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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AIDS and Rotterdam models have both come to prominence in the demand literature. Most previous research utilizes USDA per capita meat disappearance data (Piggott and Marsh, 2004; Marsh et al., 2004; Tonson et al., 2010; Tonson and Olynk, 2011) and some other studies use scanner data (Capps and Love, 2002; Lensing and Purcell, 2006; Schulz et al., 2012; Taylor and Tonson, 2013). Forecasting ability provides a 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 recalls, beef non-E. coli recalls, pork recalls, and poultry recalls resulting in hospitalization (CDC).

**BACKGROUND**

**MODEL AND DATA**

**LA/AIDS Framework**

\[ w_i = x_{i0} + \sum_{j=1}^{3} d_{ij}D_j + \sum_{j=1}^{n} y_{ij} \ln(p_j) + \beta_1 \ln(\beta_i) + \sum_{k=1}^{3} \lambda_{ik} \ln(R_{ik}) + \varepsilon_i \]

\( w_i \) is budget share of the \( i \)th good (\( i = 1, \ldots, 4 \));

\( p \) is Stone Price Index.

**Rotterdam Framework**

\[ w_i \Delta \ln(x_i) = a_i + \sum_{j=1}^{3} d_{ij}D_j + \sum_{j=1}^{n} c_{ij} \Delta \ln(p_j) + \beta_1 \Delta \ln(q) + \sum_{k=1}^{3} \lambda_{ik} \Delta \ln(R_{ik}) + v_i \]

\( w_i \) is budget share of the \( i \)th good (\( i = 1, \ldots, 3 \));

\( R_{ik} \) represents the \( k \)th 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)

**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.

<table>
<thead>
<tr>
<th>LA/AIDS Model Specimations</th>
<th>Forecasting Performance of Preferred La/AIDS Model Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>Beef</td>
</tr>
<tr>
<td>USDA disappearance</td>
<td>0.0059</td>
</tr>
<tr>
<td>Grocery Scanner</td>
<td>0.0103</td>
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<tr>
<td>MAE</td>
<td>USDA disappearance</td>
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<tr>
<td></td>
<td>Grocery Scanner</td>
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<td>MAPE</td>
<td>USDA disappearance</td>
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<td>Grocery Scanner</td>
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</tbody>
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**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).

**RESEARCH PROCEDURE**

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

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