Comparing Forecasting Ability of Demand System Using Different Data Sources: the Case of U.S. Meat Demand with Food Safety Recalls

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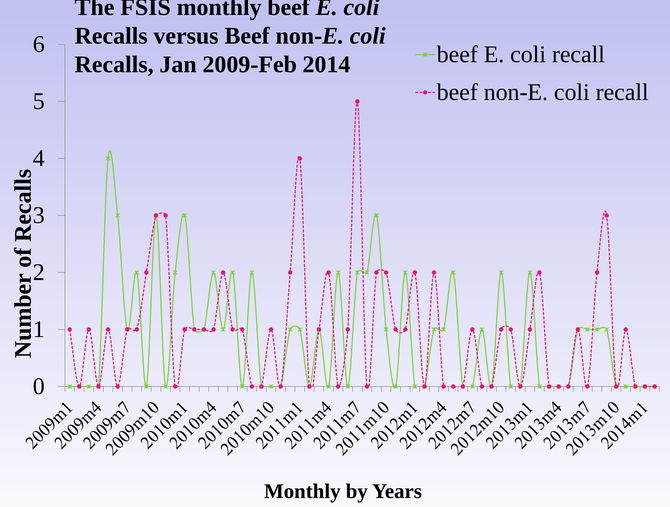
BACKGROUND

- AIDS and Rotterdam models have both come to prominence in the meat demand literature.
- Most previous research utilizes USDA per capita meat disappearance data (Piggott and Marsh, 2004; Marsh *et al*., 2004; Tonsor *et al*., 2010; Tonsor and Olynk, 2011) and some other studies use scanner data (Capps and Love, 2002; Lensing and Purcell, 2006; Schulz *et al*., 2012; Taylor and Tonsor, 2013).
- Forecasting ability provides an reliable judgment for model and data selection (Kastens and Brester, 1996).
- USDA Food Safety Inspection Services (FSIS) issued recalls have been widely used in empirical studies
- Beef recalls and consumers have been considered in a fairly aggregated and homogeneous manner in previous studies. *E. coli* O157: H7 is ranked as one of the top five pathogens contributing to domestically acquired foodborne illnesses resulting in hospitalization (CDC).



OBJECTIVES

- This study aims to compare out-of-sample forecasting ability between LA/AIDS (Linear Approximate Almost Ideal Demand System) and Rotterdam models using two sources of data.
- We will also provide an updated assessment of how specific recall information impacts U.S. meat demand by applying different demand systems and data sets.

MODEL AND DATA

- **LA/AIDS Framework**

$$w_i = \alpha_{i0} + \sum_{j=1}^{3} d_{ij} D_j + \sum_{j=1}^{n} \gamma_{ij} \ln(p_j) + \beta_i \ln(X/P) + \sum_{k=1}^{K} \sum_{l=0}^{L} \lambda_{ikl} \ln(R_{kl}) + \epsilon_i$$

w_i is budget share of the ith good (i= 1, …, 4);
P is Stone Price Index.

- **Rotterdam Framework**

$$w_i \Delta \ln(x_i) = a_i + \sum_{j=1}^{3} d_{ij} D_{ij} + \sum_{j=1}^{n} c_{ij} \Delta \ln(p_j) + \beta_i \Delta \ln(\bar{q}) + \sum_{k=1}^{K} \sum_{l=0}^{L} \lambda_{ikl} \Delta \ln(R_{kl}) + v_i$$

w_i is budget share of the ith good (i= 1, …, 3);
R_{kl} represents the kth FSIS food safety recall with lag length l. Specifically, k represents beef *E. coli* O157:H7 recalls, beef non-*E. coli* recalls, pork recalls, and poultry recalls

- **Data**
  - Grocery Store Scanner Data (S)
    - ❖ Monthly scanner data, Jan 2009 to Feb 2014
    - ❖ FreshLook Marketing Group
    - ❖ Point-of-sale and meat department random-weight sale
    - ❖ Nationwide and cover 82% U.S. grocery meat sales
  - USDA Disappearance data (D)
    - ❖ There is a large body of literature evaluating the effect of food safety information on U.S. demand utilizing per capita aggregate disappearance data from USDA
    - ❖ Quarterly USDA per capita disappearance data, 1989 (QT1) TO 2014 (QT1)
    - ❖ It refers "the resulting food supply after food disappear into the food marketing system" (USDA-ERS)

RESEARCH PROCEDURE

- Rotterdam Model (beef, pork, chicken)
- LA/AIDS Model (beef, pork, chicken)

→ Autocorrelation Corrections + Wald Tests → Preferred Model

→ Delete-A-Group Jackknife Out-of-sample forecasting

- Across Data Comparisons
  - AIDS (S) vs AIDS (D)
  - Rotterdam (S) vs Rotterdam (D)
- Across Model Comparisons
  - AIDS (S) vs Rotterdam (S)
  - AIDS (D) vs Rotterdam (D)

RESULTS OF CURRENT SCENARIO

- **Current Scenario**
  - Evaluates the forecasting ability of preferred model specification incorporating with food safety recall variables
  - The preferred LA/AIDS and Rotterdam models with two data sets have different durations of recall impacts and hence diverse model specifications.

- LA/AIDS

Forecasting Performance of Preferred LA/AIDS

	Data set	Beef	Pork	Chicken
MSE	USDA disappearance	0.0089	0.0062	0.0027
	Grocery Scanner	0.0103	0.0261	0.0204
MAE	USDA disappearance	0.0072	0.0050	0.0022
	Grocery Scanner	0.0081	0.0215	0.0172
MAPE	USDA disappearance	0.0134	0.0157	0.0155
	Grocery Scanner	0.0152	0.1005	0.0691

- Rotterdam

Forecasting Performance of Preferred Rotterdam model

	Data set	Beef	Pork	Chicken
MSE	USDA disappearance	0.0074	0.0051	0.0023
	Grocery Scanner	0.0139	0.0115	0.0111
MAE	USDA disappearance	0.0054	0.0037	0.0017
	Grocery Scanner	0.0112	0.0085	0.0089
MAPE	USDA disappearance	1.1585	0.4402	0.4642
	Grocery Scanner	0.2836	0.3630	1.0242

CURRENT FINDINGS

- Using USDA disappearance data yields better out-of-sample forecasts than grocery-store scanner data in both preferred LA/AIDS and Rotterdam model.
- Both of the two LA/AIDS model specifications (estimating by different data sets) are more accurate forecasters than the corresponding Rotterdam specifications respectively (MAPE).

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