Are People Willing to Pay for Improving the Food Environment? Evidence from A Spatial Hedonic Analysis of Residential Property Values

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Are People Willing to Pay for Improving the Food Environment? Evidence from A Spatial Hedonic Analysis of Residential Property Values

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Background

- **Motivations**
  - Growing evidence has shown that geographic access to different types of food stores can influence people's dietary habits, which further influence their body weight and overall health.
  - Evidence has shown that the odds of consuming unhealthy food and becoming overweight tend to increase, when people are exposed to abundant unhealthy food outlets such as fast food restaurants and convenience stores in their neighborhoods. Meanwhile, access to safe, fresh and nutritious foods helps build healthier eating habits and reduces the risk of obesity and other chronic diseases.
  - Although the benefits and costs of different food environment as well as factors that influence the food environment have been widely studied, research focusing on people's willingness to pay (WTP) for better diet environment is still missing. Questions such as would people be willing to pay more to live in a place that have good access to healthy food? Do they require compensations to reside close to unhealthy food retailers such as fast food restaurants and convenience stores?
  - These are all important questions to study especially from the policy perspectives. For example, if we can find evidence to show positive willingness to pay for a better food environment, it provides both justification and revenue source (from increased property taxes) for government intervention.
- **Objectives**
  - investigate impacts of different food stores on property values
  - estimate the WTPs of changing the accessibility to a variety of healthy and unhealthy food stores

Data

- Study area – Edmonton, the capital city of Alberta in Canada.
- Property transaction data for single-family residential properties – obtained from the Brookfield Real Property Solutions (RPS) company
- The sale price of a house is postulated to be the sum of the values of its attributes, grouped into four categories:
  - *(1)structural characteristics* — obtained from the RPS
  - *(2)locational characteristics* — obtained by calculating the distance from the property to Downtown, University of Alberta, the nearest hospitals and the nearest parks. The locations of these places were extracted from DMTI Spatial Inc and City of Edmonton Open Data Catalogue.
  - *(3)food environment characteristics* — obtained by calculating the distance from the property to healthy and unhealthy outlets. The locations of both healthy and unhealthy outlets were obtained from Edmonton's business licenses database.
  - *(4)neighborhood characteristics* — obtained from the Edmonton Open Data Catalogue 2016 Census.

Methods

- **The spatial lag hedonic pricing model:**

$$P = \rho WP + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + \varepsilon$$

where P is the vector of housing prices, ρ is a spatial autocorrelation parameter, W is a $n*n$ spatial weight matrix, X_1 is a matrix with observations on structural characteristics, X_2 is a matrix with observations on locational attributes, X_3 is a matrix with observations on food environment amenities, X_4 is a matrix with observations on neighborhood socioeconomic characteristics, and ε is a vector of i.i.d. error terms. *Note: based on model specification comparison, the double log functional form has the best fit. Thus, the dependent and independent variables are all in log forms.

- **Spatial weight matrices**

We consider 3 types of weight matrix W:
① Distance band weights.
② K-nearest neighbor weights.
③ Contiguity-based (queen) weights.

- **Estimation of willingness to pay**

$$MWTP_{log-log} = \frac{\partial P}{\partial x_k} = \hat{\beta}_k \left(\frac{1}{1-\hat{\rho}}\right) \frac{\bar{P}}{\bar{x}_k}$$

Where k represents one of the continuous housing characteristics, $\hat{\beta}_k$ is the estimate of variable x_k, $\hat{\rho}$ is the estimate of the spatial lag parameter, and $\bar{P}$ represents the average house prices in our study area.

Results I

- Moran's I test and the Lagrange Multiplier (LM) test results suggest that a spatial lag model shall be appropriate.
- **Table 1. Estimating Results of Different Hedonic Models with different weights (only report representative variables)**

		spatial lag model		
	OLS	Distance band weights	K-nearest neighbor weights	Contiguity-based weights
Food Environment Characteristics				
Save on Food	0.020***	0.027***	0.029***	0.025***
	(0.005)	(0.004)	(0.005)	(0.004)
Superstore	0.023***	0.016***	0.015***	0.018***
	(0.004)	(0.004)	(0.004)	(0.004)
Local grocery	0.012***	0.006*	0.006*	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)
Farmer's Market	0.021***	0.024***	0.025***	0.020***
	(0.005)	(0.005)	(0.005)	(0.005)
A and W	0.001	-0.011**	-0.011**	-0.006
	(0.005)	(0.005)	(0.005)	(0.005)
KFC	-0.005	-0.009*	-0.009*	-0.009*
	(0.005)	(0.005)	(0.005)	(0.005)
Mac	0.013***	0.006*	0.005	0.007**
	(0.004)	(0.003)	(0.003)	(0.003)
7-eleven	0.016***	0.009**	0.008**	0.009***
	(0.004)	(0.004)	(0.004)	(0.004)
Rho		0.330***	0.329***	0.299***

Note: ***Significant at 10%, **significant at 5%, *significant at 1%.

Results II

- Results show that the impacts of unhealthy food outlets on property values vary by the type of stores. Overall, housing values increase when fast food restaurants (such as A&W and KFC) are nearby and decrease as the property getting closer to convenience stores (Such as Mac and 7-eleven).
- Property values substantially drop as they are getting closer to healthy food retailers (Such as Save on food, Superstore, and local grocery stores), and farmers' markets.
- **Table 2. Estimating Results of Marginal MTP (CAD) for Spatial Lag Hedonic Models with Different Weights**

	MWTP for Spatial Lag Model		
	Distance band weights	K-nearest neighbor weights	Contiguity-based weights
Save on Food	-603.519	-647.422	-534.237
Superstore	-246.490	-230.799	-265.106
Local grocery	-171.355	-171.143	-191.122
Farmer's Market	-379.649	-394.978	-302.460
A&W	224.449	224.172	.
KFC	228.073	227.791	218.043
Mac	-182.295	.	-203.324
7-eleven	-325.474	-288.953	-311.160

- Depending on the model specification and the type and brand of the store, home-buyers' WTPs:
  - For healthy food retailers, for every 100-meter increase in distance, people are willing to pay 171 to 647 CAD.
  - For convenience stores, for every 100-meter increase in distance, people are willing to pay 182 to 325 CAD.
  - For fast food restaurants, for every 100-meter decrease in distance, people are willing to pay 224 to 265 CAD.

Conclusions

- The estimation results indicate that WTPs for healthy food retailers are negative in Edmonton. In this case, encouraging a new supermarket business to improve local healthy food access may not be the most cost-effective option because it leads to a loss of fiscal revenue due to the reduced property taxes and may lead to a reduction in public service provision elsewhere.
- Thus, it is better for local government to adopt other options such as subsidized public transportation for grocery shopping, encouraging and supporting online business and free shipping to families to improve healthy food access.
- The estimation results also suggest that WTPs for unhealthy food retailers are positive. In order to alleviate the impact of fast food restaurants to people's health conditions, the local government can use the increased fiscal revenue from property taxes to support educational campaigns and community-supported programs to promote people's healthy diet habits.

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