Local Urban Market Potential and the Spatial Allocation of Discount Retail in Polish Cities

Jaworski Norbert [1]

[1] University of Warsaw Faculty of Economic Sciences

Objective

This paper examines discount retail locations as outcomes of firm location choice and as indirect evidence of local consumer-facing market potential. Building on the consumer city perspective (Glaeser, Kolko, & Saiz, 2001), urban economics of retail allocation (Ossokina et al., 2024), retail agglomeration research (Sevtsuk, 2014; Piovani, Zachariadis, & Batty, 2017) and chain store location evidence (Jia, 2008; Holmes, 2011), it asks whether Lidl and Biedronka supermarkets' geographies reveal transferable relationships between population, accessibility, amenities, barriers and private location suitability.

Methods

The study uses reproducible spatial sources: OpenStreetMap urban feature channels, an NSP 2021 Census Grid population channel from GUS at 250m granularity, and observed Lidl/Biedronka store locations within Polish city boundaries. The empirical object is the rasterized urban surface, not a survey sample. Layers are projected to EPSG:2180 and harmonized to a 50 m modelling grid; population is resampled and interpreted at the source-grid level, not as directly observed 50 m population. Lidl and Biedronka OSM tags are excluded from explanatory POI channels and used only as target locations. Separate models are trained for each brand. The explanatory tensor contains seven channels: population, roads, rail corridors, water barriers, point-of-interest density, mobility-access proxy and public-amenity density. To reduce spatial leakage, the design uses cross-city validation: Warszawa, Łódź and Gdańsk form the training set; Kraków, Poznań and Białystok the validation set; Wrocław, Szczecin and Bydgoszcz the test set. Following spatial machine-learning arguments about spatial dependence and transferability (Kopczewska, 2022), the model estimates a brand-specific store location suitability surface. The main estimator is a conditional GAN: the generator maps context rasters into predicted store-presence surfaces, while the discriminator evaluates their spatial plausibility given the same context. Evaluation combines pixel loss with count error, count bias, mass bias, cluster morphology, Moran's I and Geary's C.

Results

Preliminary diagnostics indicate that observed discount retail geography is not reducible to residential population alone. Economically informative store presence surfaces emerge where population support coincides with road accessibility, POI intensity, public amenities and limited barrier separation. The outputs therefore translate spatial prediction into measures of revealed local-market suitability: where demand-supporting context concentrates, where

brand-specific retail mass is expected and where water or rail barriers weaken otherwise dense surroundings. Cross-city errors identify which components of the local market structure are transferable and which remain city specific.

Conclusions

The paper contributes a framework for measuring local urban market potential through revealed discount retail allocation. Predicted store presence surfaces are interpreted as indicators of private firm location suitability: areas that resemble observed store choices under the spatial structure of population, accessibility, amenities and barriers. The claim is empirical rather than normative: the model evaluates how existing retail networks encode local economic activity and how far this logic generalizes across cities. For urban economics and applied statistics, it links consumer city theory, OSM and Census Grid data, spatial ML and autocorrelation diagnostics.

Keywords: local market potential; retail allocation; consumer city; spatial machine learning; generative adversarial networks

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