The value of healthy eating vs. the value of convenience: Investigating the willingness to pay for living in food swamps

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Introduction

- Prior studies have demonstrated that the food environment plays a vital role in influencing and shaping people's dietary behaviors and health outcomes. Residents who live in communities with abundant sources of unhealthy foods but limited healthy foods consume more fast food and are more likely to develop obesity, type 2 diabetes, and hypertension (Caillavet et al., 2015).
- A specific line of food environment researches has devoted to identifying communities that are oversaturated with unhealthy dining options, the so-called "**food swamps**".
- **Research Gap**: Plenty of research dedicated to the effects of food swamps on people's diet and health, no research has been conducted to investigate how people value or disvalue such adverse food environment using non-hypothetical data. Such research can help better understand people's diet preferences and help design relevant strategies to improve the diet environment.
- **Main Objective**: To examine how unhealthy food environments influence housing prices and estimate people's willingness to pay (WTP) for (not) living in food swamps by using spatial hedonic pricing models.
- **Main contributions**:
  - ➢ This is the first research that uses a spatial hedonic pricing model to value unhealthy food environment, which adds value to the diet environment literature.
  - ➢ We use different criteria to define food swamps, which allows us to check the robustness of the results and compare the impact between different definitions.

Data

- Study area: Edmonton, the capital city of Alberta in Canada.
- The property transaction data for single-family residential properties comes mainly from Brookfield Real Estate Solutions.
- Assuming that the sales price of a house is the sum of its attribute values, which can be divided into four categories:
  1. *Food environment*
     - ➢ Living in a food swamp neighborhood or not
     - ➢ The locations fast-food restaurants and convenience stores are obtained from the city's 2018 business licenses database
  2. *House structural characteristics*
     - ➢ Living areas, property conditions, garage capacity, etc.
  3. *Locational characteristics*
     - ➢ River, downtown, University of Alberta, hospitals, and parks
     - ➢ Extracted from DMTI Spatial Inc and City of Edmonton Open Data Catalogue
  4. *Neighborhood characteristics*
     - ➢ Population density, unemployment rate, etc.
     - ➢ Obtained from Edmonton Open Data Catalogue 2016 Census

Methods

- **Identifying food swamps**

	Definition 1	Definition 2	Definition 3
Criterion 1: High availability of unhealthy food stores	√	√	√
Criterion 2: Low healthy food ratio		√	√
Criterion 3: Low income level			√

- **The spatial hedonic pricing models**
  - ➢ **S**patial lag model (SAR):

$$P = \alpha\iota_n + \rho WP + X\beta + \varepsilon$$

where P represents an $n \times 1$ vector of the housing prices, ι_n is an $n \times 1$ vector of ones. W is an $n \times n$ spatial weight matrix and ρ is the spatial autoregressive parameter. X denotes an $n \times k$ matrix that represents all explanatory variables, and β is a $k \times 1$ vector that represents parameters of explanatory variables. ε is an $n \times 1$ vector of independent and identically distributed error terms.

  - ➢ Spatial error model (SEM):

$$P = \alpha\iota_n + X\beta + u, \qquad u = \lambda Wu + \varepsilon$$

where the term Wu represents the weighted average of the disturbances and λ is the spatial autocorrelation coefficient.

  - ➢ Spatial autoregressive confused model (SAC):

$$P = \alpha\iota_n + \rho WP + X\beta + u, \qquad u = \lambda Wu + \varepsilon$$

- **Spatial weights matrix**

We consider two ways to define the weights matrix:

① K-nearest neighbor weights: $k = 5, 10, 20$.

② Contiguity-based weights: queen weights.

- **Estimation of willingness to pay for food swamps**

$$Total\ MWTP_{dummy} = \left[\exp\left(\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} M_r(W)_{ij}\right) - 1\right]\bar{P}$$

$$where\ M_r(W) = (I_n - \hat{\rho}W)^{-1} I_n \hat{\beta}_r$$

where $\hat{\beta}_r$ is the estimate of variable x_r, $\hat{\rho}$ is the estimate of the spatial lag parameter, $\bar{P}$ represents the average house prices in our study area.

Results I

Table 1 Likelihood Ratio (LR) Tests

	SAC vs SAR (Ho: λ = 0)	SAC vs SEM (Ho: ρ = 0)
Food Swamp Definition 1	459.7***	71.5***
Food Swamp Definition 2	447.4***	72.7***
Food Swamp Definition 3	450.6***	72.6***

Note: Significance denoted by ***p<0.01, , **p<0.05, and *p<0.1

- The LR tests show that SAC models cannot be simplified to SAR models or SEM models. Hence, SAC models are the relatively appropriate models to describe the data in this study.
- We therefore mainly focus on the estimation results from SAC models.

Results II

Table 2 Estimating Results of SAC Models Using the Nearest 10 Weights Matrix

	Coefficient	Total MWTP
Food Swamp Definition 1	-0.002	-1,240.12
Food Swamp Definition 2	0.022***	14,806.80**
Food Swamp Definition 3	0.024***	16,502.60***

Note: Significance denoted by ***p<0.01, **p<0.05, and *p<0.1

- Living in food swamps generated from **definition 1 is not significantly** associated with housing prices.
- Living in food swamps under **definition 2 and 3** has **a positive and statistically significant influence on housing prices.**
- Overall, the results show that **people are actually willing to pay a premium to live in a food swamp neighborhood**. Specifically,
  - ➢ Households are willing to pay C$14,806.8 to reside in a food swamp based on definition 2.
  - ➢ Households are willing to pay C$16,502.6 to reside in a food swamp based on definition 3.
- **Potential reasons for the positive WTP**
  - ➢ The convenience brought by fast food consumption
  - ➢ Unaffordability of healthy diets
  - ➢ Lack of relevant knowledge
  - ➢ In favor of the better taste of fast foods

Policy Implication

- The results indicate that people are willing to pay a premium to live in food swamps. Policy interventions such as restricting the density of unhealthy food outlets may not be cost-effective.
- Some other potential policy options are:
  - ➢ Advocate for changes to land-use zoning to permit temporary farmer's markets or mobile healthy food vending in these food swamps.
  - ➢ Provide healthy food subsidies for low-income households.
  - ➢ Provide food literacy education to enable consumers to make healthier choices in retail food settings.
  - ➢ Encourage restaurants to provide more tasty and healthy fast food and make the healthier options as the default options.

Selected references

Caillavet, R., Kyureghian, G., Nayga, R. M., & Ferrant, C. (2015). Does healthy food access matter in a French urban setting? American Journal of Agricultural Economics, 97(5), 1400-1416.

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