers are $2.6 billion" and the "estimated cost to the United States economy in higher food prices and reduced food production in the tenth year after implementation of the rule is $211.9 million.

Literature review

The review of relevant literature points out of the question of who will pay the cost associated with the implementation of COOL and how much are they willing to spend on the affected meat products? Some proponents of COOL interpret the results of their willingness to pay (WTP) studies to be evidence that premiums would exist at the supermarket for US meat products. Before reaching that conclusion, a number of other factors must be considered. All of the WTP studies utilized common contingent valuation or experimental auction methods, which have been shown to be very useful for determining values for both nonmarket and market goods. However, as with any contingent valuation or experimental research, the results obtained from these studies are estimates of potential values and are dependent upon both the methods used (research design) and the sample of the population studied. The potential for differences in WTP estimates due to elicitation method used is evident by the wide distribution of premiums across studies. The size of premiums for "Certified U.S." or "Guaranteed U.S." meat products decrease as a larger sample of the population is surveyed. The premiums elicited from the more expansive Chicago and Denver sample (Umberger et al., 2003) and the continental US sample (Loureiro & Umberger, in press) are much lower than the premiums obtained from the regional Colorado study (Loureiro & Umberger, 2003).

Several studies have attempted to quantify the expected costs of COOL (Davis, 2003; Hayes and Meyer, 2003; Sparks Companies, Inc., 2003). Annual cost estimates for the beef industry range from $200 million to $6.4 billion, and from $20 million to $1 billion for the pork industry. Proponents of COOL argue that most of the larger cost estimates are overstated (e.g., Vansickle et al., 2003). They also point to results of experimental auctions and surveys which suggest some consumers may be willing to pay a premium for beef that has been labeled by country of origin (Loureiro & Umberger, 2003; National Cattlemen's Beef Association, 2002). In November 2002, the USDA's Agricultural Marketing Service (AMS) published a "Notice of Request for Emergency Approval of a New Information Collection." In this notice, AMS reported its estimate for the record-keeping costs associated with COOL. This estimate for all industries covered by COOL was $1.968 billion. USDA/AMS estimated these costs would be distributed as follows: $1 billion for producers, $340 million for food handlers and $627.75 million for retailers.

Additionally, under these 2003 labeling guidelines, meat produced from "mixed-origin" animals, such as feeder calves imported into the United States from a country such as Mexico and finished in a US feedlot, would be labeled as "From Animals Born in Mexico, Raised and Processed in the U.S.A", (USDA /AMS 2003). Therefore, under a mandatory COOL program, all fresh meat products sold at a supermarket would carry some kind of country-of-origin label. At the retail level, US beef products could potentially be marketed next to beef products from countries such as Canada, Australia, New Zealand, Mexico, and South American countries. How would the perceived quality of US meat compare to meat imported from other countries?

Proponents of MCOOL have argued that consumers would prefer meats from domestically raised animals, and numerous willingness-to-pay studies suggest these preferences would drive premiums for U.S. meat over products from other countries (e.g., Gao & Schroeder, 2009; Link, 2009; Loureiro & Umberger, 2007; Mennecke et al., 2007; Miranda & Kónya, 2006; Umberger et al., 2003; Ward, Bailey, & Jensen, 2005). While assessing willingness-to-pay for U.S. over foreign meat is relevant, existing studies fail to assess labels that indicate a mixture of origins—such as "U.S., Canada" or "U.S., Canada, Mexico"—which are central to the MCOOL debate and prevalent in the current marketplace. In addition, some research indicates COOL has functioned more as an indicator of quality in some products rather than as a measure of safety (Johansson & Nebenzahl, 1990; Peterson & Yoshida, 2004). The resulting debates have been both heated and expansive (Brester & Smith, 2000).Schupp & Gillespie's (2001a) research indicates consumers would be supportive of mandatory COOL of beef; however, they did not determine if consumers would be willing to pay a premium to offset the potential costs of mandatory COOL. Historically in the beef and pork industries, increases in marketing and processing costs have been distributed across market levels. In the absence of a demand increase, consumers would only pay the entire costs of COOL if consumer demand for beef and pork products is completely inelastic. If consumer demands are not completely inelastic and demand increases are not large enough to maintain or increase equilibrium quantities, the incidence of COOL costs (i.e., the effects of increased marketing costs on market level prices) depends primarily on relative demand and supply elasticities at each level of the marketing chain (Tomek & Robinson, 1990).

Moreover, the US Department of Agriculture (AMS, 2003) found "little evidence that consumers are willing to pay a price premium for country of origin labeling" (p.50) and that "estimated

benefits associated with this rule are likely to be negligible" (p. 49). A number of livestock and food industry groups continue to oppose COOL as costly and unnecessary. These groups and the main livestock exporters to the United States; Canada and Mexico view the requirement as trade-distorting. Twine & Rude (2012) estimate that MCOOL was more harmful to Canadian cattle producers than appreciation of the Canadian dollar and the recent global economic recession. Additional research suggests that MCOOL has reduced the competitiveness of Canada's hog and pork industry (Rude, Gervais, & Felt, 2010). Opponents of the law have argued that the costs incurred by producers, importers, packers, wholesalers, and retailers to segregate and preserve the identity of meat products, as well as the government expenditures that would be necessary to ensure compliance would outweigh the benefits of labeling (USDA/FSIS 2000). As in any market situation, the general impact of increased marketing costs will be borne in part by consumers as higher retail prices and in part by producers as increased production costs. Although country-of-origin labeling would give U.S. producers the opportunity to create a competitive niche market, as long as consumers select U.S. beef over imported beef. As noted by Zago & Pick (2004), welfare effects of labeling regulation ultimately depend upon the perception of quality differences between imported and domestic products and the size of regulatory costs.

Apart from the COOL debate, Caswell & Padberg (1992) contend in their analysis of the role of labeling information in consumer-good markets that food labels provide more than just "point-of-purchase" information. In today's food markets, information provided through required labeling disclosures "may change the attitude of consumers or consumers advocate (even if the consumers do not read or understand it) and may change the sellers' strategy (Caswell & Padberg 1992, 466)." Several recent studies have examined international consumers' WTP for labels verifying the source of origin. Quagrainie, Untershchultz, & Veeman (1998) surveyed consumers in western Canada and found that fresh beef products originating from Alberta were preferred to products originating from other locations in Canada or the United States. Consumers in France, Germany, and the United Kingdom were surveyed in 2000 by Roosen, Lusk, & Fox (2003) to determine European consumers' preferences for beef-labeling strategies associated with origin-labeling, private brands, and mandatory labeling of beef from cattle fed genetically modified corn. Consumers in France and Germany indicated the origin of beef was more important than any other product attribute, such as brand, price, marbling, or fat content. In the

UK, however, consumers ranked origin labeling as more important than brand labeling, but steak color, price and fat content were most important (Roosen, Lusk, & Fox 2003).

Consumers may not find country-of-origin labels on much more of the food they buy, due to COOL's statutory and regulatory exemptions. First, as noted, all restaurants and other food service providers are exempt, as are all retail grocery stores that buy less than $230,000 a year in fresh fruits and vegetables. Second, "processed food items" derived from the covered commodities are exempt, and USDA, in its final rule, defined this term broadly (at 7 C.F.R. §65.220). Essentially, any time a covered commodity is subjected to a change that alters its basic character, it is considered to be processed. Although adding salt, water, or sugar do not, under USDA's definition, change the basic character, virtually any sort of cooking, curing, or mixing apparently does. For example, roasting a peanut or pecan, mixing peas with carrots, or breading a piece of meat or chicken all count as processing. As a result, only about 30% of the U.S. beef supply, 11% of all pork, 39% of chicken, and 40% of all fruit and vegetable supplies may be covered by COOL requirements at the retail level. Whole peanuts are almost always purchased in roasted form, and will not have to be labeled. Some critics argued that AMS overstepped its authority, and congressional intent, by excepting such minimally processed commodities.

In 1999, Louisiana consumers, meat processors, wholesalers, retailers, and restaurants were surveyed to determine their attitudes toward mandatory labeling of country of origin of beef (Schupp & Gillespie 2001a & 2001b). The majority of the Louisiana consumers surveyed (93%) supported mandatory labeling of fresh and frozen beef in retail stores. Most of the consumers (86%) also rated U.S beef superior to imported beef based on their expectations of higher quality and concerns with the safety of imported beef (Schupp & Gillespie 2001a). The majority of the meat handlers (82%) surveyed by Schupp & Gillespie (2001b) supported mandatory COOL of beef as well. USDA's study, "Mandatory Country of Origin Labeling of Imported Fresh Muscle Cuts of Beef and Lamb," said that some livestock producer organizations and farmer organizations supported mandatory labels, while importers, meatpackers, food processors, and grocers were opposed (FSIS, 2000). For U.S. farmers to benefit financially from mandatory labels, consumers would have to prefer domestic products to imports. If consumers do prefer domestic products, labels would allow consumers to discriminate between imports and domestic products. As a result, demand for domestic meat products in the United States would rise along

with domestic meat prices. Further, domestic products would increase their market share at the expense of imports.

However, if consumers do not generally prefer domestic products, labeling will not confer any financial benefits to domestic producers. Critics of mandatory COOL argued that large compliance costs will more than offset any consumer benefits. The USDA Agricultural Marketing Service (USDA/AMS 2002), the agency responsible for writing the final mandatory COOL rules, has stated self-certification is not sufficient, and a credible COOL program will require verifiable records and a system allowing products to be traced back to the animal of origin (Smith 2003). Others have argued that a domestic traced back system is not required to implement COOL, and that the least costly method for regulating COOL is presumption of U.S. origin unless the food product carries a label indicating it is a product of another country (Smith 2003; VanSickle et al. 2003). USDA's analysis of its final rule estimated first-year implementation costs to be approximately $2.6 billion for those affected. Of the total, each commodity producer would bear an average estimated cost of $370, intermediary firms (such as wholesalers or processors) $48,219 each, and retailers $254,685 each. The USDA analysis also included estimates of recordkeeping costs and of food sector economic losses due to the rule. Some analysts argue that origin does not matter to U.S. consumers (see, for example, Blank, 1998). A fast-food hamburger could be made from lettuce and tomato from Mexico, a bun fabricated from Canadian wheat, and a meat patty composed of lean meat from Australia and fat trimmings from the United States. Current fast-food restaurant advertising does not mention origin. Instead, it emphasizes price, portion size, flavor, and promotional toys, Country-of-Origin (Fred Kuchler, ERS). Since the publication of the USDA/AMS cost estimate, others have developed their own estimates of the costs (both direct and indirect) associated with COOL.

Notably, Vansickle et al. (2003) took exception with the USDA estimate, arguing mandatory record keeping at the producer level is not required to satisfy either the spirit or the letter of the law. They advocated labeling all imported products so that any product not labeled as an import would be assumed to be of U.S. origin. Using this assumption, VanSickle et al. estimated the record-keeping costs associated with COOL will be between $69.86 million and $193.43 million. One problem with the VanSickle et al. proposal is that it likely violates World Trade Organization guidelines and would be subject to challenge from any country claiming it was being adversely affected. At the other end of the spectrum, a 2003 report by Sparks Companies,

Inc., and *Cattle Buyers Weekly* estimated COOL will increase total costs by $3.66 to $5.60 billion dollars, not including the costs for the lamb and peanut sectors which are also covered by the COOL regulation. The Sparks estimate is based on the assumption that improved recordkeeping systems will be required throughout the supply chain to verify country-of-origin labels.

Hayes & Meyer (2003) similarly concluded the costs of COOL implementation would be significant. Based on their estimates, a system with full traceability would raise farm-level production costs for pork by $10.22/head (or by a total of just over $1billion). Hayes & Meyer also explored the potential impacts of COOL resulting from a segregated system. Assuming an own-price elasticity of pork of about -0.70, their projected $10/head increase in costs would result in a 7% decrease in retail pork demand. Further, they estimate that by 2010, U.S. pork exports could be reduced by 50% as a result of meat segregation due to COOL regulations.

Grier & Kohl (2003) also predicted several negative consequences of COOL for the pork industry including the loss of over 1,000 independent pork producers, the eventual closing of three to five U.S. pork packing plants, lower hog prices, and an aggregate loss in economic activity in the United States of over $4 billion. VanSickle et al. (2003) were decidedly more optimistic in their evaluation of the impacts of COOL. Extrapolating from willingness-to-pay estimates by Umberger et al. (2003), they calculated an "aggregate willingness to pay" in the beef industry alone of almost $3 billion.

Van Sickle et al. also noted other potential benefits such as increased consumer confidence in the labeled product. Plain & Grimes (2003) questioned the relevance of using willingness-to-pay estimates to project benefits from COOL. They noted 69% to 73% of survey respondents in the study by Umberger et al. indicated a willingness to pay a premium for beef labeled as a U.S. product. They argue that since almost 90% of muscle cuts of beef and about 75% of ground beef are already of U.S. origin, consumers will not have to pay a premium for U.S. beef even though a fairly large percentage of them express a willingness to do so.

According to American Meat Institute (2014), over the past 10 years, per capita expenditures for beef rose from $188.65 in 1998 to $287.65 in 2012. Pork expenditures also increased from $120.40 in 1998 to $160.06 in 2012. Consumers increased their spending on chicken products from more than $111 per capita in 1998 to $154.14 in 2012.Consumers spent an average of $3.03 per pound on hamburger in 2012 and $4.99 per pound for choice beef cuts. Choice beef cuts can

include loins, rib eyes, chuck and flank steaks. In 2012, meat and poultry expenditures accounted for 1.6 percent of disposable income per capita, and for 14.3 percent of total food expenditures. According to Brester*et al*. (2005), COOL will generate an additional cost of 1.24% and 3.41% for US beef and pork consumers, respectively, which will affect their expenditure patterns.

Objective

The overall goal of this paper is to analyze the effect of COOL induced expenditures on US beef and pork products using the linear expenditure function. The following specific objectives are pursued:

1. To estimate consumer expenditures on beef, pork and chicken.
2. To derive the Own and Cross-price elasticities of demand for each meat products (beef, pork and chicken).

Methodology

A Linear Expenditure System was employed. The LES first introduced by Klein and Rubin (1948) and has had great appeal in applied econometrics owing to the fact that it expresses consumer expenditures on the various commodities as linear functions of prices and income, consistently with the hypothesis of utility maximization subject to a budget constraint. The LES has three conditions; additivity, homogeneity, and symmetry of the substitution matrix. The sum of each component expenditure is equal to the total expenditure (additivity). If the total expenditure (M) and prices are multiplied by the same number, the expenditure (*zi or pixi*) should be multiplied by the same number (homogeneity) (Malinvaud 1970). In this study, there are three commodity groups: beef, pork and chicken. However, the estimation was performed by using only two (N - 1) equations, as, due to the constraints that $\sum Bi = 1$, and out of this we obtained the third one for chicken. The sum of the disturbance terms for each year is zero (Parks 1969, 1971).

The problem of singularity can be eliminated by estimating for N - 1 equation. The coefficient estimate *B* for the *nth* equation can be obtained by an appropriate linear combination. Traditional LES equation has two components; the minimum subsistence level expenditure (*riPi*) and marginal budget shares *(B,)* with the supernumerary income $(M - \sum rjPj)$ (Phillips 1983). The minimum subsistence level expenditure is the amount necessary to maintain the minimum level of life. The marginal budget share indicates the proportional share of the expenditures by the given product, which remains after minimum subsistence level expenditures on all goods are

subtracted from the total expenditures (M). This remaining expenditure is the supernumerary income, which can be allocated among the various consumer products. Consumer expenditure (retail quantities and prices) on each product is regressed on income and consumer expenditure on a related product such as chicken using quarterly data from 2004 to 2008 to represent pre COOL; and 2009 to 2013 constituting post COOL. The "pre'' and "post" COOL estimated elasticities are compared. The expenditure function for one commodity group can be expressed as (Phlips1983).

$$z_i = p_i x_i = r_i p_i + B\left(M - \sum r_j p_j\right) + e_i$$

Where

z= expenditure on a commodity (beef, pork and chicken.)

p = price

x= quantity

r = minimum subsistence quantity necessary to maintain the minimum

level of life

B =coefficient estimate,

M= total expenditure,

e = error term, and

i = subscript denoting own (single) product, and

j = subscript denoting all products including i, with 0 <*B, < 1,*

$\sum B_i = 1$ and xi $> r_i$

The utility derives from consumer expenditure (*Z*) of the meat products (beef, pork and chicken). Thus the general term of the utility function could be written as *U=U* (*Z1, Z2,...,Zi*). This function should be maximized provided that the consumer can afford the goods. This restriction is called the budget constraint and could be written as

$$\sum_{i=1}^{n} p_i Z_i \leq M$$

Where *M* is the consumer income and *p* is the price vector. In optimum, the consumer will spend the whole income on goods unless he benefits from saving up. Own-price elasticity– or simply price elasticity shows the percentage rise in the demand as a percentage rise in the price of the good itself. Formalized, the own-price elasticity is given as:

$$\varepsilon p = \frac{\partial z_i / z_i}{\partial p_i / p_i} = \frac{\partial zi\ pi}{\partial p_{iz_i}}$$

Where Z*i* defines the consumer expenditure for good *i* and *pi* defines the price of good *i*. If $|\varepsilon p| = 1$ the demand is defined as being unit elastic while the demand is defined as being elastic if $|\varepsilon p| > 1$ and inelastic if $|\varepsilon p| < 1$. If for instance $|\varepsilon p| = 1$ it means that a price increase of 1% will cause a reduction in the consumer expenditure for a good of 1% and vice versa.

Income elasticity shows the percentage increase in the demand for a given good as a result of a percentage increase in income.

$$\varepsilon i = \frac{\partial z_i / z_i}{\partial pM_i / pM_i} = \frac{\partial zi\ M}{\partial Mz_i}$$

M indicates the income.

Generally, the income elasticity for necessities is smaller than for luxury goods. It is also the case that the income elasticity of the good decreases when the income increases.

Cross-price elasticity shows the percentage increase in demand for good *i* as a result of a percentage increase in the price of good *j*. The mathematical definition of cross-price elasticity is given as;

$$\varepsilon ij = \frac{\partial z_i / z_i}{\partial p_j / p_j} = \frac{\partial zi\ pi}{\partial p_{iz_i}}$$

Cross-price elasticity for a good having a close substitution or complementary would numerically be relatively big. If there is a close substitution, the cross price elasticities will be positive as a price increase of good *i* will make the consumers substitute towards demanding good *j*. If *i* and *j* are complementary goods the cross-price elasticity will be negative.

To estimate two (N - 1) linear expenditure systems equations, the seemingly unrelated regression equation (SURE) procedure was used. The linear expenditure system permits only income and price to explain consumption behavior. However, the consumption behavior is affected not only

by income and price, but also by other factors such as preference, taste, and so on. Therefore, the residuals of each equation include information regarding those factors not considered in the equation, and consequently, are clearly correlated with residuals of other equations. Thus, the SURE procedure was employed in estimating the linear expenditure system. The own price, cross price and income elasticities results are presented in Table1 and 2.

Data sources

Quarterly data was extracted from USDA -National Chicken Council and Earth Policy Institute and Economic Research Service. The quarterly data span from 2004 to 2008 to represent pre COOL; and 2009 to 2013 constituting post COOL. The "pre'' and "post" COOL estimated elasticities are compared. The dataset consists of US quarterly consumption and retail prices of three major meat products (beef, pork and chicken). Gross Domestic Product figures in nominal terms, from 2004-2013 and population were acquired from the *Bureau of Economic Analysis* (U.S. Department of Commerce). All expenditure and GDP used in the analysis are the nominal terms to ensure that total expenditure equals money income (Parks 1971), and are converted into per capita terms by deflating by population.

Results & Discussion

Table 1 presents descriptive statistics of consumer expenditure before COOL from 2004 to 2008 while table 2 presents descriptive statistics of consumer expenditure after COOL from 2009 to 2013. The results indicate that consumers' expenditure for beef, pork and chicken increased by 10.4%, 14.5%, and 8.8%, respectively (tables1&2) after the implementation of COOL. The quantity of beef consumed decreased by 6.5% and that of pork also by 1.8%. But there was an increase in the quantity of chicken consumed by 0.2%. Moreover, the price of chicken after COOL increased by only 8.5% compared to that of beef and pork increased as high as 18.2%, 16.7%, respectively.

The own price elasticity for pork (-1.9) before COOL is greater in magnitude than the own price elasticity after COOL (-1.67). This implies 1% increase in the price of pork reduces consumer expenditure from 1.9% to 1.67%, due to reduction in quantity demanded as presented in tables 3&4. A price increase in beef due to the implementation of COOL also causes beef to be less inelastic. The own price elasticities for Pre and Post COOL are -0.65 and - 0.77, expenditure on

beef declined as consequence of decreased demand. The most striking result in tables 3&4 is the own price elasticity of chicken, the elasticity fell from -1.22 at pre-COOL to as low as -0.54 after COOL. Thus chicken has become very inelastic after COOL. Beef and pork are substitutes. A 1% increase in the price of beef due to COOL causes only 0.13% decline in the quantity demand for post COOL pork compared to 0.40% before COOL. That is, anytime the price of one of these meat products increases, consumers tends to decrease spending on others and the decline is very pronounced for pork.

Figure 1&2 also show the trend of consumer expenditure among these meat products before and after COOL. It is obvious that consumer expenditure for chicken keeps on rising before and after COOL. These results are theoretically consistent in that COOL-induced additional marketing costs reduce retail supplies and demands. The demand for poultry products increases because consumers substitute away from relatively more expensive beef and pork products. The income elasticities of demand for chicken (2.44) and pork (1.34) after COOL are greater than one. This suggests that consumers tend to consume more when their income increases, provided the expenditure on chicken and pork after COOL is proportional to the quantity of meat consumption. On the other hand, spending increases on beef is less than income increases. It can also be explained that consumers are becoming more responsive to change in price and the share of their expenditure for any of these meat products.

Conclusion

Consumers are shifting their expenditure towards the consumption of more chicken and less of beef and pork as a result of COOL under the budget constraint. The poultry industry is the only unequivocal winner of the implementation of COOL. This conclusion is consistent with ERS price data (2010) which also concluded that wholesale and retail prices for chicken, weighted to account for prices and amounts sold of whole chickens and parts, were $1.67 and $2.64 per pound lower, respectively, than beef prices and $0.67 and $1.36 per pound lower than pork prices. This increase in demand for chicken has caused a subsequent increase in prices of poultry products which has resulted in producer surplus in the poultry industry. A label can be an unnecessary trade barrier to other countries trading with US and they can also retaliate. The

National Cattlemen's Beef Association (NCBA) expressed concern that Canada's decision to pursue its case against U.S. COOL rules has the potential for retaliatory action to be taken against U.S. beef. It noted that "COOL has damaged critically important trading relationships [i.e., the import of Canadian and Mexican livestock, the value added as they pass through U.S. feedlots and are processed into meat, and the export of finished meat products back to Mexican and Canadian consumers], and is not putting additional money into the pockets of cattlemen.

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APPENDIX

Table 1.Descriptive Statistics- PRE

Variable	Mean	Std. Dev.
Quantity of beef	6948.85	210.4707
Price of beef	372.2	14.88411
Expenditure on beef	2585476	108471.6
Quantity of pork	4839.4	230.4511
Price of pork	199.15	11.29637
Expenditure on pork	965257.6	92872.25
Quantity of chicken	8757.8	264.0065
Price of chicken	168.8	7.661249
Expenditure on chicken	1477955	3810.74
Consumer total Income	5028689	201351.4

Table 2.Descriptive Statistics- POST

Variable	Mean	Std. Dev.
Quantity of beef	6499.7	194.2248
Price of beef	439.85	40.9239
Expenditure on beef	2854138	223004.4
Quantity of pork	4751.55	267.4162
Price of pork	232.4	17.7034
Expenditure on pork	1105160	116266.7
Quantity of chicken	8773.1	272.4686
Price of chicken	183.2	9.134089
Expenditure on chicken	1607821	105084.5
Consumer total Income	5567119	392762.1

PRE –COOL

Table 3. Variable Definitions and Values Used in Analysis

Parameter	Definition	Coefficient
BB	Own-price elasticity for beef	-0.65
BP	Cross-price elasticity of beef with respect to pork	0.40
BC	Cross-price elasticity of beef with respect to chicken	0.10
YB	Income elasticity of beef	0.49
PB	Cross-price elasticity of pork with respect to beef	0.52
PP	Own-price elasticity of demand for pork	-1.9
PC	Cross-price elasticity of pork with respect to chicken	0.18
YP	Income elasticity of pork	-0.27
CB	Cross-price elasticity of chicken with respect to beef	0.51
CP	Cross-price elasticity of chicken with respect to pork	0.00
CC	Own-price elasticity of demand for chicken	-1.22
YC	Income elasticity of chicken	0.64

POST-COOL

Table 4. Variable Definitions and Values Used in Analysis

Parameter	Definition	Coefficient
BB	Own-price elasticity for beef	-0.77
BP	Cross-price elasticity of beef with respect to pork	0.13
BC	Cross-price elasticity of beef with respect to chicken	0.50
YB	Income elasticity of beef	-0.23
PB	Cross-price elasticity of pork with respect to beef	1.35
PP	Own-price elasticity of demand for pork	- 1.67
PC	Cross-price elasticity of pork with respect to chicken	0.29
YP	Income elasticity of pork	1.34
CB	Cross-price elasticity of chicken with respect to beef	1.02
CP	Cross-price elasticity of chicken with respect to pork	0.25
CC	Own-price elasticity of demand for chicken	-0.54
YC	Income elasticity of chicken	2.43

Fig. 1 Trend of Consumer Expenditure before COOL

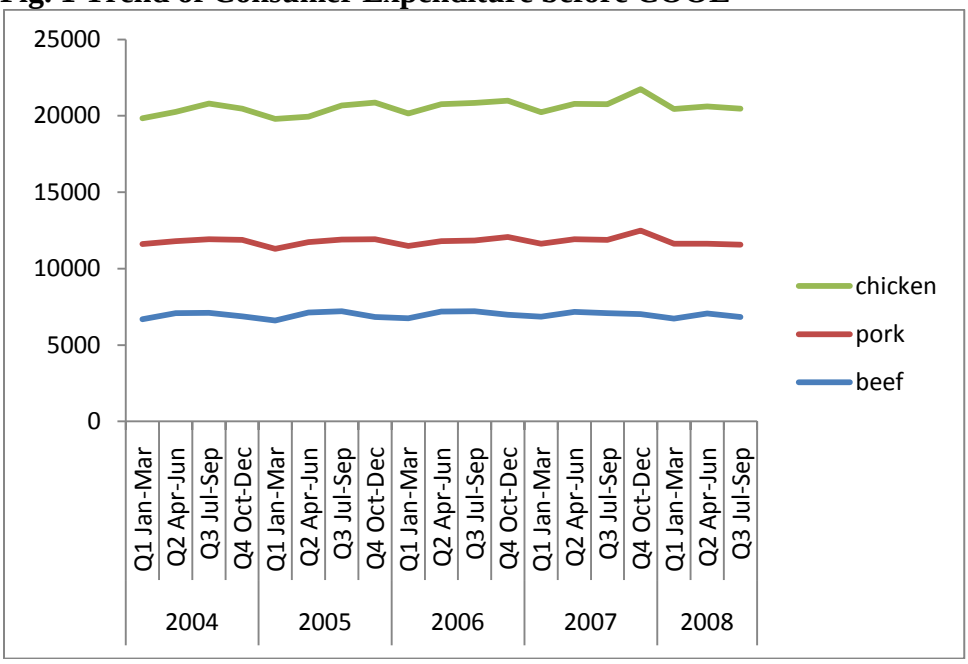

Fig.2 Trend of Consumer Expenditure after COOL