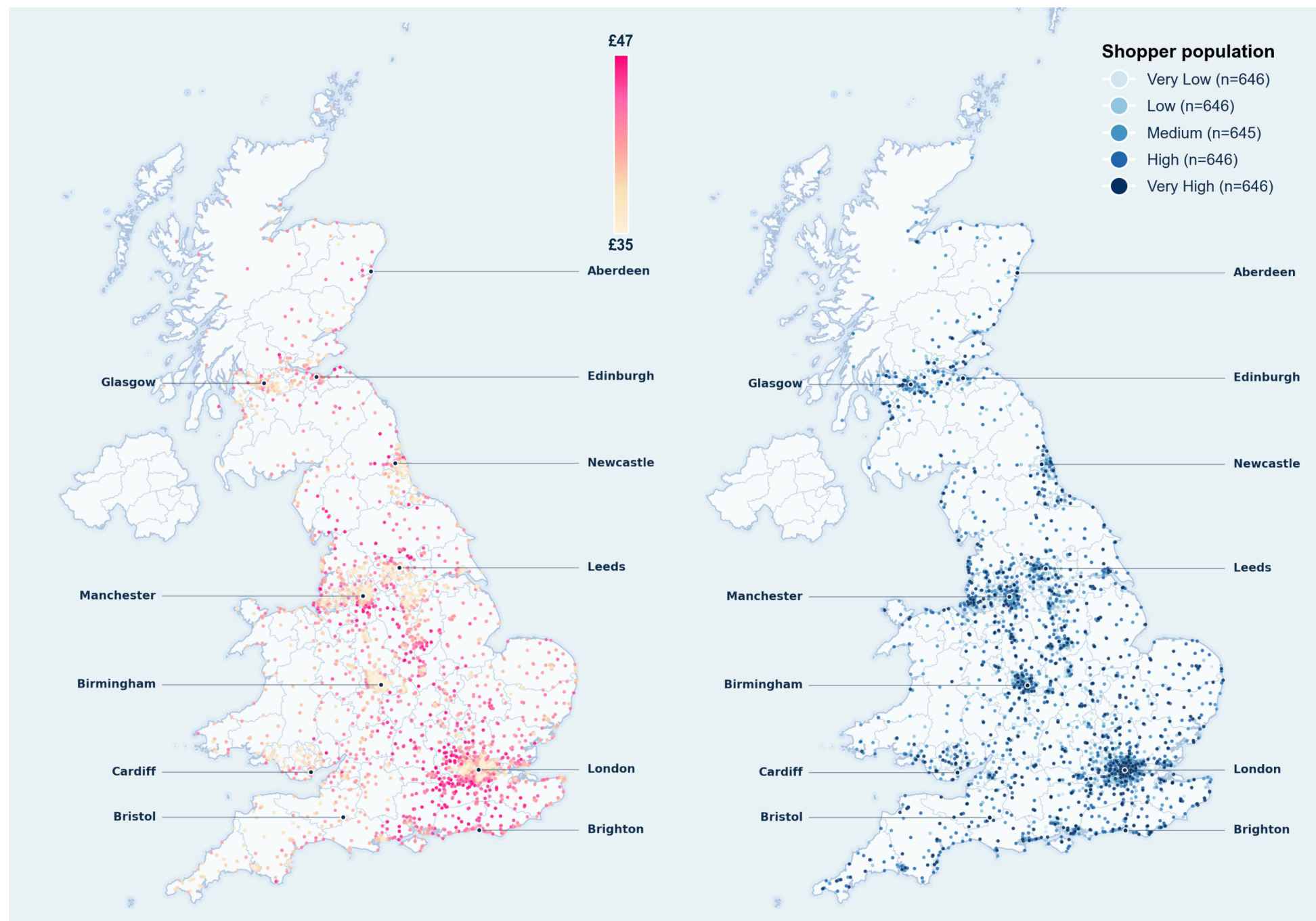


Morphology, Network Position, and Retail Expenditure: Assessing the Explanatory Power of Physical Form in Great Britain's Retail Centres

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Background and Motivation

Traditional retail planning splits into two approaches that rarely meet. Quantitative retail geography models catchments and geodemographics, often treating the physical street as if it has no bearing on outcomes. Urban morphology examines physical layout but seldom links it to economic performance, and most morphological studies are confined to single cities, making their findings hard to translate into national policy. This research closes that gap by building a nationwide framework connecting physical form to commercial performance. Across 3,229 retail centres in Great Britain, it tests whether street-network connectivity and building-morphology patterns predict residential spending once demographics are accounted for.



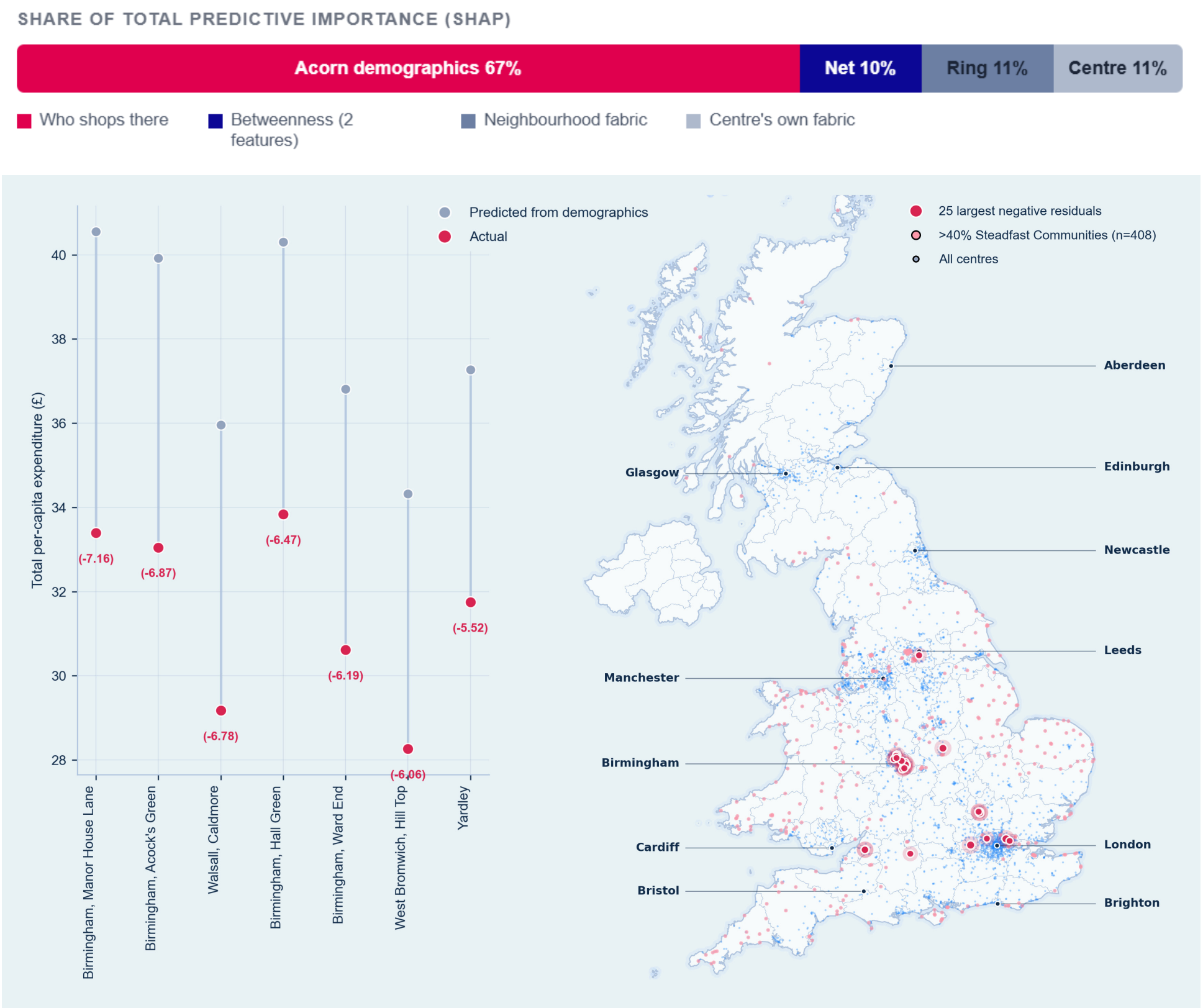
Total Per-Capita Expenditure and Shopper Population

Data and Methods

The study uses a nationwide machine-learning pipeline with a nested design. It covers 3,229 retail centres, each linked to 34 CACI consumer-spending sub-categories grouped into six residential expenditure outcomes mapped to COICOP with CACI Acorn as a control. Physical form is measured at two scales: OS OpenMap Local street networks are used to compute normalised node betweenness centrality, and building footprints define morphological types through the Hierarchical Morphotope Classification (HiMoC) framework in momepy. Both are captured for the retail core and a 400-metre residential ring around it. To handle high geodemographic multicollinearity, a series of nested XGBoost models (M0–M3) is trained, and game-theoretic SHAP (TreeExplainer) attributions isolate the independent importance of spatial structure.

Key Findings

- **Demographics dominate, but form adds signal:** Catchment geodemographics account for 69.9% of predictive importance; physical form makes up the remaining 30.1%, consistently across all six spending categories.
- **Form predicts who a centre draws, not how much they spend:** Its influence is strongest on the visitor share of trade — roughly three-quarters of what the model can explain there comes from physical form.
- **Street-network position is the strongest single physical predictor** ($r \approx 0.33$), outranking every individual building-morphology feature.
- **The neighbourhood matters more than the high street:** The fabric of the surrounding 400-metre ring predicts spending more strongly than the built form of the retail core itself.
- **"Declining" high streets mostly aren't underperforming:** Wolverhampton, Walsall and Stoke largely spend what their catchment demographics predict. The real shortfalls sit in suburban centres dominated by older, settled, home-owning households — CACI's "Steadfast Communities" segment.



Underperforming Centres and the Steadfast Finding

Value of the Research

- Empirical: This study is among the first to apply computational urban morphology to retail spending across GB. It shows that automated morphometric methods can be scaled up and repeated at the national level.
- Methodological: The research shows that using tree-based ensembles with SHAP attributions can help untangle complex spatial and economic relationships, even when traditional regression struggles with multicollinearity.
- For practice: The results challenge the idea that physical changes alone drive outcomes and suggest a new order for interventions. Instead of focusing on storefront upgrades in struggling retail areas, local authorities might achieve better results by improving walkability, street connections, and housing density within 400 metres of these areas.

