

# Estimating Cross-Market Demand Effects in Generic Dairy Advertising

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# The existing literature on generic dairy advertising

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- Significant positive returns to producers
  - Average benefit-cost ratios:
    - 5:1 for fluid milk and cheese advertising (Kaiser (1999))
    - 2:1 for fluid milk advertising (Kaiser and Chung)
- Typical approach: econometric estimation of single-equation demand model with advertising expenditure as an independent variable, using aggregate disappearance data

## Some issues (typically) not addressed

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- Vertical price transmission
  - Tax incidence, input substitution, policy, market structure
- Horizontal market relationships
  - Cross-market interactions in demand and supply
- Opportunity costs of funds invested in generic promotion

# Beggar-thy-neighbor effects in generic dairy advertising

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- Balagtas and Kim (2007) showed conceptually that interactions across dairy markets influence returns to advertising. Showed that when dairy products are substitutes in consumption, the effectiveness of advertising is affected by:
  - the direct effect of advertising on demand for non-advertised products
  - cross-price elasticities of demand for dairy products
  - own-price elasticity of demand for non-advertised dairy products

# Retail demand elasticities used in Balagtas and Kim (2007)

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	Elasticity with respect to					
	Price of ( $\eta_{ij}$ ):			Advertising Expenditure for ( $\alpha_{ij}$ ):		
Demand for:	Fluid milk	Cheese	Other dairy Products	Fluid milk	Cheese	Other dairy Products
Fluid milk	-0.20	0.02	0.00	0.036	-0.055	0.0
Cheese	0.02	-0.50	0.00	-0.018	0.027	0.0
Other dairy products	0.00	0.00	-0.60	0.0	0.0	0.020

# Effects of a 40% increase in fluid milk advertising

	1. Horizontal linkages		3. No horiz. linkages	
	% $\Delta$	$\Delta$	% $\Delta$	$\Delta$
Prices (cents per cwt)				
Net farm price of milk	0.116	1.7	0.375	5.6
Blend price	0.218	3.3	0.474	7.1
Processor price of milk in fluid milk	0.117	2.0	1.199	20.5
Processor price of milk in cheese	0.144	2.0	0.0	0.0
Processor price of milk in other products	0.140	2.0	0.0	0.0
Quantities (million lbs. per year)				
Farm supply of milk	0.116	205.7	0.375	664.2
Farm milk sold for fluid milk	1.417	775.6	1.214	664.2
Farm milk sold for cheese	-0.789	-524.4	0.0	0.0
Farm milk sold for other dairy products	-0.082	-45.5	0.0	0.0
Producer surplus (mil. dollars per year)		31		99

# Remaining empirical questions...

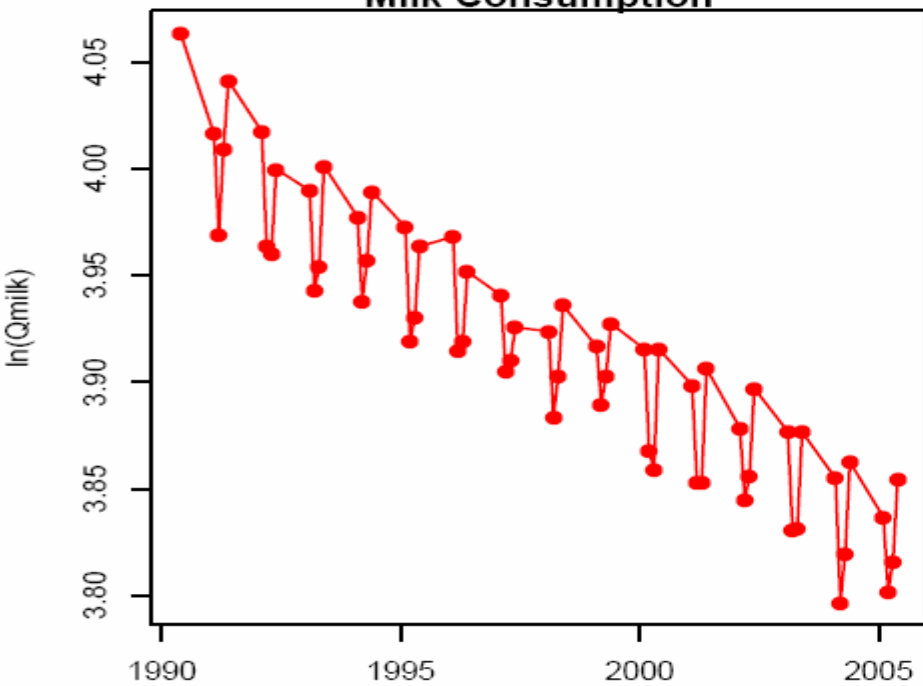
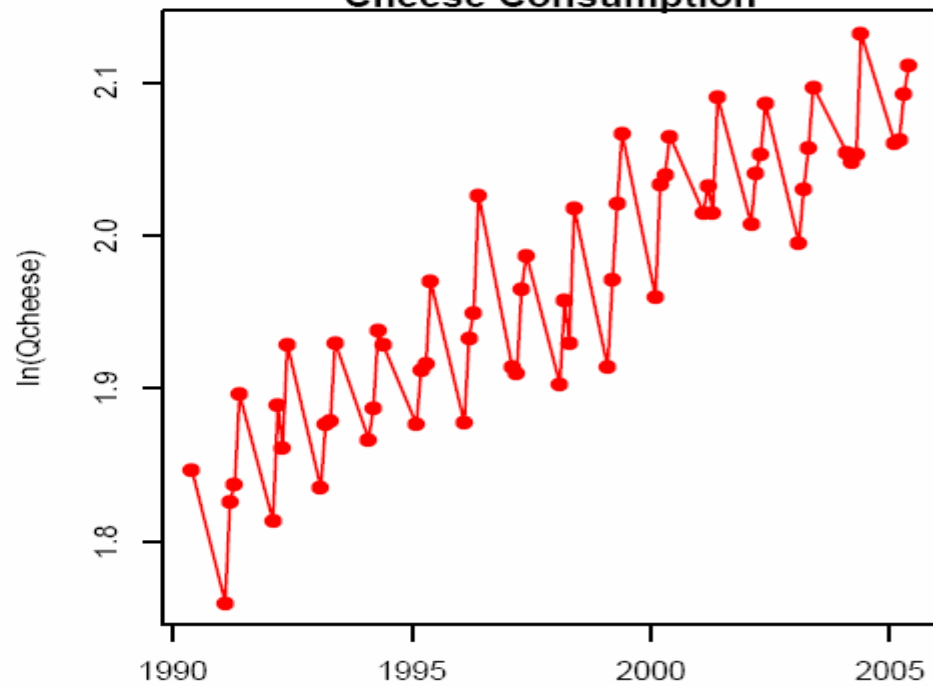
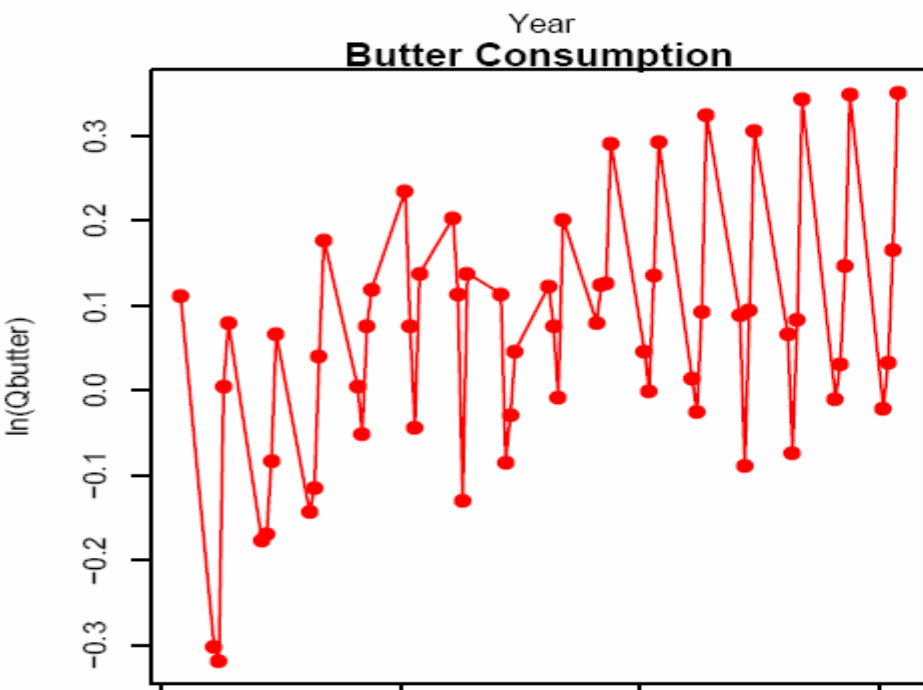
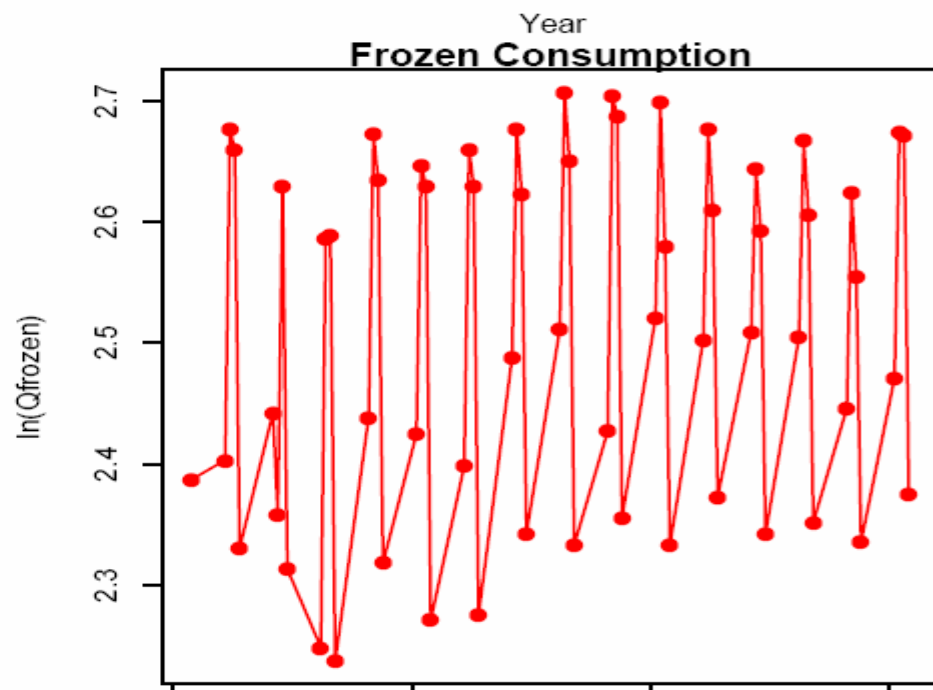
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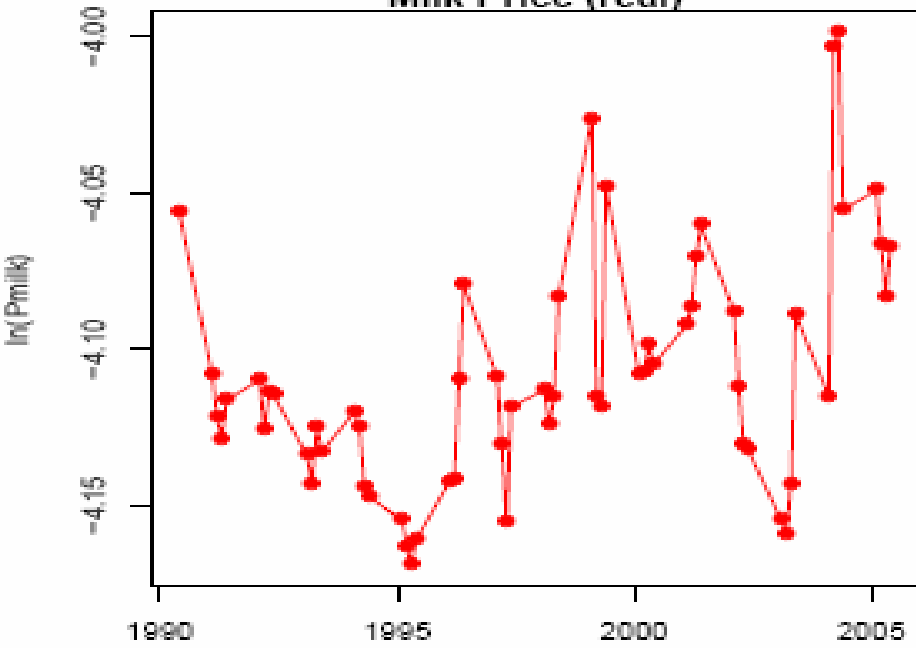
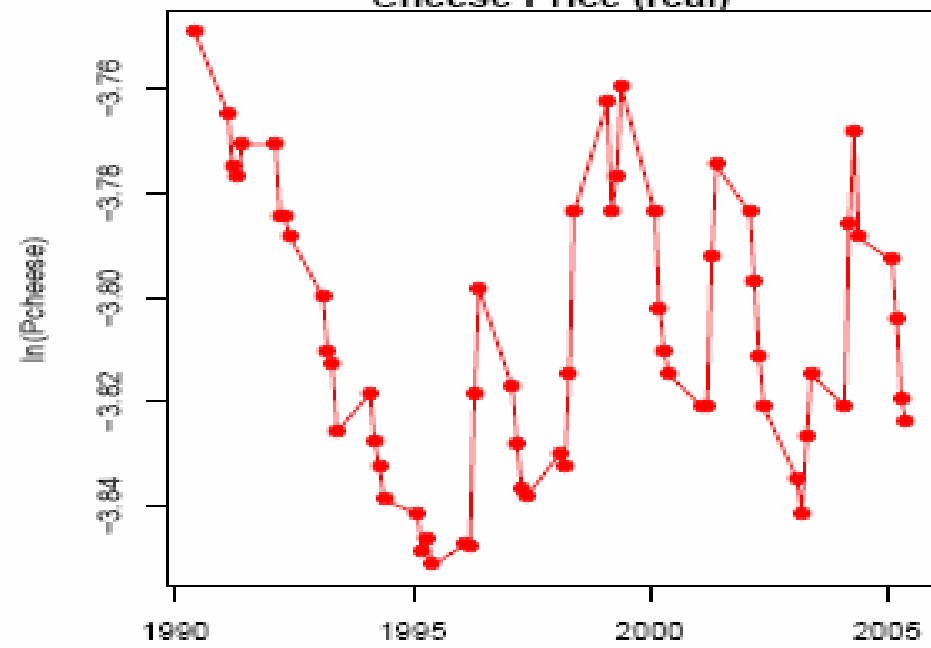
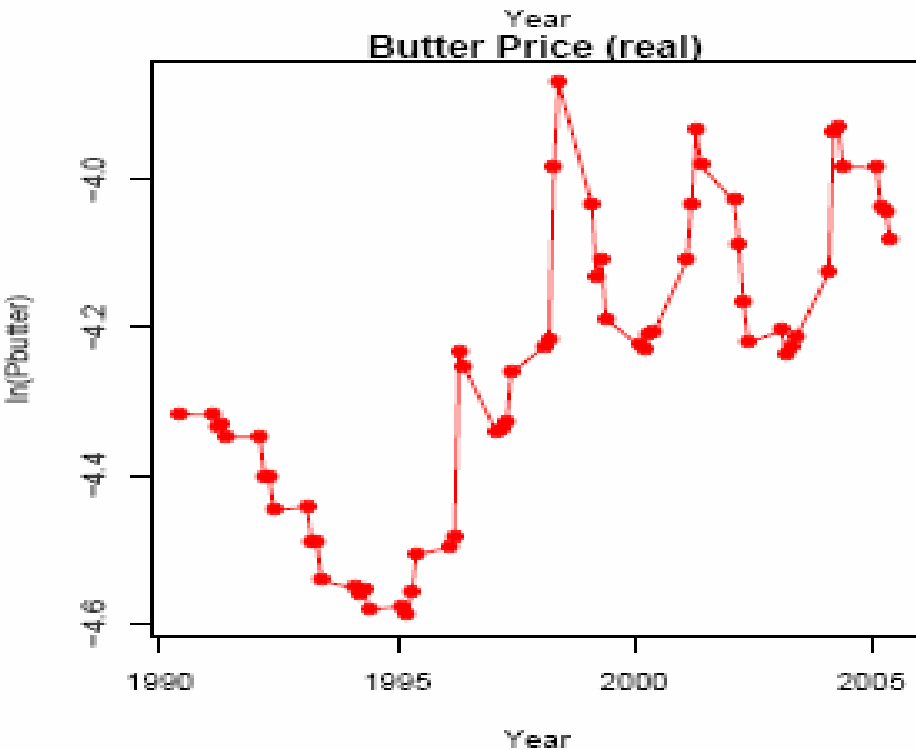
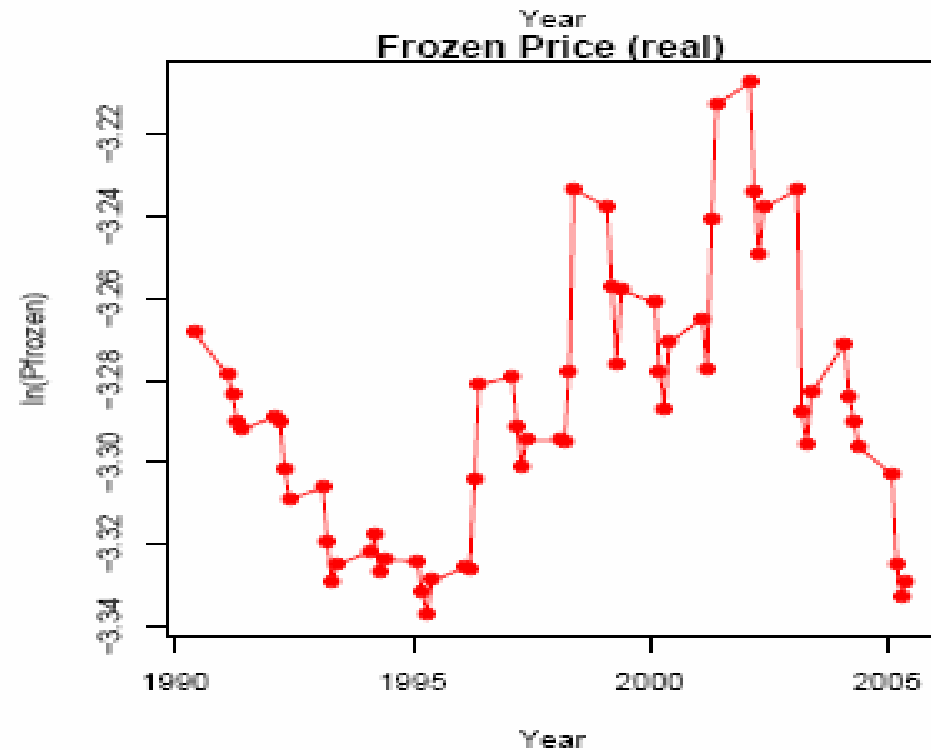
- What are the cross-price elasticities of demand among dairy products?
- What are the cross-advertising elasticities of demand among dairy products?
- What is dairy market structure, and what are the implications for vertical price transmission?
- How does policy (marketing orders, price support, border measures) affect advertising?

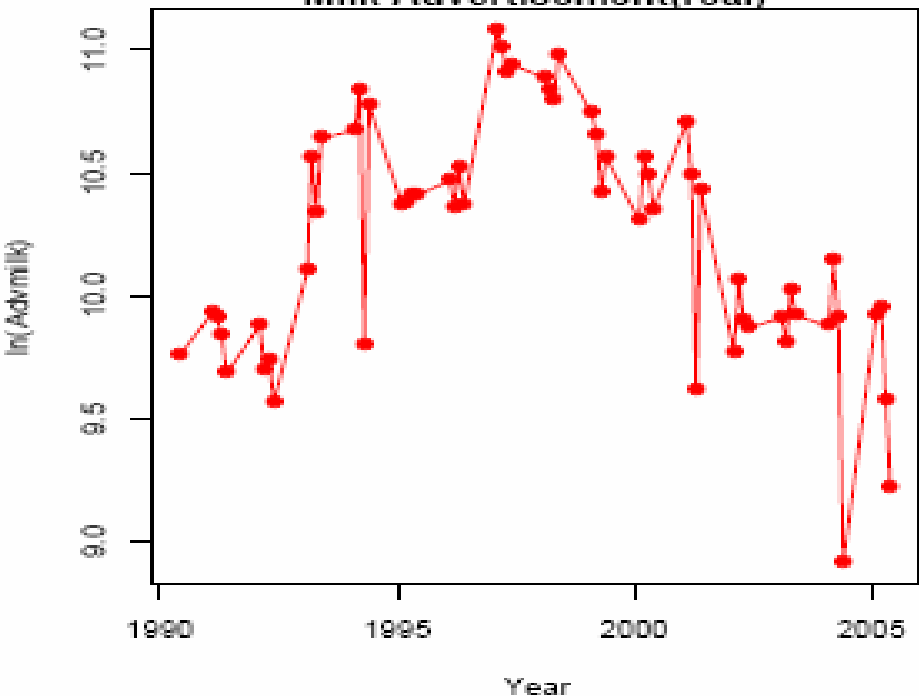
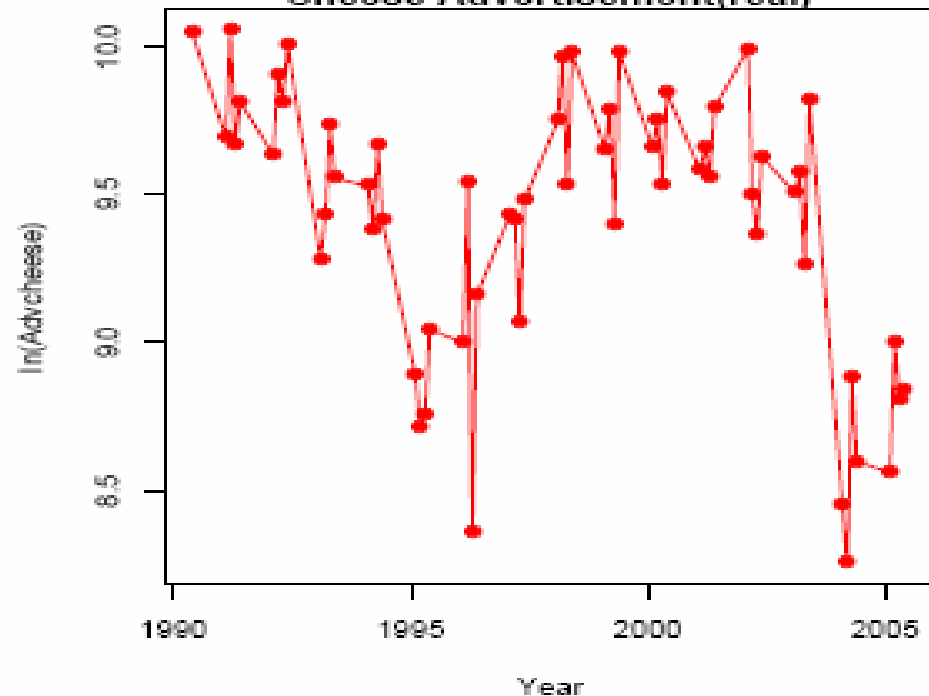
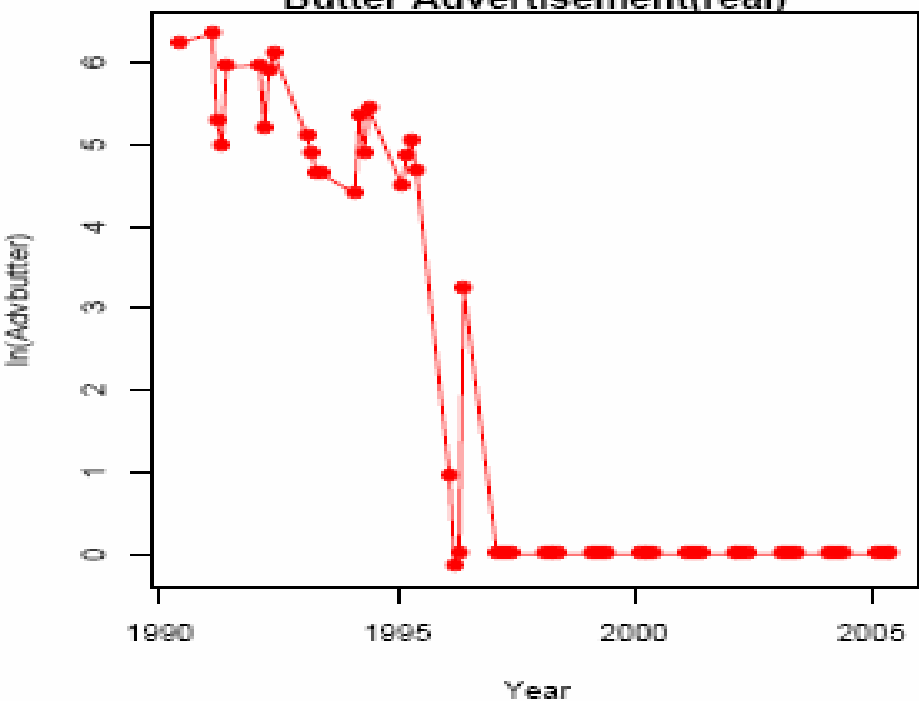
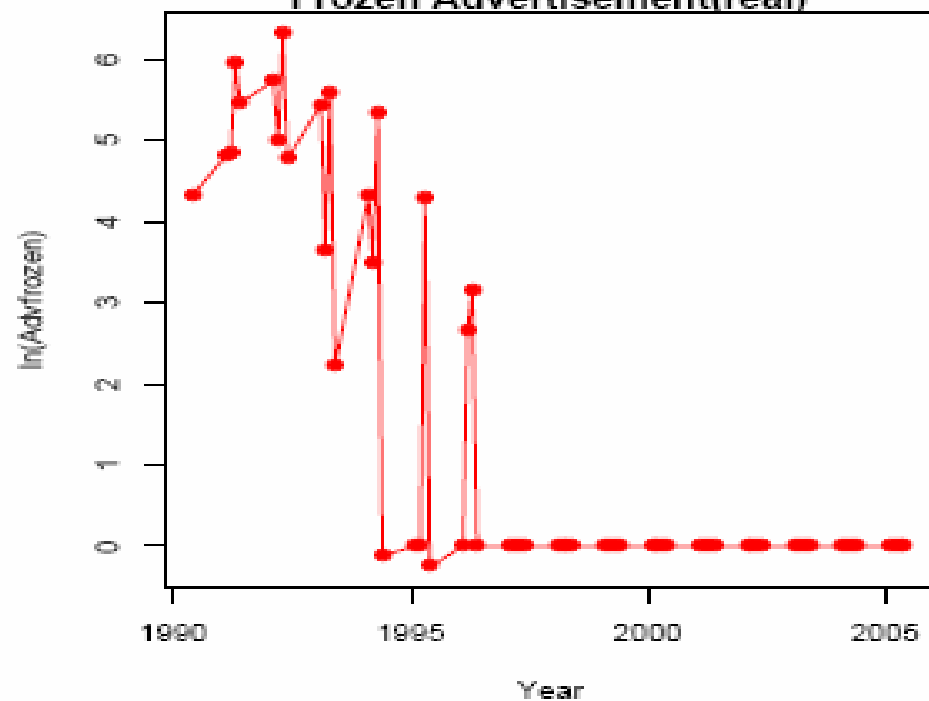
# Measuring cross-market demand effects in dairy markets

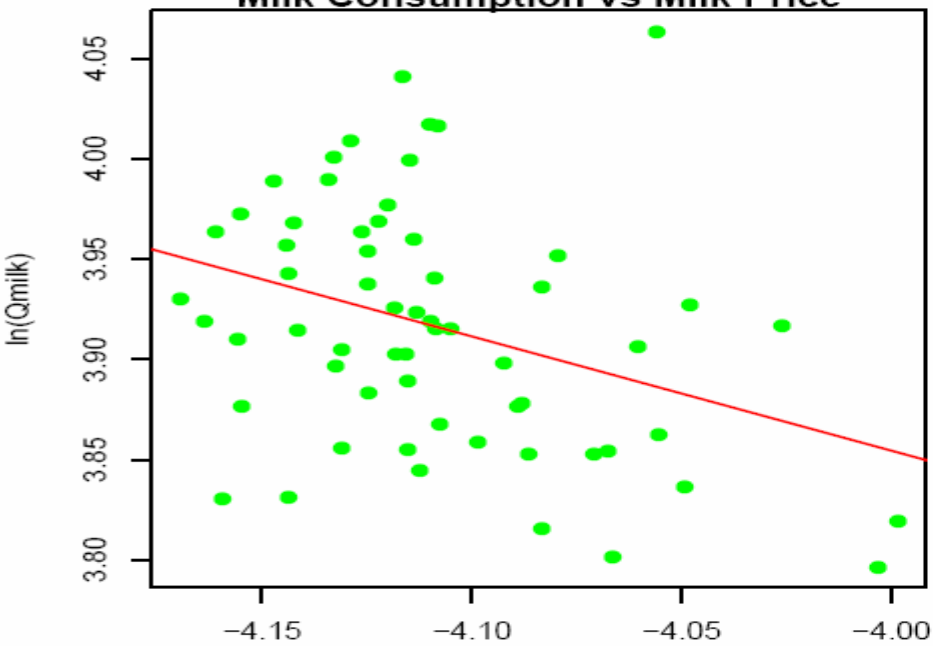
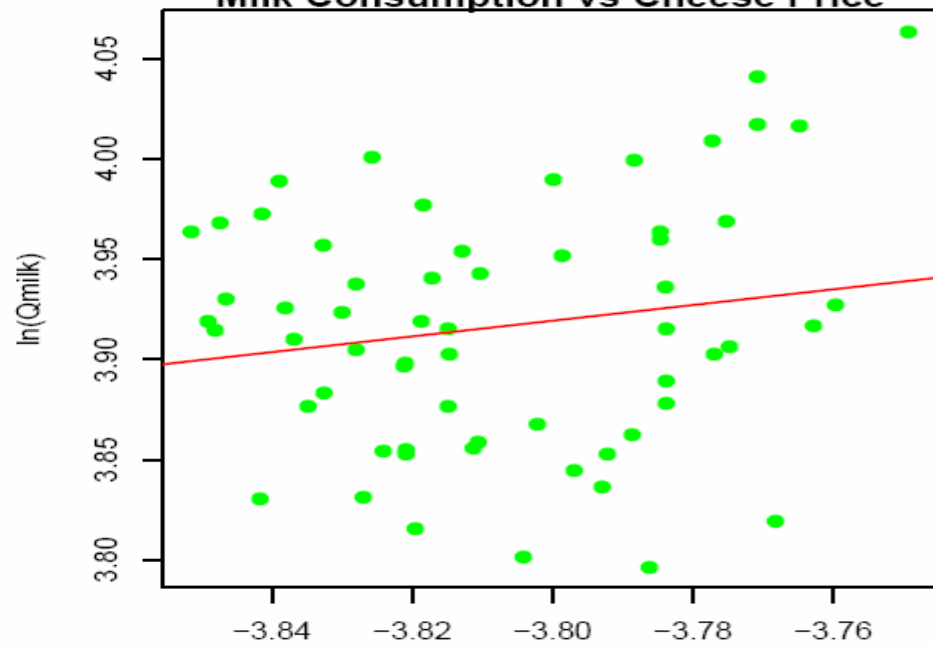
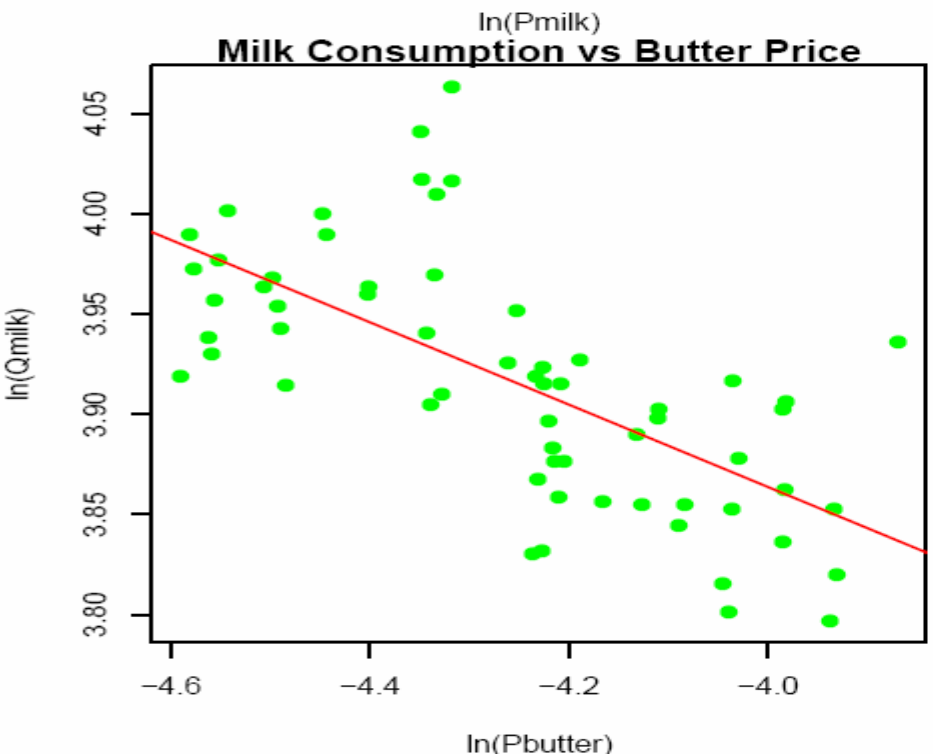
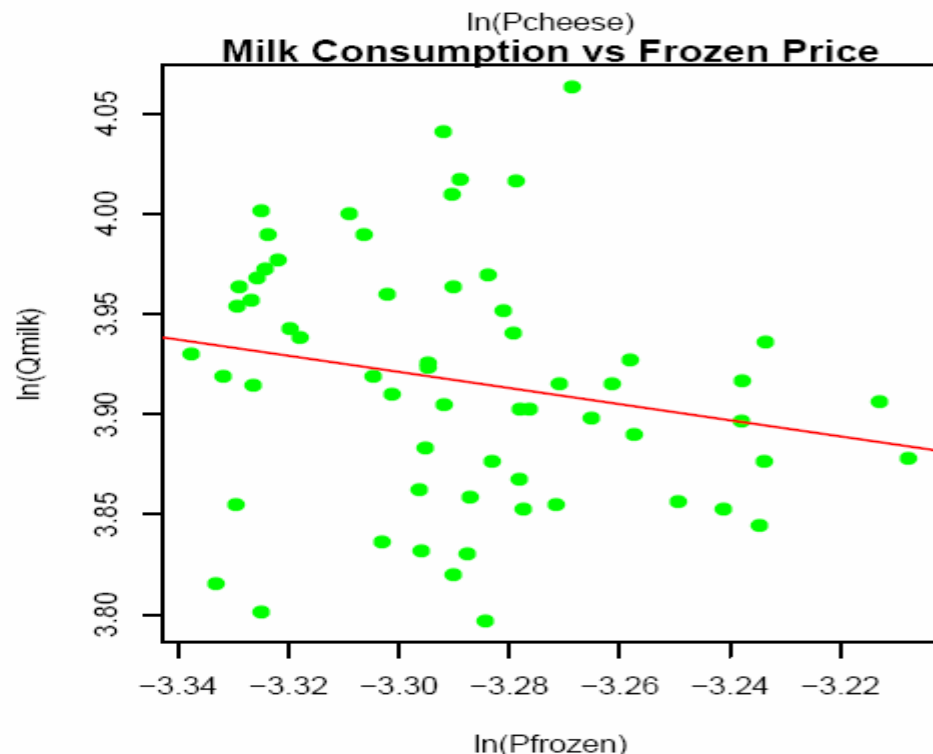
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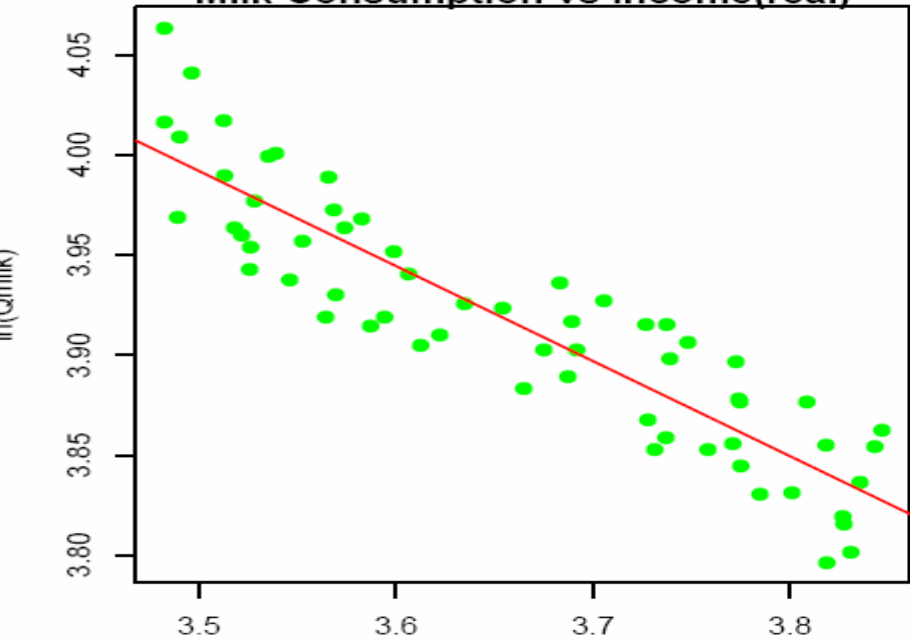
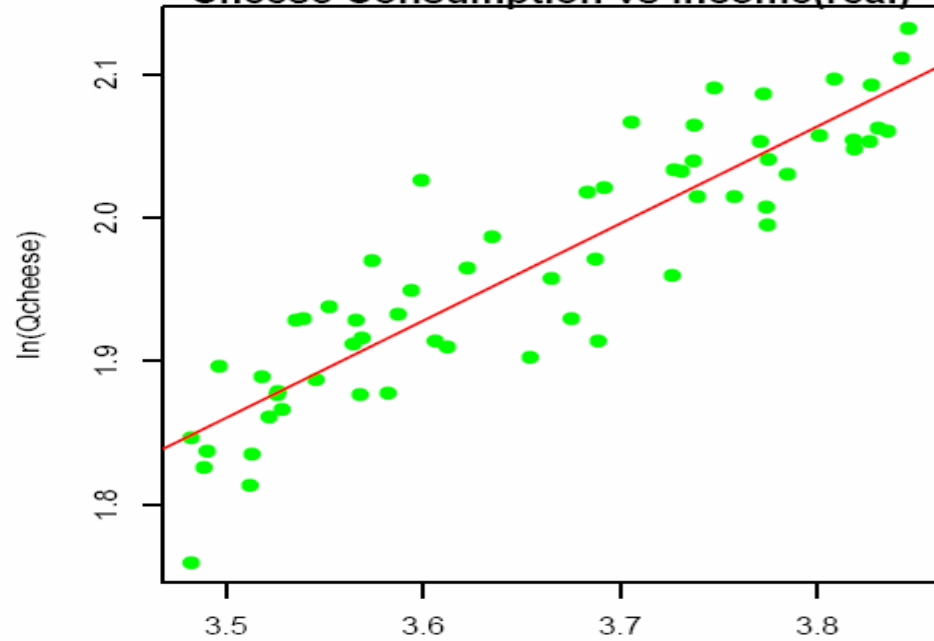
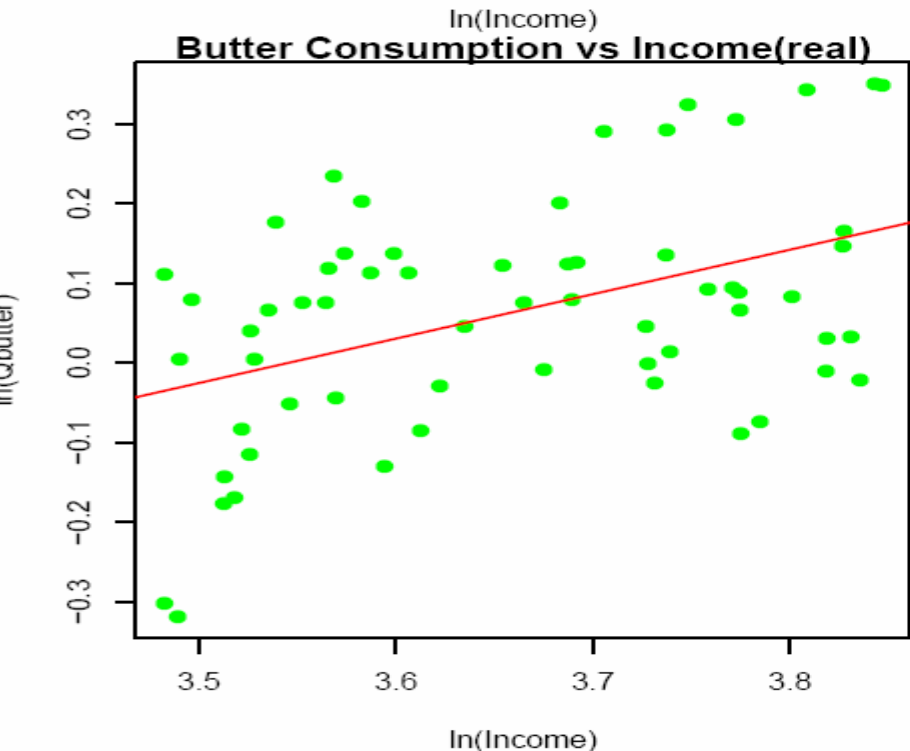
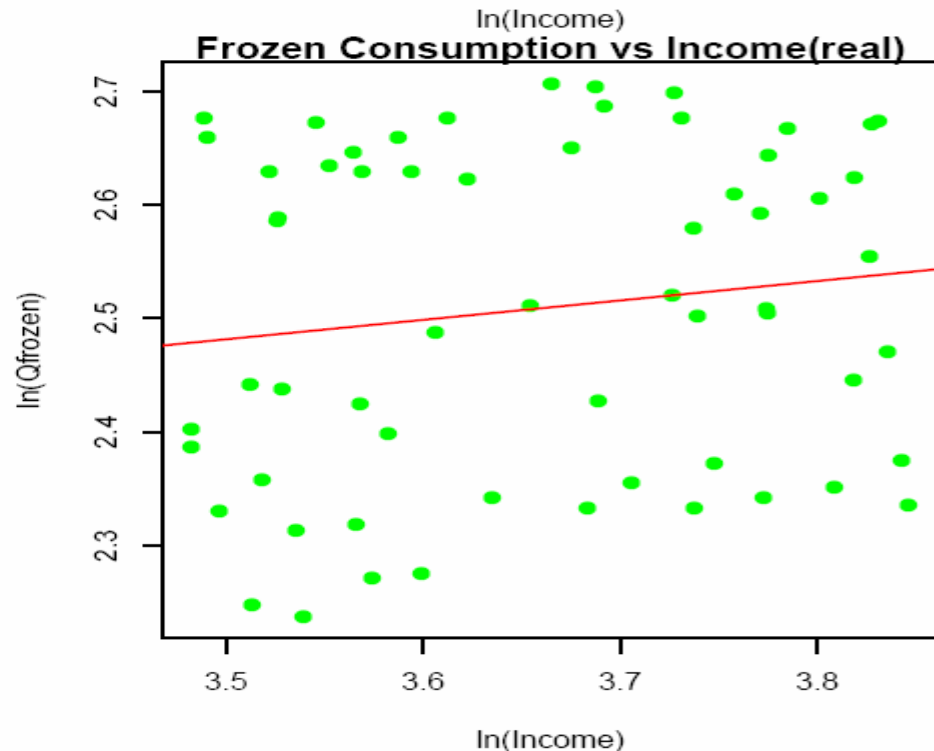
- Test for cross-market demand effects in U.S. dairy markets.
- Data from Schmit and Kaiser (2004), 1990:1-2005:4
  - Wholesale disappearance data for fluid milk, cheese, butter, frozen products
  - Consumer price indices
  - Real generic advertising expenditures by product
  - Per capita GDP, demographics

**Milk Consumption****Cheese Consumption****Butter Consumption****Frozen Consumption**

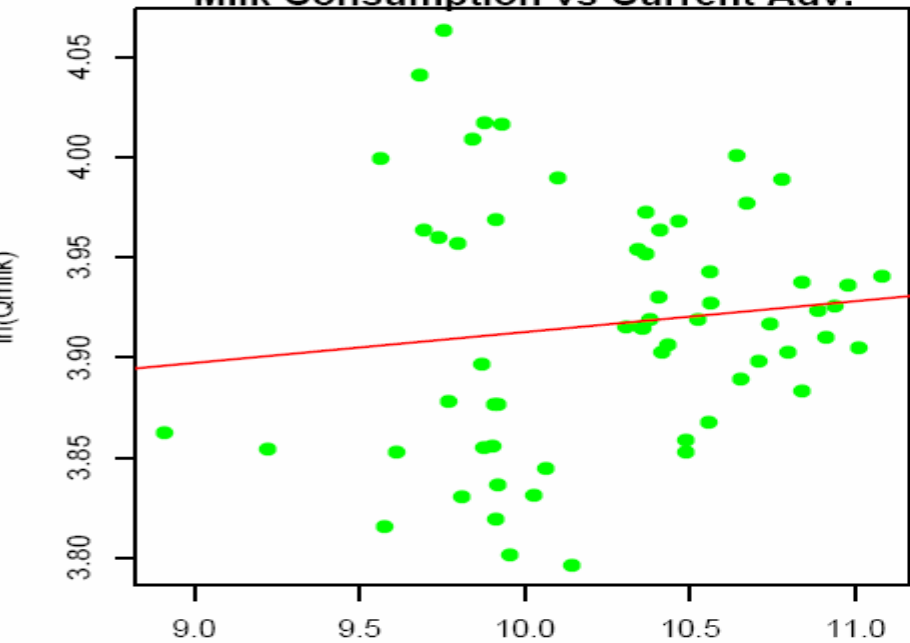
**Milk Price (real)****Cheese Price (real)****Butter Price (real)****Frozen Price (real)**

**Milk Advertisement(real)****Cheese Advertisement(real)****Butter Advertisement(real)****Frozen Advertisement(real)**

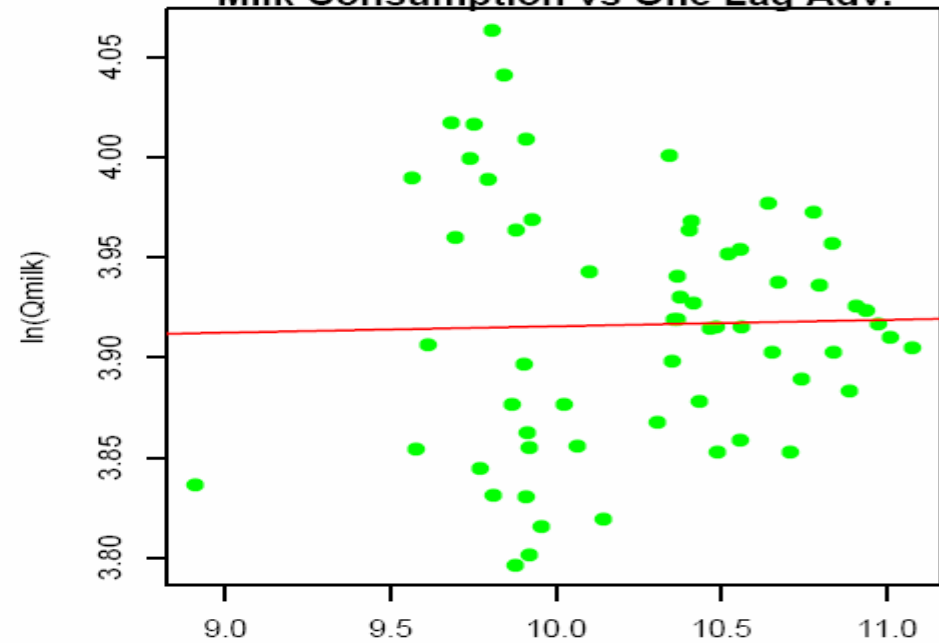
**Milk Consumption vs Milk Price****Milk Consumption vs Cheese Price****Milk Consumption vs Butter Price****Milk Consumption vs Frozen Price**

**Milk Consumption vs Income(real)****Cheese Consumption vs Income(real)****Butter Consumption vs Income(real)****Frozen Consumption vs Income(real)**

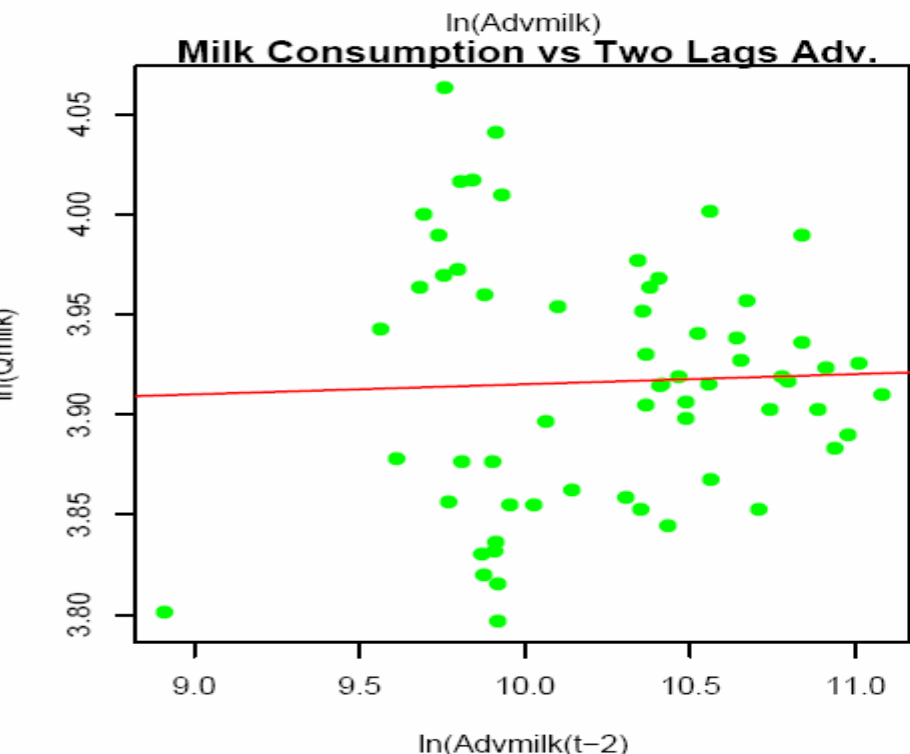
**Milk Consumption vs Current Adv.**



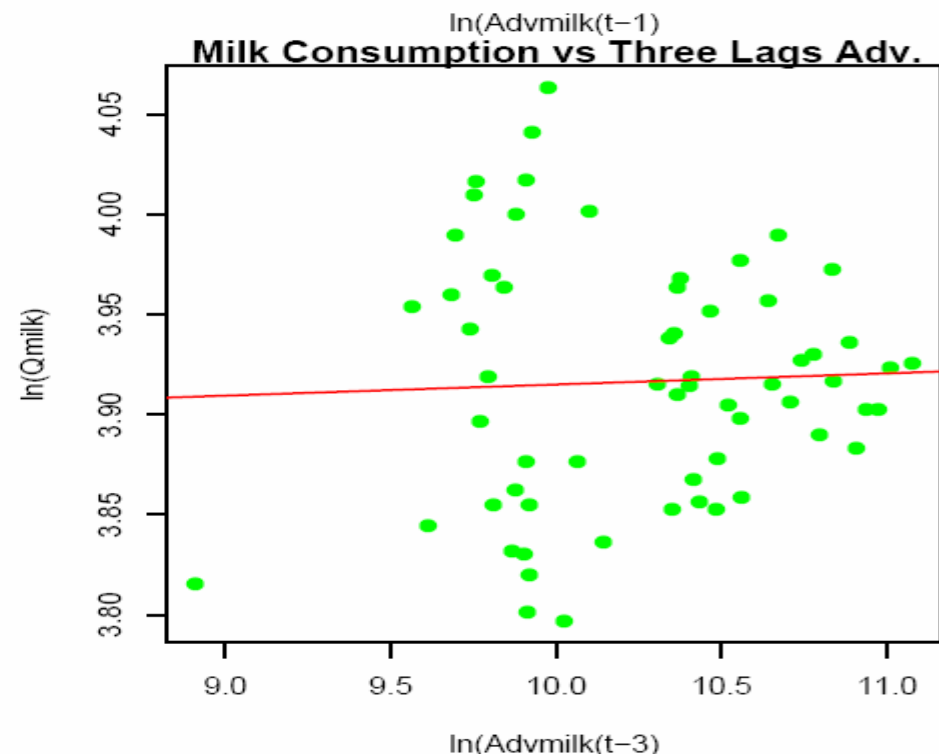
**Milk Consumption vs One Lag Adv.**



**Milk Consumption vs Two Lags Adv.**



**Milk Consumption vs Three Lags Adv.**



# Single-equation ad hoc models of fluid milk demand

$$\ln M_t = f(\ln P_{mt}, \ln P_{ct}, \ln A_{mt}, \dots, \ln A_{mt-3}, \ln A_{ct}, \dots, \ln A_{ct-3}, \text{Inc}_t, \dots)$$

Elasticity	dynamic model	trend model	S&K (2004)
Milk price	-0.23**	-0.21**	-0.04
Cheese price	0.49**	0.36**	-
Milk advertising	0.010	0.003	0.040**
Cheese advertising	0.014	0.007	-
Income	-0.5**	-0.24*	0.418**
Trend	-	-0.002**	-0.078*
Lag quantity	0.06	-	-

1. Cheese prices influence milk demand.
2. Advertising of milk and cheese is statistically insignificant.
3. Time series properties of the data seem to be crucial.

# Estimating Advertising Effects in a Demand System

## ■ LA-AIDS model w/ advertising expenditure

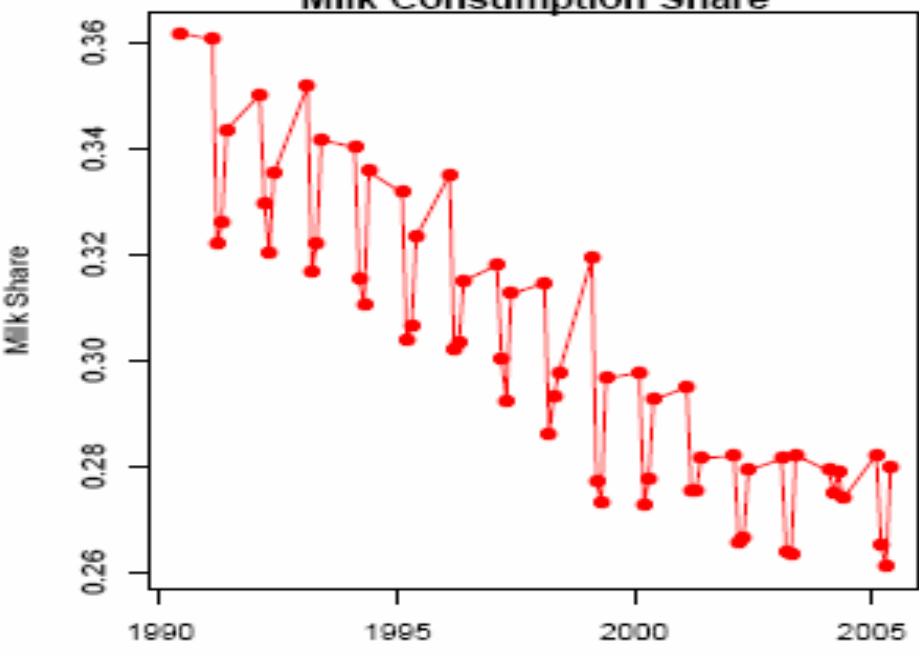
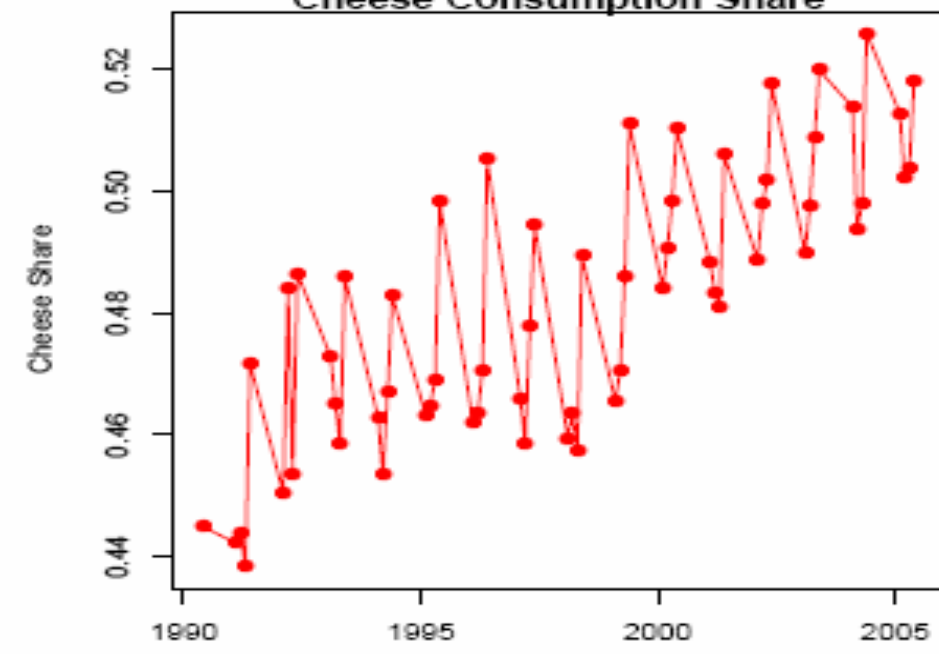
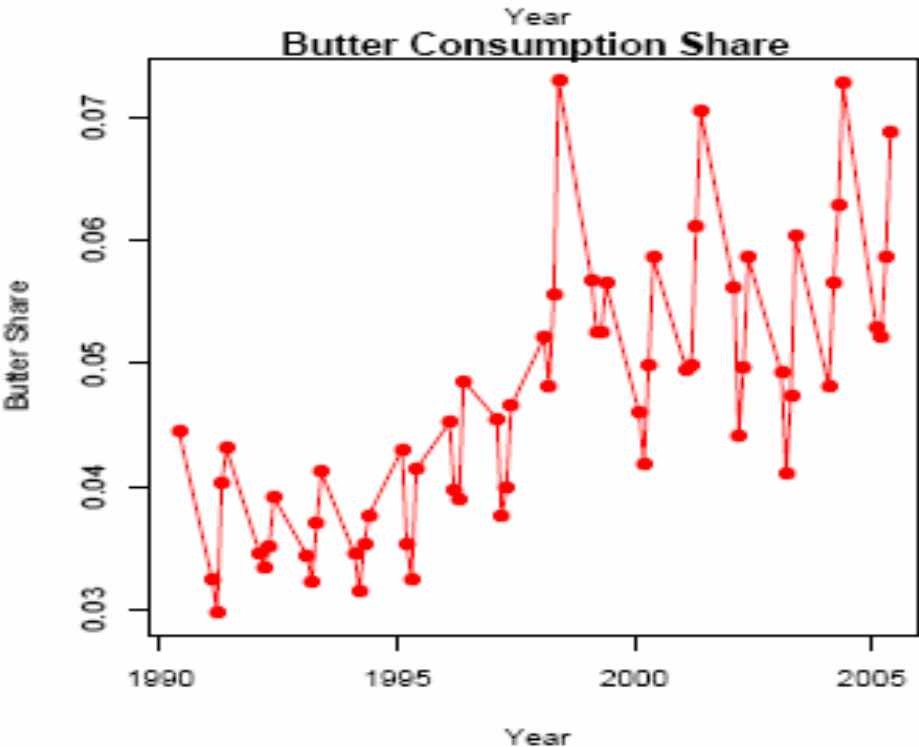
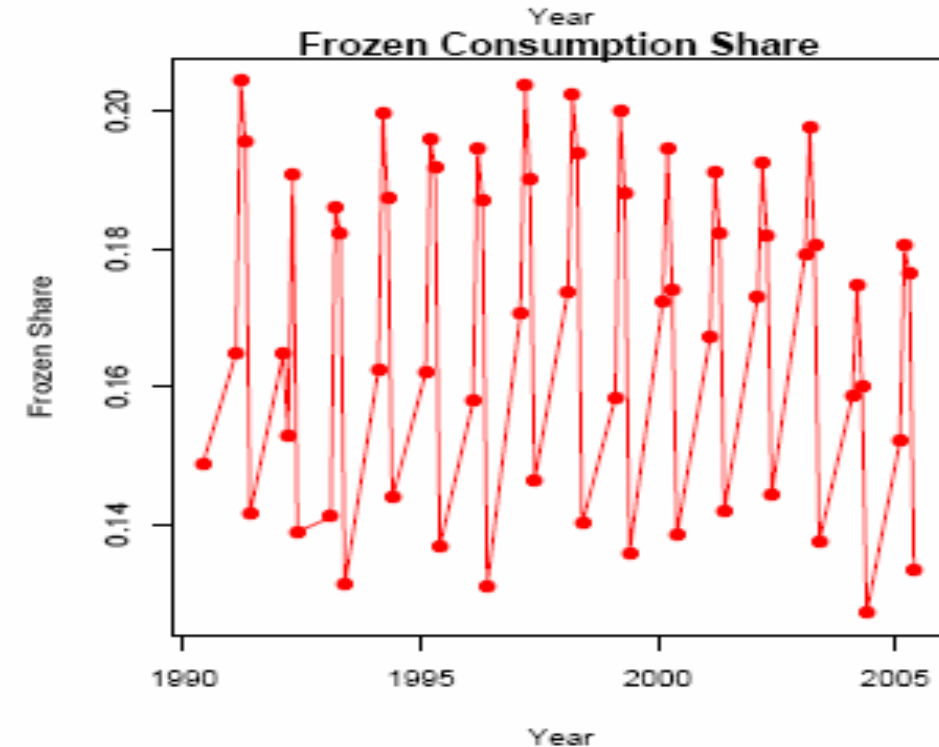
$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \sum_j \delta_{ij} a_j + \beta_i \ln(M/P) \quad (1)$$

$\ln P = \sum_i w_i \ln p_i$  The restrictions of economic theory involve only the unknown parameters so can be easily imposed. The restrictions are:

$$\sum_i \alpha_i = 1 \quad \sum_i \gamma_{ij} = 0 \quad \sum_i \delta_{ij} = 0 \quad \sum_i \beta_i = 0 \quad \text{adding up} \quad (2)$$

$$\sum_j \gamma_{ij} = 0 \quad \text{homogeneity} \quad (3)$$

$$\gamma_{ij} = \gamma_{ji} \quad \text{symmetry} \quad (4)$$

**Milk Consumption Share****Cheese Consumption Share****Butter Consumption Share****Frozen Consumption Share**

# Estimated LA-AIDS for milk, cheese, butter

	Milk	Cheese	Butter
$P_{\text{milk}}$	0.232**	-0.240**	0.008
$P_{\text{cheese}}$	-0.240**	0.293**	-0.053**
$P_{\text{butter}}$	0.008	-0.053**	-0.045**
Income	0.003**	-0.003**	0.002
Trend	-0.002**	0.002**	0.000
rho	0.3	0.3	0.3
R2	0.98	0.93	0.87

# Estimated elasticities from the dairy demand system

	Milk price	Cheese price	Butter price	Milk adv	Cheese adv	Butter adv	Income
milk	-0.34	-0.74	-0.15	-0.006	0.002	0.004	1.09
cheese	-0.40	-0.42	0.24	0.001	0.001	-0.002	0.93
butter	0.16	-0.97	-0.19	0.032	-0.028	-0.004	1.04

1. Own- and Cross-price effects appear significant, and suggest milk and cheese and butter and cheese are complements in consumption.
2. Advertising effects are not statistically significant.

# Preliminary conclusions...

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- Statistically and economically significant cross-price effects among dairy products
- These have important implications for the effectiveness of dairy advertising
- Only weak evidence for or against cross-advertising effects

# Remaining questions and ongoing work

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- What structure should be imposed on a dairy demand system?
  - Are negative cross-advertising elasticities an artifact of improperly imposed restrictions?
- How best to model dynamics?
- How best to measure advertising effort?
  - Expenditure? Goodwill?
- How to deal with endogenous prices?
  - Inverse demand system? IV?