Modelling non-residential demand for store location planning - a case study of visitor grocery expenditure in Cornwall.

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1. Introduction

We seek to incorporate visitor or tourist demand within the predictive location modelling carried out by retail site location planning teams. Location planning teams use a sophisticated suite of tools, including spatial interaction modelling (SIM), to generate store-level revenue estimations in advance of actual opening. We are working in collaboration with a major grocery retailer who note that these models consistently under-predict revenue in areas where there is a high proportion of non-residential demand – particularly where seasonal sales uplift is driven by tourist demand.

Whilst headline surveys such as the Great Britain Tourism Survey (GBTS) and International Passenger Survey (IPS) provide some indication of visitor numbers and consumption habits at a regional and sub-regional level (for example see Buccellato *et al.*, 2010), little is known about the distribution of visitors or their associated expenditure below the local authority level. Attempts to quantify this form of demand at the level of an individual store catchment are thus very limited. Here we report on research to address this demand-side weakness in retail location planning. Specifically, with reference to Cornwall, South West England, we aim to:

- Estimate small-area seasonal visitor grocery expenditure on a month-by-month basis and produce a visitor demand layer for use in retail location planning.

- Develop a SIM approach to allocate this available expenditure to grocery stores, allowing retailers to predict revenue with greater accuracy.

2. Seasonal demand uplift

Cornwall is a popular destination for domestic holidaymakers and tourism is recognised as one of Cornwall's most valuable industries (Cornwall Single Issue Panel, 2004). Resorts such as Newquay, Bude and St Ives exhibit retail provision beyond that which would be expected for a residential population of their size, largely driven by seasonal demand uplift (GVA Grimley, 2010). Our collaborating retailer, who wishes to remain anonymous, operates stores in Cornwall's major coastal resorts and close to principal visitor attractions.

With rare access to store trading information and consumer level loyalty card data, we are

able to explore seasonal sales variations and identify customers originating from outside the store catchment, via their registered loyalty card home postcode. Given the nature of these store catchments, many of these customers are likely to represent leisure visitors. Store trading data (explored fully in Newing *et al.*, 2012a) reveals that there is a clear seasonal pattern to the sales uplift experienced at stores in coastal resorts, with noticeable peaks at Easter, bank holidays in May, during the school summer break (August) and during the late October school holiday. Analysis of Loyalty card data for the corresponding period (reported separately – see Newing *et al.*, 2014) identifies that a considerable portion of this sales uplift is driven by visitor demand – with the proportion of loyalty card spend originating from customers with a home address outside the store catchment reaching over 60% during August at some stores. This highlights the considerable impact that seasonal visitor spend has on the trading characteristics of selected stores and the wider impacts for the local economy in terms of job creation and other multiplier effects.

3. Accommodation supply in Cornwall

We begin building small area visitor demand estimates with reference to the supply and utilisation of visitor accommodation. Here we specifically consider self-catering accommodation since, by definition, these forms of accommodation (which includes camping/caravanning, rented cottages/apartments and units available to rent within holiday parks), gives guests the opportunity to eat out or to purchase and prepare their own food. These forms of accommodation are thus likely to generate grocery spend within the local community (Dudding and Ryan, 2000; Timothy, 2005; Wilton, 2004) and make up 84% of the available visitor bedspaces within Cornwall[1].

Figure 1 outlines the spatial distribution of these forms of accommodation, aggregated at an Output Area (OA)[2] level from individually geo-coded property locations – with each property representing an individual cottage/apartment available to hire, or the location of a holiday park or campsite with an associated capacity (number of units or pitches and number of bedspaces). Figure 1 demonstrates that self-catering accommodation is predominantly clustered on the north coast between the major resorts of St Ives, Newquay and Bude, and on the south coast between Looe and Falmouth.

Accommodation utilisation or occupancy is highly seasonal, and a proportion of the available accommodation supply will be empty or sited on complexes that are shut for part of the year. Occupancy rates, published by local tourist authorities, account for the self reported occupancy experienced by accommodation operators. Occupancy rates are usually reported on a month-by-month basis and are used here to make inferences about the likely spatial and temporal patterns of visitor demand. Specific occupancy rates (obtained from South West Tourism, 2010) have been used here for each form of self-catering accommodation (camping/caravanning, rented cottages/apartments, units available to rent within holiday parks) for the year 2010.

In 2010, the number of occupied units is highest in August, representing the peak summer season, and at this time of year a number of large holiday parks generate spatial clusters of

[1] Based on a database provided by South West Tourism and comprehensively updated by the authors.

[2] An OA is the lowest level of aggregation for census and administrative data dissemination, containing an average of 124 households. See: Vickers, D. and Rees, P. 2006. Introducing the Area Classification of Output Areas. *Population Trends* 125, pp.15-29.

visitor demand. One OA, on the outskirts of Newquay, contains over 2,000 occupied units, and almost 8,000 bedspaces. It is reasonable to expect that the existence of these visitor demand clusters will have an impact on businesses in the resorts, as explored in the following sections.

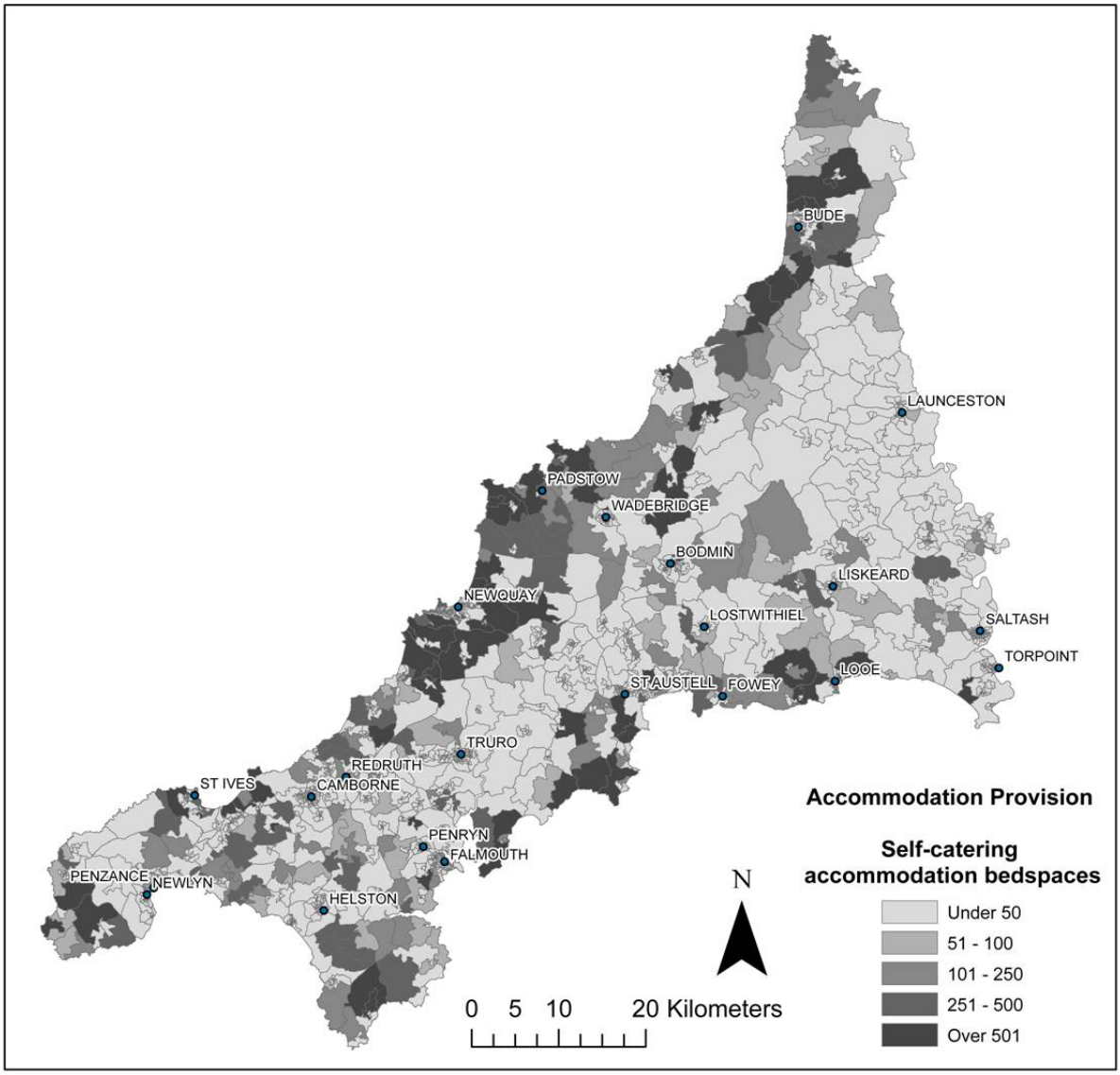

Figure 1. Spatial distribution of self-catering accommodation (number if bedspaces per OA).

4. Estimating small-area visitor grocery spend

We can estimate the available grocery spend originating from visitors, on a month-by-month basis, using estimated visitor expenditure for each unit of occupied accommodation. Expenditure rates have been derived from a series of recent surveys carried out by industry bodies/major accommodation operators to identify the spending by visitors, including spend on groceries (e.g. BH&HPA, 2011; CCC, 2007), which report an average spend of between £78.55 and £107.84 per occupied unit per week, depending on the type of accommodation.

Estimated visitor demand is highest in August with a spatial pattern driven by the underlying accommodation provision. During August, three OAs exhibit a potential weekly visitor spend of over £100,000. This represents more than a tenfold increase on the estimated

available residential grocery demand for the corresponding OAs and it can be reasonably assumed that the existence of these highly concentrated clusters of visitor demand will be driving much of the seasonal sales uplift observed by retailers. In section 5 we use a SIM to allocate the available visitor expenditure to the grocery stores in this area and identify the impact on store revenue.

5. Modelling the store level impact of small-area visitor expenditure

A spatial interaction model is used to allocate the available visitor expenditure to stores. The underlying residential expenditure is also incorporated in the model. The model allocates residential demand and visitor spend to grocery stores by estimating flows of expenditure from origin zones (the OAs containing visitor expenditure) to competing stores. The model[3] assumes that the expenditure available (O_i) within any given small area (i) is shared by competing retailers (j) in a geographically proximate area based on their accessibility and relative 'attractiveness' (W_j). Their accessibility is a function of the relative 'cost' in terms of travel time (C_{ij}), calibrated using a distance decay parameter (β) which reflects the willingness or ability of consumers to travel to stores in the region. In this application, store attractiveness is determined using store size (for more detail see Newing *et al.*, 2012b).

The model can be used to estimate weekly revenue at any of the grocery stores in Cornwall by aggregating all the expenditure flows that terminate at the store of interest. Residential flows have been calibrated with reference to the retailers' loyalty card data, allowing appropriate model parameters to be set. Visitor demand is modelled in the same way, although in the absence of corresponding flow data, parameters have been set with reference to residential demand, and future work, documented subsequently, aims to develop specific model parameters for visitor demand. With reference to a store in a Cornish coastal resort operated by our collaborating retailer, Table 1 outlines the proportion of the modelled store revenue that is accounted for by visitor and residential demand, using three selected weeks at different times within the tourist season.

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[3] $S_{ij} = A_i O_i W_j \, exp^{-\beta C_{ij}}$

Where: S_{ij} represents the interaction or expenditure flow between zone $_i$ and store $_j$

A_i is a balancing factor which takes account of competition and ensures that all demand is allocated to stores within the region. It is calculated as:

$$Ai = \frac{1}{\sum_j W_j \, exp^{-\beta C_{ij}}}$$

O_i represents the demand or expenditure available in residential zone $_i$

W_j accounts for the attractiveness of store $_j$

$exp^{-\beta C_{ij}}$ is the distance deterrence term, incorporating β, the distance decay parameter, and C_{ij}, the distance between zone $_i$ and store $_j$.

Table 1: Revenue estimations using the SIM for a store of interest in Cornwall.

Selected week during	Proportion of modelled store revenue accounted for by residential and visitor demand:	
	Residential Demand	Visitor Demand
Jan 2010	97%	3%
Apr 2010	75%	25%
Jun 2010	64%	36%
Aug 2010	55%	45%

In common with the store trading data presented by Newing *et al.* (2012a), it is clear from table 1 that modelled residential demand accounts for a noticeably smaller proportion of overall store revenue during the peak summer season. The importance of visitor spend as a driver of store revenue is evident on table 1, with this form of expenditure representing an estimated 45% of the modelled store revenue in August 2010 and yet just 3% in January. Modelled revenue can also be compared to recorded store revenue with all revenue predictions within 10% of recorded store revenue, except August, where only 84% of recorded in-store revenue is estimated using our model. We believe that this is due to additional visitor demand originating from visitors not using self-catered accommodation as discussed below. The model represents a work in progress and proposed developments are outlined in the following section.

6. Conclusions and implications

This extended abstract briefly outlines a framework for identifying the economic impact of visitor expenditure at the level of individual store catchments. Using visitor grocery demand in Cornwall as an example, we have demonstrated that the self-catering accommodation stock, coupled with occupancy and expenditure rates can be used to generate a series of seasonal visitor demand layers. In turn these form the input to a SIM approach to incorporate this form of seasonal demand in store level revenue predictions. Subsequent work seeks to develop the expenditure estimates further to incorporate all forms of visitor demand (including day visitors, visitors staying with friends and relatives and expenditure by hosts, among others). A SIM disaggregated on both the demand and supply side is also proposed – allowing visitor and residential demand to be handled separately, with model parameters set such that the relative attractiveness of different types of store (and specifically stores in major tourist resorts) can be set independently for visitors and locals.

Tourism is an important driver of demand in many retail sectors and to enable provision of viable services within tourist resorts, accurate small-area estimates of seasonal visitor demand are required. The modelling highlighted in this extended abstract provides a valuable tool to assist store location planners and enable the retail industry and tourist sector to identify the local economic impact of visitor spend.

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Biography

Andy Newing is a research postgraduate at the University of Leeds. His research currently focuses on retail modelling for grocery store location planning. He has a background in spatial analysis with particular interest in applications in retail and health geographies.

Graham Clarke is Professor of Geography at the University of Leeds. His research interests include GIS, urban services, retail and business geography, urban modelling and continuing professional education.

Martin Clarke is Professor of Geographic Modelling in the School of Geography at the University of Leeds. From 1990 to 2004 he was Chief Executive of GMAP Ltd which specialised in network planning and location analysis. Currently Martin is leading a major collaborative research initiative on 'Future Cities'.

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