FOOD ACCESS FOR LOW INCOME INDIVIDUALS

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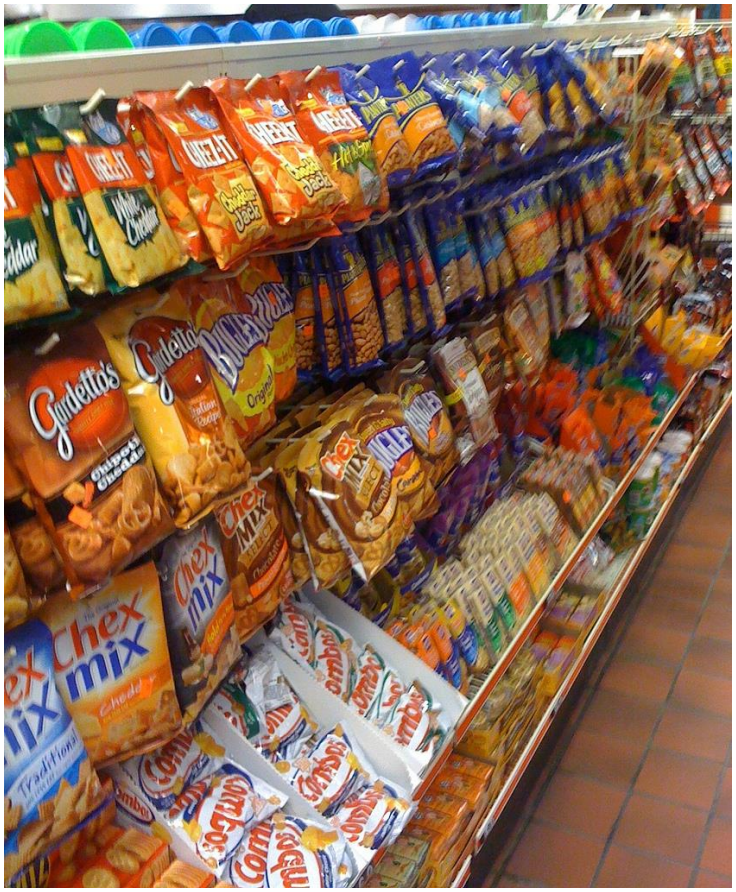
Contents

- Introduction/Background
- Methodology
- Model Results
- Our Metric
- Conclusion

Land use consolidation changed how food was purchased

Source: Austin Briggs and YourHub.com, https://www.denverpost.com/2014/09/02/longtime-mom-and-pop-store-golds-corner-grocery-closing-in-wheat-ridge/

Food purchasing patterns led to unhealthy food environments



- Defining ***Food Environments*** (FEs)
- Healthy options further away
- Negative effects of unhealthy FE

USDA Definition of a Food Desert

Any low-income census tract in which either 500 people or 33 percent of the population reside more than one mile from a supermarket or large grocery store.

Flaws in FD definition

The USDA definition is lacking:

- Mobility options available
- Through-the-network distances
- Food shopping behaviors

Additionally, many different metrics exist in the literature, there is no standard measure

Our proposed solution: location choice modeling

Food shopping location data for low income individuals used to understand the relationship between food access and

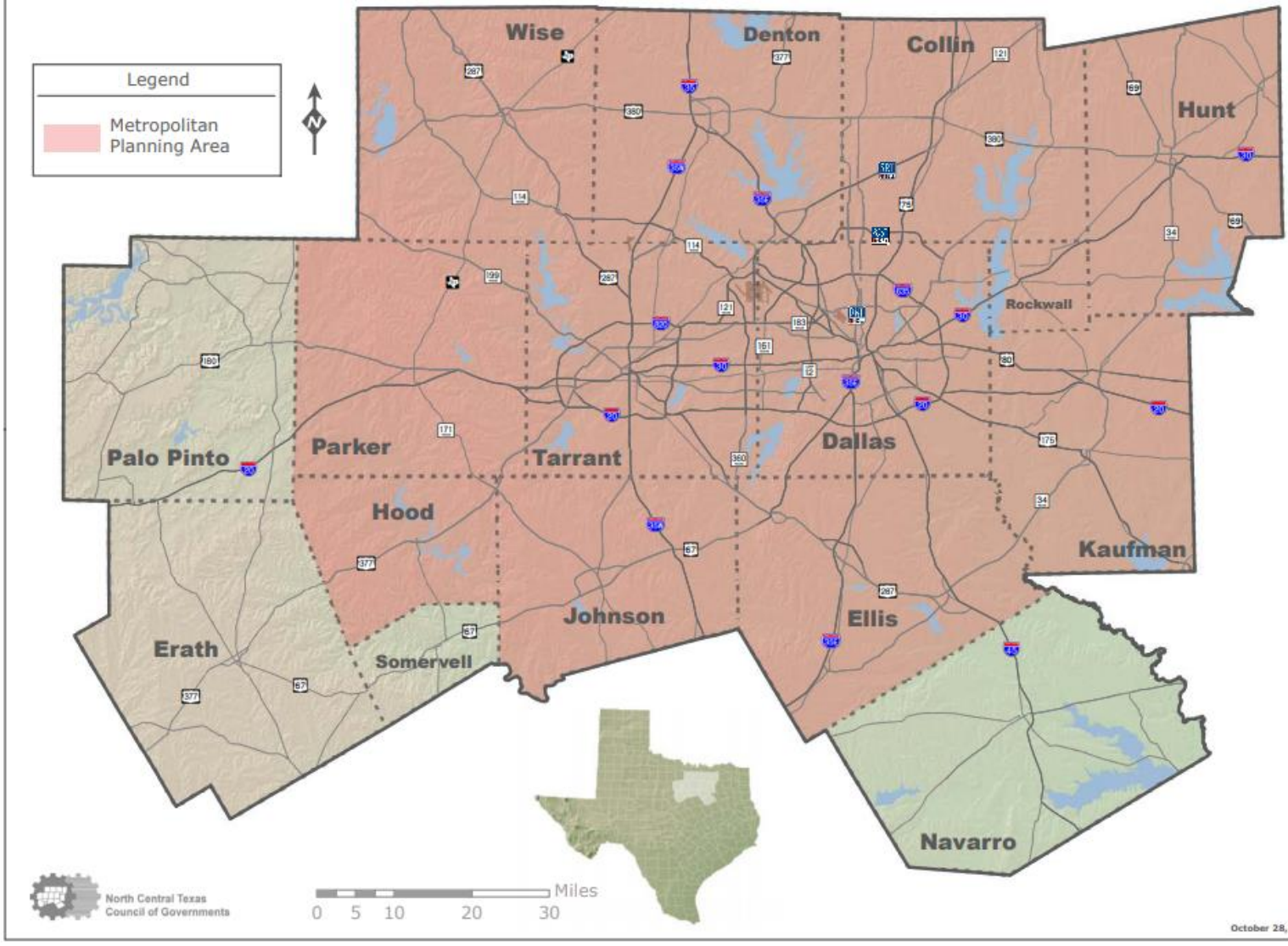
- Demographic characteristics
- mobility options
- Other FE factors

Purpose: to develop a multivariate metric for food accessibility

Methodology

- Zones with food-shopping locations form choice set
- Bhat *et al.* (2003) describe the mathematical procedure used to apply the spatial location choice model
- MNL prediction procedure is used to predict the spatial location choice

The North Central Texas Council of Governments Region



Courtesy North Central Texas Council of Governments, 2011: https://www.nctcog.org/nctcg/media/Transportation/DocsMaps/Data/Maps/RegionalMap_Web.pdf

Low Income food shopping travel

- 1,005 food shopping outings of low-income HH analyzed
- Up to 50 zone alternatives for every outing, each alt. is a zone with a food shopping location
- Avg. dist. of food shopping location from home is 6.45 miles
- 93.5% of travel is by car, SUV, van, truck
- Mean vehicle ownership 1.39 per household
- 15.9% of low-income food shoppers in final sample are full-time workers

Composite size equations

$$Composite\ Size = \alpha * distance + \beta * \ln(size - attributes) + \varepsilon$$

$$U_{ij} = \alpha(dis_i) + \beta(CompositeSize_j) + \varepsilon_{ij}$$

Composite size variable estimation

Variables	NLMNL Results	
	Coeff.	t-stat.
Distance from home	-0.4024	-47.45
Composite Size	0.3085	6.56
number of retail developments	0.8762	1.89
number of recreational developments	1.4801	2.21
Number of Observations	50,250	
Log-likelihood at convergence	-2567.20	

Results

Variables	MNL model	
	Coefficient	t-statistic
Attributes of alternative		
Number of wholesale stores	0.2990	2.07
Number of supercentres	0.4152	4.69
TSZ is adjacent to home zone	0.8966	5.06
TSZ is the same as home zone	0.7995	4.03
Population Density (persons/sq. mi.)	-0.0010	-2.27
Composite Size measure	0.2240	1.97
Distance from home (miles)	-0.5491	-6.25

Results

Variables	MNL model	
	Coefficient	t-statistic
Socio-demographic interactions		
with Income >$50K		
TSZ neither same nor adjacent to home	0.6196	2.14
with Distance from home (miles)		
Number of vehicles in household	0.0396	3.66
Number of adults in the household	-0.0643	-4.01
High-density residential location dummy	0.0172	2.45
Presence of child under 5 years of age	0.0906	5.08
Full time employment dummy	0.1315	7.86
TSZ neither same nor adjacent to home	0.1507	1.99
Number of wholesale stores	0.0228	2.22
Number of supercentres	0.0248	2.56
Composite size measure	0.0262	2.55

Resulting metric and its formulation

$$Acc_i = \ln\left[\sum_{j=1}^{J}\left(\frac{1}{J}\right)\left(\frac{O_i^{\alpha}}{C_{ji}^{\beta}}\right)\right]$$

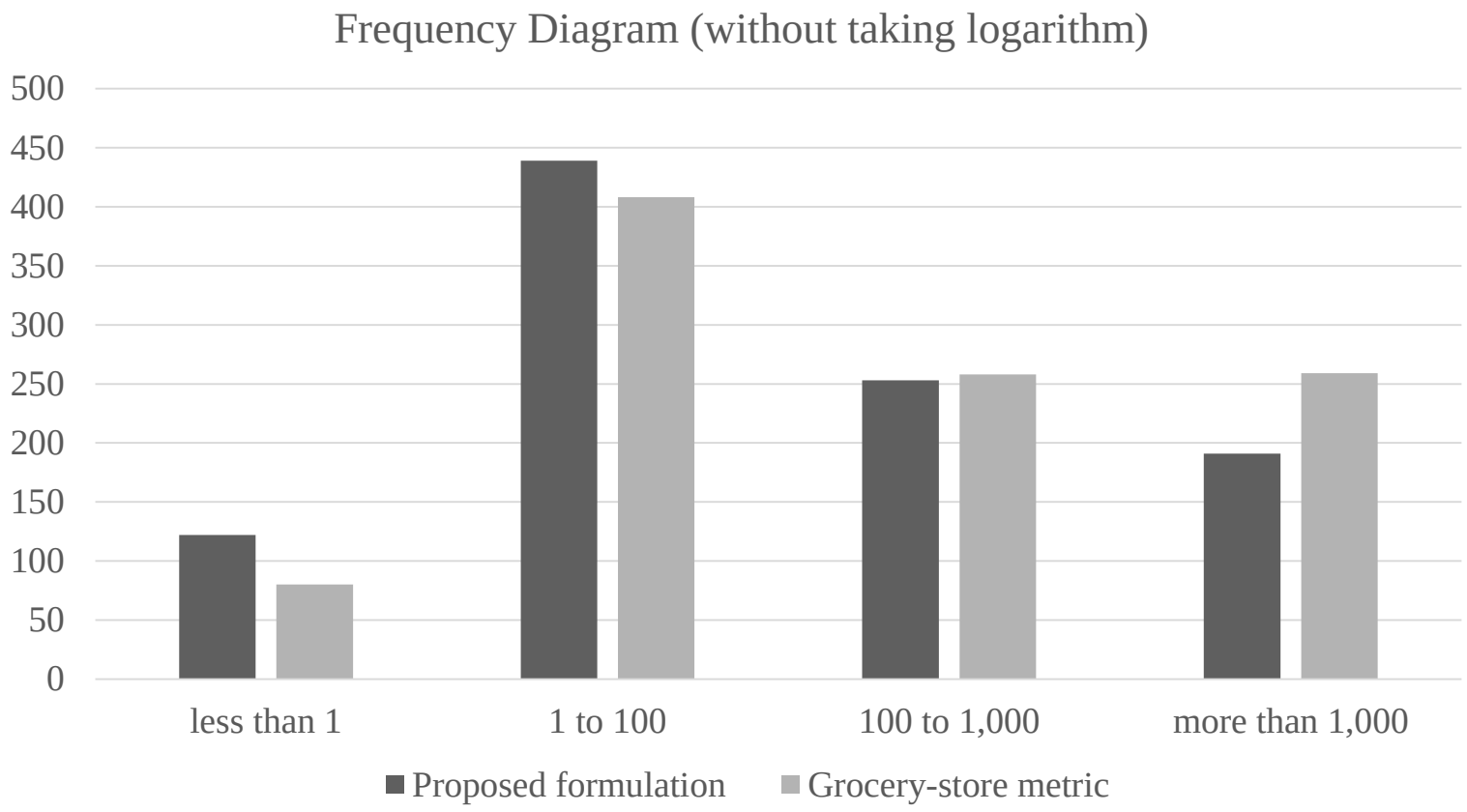
In this equation,

α, β = parameters estimated from destination mode choice models for the region under consideration

O_i = sum of all measures of attractiveness for the TSZ i [Here, O_i = γ_1 (Number of wholesale stores) + γ_2 (Number of supercentres) + γ_3 (population density) + γ_4 (Composite Size of destination TSZ)]

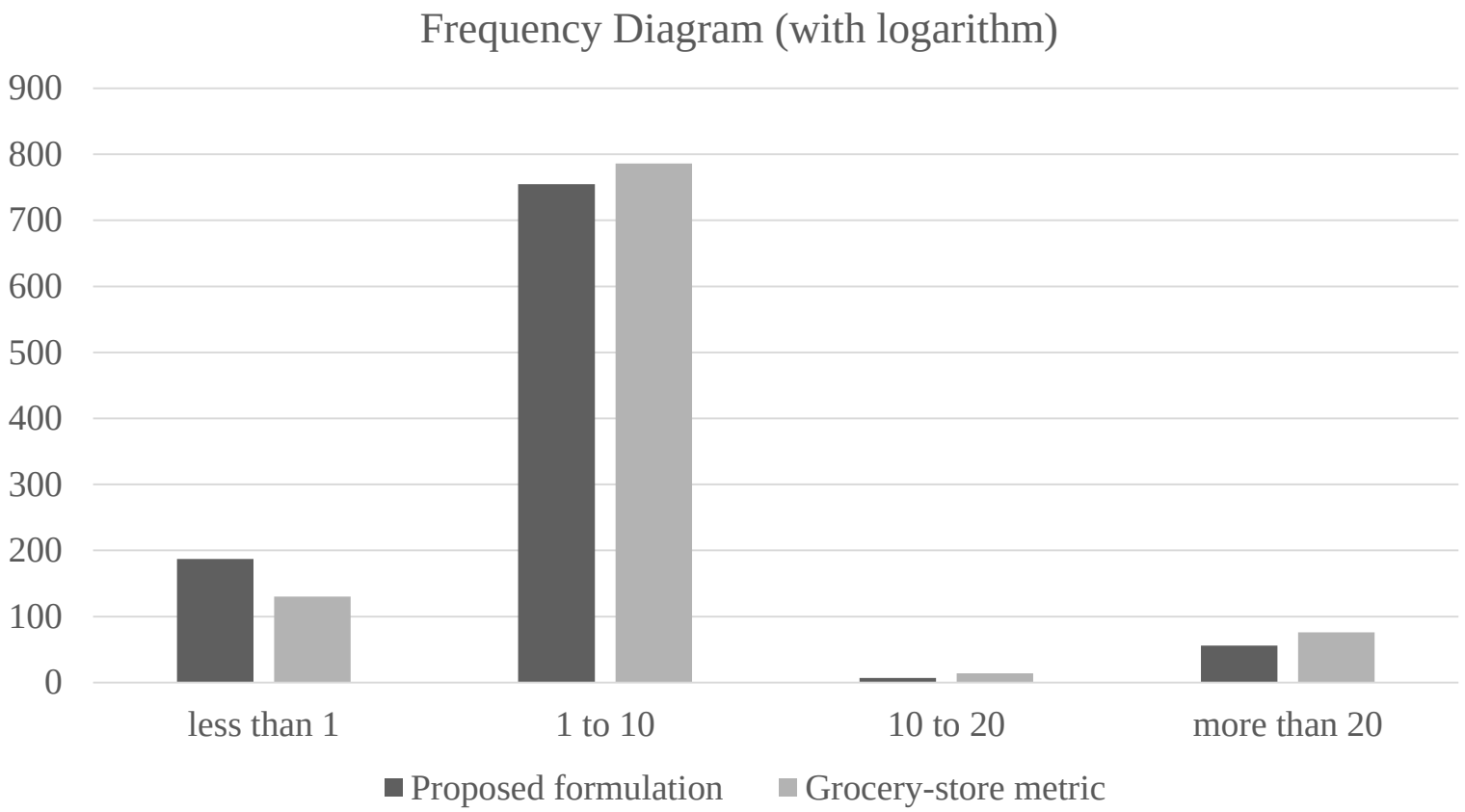
$C_{ji} = \lambda * Distance$. This is an impedance measure between origin zones j and destination zone i based on distance (Bhat *et al.*, 2002 provide the region-specific default value of this parameter, we can directly use the ones estimated for Dallas-Fort Worth metropolitan region).

Resulting metric comparison



Frequency Diagram (without taking logarithm) to compare the proposed formulation with grocery-store metric

Resulting metric comparison



Frequency Diagram (with logarithm) to compare the proposed formulation with grocery-store metric

Results

- Supercenters and Wholesale stores
- Composite size - larger zones with more opportunities for retail and recreation are preferred
- Presence of children of different ages has different impacts

Study impact and future work

- We remove limitations of USDA food desert definition
- Wholesale/Supercenters should be encouraged to market healthy food to low-income shoppers
- Future – shopping choices

THANK YOU!

References

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