Testing Local Bias in Food Consumption:
The Case of Fluid Milk*

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Abstract

This article provides the first set of estimates of the degree of local bias in food consumption, by adapting the international trade notion of home bias, which describes the tendency of consumers to favour domestic over imported goods, to local bias, which describes the tendency of consumers to favour local over nonlocal food. Using state boundaries to define local and household data on milk purchases from 2007 until 2016 in the New England region, estimates from the Armington model confirm bias for locally produced milk.

Keywords: Local bias, home bias, local food, milk

Introduction

Americans are increasingly buying local food and willing to pay a premium for its perceived attributes, such as safety, freshness, quality, healthfulness, friendliness to animals and the environment, and benefits to local economies (Loureiro and Umberger 2003; Bond, Thilmany, and Bond 2009; Toler et al. 2009; Martinez et al. 2010; Onozaka, Nurse, and McFadden 2010; Low et al. 2015; Khachatryan et al. 2018). Yet, because individuals and organizations disagree about the meaning of local (NC State Extension, Undated), there is no uniform definition of this concept. While the 2008 Farm Bill defines local food as 'any food grown or transported within 400 miles or within a state', consumers define local food based on how it is grown (e.g., organic vs conventional), who produces it (large vs small farmers), how far the food travels, and how it is marketed (direct from farmers or through intermediaries).

Lacking a uniform definition, researchers often revert to state boundaries to delineate local food (Hand and Martinez 2010), and surveys do find that consumers are willing to pay a premium for in-state foods (Darby et al. 2008). Such 'favoritism' for in-state food is analogous to favouritism for national products relative to imports (Winfree and Watson 2017). While the latter, known in the literature as "home bias', has been widely tested since McCallum's (1995) seminal work two decades ago, the former, which we introduce and analogously label 'local bias', has yet to be formally tested. Our objective in this article is to provide such a test.

Our analysis is premised on two assumptions. First, to the extent that there are no trade frictions between states within the United States, as would be the case between the United States and other countries, we ignore the supply side, other than using state fixed effects, and focus on

demand. Second, granted that consumers condition their purchases of local food on price or on other attributes, such as those listed in the opening paragraph, local bias can still be important since some of the characteristics can also be present in non-local food. The challenge is to identify local bias given the effect of prices and other attributes on local food demand. We use fluid milk in New England as a case study in part because local milk can be readily identified by consumers.

Model

Let the milk choices by a household be divided into two types: local (L) and non-local (NL), and let the household utility function be separable from the consumption of other food and non-food products. Adapting the notation for home bias used by Armington (1969) and Lopez, Pagoulatos, and Gonzalez (2006), the utility function a household takes is assumed to be of the constant elasticity of substitution form:

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

where, A is a scale parameter, L is the quantity of local milk, NL is the quantity of non-local milk, $\gamma=(\sigma-1)/\sigma$ where σ is the constant elasticity of substitution between local and non-local milk. The terms β and $(1-\beta)$ are the preference weights for local and non-local milk, where and $0 \le \beta \le 1$. $\beta=1$ would indicate absolute preference of local milk.

Maximization of (1) subject to the budget constraint yields the Marshallian demand functions for L and NL. Taking the ratio of the two functions yields the expression:

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

where P_{NL} and P_L are the price of non-local and local milk, respectively. Logging (2), appending the subscripts i and t for household and time, respectively, and adding an error term yields the estimating expression:

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

where $Q_{it}=ln(L_{it}/NL_{it})$, $\alpha_i=\sigma_i \ ln[\beta_i/(1-\beta_i)]$, $P_{it}=ln(P_{NLit}/P_{Lit})$, and μ_{it} denotes an error term. The parameters to be estimated are α_i and σ_i. It follows from (3) that the measure of local bias (*LB*) by the ith household is given by the expression:

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

How household characteristics affect LB can be examined using the linear model:

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

where Z_{ij} is the vector of household characteristics $(j = 1,\dots,K)$, U_i is a random error, and γ_0 and γ_js are parameters to be estimated.

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Figure 1 distills the idea behind the model. At prevailing prices with a similar rise in income, household A prefers local milk but occasionally purchases non-local milk, while household B does the reverse. Their respective consumption bundles, denoted as different (L*/NL*) ratios, lie on different paths because of their differences in local bias for milk. In this paper, we propose that the differences in local bias are due primarily to households' socio-demographic characteristics.

Data

We used the Nielsen Consumer Panel dataset on weekly milk purchases from 2007 to 2016 by households from the six states of the New England region. In addition, this dataset supplied individual household characteristics of interest (income, presence of children, household size, and high school education and race of the head of household). Following Darby et al. (2008), we define local as within state boundaries, and designated as local milk bottled within the same state of consumption. Finally, we used state fixed effects to account for unobserved characteristics. The data procedures generated 7,121 household-level observations available for estimation.

Estimation procedure and results

We extend equation (3) to a linear mixed model to estimate the parameters α_i and σ_i, with each parameter having a fixed component and a random component:

$$Q_{it} = \alpha_0 + \sigma_1 P_{it} + \alpha_{0i} + \sigma_{1i} P_{it} + \mu_{it}. \tag{5}$$

The ($\alpha_0 + \sigma_1 P_{it}$) is the fixed effect portion of the model, and ($\alpha_{0i} + \sigma_{1i} P_{it}$) is the random effect. μ_{it} is the random error term. Measures of local bias were first obtained for each household using equation (4) and estimates from equation (3), and then regressed on household characteristics and state fixed effects using equation (5).

The regression estimates for equation (5) are presented in Table 1. These estimates reveal that while whites, richer households, and household heads having at least a high school degree exhibit local bias, Hispanics exhibit non-local bias compared to non-Hispanics. The positive relationship between local bias and household income is not surprising, as local milk, and local foods in general, commands a significantly higher price than non-local products. Thus, affordability becomes a significant determinant for households to choose local milk. The coefficients for state fixed effects indicate that households in Vermont have significantly higher local bias, while households in New Hampshire have a significantly lower local bias. Figure 2 presents the distribution of the estimates of local bias for all 7,121 households in the sample. The estimated mean is approximately 0.4, and the range shows that only a minority of households have local biases above 0.6 or below 0.2

Summary and conclusion

In this paper we adapted the notion of home bias in international trade economics, which describes the tendency of consumers to favour domestic over imported goods, to local bias, which describes the tendency of consumers to favour locally produced food. Using state boundaries to define local and individual household data on weekly milk purchases in the New

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England region, we confirmed the presence of strong local bias among these households. Furthermore, the degree of local bias for fluid milk is higher among white households, higher income households, whose heads have at least a high school degree, and who reside in Vermont, and lower among Hispanics and larger households who reside in Maine. Overall, our results suggest that the home bias literature can provide a sage to enrich empirical applications of models to better understand the behaviour of consumers towards local foods.
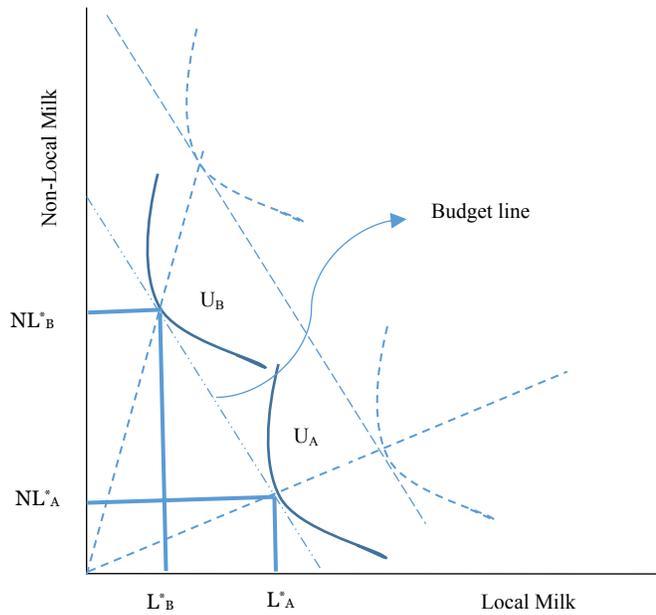
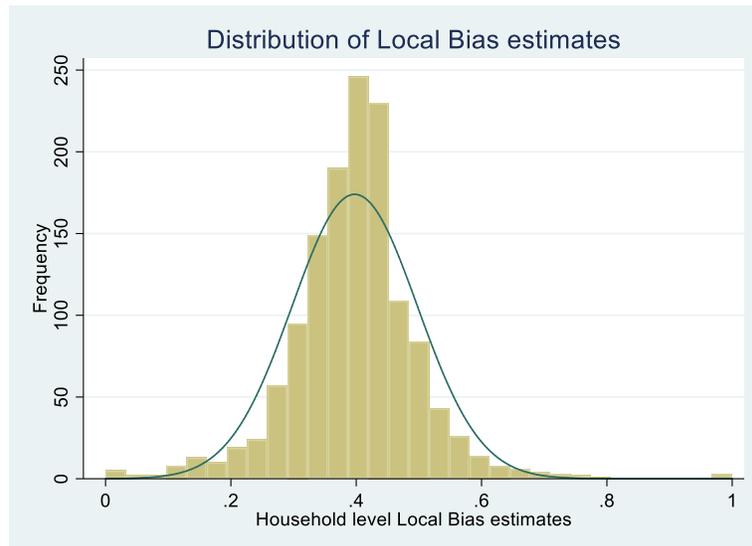Figure 1: Two households with different local biases for milk

Figure 2: Distribution of local bias estimates

Table 1: Estimates of the determinants of local bias for fluid milk in New England

VARIABLES	Dependent variable=Local Bias (N=7,121)	
	Estimates	Standard Error
Household characteristics		
Income quintile-2nd	0.011**	0.005
Income quintile-3rd	-0.003	0.005
Income quintile-4th and 5th	0.017***	0.004
Children (1/0)	0.0003	0.006
Household size	-0.003*	0.002
HH head high school (1/0)	0.008*	0.004
White (1/0)	0.025***	0.006
Hispanic (1/0)	-0.018**	0.007
State fixed effects		
Maine	0.001	0.004
Massachusetts	-0.003	0.005
New Hampshire	-0.047***	0.014
Rhode Island	0.011	0.007
Vermont	0.056***	0.005
Constant	0.368***	0.008
R-squared	0.024	

Note: *, **, *** indicate less than 10%, 5% and 1% level of significance. Connecticut is the benchmark for state fixed effects.

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