Exploring Regional Patterns of Agritourism in the U.S.: What's Driving Clusters of Enterprises?

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Agritourism is a consumer-driven innovation that producers are exploring as a means to diversify and grow farm-based revenues. In order to help guide management and policy decisions, we conduct an exploratory spatial data analysis and find that travel infrastructure, region and rurality, characteristics of the local economy, and proximity to outdoor attractions are all significantly associated with the probability of a county being an agritourism hot spot. Mapping our primary spatial analysis' residuals, we further identify counties with unique agritourism market conditions as a starting point to identify best practices that other regions interested in agritourism development might follow.

Key Words: agritourism, hot spots, regional development, spatial analysis, tourism

Introduction

Beginning and small- and medium-sized farms are increasingly exploring alternative business strategies (e.g., local and regional food systems and/or agritourism) to remain competitive compared to larger farms, which can take advantage of economies of scale and global markets (Wilson, Thilmany, and Watson 2006, Thilmany and Ahearn 2013, Hardesty et al. 2014). This evolution in American agriculture has resulted in many farms and ranches diversifying their business by adopting more diverse activities, such as agritourism, as alternative or additional revenue sources.

The objective of agritourism may be to assist farms and ranches in staying economically viable or, more broadly, to revitalize rural economies, better educate the public about agriculture, and/or preserve agricultural heritage. Agritourism may be an attractive option to community-focused farms because it provides more labor opportunities for members of the family or

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community, better networks the farm into the local service economy, and educates the public about agriculture (Nickerson, Black, and McCool 2001, Phillip, Hunter, and Blackstock 2010, Tew and Barbieri 2012). Given these compelling reasons to adopt agritourism, it is not surprising that agritourism revenues have been steadily growing in the United States. Between 2002 and 2007, national gross agritourism revenue grew 142 percent in real terms, and between 2007 and 2012, continued to grow by 13 percent (NASS 2012).

The location of a farm is considered an inherent endowment with place-based values in the eyes of travelers, because some locations already attract travelers. Thus, there may be a relationship between the viability of a potential agritourism enterprise and its location. Better understanding the characteristics of a region in which agritourism is most viable may help guide farm managers and public policy and programming decision makers, e.g., supporting only enterprises in viable locations. We are not aware of any research investigating the spatial aspects of agritourism and hope this article spurs a body of research on the topic.

We posit that development strategies focused on the agritourism sector need to understand how overall competitiveness and relevant travel and recreational market forces may vary across heterogeneous regions of the United States. We seek to identify the location of agritourism clusters and identify what determines their existence. The key research question addressed in this study is, does a variety of place-based factors explain the prevalence of agritourism across the United States? If so, where are the greatest opportunities for focused development leveraging those factors in the U.S. agritourism sector?

Analyzing the drivers of regional agritourism patterns may paint a clearer picture for policy makers interested in investing in community and economic development programming in rural areas with agricultural and natural resource linkages. Results may also assist policy makers and practitioners who may want to reflect on whether or not there are policies or regulations acting as barriers to the industry.

After overviewing the existing literature of agritourism operator and spatial motivators, we outline and describe the two methods used. The first analysis uses county-level data to produce a map of statistically significant hot spots of agritourism activity. We then explore exogenous factors explaining the incidence of these hot spots in the second stage with a probit model. This two-step approach provides a comprehensive analysis of how place-based factors affect the prevalence (and presumably the success of) agritourism in the contiguous United States. Our results suggest that distances to outdoor attractions and populations and travel infrastructure play a role in determining whether a U.S. county is a hot spot for agritourism. We map regression residuals and identify outliers, counties with relatively high or low regression residuals, and infer that a set of unforeseen opportunities or barriers specific to that locale may be influencing these outliers. The paper concludes with a discussion of our results, outlining of policy implications, and areas for further research.

Literature Review

Despite recent rapid growth, research on the economics of agritourism is limited. One vein of research examines what motivates producers to diversity their agricultural business into agritourism. Another vein of complementary research explores consumer behavior and experiences with agritourism, to better inform producers of appropriate agritourism marketing strategies. No research of which we are aware investigates the spatial drivers of agritourism, despite Cole (2007) calling for the use of regional science methods, such as exploratory spatial data analysis, to better address tourism and the impact of tourism promotion.

The relatively fast-paced growth of agritourism is noteworthy, but more interesting is why and how agritourism is developing differentially across the United States. This spatial variation may be partly due to the variation in farm and ranch operators' motivation to participate in agritourism. Tew and Barbieri (2012) identify some of these motivations as "increase[ing] farm revenues, market opportunities and social bonding, opportunities to keep family together, and personal pursuits." Additional motivations are local economic development, or positive spillovers from agritourism to the community.

Farmers and ranchers may pursue agritourism to diversify their business portfolio and make their enterprises more resilient. Increasingly, smaller farms and ranches must diversify their agricultural enterprises to stay viable in competitive crop and livestock commodity markets driven by economies of scale (Ilbery et al. 1998, Sharpley and Vass 2006, Ollenburg and Buckley 2007, Tew and Barbieri 2012). Gains in productivity from large-scale agriculture and exposure to global market forces are widely cited reasons smaller scale (or beginning) farms have trouble staying in business. Thus, alternative business models that integrate direct sales, local markets, and agritourism are important to such farms (Veeck, Che, and Veeck 2006, Thilmany and Ahearn 2013, Hardesty et al. 2014).

In some areas of the United States, urban sprawl pressures have increased the costs of operating an agricultural business in or near more densely populated areas (Nickerson, Black, and McCool 2001, Veeck, Che, and Veeck 2006). Agritourism may take advantage of this urban proximity.

Economic motivators related to employment for family members and increased and/or more stabilized revenue are the most frequently noted agritourism goals by farm/ranch principal operators (Nickerson, Black, and McCool 2001, Barbieri and Mahoney 2009, Barbieri 2013). Other goals noted in the literature include personal interests, educating the public, and companionship with guests (McGehee and Kim 2004, Tew and Barbieri 2012). Barbieri (2013) found that, relative to other farm diversification strategies, agritourism was the most successful at generating spillovers in line with social goals such as creating jobs for non-family members, preserving cultural and historical heritage, and adopting sustainable practices.

Perhaps most intriguing to economic development practitioners and researchers are the positive spillovers to surrounding areas attributed to agritourism. Research supports strong potential for agritourism sites to attract tourists from out of town, who then spend money at local establishments such as restaurants, gas stations, and hotels in the rural area (Veeck, Che, and Veeck 2006, Saxena et al. 2007, Barbieri 2009, Tew and Barbieri 2012). Agritourism may broaden the local tax base, making communities more resilient in recessionary periods because agritourism is a relatively low-cost substitute for other types of travel (Veeck, Che, and Veeck 2006, Sullins, Moxon, and McFadden 2010). However, Brown et al. (2014) find that agritourism sales do not significantly increase per capita income or per capita farm sales at a national level but may still have positive effects at regional levels. While many rural communities have recognized potential societal benefits from agritourism and have developed programs supporting agritourism, other regions have been slower to offer support (Veeck, Che, and Veeck 2006). There appear to be clear differences across regions, perhaps due to policy.

Farmers and ranchers incorporating agritourism into their businesses are often viewed as agricultural entrepreneurs, and regional variation in entrepreneurship rates has been well documented (Low, Henderson and Weiler 2005, Mack and Qian 2016). Regional variation in farm entrepreneurship rates is also expected. In a nationally representative survey, 20 percent of producers participating in agritourism also participated in additional on-farm enterprises that some consider entrepreneurial, such as local food sales and production of value-added goods (Vogel 2012, Liang and Dunn 2014). The notion of agritourism operators as entrepreneurial is consistent with past work on tourism (Marcouiller 2007, Liang and Dunn 2014) that concludes agricultural entrepreneurs use business skills to differentiate their business as a means to mitigate the volatility of commodity markets (Nickerson, Black, and McCool 2001, Barbieri and Mahoney 2009, Tew and Barbieri 2012).

Despite agritourism's rapid growth, research on the spatial distribution of agritourism and its spatial drivers is limited. Bagi and Reeder (2012) found agritourism rates were highest in the Southern Plains and Inter-Mountain West using data from a nationally representative survey, but more spatially detailed estimates were impossible. Operator motivations are not the only factors associated with differences in agritourism rates across space; site characteristics, such as surrounding scenic beauty and proximity to urban areas, affect the success of an agritourism site (Veeck, Che, and Veeck 2006, Che 2007, Bagi and Reeder 2012). Research shows that areas rich in natural resources are more likely to be conducive to recreation and tourism (Gartner 2005), but there is at least one contradiction to this theory in the literature. Hill et al. (2014), in their travel cost model, hypothesized high natural amenities would lead to more agritourism trips, but they found a negative and significant association with natural amenities. Hill et al. suggest the negative relationship could be due to the study being limited to Colorado,

where topography plays a role in the location of agricultural operations. We hope that by studying the entire contiguous United States, this sort of limitation will be overcome.

A major contribution of this paper is to expand on initial attempts to add place-based factors into modeling agritourism using regional science methods. We believe these methods are appropriate, given the spatial heterogeneity in the agritourism sector and the presumed dependence of these operations on place-based factors (e.g., scenic highways, present in some places and absent in others, being part of rural tourism systems, according to Gartner (2005)). We focus on regions with high shares of farms involved in agritourism, or agritourism hot spots, as a first attempt to understand the impacts of place-based factors on agritourism.

Methods and Data

To understand the determinants of agritourism clusters, we must first define the clusters and identify their location. For the former, we conducted a local indicators of spatial autocorrelation (LISA) analysis to identify the agritourism hot spots. LISA results were subsequently used as the limited dependent variable in a probit model to confirm whether or not factors reported as significant in previous business location and tourism literature are relevant in these data.[1]

The LISA analysis was first proposed by Anselin (1995) as a way of decomposing a global indicator of spatial autocorrelation, e.g., Moran's I, into individual units. The purpose of this decomposition is to explore the spatial autocorrelation of each observation, and identify patterns or clusters of significant spatial autocorrelation across space (Anselin 1995). Using the results of the LISA analysis, one can produce choropleth maps that identify these areas of significantly high positive autocorrelation (hot spots) and areas of significantly low positive autocorrelation (cold spots). These maps provide the researcher with an intuitive view of the activity in question, allowing them to determine patterns and hypothesize which factors may influence these patterns over the space in question. Despite a call to marry the study of tourism with regional science methods (Cole 2007), we do not know of any other research examining spatial autocorrelation of tourism or agritourism.

The LISA analysis serves as an exploratory study highlighting the importance of incorporating the dimensions of space into tourism industry assessments. In

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[1] While a spatial lag or error model using a continuous variable may provide interesting information on spatial dependence or heterogeneity within the agritourism industry, this is not the goal of our exploratory analysis into determinants of agritourism clusters. We leave this exercise for future work, which can build on this research. Future work using confidential microdata from the Census of Agriculture, rather than the public-use files we use, would be optimal.

fact, the nature of our discrete dependent variable being an indicator of significant positive spatial autocorrelation from neighboring counties could perceivably lead to econometric issues, such as endogeneity arising from describing a significant spatial autocorrelation using a spatial auto regressive parameter, if the model were estimated with a spatial probit model.

For this analysis, a National Agricultural Statistics Service county shapefile was merged with 2012 Census of Agriculture data on the number of farms in each county with agritourism revenue (akin to the measures used in the business location literature).[2] While not a perfect solution, we treat counties with undisclosed agritourism data as zeros in the LISA analysis. Treating counties with an undisclosed number of agritourism operations should not bias LISA hot spot results because these counties, by definition, have few agritourism farms and ranches. Dropping these undisclosed counties could bias the prevalence and location of cold spots (we likely underestimate agritourism participation in counties with undisclosed data by treating the share as zero).

A global indicator of spatial autocorrelation in the percentage of farms reporting agritourism income, Moran's I, was calculated first. Figure 1 is a scatter plot showing the dispersion of spatial autocorrelation across counties. A clear positive trend can be seen, as indicated by the Moran's I of 0.4505; its p-value is significantly below the 1 percent level supporting the choice to use our preferred methodological approach. The horizontal axis of the Moran's I scatter plot indicates the level of agritourism (measured as the percent of farms with agritourism) of a particular county i. The vertical axis indicates the level of agritourism in county i's neighborhood. Observations in the first (top right) or third (bottom left) quadrants of the Moran's I scatterplot: (1) a high share of farms/ranches participating in agritourism and neighbors who also have a high share of participation; or, (2) a low share of agritourism operations surrounded by neighbors with similarly lower levels. Counties in the second and fourth quadrants exhibit negative autocorrelation and have higher levels of agritourism participation compared to their neighbors or have lower levels of agritourism participation than their neighbors have.[3]

The LISA analysis results are presented as a map in which counties exhibiting significant ($p < 0.05$) spatial autocorrelation are highlighted. When looking at this output in Figure 2, it is important to remember that these shaded areas are the "cores" of the spatial clusters. For example, counties bordering the hot spots most likely also have high levels of agritourism because they helped define the hot spot as having significant spatial autocorrelation. One

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[2]   Farms with any agritourism are defined as those receiving any income from agritourism and recreational services, such as farm or winery tours, hayrack rides, hunting, fishing, etc. Figure A3 is a county-level choropleth map of this variable.

[3]   We use a first-order queen's contiguity weighting matrix that defines a neighbor for county i as any county that shares a border with county i.
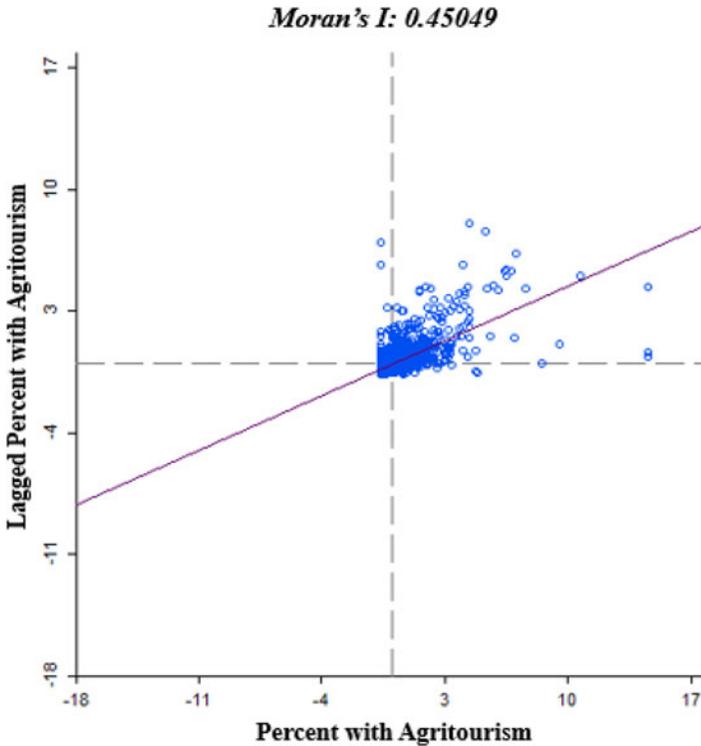
Figure 1. Moran's I Scatter Plot, County-Level Percent of Farms with Agritourism Revenue, 2012

can think of the shaded counties as the cores, with the autocorrelation spreading out and diminishing in intensity from these core areas.

The LISA analysis (Figure 2) shows interesting patterns among the percent of farms using agritourism in the United States but does not give any indication, other than regionally focused hypotheses derived from the literature, of what drives these clusters of positive autocorrelation. While the incidence of hot spots from the LISA will be explored in detail subsequently, we can use this map to drive some of our *a priori* expectations on spatial influences on where agritourism enterprises exist.

First, and perhaps most apparent, is the difference in agritourism across regions. The small number of hot spot counties limit our ability to analyze hotspots in separate regions of the country, so without having well-defined "agritourism zones" we adopt the four U.S. Census regions to capture some regional heterogeneity. These Census regions include the West, Midwest, South, and Northeast. The Midwest has the greatest number of cold spots and fewest hot spots in the contiguous United States, while the three other regions portray at least some significant clusters of hot spots. The map shows patterns
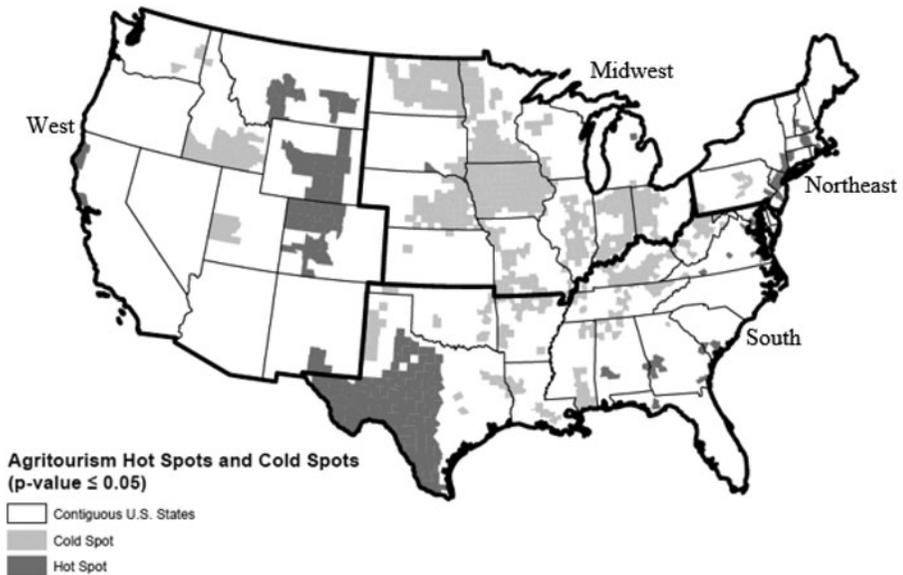
Figure 2. Significant Clusters of Spatial Autocorrelation in Percent of Farms with Agritourism Revenue, 2012

of agritourism in areas that differ in climate, culture, and landscape (locational characteristics that are likely important for the tourism sector), indicating interaction terms might be conducive to explaining how heterogeneity among these explanatory variables influences hot spot patterns.

We use a probit regression to explore exogenous factors related to the incidence of a hot spot.[4] We examine the relationship between the dependent variable (agritourism hot spots or not) and a set of independent variables, **X,** and assume that the error terms are normally distributed. Equation 1 makes use of this assumption, showing that the probability that county i is a hot spot depends on the set of independent variables for that respective county. One important change in the interpretation of the coefficients is that they now represent changes in the z-score, so a transformation is made to retrieve marginal effects. Both z-score coefficients and marginal effects are included in the results.

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[4] The study of spatial dependence in discrete choice models, particularly in the context of the spatial probit model has not received much attention in the literature compared to spatial continuous models. In part, this is due to the added complexity and computational expense (Fleming 2004). It is likely that the spatial correlation in our dependent variable induces heteroskedasticity, making our probit estimator inconsistent but, as this paper is a first-look at this topic, and a spatial probit for such a large sample would be time consuming, we use a standard probit model and leave the spatial probit for future work.

(1) $$P_i \equiv Pr(y_i = 1 | \mathbf{x_i}) = \Phi(x_i'\beta) \quad \text{where} \quad y_i = \begin{cases} 1 \text{ if county } i \text{ is a hotspot} \\ 0 \text{ if otherwise} \end{cases}$$

Twenty-one independent variables were regressed on agritourism hot spot counties in the probit model via maximum likelihood estimation. Summary statistics and data sources for all independent variables are in Table 1.

The four regional dummy variables are South, West, Northeast, and Midwest, with the Midwest region serving as the reference group, due to the small number of hotspots in the region and relatively low levels of agritourism, making it a logical baseline for comparison. Regional dummy variables were expected to capture cultural, agricultural, land, natural resource, and climate characteristics specific to each region.

Because scenic highways are part of rural tourism systems (Gartner 2005), miles of designated scenic byways (national or state) and interstate highways are expected to increase the probability of the county being a hot spot due to greater access to travel infrastructure and past research finding the importance of this transportation access (Bhat et al. 2014). In terms of past agritourism research, Sullins, Moxon, and McFadden (2010) suggest, in a cluster analysis of Colorado agritourists, that many travelers treat agritourism sites as secondary or spontaneous visits on their way to some other primary destination. This indicates that counties with more miles of interstate highway and scenic byways may have more travelers passing through. This increase in the potential demand for agritourism may subsequently incentivize more farms and ranches to adopt the activity. Squared terms of these variables were included in the model to capture the hypothesized diminishing effect for each additional byway or interstate mile within a county.

Similarly, based on Sullins, Moxon, and McFadden (2010), the coefficients for travel time to a national park and large city were expected to be negative. As mentioned above, more travelers passing through these counties should increase the probability of a spontaneous or secondary stop, further incentivizing local farmers and ranchers to take advantage of the road traffic and adopt an agritourism enterprise. Given this theory, we expect to see agritourism hot spots near other tourist attractions such as large cities and national parks. Using visual inspection of natural breaks in a histogram of visitor numbers to national parks and monuments in 2012, we established a visitor threshold of 40,000 visitors or more per year, because not all national designations lead to large visitation numbers (National Parks Service 2015).[5] To capture regional differences in national parks, we also include interaction terms between travel time to a national park and Census regions.

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[5]   This threshold excludes some less-visited national parks, monuments, or historical sites that are not expected to be major destinations for visitors or drivers of tourism (e.g., traffic circles such as Logan Circle in Washington, D.C.).

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	Source
Agritourism Hot Spot (Dichotomous)	0.0609	0.2391	0	1	2012—U.S. Census of Agriculture, GIS
Natural Amenities Scale	0.0525	2.2772	−6.4	11.17	1999—USDA
Byways/100 sq. mi.	1.8872	3.4165	0	51.4141	2015—FHWA, GIS
Interstates/100 sq. mi.	1.7064	3.0159	0	57.5905	2015—FHWA, GIS
Breadth	0.2470	0.0942	0.0300	0.7104	2006—BEA
Average Patents per 10 k People	1.2390	2.4822	0	46.3148	2002–2006—BEA
Minutes to City of ≥250 K People	102.1481	96.7269	0	627.41	2015—USDA, GIS
Hours to National Park	1.6402	0.9271	0.0110	6.8089	2015—USDA, National Parks Service, GIS
Hrs. National Park *South*	0.6247	0.8652	0	5.4631	2015—USDA, National Parks Service, GIS
Hrs. National Park *West*	0.2794	0.7871	0	6.8089	2015—USDA, National Parks Service, GIS
Hrs. National Park *Northeast*	0.1002	0.4421	0	4.0692	2015—USDA, National Parks Service, GIS
Population (people)	97,010.66	309,298.8	82	9,818,605	2012—Rural Atlas Data
Per Capita Income ($)	38,476.81	10,235.28	17,744	121,459	2012—Rural Atlas Data
Average Farm Size (Acres)	629.4802	1,458.239	0	37,952	2012—U.S. Census of Agriculture
Avg. Farm Size *South* (Acres)	237.8427	1,243.506	0	37,952	2012—U.S. Census of Agriculture
Avg. Farm Size *West* (Acres)	178.4533	729.077	0	7,442	2012—U.S. Census of Agriculture
Avg. Farm Size *Northeast* (Acres)	9.5705	40.3413	0	565	2012—U.S. Census of Agriculture
Regional Dummy Variables	States				
West States	Oregon, Washington, California, Idaho, Nevada, Arizona, Montana, Wyoming, Colorado, Utah, New Mexico				
Midwest States	North Dakota, South Dakota, Nebraska, Illinois, Indiana, Iowa, Ohio, Minnesota, Wisconsin, Michigan, Kansas, Missouri				
Northeast States	Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Pennsylvania, New York, New Jersey, Massachusetts				
South States	South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, West Virginia, Kentucky, Tennessee, North Carolina, Virginia, Texas, Oklahoma, Maryland, Delaware				

Although previous literature has not explored this notion, it seems intuitive that counties with higher rates of entrepreneurship and innovation are more likely to have agritourism businesses. On the supply side, farm operators in these areas may be influenced by their cohorts' entrepreneurial interests and skills, and on the demand side, agritourism may be more attractive to these innovative citizens. In order to measure a county's entrepreneurial propensity, both the breadth of entrepreneurship (the nonfarm proprietorship rate) and patents per 10,000 people were included in the model. *Breadth* is measured as the number of nonfarm proprietors as a share of the total employment in the county. Because most farmers and ranch operators are proprietors, we used nonfarm proprietors to control for the entrepreneurial nature of the county because farm proprietorships would be highly correlated with the dominance of production agriculture in the county's economy. While patents provide a slightly different measure of the entrepreneurial spirit of a county, we interpret it as a measure of innovation output, whereas breadth is more a measure of the degree of entrepreneurial activity in a county.

Counties with higher per capita income were assumed to have a higher demand for agritourism, and thus per capita income was included and expected to have a positive result on the probability of county i being a hot spot. Counties with larger populations were also assumed to have a higher demand for agritourism, leading to a similar a priori expectation for the natural log of population in county i.

Lastly, to help capture differences in agricultural industry structure, interaction terms between average farm size and regions were included. According to a study in Montana by Nickerson, Black, and McCool (2001), large farms may be more likely to adopt agritourism than small farms, in order to cover larger asset ownership, property tax, and managerial costs. Other studies have suggested small farmers may have a higher propensity to seek diversification options, however.

Regression Analysis Results

The total number of observations (counties) included in the regression analysis was 2,954, after dropping counties with an undisclosed number of agritourism farms and ranches.[6] Dropping undisclosed counties should not bias the model's

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[6]   Some cells in the Census of Agriculture are undisclosed for the protection of individual farms' privacy, i.e., counties with the lowest levels of agritourism are undisclosed. The presence of counties with undisclosed agritourism data make using a conventional spatial error or spatial lag model with a continuous dependent variable less attractive. In future work, we hope to access the confidential Census of Agriculture microdata to overcome this problem. Alaska and Hawaii are excluded from the analysis because they are not adjacent to the continental United States, which is necessary for the LISA analysis.

parameter estimates because the regression analysis only focuses on hot spots, i.e., high concentrations of agritourism. Regression results are in Table 2.[7]

The only statistically significant ($p < 0.01$) region dummy in the regression results was the propensity to see a higher share of farms and ranches with agritourism in the Northeast, where a given county is 89 percent more likely to be a hot spot than a given county in the Midwest. The Northeast finding is consistent with Liang and Dunn (2014) and Brown et al. (2014), who note the higher propensity of agritourism and other local foods activities in that region. Referring to the location of the hot spots (Figure 2), it was surprising that coefficients on neither the South nor the West were positive and significant, but this may simply imply that the hot spots in these regions can be explained by the broader set of independent locational variables. These regional findings may be partially driven by a bias in the LISA analysis due to the relative size difference in counties between east coast and west coast states (the latter having larger counties).

Miles of scenic byway per hundred square miles and its squared term followed a priori expectations, whereas the analogous interstate variables did not. An additional mile of scenic byway for every 100 square miles in county i leads to a 0.28 percent increase in the probability that the county is an agritourism hot spot. Because the mean is just under 1.9 miles of scenic byway per 100 square miles, our result suggests that doubling the miles of scenic byways would lead to a 0.53 percent increase in the probability that the county is a hot spot, so the statistically significant effect ($p < 0.05$ percent) has a relatively small magnitude.[8]

That the coefficient on miles of *interstate per 100 sq. mi.* was not significant may imply that agritourists are more likely to travel via scenic byways than interstates on their way to their primary destinations for leisure travel, whereas interstates are more conducive to use by travelers hoping to reach destinations in the shortest time possible. Additionally, interstates have few exits relative to the open entry/exit nature of most scenic byways, which may increase the perceived marginal travel cost of potential agritourists to exit and visit the site from an interstate when compared to a byway.

Neither of the entrepreneurial propensity variables, *Breadth* and *Patents per 10 k People* had coefficients significantly different from zero. Although these

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[7]   The L.M. test indicates the model is statistically significant at the 1 percent level, and the pseudo R^2 of 30.69 percent provides a goodness-of-fit for iterative maximum likelihood models. Variance inflation factors did not suggest a compromising level of multicollinearity.

[8]   An endogeneity problem with *Byways per 100 sq. mi.* may exist. While the Scenic Byway Program started in 1991 (Federal Highway Administration 2015), and the bulk of agritourism growth occurred after 2007, there were not sufficient data to tell when all the scenic byways with an official state designation were adopted into the program. Because these dates were ambiguous, it is difficult to tell which came first, the agritourism activity or the scenic byways. No formal tests for endogeneity were conducted, but a regression omitting the two byway variables was performed as a form of sensitivity analysis, and we did not find any notable changes in other results.

Table 2. Probit Results on Agritourism Hot Spots

Variable	Z-Score Coefficient	Marginal Effects
South	0.1804 (0.5332)	0.0061 (0.0186)
West	−0.2004 (0.6012)	−0.0057 (0.0146)
Northeast	3.7995*** (0.6646)	0.8968*** (0.1037)
Natural Amenities Scale	0.2107*** (0.0303)	0.0070*** (0.0017)
Byways/100 sq. mi.	0.0857** (0.0391)	0.0028** (0.0014)
(Byways/100 sq. mi.)^2	−0.0103** (0.0042)	−0.0003** (0.0002)
Interstate/100 sq. mi.	0.0560 (0.0541)	0.0019 (0.0018)
(Interstate/100 sq. mi.)^2	−0.0153* (0.0079)	−0.0005* (0.0003)
Breadth	−0.2373 (0.5708)	−0.0079 (0.0190)
Patents per 10 k People	0.0196 (0.0183)	0.0006 (0.0006)
Travel Time to City of ≥250 k People	0.0011* (0.0007)	0.0001 (0.0001)
Travel Time to National Park (≥40 k visitors/year)	−0.2036 (0.2664)	−0.0068 (0.0085)
Park Time × South	0.5511** (0.2751)	0.0183** (0.0088)
Park Time × West	0.1024 (0.2898)	0.0034 (0.0094)
Park Time × Northeast	−1.1355*** (0.4361)	−0.0377** (0.0171)
Ln(population)	−0.1914*** (0.0470)	−0.0063*** (0.0020)
Per Capita income	0.0001*** (0.0001)	0.0001** (0.0001)
Avg. Farm Size (acres)	−0.0003 (0.0004)	−0.0001 (0.0001)
Farm Size × South	0.0004 (0.0004)	0.0001 (0.0001)
Farm Size × West	0.0005 (0.0004)	0.0001 (0.0001)
Farm Size × Northeast	−0.0127*** (0.0037)	−0.0004*** (0.0002)
Constant	−0.9877 (0.7762)	Predicted $Y = 0.0129$

Observations = 2,954
Pseudo R^2 = 0.3069
LR Chi^2(21) = 399.24 p-value = 0.0001 (Standard Errors in parentheses).
*Significant at <10 percent, **Significant at <5 percent, ***Significant at <1 percent.

variables are not significant, it does not necessarily mean that the entrepreneurial nature of a county does not play a role in whether or not the county is a hot spot for agritourism.

The coefficient on *Travel Time to City of* ≥250 k *People* was only significant at the 10 percent level (p < 0.10), but positive, suggesting a more remote location is marginally associated with the presence of agritourism hot spots. *Travel Time to National Park* was only significant when interacted with the South and Northeast regions, but with unexpectedly opposite signs. In the Northeast region, a 1-h decrease in travel time to a national park or monument increased the probability of the county being a hot spot by 3.77 percent

relative to a county in the Midwest. The South experienced an opposite effect; results suggest counties closer to national parks and monuments are less likely to be hot spots for agritourism in the South, compared to the Midwest. With respect to the Northeast result, urbanization may create travel opportunities from within-region visitors from urban areas.

Nationally, average farm size was unrelated to the probability of a county being a hot spot for agritourism. Compared to the Midwest, counties in the Northeast with a lower average farm size were more conducive to being a hot spot than counties with a larger average farm size, likely due to the type of agricultural enterprises and operators in the Northeast and urban proximity.

Similar to Bagi and Reeder's (2012) findings, the natural amenities scale coefficient is positive and significant (p < 0.01) indicating a positive relationship between natural amenities and agritourism. On average, a one-unit increase in the natural amenities scale index increases the probability that a county is a hot spot by 0.70 percent. This implies that a county one-half a standard deviation above the average natural amenities index score of 0.0525 is nearly 80 percent more likely to be an agritourism hotspot than counties at the mean, a notable difference in absolute terms. Although there is little a county can do about its natural amenity endowment, understanding how locational attributes influence a place's competitiveness is important for the environmental scan that underlies any planning exercise or policy formulation (McGranahan 1999). The amenity result also suggests some areas may be better places for public investment/support of agritourism than other places.

The coefficient on *Per Capita Income* followed a priori expectations, suggesting that a higher per capita income is associated with a higher propensity to be an agritourism hot spot, all else being equal. More disposable income may mean more money to spend locally on agricultural recreation.

Ln(Population) had a significant (p < 0.01), negative coefficient, suggesting that agritourism hot spots are more likely where population density is lower. The log population result makes sense given the positive coefficient on *Travel Time to City of* ≥250 k *People*. It seems agritourism hot spots are more likely to exist in less populated areas, contrary to business location models, which find population and the number of enterprises are positively correlated (Bhat et al. 2014). Thus, rural areas could take advantage of factors that draw visitors to the area (history, natural resources, byways, or national parks) and may consider the presence of such factors in their decision to start up an agritourism operation. The negative coefficient on population may also be a story of resiliency; farms and ranches in less-populated areas are more likely to adopt agritourism due to having few other economic development opportunities.

Residuals Analysis

While the probit model identified interesting factors associated with a county's probability of being an agritourism hot spot, we recognize some regional or local subtleties are lost due to the broad geographic scope of the model. For

this reason, we examine the regression residuals, which offer valuable insight into how paucity in model specification may result in residuals that are spatially related. Where the share of farms or ranches with agritourism is higher or lower than the model would lead us to expect, we infer a set of unforeseen opportunities or barriers affect that locale.

Counties with high and low residuals show some degree of clustering (Figure 3). High residual counties (0.95 to 1.0, in black) can be thought of as counties that were predicted not to be hot spots by the probit model, but really were agritourism hot spots. In contrast, low residual counties (−0.5 to −1.0, dark grey) were predicted to be agritourism hot spots, but were not (at least as indicated by the LISA analysis). These counties could represent locations where either something innovative emerged, allowing operators to take advantage of opportunities unaccounted for in our model or, they could represent counties in which the agritourism industry has great potential but is hindered by unforeseen obstacles.[9]
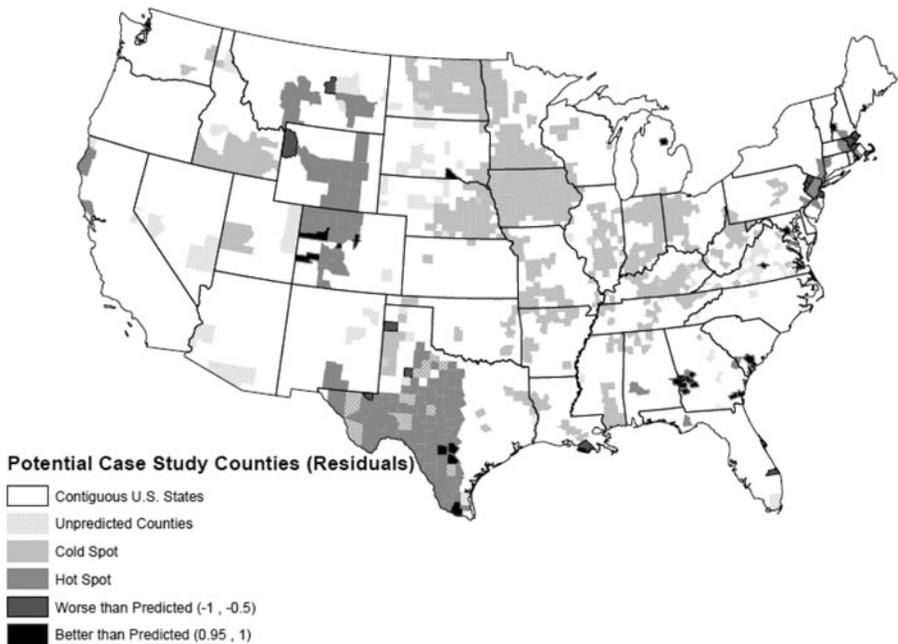
The Northeast, Texas, and the Rocky Mountain states provide some visual evidence of residual clusters, but there also seem to be spatial outliers with less agritourism than predicted in Louisiana, Florida, and Northern Texas (Figure 3). While these counties could simply be designated as "unique" due to the model's conservative specification, we believe that the robust LISA and probit results illustrate that the model residuals may hold interesting information on what causes agritourism farms/ranches in these counties to be relatively abundant (or scarce) relative to peer counties. The expanding literature on the potential benefits of agritourism to local communities suggests case studies be conducted on counties with unusual levels of agritourism. We hope future research uses both in-depth case studies and in-depth farm-level microdata to better understand drivers (or lack thereof) of agritourism in various regions. A full list of these hot spots is listed in Figures A1 and A2.

Conclusions and Implications for Rural Development

The evolution of market structure within the U.S. agriculture sector has led to increasing support for enterprise diversification strategies, like agritourism, in sustaining agricultural businesses (Liang and Dunn 2014). Rural communities' efforts to find economic development strategies that allow them to remain viable in an era of rapid urbanization has further catalyzed interest in agritourism. The spatial heterogeneity of agritourism and its drivers suggest

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[9] It is worth a reminder that hot spot counties classified by the LISA analysis are really just the center of a regional agritourism cluster. Furthermore, because the probit model includes multiple spatial variables, the low residual counties theoretically imply that adjacent counties should also have a relatively high proportion of agritourism farms (hence contributing to the county's classification as a hot spot).

Potential Case Study Counties (Residuals)

- Contiguous U.S. States
- Unpredicted Counties
- Cold Spot
- Hot Spot
- Worse than Predicted (-1 , -0.5)
- Better than Predicted (0.95 , 1)

Figure 3. Counties with High/Low Residuals when Predicting Presence of Agritourism

some communities may be more successful in using agritourism as a strategy to sustain agricultural enterprises and their rural communities.

This study examined the drivers of agritourism clusters to try to understand what place-based features are associated with their creation. Our results suggest that in more densely populated regions such as in the Northeast, farms appear to recognize the value of their urban proximity, taking advantage of travelers' willingness to visit their operations. In short, easily accessible rural counties with scenic beauty are more likely to have a relatively high percentage of farms or ranches with agritourism—an agritourism hot spot.

Perhaps the most significant contributions this research makes to the existing literature are: (1) its scope (i.e., observing agritourism across all contiguous 48 states), (2) identification of significant agritourism hot spots, and (3) use of location and spatial parameters to describe factors associated with agritourism hot spots.

Beyond informing agritourism managers, our results may provide policy makers and economic development practitioners with a more complete picture of the current extent and potential growth of the industry, with a particular focus on the "appropriate fit" of various agritourism models for different locations. It is likely that public support for agritourism industries will have to take different approaches to developing a successful local

industry depending on the unique locational assets in a region. Policy makers and economic developers may find our results useful for addressing opportunities and barriers to growth in their region's agritourism industry.

This research was limited by the available data to examine the prevalence of agritourism enterprises on U.S. farms. The next logical step is to try to determine the factors associated with higher agritourism revenue on participating farms and ranches, but this requires farm-level data that include agritourism revenue and total farm revenue. Future work could also compare the relative success of agritourism operations in "spillover" regions and "resiliency" regions, using farm-level data. Unfortunately, the farm-level data necessary to analyze the spillover effects from place-based factors and industry agglomeration is not publicly available. Thus, we leave these questions for future research.

Supplementary Material

Supplementary material for this article can be found at https://doi.org/10.1017/age.2017.36.

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