Local bias in fluid milk consumption

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Selected Paper prepared for presentation at the 2018 Agricultural & Applied Economics Association Annual Meeting, Washington, D.C., August 5-August 7

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INTRODUCTION

American consumers are increasingly choosing to buy locally-produced food because of its perceived benefits on human health, environment and the local economy (Khanal and Azzam, 2017). Consumers preference for local food is analogous to consumer preferences domestic products relative to imports. While the latter, known in the literature as "home bias" in the international trade literature as baptized by McCallum's (1995), we analogously introduce the term "local bias" to examine preference for local vs. non-local food using fluid milk consumption in the New England states as a case study.

OBJECTIVES

- Apply the Armington (1969) demand model of home bias to estimate the degree of local bias in the consumption of fluid milk in New England states,
- Identify the types of consumers more likely to exhibit a higher degree of local bias, and
- Estimate the degree of local bias in different states and cities within New England.

EMPIRICAL MODEL

Let the milk choices be divided into two types: local (L) and non-local (NL) and let the household utility function be separable from the consumption of non-food products. Following Lopez et al. (2006), adopt constant elasticity of substitution utility function which is given by:

$$U(L, NL) = A[\beta NL^{\gamma} + (1-\beta)L^{\gamma}]^{1/\gamma} \quad (1)$$

where, A is a scale parameter, L is quantity of local product consumed, NL is quantity of non-local food consumed, γ=(σ-1)/σ where σ is the constant elasticity of substitution between local and non-local goods. The terms β and (1-β) are the preference weights for non-local and local products and 0=<β<=1. If β=0, (1-β)=1 and there is absolute preference for locally produced food.

Maximize (1) subject to budget constraint to obtain Marshallian demand functions of L and NL, take the ratio of NL to L to obtain:

$$\frac{NL^*}{L^*} = \left[\left(\frac{\beta}{1-\beta}\right)\frac{P_L}{P_{NL}}\right]^{\delta}, \quad (2)$$

where P_j is the price of food *j (j=NL and L)*. Express this in logarithmic form and adding a random error yields:

$$Q_{it} = \alpha_i + \sigma_i P_{it} + \mu_{it} \quad (3)$$

Where $\alpha_i=\sigma_i\, ln[\beta_i/(1-\beta_i)]$, $Q_{it}=ln(NL_{it}/L_{it})$, $P_{it}=ln(P_{Lit}/P_{NLit})$,*i* is a household, *t* denotes time in month, μ_{it} denotes an error term, and α_i, σ_i are parameters to be estimated. Note that the intercept embodies information about utility weight on non-local vs. local foods.

We used linear mixed model to estimate α_i and σ_i. We estimated these parameters for each household assuming that the P_{it} has different impacts for each household.

An empirical measure of local bias (*LB*) with respect to food products in household i is then given by:

$$LB_i = 1 - \beta_i = \frac{1}{1+\exp(\alpha_i/\sigma_i)} \quad (4)$$

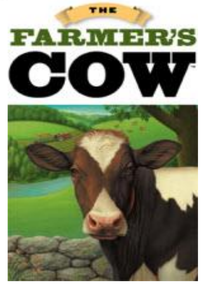
We employ a simple linear model explain the variation of *LB* across households:

$$LB_i = \gamma_0 + \gamma_j \sum_{j=1}^{K} Z_{ij} + U_i \quad (5)$$

Where Zij is a vector of exogenous factors (j=1,…..,K) affecting the degree of local bias based on substitutability of local and non-local fluid milk in household *i (i=1,.....,n)*. U_i is a random error and γ_0 and γ_j are parameters to be estimated.

DATA AND ESTIMATION

We used Nielsen Homescan consumer panel dataset of households' weekly milk purchases from 2007 to 2016. For this purpose, we chose the New England region, which covers 10 designated market areas (DMAs), with two of the DMAs overlapping with parts of New York. The purchases were aggregated to four-weekly observations. We follow Darby et al.(2008) to define local as within state boundaries and designated as local milk bottled within the same state of consumption by matching the milk brands to the bottling milk plans from Google and state dairy reports



Figures: a) DMA in the New England b) Example of local brand milk (of Connecticut)

RESULTS

Table 1: Number of milk brands identified as local in each states of the New England

States	Number of local fluid milk brands
Connecticut	11
Massachusetts	16
Rhode Island	2
Vermont	18
Maine	5
New Hampshire	9
Total	61

As Vermont is one of the states having strong dairy ecomies, the number of brands of fluid milk are also highest in this state which is followed by Massachusetts and Connecticut. Rhode Island and Maine have less than 5 local fluid milk brands listed in Nielsen Homescan consumer panel dataset.

Table 2: Local milk consumption and estimation and local bias in New England

Designated Market Area	Average Local Milk Consumption	Local Bias (LB = 1-β) (N=147,285)
Portland Auburn	0.21 (0.41)	0.44
New York	0.15 (0.36)	0.45
Boston	0.14 (0.35)	0.43
Providence-New Bedford	0.21 (0.41)	0.44
Burlington-Plattsburg	0.19 (0.39)	0.47
Albany-Schenectady-Troy	0.17 (0.37)	0.39
Hartford-New Haven	0.19 (0.39)	0.42
Springfield-Holyoke	0.24 (0.42)	0.46
Bangor	0.20 (0.40)	0.39
Presque-Isle	0.20 (0.40)	0.46
All New England	0.17 (0.38)	0.43

Figures in parentheses are standard deviations

Table 3: Estimated Parameters for Local Bias of Milk Consumption in New England

Variables	Model 1 (N=600,637)	Model2 (N=600,637)
Income Quintile 2	0.0121*** (0.0009)	0.0114*** (0.0009)
Income Quintile 3	0.0064*** (0.0009)	0.0064*** (0.0009)
Income Quintiles 4 & 5	0.0001 (0.0008)	-0.0011 (0.0008)
Household_size	0.0005 (0.0003)	0.0003 (0.0003)
Children	-0.065*** (0.0009)	-0.0259*** (0.0009)
College Education	0.004*** (0.0008)	0.0028*** (0.0008)
Race	0.0170*** (0.0010)	0.017*** (0.0011)
Hispanic	-0.012*** (0.0019)	-0.0142*** (0.0020)
Constant	0.42*** (0.0016)	0.42*** (0.0014)
State Fixed Effect	YES	NO

Figures in the parentheses are standard errors
*** indicates less than 1% significance level

CONCLUSIONS

- Application of models of home bias in international trade can provide useful methodologies to examine consumer behaviour with respect to local foods. In our case, the Armington (1969) produced plausible results in terms of the degree as well as the determinants of local bias among consumers of fluid milk in New England.
- Consumers with a higher preference for locally (state) produced milk are those who are white, non-Hispanic, middle income, college educated and without children.
- Among the 10 designated market areas within New England, consumers in the Portland-Auburn area had the highest degree of local bias whereas consumers in the New York area had the lowest.
- Even though an average consumer buying local milk had a degree of local bias of 0.41 out of a maximum of 1.0 for the New England area, consumers have heterogeneous degrees of home bias making it necessary to focus on market segments of strong preferences to local foods.

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