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Comment on

Spatial models in marketing research and practice

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It pleases this geographer to see the dissemination of the newer developments of spatial models in marketing to a broader audience. Marketing is inherently spatial. More often than not, key decision makers ignore the impact of space, or handle it too simplistically to aid decision making. Space as expressed in terms of distance, location, contiguity, networks, or even space–time metrics, influences the behaviours of consumers and business in many different ways.

Bronnenberg outlines how many of these areas are modelled in marketing today. Generally these models capture the spatial influences directly as independent variables in the model itself or as spatial 'weights' designed to model the spatial similarity among observations. In the latter case, the weights are designed as measurable components of the model error term. Both these approaches are designed to improve model performance (i.e. explanation in some cases, prediction in all cases) by modeling the heterogeneity among observations that are correlated with distance metrics. Yang and Allenby [1] build a hierarchical Bayes choice model using patterns of both space and social networks. It is particularly intriguing because it goes beyond using pure spatial contiguity as a metric of heterogeneity.

In human society, a process of spatial congregation and segregation occurs. For a variety of reasons, people, businesses, and other activities have a tendency to congregate with others like themselves with whom they share common interests, activities, needs, desires, etc. This tendency to congregate also leads to separation from others in space. The segregation of people, businesses, and activities coexists with the congregation process because not everyone can be everywhere simultaneously. This leads to the spatial patterns of human activity studied by geographers and marketers alike. While I have not described the concepts of spatial congregation and segregation, the point I make is that human activities in space will display a high degree of spatial autocorrelation because of these processes. As such, any model that attempts to account for respondent heterogeneity through the use of spatial variables, or weights, will predict better than models that do not.

The use of spatial autocorrelation models to improve prediction, either in time, across space, or in the instances of missing data are important improvements to current models in marketing. However, I caution the user of spatial models that the improved predictability should not come

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at the cost of knowing why the spatial autocorrelation exists in the first place. Simply adding variables that account for the spatial contiguity of respondents, either in the direct set of independent variables (my preferred approach), or in a spatial autocorrelation weighting matrix to account for unobserved heterogeneity caused by factors unknown, will not enable the researcher to more fully understand the human processes that lead to the results modeled. In many cases, such models may be all we have available because the alternative is too complex to model, or to fully comprehend. I am not suggesting we do not use spatial models in marketing because of this observation, only that the user be fully aware of what conclusions they draw from these models.

Practitioners have used simple spatial models for some time. Businesses are relying more and more on sophisticated geographic information systems to improve their marketing, sales, Customer Relationship Management (CRM), or related database systems. CRM systems have always contained some type of spatial data about the customer, if only in the form of an address. Only recently have CRM and Geographic Information Systems (GIS) systems begun to enable the user to build spatial models and account for space and/or location in their data analytics. Even so, the models are still rudimentary.

The models described in the Bronnenberg paper are state of the art, but many years away from being used regularly by the practitioner. This is generally true for most sophisticated spatial models. Use of these models by practitioners will be delayed until the major analytic software vendors make a concerted effort to operationalize the Bayesian and weighted inferential spatial statistical models, thus making them easier to use. Conjoint and choice models displayed a similar slow diffusion throughout the field of marketing until the advent of inexpensive commercially available software that made it easier for practitioners to use them. Finally, until business programs at major universities more universally incorporate spatial models into their curriculum, the diffusion of these advances will be slow.

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Comment on

Spatial models in marketing research and practice

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Accounting for the location of economic agents represents an important advance in statistical analysis. The spatial model technique presented by Bart Bronnenberg in this Special Issue is an important contribution to the field. It allows practitioners to understand behaviour of economic agents when that behaviour is related to the actions and choices of others. This works in situations where the agents are retail stores, choosing what products to promote and where to place them on shelves. It works with consumers, whose preferences are influenced by the choices of their friends and neighbours. It enables prediction of consumer demand and market share in markets where some characteristics are unobserved. Without understanding unexplained interdependence of observed data, predictions will be flawed and, because of those flaws, our understanding of the underlying behaviour of consumers and firms will be weaker.

There are many problems to which this technique is applicable and to which it has not yet been applied. In business-to-business research, purchase decisions for many items require input and approval from multiple decision makers. For example, the adoption of a new health plan requires initial selection by the human resources staff, approval of budgets by finance and, frequently, final approval by the CEO or Board of Directors. Each of these agents acts 'independently' in formulating opinions of competing offers. However, because all work in the same organization, these agents are likely to have similar tastes. If we conduct conjoint experiments with several people from the same firm, we would expect correlations in their behaviour beyond what would be predicted by simple logit models. To extend this thought further, each decision maker has tastes that are formed by the current workplace and previous workplaces. My tastes are a function of where I am today and everywhere I've been previously and are related to those of people who have influenced me along the way. Controlling for and understanding this interrelation of preferences is at the heart of the spatial modelling technique.

The spatial modelling technique is open to some questions. Why is the distance between observations understood through an error term? Why is this relationship not specified directly in the model? As a practitioner, it is not clear to me why our understanding of behaviour would not be as accurate and more complete if these relationships were part of the model rather than

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the error term. Finally, it is important to consider sources of error and the process that generates the data used in the model. Sophisticated error distributions should not be used as a convenience, forcing errant data to improve model fit. Instead, the model and error structure should be chosen to reflect the data-generating mechanism as accurately and completely as possible.

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Rejoinder for

Spatial models in marketing research and practice

Thanks to Thomas Eagle and Paul Markowitz for making several insightful comments on the potential and applicability of spatial models to marketing practice. Both commenters make essentially the same two (distinct and very valid) points. First, Thomas Eagle warns that while improvements in model fit and hold-out prediction are nice things to behold in empirical modelling, a separate and important research goal is to understand the processes that give rise to the spatial dependence found in many cross-sectional data sets. Paul Markowitz makes a similar point by stating that models and error-structures should not be chosen as a convenience but rather to reflect the actual processes at work.

It is not difficult to agree with these comments. Thomas Eagle suggests that the underlying processes of spatial dependence come from a tendency of human activity to congregate. This idea is shared with those expressed in economic models of agglomeration [1, 2] and endogenous growth [3, 4]. Empirically, estimation of such models is especially feasible if the analyst observes humans or firms before congregation has happened. For many cases, such observations are too far in the past or otherwise not present. In such cases, the spatial phenomena can be captured through a spatial model. However, I agree that a statistical description of the observed data does not (nor should aim to) substitute for an empirical statement of a theory.

Second, both commentors seem to prefer to account for spatial contiguity directly through independent variables rather than using a more 'sophisticated' error distribution that reflects spatial proximity. Again, it is not hard to see their point. Using fixed spatial effects is simple and can be easier in estimation (but see Reference [5] about the biased nature of some fixed effects estimators, most notably for the spatial autoregressive model). Therefore, if computation is an issue, a fixed effects specification of spatial variables may well be justifiable. However, if the objective is prediction or accounting for unobserved variables with a spatial structure, then modelling the spatial dependence through the error terms, albeit perhaps more cumbersome, has its advantages (see Reference [6] for an example). When using a random effects approach, there is no need for a functional specification of how the spatial variables map into behaviour. Merely collapsing the space to a distance metric suffices in practice to improve prediction and fit.

Finally, it is interesting to speculate on the practical adoption of formal methods of cross-sectional modelling. I believe that the relative ease with which these methods are implemented in hierarchical estimation methods will see to it that their application becomes practical in the future. More importantly, it is also hoped that a more formal treatment of the cross-sectional dimension of data will help managers solve practical marketing problems.

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