A GEOGRAPHIC EXPLORATION OF THE SOCIAL AND ECONOMIC SUSTAINABILITY OF FARMERS’ MARKETS AND THE RURAL COMMUNITIES THAT MAKE THEM WORK

By

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A GEOGRAPHIC EXPLORATION OF THE SOCIAL AND ECONOMIC SUSTAINABILITY OF FARMERS’ MARKETS AND THE RURAL COMMUNITIES THAT MAKE THEM WORK

Abstract

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The food we eat is entwined within our social and economic fabrics, forming food systems incorporating everything from environmental conditions, to the communities that grow it, to its path from farm to table. Thus the study of food is inherently interdisciplinary, and requires scholarly flexibility to make sense of it. This dissertation seeks to provide the needed flexibility through the combined knowledge and methodologies of Economics, Community and Rural Sociology, and Geography. Each of the three chapters contained here, provide a varied integration of these three disciplines.

Chapter One, “Decisions to Direct Market: Geographic Influences on Conventions in Organic Production,” draws from a theoretical critique, Conventions Theory, of both traditional economics and sociology to formulate a socio-economic exploration of the influences of ideology on organic producer motivations for participating in direct-to-consumer markets. This chapter additionally allows these ideological influences the ability to be subject to changing geographical locations that may alter the responses to various stimuli. A technique called Geographically Weighted Regression accounts for this non-stationary response.
Chapter Two, “Counter-Hegemonic Possibilities: Recovering the Spaces of Food Consumption?,” turns the subject to the positioning of farmers’ markets within the context of the larger industrial and population distributions of Washington State. This chapter seeks to uncover the relationship between the locations of farmers’ markets and that of supermarkets which are themselves related to the overall industrial locations patterns of the state. The local food movement possesses a dialogue of re-embedding agriculture and food within its social context. This chapter explores whether this leads to a more equitable distribution of healthy food options.

Chapter Three, “If You Build It, Will They Come?: Assessing Accessibility Influences on Low Income Consumer Participation in Farmers’ Markets,” continues the thread of Chapter Two through a consideration of potential rural and urban food deserts that are created partially as a result of the location realizations uncovered in chapter two. I then utilize a series of spatially informed regressions to consider the influence of geographic accessibility on the willingness and/or ability of recipients of food assistance programs, the WIC Farmers’ Market Nutrition Program, to utilize their vouchers.
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INTRODUCTION

Food and agricultural systems of the world are arguably dominated by a temporally and spatially disconnected handful of global corporations. These corporations and the neoliberal ideologies, of which they are a production, possess a hegemonic grasp on the perceived ‘common sense’ of a system that produces ‘what is in everyone’s interest’ (Evans, 2005). In this sense, we can recognize hegemony in a Gramscian context in which Carroll has argued is “a historically specific organization of consent that rests upon – but cannot be read off – a practical material base” (1992:8). This definition suggests that the neoliberal power, as our current manifestation of hegemony, cannot rule by force alone; rather, it requires the consent (implicit or otherwise) of the exploited. Further, the neo-Gramscian approach suggests that social movement actions cannot be considered devoid of the exploitative power structures in which they are forming to resist (Carroll and Ratner, 1994). Margaret Thatcher is often quoted as having suggested “there is no alternative” (Evans, 2005), but we must ask whether that statement holds any water in the realm of food production or whether a counter-hegemonic movement like those having been observed within both labor and women’s movements is possible and occurring in food and more broadly, agriculture. Few industries provide as visible a shrinking space as that of agriculture; its effects are readily visible on the face of the family farms that once populated rural America. This shrinkage of space and Thatcher’s assertion drives the exploration contained in this manuscript to consider whether a viable alternative does exist and whether any such alternative is counter-hegemonic in its approach and capacity, or whether they are simply a niche created by an innovative few that will soon be subsumed by the neoliberal ideals it set out to counter.
To begin the exploration of the counter-hegemonic possibilities in our food system, this manuscript provides a trio of complementary studies by which we can further understand the structural and behavioral conditions present within alternative food networks (AFNs), predominately within farmers’ markets. The system of farmers’ markets now exceeds 7,000 nationwide and may generally be thought of as having three principle actors: the producers, the consumers, and the markets themselves. In their aggregate, the decisions of these actors form the conditions of interaction that shape the direct-to-consumer marketplace. The three chapters contained here take the actions of each of these actors into consideration.

The first chapter is grounded in conventions theory and an expansion of Storper’s productive worlds (Storper and Salais, 1997). It is within these productive worlds, that attention is drawn to the diverse modes of coordination between actors, producers, and consumers, and the requirements and consequences of such coordination. With conventions theory as the backdrop, the chapter explores the influence of producers’ justifications for becoming an organically certified producer on their participation in direct-to-consumer marketing. Here, the market venue is not limited to farmers’ markets, but also includes channels such as farm stands and community supported agriculture (CSA). Additionally, this chapter addresses the readily recognizable variation in agricultural histories throughout Washington and the influence this has on the type of marketing channels a producer may participate. To accomplish this, Geographically Weighted Regression (GWR) techniques are implemented that allow fluidity in the regression coefficients to suitably account for local variation.
Chapter Two directs attention squarely on the location of markets in relation to the more fixed retail food centers of supermarkets. The chapter begins with an exercise to place the supermarket within the context of Washington State’s industrial diversity as a whole. This exercise is accomplished through extensions from early work by Walter Christaller and his Central Place Theory and Hierarchy Principle. Christaller’s work forms a basis from which the newer Number Average Size (NAS) rule may be considered. NAS suggests that as the number of cities, or centers, in which an industry is found increases, the average size of the cities in which it is found will decrease. In other words, industries that locate in a small number of cities will tend to locate in the largest of these cities. This relationship, should it hold, has direct implications for the retail food industry and recent observations of concentration and consolidation within it. Where the relationship may be found to hold, smaller, rural communities face increasing difficulties in maintaining quality access to healthy and affordable food.

After establishing the relationship between retail food stores and the larger industrial patterns in the state, Chapter Two then considers whether farmers’ markets and their attempts to re-localize food production and consumption produce a different location pattern that may alleviate some of the access inequalities present in the larger food system. To answer this question, the chapter draws upon point pattern analyses to compare the distribution of farmers’ markets and supermarkets. Using a bivariate K-function, the markets are evaluated on the basis of the random labeling hypothesis. The random labeling hypothesis asks whether a set of points, here identified as farmers’ markets, can be considered a different pattern as
compared to that of a control population, supermarkets, or whether they represent a random draw from the control.

Finally, Chapter Three advances from the considerations found in Chapter Two to evaluate whether any access inequalities present in the location of farmers’ markets has an influence on the ability and willingness of consumers receiving food assistance to engage in the perceived benefits of the farmers’ market. This chapter develops a ‘food desert’ characterization of Washington State, both in its rural and urban settings. Food deserts are generally conceived as areas of high poverty and low access to healthy food sources. The initial characterization is based in similar fashion as many other food desert studies in relation to supermarkets. The chapter then considers whether farmers’ markets are making inroads to alleviating the areas with low access. Using data collected from the state’s health agency on the number of vouchers distributed and subsequently redeemed in the Women Infants and Children (WIC) Farmers’ Market Nutrition Program (FMNP), the chapter evaluates the influence of distance and accessibility on redemption rate of the vouchers.

Alternative food networks are readily identifiable as seeking to fulfill the promise of reengaging the producer and consumer; however, direct buying and selling absent a middle man, or a refrigerated 18-wheeler, is not in and of itself counter-hegemonic. The local and/or organic label does not inherently imply absence of a lone profit maximization motive reminiscent of those creating the current state of agricultural production. It is simply another market avenue for consumers and producers to exchange goods for money, unless it can reorient such markets toward a more just provisioning of human needs in a sustainable fashion. A just provisioning, a counter-hegemonic movement, suggests that a re-embedded market will
ensure that nutritious food gathered in a sustainable and culturally acceptable way will be available to everyone, not just those that can afford it. Johnston (2007) has proposed two eco-social criteria that can be deemed valuable in considering counter-hegemonic food politics: (1) *Reclaiming the Commons* and, (2) *Creating post-consumer needs and desires.*

Johnston borrows from Mano (2002:69) in describing the commons as an “economy of care and concern” in which needs are not met through the exclusive privilege of a commodity, rather through a blend of needs reduction, need prevention, cooperation, and collective approaches.” Johnston’s argument, via Mano, is that in advanced capitalist societies, human needs are met by global actors through commodity production and consumption that progress towards the elimination of self-reliance, and thus autonomy, and a closure of the commons. Further, food movements are therefore counter-hegemonic when they resist the closure of the commons through democratic control of production and consumption. The second criterion suggested by Johnston reflects the need of a social movement to not rely solely on fear; rather, she argues for a creation of a foundation of shared identities and understanding of a ‘good life’ that can produce a sustained mobilization and effect. The essence of her criteria is that counter-hegemonic projects must speak to the need for pleasure, beauty, and desire, thus giving a viable alternative that is not seen simply as a sacrifice.

Given the above suggested criteria for AFNs to be counter-hegemonic, the following three chapters are developed to explore deviation away from the singular hegemonic ideals of a profit maximizing producer or system. They seek to understand the degree by which food networks are organized around the “belief that good food should be affordable, accessible and
based on sustainable production methods. The organization cannot afford to lose money, but profits are secondary to these primary goals” (Johnston 2007:107).

I have suggested here that the proposed eco-social criteria suggested by Johnston (2007) are a valuable beginning to understanding the degree to which an alternative food structure is counter-hegemonic. The overarching goal of this manuscript is to go beyond the uncritical assumption that ‘local’ is inherently good and the antithesis of ‘global’, as well as to reveal the mechanisms that can aid in ensuring that ‘good food’ is not just yuppie food.
References


CHAPTER 1 - DECISIONS TO DIRECT MARKET: GEOGRAPHIC INFLUENCES ON CONVENTIONS IN ORGANIC PRODUCTION

Abstract

Substantial academic interest over the last two decades has focused on the notion of bifurcation within organic agriculture; however, recent examinations of the organic industry have revealed the inability of this dualistic assumption to fully account for the spectrum of variation in production schemes. Using data from a 2007 survey of certified organic producers, this paper seeks to empirically demonstrate the effects of producers’ ‘worlds of justification’ on willingness to participate in direct-to-consumer markets. Nearly sixty percent of respondents participated in at least one form of direct-to-consumer marketing. This paper tests whether justifications are influenced by the existing spatial relationships that define the producers’ structural connections with agriculture as well as their proximity to viable direct markets. We assess not only the impacts of producers’ justifications on market delivery mechanisms, but also the variation of impacts across space. Employing a Geographically Weighted Regression (GWR) model, this paper moves beyond the constraints of global regression models that hold relationships constant throughout the study area. GWR thus allows for the accounting of spatial non-stationarity of producer characteristics that would be expected in an agriculturally diverse region.

1. Introduction

1 This chapter previously appeared as: Sage, J.L., Goldberger, J.R., 2012. Decisions to direct market: geographic
According to the first national census of organic agriculture, Washington State trails only California and Wisconsin, with 886 certified organic and exempt farms on 82,216 acres, and second only to California in revenue from sales (USDA, 2008). Such a large number of certified producers and generated revenue should cause one to consider whether this is the organic agriculture envisioned by the early proponents of the organic movement, or simply an emerging organic ‘sector’ within the larger food system. These early progenitors of organic agriculture developed it as a re-emphasis on small-scale family farms that shun synthetic chemical applications and re-localize distribution channels (Grey, 2000). This connotation has additionally developed out of a movement that set out to oppose the status quo of the industrialization of agriculture—a status quo that had little credibility in food safety, land use, and social justice (Buck et al., 1997; Lampkin, 1990). A closer look into the 2008 census of organic agriculture in Washington State shows direct-to-consumer marketing networks make up less than three percent of the organic sales statewide—not exactly a massive repeal of the industrialization of agriculture, but substantial nonetheless. Farmers markets lead the way for direct sales with 1.7 percent of the state’s total sales via participation by 130 certified organic producers. These 130 producers represent 15 percent of the state’s certified organic producers. Additional direct-to-consumer venues in the state include farm stands (129 producers), Community Supported Agriculture (CSA) (60 producers), and other means (27 producers) (USDA, 2008).

Over the last two decades, the development of ‘alternative food networks’ (AFNs) have attracted significant academic and public attention via a proliferation of case studies as these networks seek to fill both the geographic and ideological gaps left by conventional systems of
production and delivery (Sonnino and Marsden, 2006). A key characteristic in the development of AFNs is the re-spatializing of food into the local such that quality is represented by the perception of being directly linked to local farming practices, rural nature, landscapes, and resources (Renting et al., 2003). Additional characteristics of AFNs include: (1) significantly shortened distances between producer and consumer; (2) smaller farm size and scale, usually organic or holistic as compared to agribusiness-oriented; (3) reliance on alternative food purchasing venues such as cooperatives, farmers markets, and CSA; and (4) commitment to the social, economic, and environmental considerations of food production (Jarosz, 2008). These characteristics stand in contrast to the commonly portrayed agriculture of much of Washington’s conventional systems involving large capital investments with sophisticated production and transportation strategies and technologies (Ostrom and Jussaume, 2007).

Alternative food networks in the form of direct-to-consumer marketing have begun to flourish, in part because of their appeal to many farmers and consumers, resulting from the reestablishment of a human connection at the meeting place of agricultural production and food consumption that has been largely absent for the last half century in the time of rising prevalence of the ‘supercenter’. This development of connections is observable as social ties, or social embeddedness, complete with reciprocity and trust (Hinrichs, 2000). Kloppenburg et al. (1996) suggest this proliferation of small-scale, cooperative, and collective production is a reflection of the building of a ‘commensal community’, seeking the recovery of social linkages beyond the atomistic market relationships. Advocates of such relocalization processes suggest it to be “something done by people, not to them” (Hines, 2000:31).
As we observe a small but growing percentage of certified organic producers using farmers markets and other forms of direct-to-consumer marketing, we must ask ourselves what distinguishes these producers from those who are also certified organic but not engaged in direct marketing activities. This paper draws on a 2007 survey of certified organic producers in Washington State (Goldberger, 2008) to explore the factors considered by producers when deciding to farm organically. We seek to understand producers’ participation in direct-to-consumer marketing based on the reported importance of various economic, social, and environmental motivations for farming organically. Conventions theory (Boltanski and Thevenot, 2006 [1991]) serves as a valuable tool to allow for a careful elaboration of producers’ justifications for marketing directly to consumers. Further, it can be expected that producers who have similar reasons for farming organically may have different outcomes in their decision to direct market based not only on the type of crops they produce, but also on the geographic area in which they operate. Geography plays an important role in a region’s production possibilities and feasible markets available to a producer, thus revealing geography not only as a differentiation of place, but also a differentiator of economies and ideology. As such, this paper employs a spatially specific regression technique known as Geographically Weighted Regression (GWR) (Fotheringham et al., 2002) which allows for non-stationary reactions to stimuli. In this case, it allows the factors taken into account by each producer to vary in their influence on the decision to direct market.
2. The Literature

2.1. Marketing Strategies

Research over the last two decades strongly suggests that large national and transnational companies are outwardly assuming the ideologies of the niche markets commonly referred to as alternative agriculture (Campbell and Liepens, 2001; Friedmann, 1993). Friedmann (1993) argues that agribusiness displays a commitment to green ideals but minimally changes its production practices to meet the certification requirements. MacRae et al. (1993) refer to this process as ‘corporate greening’. Ostrom and Jussaume (2007) suggest these national and transnational actors are rather adept at identifying and moving into high value niche markets. Blank and Thompson (2004) discuss corporate greening in relation to the ‘wheel of retailing’ model of Kohls and Uhl (1980). In Blank and Thompson’s interpretation, the wheel of retailing focuses on the basis for competition between firms over time as innovations (e.g., organic agriculture) create opportunities for market segmentation and product differentiation. In their description, all firms are initially in a competitive market where the competition is based on low prices and low services. Firms attempt to differentiate themselves either though price, service, or quality. In their first proposition, Blank and Thompson (2004) identify the beginning of the cycle through an innovator who is able to offer consumers a higher quality product at a higher price than that of the standard market. Many in the organic foods literature make this quality claim (Marsden et al., 2000). Over time, if this niche proves profitable, it will attract more producers, thereby changing the face of the niche from a potential monopoly towards a competitive market. This shifts the focus from product quality to price, which favors those firms who can produce most efficiently.
The wheel of retailing is similar to the notion of the conventionalization of organic agriculture. Conventionalization is a more sociologically centered theory of the changing face of organic agriculture. This perspective views the entrance of capitalistic structure into organic production as marginalizing the original social and biophysical aspects of the organic movement, resulting in reductions of the more movement-oriented producers’ market shares, marginal profits, and legitimacy (Coombes and Campbell, 1998). Buck et al. (1997) identify practices and traits that are indicative of agribusiness infiltration: increased export orientation, increased use of off-farm inputs (thus increased requirement for capitalization and debt (Hall and Mogyorody, 2001)), decreased crop diversity, increased size, active involvement by processors and wholesalers, and increased contract growing. Conventionalization results in the bifurcation between ‘organic movement’ and ‘organic sector’ production and distribution. The latter is characterized by the methods, distribution channels, and ideologies associated with conventional agricultural production (Buck et al., 1997). Empirical evidence of conventionalization tends to come from studies of U.S. organic agriculture. For example, Guptill (2009) found support for the conventionalization thesis in her study of the organic dairy industry in upstate New York; however, she notes that the presence of industrial logic does not have a singular predictable impact on producer decision making. The more substantially supportive work for the conventionalization thesis comes from Guthman (2004a) in her follow up to Buck et al. (1997), as well as in her response to critics of the thesis (Guthman, 2004b). Guthman (2004a) argues that organic agriculture in California is not the often assumed anti-technology, anti-globalism, non-capitalist alternative to industrial agriculture.
Arguments that either partially support (Hall and Mogyorody, 2001) or counter the conventionalization thesis tend to come from outside the U.S. (e.g., Coombes and Campbell, 1998). Lockie and Halpin (2005) note that despite the practical significance of the conventionalization thesis, substantial disagreement remains regarding its dynamics and meaning. These differences tend to suggest that a region’s or country’s agricultural geography and history play important roles in the future development of organic production—a point readily acknowledged by Guthman (2004b) as she suggests that most organic farms in California reflect the agrarian structure of California. In light of the corporate greening that has occurred, whether it fits into the conventionalization thesis or not, a tangentially related alternative food structure is finding significant holdings throughout the U.S. This structure is the decentralized, direct market, local food movement that hopes to challenge the spatially disconnected agribusiness ideology and distribution structure.

This newer structure adds another level to the complex diversity of production practices and marketing strategies already in play throughout the U.S. and worldwide. Several works over the last decade have explored when and where these direct marketing activities take root and succeed. Examining small fruit and specialty product markets in Virginia, Monson et al. (2008) saw reasonable success in predicting producers’ direct marketing behavior when regressed on farm, demographic, and socioeconomic variables. They found that those producers who operate small farms, rely less on small fruit, and practice organic farming without becoming certified are more likely to use direct marketing channels. In addition to specific producer characteristics, the socioeconomic characteristics of the producers’ location have been demonstrated to be important (Jarosz, 2008). Likewise, Morgan and Alipoe (2001)
find that geographic location is a key determinant of direct marketing success. Other studies have similarly lent support to the importance of geographic location, especially as it relates to potential consumer income and its impact on vendor performance (Feenstra et al., 2003; Griffin and Frongillo, 2003; Schatzer et al., 1989; Varner and Otto, 2008). Schmit and Gomez (2011) identify a positive relationship between the number of consumers needing to travel less than five miles to a market and increasing vendor satisfaction. They also suggest that vendors selling at farmers markets tend to be more satisfied with selling at fewer markets, suggesting that they tend to maximize their productivity by attending the ‘best’ markets, thus potentially putting markets in more economically challenged, lower disposable income, or lower population density areas at an operational disadvantage. Location decisions made at least partly on the basis of disposable income, and thus effective demand, is not a new phenomenon, as geographers have suggested that stores locate not only on the basis of population density, but also available income (e.g. Getis, 1965).

Several authors have begun to highlight a spectrum of agricultural production practices and ideologies that result in a potentially insufficient nature of identifying such bifurcations as either present or absent (Morgan et al., 2006; Rosin and Campbell 2009). Morgan et al. suggest an expansion of Storper and Salias’ (1997) interpretation of productive worlds, in which attention is drawn to the diverse modes of coordination between actors and the requirements and consequences of such coordination. Storper and Salias identify four possible worlds of production stemming from the two elementary actions taken by producers: construction of the market (generic or dedicated product) and construction of the technology (standardized or specialized). The first of these worlds, the industrialized world, is the result of a choice of a
generic market and standardized technology. Producers compete on the basis of price, each with a set of similar products produced with undifferentiated technologies. The use of standardized technology to create dedicated products creates the market world. An emphasis on dedicated products and specialized technology constitutes the interpersonal world in which competition is based on quality as opposed to prices as in the previous two worlds. Finally, the world of intellectual resources centers on specialized technology for a generic market. Competition forms through learning, with the objective of changing the qualities of existing objects or services.

To build upon these worlds, Morgan et al. (2006) suggest the worlds of food that now comprise the contemporary food sector work not just according to an economic logic, as Storper and Salias (1997) imply, but also in accordance with a cultural, ecological, and political logic. Morgan et al. suggest that conventions theory (CT) (defined below) is insufficient despite overcoming its binary predecessors because it neglects the role of nature in more localized agri-food ecologies. However, we argue that the seven worlds below can adequately account for much of the variation in logic that is in itself partly a production of the ecological realities in which the various worlds are negotiated. As such, we follow the lead of Rosin and Campbell (2009) in using CT as described below.

Rosin and Campbell (2009) propose a framework to move beyond bifurcation and answer Lockie and Halpin’s (2005) call to eliminate the dualistic nature of the conventionalization debate. They draw upon CT as developed by Boltanski and Thevenot (2006 [1991]) in which a
socioeconomic perspective is developed through their assignment of worlds of justification along with their associated bases for order of worth\(^2\) (Table 1).

**Table 1. Worlds of Justification and their Orders of Worth (adapted from Rosin and Campbell, 2009).**

<table>
<thead>
<tr>
<th>Bases for Orders of Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
</tr>
<tr>
<td>Prices and the capacity to claim a price premium</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
<tr>
<td>Efficiencies in Production and distribution to set standards</td>
</tr>
<tr>
<td>Civic</td>
</tr>
<tr>
<td>Contribution to the good of civil society</td>
</tr>
<tr>
<td>Green</td>
</tr>
<tr>
<td>Contribution to the good of the environment</td>
</tr>
<tr>
<td>Domestic</td>
</tr>
<tr>
<td>Personal relationship (actual or virtual)</td>
</tr>
<tr>
<td>Inspired</td>
</tr>
<tr>
<td>Reference to a higher ideal based in passion, emotion or creativity</td>
</tr>
<tr>
<td>Renown</td>
</tr>
<tr>
<td>Public opinion and general social standing</td>
</tr>
</tbody>
</table>

Rosin and Campbell (2009) claim the traditional conventionalization and bifurcation theses present a concrete characterization of ‘conventional-like’ organics that falls within the worlds of market and industrial while the artisan or locally-oriented producers fall within the worlds of civic and green. They contend this segmentation identifies the inconsistencies of the

\(^2\) ‘Orders of worth’ are the means by which both the human and object actors are valorized within the worlds of justification or social interaction (Rosin and Campbell, 2009).
“idealized” representation of organic with the real-world applications, but through an overly structured framework, and thus fails to account for the continuum that is organic production. Rosin and Campbell cite three specific advantages of adopting the CT approach over its predecessors: (1) it places organic within larger agri-food systems, rather than diametrically opposed to conventional; (2) it acknowledges the heterogeneity and strategic nature of the positioning of participants in agri-food systems relative to the organic designation; and (3) it identifies sites of action and the means by which they are engaged, thereby opening them to political action (Rosin and Campbell, 2009:45).

Organic agriculture is dynamic with no one market structure defining it. Organic producers are likewise a dynamic group with a wide range of justifications for their production choices. Much of this diversity can be attributed to producers’ economic, ideological, and geographic places of action. The GWR model outlined in the next section permits a quantitative measure to be established that increases our ability to understand some of the potential variation observed in the literature cited above. It provides us the opportunity to discover when, where, and under what circumstances the conventionalization thesis holds and when we should move beyond its structured framework.

3. Data and Methods

3.1. Survey of Washington’s Certified Organic Producers

In October through December of 2007 a survey was conducted of all certified organic producers in Washington State. The survey population consisted of 670 producers certified by the Washington State Department of Agriculture’s Organic Food Program and 14 producers certified by Oregon Tilth. Forty nine individuals were excluded because of ineligibility (e.g.,
producers in transition to organic but not yet organic) and bad addresses. Three hundred fifty six individuals completed the survey for a response rate of 56.1 percent. The survey questionnaire included questions about reasons for farming organically, marketing practices, sources of agricultural information, agricultural goals and challenges, farm characteristics, and farmer demographics.

This paper focuses on the marketing strategies employed by the producers surveyed. The decision to direct market to consumers is included as the dependent, binary variable for a logistic regression. Survey respondents are assigned a ‘1’ if they used roadside stands, farm stores, farmers markets, CSAs, U-pick operations, websites, catalogs, festivals, fairs, other farmers, or other direct-to-consumer channels to market their certified organic products in 2007, and a ‘0’ if they did not use any of these marketing channels.

The primary set of independent variables are based on a survey question about the importance (on a scale from 1= ‘Not Important’ to 5= ‘Very Important’) of different factors in the decision to farm organically. Table 2 presents the means for these factors in decreasing order of importance. In the third column of Table 2 we include the ‘world of justification’ associated with each factor. Because several factors address multiple justifications, similar justifications were grouped together. Market/Industrial (MI) combines Market Performance and Industrial Efficiency. Civic/Green (CG) combines Civic Equality and Green. Renown/Inspired/Domestic (RID) combines Renown, Inspired, and Domestic Relations. We created MI, CG, and RID variables by calculating the means for the factors included in each group. Summated scales were also constructed but produced no discernible model performance differences from the mean scores.
Table 2. Importance of Ideological Factors in Producers’ Decision to Farm Organically.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean Scores on a Scale from 1 (&quot;Not Important&quot;) to 5 (&quot;Very Important&quot;)</th>
<th>Convention Grouping*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price premiums for certified organic products</td>
<td>4.07</td>
<td>MI</td>
</tr>
<tr>
<td>Consumer demand for organic products</td>
<td>4.06</td>
<td>MI</td>
</tr>
<tr>
<td>Economic sustainability of farm</td>
<td>4.05</td>
<td>MI</td>
</tr>
<tr>
<td>Land stewardship / environmental sustainability</td>
<td>4.04</td>
<td>CG</td>
</tr>
<tr>
<td>Quality of organically grown produce</td>
<td>3.85</td>
<td>RID</td>
</tr>
<tr>
<td>Health of consumers</td>
<td>3.81</td>
<td>CG</td>
</tr>
<tr>
<td>Personal, family, or farm worker health</td>
<td>3.71</td>
<td>CG</td>
</tr>
<tr>
<td>Community values / quality of life</td>
<td>3.65</td>
<td>CG</td>
</tr>
<tr>
<td>Challenging, intellectually appealing</td>
<td>3.34</td>
<td>RID</td>
</tr>
<tr>
<td>Reduced dependency on large corporations</td>
<td>3.24</td>
<td>CG</td>
</tr>
<tr>
<td>Philosophical or spiritual reasons</td>
<td>3.22</td>
<td>RID</td>
</tr>
<tr>
<td>Local marketing opportunities for certified organic products</td>
<td>3.18</td>
<td>CG</td>
</tr>
<tr>
<td>Means of farm diversification</td>
<td>2.99</td>
<td>MI</td>
</tr>
<tr>
<td>Customer or buyer required organic certification</td>
<td>2.98</td>
<td>MI</td>
</tr>
<tr>
<td>Humane treatment of animals</td>
<td>2.94</td>
<td>CG</td>
</tr>
<tr>
<td>Interest in learning new production methods</td>
<td>2.94</td>
<td>RID</td>
</tr>
<tr>
<td>Desire to pass farm to next generation</td>
<td>2.91</td>
<td>RID</td>
</tr>
<tr>
<td>Social justice / equity concerns</td>
<td>2.71</td>
<td>CG</td>
</tr>
<tr>
<td>Opportunities to network with other farmers</td>
<td>2.65</td>
<td>RID</td>
</tr>
<tr>
<td>Reduced input costs</td>
<td>2.38</td>
<td>MI</td>
</tr>
<tr>
<td>Overseas marketing opportunities for certified organic products</td>
<td>1.81</td>
<td>MI</td>
</tr>
</tbody>
</table>

*Nonresponses ranged from 8 to 25

*MI=Market/Industrial; CG=Civic/Green; RID=Renown/Inspired/Domestic

Additional independent variables are based on direct survey questions about whether or not respondents had always farmed organically and how many acres were devoted to the production of certified organic crops or livestock in 2007. Also included are dummy variables (tree fruit, vegetables, and dairy/livestock) representing the largest portion of a respondent’s 2007 gross organic farm income.
3.2. *Regression Models*

We use two different regression models in our analysis. In both regressions, producers who participate in direct-to-consumer marketing are assigned a ‘1’, while those who do not are assigned a ‘0’. First, we use a logistic regression model because of the binary nature of the dependent variable. This will be referred to as the global regression model and establishes a baseline of comparison for the second model. One major assumption of global regression models, whether linear or logistic, is the independence of the observations. This assumption is not likely valid when considering geographic data as a result of potential spatial autocorrelation. To test for spatial autocorrelation in the survey variables, a correlation of variables between near observations, Moran’s I\(^3\), is used. In addition to the independence assumption being likely to fail, a second shortcoming of a global model is that the parameters are assumed to be fixed throughout the study area. For this to hold, a given stimulus must provoke the same response each time, independent of where that stimulus occurs. For the purposes of this study, the effect of changing importance of the factors identified in Table 2 would need to produce a similar response by producers throughout the state. In other words, a scoring of ‘very important’ on the ‘consumer demand for organics’ question by a producer near the liberal leaning Seattle with its plethora of direct market options, would under a global regression model have the same impact on probability of direct marketing as a similarly high score by a producer near Yakima, which has a deep agricultural export history. This is known as

\[^3\] Moran’s I is calculated on a -1 to 1 scale with -1 being perfect negative correlation (dispersion), zero being complete spatial randomness, and 1 being perfect positive correlation (clustered). P-values are rendered using a randomness test of 999 iterations.
stationarity, and is not likely to occur given the large variability across Washington. The more likely result is spatial non-stationarity, or geographic heterogeneity, in which responses to stimuli vary across the study area.

To overcome this spatial non-stationarity, we use a Binary Logistic Geographically Weighted Regression (GWR) based on the methods in Fotheringham et al. (2002). In a GWR regression, the parameters take on locally specific values. The model is fit using iteratively reweighted least squares. Given Washington’s diverse landscape and varying density of respondents in a given area, an adaptive bandwidth\(^4\) is employed that seeks to minimize the Akaike Information Criterion\(^5\) (AIC), a goodness of fit statistic. By performing a regression at each point of observation, this model is able to account for the decreasing influence of neighboring producers and, by extension, the local socio-cultural and resource characteristics that affect producers’ decisions as the distance between them increases. Thus, Tobler’s first law of geography—that everything is related but closer things are more related—is accounted for.

\(^4\) A major aspect of GWR is the selection of the bandwidth that informs the regression’s weighting function. This can be done in one of two ways, and both tend to be based on Gaussian functions. Should one suspect that the data to be observed are equally dispersed throughout the study area, then a fixed bandwidth may be used. However, it is likely that this will not be the case. Take for instance a study in which centroids of census blocks are used as data points. In the more populated urban areas, these centroids will be close together. Alternatively, in rural areas they will be more dispersed. If a fixed bandwidth is used, the regressions in the urban areas will be based on a larger number of data points and may obscure fine variation as a result. Conversely, local regressions in rural areas will be based on fewer data points resulting in large estimate variances. An adaptive bandwidth, therefore, can be used to allow the utilization of the most appropriate bandwidth for the specific region.

\(^5\) Models with lower AIC values are better suited to the data and reductions of 30 points or more can be considered a significant improvement.
4. Results

4.1. Spatial Autocorrelation

To identify the presence of spatial autocorrelation in the ordinal survey responses regarding the importance of various factors in producers’ decision to become a certified organic producer, we used the Moran’s I statistic. Where spatial autocorrelation is found, its presence will suggest a violation of the necessary independence assumptions of the residuals and produce questionably valid hypothesis testing results, thus inflating the test statistic and increasing the chance of a Type I error. The Moran’s I result for the constructed variable measuring the importance of justifications concerning Renown/Inspired/Domestic Relations (RID) worlds to the producer demonstrated only the slightest indication of spatial autocorrelation (I=0.0403, p<.1), thus Moran’s I does not appear to substantially deviate from random. Of greater significance are the Moran’s I for the Market/Industrial (MI) and Civic/Green (CG) justification variables in which values of I= 0.082 (p<.01) and I=0.1168 (p<.001) respectively were observed. These two values suggest a significant departure from complete spatial randomness and a cause of concern for global regression assumptions of independence. Further evidence of spatially correlated observations can be seen in the bivariate Moran’s I in which the MI justification is compared against its CG counterpart. In this bivariate test we observe a Moran’s I = -0.1212 (p<.001). In this bivariate case, the neighboring values of one variable (MI) are regressed on the values of the other variable (CG). The negative spatial correlation between these variables is thus quite evident.
4.2. Global Logistic Regression

Despite the fact that a regression model that fails to account for spatial autocorrelation will produce potentially erroneous results, a traditional logistic regression is useful as a basis of comparison for the GWR model. After eliminating observations with missing data, the model was left with 255 observations out of the original 356 completed surveys. Inspection of the omitted observations revealed no weighted impact on the results of any one area of the state. The regression model with variables accounting for not only the constructed justification variables, but also whether the producer had always farmed organically, organic acreage, and major organic product (tree fruit, vegetables, or dairy/livestock) yielded a pseudo-$R^2$ of 0.30 and a corrected AIC (AICc) of 262.53. Producers who reported having always farmed organically were coded as ‘1’ while those who switched from conventional agriculture received a ‘0’. Table 3 demonstrates a significant positive effect (odds ratio = 2.943, p<.01) on the likelihood of participating in direct-to-consumer marketing if a producer has always been an organic producer. The odds ratio demonstrates that a producer who has always farmed organically is nearly three times more likely to participate in direct marketing compared to a producer who switched from conventional production. The only ‘major product’ binary variable to show relatively high significance was dairy/livestock. Dairy/livestock producers were significantly less likely to participate in a direct-to-consumer marketing strategy (odds ratio = 0.365) compared to other major producer types. This supports previous surveys by Ostrom and Jussaume (2007) who observed substantially lower direct-from-farmer demand for animal products such as eggs and meat. Of the 45 respondents who identified dairy/livestock as their major product, 20 participated in direct-to-consumer marketing. Roadside stands and farm stores (11
respondents) were the most popular direct marketing methods, followed by website or catalog sales (9 respondents), farmers markets (8 respondents), and other farmers (8 respondents).

Most dairy/livestock producers used more than one direct marketing method.

**Table 3. Logistic Regression of Survey Variables on Direct-to-Consumer Marketing Decisions.**

| Explanatory Variables                  | Coefficient | Odds Ratio | Std. Err. | T     | P>|z| |
|----------------------------------------|-------------|------------|-----------|-------|------|
| Intercept                              | 1.125       | -          | 0.876     | 1.284 | 0.199|
| Always farmed organically (Dummy)      | 1.079       | 2.943      | 1.130     | 2.810 | 0.005|
| Tree fruit as major product (Dummy)    | -0.655      | 0.519      | 0.214     | -1.589| 0.112|
| Vegetables as major product (Dummy)    | -0.109      | 0.897      | 0.417     | -0.234| 0.815|
| Dairy/livestock as major product (Dummy)| -1.007     | 0.365      | 0.200     | -1.838| 0.066|
| Total organic acres                    | 0.001       | 1.001      | 0.001     | 1.199 | 0.231|
| Market/Industrial (MI) factors         | -1.152      | 0.316      | 0.086     | -4.242| 0.000|
| Civic/Green (CG) factors               | 1.196       | 3.306      | 0.929     | 4.253 | 0.000|
| Renown/Inspired/Domestic (RID) factors | -0.365      | 0.694      | 0.211     | -1.200| 0.230|

Both the MI and CG factors are demonstrated in this model to be significant factors in the decision to direct market. Table 3 shows that unit increases in the value placed on MI justifications for their decision to farm organically substantially reduces the likelihood of participating in direct market venues (odds ratio = 0.316, p<.001). An odds ratio less than one indicates that as the variable of interest increases, the likelihood of participating in direct marketing decreases. Those producers who place high value on CG justifications are significantly more likely to direct market than those who place low value on CG justifications (odds ratio = 3.306, p<.001). Though significant in their effects, these results should be interpreted cautiously as it has already been demonstrated that spatial autocorrelation may influence the outcome.
4.3. *Logistic GWR*

The use of GWR allows us to account for not only the heterogeneity in responses to the explanatory variables, but also the spatial autocorrelation in the variables. To test whether the GWR model has indeed accomplished this goal, a Moran’s I was performed on the model residuals. In this test, a Moran’s I value that is not significantly different than zero indicates suitable accounting for the spatial autocorrelation. The residuals thus have complete spatial randomness. This GWR model does just that ($I = -0.0315$), with a non-significant $p$-value.

GWR models produce a large amount of data in their output files resulting from regressions being conducted at each observation. To reduce this data to a meaningful amount of information, we present a five-number summary table to detail the model’s minimum, lower quartile, median, upper quartile, and maximum values for both its coefficient estimates and the associated odds ratios (Table 4). Tables 3 and 4 reveal similar coefficients for the values found in the global regression and the median values of the GWR parameters. Only the coefficient for the vegetable dummy variable differs in sign; global regression produces a negative coefficient, while the GWR produces a positive median value with a range that spans from negative to positive. However, this coefficient in the global regression is not a significant result (see Table 3). The two quartile values for each parameter begin to reveal the variability in estimates for all of these variables. The estimate for the variable concerning whether a producer has always farmed organically is especially varied with a wide range between the lower and upper quartile values. Recall from earlier discussion that an adaptive bandwidth was selected to run the GWR model. Bandwidth selection was based on AICc minimization. To conduct this selection, the
criterion statistic was calculated at increasing bandwidths to observe the convergence function. Convergence occurs at a local sample size of 246 observations.

| Table 4. Five-Number Summary for Logistic GWR of Survey Variables on Direct-to-Consumer Marketing Decisions. |
|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Explanatory Variables                            | Minimum | Lwr Quartile | Median | Upr Quartile | Maximum |
| Intercept                                         | -0.17 | 0.84 | 0.29 | 1.34 | 0.88 | 2.42 | 1.24 | 3.45 | 1.76 | 5.79 |
| Always farmed organically (Dummy)                 | 0.64 | 1.90 | 0.85 | 2.35 | 1.24 | 3.44 | 1.40 | 4.06 | 1.49 | 4.44 |
| Tree fruit as major product (Dummy)               | -0.93 | 0.40 | -0.78 | 0.46 | -0.61 | 0.55 | -0.49 | 0.61 | -0.24 | 0.79 |
| Vegetables as major product (Dummy)               | -0.51 | 0.60 | -0.07 | 0.93 | 0.05 | 1.05 | 0.14 | 1.15 | 0.38 | 1.46 |
| Dairy/livestock as major product (Dummy)          | -1.72 | 0.18 | -1.23 | 0.29 | -1.01 | 0.37 | -0.73 | 0.48 | -0.40 | 0.67 |
| Total organic acres                               | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 |
| Market/Industrial (MI) factors                    | -1.38 | 0.25 | -1.18 | 0.31 | -1.08 | 0.34 | -0.99 | 0.37 | -0.86 | 0.42 |
| Civic/Green (CG) factors                          | 1.02 | 2.76 | 1.04 | 2.83 | 1.10 | 3.01 | 1.23 | 3.42 | 1.31 | 3.71 |
| Renown/Inspired/Domestic (RID) factors            | -0.65 | 0.52 | -0.49 | 0.61 | -0.37 | 0.69 | -0.14 | 0.87 | 0.09 | 1.10 |

To better visualize what these varying coefficients and odds ratios mean, contoured maps can be constructed (Fotheringham et al., 2002) through a trend line interpolation process, in which the observation points and their local parameter odds ratios are used to estimate the value at unobserved points. Figure 1 displays this process in relation to the odds ratios produced for the MI variable. All areas of Washington have negative estimates, and thus an odds ratio less than one, indicating that as the importance of the factors concerning MI justifications increases, the likelihood of a producer participating in direct marketing decreases.
As we get further from 1, and closer to 0, this effect is heightened. It is important to note that the color scheme represents increasing effect of the variable; thus, the further from one, the darker the shade. As such, the Yakima Valley region in South Central Washington, appears to demonstrate the least negative response to higher values of MI justification. In a similar fashion, Figure 2 displays the odds ratio distribution for the factors indicating importance of CG justifications. A clear distinction between eastern and western Washington is apparent. Producers west of the Cascade Mountains (which run north-south approximately 60 miles east of Seattle) demonstrate a larger response to higher value placed on CG justifications than their eastern Washington counterparts.

As reported above, the global logistic model resulted in a pseudo $R^2 = 0.30$ and an AICc of 262.53. The GWR model produces local $R^2$ estimates that range from 0.34 to 0.45 with a median value of .40, which suggests some improvement over the global model in addition to the added specificity of place. The AICc value (265.21) for the GWR model is roughly equivalent to that for the global model, suggesting similar strength of fit by this standard. Despite the lack of substantial overall improvement by AICc standards, the variability in parameter estimates and the ability to locally dissect the various justifications of the producers throughout the state suggest great value in using GWR to understand the effects of these non-stationary parameters.
Figure 1. Market/Industrial Value Factor Results for Geographically Weighted Regression Odds Ratio on the Binary Dependent Variable of Choice to Market Direct-to-Consumers.
Figure 2. Civic/Green Value Factor Results for Geographically Weighted Regression Odds Ratio on the Binary Dependent Variable of Choice to Market Direct-to-Consumers.
5. Discussion and Conclusion

Suggesting that Washington has a diverse agricultural landscape is by no means a novel idea, nor is the notion that direct marketing has vital place and crop type specificities. Ostrom and Jussaume (2007) present these facts quite clearly when they conclude that to undertake the task of remaking the food system, a ‘one-model-fits-all’ approach is insufficient. Our results support Ostrom and Jussaume’s conclusion, while also bringing us closer to an understanding of the locally specific constraints and opportunities that must be considered in attempting to define sufficiently flexible models that seek to enable the remaking of a food system. We find that a globally oriented model, though producing significant results that appear logical, blurs the uniqueness of place that plays a substantial role in the outcome of a direct-to-consumer marketing decision by an individual producer. Additionally, the uniqueness of place, as demonstrated through GWR, has a mitigating effect on a producer’s outward expression (i.e., the market(s) they choose to participate in) of the factors considered to be important in the decision to farm organically. This observation has the tendency to be obscured by a binary thesis like conventionalization. Similar to previous studies (e.g., Coombes and Campbell, 1998; Hall and Mogyorody, 2001), Washington’s agricultural geography plays a pivotal role in the local feasibility of direct marketing venues.

Through the combined use of conventions theory and a locally specific regression model (GWR), this paper takes several steps forward in enhancing our ability to examine the local factors that influence marketing decisions. The three most important factors modeled here include whether or not producers have always farmed organically, as well as their emphasis on MI and CG factors as reasons to farm organically; each related to the agricultural history and
dominant cropping system of the producers’ locale. For instance, Washington ranked fifth nationally (over 123 million bushels) after North Dakota, Kansas, Montana, and South Dakota, in wheat production (USDA, 2010a); much of which is produced in the southeast region of the state. Of this production, 85 to 90 percent is sold to export markets (WSDOT, 2008). Similarly, Washington’s Columbia Basin and Yakima Valley regions are home to the largest apple growing region in the nation. Washington is ranked first in apple production with 2.7 million tons of apples produced in 2009 (USDA, 2010b).

Of particular importance in this study are the variables related to conventions theory. Significant t-tests for each (RID: \( t = -4.097, p<0.001 \); MI: \( t = 4.655, p<0.001 \); CG: \( t = -6.961, p<0.001 \)) demonstrate a difference in the importance of various justifications for those who participate in direct-to-consumer marketing and those who do not market directly to consumers. Taking the two justifications demonstrated to be significant in the GWR model in turn, we can first consider the constructed MI factor. It is of little surprise that this variable is negatively related to the likelihood of participating in direct-to-consumer marketing. The particularly compelling aspect of this factor, as visible in Figure 1, is the large effect high MI orientation has on those producers outside of the Yakima Valley specifically, and the central part of the state more generally. These results suggest that those producers outside of this highly export-oriented region have significant decline in their willingness to direct market as their market-driven justifications rise. Table 5 provides further possible explanation for this observation. Here, we can see that those producers who are located in the central counties of Washington are already substantially less likely to direct market to consumers than their counterparts to the east and west. They are also much more likely to be converts from
conventional farming. Given the already low numbers of producers who direct market for this reason, it is understandable that increases in MI justifications create less of a reaction than in other parts of the state.

**Table 5. Agricultural Statistics District Comparisons.**

<table>
<thead>
<tr>
<th></th>
<th>West n=109</th>
<th>Central n=97</th>
<th>East Central n=25</th>
<th>Northeast n=15</th>
<th>Southeast n=9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion who direct market</td>
<td>70.60%</td>
<td>41.20%</td>
<td>44%</td>
<td>93.30%</td>
<td>77.80%</td>
</tr>
<tr>
<td>Proportion who have always been organic</td>
<td>53.20%</td>
<td>27.80%</td>
<td>8%</td>
<td>100%</td>
<td>44.40%</td>
</tr>
<tr>
<td>Mean Market/Industrial (MI) score</td>
<td>3</td>
<td>3.27</td>
<td>3.59</td>
<td>3.02</td>
<td>3.33</td>
</tr>
<tr>
<td>Mean Civic/Green (CG) score</td>
<td>3.64</td>
<td>3.13</td>
<td>2.96</td>
<td>3.94</td>
<td>3.76</td>
</tr>
<tr>
<td>Mean Renown/Inspired/Domestic (RID) score</td>
<td>3.16</td>
<td>3.11</td>
<td>2.79</td>
<td>3.71</td>
<td>3.57</td>
</tr>
</tbody>
</table>


In terms of the influence of having higher degrees of CG ideals, Figure 2 displays a readily visible east-west divide. This does not imply that western Washington necessarily has producers with stronger CG ideals. What it does suggest, however, is the apparently readily available markets for these producers to engage in direct-to-consumer marketing compared to their eastern counterparts. This finding is in general agreement with those observations made by previous research (e.g., Jarosz, 2008). Jarosz identifies the progressive politics of a well-educated middle class of the greater Seattle region as a strong driver of social sustainability of rural landscapes and an engine of demand for organic produce grown close to home. As of 2010, Washington had nearly 170 farmers markets (Figure 3). Breaking the state down by its agricultural statistics districts, we see that the western district contains 65 percent of all the farmers markets in the state. Though the western district has the lowest per capita number of markets of any of the districts, it is important to recognize that many of the markets in the remaining four regions are small rural markets averaging fewer than ten vendors.
Figure 3. Washington State Agricultural Statistics Districts (ASD) and their associated farmers markets. (n = number of markets found in the region).
Additionally, it should be emphasized that even though eastern Washington on the whole does not yield as high estimates for the CG coefficient, they are nonetheless quite positive and significant, indicating a potential interest in engaging in direct marketing but potentially a lack of a market and consumer base to make such a venture worthwhile. The northeast district (Figure 3) has one of the highest percentages of small farms in the state, with greater than 97 percent of all farms classified as small farms (USDA, 2007). We also find that all fifteen organic farms responding from this region have always been organic, with very high average CG scores and all but one participated in direct marketing activity. These observations set the northeast district apart from the remaining districts in the eastern part of the state, which as described earlier have a much larger conventional agriculture presence with substantial export activity. The Northeast’s high participation in direct marketing may likely be a result of available market opportunities in the Spokane area, as well as their separation from the large export-based economies of the other eastern districts.

While this paper begins to provide justification for a more locally valid approach to understanding efforts to develop alternative food networks, it only takes into account one side of the agri-food system. Future research should seek to advance the findings here by investigating producer motivations as well as the consumer interactions that influence direct marketing decisions by producers. Additionally, future analyses would be well served to develop a means by which the entirety of agricultural ‘place’ characteristics, including regulatory structure and policy emphasis, can be incorporated. This would enhance our ability to characterize the observed differences in effects of changing opinions regarding each of the various conventions.
References


CHAPTER 2 - COUNTER-HEGEMONIC POSSIBILITIES: RECOVERING THE SPACES OF FOOD CONSUMPTION?

Abstract

The mid-20th century saw significant interest from economic geographers in the periodic peasant market place; however, that interest waned as it gave way to developed countries and their spatially fixed retail outlets. This paper revisits the previously developed rationale for market placement under a new, contemporary lens: that of farmers’ market locations intertwined in the developed world and its fixed retail. Previous research has documented the restructuring effects as local grocery stores that once served small communities are replaced by larger chain stores at further distances from these communities. This research utilizes the line of reasoning extending from Christaller’s original central place hierarchies: the Number-Average-Size rule. Central to this questioning is whether the ‘center’ level that can sustain a grocery store is climbing, thus placing increasing proportions of the population in disadvantaged positions of limited access to healthy food. Further, this research extends the conceptualization to the farmers’ market system that often portrays itself as an alternative ethic to the globalizing food system. This effort examines whether the discourse of local matches the ‘on the ground’ actions taking place, or whether farmers markets are following the same location decision strategies as the conventional food distribution channels they try to separate themselves from. The results from bivariate spatial point pattern analyses reinforce notions of the retail food system leaving multiple areas of Washington in effective food deserts and suggests farmers’ markets have a strong tendency to be located close to those retail outlets.

1. **Introduction**

In recent years, a growing body of literature has suggested that efforts to re-localize food networks have had an unbalanced effect when considering who benefits from the increased access to fresh produce (Guthman et al., 2006); these beneficiaries are largely of the metropolitan middle class (Jarosz, 2008). Price perception has been suggested as a culprit behind the low level of consumption by lower-income households of fresh and local foods. Others also suggest the consumption levels result from differences in social and cultural norms between those who do and do not consume local produce (Guthman, 2004), identifying food as a marker of social class (Johnston, 2007). Yet others suggest simply a lack of knowledge regarding the benefits of fresh, local food and the true costs of the conventional food system (Allen et al., 2003). Each of these observations are likely contributors. What is often overlooked however, is the relationship between where local sources of produce can be obtained, where lower-income neighborhoods are found, and the capacity of residents to traverse this distance. In a survey of California market managers, it was found that nearly 52 percent believed local demographics played an important role in the income distribution of their customers (Guthman et al., 2006). Observations of this type urge the question of whether farmers’ markets are located in much the same manner as other food outlets, and whether this perpetuates spatial mismatches with poorer communities.

The term ‘food desert’, used to identify poor areas with low access to healthy food, is becoming a common phrase in popular media as identified by several studies from the UK, Canada, and more recently the United States (Wrigley et al., 2002; Smoyer-Tomic et al., 2006). Several definitions of food deserts have been suggested in recent years and vary by country of
consideration, as well as whether the researchers examined rural or urban settings, but all are based on the interplay of poverty and accessibility (Morton and Blanchard, 2007; Larsen and Gilliland, 2008).

Despite efforts to provide quality representations of potential food deserts in many locales, the majority of such studies fail to include accessibility to farmers’ markets in these areas. The studies identified above generally utilize supermarket locations as the lone source of good food with convenience stores and fast food restaurants being the antithesis. However, several recent considerations have begun to consider the spatial relationships of local or healthy food venues, even enticing an entire issue dedicated to the topic in *Applied Geography* (e.g., Eckert and Shetty, 2011; Hubley, 2011; Kremer and DeLiberty, 2011). Additionally, the majority of the food desert research has stopped at the level of identifying communities or regions with high or low access and has fallen short of identifying the broader spatial patterns organization of retail food, namely supermarkets within a region as it relates to the location tendencies of industry at large. This current research expands upon the previous studies by taking the next step towards identifying a spatial structure, first with supermarkets as a component of a region’s industrial diversity, and then with a determination of whether farmers’ markets have an identifiably different distribution and thus the potential of filling the geographic gaps left by supermarkets. To identify the spatial structure, we first draw upon the literature and methods developed from Christaller’s (1933) central place hierarchies, specifically the application of the Number-Average Size Rule (Mori et al., 2008). Following this characterization, we step away from the economic centers framework for one that uses the
physical location points of supermarkets and farmers’ markets to create a continuous measure of the co-agglomeration of the two.

The remainder of the paper is organized into four sections. Section two briefly reviews the literature on the consolidation and concentration of retail food outlets (2.1), food deserts in Washington (2.2) as well as the response by local food movements, with particular attention to farmers’ markets (2.3) and their strong tendency to be today’s version of the periodic market. Following this review, we provide descriptions and analyses of the two models being utilized. The first model is based on Christaller’s Central Place Theory (3.1), followed by a second order analysis of co-agglomeration using the random labeling hypothesis (Diggle and Chetwynd, 1991) (3.2). We then tie the models and their outcomes together in the discussion (4).

2. Literature Review

2.1. Concentration in the Retail Food System

Richard Tedlow (1990) develops an historical perspective of the rise of the Great Atlantic and Pacific Tea Company (A&P) as an exemplification of the changing face of retail food outlets. Through the development of this perspective, a formulation of the mechanisms by which the present realization of the retail food landscape may be understood. Tedlow identifies several major contributors to the evolution of retail food in the United States. The first major event was the growth in chain stores near the turn of the 20th century. These new chains were, through their gained efficiencies, able to offer lower prices than their independent counterparts. The second stage in retail evolution came with the rise of the supermarkets which Tedlow estimates to be roughly five times larger in size than their grocer predecessors. The combination of these two activities allowed the new supermarket chains to capitalize on
both economies of scope and scale (Ellickson, 2007). Using Sutton’s (1991) exogenous fixed costs (EFC) framework, Ellickson demonstrates a model of supermarket competition in which in order to be, or remain, competitive the supermarket is pressured to provide ever wider arrays of products. This, he suggests, limits the number of firms that can profitably enter a market thus creating a concentrated industry, even in larger markets.

In 1993, the major retail food corporations accounted for roughly 20 percent of the food-at-home (FAH) retail sales in the US. By 2000, they accounted for greater than 40 percent and concentration (CR4) in any given metropolitan area exceeded 73 percent (Hendrickson et al., 2001). Since at least the early 1990’s, the traditional supermarket has seen its share of food sales slowly eroded as nontraditional retailers have increased their share of the FAH sales from 17.1 percent in 1994 to 31.6 percent in 2005 (Martinez, 2007). This heightened competition has resulted in consolidation and concentration contributing to changing relationships within the food marketing chain.

Not only have the large supercenters increased their share of the FAH, but the food-away-from-home (FAFH) market has grown to 48.5 percent of total food expenditures in 2005. These changing conditions have necessitated the traditional grocery retailers to respond through cost-cutting measures, product differentiation, or both. Much of this restructuring has come in the form of focusing on the most profitable stores in the most geographically beneficial areas (Martinez, 2007). With consolidation being a major response to these downward price pressures, one must wonder if the consumer inherently benefits. An examination of these consolidating activities finds that even where efficiency gains were realized, that cost savings were not always passed onto the consumer (Sharkey and Stiegart, 2006). This combined with
the identification that from 1992 to 2002, the number of grocery stores fell from 104,105 to 95,514 (Martinez, 2007). Considering only supermarkets (NAICS defined), these trends are further highlighted with the number of establishments falling from 69,461 in 1997 to 64,881 in 2007 nationwide according to the respective economic censuses. Previous research has documented the restructuring effects as local grocery stores that once served small communities are replaced by larger, chain stores located at further distances from these communities (Morton and Blanchard, 2007).

2.2 Response of Alternative Food Networks

Over the last several decades, development of ‘alternative food networks’ (AFNs) as defined by their ‘quality’ and ‘transparency’, has attracted significant academic and public attention as these networks seek to fill both the geographic and ideological gaps left by conventional systems of production and delivery (Sonnino and Marsden, 2006). A key characteristic in the development of AFNs is their re-spatializing of food into the ‘local’ such that quality is represented by the perception of being directly linked to local farming practices, rural nature, landscapes, and resources (Renting et al., 2003). Central to the nature of AFNs is the “belief that good food should be affordable, accessible and based on sustainable production methods. The organization cannot afford to lose money, but profits are secondary to these primary goals” (Johnston, 2007:107). AFNs seek to fulfill the promise of re-engaging the producer and consumer; however, direct buying and selling absent a middle man, or a refrigerated 18-wheeler, is not in and of itself counter-hegemonic. Local does not inherently imply absence of a profit maximization motive reminiscent of those creating the current state of agricultural production. It is simply another market avenue for consumers and producers to
exchange goods for money, unless it can reorient such markets toward a more just provisioning of human needs in a sustainable fashion. A just provisioning, a counter-hegemonic movement, suggests that a re-embedded market will ensure that nutritious food gathered in a sustainable and culturally acceptable way will be available to everyone, not just those that can afford it.

As efforts to re-localize the food system continue to flourish, a reflexive eye must be focused on the distributional tendencies, both spatially and temporally, of farmers’ markets. If claims of an alternative or counter ethic are to be substantiated, then the realizations of market location and timing should be carefully considered in relation to the distributional tendencies of the current system of food retail. Thus, this paper identifies whether farmers’ markets increase access to good food, or simply reproduce the gaps in access that already exist.

Realizing the impacts of high fixed costs on the concentration and location decisions of supermarkets, what can now be said about the rather distinctly different economic considerations of farmers’ markets? Are they able to deviate from the location patterns created by the more fixed retail of supermarkets and increase access to those underserved areas? Farmers’ markets in the 21st century can be readily compared to those periodic markets considered several decades ago by researchers interested in rural market activity. Stepping back a bit, we can seek to understand why periodic markets existed in the first place. Typically, periodic markets were a function of rural regions in lesser developed countries (e.g., Skinner, 1965). For the farmer, a periodic market was advantageous because of the demands of their diverse economic roles. They could not afford to spend all their time selling their product, and had to split time between production, harvest, selling, transporting to and from, and thus selling once a week proved to be advantageous. The basic models demonstrate that periodic
marketing will exist whenever firm threshold exceeds the range of the good (e.g., Bromley et al., 1975). Given the dual travel required for both producers and consumers, periodic markets were established at times convenient for both, and were located at sites of high centrality, accessibility, and proximity to other services. These observations can be extended to the periodic markets of today in that farmers involved in direct marketing must select a limited number of markets to participate in, as they still have diverse economic roles and are generally small and thus do not necessarily have a readily available workforce to staff many markets or permanent stands. As such, the individual farmer must make a decision on which market to participate. This is obviously not a simple matter of which market is closest. First and foremost all markets are not equal. Markets vary by timing and location, and thus the amount of through traffic they attract, and the type of clientele they bring in, in addition to the number of slots that are available. The number of slots available has at least two effects for a farmer to consider: (1) with more slots to be filled, the more other vendors that may have related products, thus increasing competition; (2) as the number of vendors increases, the attractiveness of the market to consumers increases (e.g., Hay and Smith, 1980).

Farmers’ market vendors have been shown to be generally more satisfied with markets in which there are more vendors and by needing to participate in fewer markets (Schmit and Gomez, 2010). Schmit and Gomez note that these observations place economically challenged, either poor urban or rural communities, at a disadvantage as far as garnering a viable market. Julie Guthman and colleagues (2006) have related this to the issue of squaring farm and food security. In light of the already slim margins that producers participating in direct markets face,
trying to account for food security issues may not be viable for them without some form of assistance.

Though farmers’ markets, market managers, and market vendors face a rather different set of economic considerations as do the larger fixed retail outlets, they nonetheless do face economic constraints of the locations where they may be viable. The question persists then, whether these differing constraints produce similar or different distribution patterns as is now evident in FAH distributions.

2.3 Food Deserts

Sage et al. (Forthcoming) established the presence and locations of food deserts in the state of Washington. They located food deserts in 10 of the 13 urbanized areas (UA) of the state via a criterion in which those tracts with poverty rates in excess of 20 percent and whose population weighted average distance to a grocer exceeded one kilometer were labeled food deserts. Within the state’s 13 UAs, 737 tracts out of the total 1004, were considered low access tracts, meaning their population weighted distance to a full service grocer (>50 employees) is more than a 1 km walk. Further, of the 104 identified high poverty tracts, 64 were also low access (62 percent). Sage et al. further considered the location of farmers’ markets in relation to their observed food deserts and found 16 of the 64 tracts to be within 1 km of a farmers’ market. The 16 tracts are spread throughout the state, with eight of the ten UAs having food desert tracts possessing at least one farmers’ market within walking distance.

Focusing on the potential of rural food deserts, Sage et al. (Forthcoming) identified 18 food desert tracts in the state. Recall that rural tracts cover much larger geographic areas than do urban tracts. Further, the identification strategy of a food deserts also changes when
considering a rural area. The poverty level threshold is maintained; however, the 1 km walk is no longer a useful measure and thus it is replaced by a 16.1 km (10 mi) drive. Refer to Sage et al. for a complete methodological description. The tracts identified as rural food deserts were found to have a population weighted average distance from a grocer of almost 48 km (30 miles), considerably higher than the threshold distance for the designation. When adding in the consideration of farmers’ markets, access is improved in 13 of the 18 tracts resulting in an average distance of 30.7 km (19 miles), though still in excess of the food desert determination. As of 2010, Washington 38 rural farmers’ markets were in operation, and three were in identified food deserts. While several food deserts are at least partially alleviated by the presence of a farmers’ market, many still face rather limited access to good food. This observation suggests some progress has been made, though does not yet provide strong support for a different locational tendency. This is systematically explored further in section three.

3. Models

With these trends at the heart of the matter, the impetus for this research begins to arise. Previous research has documented the restructuring effects that are occurring as local grocery stores that once served small communities are replaced by larger, chain stores at further distances from these communities (Tedlow, 1990). However, limited attention has been paid to the theoretical foundations that produced the observed structure of site location in the first place as it is nested within the larger industrial structure of a region. This research fills this knowledge gap in two stages. First, we extend the line of thought originating from the original central place hierarchies developed by Walter Christaller in 1933 by testing whether the
empirical regularities of the Number Average Size rule (NAS) observed by Mori et al. (2008) in Japan are present at the Washington state level in the US. Next, we carry forward the information gained from the NAS models to consider the point pattern relationships between conventional retail food locations and farmers’ markets. To test these patterns, we consider their adherence to co-agglomeration and the random labeling hypothesis.

3.1 Central Place Hierarchy and the Number Average Size Rule

The effects of retail food consolidation and concentration are likely to have an uneven impact across space. The USDA has undertaken an ambitious effort to characterize the food environment nationwide, down to the level of an individual county, and while revealing in the magnitude by which we can picture what has taken place in recent decades, we still lack an understanding of how the phenomena emerged. Similar critiques have been leveled at Christaller’s central place theory (Fujita et al., 1999). The current research moves past simple descriptions of the present state to motivate both of these lines of inquiry towards explanations of structure. This progression can be envisioned through a theoretical spatial market and hierarchical perspective in which we suggest that as a given retailer grows, so too does the threshold it needs to profitably operate. Threshold refers to the minimum level of demand needed to ensure survival of a producer or retailer (Lloyd and Dicken, 1977). Likewise, as this retailer grows in both size and amenities offered, it should be observed that their range, the maximum distance a consumer will travel, increases as well. We can further speculate that as this occurs, those other retailers that originally occupied the region may no longer be able to compete with the growing retailer in either costs or a differentiated product or both. This often necessitates an altering of their strategy or exit the market altogether (Martinez, 2007).
result repeats itself across a country, or other given region of study, it can be demonstrated that the function of “grocery store” must now be provided by a higher order center than in previous decades. O’Brien (2008) found evidence from rural Iowa to suggest that in 2000 the average population required to maintain a grocery store was over 2,800. In 2005, she suggests this requirement has risen to over 3,200. To compound the issue, this rising requirement runs counter to the declining population numbers of many rural towns (Bailey, 2010). Subsequently, many of these rural centers can no longer support a grocery store and thus their residents must travel further to a larger center to obtain food. Central, then, to this line of questioning is whether the ‘center’ level that can sustain a grocery store is increasing in a manner consistent with the hierarchy principle and thus the NAS rule.

To develop an understanding of the center level from which “grocery stores” now function, we begin from a similar premise as that of Mori, Nishikimi, and Smith (2008) in their consideration of industrial distribution throughout Japan. Given this premise, we largely duplicate their methods with some deviation and with a focus on what the general industrial distribution in Washington means for retail food distribution specifically, if anything. Mori et al. began with the objective of attempting to encapsulate any empirical regularity in the locational patterns of Japanese industry and are able to show a significant negative log-linear relation between the number and the average population size of metro areas in which a particular industry is present. They assign this relationship as the Number-Average Size Rule (NAS), and further demonstrate its consistency with Christaller’s Hierarchy Principle. Our research

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7 By duplicating Mori, Nishikimi, and Smith (2008) we not only gain for ourselves a model that has been demonstrated to provide strong indications of empirical regularities, but we also contribute to the overall development of the model by providing a test of NAS in a different geographic region and with an alternative geographic scale of an ‘economic city,’ thus adding to the robustness of the model.
establishes whether these same observations hold in the state of Washington. Mori et al.’s work was conducted on a national scale, and as such took advantage of the Japanese version of the US’s core based statistical areas (CBSA); however, given that the present analysis is conducted in a single state and with the specific interest of obtaining a finer degree of detail of industrial distribution, we break the ‘economic city’ down to a smaller scale, and identify them as economic centers.

3.1.1 Data and Measurement: Industrial Regularities of Washington

The Economic Center: The underlying task in the creation of economic centers within Washington is to identify an appropriate set of hierarchical centers, and thus enable an evaluation of the applicability of the hierarchy principle. An identification of an appropriate measure of a center is not necessarily a straightforward endeavor. Setting the level of aggregation too high tends to blur the geographic variability within the spatial units. For example, assigning spatial units in a similar fashion to that of Mori et al. (2008), discrete spatial units derived from the US census’ CBSAs would be used resulting in Figure 4. However, as evident from the figure, problems arise with this characterization as the void areas go unaccounted for in such an analysis. Additionally, this scale is too large in that our major concern here is to describe the access variation of communities to food sources, and this scale masks this variation.

An alternative representation of a set of hierarchical centers could be the use of the Census designated places in the state; however, this representation overly atomizes the state without providing a reliable means to characterize economic interaction. Additionally, data availability is not readily accessible at this fine of geographic scale. Thus an intermediate scale
needs to be produced that not only incorporates the entirety of the economic actors of the state, but also provides a solid representation of which parts of the state act as an economic entity. To achieve this, we assign the ‘economic center’ to be aggregations of zip codes. Those zip codes that are associated (contained in or whose boundary is crossed by) with a specific Urban Area (UA) will be assigned to that UA, and all those unaffiliated with an UA will be aggregated by common Post Office name (Figure 5). This method allows for the inclusion of all zip codes in Washington, while not adhering to overly artificial administrative city limits, but still allows for analysis at a level for which there are sufficient data rendered from the zip code business pattern data (ZCBP). The artificiality of city limits is particularly relevant when considering rural populations and industry as many of the residents and business do not reside within the official boundaries of the city and thus may be missed if not considering the whole zip code. By using the spatial units shown in Figure 5, a set of 386 distinct economic cities is created. Fourteen of these cities are created based on UA’s, while the remaining 372 are based on aggregate zip codes.
Figure 4. Washington State Core Based Statistical Areas.

Figure 5. Economic Cities of Washington (plus buffer into Oregon, and Idaho).
Industry Choice Centers: Using the 2008 Zip Code Business Pattern (ZCBP) data set for all zip codes in Washington, in addition to those within a 20-mile buffer into Oregon and Idaho, this paper establishes a presence (1) or absence (0) indication for all 3-digit NAICS industries (n=85) in addition to a full 6-digit NAICS for supermarkets that is additionally broken out to identify full service supermarkets, those with at least 50 employees. These zip code present or absent indications are then aggregated to the economic city to establish industry-choice centers for each industry. Mori et al. (2008) define an industry-choice center as any center in which positive employment exists. It is important to recognize here that this paper is limiting industry choice to present or absent and thus gives no indication of the level of activity of any given industry in any given center.

3.1.2. Results: Number Average Size Rule

Mori et al. (2008) empirically demonstrated the NAS rule for the entire nation of Japan and in their closing suggest the need to examine the rule on a variety of regional scales, and in other nations. This paper does just that and begins to offer supporting evidence as to the robustness of their findings. Figure 6 displays the log-linearized relationship between the number (IndChoice) and average size (AveSize) of industry choice centers. The results produce a very strong log-linear relationship:

\[
\log(\text{AveSize}) = 15.224 - 0.884\log(\text{IndChoice}), \quad R^2 = 0.9990 \quad (\text{Equation 1})
\]

These findings suggest that as the degree of localization of an industry decreases, measured as an increase in the number of industry choice centers, the average size of the

\(^8\) Standard Errors for the constant and independent variable are 0.01373 and 0.00304 respectively. Both coefficients are significant at at least the one percent level, with the P-values being essentially zero.
center also decreases. Note that the relationship does not suggest causality, only relatedness. What this observation further suggests is the tendency for a highly localized industry to locate in larger centers. This notion can be understood as a direct extension from the original principles set out by Christaller’s Hierarchy Principle, as it reinforces the assertion that industries found at one center will also be found at higher centers (Christaller, 1966). Three increasingly specific components of the FAH industry are additionally highlighted in Figure 6. Following standard NAICS classification, the 445 enumeration is the most general of the three categories in the figure. The 445 designation includes all food and beverage stores (Supermarkets, Convenience Stores, Specialty Food Stores, Fish and Seafood markets, etc.), while the 445110 includes only Supermarkets and other Grocery Stores, excluding convenience stores and is independent of employee number. The most specific classification includes only those from the 445110 classification with at least 50 employees. The figure demonstrates that as one moves closer to what has been considered full service grocers (Morton and Blanchard, 2007; Schafft et al., 2009), the number of industry choice centers decreases, while the average size increases.

To reinforce the observations above, we can refine the hierarchy definition in a more regionally structured form. Figure 7 provides a glimpse of the industrial diversity of centers in relation to their populations as summed from their 2000 Census block populations. Though not as tight of a log-linear fit as Figure 6, it nonetheless produces an $R^2$ of 0.7209.

$$\log(\text{IndDiv}) = -1.0473 + 0.512\log(\text{PopSize}), \quad R^2 = 0.7209$$

(Equation 2)
Figure 6. Size and Number of Industry-Choice Centers.

![Graph showing the relationship between the log of the average size of industry-choice centers and the log of the number of industry-choice centers.]

Figure 7. Population Size and Industrial Diversity of Centers.

![Graph showing the relationship between the log of industrial diversity and the log of the population size of centers.]

Additional support for the relationship between industrial diversity and population size rankings can be taken from Spearman’s rank correlation that results in a rho of 0.9215, showing strong agreement with Figure 7.

Given the positive results of the figures above, we can continue with the argument developed by Mori et al. (2008) and redefine the Hierarchy Principle in terms of industrial diversity. This redefinition stipulates that an industrial pattern will satisfy the Hierarchy Principle iff industries found in a given center are also found in all centers with diversities at least as large. Figure 8 creates a visual depiction of the empirical realization of industrial location in Washington State.
Figure 8. Industrial Location Based Hierarchy Principle.
Figure 8 provides itself for a cumbersome interpretation; however, its results are rather impressive. Each center in the study area is represented along the horizontal axis in rank order by the number of industries present, its industrial diversity. With this ranking, both Seattle and Portland (recall that border centers along the OR and ID boundaries are also included) have industrial diversities of 85 and are thus found to the right most of the graph. In other words, both Seattle and Portland possess every feasible industry. Moving horizontally closer to the origin, center’s industrial diversity decreases. The vertical axis is a rank order of the number of industry choice centers. Those industries that are ubiquitous throughout the study area’s centers (lower-order industries) find themselves at the top of the figure, while those having only a small select number of centers in which it locates (higher-order centers) are closer to the origin. With this understanding of the axis meaning, each “+” represents the occurrence of a center of a given column possessing an industry of a given row. Readily evident now is the tendency of the figure to become sparser closer to the origin. This can be interpreted as most higher-order industries are not locating in centers with low diversity. These observations are highly suggestive of adherence to the Hierarchy Principle. To test this observation, Mori et al. constructed a hierarchy-share statistic to confirm the statistical significance of the general observations seen in the figure. Using this statistic, we find the hierarchy share of industrial location in Washington to be 0.365. The hierarchy share measures the degree of closeness to the hierarchy principle, where the share ranges from 0 to 1, with 1 being perfect adherence. Our empirical observation of 0.365 is significantly higher than the 0.013 (standard deviation of 0.017) obtained from patterns of 1000 randomly generated simulations. There were no random
simulations that exceeded a hierarchy-share of greater than 0.12, less than half of what was empirically demonstrated.

3.2 Co-Agglomeration and the Random Labeling Hypothesis

The above analyses, though mostly aspatial in nature, suggest that industry within Washington has varying degrees of geographic structure, largely consistent with the Hierarchy Principle. The utilization of techniques to formulate the NAS rule, while giving a strong indication of the center level at which a particular industry may occur, does not provide the necessary information to indicate the location decisions of retail food and its presumed counter, farmers’ markets, within a center. This is particularly relevant for larger centers such as Seattle, which intuitively hosts the most functions within the state, and very likely multiple components of that function. Given that the objective of this paper is to identify constraints to accessing nutritious and healthy food, attention is now directed towards digging into specific physical realizations of site location decisions. Literature and methodology from the consideration of industrial agglomeration allows us to observe tendencies of cluster formation and persistence within both the retail food sector, and farmers’ markets. Understanding whether and how clusters of markets form is of substantial interest within academia and for policy makers and food advocates.

Industrial agglomeration studies have tended to flow from the early considerations identified by Marshall (1890), who suggested that positive externalities arise by plants locating near like plants. These externalities, Marshall suggests, are founded on reduced costs due to proximity to suppliers and customers, increased access to a local and specialized labor market, and from knowledge spillovers from other plants (Devereux et al., 2004). Further, new
economic geography literature stemming from work by Fujita et al. (1999) ties industrial agglomeration to transport costs.

The studies cited above focus on the determinants of agglomeration as they relate to supply side effects, which also impact food retailers. However, they are also likely driven by somewhat different externalities that arise by clustering near other like retail activities that aid in capturing advantages related to consumers’ shopping behavior (Berry and Parr, 1988). Market access effects for both consumers and suppliers tend to encourage agglomeration and increase as transport cost increases (Takatsuku and Zeng, 2009).

The original question of whether farmers’ markets improve access to residents already disadvantaged by the location of supermarkets can be answered by means of determining whether supermarkets serve as an attractant or dispersant of farmers’ markets. If the history and evolution of the retail food industry has indeed produced inequality in access to healthy and nutritious food, we should be able to identify a locational pattern that suggests agglomeration or dispersion of supermarkets. Section 3.1 has already demonstrated the likelihood that full service (50 employees or more) grocers are not readily located in smaller centers. Similarly, if it can be demonstrated that farmers’ markets possess the same distributional tendencies, then it can be suggested that they are perpetuating the access discrepancies already felt in the traditional retail food industry.

3.2.1 Data and Measurement

Several mechanisms have been developed to consider the geographic tendencies of industries. Arbia et al. (2008) identify a series of indices they characterize as measures based on the distribution of activity over discrete geographic units. The first of these indices is based
on variants of the Gini coefficient (Krugman, 1991; Amiti, 1998), while the second accounts for space and seeks to control for underlying industrial concentration (Ellison and Glaeser, 1999; Maurel and Sedillot, 1999). However, Arbia et al. (2008) argue that these types of indices tend to neglect the problem of arbitrariness of the geographical scale or partition employed.\footnote{These are indeed scale issues addressed in section 3.1 as we did utilize discrete geographical areas (the ‘economic city’). These areas were necessitated by the ready availability of data for all industries at the zip code level as compared to the precise locations we have for this section.} To overcome the discrete nature of using geographic units (e.g., counties, zip codes, census tracts), and the aggregation errors that may arise as a result, industry locations can be conceptualized as the realization of a point pattern process. Duranton and Overman (2002) suggest the usage of points (e.g., physical location of a supermarket) such that a continuous measure of location may be modeled that avoids aggregation errors. From the point process realization, the average number of events per unit area, the intensity ($\lambda$), may be determined, given we know the domain ($D$) in which the points may occur (Schabenberger and Gotway, 2005). In general consideration of the behavior of point patterns, a test for complete spatial randomness (CSR) may be conducted in which one seeks support suggesting that $\lambda$ is homogenous throughout $D$, and the events are Poisson distributed. However, in many cases it is readily apparent that CSR will be easily rejected. Such will be the case when considering the population of a state like Washington. As we have already seen, the population is highly concentrated in the greater Seattle area with other smaller centers and large rural swaths spread throughout the state. Thus any consideration of CSR will not lend any valuable conclusions that are not already obvious, though it does provide a quality starting point for more detailed consideration. K-functions (Ripley, 1976) also known as a reduced second moment measures (Cressie, 1993),
have been repeatedly used for their simplicity in identifying clustered or regular events and is represented as:

\[ K(r) = \lambda^{-1}E\{\text{Number of points falling at a distance } \leq r \text{ from each point}\} \quad (\text{Equation 3}) \]

where \( r \) is an arbitrary distance from an event and \( \lambda K(r) \) represents the expected number of additional random points within radius \( r \).

Arbia and Espa (1996) introduced the use of K-functions to economic analysis. In this paper, we utilize the later adaptation made by Arbia et al. (2008) in which they consider a bivariate distribution of clustering identification. This adaptation allows for the consideration of the spatial relationship between two types of points within a study area. In particular, we make use of the bivariate K-function to attempt to highlight Devereux et al.’s (2004) definition of co-location and consider whether there are grounds to suggest the presence of positive externalities between supermarkets and farmers’ markets. One example of the manifestation of a positive externality created by supermarkets that benefit farmers’ markets is the creation of high volumes of potential consumers who may choose to patronize a farmers’ market because of its convenience in relationship to other retail or recreational activities.

Arbia et al. (2008) suggest the bivariate extension of the K-function as a means to describe spatial clusters of pairs of firms. They, like Diggle (2003), form a pair of testable hypotheses that form a base from which to identify null models regarding the behavior of pairs of points; spatial independence and random labeling. Under spatial independence, the null hypothesis suggests the random field generating the location of points of type-\( s \) (say supermarkets) is independent of that generating the location of type-\( f \) (farmers’ market) points.
(Lotwick and Silverman, 1982). Using supermarkets and farmers’ markets as our two firm types \((s,f)\), we can consider a circle of radius \(r\) about an arbitrary type-\(s\). If within \(r\), we observe the occurrence of more type-\(f\) than would be expected under the null of independence, then positive dependence is indicated, suggesting agglomeration. Alternatively, where fewer type-\(f\) are found within \(r\) of an arbitrary type-\(s\), we observe inhibition (Arbia et al., 2008).

A second potential formulation of a null hypothesis is that of random labeling. This formation does not depend on CSR (Diggle, 2003) and is based on a null hypothesis suggesting that each event is equally likely to be a type-\(s\) or -\(f\). Here the events arise from a single point process and a second process gives rise to the determination of event type (Schabenberger and Gotway, 2005). Under this null hypothesis:

\[
K_{ss}(r)=K_{sf}(r)=K_{ff}(r)=K(r),
\]

(Equation 4)

where the bivariate \(K\)-function is defined as:

\[
K_{sf}(r) = \lambda_f^{-1}E \left\{ \text{Number of points of Type } s \text{ falling at a distance } \leq r \text{ from an arbitrary Type } f \text{ point} \right\}
\]

(Equation 5)

If within \(r\) about a point \(s\), there are more type \(f\) points than expected under the null, then

\[
K_{sf}(r) > K(r),
\]

(Equation 6)

and we could consider the two types to be positively dependent, revealing a presence of agglomeration (Arbia et al., 2008). Inhibition is observed where the opposite is true. Diggle and Chetwynd (1991) operationalized departures from the null of random labeling through a computation of pair-wise differences between the various bivariate \(K\)-functions in comparison to simulated confidence intervals created by shuffling each point’s identifying mark (either \(s\) or \(f\)).
The importance of performing an analysis under the appropriate null hypothesis should not be understated, as the spatial independence and random labeling nulls lead to rather distinct interpretations. The two are equivalent if and only if $s$ and $f$ are events of Poisson processes. Reasonable arguments can likely be made to utilize either of the nulls suggested here for consideration of the association between the location of supermarkets and that of farmers’ markets; however, with similar reasoning as that of Diggle and Chetwynd (1991), it seems apparent that that unevenness of the population across a state should lead to the use of the random labeling hypothesis in this analysis. Subsequently, the remainder of this section will proceed with random labeling as the null model. This null implies that events to be labeled as $f$ represent a random thinning of the full set of unlabeled events consisting of both $s$ and $f$ (see Diggle and Chetwynd (1991) for a complete examination of the hypothesis and tests of significance). Marcon and Puech (2003) similarly implemented the random labeling hypothesis to consider a population of cases, firms belonging to a particular sector, as compared to the control of all other manufacturing firms.

The supermarket location database is populated using a dataset from ReferenceUSA (exported Fall 2010). The complete dataset includes 3812 retail food sources ranging from Supermarkets down to Convenience Stores. From this original set, all retailers whose primary or secondary designation aligned with what could reasonably be considered a major food retailer was designated a ‘grocer’. These designations include, but are not limited to: Grocer-Retail, Department Store (e.g., Fred Meyer), Grocer-Wholesaler, and Wholesale Club (e.g., Costco). All designations not meeting the established requirements were designated ‘non-grocers’. In addition, those potentially meeting the correct designation, but having fewer than
10 employees were also designated as ‘non-grocers’. Spot checks of those establishments not meeting the 10 employee threshold showed them to be more like convenience stores than grocery stores. The grocer designees were further segmented by employee size with the creation of three categories: >50 employees, >20 employees, >10 employees. Spot checks of the data and consultation with the data generating firm have been conducted to verify the reliability of the data. The initial analysis is conducted using the subset of grocers that meet the 50 employee cutoff. Discussion of the ramifications of relaxing the employee cutoff to the smaller store size levels will be addressed in the concluding remarks of the paper.

Washington’s collection of farmers’ markets is increasing yearly, with the large majority being centered in the vicinity of the greater Seattle area; 57 out of the total 169 markets. We have collected and maintained an accurate database of market locations and operating hours for these markets and continue to update it as new markets come on, move, or fail. Using this dataset of markets, sites were geocoded in ArcGIS to the most accurate level feasible. In the 2010 market season, 169 markets were in operation throughout the state. Unlike supermarkets and other permanent sites of retail activity, a farmers’ market may move year to year. This is especially true for the lesser or non-established markets as they seek out the most suitable site for their market. With such uncertainty and variability in market locations, all attempts were made to geocode the sites to the most recent market location that corresponds to the location of the market during the time period approximately the same as when the grocer data was rendered.

Most markets are able to be geocoded to their exact address or block; however, some small rural markets (n=4) do not have accurate enough available information to do so and thus their markets are located at the geographic center of the town. Given the small size of these towns, little error should be expected.
3.2.2. Results: Locating Farmers’ Markets

The previous discussions related to Washington’s industries in relation to the Hierarchy Principle demonstrated the rather structured form of industrial location about the state’s economic centers and their relationship to the population of the centers. With this already understood, the bivariate K-functions under the null of random labeling allows an examination both between and within centers. The analysis domain remains that of the entire state, in which we find 504 supermarkets ($n_s$) and 169 farmers’ markets ($n_f$), for 673 total points ($n$). By dividing $n$ by the area of the state ($A=71300\text{mi}^2$ or 22 units$^2$), we calculate an average intensity ($\lambda=n/A$) of 30.6 points per square unit. Supermarkets produce an intensity of 22.9, while farmers’ markets come in at 7.68. The distribution of all points is shown in Figure 9 below, alongside a randomly generated set of 673 points for comparison. Clustering is readily visible.
Figure 9. Distribution of unmarked Farmers’ Market and Supermarkets in Washington. (a) Empirical realization; (b) Randomly generated distribution.
The initial question to answer is whether the realized process in frame (a) of Figure 9 deviates from a random location pattern, such as that of frame (b) to an extent to suggest clustering of the points. To establish whether this deviation exists, we use second-order properties to construct the distance relationship between pairs of points, independent of whether it is of s or f mark. Figure 10 depicts the departure of the point process from complete spatial randomness (CSR). All estimated K-functions fall well above the theoretical Poisson distribution which could be expected from a distribution found in Figure 9b. Thus, what appeared to be visually obvious is confirmed, in that the points are indeed significantly clustered.
**Figure 10.** K-Function of all points in the domain. (iso=Ripley isotropic correction estimate of K(r); trans=translation-corrected estimate of K(r); border=border-corrected estimate of K(r); theo=theoretical Poisson K(r).) (r ≈ 57 miles)
Having now established that the observed point pattern observed in frame (a) of Figure 9 is indeed clustered, we now turn to establish whether the points marked as $f$ can be considered to be conditionally independent and identically distributed to those marked $s$. In other words, do the 169 farmers’ markets represent a random thinning of the 673 unmarked points? First, consider the visual relationship between the two point patterns in Figure 11. The point patterns appear, at the scale of the entire state, to be very similar. Using the Random Labeling Hypothesis, repeated simulations of which points are marked $f$ are conducted, holding the physical points fixed. These repeated simulations thus test the null hypothesis that the $f$ marked points are a random thinning of the entire set of points. Figure 12 displays the results of this random labeling test, with the gray area representing the envelope of the random reassignments. Where the observed distribution falls within the gray area $(K_{fs}(r) = K(r))$, the random Labeling Hypothesis is accepted. When the observed distribution rises above the envelope $(K_{fs}(r) > K(r))$, indication of positive dependence is indicated between the two point types. Repulsion or inhibition $(K_{fs}(r) < K(r))$ is indicated when below the envelope. From Figure 12, it can be observed that the random labeling hypothesis should be rejected at all $r$, with indication of positive dependence. As a result, farmers’ markets can be considered to be located closer to supermarkets at all distances than would be expected if we could not differentiate between point types.
Figure 11. Split distribution of farmers’ markets (f) and supermarkets (s).
Figure 12. Test of Random Labeling.
4. Discussion

4.1. Industrial Structure

The exercise described in section 3.2 allows for the consideration of the observed distributional tendencies of industry in Washington. From this, insight can be gained as to what this particularly means for the retail food industry. We can now consider if there exists a ‘center’ threshold below which a supermarket is no longer likely to be sustainable, or even currently be provided. Also, a basis can be established from which the accessibility effects of a concentrating retail food industry may be considered. Figure 6 highlighted where food retailers of varying size fit within the overall characterization of NAS. The NAICS code 445 includes all retail food outlets, from the largest supermarkets down to the smallest convenience stores. This point is observed to fall near the lower right side of the distribution of all industries, providing an indication that retail food in its entirety is a low order function that may be effectively provisioned from many center levels, and is so from 69 percent of them. These food outlets are found in the sixth most number of centers of any industry. As we move towards a more specific NAICS of 445110, which does not include the convenience store, we can observe a movement up and to the left along the distribution. This movement indicates not only a reduction in the number of centers that provide the function, but also that those centers that dropped out tend to be smaller on average. Further movement up and to the left can be observed as we consider the grocers with at least 50 employees. By the time the function of offering full service grocery functions is considered, the number of centers with positive presence has been reduced to 77. Using the NAS rule, we demonstrated that Washington’s industrial distribution very nearly follows that of what could be considered the upper bound
(Figure 6). The upper bound of NAS can be considered the perfect scenario in which industries without exception locate in the centers with the greatest population. For example, an industry that has ten industry choice centers locates in the ten largest centers of the region. This near adherence to the upper bound suggests little intrastate freedom of industrial locations independent of the pervasiveness of an industry. In other words, an industry with two industry-choice centers is just as likely to hug the upper bound as is an industry with 100 industry-choice centers. Additionally, recall the realization of a hierarchy share of 0.365 for industrial location as a whole in Washington. Narrowing the calculation to just the food retailer (NAICS 445) events produces an increased hierarchy share of 0.402, indicating that this particular industry falls more closely in line with the Hierarchy Principle than does industry as a whole. Further narrowing the calculation produces a Hierarchy Share of 0.532 when considering only those grocers and supermarkets with at least 50 employees. Only seven industry classifications possess higher hierarchy shares than does this supermarket group.

Though not examined in detail here, the direct implications of a concentrating and consolidating FAH sector may contribute to the findings above and should be further examined. Large grocery chains such as Albertsons, Safeway, QFC, and Fred Meyer—as well as retail chains such as Wal-Mart, Costco, Walgreens, and Target—have the majority of Washington’s market and operate regional distribution centers to service their stores. In the Seattle area, Safeway (29.5 percent), Albertsons (9 percent), the two Kroger chains, QFC (14.6 percent) and Fred Meyer (10.1 percent), and Wal-Mart (8.2 percent) combine for more than 70 percent of the
market.\textsuperscript{11} Safeway’s northwest distribution centers service 155 stores in Washington.

Albertson’s serves 53 stores in the Seattle market and 73 statewide. Costco has 27 stores statewide. Kroger’s QFC and Fred Meyer combine to operate 122 stores. There were also 27 Wal-Mart Supercenters as of the summer of 2010, with more coming into the market since.\textsuperscript{12}

4.2 Co-Agglomeration

The primary objective of this paper sought to use spatially informed methodologies to determine whether potential food deserts throughout Washington State, both in urban and rural settings, may be considered to be systematically alleviated or potentially exacerbated by farmers’ markets. We first identify, via K-functions, that supermarkets are indeed clustered within the state; an obvious result when viewing Figure 11\textsuperscript{s} in addition to the results suggested by NAS. Drawing from Sage et al. (Forthcoming), we know that this clustering has produced identifiable food deserts in 10 of the state’s 13 urbanized areas. Using bivariate K-functions under the random labeling hypothesis, we examined whether the point distribution of farmers’ markets could be considered a random thinning of all the points considered (supermarkets and farmers’ markets together), or whether they may be considered to agglomerate about supermarkets or be dispersed by them.

Conceivably, for the point pattern distribution of farmers’ markets to systematically deviate from that of the supermarket distribution and enable a suggestion that they may be contributing to alleviating food deserts, they would need to demonstrate repulsion from the


\textsuperscript{12}Numbers based on infoUSA database from September 2010.
supermarket points at all radii considered in Figure 12. Repulsion would suggest a tendency to locate in areas not currently served by supermarkets, whether urban or rural. This is not observed in Washington. In fact, at all distances, we observe just the opposite. At these distances, effectively within a center, urban area, or even larger geographic scales, farmers’ markets are attracted to the locations of supermarkets. By attraction, we imply that for a given radius about any arbitrary supermarket, we find proportionately more farmers’ markets than other supermarkets. This observation takes into account their respective densities.

5. Conclusion

It would be an overgeneralization to suggest that farmers’ markets do not deviate from traditional supermarket location tendencies and are never able to step in and aid in alleviating food deserts. In fact, there are several very successful markets, mostly urban, that are found in or near food deserts; however, these tend to be the exception as opposed to the rule. Recent studies have questioned and explored the potential for “win-win” scenarios in producing both farm and food security (Allen, 1999; Hinrichs and Kremer, 2002; Guthman et al., 2006). Guthman et al. (2006) explicitly asked whether it is possible to simultaneously provide fresh, nutritious food that is affordable to low-income consumers while providing adequate returns to small-scale, sustainable farmers via farmers’ markets. They find that farmers’ markets do not in and of themselves create an economic win-win for producers and low income consumers without additional directed effort. We find general support for these previous observations in that the location of markets throughout the state appears to be agglomerated about supermarkets. This agglomeration suggests these types of locations are advantageous for the markets and their vendors, as well as many consumers; however, it also suggests that those
consumers who are geographically left disadvantaged by the current supermarket locations, remain so under the more localized venue of farmers’ market. Thus, despite the altered ethic of food distribution, perpetuation of access inequalities continues. A large majority of farmers’ market vendors participate in only one or two markets per week, making selectivity of which market they attend a critical decision. Schmit and Gomez (2011) have shown that vendors are generally more satisfied with markets in which there are more vendors and by needing to participate in fewer markets. We have demonstrated growing support for observations like that of Schmit and Gomez and provide a mechanism for understanding just why economically challenged, either poor urban or rural communities, face an uphill battle in garnering and supporting a viable market.
References


Sage, J.L., McCracken, V.A., Sage, R.A., Forthcoming. If you build it, will they come?: Assessing accessibility influences on low income consumer participation in farmers’ markets.


CHAPTER 3 - IF YOU BUILD IT, WILL THEY COME?: ASSESSING ACCESSIBILITY INFLUENCES ON LOW INCOME CONSUMER PARTICIPATION IN FARMERS’ MARKETS.13

Abstract

Pressures of the globalized food system have left many communities and individuals in precarious situations in which nutritious and accessible food is not a given. Research has begun to suggest that re-localization efforts will not inherently alleviate these trends without directed efforts to produce exchanges that enhance both food and farm security. Through an extension of the conventional visualization of ‘food deserts’, this paper expands the concept to include farmers’ market accessibility. This expansion allows for a better understanding of the challenges that exist for such markets, given their constrained spatial characteristics. Such knowledge can be used to improve the effectiveness and efficiency of delivery of federal food assistance programs through local food channels. This paper accomplishes these goals by operationalizing ‘food deserts’ in the state of Washington and identifying the effects of the location of WIC FMNP participating farmers’ markets in relation to their clientele on redemption rates and ultimately the ability of these programs and farmers’ markets to combat food insecurity.

1. Introduction

Farmers’ markets have, largely over the last decade, become an increasingly important institution within community development, food security, and health (Young et al., 2011; Briggs et al., 2010). The recognition of this value can be witnessed in the exploding numbers of markets cropping up throughout the United States; more than 7,000 markets operated in the 2011 season (USDA-AMS, 2011). As increasing evidence to the relationship between diet and various health indicators like cardiovascular disease, obesity, and other chronic diseases builds, the promotion of farmers’ markets and other local outlets has been proffered as a means to increase consumption of fruits and vegetable (Larsen et al., 2009). However, as this rapid growth continues, several studies have indicated disparities in participation by low-income communities, as many of the beneficiaries of the relocalization movement are of the metropolitan middle-class (e.g., Jarosz, 2008; Kremer and DeLiberty, 2011). This suggestion of a spatial disparity in access to such healthy food choices is reminiscent of arguments made in regards to food and other amenity access in general, as an effect of the reduction or elimination of urban amenities that reached what some would say is a low point in the 1980s with net losses of supermarkets in cities while net gains were experienced nationwide (Eisenhauer, 2001), mostly in the suburban regions of metropolitan areas. However, in the case of farmers’ markets it may be the failure of thriving markets to arise in such communities. Briggs et al. (2010) suggest low-income communities provide unique opportunities for direct marketing, but with that come economic, social, and even cultural barriers to successful operation. Schmit and Gomez (2011) found among vendors at farmers’ markets in upstate New York that vendors prefer to sell in a limited number of farmers’ markets, thus supporting efforts
to centrally locate markets that provide more convenient locations with ample customer base. They further indicate that such markets contribute to vendor performance and thus vendor satisfaction with the market.

It is within conclusions such as that of Schmit and Gomez (2011) in which concerns over the ability of a relocalized food system to balance food and farm security arise. Recent studies have begun to question and explore the potential for “win-win” scenarios in producing both farm and food security (Allen, 1999; Hinrichs and Kremer, 2002; Guthman et al., 2006). Guthman et al. (2006) explicitly ask whether it is possible to simultaneously provide fresh, nutritious food that is affordable to low-income consumers while providing adequate returns to small-scale, sustainable farmers via farmers’ markets. Centralizing farmers’ markets to high traffic areas undoubtedly provide increased opportunity for market and vendor success and thus positive community outcomes in terms of increased access to fruits and vegetables as well as increased retention of food dollars in the local community. However, its ability to address food security for those most in need of improved access remains to be seen.

Largely driven by a push for economies of scale (Kaufman, 1998), the effects of a consolidating and centralizing food system (Hendrickson et al., 2001) are already being felt throughout many low-income communities, both in urban (Eisenhauer, 2001; Larsen and Gilliland, 2008; Sparks et al., 2009) and rural settings (Morton and Blanchard, 2007; Schafft et al., 2009; Sharkey, 2009). The evolution of the phenomenon now commonly known as ‘food deserts’ is the result. Others have similarly identified the disinclination of supermarkets to locate in poorer communities as ‘supermarket redlining’ (Eisenhauer, 2001).
Several studies from the UK, Canada, and more recently the United States have begun to uncover what has come to be coined as food deserts (e.g., Wrigley et al., 2002; Smoyer-Tomic et al., 2006; Sparks et al., 2009). Exact and consistent definitions of a food desert are not to be found; however, several definitions of food deserts have been suggested in recent years and generally vary by country of consideration, as well as by whether the researchers examined rural or urban settings. For example, Morton and Blanchard (2007) considered the entirety of the continental United States and identified food deserts as counties in which all residents must drive more than 10 miles to the nearest supermarket chain or supercenter. In contrast, Larsen and Gilliland (2008) estimated the prevalence of food deserts in London, Ontario through multiple means, including within walking distance (grocery store within 500 or 1000 meters) and public transit availability (10 minute non-transferring bus ride combined with a 500 meter walk). The 2008 Farm Bill has additionally weighed in with their food desert definition being “area in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower income neighborhoods and communities” (Title VI, Sec. 7527) (USDA-ERS, 2009). This definition is quite vague with openness in definition of the meaning of “limited access” as well as “nutritious food” and “low income.” Despite efforts to provide quality representations of potential food deserts in many locales, the majority of such studies minimally address or even fail to include accessibility to farmers’ markets in these areas considered food deserts. Bader et al. (2010) found in New York City, that small outlets such as fruit and vegetable markets and farmers’ markets when combined in consideration with the larger supermarkets, can be particularly important in increasing access to healthy food. They found this to be of highest effect in relation to ethnic minorities such as Hispanic, Asian and
immigrant neighborhoods. Most studies already identified generally utilize grocery store and supercenter locations as the source of fresh produce. As addressed by the USDA’s report to Congress on the access to affordable and nutritious foods, the omission of food venues other than supermarkets and other larger grocers may overlook the service of areas by independent and smaller stores, as well as other alternative venues (USDA-ERS, 2009).

The objectives of this paper are to uncover the presence of traditionally conceived food deserts in Washington State. Traditionally conceived food deserts are those high poverty areas with restricted access to healthy food; first considered here to be access to a large grocery store. We then move beyond the traditional consideration to further evaluate whether the present distribution of farmers’ markets aids in minimizing the effects of food deserts, or alternatively whether they reproduce the same locational disparities as already observed with other food sources. Identification of food deserts and gaps in accessibility of farmers’ markets are only half of the equation. Several studies have demonstrated the remarkably low, less than 25 percent, participation rates in farmers’ markets of those receiving food stamps (e.g., Kantor, 2001). Similarly, Conrey et al. (2003) observed WIC Farmers’ Market Nutrition Program (FMNP) redemption rates of less than 70 percent over the span of 1996-2001. In 2010, Washington WIC FMNP recipients redeemed 69 percent of the distributed vouchers. Alexander (1996) suggests that the three keys to improving the success of FMNPs are education, access to markets, and market quality. To get at the heart of the food insecurity issue in this study, we conclude with an examination of the effects of market location and their relationship to low income communities on the rate of redemption of food assistance program benefits, namely the WIC FMNP.
The results of this research lead to a more thorough understanding of the variation in
effectiveness of food assistance programs designed to reduce food poverty by increasing access
to local produce markets, and suggest efficiency improvements in the programs. Washington is
the third leading producer of organic produce in the U.S. (USDA, 2007) with numerous, well
established, and emerging farmers’ markets throughout the state, making it a prime location
for such a study.

1.1. Farmers Market Nutrition Programs (FMNP)

The WIC FMNP was established by Congress in 1992 and as of FY 2010, 45 states
participated in the program serving more than two million participants. The program is
generally administered through a federal-state partnership in which cash grants are provided to
state agencies by the Food and Nutrition Service (FNS). The FMNP of Washington has
developed a cooperative effort with the Washington State Farmers Market Association in a
move to provide locally grown fruits and vegetables for WIC families throughout the state. In
addition to improving awareness and access to farmers’ markets by high-risk families, the
program also educates participants about the benefits of eating more fruits and vegetables and
their relationship to preventing chronic disease. The FMNP operates yearly, June through
September, and is available to all enrolled WIC clients (pregnant women, breastfeeding women,
postpartum women, children from birth-5 years old) (USDA-FNS, 2011). All participants are
provided packets of $2 checks that are redeemable at all participating farmers’ markets from
June through September. In 2010 the program directly provided Washington farmers with over
$695,000 in sales. Nationwide, the WIC FMNP was active in over 3,600 markets with 18,245
farmers collecting $15.7 million in direct revenue. Early analysis of the FMNP suggest that the
economic welfare gains of the participants in the program are considerably more than the market value of the coupon, largely due to the gains in information that usually accompany the receipt of the vouchers. Additional welfare gains, in the range of 7-9 percent are experienced by the farmers. The gains by these two groups more than offset the highly diffused losses experienced by non-FMNP users who may have a negative welfare change due to changes in prices reflective of the program (Just and Weninger, 1997).

2. Data and Methods

The following sections comprise the methodological steps taken to achieve the previously outlined goals of the study. Analysis begins with the creation of a traditional food desert assessment followed by expansion into the consideration of farmers’ market roles in alleviating or perpetuating those deserts. Subsequent to the identification of potential food desert areas, we examine the variability of utilization of food assistance program benefits at farmers’ markets.

2.1. Supermarket Accessibility

Supermarket Locations: A spatially referenced database of all supermarkets in the state of Washington was created consistent with much of the existing literature on food deserts. Similar to the restrictions used by Sparks et al. (2009), these supermarkets are assumed to sell a full host of food products, though the requirement that they be a part of a large distribution system supplying multiple stores or a chain is relaxed in order to maintain those grocers that remain independent entities of significant size. We begin from the premise that those supermarkets that employ at least 50 employees will likely be able to supply the full host of products, a measure also used by other analyses including that by Blanchard and Matthews
The database is populated using a dataset from ReferenceUSA. The complete dataset includes 3812 retail food sources ranging in size from Supermarkets down to Convenience Stores. From this original set, all retailers whose primary or secondary designation aligned with what could reasonably be considered a major food retailer was designated a ‘grocer’. These designations include, but are not limited to: Grocer-Retail, Department Store (e.g., Fred Meyer); Grocer-Wholesaler, and Wholesale Club (e.g., Costco). All designations not meeting the established requirements were designated ‘non-grocers’. In addition, those potentially meeting the correct designation, but having fewer than 10 employees were also designated as ‘non-grocers’. The grocer designees were further segmented by employee size with the creation of three categories: >50 employees, >20 employees, >10 employees. Spot checks of the data and consultation with the data generating firm were conducted to verify the reliability of the data. The remainder of the chapter is conducted using the subset of grocers that meet the 50 employee cutoff. Discussion of the ramifications of relaxing the employee cutoff to the smaller store size levels will be addressed in the concluding remarks of the chapter.

**Food Desert Determination:** Food deserts are generally conceived as a function of a population’s ability to traverse a specified distance to a source of good food. Given the highly diverse geographic setting of Washington, one metric for this assessment does not capture a reliable measure of access limitations for all residents of the state. As such, two metrics are used; the first is based on walkable distances and used for the denser tracts, while the second uses a driving distance for the sparser tracts. To make a logical separation of which tracts to consider under which metric, the 2000 US Census Tracts and the Urbanized Areas (UA) of Washington are used to designate those areas to be considered urban and thus warranting
consideration via walkable distances. Those UAs that cross the state boundary with either Oregon or Idaho (Vancouver-Portland and Lewiston-Clarkston) will only be considered in relation to the Washington components. Sparks et al. (2009) can be referred to for an evaluation of Portland, Oregon.

Hewko et al. (2002) suggest that access to amenities under the assumption that the population may likely walk, can be estimated using a Euclidean distance given the propensity of walkers to use a combination of network sidewalks and ‘short-cuts’. A reasonable walking distance of 1 km (0.62mi) will be used as the estimated breakpoint between high and low access. This measurement maintains general consistency with other food desert studies whose walking distance for urban areas tend to range from .5 km (Wrigley et al. 2003) out to a 1 mile (1.61km) walk (USDA-ERS, 2009). However, the same is not true for driving trips in which the path is, almost without exception, linked to the road network. As such, the network will be the basis for measuring access for the remaining tracts of the state. By using travel distance over a Euclidean distance, we more reliably estimate the time constraints that impact consumer decisions or inability to navigate required distances. Identification of what constitutes high versus low access has typically been done using a 10 mile (16.1km) estimate. All areas within this distance will be considered high access areas, while those areas beyond this distance will be considered low access. Those tracts considered low access and that have greater than 20 percent of its population living under the poverty level, according to the 2000 Census, are deemed to be food deserts.

To develop an accurate measurement of the distance that households of a neighborhood or tract must travel to access a food source (supermarkets, convenience stores,
and farmers’ markets), the tracts are first disaggregated to their block level points and their associated population counts. By using the block level population counts rather than the geographic centroid of the tracts, a more precise measurement of the variability of the population within the tract can be accounted for. Distances, Euclidean in urban and network in rural, from these geographically accurate block points are then aggregated to the tract level to estimate the population weighted distance to the nearest retail food source. The calculation for this aggregation is as follows:

\[ T_i = \frac{\sum_{k \in i} b_k \cdot \min |d_{kj}|}{\sum_{k} b_k} \]  

(Equation 1)

where, \( T_i \) is the population weighted distance to retail source type for the tract neighborhood \( i \), \( b_k \) is the total population of block group \( k \), and \( d_{kj} \) is the distance between block \( k \) and retail source \( j \). Hewko et al. (2002) conclude that such a weighted distance calculation minimizes the aggregation error relative to other methods that fail to account for uneven population distribution within a tract.

2.2 Farmers’ Market Accessibility

Farmers’ Market Locations: Washington’s collection of farmers’ markets is increasing yearly, with the large majority being centered in the vicinity of the greater Seattle area\(^{14} \): 57 out of the total 169 markets in 2010. We have collected and maintained an accurate database of market locations, as well as days and hours of operation for these markets and continue to update it as new markets come on, move locations, or fail. Using this dataset of markets, the

\(^{14}\) The ‘Greater Seattle Area’ refers to the area of the east side on the Puget Sound that is within the Seattle-Tacoma Urbanized Area (UA).
sites were geocoded in ArcGIS to the most accurate level feasible. Unlike supermarkets and other permanent sites of retail activity, a farmers’ market may move year to year. This is especially true for the lesser or non-established markets as they seek out the most suitable site to locate. With such uncertainty and variability in market locations, all attempts were made to geocode the sites to the most recent market location that corresponds to the location of the market during the time period for which data on food assistance redemption figures were estimated. Distance measures were created in the same manner as that of supermarkets.

3. Models

We are interested in the spatial relationships of the population of Washington and the location of farmers’ markets. With this interest, we now turn to the creation of regression models that seek to account for any potential spatial dependencies in the data. Typical approaches to empirical regression analysis with spatial data take the form of a general-to-specific (e.g., LeSage and Pace 2009) or a specific-to-general (e.g., Florax et al. 2003) model development. Both approaches seek to identify the model that best identifies the data generating process. The general-to-specific approach conceptually begins with the Manski model accounting for the three different spatial interaction types identified by Manski (1993) and recently detailed in a series of stepwise considerations by Elhorst (2010). The three interaction types include: (1) endogenous interaction of the dependent variable, spatial autoregressive; (2) exogenous interaction of the explanatory variables; (3) correlated residuals. The Manski model takes all three spatial effects into consideration in the form of:

\[ Y = \alpha + \rho WY + X \beta + WX \theta + u, \]  
\[ u = \lambda Wu + \epsilon, \]  

(Equation 2)  
(Equation 3)
where $WY$ accounts for the endogenous interaction of the dependent variable, making $\rho$ the spatial autoregressive coefficient, $WX$ models the exogenous interaction of the explanatory variables, making $\theta$ a vector of fixed unknown parameters similar to that of $\beta$ in an OLS, $W\epsilon$ models the correlated residuals making $\lambda$ the spatial autocorrelation coefficient. Conceptually, the Manski model would be a departure point for consideration in the general-to-specific approach; however, Elhorst verified through a Monte Carlo experiment what was noted by Manski, in that one of the interaction effects must be excluded otherwise the parameters will be unidentified and not able to be meaningfully interpreted.

Elhorst (2010) summarizes a set of linear spatial econometric models of which one may move from the most general Manski model to the most specific OLS model with no spatial effects through a series of examinations testing for zero presence of significant coefficients in any of the three spatial interaction terms. Where $\theta=0$, the Manski model may be represented as the Kelejian-Prucha model [this is the name given by Elhorst (2010) to the model also called the SAC by LeSage and Pace]:

$$Y = \alpha + \rho WY + X\theta + \epsilon,$$

(Equation 4)

$$u = \lambda W\epsilon + \epsilon,$$

(Equation 5)

where both a spatially lagged dependent variable and a spatially autocorrelated error term are considered. Alternatively, where $\lambda=0$ the Manski model may be represented as a Spatial Durbin Model:

$$Y = \alpha + \rho WY + X\theta + WX\theta + \epsilon,$$

(Equation 6)

where spatially lagged independent and dependent variables are considered. Finally, where $\rho=0$ the Manski model may be represented as a Spatial Durbin Error Model:
\[ Y = \alpha + X\theta + WX\theta + u, \]  \hspace{1cm} (Equation 7)

\[ u = \lambda Wu + \varepsilon, \]  \hspace{1cm} (Equation 8)

where a spatially lagged vector of independent variables are considered in conjunction with a spatially autocorrelated error term. Further reductions may be made from these three models to result in spatial lag or spatial error models where adequate evidence exists to suggest only one mode of spatial dependence is occurring. The former is represented as:

\[ Y = \alpha + \rho WY + X\theta + \varepsilon, \]  \hspace{1cm} (Equation 9)

while the latter as:

\[ Y = \alpha + X\theta + u, \]  \hspace{1cm} (Equation 10)

\[ u = \lambda Wu + \varepsilon, \]  \hspace{1cm} (Equation 11)

In this paper, we follow the recommendation of Elhorst (2010) and first estimate the OLS model and conduct Lagrange Multiplier tests to suggest the need for a spatial lag or spatial error model. Where one or both models are suggested to provide improvements over the OLS, we conduct a Spatial Durbin model followed by a likelihood ratio (LR) test to test hypotheses of \( H_0: \theta = 0 \) and \( H_0: \theta + \rho \beta = 0 \). The former suggests the Spatial Durbin can be reduced to the Spatial Lag model, and the latter suggests reduction to a spatial error. Where both tests are rejected, the Spatial Durbin is considered to best describe the data. These models and test are conducted on the following scenario.

3.1 Voucher Redemption Rates

Our regression analysis seeks to identify any presence of spatial variation with respect to the previously identified 69 percent redemption rate of WIC FMNP vouchers in 2010. To achieve this, data was obtained on the dollar value redeemed at each participating farmers’
market in the state from the WIC FMNP in 2009 and 2010. Limitations of available secondary data prevent perfect knowledge of how far each WIC voucher recipient must travel to redeem their vouchers. Data however, is available on the number of vouchers issued by each WIC clinic and the number of those vouchers redeemed. Using this available data, WIC clinic sites are used as an initial proxy for recipient location. Clinic service areas are subsequently constructed using a similar population weighted distance equation displayed in equation 1. However, in this situation we are concerned with the population weighted distance from the census block to the nearest WIC clinic. The assumption that participants will travel to the nearest clinic is a simple, though often realistic assumption (Burkey, 2010). Once clinic market areas are established, regressions can be estimated to understand the influence of farmers’ market accessibility, as measured by distance to the market, on clinic level redemption rates. Distance is measured in two fashions: (1) the distance from the WIC clinic to the nearest farmers’ market, and (2) the population weighted average distance of the population in the clinic area to farmers’ markets. Additional covariates accounting for clinic market area include poverty rates, access to other food retail outlets, as well as indications of racial makeup, and vehicle access.

4. Results

4.1. Washington’s Food Deserts

The retail food landscape of Washington for the purposes of purchases for ‘food at home’ (FAH) is readily observed to have two mostly distinct components—that of the urban food-scape and that of the rural food-scape. As such, it is not surprising that there is a high density of grocers (greater than 50 employees) in the greater Seattle area, as well as other, smaller, clusters in the other Urbanized Areas (UAs) of the state (Figure 13). The figure
suggests that farmers’ markets form rather similar clustering in the UAs and throughout the state as do the grocers. There are farmers’ markets in several rural areas; however, not served by what is considered to be a full service grocer.

The food desert notion is a twofold phenomenon. It is the manifestation of not only the distance needed to travel to obtain healthy and affordable food, but also the ability to traverse that distance in a reliable and consistent manner without undue hardship. Figure 14 peels Washington to the next layer in the depiction of poverty, at the census tract level, throughout the state. The figure suggests a spatial pattern as to where high poverty occurs, both in urban and rural contexts. Figure 14 additionally reveals the occurrences of rural food deserts. Note where these food desert tracts are located in relation to the large gaps between supermarket occurrences from Figure 13. The Moran’s I statistic\(^{15}\) is a test of the occurrence of spatial autocorrelation in a variable. Spatial autocorrelation of poverty rates becomes important when considering amenity (e.g., food) access inequalities. Indication of spatial autocorrelation is confirmed (Moran’s I=0.4794, p<0.001) for tract level poverty rate, thus indicting a very significant degree of clustering. Similarly, an even higher degree of clustering is indicated when considering vehicle ownership rates, I=0.5332 (p<0.001). The owning or accessibility of a vehicle is an important determinant in traversing the necessary distance between residence and food retailer. Finally, a Bivariate depiction of a Moran’s I, reveals that not only can tracts be considered to be clustered by poverty rate, and by vehicle ownership rates, but that these two variables are mutually clustered, I=0.3383 (p<0.001).

\[^{15}\] I = \left( \frac{n}{\sum_{i} \sum_{j} w_{ij}} \right) \left( \frac{\sum_{i} \sum_{j} w_{ij}(x_{i}-\bar{x})(x_{j}-\bar{x})}{\sum_{i}(x_{i}-\bar{x})^{2}} \right)
Figure 13. Grocer and Farmers’ Market Locations throughout Washington State.
Figure 14. Statewide, tract level poverty rates.
The Moran’s I result is a global indicator of spatial autocorrelation, meaning considered over the entire statewide study area. Although they are very useful when considering spatial patterns as a whole, the interest of this paper is the local level access equality constraints felt by high poverty neighborhoods. With this objective in mind, a Local Indicator of Spatial Autocorrelation (LISA) is additionally used. LISA, as opposed to Moran’s I, provides indication of where significant clustering occurs and whether that clustering is high poverty tracts clustered with other high poverty tracts (high-high) or low poverty tracts clustered with other low poverty tracts (low-low) (Figure 15). From this LISA cluster map, observable trends in relatedness to the food desert map (Figure 14) begin to unfold. Large areas of blue fall in many of the suburban regions of the larger UAs, while several of the urban core districts and remote rural regions appear in red. These observations of localized clustering occur at least at the p<0.05 level using a first order, queens contiguity weights matrix.
Figure 15. LISA cluster map of the proportion of tract population that is less than the poverty level.

Figure 16. Multivariate LISA cluster map of the proportion of the tract population that is less than poverty line as compared with the proportion that does not have a vehicle.
Similar to Figure 15 above, Figure 16 provides a multivariate LISA cluster map of poverty and vehicle ownership. In the figure, the blue regions indicate clustering of low poverty levels with low proportions of the population that do not own vehicles. Red clusters suggest high poverty rates tracts whose neighbors have high rates of no vehicle ownership that depart from what would be expected under conditions of spatial randomness. Of important note here is the lack of red regions in the rural areas where it was earlier observed to have high poverty levels. In their place, either insignificant associations occur, or alternatively, the pink (high-low) tracts indicate high poverty tracts in association with neighbors whose lack of vehicle ownership is on average low. This observation suggests that despite high poverty rates in rural tracts, access to a vehicle is not as much an inhibitor as those in the urban settings. However, this does not imply a reliable vehicle, or the ability to drive it.

4.2. The Urban Food Desert

Washington has 13 UAs, of which three contain no tracts that meet the food desert criteria set forth in this paper either because there are no tracts with greater than 20 percent poverty or because those high poverty tracts that may be present do not demonstrate low access conditions. Within the 13 UAs, 737 tracts out of the total 1004, could be considered low access tracts, meaning their population weighted distance to a full service grocer (>50 employees) is more than a 1 km walk. Relaxing the 50 employee cutoff to one of 20 employees, brings 63 tracts out of the low access designation, leaving 674 tracts remaining at a distance greater than 1 km. Meanwhile, 345 of the 737 low access tracts, 47 percent, are at distances less than 1 km from a non-grocer. Recall that non-grocers are those establishments, such as convenience stores, that are considered to not be a full service food retail outlet, yet
have some food available. Considering now just the high poverty tracts, 64 of the 104 are found to be low access. This observation, compounded with the previously described relationship between poverty and vehicle ownership in urban areas, leads us to identify these 64 tracts as the urban food deserts of Washington. A full 59 of these 64 tracts, 92 percent, are found to be at distances less than 1 km from a non-grocer.

On average, urban tracts are found to be 2.06 km from a full service grocer, 1.23 km from a non-grocer (e.g., convenience store), and 4.24 km from the nearest farmers’ market. Narrowing the focus to just those tracts with a high poverty rate, we observe a reduced distance to food source for each category, 1.36 km to a grocer, 0.57 km to a non-grocer, and 2.40 km to a farmers’ market. These averages may at first seem counterintuitive given our premise is centered on the lack of access for high poverty tracts; however, these results are consistent with those previously observed in the Portland area by Sparks et al. (2009). They suggest the distribution may be attributable to the spatial history of the region, the recent and steady population growth, and land-use planning laws that result in less concentrated residential poverty and thus less defined access issues. That being said, we do still observe 62 percent of the high poverty urban tracts having food access constraints. Additionally, Sparks et al. point out that the food desert classification used here and in their work only identifies the access limitations of those poorer residents who live in tracts of high poverty concentration, and omits those who live in less concentrated tracts. Subsequently, they suggest the potential for food access problems outside of food desert considerations. The urbanized areas of Washington support this concern. We identify nearly 3.5 million residents residing in tracts deemed low access, of which almost 300,000 lived below the poverty threshold. Just fewer
than 70,000 of these residents live in identified high poverty tracts. Thus, considering only high poverty tracts omits 77 percent of the urban population living below the poverty line.

Turning now to the location of farmers’ markets in relation to the observed food deserts in urban areas, we observe that of the 64 food desert tracts, 16 are now within 1 km of a farmers’ market. Of the nearly 70,000 food desert residents living below the poverty line, 23 percent are now less than 1 km from a farmers’ market. The 16 tracts are spread throughout the state, with eight of the ten UAs having food desert tracts possessing at least one farmers’ market within walking distance. Fifteen of the state’s 94 UA farmers’ markets are located in what are traditionally considered food deserts.

The Seattle Urbanized Area is by far the largest in the state and encompasses the majority of the eastern Puget Sound from roughly Everett on the north to Tacoma on the south. Associated with this UA are 609 tracts, of which 44 have poverty rates in excess of 20 percent. Of the 44 high poverty tracts, 28 are considered to also be low access tracts in relation to full service grocers. The statewide clustering of high poverty noted previously is further evidenced in the Seattle UA. Here, the 28 tracts identified as food desert tracts are largely grouped into two distinct sections of the UA, each of which also contain other nonfood desert tracts, though still high poverty tracts. The depiction of the Seattle UA has been broken out into two frames (Figure 17) to better visualize the distribution of both grocers and farmers’ markets throughout the UA. From these frames, it becomes apparent that the markets may not be randomly distributed throughout the UA; there is a suggestion of a spatial pattern to their locations. Sage and McCracken (Forthcoming) verify this pattern as one of attraction to areas already served by
grocers. Throughout the UA, 29 of the 57 markets are located within one kilometer of a full service grocer.16

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Figure 17a. Seattle-Central retail food distribution.

Figure 17b. Seattle-South (Tacoma) retail food distribution.
4.3. The Rural Food Desert

Within Washington, 82 tracts have been identified as meeting the defined requirements of a food desert; 18 of these tracts are rural. These tracts can be seen in Figure 14. Recall that as we shift our focus away from the urban setting to that of the rural one, we also shift our definition of food desert. Maintained is the requirement that the tracts are high poverty (>20 percent), though changed is that we now use a network distance of 16.1 km (10 miles) as the condition of what constitutes low access. The tracts identified as rural food deserts have a population weighted average distance from a grocer of almost 48 km (30 miles), considerably higher than the threshold distance for the designation. Additionally, it could be argued and is a valid consideration that grocers in rural areas may still provide a whole host of food options though at smaller sizes, thus they would also have fewer employees. Dropping the required employee size to 20 reduces the average distance to 28 km (17 miles) and seven of the eighteen tracts would no longer come under food desert identification. Interestingly, all of these tracts are considerably closer to non-grocer sources of food, 16 km on average. Further, as suggested previously, vehicle ownership among high poverty rural tracts is much higher than comparably high poverty tracts in urban settings. On average, these rural tracts have a no-vehicle ownership rate of just fewer than seven percent.

Access is improved to farmers’ markets, over grocers, in 13 of the 18 tracts resulting in an average distance of 30.7 km (19 miles), an average that tends high due to 3 tracts in excess of 80 km from a market. Rural farmers’ markets, those outside of a 0.5 km buffer around an UA or urban cluster (UC), constitute 38 out of the 169 markets statewide. Three of these 38 markets are located in food deserts. Markets that have yet to be discussed are those not
exactly rural by definition, yet not found in association with an urbanized area. These markets
found are in urban clusters: 37 markets make up this group. Three of these UC markets are
located in rural food deserts. The 18 rural food desert tracts have substantial overlap with four
of the five large Native American Reservations of Washington. Many other, smaller
reservations are found along coastal and inland waterways. The four reservations are those of
the Makah, Quinault, Yakima, and Colville Tribes. The only large reservation not identified as a
rural food desert is that of the Spokane Tribe; however, it is still a high poverty tract.

4.4. Utilizing the WIC FMNP

The above urban and rural sections unfold the locational aspects of both grocers and
farmers’ markets throughout the state; however, the picture is not complete until an
understanding of what these aspects mean for usage of the WIC program. In 2010, 123 farmers’
markets collected nearly $700,000 in WIC FMNP vouchers. Table 6 highlights the basic elements
of the differences between markets in Urban Areas, Urban Clusters, and Rural areas. From this
table, it becomes evident that urban markets tend to be larger in both the number of farmers
participating and the volume of WIC usage. Additionally, it can be seen that higher percentages
of both UA and UC markets are able to accept the WIC vouchers.

Further variation can be observed when considering markets that are located in food
deserts as compared to those not in food deserts. The markets within food deserts, eleven of
them accepting WIC vouchers, on average saw nearly double the amount of WIC vouchers
redeemed, nearly $11,000, as compared to those markets outside of the food deserts, just over
$5,000. These distinctions appear evident even while considering size of the market in terms of
the number of farmer vendors present. As encouraging as these redemptions are, an
unsettling notion takes shape in that of the 21 identified markets in food deserts, six of them are either rural or found in urban clusters as opposed to an urban area, and only two of these six were set up to accept WIC vouchers in 2010. However, 9 of the 15 markets found in urban food deserts do accept the WIC vouchers and collect them at rather impressive levels. While farmers’ markets in food deserts make up only eight percent of the markets statewide, they collect more than 17 percent of the WIC vouchers.

Table 6. 2009 WIC FMNP redemptions by market type. UA=Urbanized Area; UC=Urban Cluster; Rural = remaining markets.

<table>
<thead>
<tr>
<th></th>
<th>UA</th>
<th>UC</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Markets</td>
<td>94</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>Number of Markets Accepting WIC FMNP</td>
<td>76</td>
<td>28</td>
<td>19</td>
</tr>
<tr>
<td>Average number of Vendors accepting WIC FMNP</td>
<td>15</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Average WIC ($) per market</td>
<td>$7,577</td>
<td>$3,781</td>
<td>$729</td>
</tr>
<tr>
<td>Total WIC ($)</td>
<td>$575,892</td>
<td>$105,872</td>
<td>$13,852</td>
</tr>
</tbody>
</table>

The above discussion highlights the differences between markets in and out of food deserts, as well as between markets located in various levels of population density. However, to get a more fluid understanding of the relationship between market and residential location, with particular focus on poverty rates, we turn now to discussion of the regression models.

4.5. Voucher Redemption Rates

In 2010, the Washington Department of Health reported redemption data for health clinics throughout the state that were issued WIC FMNP vouchers (n=108), which were in turn issued to their clients. Under the conditions previously described for the creation of clinic market areas, regressions to explain redemption rates were conducted using information from
the 105 clinics\textsuperscript{17}. The resulting clinic market areas are shown in Figure 18 with their associated redemption rates.

\textsuperscript{17} One of the remaining three clinics was omitted due to not being identified as the closest clinic for any population weighted census tract centroid. The other two were not able to be successfully geocoded.
Figure 18. WIC clinic market areas and associated redemption rates.
A spatial pattern to the redemption rate appears to be visually present when viewing Figure 18. To validate the pattern, we again turn to Moran’s I which indicates significant clustering of the redemption rates at a global level (I = 0.290, p<0.001), providing our first indication that an OLS regression may not be the best option. Before considering the full implications suggested by the regression results of Table 7, we can assess the performance of each model. We first test for heteroskedasticity in the error variance and find no significant results based on the Breusch-Pagan, Koenker-Bassett, or White tests. Thus, heteroskedasticity is not considered to be of concern. Significant Moran’s I (I=0.166, p<0.001) on the OLS residuals in addition to significant results on the LM test for error dependence (p<0.01) suggest the need to consider a spatial error model (SEM). Additional significant results arise in the LM test for a missing spatially lagged dependent variable (p<0.01), suggesting the need to consider a spatial lag or spatial autoregressive model (SLM). Upon estimation of these models, we find both the SLM (LR=76.74) and the SEM (LR=77.35) to produce significant improvement in performance over the OLS model (LR=73.20), as indicated by significant (p<0.01) log likelihood ratio tests. Additionally, the SLM and SEM models improve $R^2$ to 0.47 and 0.48 respectively over the 0.42 that was rendered from the aspatial OLS model. We present the results of both models in Table 7 along with the OLS results. Looking first at the spatial lag term, Rho, we observe significant and positive spatial dependence of observations on neighboring observations, thus contributing to the production of model improvement. Similarly, the SEM produces a positive and significant Lambda coefficient on the spatially correlated error terms. Negligible performance differences exist between the two spatial models. Following the recommendation of Elhorst (2010), with the findings of significant improvement by the SLM and SEM models, we further
conducted a Spatial Durbin Model (SDM). Recall, the purpose of continuing with an SDM are to test the hypothesis of \( H_{0}^{1}: \theta = 0 \), where \( \theta \) is the coefficient on the lagged independent variables. We find that none of the lagged coefficients are significant, thus there is no reason to reject \( H_{0}^{1} \). This failure to reject suggests that the SLM may reasonably represent the data generating process (DGP); however, the second requirement suggested by Elhorst requires the robust LM test to be significant. We do not find significance in this test, thus the SLM cannot be considered to fully represent the DGP. The second testable hypothesis in the SDM is \( H_{0}^{2}: \theta + \rho \beta = 0 \). Suffering from the same lack of significance in its robust LM test, the SEM can also not be considered to fully represent the DGP despite being a marked improvement over the OLS model. Subsequently, we can conclude that the SDM best describes the data, as it generalizes both the spatial lag and the spatial error models (Elhorst, 2010). The remainder of the discussion will thus be centered about the SDM variable results.
Table 7. OLS, SLM, SEM, and SDM Regressions on the Clinic Level Redemption Rate.

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>SLM</th>
<th>SEM</th>
<th>SDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>0.656</td>
<td>0.412</td>
<td>0.657</td>
<td>0.492</td>
</tr>
<tr>
<td></td>
<td>(0.072)*****</td>
<td>(0.167)*****</td>
<td>(0.072)*****</td>
<td>(0.166)*****</td>
</tr>
<tr>
<td>Quantity Distributed to Clinic</td>
<td>1.13E-05</td>
<td>1.08E-05</td>
<td>1.14E-05</td>
<td>1.03E-05</td>
</tr>
<tr>
<td></td>
<td>(3.05E-06)*****</td>
<td>(2.75E-06)*****</td>
<td>(2.81E-06)*****</td>
<td>(2.920E-06)*****</td>
</tr>
<tr>
<td>Proportion of Population identified as Latino</td>
<td>0.986</td>
<td>0.713</td>
<td>0.655</td>
<td>0.329</td>
</tr>
<tr>
<td></td>
<td>(0.376)****</td>
<td>(0.347)****</td>
<td>(0.368)**</td>
<td>(0.402)***</td>
</tr>
<tr>
<td>Proportion of Population Living under the Poverty Line</td>
<td>1.31</td>
<td>1.359</td>
<td>1.377</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>(0.485)****</td>
<td>(0.434)****</td>
<td>(0.427)****</td>
<td>(0.465)****</td>
</tr>
<tr>
<td>Proportion of Population between 100-200% of Poverty Line</td>
<td>-1.546</td>
<td>-1.331</td>
<td>-1.542</td>
<td>-1.383</td>
</tr>
<tr>
<td></td>
<td>(0.446)****</td>
<td>(0.409)****</td>
<td>(0.409)****</td>
<td>(0.449)*****</td>
</tr>
<tr>
<td>Average Distance to Grocer (&gt;50 employees)</td>
<td>0.004</td>
<td>0.002</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.002)*</td>
<td>(0.002)***</td>
<td>(0.002)***</td>
<td>(0.002)***</td>
</tr>
<tr>
<td>Average Distance to Farmers’ Market</td>
<td>0.009</td>
<td>0.012</td>
<td>0.012</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.006)***</td>
<td>(0.006)***</td>
<td>(0.006)***</td>
<td>(0.006)***</td>
</tr>
<tr>
<td>Distance from Clinic to Nearest Market Accepting WIC</td>
<td>-0.003</td>
<td>-0.003</td>
<td>-0.003</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.001)***</td>
<td>(0.001)**</td>
<td>(0.001)**</td>
<td>(0.001)****</td>
</tr>
<tr>
<td>Proportion of the Population with no Vehicle</td>
<td>-0.084</td>
<td>-0.13</td>
<td>-0.12</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>(0.118)***</td>
<td>(0.106)***</td>
<td>(0.110)***</td>
<td>(0.123)***</td>
</tr>
<tr>
<td>Total Number of Area Markets</td>
<td>-0.068</td>
<td>-0.063</td>
<td>-0.06</td>
<td>-0.056</td>
</tr>
<tr>
<td></td>
<td>(0.020)*****</td>
<td>(0.018)*****</td>
<td>(0.018)*****</td>
<td>(0.019)*****</td>
</tr>
<tr>
<td>Number of WIC Accepting Markets</td>
<td>0.078</td>
<td>0.077</td>
<td>0.07</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>(0.026)****</td>
<td>(0.023)****</td>
<td>(0.023)****</td>
<td>(0.023)****</td>
</tr>
<tr>
<td>Interaction: Proportion Latino &amp; Proportion in Poverty</td>
<td>-2.564</td>
<td>-1843</td>
<td>-125</td>
<td>-0.99</td>
</tr>
<tr>
<td></td>
<td>(1575)***</td>
<td>(1412)***</td>
<td>(1514)***</td>
<td>(1578)***</td>
</tr>
<tr>
<td>Interaction: Proportion in Poverty &amp; Weighted Distance to Market</td>
<td>-0.053</td>
<td>-0.061</td>
<td>-0.06</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(0.031)***</td>
<td>(0.027)**</td>
<td>(0.027)**</td>
<td>(0.028)*</td>
</tr>
<tr>
<td>Lagged Error (λ)</td>
<td></td>
<td></td>
<td></td>
<td>0.436</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.12)***</td>
</tr>
<tr>
<td>Lagged Percent Redeemed (p)</td>
<td>0.335</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.114)*****</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagged Independent Variables (θ)</td>
<td>None</td>
<td></td>
<td></td>
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<tr>
<td>Log Likelihood</td>
<td>73.2</td>
<td>76.74</td>
<td>77.35</td>
<td>82.71</td>
</tr>
<tr>
<td>Moran’s I (error)</td>
<td>0.166***</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lagrange Multiplier</td>
<td>7.24***</td>
<td>7.54***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robust LM</td>
<td>0.448</td>
<td>0.746</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Std Error);* p<0.1; **p<0.05; ***p<0.01
The major variable of interest when creating the regression models was residential distance from farmers’ markets and how that impacts redemption rates. Each model indicates the presence of a positive relationship. This relationship suggests, holding other factors constant, that as the average weighted distance a population must travel to get to a market increased, so too does the rate at which WIC vouchers are redeemed at markets. This result first appears counterintuitive. A second potential measure of distance needed to travel by the WIC-using population is generated by the minimum distance between the WIC clinics themselves and their nearest farmers’ market. This variable produces the opposite sign of the original distance measure and suggests that as distance between the clinic and a market increases, the redemption rate decreases. To better gauge the results of the weighted distance variable, an interaction variable was created to determine whether poverty rate influences the expression of the distance variable. We find here that increasing levels of poverty have increasingly negative impacts on the influence of weighted distance to the market. The proportion of the market area’s population with income less than the poverty line demonstrates a significant and positive relationship with WIC FMNP voucher redemption rates, as does the proportion of the areas’ population that identifies as Latino in each model except the SDM. The volume of vouchers distributed to each clinic similarly has a positive relationship. Meanwhile, the proportion of the market area that has an income between 100 and 200 percent of the poverty line shows a significant negative relationship to redemption rates. The differing signs between the proportion under the poverty line and those greater than, but less than 200 percent of it, begins to provide some insight as to who the major redeemers of the vouchers might be. Interpreting the coefficients from the regression models leads to
interesting results of the effects of poverty levels on redemption rates. The positive coefficient on the proportion of the population with household income placing them below the poverty level suggests that as the extent of high poverty increases for a region, their propensity to redeem their WIC vouchers also increases. Alternatively, as the proportion of the population between 100 and 200 percent of the poverty level increases, we observe a reduction in the redemption rates. Recall that the coefficients for each variable are interpreted as changes holding all other variables constant. These countering observations suggest that those most in need of food assistance are likely those that use it at the higher rates. An important significant result arises in consideration of the relationship between the total number of markets in a clinic area and the number of WIC-accepting markets in the clinic area. Simply considering the total number of markets in an area produces a negative relationship to the rate of redemption, while the number of WIC-accepting markets produces a positive relationship

5. Discussion and Conclusion

The primary objective of this research was the implementation of spatially informed methodologies to aid in determining whether potential food deserts throughout Washington State, both in urban and rural settings, are systematically alleviated or exacerbated by farmers’ markets. Additionally, we sought to understand how this relationship relates to the effectiveness of food assistance programs aimed at reducing food poverty and insecurity at community levels. Results suggest distinct differences in current abilities of markets to significantly alter the healthy food landscapes of low income areas of Washington, depending on whether the market is in a rural or urban setting. Of the 64 tracts found to be urban food deserts, 16 were found to have the effects of their low food access reduced, even with the
heavy tendency of farmers’ markets to locate close to the supermarkets whose locations were used to determine the presence of food deserts. In the larger urbanized areas like Seattle, 29 of the 57 markets are found to be within the 1 km buffer of a grocer, and many others are not far away from them. These observations, should they continue to unfold, have several potential implications. Schmit and Gomez (2011) also found that farmers’ market vendors find positive value in locating near other retail activity, an effect of agglomeration in a sense. In this light it should be of little surprise that we see so many of these markets locating so close to established grocers, which are themselves generally in areas of more retail activity. Despite this trend, 15 farmers’ markets, of which nine accept WIC, are found in urban food deserts. These observations suggest that nearly a quarter of the high poverty residents of food deserts can be considered to now have quality access to a healthy food source when considering farmers’ markets in conjunction with supermarkets.

The generally positive results for food access witnessed in the urban food deserts do not carry over as well to those of the smaller urban clusters (UCs) or rural areas of the state. Here, we find that of the 18 rural tracts identified as food deserts, 13 have those distances reduced with access to a farmers’ market, but not to a large enough degree to take them out of a food desert category. Additionally, a combined six markets between the rural and UC areas of the state are found in food deserts, though none accepted WIC. These markets also tend to be very small with only a few vendors at each.

Demonstrated in other recent studies, time and location considerations suggest that market vendors receive higher satisfaction from selling in a limited number of larger markets possessing more amenities and varied production-based vendors (Schmit and Gomez, 2011).
The rapid proliferation of markets in the greater Seattle area are further evidence of this observation. With the exception of a handful of vendors, most farmers participating in markets do so at five or fewer markets. Of the 688 farmers who accepted WIC vouchers in 2009, 659 were at five or fewer markets, and 460 attended only one. It is thus not surprising that rural markets are considerably smaller than their UA or even UC counterparts, with only an average of six farmers attending the rural markets and accepting WIC vouchers while 15 farmers are on average able to do so in UA markets. These early observations support the concerns raised by previous authors (Allen, 1999; Hinrichs and Kremer, 2006; Guthman et al., 2006) as they considered whether it is possible to simultaneously provide fresh, nutritious food that is affordable to low-income consumers while providing adequate returns to small-scale farmers at farmers’ markets.

We demonstrate here that central to all potential food security solutions is the necessary consideration of access. Further, access is not simply a manifestation of a certain distance to be travelled. As can be observed from Figure 16, a strong relationship exists, particularly in urban centers, between poverty rates and vehicle ownership. This relationship makes the ability to traverse any given distance an important consideration above that of simply how far that distance is. This observation is further emphasized in the regression results where we find that through the interaction of poverty, the influence of increasing distances is increased. This interaction suggests that as the poverty level of a given geographic region increases, the effect of a needed distance to travel to utilize a food assistance benefit is heightened. These relationships place added value on collaboration between markets in or near
Finally, we find several instances of food deserts in urban areas in which the nearest grocer effectively splits the food desert tracts, but is not within walkable distance to either. The question should be asked ‘Is that a bad spot for the retailer? For the consumers?’ This could be framed in the sense of could this area support two grocers that could have potentially been placed in either high poverty tract? It is very plausible that the current location is optimal for both parties independent of its technical definition as a food desert. To really get at the heart of this observation and others, more research is needed on a case by case basis to fill in the gaps that cannot be observed from a large database of grocer or market locations. Each community has its nuances that need exploring. These recognitions speak to some of the larger criticisms of research conducted on food deserts covering large geographic areas (Sharkey, 2009); that is, the failure to ground truth the data both in terms of the not only the potential access as understood through large data sets, but also consumer behavior in their understanding of their food landscape.
References


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DISCUSSION

Perhaps as early as Jim Hightower’s writing of *Hard Tomatoes, Hard Times* in 1973 or the even earlier publishing of Rachel Carson’s *Silent Spring* in 1962, the perceived ‘common sense’ and reality of what is considered to be ‘in everyone’s interest’ has been questioned. Growing from the likes of these writings, and many others, a host of evolving alternatives to the now readily observable globalized food system have emerged. The underlying theme of the preceding chapters revolve about the degree of ‘alternative’ in some of these alternative food networks (AFN). The dominant food and agricultural systems of the world have come under continued public scrutiny stemming from a gamut of environmental concerns, health outcomes, as well as economic equality and social justice worries. Simply because the promoters of alternative food networks pose them as better options to the conventional system, does not inherently make it so. Just as has been done with the global food system, a critical eye should be focused on proposed alternatives. This current research has taken several steps towards an understanding of alterntiveness and the potential for counter-hegemony.

Having provided a trio of complementary studies from which we can further understand the some structural and behavioral conditions present within AFNs, this manuscript places alternative food networks within the context of the larger food system. Both researchers and practitioners are provided with several means by which to view and evaluate potential points of departure from the conventional systems of food and agriculture. Though conceptually many points of departure exist that may move an alternative food structure towards a counter-hegemonic position, I draw upon two such means: the market venue a producer chooses to participate, and the location strategies of farmers’ markets in relation to other retail food
venues. Though these two points of departure are discussed in detail throughout this manuscript, they are but a beginning to understanding the degree of alternativeness that exists.

Decisions by certified organic producers to participate in direct to consumer markets are found to reflect both the ideological and geographic locations of the producers. Producers are demonstrated to identify a host of justifications for becoming a certified organic producer. These justifications then manifest themselves differently in relation to different parts of the state with vastly different agricultural histories and practices. Further exploration behind these differences is warranted. Additional research should continue to explore the variability that exists even within those that do decide to direct market. It would be premature to assume that simply participating in a direct market venue is fully indicative of movement towards counter-hegemony. Such research lines may evaluate the tendency of producers participating in farmers’ markets to overlook their small, local markets for larger markets in urban settings. This is not to say that such a decision is in some way ‘bad’, just that it is an economic reality that may perpetuate the already disadvantage communities in both an urban or rural setting.

The need for such research is further highlighted by the results identified in Chapters Two and Three in which I observe farmers’ markets closely mirroring the distribution of fixed retail food outlets. In this second potential point of departure, that of where good, healthy food may be obtained, I find little evidence to suggest that the economic pressures that produced the location of supermarkets is not also now impacting the location of farmers’ markets. Similar to the consideration of a producer choosing a larger market over a smaller one, the decision to locate a market has economic consequences, not the least of which is failure of the market to thrive.
The methods used throughout this manuscript seek to interact several disciplines that are necessarily valuable when considering an interdisciplinary topic such as food, as well as the provisioning of and access to it. By taking a socio-economic perspective, such as that found in Conventions Theory, and interacting it on a spatial plane, the diversity of negotiated social and economic exchanges may be more nuanced thus allowing practitioners to better understand the needs of their constituencies on either side of the table. Further, spatial methods such as point pattern analyses permits not only a reflexive picture of the on the ground realization of a food system distribution, but also the ability to compare it against other systems of distribution.

Finally, the dialogue of AFNs are readily identifiable as seeking to fulfill the promise of reengaging the producer and consumer; however, unless such markets are reoriented toward a more just provisioning of human needs in a sustainable fashion, it is simply another market avenue for consumers and producers to exchange goods for money. A just provisioning, a counter-hegemonic movement, suggests that a re-embedded market will ensure that nutritious food gathered in a sustainable and culturally acceptable way will be available to everyone, not just those that can afford it. Here, affordability must be understood as the ability to not only purchase the good, but also reliably traverse to and from the market place.