

# **The Impact of Pork Advertising on US Meat Demand in the Presence of Competing Beef Advertising and Food Safety Events**

**Nicholas E. Piggott**

North Carolina State University, Raleigh, NC

**Chen Zhen**

RTI International, RTP, NC

**Robert H. Beach**

RTI International, RTP, NC

**Michael K. Wohlgenant**

North Carolina State University, Raleigh, NC

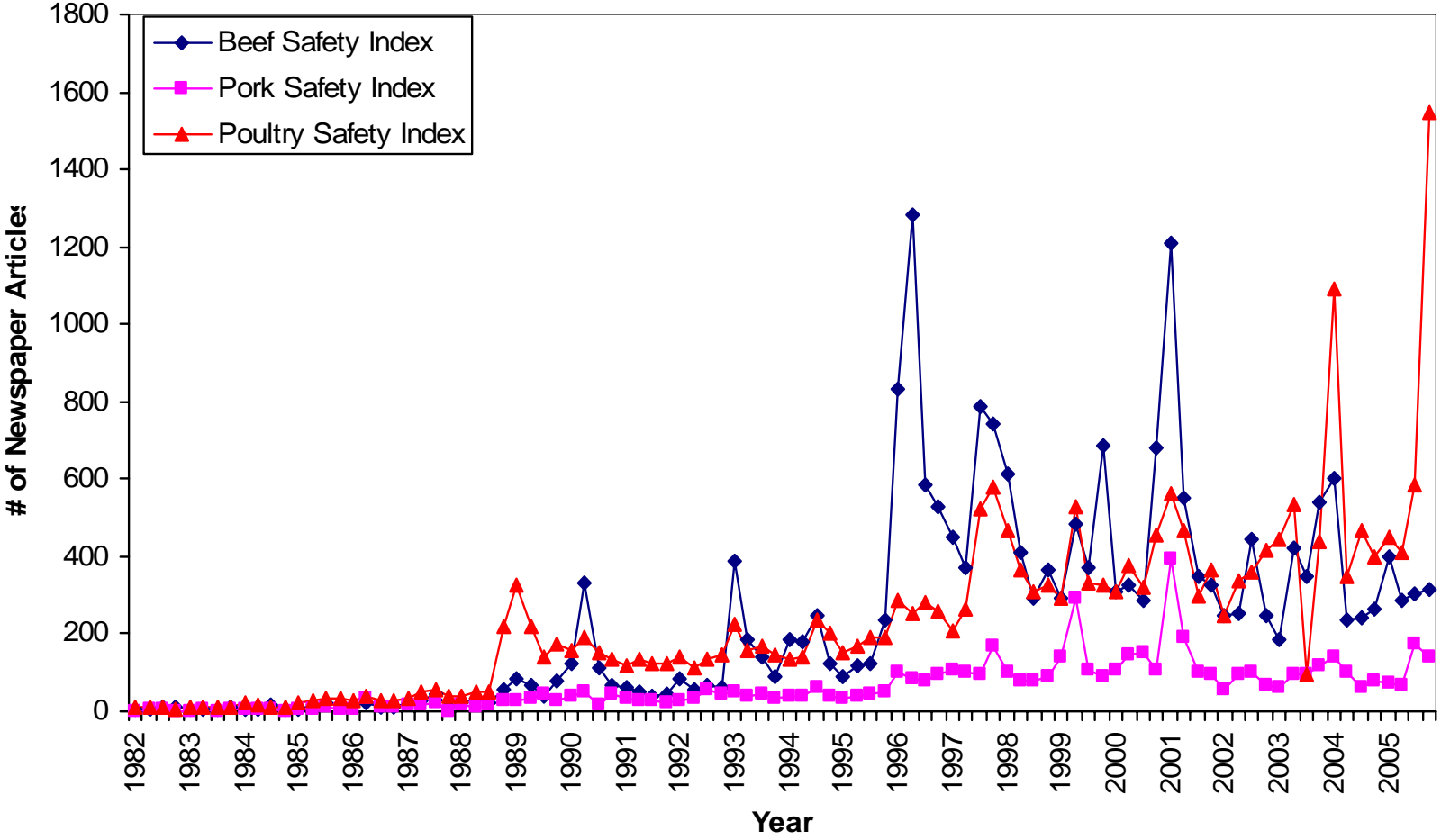
# Research Objectives

- Model generic promotion and food safety in meat demand simultaneously
- Investigate the lag structure of promotion effects on meat demand using a more flexible lag specification
- Update the food safety indices in Piggott and Marsh to 2005

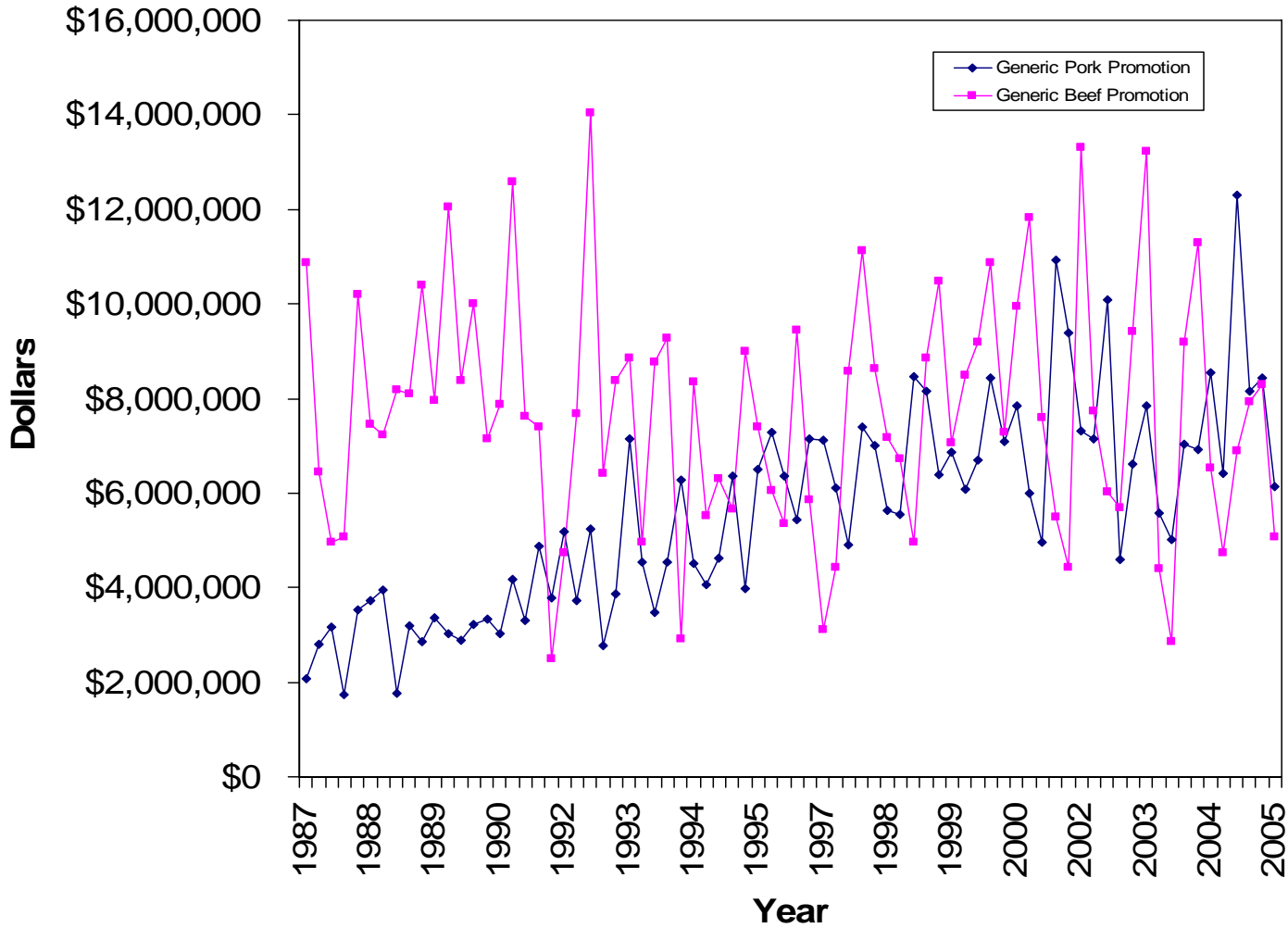
# Previous Demand Studies on Generic Advertising and Food Safety

- Brester and Schroeder (1995), Rotterdam, generic and branded beef and pork advertising
- Kinnucan et al (1997), Rotterdam, generic beef and pork advertising
- Burton and Young (1996), Almost Ideal Demand, British BSE newspaper count
- Piggott and Marsh (2004), Generalized Almost Ideal Demand, beef, pork and poultry safety news count

# Food Safety Media Indices



### Generic Beef and Pork Promotion



Sources: National Pork Board; Ronald Ward, University of Florida

## Summary Statistics for Promotion and Food Safety Variables

<b>Variable</b>	<b>Sample period</b>	<b>Average</b>	<b>Std. Dev.</b>	<b>Minimum</b>	<b>Maximum</b>
Beef food safety	1982(1)- 1999(3)	174.2	245.0	3	1283
	1999(4)- 2005(4)	402.2	219.3	185	1210
Pork food safety	1982(1)- 1999(3)	43.1	46.9	0	292
	1999(4)- 2005(4)	117	68.0	54	395
Poultry food safety	1982(1)- 1999(3)	153.0	135.7	6	582
	1999(4)- 2005(4)	466.1	283.9	96	1547
Beef Generic Advertising (\$1,000)	1987(1)- 2005(4)	7,711.8	2,540.3	2,482.2	14,042.8
Pork Generic Advertising (\$1,000)	1987(1)- 2005(4)	5,602.7	2,180.9	1,747.5	12,290.4

# Using Polynomial Inverse Lags (Mitchell and Speaker) to Transform Promotion Expenditures

True model: 
$$Y_t = b + \sum_{i=0}^{\infty} w_i X_{t-i} + e_t$$

where  $Y_t$  = sales of commodity being promoted at t  
 $X_t$  = promotion expenditure at t

Estimable model: 
$$Y_t = b + \sum_{j=2}^n a_j Z_{jt} + R_t + e_t$$

where 
$$Z_{jt} = \sum_{i=0}^{t-1} \frac{X_{t-i}}{(i+1)^j}, \quad j = 2, \dots, n,$$

$n$  = highest degree of polynomial for the lag

## The Generalized Almost Ideal Demand (Bollino)

$$w_i = \left( \frac{p_i c_i}{M} \right) + \left( \frac{M^*}{M} \right) \left( \alpha_i + \sum_j^N \gamma_{ij} \ln p_j + \beta_i \ln \left( \frac{M^*}{P} \right) \right) + e_i$$

where  $\ln P = \delta + \sum_{j=1}^N \alpha_j \ln p_j + \frac{1}{2} \sum_{k=1}^N \sum_{j=1}^N \gamma_{kj} \ln p_k \ln p_j$

$p_i$  = price of good i

$c_i$  = pre-committed quantity of good i

$M^*$  = supernumerary expenditure

$M$  = total expenditure

# Including Promotion and Food Safety Variables into the Demand System

Translating procedure (Pollak and Wales):

$$c_i = c_{i0} + \kappa_{i1}qd1 + \kappa_{i2}qd2 + \kappa_{i3}qd3 + \varphi_i D0205 + \tau_i T \\ + \phi_{i,b}bfs_t + \phi_{i,p}pks_t + \phi_{i,c}pys_t \\ + \sum_{j=2}^n \omega_{i,j,b} ZBDE_{jt} + \sum_{j=2}^n \omega_{i,j,p} ZPDE_{jt}$$

where  $qd1, qd2, qd3$  = quarterly dummies

$T$  = time trend

$bfs, pks, pys$  = beef, pork, and poultry food safety, respectively

$ZBDE, ZPDE$  = polynomial inverse lag transformation of beef and pork promotion expenditures, respectively

# Estimated Effects of Generic Promotion and Food Safety on Pre-committed Quantities

variable	beef	pork	poultry
constant	<b>14.1665**</b> (1.1223)	<b>7.3004**</b> (1.3069)	<b>7.1534*</b> (3.6867)
beef food safety	<b>-0.0014**</b> (0.0003)	<b>-0.0016**</b> (0.0003)	<b>-0.0019**</b> (0.0004)
pork food safety	-0.0023 (0.0013)	-0.0017 (0.0012)	-0.0017 (0.0018)
poultry food safety	-0.0003 (0.0002)	-0.0007 (0.0004)	<b>-0.0015*</b> (0.0007)
2 <sup>nd</sup> degree PIL beef promotion	-2E-7 (1.281E-7)	-1.36E-7 (9.379E-8)	<b>-3.23E-7**</b> (1.18E-7)
3 <sup>rd</sup> degree PIL beef promotion	2.497E-7 (1.306E-7)	1.897E-7 (9.905E-8)	<b>3.709E-7**</b> (1.26E-7)
2 <sup>nd</sup> degree PIL pork promotion	1.824E-7 (1.691E-7)	<b>5.273E-7**</b> (1.855E-7)	<b>8.562E-7**</b> (3.067E-7)
3 <sup>rd</sup> degree PIL beef promotion	-2.68E-7 (1.718E-7)	<b>-5.94E-7**</b> (1.962E-7)	<b>-9.06E-7**</b> (3.233E-7)

## Estimated Price, Expenditure, Food Safety, and Promotion Elasticities

	beef quantity	pork quantity	poultry quantity
<b>Marshallian Price Elasticities</b>			
beef price	-0.7835	-0.2610	-0.0598
pork price	-0.1222	-0.6526	-0.1785
poultry price	-0.1051	-0.2196	-0.4190
<b>Expenditure Elasticities</b>			
Expenditure	1.0108	1.1333	0.6573
<b>Food Safety Elasticities</b>			
beef food safety	-0.0011 (0.0013)	-0.0019 (0.0016)	0.0048 (-0.00035)
pork food safety	-0.0024 (-0.0092)	0.0014 (-0.0055)	0.0036 (0.0154)
poultry food safety	0.0027 (0.0085)	-0.0005 (0.0036)	-0.0055 (-0.0204)
<b>Long-Run Generic Promotion Elasticities</b>			
generic beef promotion	-0.0013	0.0119	-0.0137
generic pork promotion	-0.0287	0.0207	0.0380

Note: Piggott and Marsh's estimates using data from 1982(1) to 1999(3).

# Conclusion

- Food safety information had very small effect on U.S. meat demand in the past
- Beef food safety information is found to negatively impact beef demand using the updated sample
- Pork food safety information is not found to adversely affect pork demand using the updated sample
- Pork promotion increased pork and poultry consumption at the expense of beef demand