Abstract

Godette, Sherrie K. Assessing the Promise and Realities of Local Food Systems: Does Government Intervention Help? (Under the direction of Drs. Branda Nowell and Jeffrey Diebold)

Local food systems are believed to be the panacea for several social, economic, and health issues thought to be created or exacerbated by the conventional food market structure. However, there is a lack of evidence to demonstrate the legitimacy of local food development as an effective strategy in mitigating the failures associated with conventional food systems. Moreover, the federal government has contributed a significant amount of investment to support the development of local food systems, however there is also insufficient evidence that government programs are actually targeting populations said to be socioeconomically disadvantaged. This body of work addresses these gaps by examining the links between local food market availability and various social (food access), health (obesity and diabetes prevalence), and economic outcomes/conditions (share of local food income to total agriculture income, number of small and mid-size farms, total farmland). In addition, this work examines the potential of government intervention in mitigating food system related inequities through the support of local food market development. The purpose of this work is inform decisions and policies concerned with developing environments that promote just and equitable food systems.
Assessing the Promise and Realities of Local Food Systems: Does Government Intervention Help?

by

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Dedication

This dissertation is dedicated to all the people who believed in me and my work.
Biography

Sherrie K. Godette was born and raised in Eastern North Carolina. She earned both her Bachelors’ and Masters’ of Science degrees at North Carolina Agricultural and Technical State University in Applied Business and Economics. She has a decade of work experience with the United States Department of Agriculture, Forest Service in the areas of procurement, acquisitions, and contracting; education and outreach; program management; and national recruitment. Her doctoral research focused on studying the benefits and challenges of local food system development and assessing the role of government in mitigating challenges in the food system. Through her research she seeks help communities improve their lives through informed decision-making based on careful and thoughtful observation of environment, people, and the social dynamics between them. Sherrie’s research in food system development has been presented at the Rural Sociological Society and International Society of Ecological Economic conferences. In addition, she has led and co-authored research published in the Journal of Agriculture, Food Systems, and Community Development. Her broad research interests are in organizational / systems development and change, performance management, program and policy evaluation, and agribusiness and marketing.
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Chapter 1: Introduction

Many scholars in the social ecology, community health, and agriculture fields are beginning to link negative ecological (declining farm populations), socio-cultural (increased health risks and disparities), and economic (increasing market barriers and income disparities) issues to the conventional food system (O’Hara and Stagl, 2001; Feagan, 2007). The prevailing argument is that the food environment has significant impacts on important community level outcomes; therefore we should design environments that promote more healthy community behaviors and positive socio-economic outcomes.

In response to increasing awareness of the linkages between food environment and community health and economic well-being, there has been a surge in academic research, advocacy and government support towards local food system development (Ilbery et al., 2006; Friedmann and McNair, 2008; Coderre, Boivin, & Etaabaa, 2010; Mirosa & Lawson; 2010). A common perception of local food systems is that they “are rooted in particular places, aim to be economically viable for farmers and consumers, use ecologically sound production and distribution practices, and enhance social equity and democracy for all members of the community” (Feenstra, 1997:28; Hinrichs, 2000). Advocates of local food systems believe that these systems hold the key to three desirable outcomes:

1. Help increase food access in areas underserved by traditional markets (i.e., food deserts) (Schmidt et al, 2011; Beaulac, Kristjansson, Cummins, 2009);
2. Contribute to the promotion of better community health in general by increasing availability and access to fresh healthy foods (Block, Scribner, Desalvo; Walker, Keane, Burke, 2010; Morland, 2009); and
3. Help stabilize local economies and support local food infrastructure by providing viable more accessible markets for small and mid-sized farmers (Andreatta & Wickliffe, 2001; Martinez et al., 2010; Stevenson et al; 2011; Schmidt et al.; 2011).
While a great deal of effort has been put forth to develop and study local food systems, there is inadequate information and evidence that these systems are actually plugging gaps that conventional food systems are said to create. It should be noted that there are many conceptual issues that plague the food accessibility, food desert, and local food literatures. These ambiguities increase the difficulties and complexity in conducting research in these areas which also raises challenges in making comparisons between studies (Jilscott et al., 2011). For example, food access or food deserts are often defined in terms of proximity to conventional food markets (e.g. grocery stores/supermarkets), rarely are these concepts defined in terms of availability and accessibility to local food markets. This limited conceptualization of healthy food access provides us with an incomplete picture of food and agriculture systems; in addition it limits the measurement of actual food security in a community. Local food market as well as conventional food market analysis must be considered if we are to truly understand and assess food systems and its impacts.

Furthermore, community organizations and government agencies at all levels have created programs to develop, promote, and support local food economies (Ilbery et al., 2006; Friedmann and McNair, 2008; Coderre et al., 2010; Mirosa and Lawson, 2010; Godette, Beratan, & Nowell; 2015). For example, the U.S. Department of Agriculture began its “Know Your Farmer, Know Your Food” initiative in 2012 to implement the president’s plan to strengthen local and regional food markets (Maple et al., 2013; USDA, 2014). Government intervention in local food system development is a sign that there are market failures in the conventional food system. In this body of work market failures are defined as the insufficient availability or accessibility to food markets. Market correction through government action and policy is usually justified by perceived and proven inefficiencies in the free market system; however some perspectives justify government intervention through principles based on moral values such as social justice. Food justice is defined as “ensuring that all individuals, families, communities have access to healthy, high quality, low cost, locally grown, culturally relevant and nutritious food from seed to plate” (Social Justice Learning Institute, 2012). Food justice is a philosophic perspective based on social and distributive justice principles. Given that market failure arguments are usually efficiency-
based these principles are useful in understanding the social deficiencies associated with the design and structure of free markets. The food justice movement is aimed at applying socially just solutions to address inequality in the food systems (Scorza, Henderson, & Castillio, 2012).

Food justice advocates argue that food security is achieved through a distinct focus on and prioritization of food justice in under-served communities, more specifically in food deserts (Scorza et al., 2012). It is argued here that the existing disparities among groups and places in terms of food access, health, and economic sustainability are partially attributable to the structure and design of the conventional food system. From the social perspective, these inequities can be viewed as market failure because the structure of the food system may create undue burden or challenges for certain groups or places to derive enough benefit to maintain a healthy and stable life.

Figures 1 and 2 show the logic behind the market failure framework used in the following studies. While market failure is a commonly used justification for government intervention (Rocha, 2007), there is inadequate evidence that government support and intervention decreases inefficiencies and inequities in the food system. In this body of work market failure is defined based upon social justice principles and local food system development is evaluated as a social justice solution. Given these perspectives, it is important to conduct assessments on not just the extent to which local food systems are helping to mitigate the issues stemming from the conventional market system, but also the efficacy of government assistance to correct the failures through the supporting local food system development.

This dissertation includes three separate but related studies that explore different aspect of food system problems. The studies in this dissertation can exist independently; however they are related as a body of research that examines whether local food systems are fulfilling their promise or whether they are susceptible to market failures similar to conventional food systems. Further, this research examines the potential for government intervention in contributing to the amelioration of food system market failures through local food system development assistance.
Figure 1. Logic of market failure based on food access and healthy food market availability (Chapters 2 and 3)

Figure 2. Logic of market failure based on local food market availability and local economic outcomes (Chapter 4)

Chapter Two is entitled *Food deserts, farmers’ market availability, and government intervention*. This chapter contributes to our understanding of the potential local food system contributing to the mitigation of food access disparities by looking at the availability of local food markets in food deserts vs. non-food deserts. In addition, this chapter also examines the extent to which government intervention contributes to the mitigation of food access disparities given the level of assistance provided to food deserts? To further examine how
other environmental features, in particular urban proximity, may influence local food market availability in food desert compared to non food desert counties geographic comparisons are made based upon the Office of Management and Budgets (OMB) metropolitan area delineation (OMB, 2013). This chapter serves as an assessment of the potential for local food system development in mitigating inequities in food access and government’s potential in reducing these inequities through grants-making interventions.

Chapter Three is entitled *Examining the association between the local food environment and health outcomes in the context of food deserts and non food deserts*. To advance the research on food environment and health, this chapter examines the county-level link between the both local and conventional food market availability and food-related health risks, obesity and diabetes prevalence. This study also examines whether being a food desert moderates the link between farmers’ market availability and health outcomes. Chapter 2 provides us insights as to the potential of local food markets promoting positive health conditions/outcomes.

Chapter Four is entitled *Examining the Relationship between Local Food Market Availability and County-level Food System Related Economic Outcomes*. While it is believed that the presence of local food markets can help contribute to the sustainability of local economies, especially the local agriculture economy, there is little evidence to support whether these type of benefits are being realized at this level. To fill this gap, this study examines the link between of local food market availability and four food-related economic outcomes/conditions: 1) the proportion of direct sales to total agriculture sales; 2) total number of farms; 3) total small and mid-size farms; and 4) total acres in farmland. This may contribute to the food system literature by enhancing our understanding about the distribution of benefits generated by local food systems. Given the level of government action and policy toward supporting local food development, this chapter also examines the extent to which government intervention moderates the relationship between local food market availability and the four food-related economic outcomes/conditions. Chapter 3 serves as an evaluation of local food markets potential in promoting equitable and sustainable economies and of government intervention in achieving these goals.
Multivariate regression analysis was used to test the statistical significance of the relationships of interest in the three chapters outlined above. Data was extracted and integrated using multiple sources including USDA-ERS Food Environment Atlas, U.S. Census of Agriculture, U.S. Census, Center for Disease Control BFRSS, and County Health Rankings databases. In concert these studies are meant to inform community/economic policy and planning decisions as a means to improve community food access, health, and economies.

References


Chapter Two: Food Deserts, Local Food Systems, and Government Intervention
Introduction

It is argued that the conventional food system “premised on neo-liberal economics and the power of large companies has failed to solve the problems associated with food and disease” (Caraher & Coveney, 2004:595). Further, it is believed that the conventional food system has created or exacerbated issues concerned with poor food access and equity in certain communities and populations (Caraher & Coveney, 2004; Baker, Shootman, Barnidge, & Kelly, 2006). The lack of affordable, healthy food options diminishes people’s ability to access healthy food needed to maintain a healthy diet (Hendrickson, Smith & Elkenberry, 2006).

Areas characterized by low healthy food accessibility are referred to as food deserts. There are various definitions of the food desert concept, however for this research food deserts are defined as parts of the country deprived of fresh fruit, vegetables, and other healthful nutritious foods. The existence of food deserts is largely attributed to a lack of grocery stores, farmer’s markets, and other healthy food providers (American Nutrition Association, 2015). Environmental conditions or features commonly cited as contributing to or being associated with the emergence of food deserts include: insufficient population base; changes in distribution channels, and demographic characteristics such as low-income, minority, elderly, and less educated residents (Morton & Blanchard, 2007).

The insufficiency of food outlets selling healthy foods can be viewed as a manifestation of market failure (Rocha, 2009) in the conventional food system. In recognition of this market deficiency the federal and state governments and communities across the U.S. have been developing strategies and policies to mitigate the so-called food desert problem. One prominent strategy advocated over the last twenty years is local food system development. Local food markets such as farmers’ markets are viewed as alternative healthy food sources that can be developed in places void of or far from conventional food markets (Jilscott, Keyserling, Crawford, McGuirt, & Ammerman, 2011). Research suggests that the presence of local food markets may facilitate greater food and vegetable consumption in food deserts (Zepeda, Reznickova, & Lohr, 2014); however there is little evidence that local food markets
are actually being developed in these areas. In addition, there are few studies that evaluate the role of government intervention in contributing to greater local food market availability in disadvantaged areas such as food deserts.

To address these knowledge gaps, this study uses multivariate regression analysis to examine whether there is disparity in farmers’ market availability between food desert counties and non food desert counties. In addition, this study examines how government intervention (specifically grant-making to support local food development) is related to the level of farmers’ market availability in food deserts compared to non food deserts. The findings from this research intend to inform local food, health, and economic development policy as a means to improve food access and health in communities disadvantaged in these ways.

**Literature Review**

*The food desert concept.* The food desert concept is a way of describing food insecurity in certain geographic contexts. Food security is one of the most pressing challenges in the current socio-political space and is built on three pillars: 1) food availability; 2) food accessibility; and 3) food use (Ziervogel & Ericksen, 2010; World Health Organization, 2014). Places in which these pillars are not built or maintained are deemed food deserts. While the concepts of food availability and food accessibility define different dimensions of the food security concept, they are often used interchangeably in research. To clarify the difference in these concepts, in this study food availability refers to the quantity of food or markets available, while food accessibility refers to ability to obtain food (World Health Organization, 2014) given conditions such as proximity to food markets, socioeconomic status, and access to transportation. Guided by the logic that markets that sell food must be available in order for consumers to access goods, food availability can be viewed as an important precursor to food access. Studies rarely separate these concepts or demonstrate the interdependencies of food security dimensions in conceptualizing and/or explaining the emergence of food deserts. In other words, food security and food desert studies rarely examine how and whether areas are disadvantaged in terms of just availability or
accessibility or both. Peripherally, this study attempts to highlight the challenges in doing food security and related research given the ambiguity and limitations of food security concepts used in literature.

The food desert problem. According to the USDA, Economic Research Service approximately 13.5 million people in the US resided in food deserts in 2010 (USDA, 2011). Public health research has long suggested that a healthy diet (e.g. consumption of fresh fruits and vegetables) is associated with reduced risk of several chronic diseases including heart disease, stroke, hypertension, obesity, diabetes, and certain cancers (Must, Dallal, & Dietz, 1991; Segal, Carter, & Zimmet, 1994; Bhattacharya & Currie, 2001; White, 2007; Larsen & Gilliland, 2009; Adams, Ulrich, & Coleman, 2010). The major concern with food deserts is that there is insufficient quantity or quality of food in particular geographic areas (Hallett & McDermott, 2011) to encourage or support healthy diets. In the literature, the insufficient quantity or quality of food is commonly attributed to the lack of available markets that provide affordable healthy food options such as grocery stores, supermarkets, and other healthy food providers (Alston, Sumner, & Vosti, 2008; Hendrickson et al., 2006). Quantity and quality of available food options is a function of the markets that are present in a given area. Glanz and colleagues (2007) found that conventional markets, such as grocery stores, had greater availability of healthier food options compared to convenience stores. Morris and co-researchers (1992) found that small/medium stores carried smaller amounts of fresh food compared to big box stores. Food deserts are defined as being disadvantaged in terms of having limited access to these food outlets. Hendrickson and colleagues (2006) found that the availability of food stores in rural and urban food deserts are more limited in variety and quantity of food compared to non food deserts. In addition, Walker, Keane, and Burke (2010) found that food deserts have less varieties and quantities of food market availability.

Food deserts are also often linked to particular demographic, socioeconomic, and environmental conditions. Low income or poor neighborhoods are commonly cited socioeconomic conditions linked to limited food access (Morland, 2000; Morland, Wing, & Diez Roux, 2002; Morland, Diez Roux, & Wing, 2006; Besharov, 2010). The major issue
with these conditions is that residents that live in low income neighborhoods lacking access to healthy food markets may also experience higher obesity prevalence (Jilscott et al., 2011; Ghosh-Dastidar et al., 2014) and other chronic illnesses compared to residents in more affluent neighborhoods. Therefore, neighborhoods, especially low-income ones, may be more negatively impacted by the lack of access to healthy foods in that they may contribute to greater health risk in these communities.

*The food desert problem as a manifestation of market failure.* The economic perspective has been promoted as a good lens through which to analyze food deserts, food availability and access. However, some researchers argue that this perspective is relatively absent in the food security discourse (Besharov, 2010). According to Besharov (2010), the economic perspective is especially important to the discourse because the main concern in economics is the allocation of resources. The theory of market failure is a common economic theory that can be used to explain the inefficiencies or insufficiencies in existing markets to distribute/allocate food equitably. A main argument in this paper is that the existence of food deserts can be viewed as a market failure in the conventional food system because of this deficiency. Market failures occur when free markets are “socially inefficient” (i.e. when social costs for a market or good outweigh the social benefits of the market/good) or when the full benefits for the use of social sources are not realized (Rocha, 2007:14). It is suggested that markets can become inefficient when private markets do not provide enough of an activity or good even when the benefits it provide greatly outweighs its social costs (i.e. positive externalities\(^1\)) (Rocha, 2007:16).

Given that market failure arguments are usually efficiency based other perspectives are useful in defining market deficiencies such as perspectives grounded in social justice principles. The food justice movement is one aimed at applying social justice solutions to address inequality in the food systems with a commitment to equitable economic development in the food supply chain (Scorza, Henderson, & Castillo, 2012). Food justice is defined as “ensuring that all individuals, families, communities have access to healthy, high

\(^1\) Positives externality refer to positive nonmonetary effects that not taken into account during the decision making process (Baumol & Oates, 1975)
quality, low cost, locally grown, culturally relevant and nutritious food from seed to plate” (Social Justice Learning Institute, 2012). Food justice advocates argue that food security is achieved through a distinct focus on and prioritization of food justice in underserved communities, more specifically in food deserts (Scorza, et al., 2012). Therefore, in order for market or organizational efforts to be deemed just in terms of increasing healthy food access for all, they must target areas most disadvantaged by food system deficiencies.

In this study, the insufficiency of available markets that provide healthy food options in disadvantaged communities is viewed as market failure because it can lead to inequitable distribution of healthy food options which may ultimately lead to greater societal cost overall. Figure 1 shows the logic of market failure in the food system described in this paper. Coming from the perspective that food market availability (i.e. the number of markets present) within a community is an important precursor to food access and consumption.

![Figure 1. Logic of market failure based on healthy food market availability](image)

The logic here is that limited food market availability places constraints on people’s access to healthy food. This may lead to little or no consumption of healthy foods in areas deemed
food deserts. Low healthy food consumption may induce the prevalence of negative health risks such as obesity, cardiovascular disease, and diabetes. The emergence of these health risks may ultimately lead to high public health costs. From this perspective, public health cost can be viewed as a social cost due to healthy food market deficiency. Given that food deserts are defined by insufficiency of and limited access to healthy food, it is likely that much of these social costs derive from these areas.

Local food development as strategy toward mitigating the food desert problem. Local food system development has been promoted as a strategy or a theory of change toward increasing healthy food access in places considered being food deserts (see Figure 2). The term “local food system” is a broad concept that is commonly defined as a system in which foods are grown or produced, processed, and distributed locally at the household, neighborhood, municipal, and even regional levels (Dahlberg, 1994). Local food systems usually consist of localized markets such as local food hubs, farmers’ market, community supported agriculture (CSAs), and roadside stands. One of the most valued aspects of local food markets are the markets’ close proximity to residents within a geographic area. This is a valued characteristic of local food markets because it implies several community benefits including a reduction in food production and marketing chains, closer ties between farmer and consumer, and less external resource dependency. Reductions in food chains mean that food travel less miles, is handled less, and can be consumed soon after harvest—which should equal fresher and healthier produce. Strong ties between farmer and consumer create more opportunities for informational exchanges about how and where food is produced. This information exchange may then lead to changes in attitudes toward food and toward supporting local agriculture. Which may lead to more sustainable economies for local farms (and the local labor employed by the farms) and better health outcomes for residents who consume more healthy goods provided by these markets. This is believed to ultimately lead to a reduction in public health cost associated with treating food related disease. Given this logic, many assume that developing local food systems may be an effective strategy toward increasing food access in disadvantaged areas such as food deserts (Fisher & Birch, 1999; Story, Kaphingst, Robinson-
O’Brian, & Glanz, 2008; Larson, Story, & Nelson, 2009; McCormack & Laska, 2010; Jilscott et al., 2011).

Figure 2. Theory of change in improving healthy food accessibility through local food system development.

There is limited, but some evidence to suggest that the presence of local food markets actually contribute to improvements in food access and healthier eating habits in food deserts. Examining the impacts of a farmers’ market in a Canadian food desert, Larsen and Gilliland (2009) found that the introduction of the farmers’ market increased the availability of healthy food and reduced the overall food costs for households in an urban community. Findings from Zepeda and colleagues’ (2014) study of the effectiveness of mobile markets in food deserts show that mobile markets helped to facilitate healthy eating in both urban and rural food deserts. These findings demonstrate how the introduction of local food markets in a food environment can increase competition with existing markets, thus decrease overall cost and accessibility to higher quality foods. While these studies show that the presence of
local food markets can help promote healthy food consumption at the local level, to my knowledge there are no national level quantitative studies that examine the relationship between local food market availability and food deserts.

While there is a great deal of advocacy for local food system development; there are researchers that caution against generalizations made about local food market benefits. Crafted in the spirit of social justice principles the common perception and appeal of local food systems is that they “are rooted in particular places, aim to… enhance social equity and democracy for all members of the community” (Feenstra, 1997, p.28; Hinrichs, 2000). However, some researchers challenge this assumption and other expectations that underlie local food systems (LFS) (Hinrichs, 2003; Born & Purcell 2006; DuPuis & Gillon, 2009; Mount, 2012; Low et al., 2015; Godette, Beratan, & Nowell, 2015). Researchers in this camp suggest that local food markets have the potential to be elite niche markets (Allen et al., 2004; Goodman, 2003; DuPuis & Goodman, 2005) thus possibly contributing the food access disparities. These researchers have recognized the need to evaluate the cost and distribution of benefits that are generated by these systems and advocate for more sophisticated assessments of the local food strategy (Desrochers & Shimizu, 2008; Low & Vogel, 2011; Godette, et al., 2015)

The role of government in addressing the food desert problem. Market failure is a traditional argument used to generate the support for and implementation of policies or government intervention in various aspects of social life including health, education, and public safety (Rocha, 2007; Bellinger, 2007). While most intervention measures are justified through efficiency arguments, government action in markets is also justified through equity concerns (Bellinger, 2007) such as ones guided by social justice principles discussed above.

Government action toward identifying and eliminating food deserts serves as evidence that the government acknowledges that there is a failure in conventional food markets to locate/emerge in certain areas. The federal government, particularly the USDA, has a long history in creating and implementing policies to correct deficiencies and inequities in the food and agriculture systems. In the past decade the USDA increased their attention and
action toward reducing food access disparities thought to be caused by the conventional market structure. One of the more recent core intervention strategies promoted by the USDA is the local food system development strategy. In the 2008 Farm Bill, the USDA was commissioned to provide a report to assess the prevalence of food deserts and provide measures to correct or mitigate the issues associated with the existence food deserts (USDA, 2010). Through the Healthy Food Financing Initiative (HFFI)\(^2\), the Obama Administration allocated $400 million towards assessing the prevalence of food deserts in the U.S. and developing strategic measures to address the forces that drive and reduce the food desert problem (U.S. DHHS, 2010; US White House, 2010).

The creation and support of these types of programs are a result of a growing demand for local and healthier foods (Freedman, Bell & Collins, 2011; USDA, 2014), as well as a common view held among many policy makers that access to food is a right (Rocha, 2007) and public health risks can be reduced through increasing the availability of and accessibility to local food markets (Cummins & Macintyre, 2002a; Wrigley, 2002). As a result of legislative support, local food systems have been linked to numerous USDA priorities—including “enhancing the rural economy and the environment, improving food access and nutrition, informing consumer demand, and strengthening agricultural producers and markets” (Low et al, 2015). An example of a government program to support local food market development includes the Local Food Promotion Program sponsored by the USDA, Agricultural Marketing Service. The federal government also supports a suite of other programs under the Know Your Farmer Know Your Food initiative. A main objective of these types of programs is to support the development and expansion of local food markets as a means to increase consumption and access to locally and regionally produced foods, especially in places that have low food access (food deserts) (USDA, n.d.).

**Research Gaps.** Despite optimism among policy makers, scholars, and advocates that local food systems aid in ameliorating food security and health disparities, we know little about the extent to which this is true. While there is qualitative evidence that suggest that local food development can provide social benefits to disadvantage communities such as food deserts

\(^2\) HFFI is a part of the First Lady Michelle Obama’s *Let’s Move Initiative* to end childhood obesity.
(example Zepeda et al., 2014), there is little quantitative evidence that these benefits are being realized in food deserts across the nation. There is evidence that suggests that these markets are mostly developed in more urbanized affluent areas (Martinez et al., 2010) and that local food markets are not being developed in disadvantaged areas (Rundle et al., 2009; Walker et al., 2010). If this is true, it is possible that local food systems are not being developed in a just way (i.e. in a manner that may reduce food access inequalities); rather they may contribute to or exacerbate these disparities by not locating/emerging in areas that lack conventional market availability. This study addresses these knowledge gaps by testing whether any significant differences exist between food desert and non food desert farmers’ market availability at the county level (see Model 1 in Figure 3).

![Figure 3](image_url)

**Figure 3.** Relational Models 1 and 2, modeling the relationship local food market availability in food deserts and non food deserts and the moderating ‘effect’ of government intervention.

Furthermore, there are few studies that quantitatively examine the role of government in mitigating the food desert problem through providing assistance for local food system
development. While government organizations, such as the USDA, have made clear their intentions in promoting the local food market development strategy it is unclear whether these supports are actually targeting food deserts. For these reasons a key area of concern in the study of food security should be to assess whether the policies and action toward developing local food systems are effective strategies toward meeting community level food access needs (Godette et al., 2015). From the public management perspective, the level of government support (i.e. public tax dollars) being contributed to the local food system development strategy make it necessary to evaluate whether these strategies are achieving two main goals: 1) helping to increase healthy food access; and 2) targeting the populations most disadvantaged by the existing food system—in this case food deserts. This research serves a springboard toward evaluating the progress toward these goals.

Food desert and accessibility literatures state that access to healthy food environments is a “function of availability, which is dependent on measures of proximity, race/ethnicity, income, and age” (Adams et al., 2010:58). Given the list of other environmental factors associated with food deserts and food market availability these relationships are examined by adjusting for certain demographic, socioeconomic, food production capacity and geographic conditions. Guided by the view that local food markets may be elite niche markets that are not designed to create equitable access to healthy food the following hypothesis is tested:

**Hypothesis 1:** There is a significant difference in farmers’ market availability in food deserts compared to food deserts, with food deserts having significantly less.

Given the level of government support and assistance in local food system development this study also examines the role of government in helping to reduce the disparity in healthy food market availability. In other words, this study addresses the question of whether government intervention in local food system development is focused on the most disadvantaged in terms of food accessibility (i.e. food deserts) (see Model 2 in Figure 3). If government efforts to support local food development are aimed at achieving food justice goals such as mitigating
the food desert problem then their grant-making efforts should reflect this objective. Assuming that government assistance is distributed in a just manner the following hypothesis is tested:

_Hypothesis 2: Food desert counties will be recipients of more government assistance._

**Methods**

_Data collection._ Data for this research was collected mainly from the U.S. Economic Research Service Food Environment Atlas. The Food Environmental Atlas is an interactive tool that allows users to illustrate maps and download data that represent the state of food accessibility in the United States. Information such as the availability and accessibility to local and conventional food markets as well as county level socioeconomic and geographic characteristics is included in the database. Table 1 shows the data that was collected, the variable it defines in the models, the source, and year from which the data was produced.

_Method of Analysis._ A systematic sampling stratification approach was used in this study to also examine the moderating effect of geography or urban proximity on the relationship between farmers’ market availability in food deserts compared to non food deserts. Research on local food market development shows that local food markets tend to be higher in more populated, urban and suburban areas in the West and Northeast regions (Martinez et al., 2010; Low & Vogel, 2011). Also in previous work by Godette and colleagues (2015) they found that county cooperative extension agents believed that population and urban proximity were important contingencies of local food market availability and sustainability.
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ market availability³</td>
<td>The number of farmers’ markets available/existing in a county in 2010.</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td><strong>Main Independent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert</td>
<td>Food deserts are defined as at least 33 percent of people living in a county that have low income⁴ and more than 1 mile from a supermarket or large grocery store if in an urban area, or more than 10 miles from a supermarket or large grocery store⁵ if in a rural area. All counties that met the USDA food desert definition (above) were coded 1 = Food Desert County; all other counties were coded 0 = Non Food Desert County</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td><strong>Moderating Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government intervention</td>
<td>Total local food market grant funds awarded in 2009.</td>
<td>Know Your Farmer Know Your Food Database, 2009</td>
</tr>
<tr>
<td></td>
<td><strong>Total government</strong> = Total grants awarded / $100,000</td>
<td></td>
</tr>
<tr>
<td><strong>Demographic and Socioeconomic Control Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population</td>
<td>Total population in county</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td>Median household income</td>
<td>Median household income</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td>Percent population in poverty</td>
<td>Percent of population under poverty level</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td>PSED</td>
<td>Percent of population with some college education</td>
<td>County Health Rankings Report</td>
</tr>
</tbody>
</table>

³ Farmer’s market data was used because the there is limited quantitative data on the other local food market structures (Godette, Beratan, & Nowell, 2015). In addition, farmer’s markets are the most promoted and developed local food market strategies.

⁴ Low-income is defined as annual family income of less than or equal to 200 percent of the Federal poverty threshold based on family size (USDA-ERS, 2012).

⁵ Markets fit within this definition with they reported at least $2 million in annual sales and contained all the major food departments found in a traditional supermarket, including fresh meat and poultry, dairy, dry and packaged foods, and frozen foods.
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent population age 65 and older</td>
<td>Percent of population age 65 and older</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td>African American population</td>
<td>Percent of African American residents in county</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td>Hispanic population</td>
<td>Percent of Hispanic residents in county</td>
<td>USDA, Food Environment Atlas</td>
</tr>
<tr>
<td><strong>Geographic Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rurality</td>
<td>Percent of county that is rural</td>
<td>Atlas of Rural and Small Town America</td>
</tr>
<tr>
<td>Region</td>
<td>Geographic U.S. region county lies within. Regional variables were coded as binaries (e.g. Northeast regional binary: counties representing the Northeast =1; counties representing all other regions = 0. Four binaries were calculated for each region. Note: one regional binary was dropped from each model in order to reduce multicollinearity.</td>
<td></td>
</tr>
</tbody>
</table>

To adjust for some of these contingencies, the sample was stratified using the USDA Economic Research Service’s Rural-Urban Continuum Codes. Rural-Urban Continuum Codes (RUCCs) distinguish metropolitan (urban) counties by the population size of their metro area, and nonmetropolitan (suburban) counties by the degree of urbanization and adjacency to metro areas (USDA-ERS, 2010). This operationalization provides a more robust classification of residential environment, beyond the simple dichotomous view of metropolitan versus non-metropolitan. In addition, it allows for the analysis of phenomena related to the degree of rurality and urban proximity (USDA-ERS, 2013). There are nine categories in the Rural-Urban Continuum, see table 2. The categories were organized into three sub-sample groups: metropolitan counties (urban), metro-adjacent counties (suburban), and rural counties. Other food desert studies have been based on similar stratification.
techniques (Moore, Probst, Tompkins, Cuffe, & Martin, 2007). To see how the RUCCs were stratified in this study see table 2.

Robust regression analysis was used to test the county level differences in local food market availability in food desert compared to non food desert counties, adjusting for certain demographic, socioeconomic, food production capacity, and other geographic conditions (see Table 2 for more details on control variables). This same methodology was also used to examine the moderating effect of government intervention on local food market availability in food desert compared to non food desert counties. The total amount of local food system development grant dollars awarded in the county was used as a proxy for government intervention. In this study government intervention is defined as the federal government providing subsidies/assistance through grant/loan initiatives to support local food development.

<table>
<thead>
<tr>
<th>RUCC Code</th>
<th>Sub-sample Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metropolitan (Urban) Counties</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Counties in metro areas of 1 million population or more</td>
</tr>
<tr>
<td>2</td>
<td>Counties in metro areas of 250,000 to 1 million population</td>
</tr>
<tr>
<td>3</td>
<td>Counties in metro areas of fewer than 250,000 population</td>
</tr>
<tr>
<td><strong>Metro-Adjacent (Suburban) Counties</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Urban population of 20,000 or more, adjacent to a metro area</td>
</tr>
<tr>
<td>6</td>
<td>Urban population of 2,500 to 19,999, adjacent to a metro area</td>
</tr>
<tr>
<td>8</td>
<td>Completely rural or less than 2,500 urban population, adjacent to a metro area</td>
</tr>
<tr>
<td><strong>Non Metro-adjacent (Rural) Counties</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Urban population of 20,000 or more, not adjacent to a metro area</td>
</tr>
<tr>
<td>7</td>
<td>Urban population of 2,500 to 19,999, not adjacent to a metro area</td>
</tr>
<tr>
<td>9</td>
<td>Completely rural or less than 2,500 urban population, not adjacent to a metro area</td>
</tr>
</tbody>
</table>
Given that it takes time for a government intervention to take effect, the amount of grant/loans awarded was lagged in the model for t-1 years of the farmers’ market data. This data was sourced from the Know Your Farmer Know Your Food (KYF2) project database provided by the U.S. Department of Agriculture. KYF2 programs help communities scale up local and regional food systems as a means to strengthen their economies. Agencies under the USDA umbrella (and nine other federal agencies) have provided financial assistance in the form of grants and loans to support this work (USDA, n.d). To test the moderating effects of the total government grants/loans awarded (in $100,000), a two-way interaction was computed: the interaction between total grants in dollars and the food desert binary.

In order to account for confounding and contextual factors that may influence local food market availability, several controls were included in the models. These controls include socioeconomic, demographic, food production capacity and geographic features of the county. The selection of these variables is based on relationships highlighted in the food security and local food literatures and by using basic logic to identify other variables that may significantly influence market availability in food deserts (e.g. local production capacity). More detailed descriptions of these variables can be found in Table 2.

### Findings

**Descriptive statistics**. Table 3 displays the descriptive statistics for the main dependent and moderating variables for the full sample and for each geographically designated sub-sample group. Twenty percent of all U.S. counties met the USDA's criteria for being classified as a food desert.

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6 Note while this models in this study were lagged for to t-1 it is the author’s opinion that the performance of interventions may not be accurately measured within a year’s time, however to accurately measure performance process, intermediate, and late outcomes must be monitored prior to, during, and well after the intervention. Therefore, this study represents the evaluation of process goals (e.g. targeting the most disadvantaged communities) of government interventions in local food system development.

7 Note: When comparing the population, median income, poverty and percent of population with some college education food deserts in all geographic designation had slightly lower population, median household income and percentage of residents with some college, and slightly higher poverty, percent of residents that are Black, Hispanic and 65 and older. In addition, food desert counties are more rural.
food desert. In terms of farmers’ market availability and grant/loan dollars awarded, urban counties tended to be higher than average, while suburban counties tended to fall in the mid-range, and rural counties fell on the lower end of the spectrum.

Overall, the average county had two farmers’ markets available in 2010. Urban counties had higher farmers’ market availability on average than the other geographic sub-groups, while among suburban and rural counties’ average farmers’ market availability was approximately the same. On average, the counties in the sample received $15,513 in financial assistance from the programs listed under the KYF2 initiative. Urban counties had the greatest financial assistance on average ($32,211), while rural counties had the least ($4,728). To give some perspective, metropolitan counties awarded government grants/loans received approximately six times the funds that suburban and rural counties received.

Table 3. Descriptive Statistics by Geographic Designation

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ markets availability</td>
<td>2 (1.96)</td>
<td>4.53</td>
<td>0</td>
<td>102</td>
</tr>
<tr>
<td>Total grants/loans awarded to county (in $100,000)</td>
<td>$15,513</td>
<td>$102,465</td>
<td>$0</td>
<td>$2,474,000</td>
</tr>
<tr>
<td><strong>Urban</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ markets availability</td>
<td>4 (3.5)</td>
<td>6.8</td>
<td>0</td>
<td>102</td>
</tr>
<tr>
<td>Total grants/loans awarded to county (in $100,000)</td>
<td>$32,211</td>
<td>$155,130</td>
<td>$0</td>
<td>$2,474,000</td>
</tr>
<tr>
<td><strong>Suburban</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ markets availability</td>
<td>1 (1.2)</td>
<td>1.72</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Total grants/loans awarded to county (in $100,000)</td>
<td>$6,429</td>
<td>$50,722</td>
<td>$0</td>
<td>$1,388,549</td>
</tr>
<tr>
<td><strong>Rural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ markets availability</td>
<td>1 (.904)</td>
<td>1.60</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Total grants/loans awarded to county (in $100,000)</td>
<td>$4,728</td>
<td>$52,508</td>
<td>$0</td>
<td>$841,610</td>
</tr>
</tbody>
</table>

Table 4 displays additional sub-sample group descriptive statistics, comparing food desert and non food desert county level farmers’ market availability and government financial assistance for local food development. Overall, approximately three percent of the county population is considered to be food desert counties. There were a greater proportion of rural
food desert counties than urban and suburban food desert counties. In terms of government intervention, non food desert counties received more grant/loan assistance on average than food deserts counties across all geographic designations except for suburban counties. In fact, suburban food deserts received more grant or loan assistance on average than suburban non food deserts. This trend was not found in the other geographies.

<table>
<thead>
<tr>
<th>Sample Group / Sub-group</th>
<th>Number of counties</th>
<th>Average number of farmers’ markets</th>
<th>Percent of counties with farmers’ markets available</th>
<th>Percent of counties awarded grants/loans</th>
<th>Average grants/loans awarded ($100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Counties(^a)</td>
<td>Non Food Deserts</td>
<td>3042</td>
<td>2</td>
<td>62.0%</td>
<td>9.3%</td>
</tr>
<tr>
<td></td>
<td>Food Deserts</td>
<td>91 (3%)</td>
<td>1</td>
<td>13.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Metro Counties(^b)</td>
<td>Non Food Deserts</td>
<td>1158</td>
<td>4 (3.5)</td>
<td>72.0%</td>
<td>15.5%</td>
</tr>
<tr>
<td></td>
<td>Food Deserts</td>
<td>5 (0.4%)</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Suburban Counties(^c)</td>
<td>Non Food Deserts</td>
<td>1008</td>
<td>1 (1.2)</td>
<td>60.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td></td>
<td>Food Deserts</td>
<td>19 (1.9%)</td>
<td>&lt;1 (0.316)</td>
<td>39.7%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Rural Counties(^d)</td>
<td>Non Food Deserts</td>
<td>854</td>
<td>&lt;1 (0.963)</td>
<td>56.8%</td>
<td>4.5%</td>
</tr>
<tr>
<td></td>
<td>Food Deserts</td>
<td>62 (7.2%)</td>
<td>&lt;1 (0.147)</td>
<td>35.3%</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

*Regression results – variation in food desert and non food desert farmers’ market availability.* Table 5 shows the regression results for the main dependent and independent variables, adjusted for stated demographic, socioeconomic, food capacity, and geographic conditions in a county. In partial support of *Hypothesis 1* the results show a statistically significant difference in farmers’ market availability between food desert counties and non
food desert counties in suburban and rural contexts. According to the results, suburban food desert counties had slightly fewer farmers’ markets than their food desert counterparts. No statistically significant differences are observed in the number of farmers’ markets between urban food desert and urban non food desert counties.

### Table 5. Regression Statistics for direct and moderating effects on the level of farmers’ market availability in food desert compared to non food deserts across county level metropolitan statistical area designation.

<table>
<thead>
<tr>
<th>Independent / Moderating Variables</th>
<th>Full Sample</th>
<th>Urban</th>
<th>Suburban (Urban-adjacent)</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td></td>
<td>β</td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>-0.342*</td>
<td>-0.470*</td>
<td>-0.454*</td>
<td>-0.217*</td>
</tr>
<tr>
<td>Total local food grants awarded, 2009</td>
<td>0.376*</td>
<td>0.083</td>
<td></td>
<td>0.252</td>
</tr>
<tr>
<td>Food Desert Binary * Total local food grants awarded (in $100,000)</td>
<td>-1.19^</td>
<td>-0.174</td>
<td></td>
<td>-1.61*</td>
</tr>
<tr>
<td>Urban</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>1.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total local food grants awarded, 2009</td>
<td>0.379*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary * Total local food grants awarded (in $100,000)</td>
<td>Omitted^</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban (Urban-adjacent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>-0.470*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total local food grants awarded, 2009</td>
<td>0.083</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary * Total local food grants awarded (in $100,000)</td>
<td>-0.174</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>-0.217*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total local food grants awarded, 2009</td>
<td>0.252</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary * Total local food grants awarded (in $100,000)</td>
<td>-1.61*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 3050 ; R^2 = 0.654; R^2 = 0.654  
^N = 1121 ; R^2 = 0.681; R^2 = 0.681  
*N = 1013 ; R^2 = 0.322; R^2 = 0.322  
^N = 916 ; R^2 = 0.372; R^2 = 0.372  
*Significant at the p < 0.05  
^Significant at the p < 0.10  
Food Desert Binary: Food Desert county = 1; Non food desert county = 0  
All models are adjusted for demographic, socioeconomic, production capacity, and geographic conditions using robust standard errors

---

8 The interaction effect was not computable due marginal representation of food desert counties in the urban sample (i.e. only 5 urban food deserts counties in the sample, none of these counties had farmers’ markets or received government assistance.
Regression results – the moderating effect of government intervention on farmers’ market availability in food desert and non food desert counties. Table 5 also provides the regression results for the main dependent and independent variables moderated by the amount of federally subsidized local food system development grant/loan dollars awarded, which is used as a proxy for government intervention. According to Table 5, additional $100,000 in grants/loans awarded in rural food deserts was associated with fewer farmers’ markets. These findings suggest that more government funding went to rural food desert counties with less farmers’ market availability. Figure 4 provides a more detailed picture of this interaction effect.

Figure 4. Interaction effects between food desert counties and government intervention on the predicted value of farmers’ market availability in rural counties
According to the figure steep declining slope of the food desert county line shows that in rural food desert counties more financial assistance is associated with counties that had fewer farmers’ markets, while in non food desert counties more assistance was associated with counties with more farmers’ markets. Partially supporting *Hypothesis 2*, these results imply that government intervention is actually targeting the most disadvantaged food desert counties in terms of farmers’ market availability; however it also suggests that significantly higher levels of government assistance flowed into counties that were more advantaged in this way. This is also supported by the findings that show a significant direct positive link between government assistance and farmers’ market availability in urban counties overall. According to the results, more grant assistance is associated with slightly more farmers’ markets in urban counties. While the magnitude of the coefficients are marginal the main takeaway is that these models show that there may be significantly fewer farmers’ markets in areas that have low access to conventional markets and that local food government assistance programs are targeting both advantage and disadvantaged counties in terms of conventional food market access. The implications of these findings are outlined in the discussion section.

**Discussion and implications**

*What is the potential of local food system development in contributing to the amelioration of food access disparities?* While local food systems are viewed and promoted as equitable and just systems that can help mitigate food access issues, the distribution of these markets suggest that local food markets may be elite niche markets (Allen, 2004; DuPuis & Goodman 2005). In this study, rural food desert counties had significantly fewer farmers’ markets than non food desert counties across geographic context. These findings also support research suggesting that local food markets are not being developed in areas with limited healthy food access, rather being developed in areas already advantaged in this way (Li, 2014; Rundle et al., 2009). Given these findings, it is reasonable to say the local food markets are not being developed in line with the social justice principles attached to the local food concept instead they seem to be emerging in response to traditional factors of market demand including
denser population and higher income. Therefore it can be said the local food market development may be exacerbating food system market failures rather than correcting them.

A limitation to this finding is related to the uncertainty of whether there is truly a disparity in market availability and accessibility or whether the existing market structure in a county is a reflection of the demand for particular markets. In other words it may be possible that residents that live in suburban and rural food deserts do not prefer to consume products sold at farmers’ markets; therefore this is why they are less prevalent in these environments. In addition, it may be cost prohibitive to build particular local food markets such as farmers’ markets in suburban and rural food deserts. For instance, population density is lower in suburban and rural compared to urban counties. Higher population density in urban contexts provide conditions that create incentives for greater market development to occur—greater population base equal more demand which equals greater profit potential. Researchers have cautioned against the assumption that people who lack access to healthy food do so because they choose to. Through interviews with residents of both urban and rural food deserts Zepeda and colleagues (2014) found that the residents, like many, desire fresh quality foods, however they highlighted the challenges in accessing fruits and vegetables including the lack of available markets that provide these options and/or limited income to afford these options. Given that there may be some demand for fresh nutritious foods the findings in this study demonstrate that there may be possible needs/desires being unmet in food deserts. Future research should focus on assessing the level of demand for healthy food options in communities that have challenges accessing healthy foods. Scorza and colleagues (2012) also highlight the challenges in developing health food environments in food insecure communities. They highlight the fact that in many cases the residents of these communities lack enough information and education to make more informed decisions about food system development. Therefore, in order to food systems to be more just/equitable then educational initiatives may need to be incorporated in the development process, otherwise these initiatives run a high risk of being ineffective in reducing inequities.
Government supported local food system development programs are targeting both advantaged and disadvantaged counties. According to the results in this study, more government grant/loan dollars were directly linked to higher farmers’ market availability in urban counties. In rural counties, more government assistance was awarded in food desert counties with fewer farmers’ markets while in rural non food desert counties more government assistance was linked to higher farmers’ market availability. These findings suggest that government assistance programs may have targeted some progressive counties while also targeting non progressive counties in terms of farmers’ market development. One explanation for these findings is that government is simultaneously helping disadvantaged areas while also investing in areas where local food development strategies are most successful. A high density of farmers’ markets is evidence that local food market development is progressing well in an area. Therefore, areas like these usually serve as suitable test beds to investigate the efficacy of possible strategic paths.

Assuming that the lack of grant funding explains this relationship, the question is then why some areas receive more funding than others. A simple explanation may be that grant funding is highly dependent on population, therefore urban counties receive more attention. Another explanation may be that organizations within urban counties are more aware of grant and assistance programs, and thus have better access to these resources. In a local food policy survey conducted by the International City/County Management Association (ICMA) and Michigan State University (MSU)’s Center for Regional Food Systems, researchers found that over 75 percent of city/county governments surveyed were unaware of the support provided through programs under the Know Your Farmer Know Your Food initiative (ICMA-MSU, 2012). Although geographic variation in city/county governments’ KYF2 program awareness was not reported in the ICMA-MSU study it is possible that the lack of awareness of these programs was most prominent among more suburban and rural cities/counties containing food deserts.

Urban areas have always been viewed as the “incubators of new ideas, technology, and mass opinion that spread outward to people living in small places and the countryside” (Fischer,
Given that funding for local food initiatives did not proliferate until after the passage of the 2008 Farm Bill, it is reasonable to hypothesize that more urbanized counties receive more local food system development assistance. Analyzing this information from a diffusion of innovation perspective, the higher grant amounts awarded to urban areas may reflect the fact that such areas are usually early adopters of new ideas, technologies, and programs. Future research should examine whether the grant amounts changed over time demonstrating a diffusion of adoption and practice from urban to more rural areas.

Another possible explanation is that government agencies may have targeted areas with the highest critical need. For example, urban counties and non food deserts on average have higher population density, which implies more people in need, thus justifying provision of more assistance. Since this study is based on data from five and six years ago, it is also possible that agency selection for local food system development grants and loans solicited after 2009 may have evolved over time. Longitudinal studies are needed that examine the link between government assistance programs and local food system in the long-run. These types of studies may provide greater insights about the efficacy of government intervention in mitigating food system related disparities through the support of local food system development.

**Other study limitations.** There are several other notable limitations to this study. As previously mentioned the cross-sectional nature of this study poses limitations to deriving causal conclusions. Future research should focus on longitudinal analysis of local food development, possibly examining what factors contribute to the development and sustainability of local food markets overtime. This study is also limited in terms of the level of analysis used. Analysis at the county level is coarse grain which means that it does not capture the micro level (e.g. city or neighborhood level) or finer grained factors (e.g. such as tastes/preferences and knowledge/awareness of the benefits of shopping at local food markets) that may influence whether markets will locate/emerge in certain places. This limitation can be observed in the case of the urban sub-sample group. In the literature, food
insecurity is a major issue in the urban context; however at the county level this is not apparent. In this study only 5 urban counties were considered food deserts. Given household and individual level barriers to food access, such as transportation access, county level analyses limit our ability to understand the impact of these more micro-level nuances. While county-level of analysis is limited in revealing these more micro level nuances ecological (i.e. aggregate level) analysis are common in the food environment literature (Chou et al., 2004; Maddock, 2004; Mehta & Chang, 2008; Pickett et al., 2005; Vandegrift & Yoked, 2004; Jilscott et al., 2011; Salois, 2012), providing analyses at the county, state, and country levels. Also analysis at the county level does capture an aspect of shopping behavior that most studies do not consider…people shop at markets not only in close proximity to their homes, but also at markets close to work and other places they frequently travel to across their residing county.

There are also limitations attributable to endogeneity issues including omitted variable bias and dual causality. Socio-political forces including existing local/state policy support may also explain the level of farmer’s market development in a county. Federal organizations are not the only agencies of change in the food system, in many cases local food system development is stimulated and support by local agencies such as state- and local-level governments, nonprofit and grassroots organizations (Scorza, Henderson, & Castillio, 2012). In addition, many states and counties have designated local food policy councils that provide guidance to policymakers on how to design policy to enhance state and regional food systems. While local or grassroots action are at the center of many local food system efforts, in many cases these efforts are funded by state and/or federal level governments. Given, the level of government intervention associated with the local food system development, this study provides important insights as to the role of federal government in the process. However, future research should consider how food system programs and initiatives at multiple levels can impact the development of local food markets in food deserts. Another notable omission is the grant objectives associated with selected projects (i.e. the selection criteria for the government and the amount agencies decided to allocate toward each project).
While grant proposal objectives and selection criteria was not considered here examining the conditions associated with the allocation of public dollars toward local food development provides us with important insights on how public dollars are allocated / distributed. In the food justice movement the most critical stakeholders to help are residents that reside in food desert communities (Scorza et al., 2012). To the extent that the public agrees with this perspective then this study provides important insights as to whether this has occurred. Other authors have highlighted limitations in using data from the USDA Food Environment Atlas including systematic bias and errors in the ERS Food Environment Atlas, such as differential representation of data in urban areas compared to rural areas (Jilscott et al., 2011). Despite these limitations, this study conducted national level analyses that adjusted for potential confounding and moderating effects of contextual features such as urban proximity and socioeconomic makeup of the county.

While it can be assumed that the conditions that characterize a food desert county (limited access to large chain grocery stores/supermarkets and low income) determine the number of farmers’ markets developed in the county, it also possible to conceptualize food deserts in terms of an area’s proximity to farmers’ markets. Given this, it not reasonable to say that one causes the other, rather these factors are associated with one another. This further reinforces the causal limitations of the models in this study, It is the my opinion that the food desert concept is limited in that it is rarely, if ever, measured in multi-dimensional fashion that captures both the availability and accessibility to all types markets that provide healthy food options (e.g. both local and conventional food markets). Therefore, it is argued that until the food desert concept is measured based on the multifaceted nature of the food system then any study using this concept will be limiting in terms of capturing the true nature of food security issues and how to ameliorate them.

Conclusions

Overall, the findings in this study suggest that local food market development may not be emerging in a way that contributes to the mitigation of the food desert problem. There is
evidence to suggest that government intervention in local food system is intended to help ameliorate food accessibility issues by targeting rural food deserts counties; however, these programs also seem to be simultaneously investing in more advantaged areas in terms of food market accessibility and availability (rural non food deserts and urban counties). These findings reinforce the point that while local food system are believed to have the capacity to diminish inequities in the food system more work needs to be done before these goals can be realized. These efforts should be only temporarily dependent on government support and should move towards reliance on community stakeholders. Greater local support may lead to more equitable and sustainable food systems.

References


Chapter Three: Examining the association between the local food environment and health outcomes in the context of food desert and non food desert counties
Introduction

Public health research has long suggested that certain health risks are exacerbated by poor diet and exercise habits (Adams, Ulrich, & Coleman, 2010). In 2010, the White House Task Force on Childhood Obesity found that limited access to healthy food choices can lead to poor diets and higher levels of obesity and other diet-related diseases. Other research suggests that the types of food stores and restaurants available in a community are important determinants of diet-related health outcomes (Morland, 2009; Drewnowski & Aggarwal, 2012; Drewnowski, 2013; Larson & Gililand, 2008, 2009; Powell, Hill, & Clancy, 2007; Freedman, Bell, & Collins, 2011; Walker, Keane, & Burke, 2010; WHO, 2012; Healthy People 2020, 2010; CDC, n.d.). It is believed that many chronic diseases can be reduced if individuals have greater access to outlets that sell healthy food options (e.g. fruits and vegetables) (Blanck et al. 2009; Flegal, Carroll, Ogden, & Curtin, 2010; Liu et al. 2000; Olshansky, 2005; Freedman, et al., 2011). Places that are most disadvantaged in terms of healthy food accessibility are commonly referred to as food deserts. Food deserts are defined by the USDA as areas where 33 percent or more of the residents live 1 mile (in urban settings) and 10 miles (in rural settings) away from the nearest grocery store or supermarket and also live below the poverty threshold (USDA-ERS, n.d.). A major concern with food deserts is that residents that live in these areas are more likely to experience higher obesity and other chronic illnesses compared to residents that have ample availability and accessibility to healthy food markets (Ghosh-Dastidar et al., 2014).

Over the last two decades local food system development has been promoted as a good strategy toward increasing healthy food options in places that lack or are deprived of markets that sell fresh foods such as fruits and vegetables. Advocates, scholars, and policymakers of local food system development believe that local food systems have the “capacity to change the structure of the food system, which may lead to enhanced community food security, fewer food deserts, and improvements in consumer health outcomes that are linked to eating habits” (Adams & Salois, 2010; Salois, 2012:39).
While there is substantial research on the association between conventional market availability and obesity and diabetes prevalence, the association between these health risks and local food market availability is understudied (Jilscott, Keyserling, Crawford, McGuirt, & Ammerman, 2011; Salois, 2012). Existing research suggests that the presence of local food markets, along with some conventional food markets (e.g. grocery stores/supermarkets) is inversely related to obesity and diabetes prevalence (Jilscott et al., 2011; Salois, 2012). However, the literature is relatively silent on whether these relationships hold in the context of food deserts compared to non food deserts. Given the assumption that local food market development is a good strategy to mitigate the so-called food desert problem and the health issues associated with it (Fisher & Birch, 1999; Story et al., 2008; Larson, Story, & Nelson, 2009; McCormack & Laska, 2010; Jilscott, 2011), examination of these phenomena should be in the context of comparing food deserts to non food deserts.

To fill these knowledge gaps, this research uses multivariate regression analysis to test the relationship between local and conventional food market availability and two health risks: obesity and diabetes. These relationships are explored by addressing the following research questions: 1) is health risk higher in food deserts compared to non food deserts?; 2) what is the relationship between local and conventional food market availability and health risks (see Figure 1 Model 1); and 3) does local food market availability have a differential association to health risk in the context of food deserts and non food deserts (see Figure 1 Model 2)?

The purpose of this research is to contribute the public health and food system literatures by providing more insight as to the relationship between local and conventional food environments and health outcomes. These types of studies are essential to informing the design and implementation of policy focused on improving health as means increase community well-being and reduce public health costs.
Figure 1. Models of the association between local and conventional food market availability and health outcomes in general (Model 1) and in the context of food deserts (Model 2)

**Literature Review**

*Growing cost of health risks in the U.S.* The costs associated with the treatment of health risks such as obesity and diabetes is growing at a tremendous rate in the United States. According to the CDC, the U.S. spent an estimated $176 billion in diabetes medical-related costs in 2012 and more than $78.6 billion in obesity-related medical costs (CDC, 2010a; 2010b). Researchers have suggested that if left unchecked medical-related costs associated with obesity may rise by $48 to $66 billion a year (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011).

*Association between food environment, food deserts, obesity and diabetes prevalence.* Research suggests that there are numerous social determinants of health. Social determinants of health are defined as conditions in which people are born, work, live, grow, and age (WHO, 2012; Healthy People 2020, 2010; CDC, n.d.). Healthy People 2020 organize these
determinants under five categories: economic stability, education, social and community context, health and healthcare, and neighborhood and built environment (Healthy People 2020, 2010). In this study the neighborhood and built environment, particularly the built food environment is examined as an important determinant of health outcomes. A great deal of research suggests that the food environment or the availability and accessibility of food markets greatly contribute to individuals’ food consumption and other diet related behaviors (Must, Dallal, & Dietz., 1991; Segal, Carter, & Zimmet., 1994; Bhattacharya, Currie, & Haider, 2004; White, 2007; Larsen & Gilliland, 2009; Adams et al., 2010). There is several barriers to fruit and vegetable consumption for some individuals and communities. Two well known barriers are the premium cost of produce compared to less healthy food options (Reicks, Randall, & Haynes, 1994; Drewnowski & Specter, 2004; Jilscott et al., 2011) and/or the limited or lack of availability of conventional retail outlets (e.g. grocery stores and supermarkets) that may provide affordable produce (Jilscott et al., 2011, Blanck et al. 2009; Flegal et al. 2010; Hung et al. 2004; Liu et al. 2000; Olshansky, 2005; Department of Health and Human Services, 2001; Freedman, et al., 2011).

Geographic areas limited or void of healthy food markets are commonly referred to as food deserts. While there multiple conceptualizations, the USDA defines food deserts in terms proximity to particular conventional markets and the household income level. It is believed that people who live in food deserts are more susceptible to higher prevalence of obesity and other health risks (Jilscott et al., 2011; Salois, 2012). Certain population groups and conditions have been found to be linked to lack of healthy food access, obesity, and diabetes. For example low-income, Blacks, and Hispanics are groups often cited as having more limited fruit and vegetable access and higher rates of diabetes and obesity (Morland, 2000; Morland, et al., 2002a; Morland et al., 2002b; Morland, et al., 2006; Besharov, 2010; Jilscott et al., 2011; Salois, 2012).

Conventional food markets are defined as traditional brick and mortar style retail stores that sell food that is usually imported from sources external to the area. Examples of these markets are convenience stores, fast food restaurants, grocery stores /supermarkets, and supercenters. According USDA-ERS definitions grocery stores and supermarkets are food
stores that “reported at least $2 million in annual sales and contained all the major food departments found in a traditional supermarket, including fresh meat and poultry, dairy, dry and packaged foods, and frozen foods” (USDA-ERS, 2010). Supercenters and warehouse clubs are markets that are “primarily engaged in retailing a general line of groceries in combination with general lines of new merchandise, such as apparel, furniture, and appliances” (USDA-ERS, 2010). Grocery stores and supermarkets are found to provide greater quantities and varieties of healthy food options than other conventional markets, such as convenience stores and fast food restaurants (Morland et al., 2002b).

Most studies that examine the association between obesity and conventional market availability found that obesity prevalence is inversely related to the availability of conventional markets such as grocery stores and supermarkets (Morland & Everton, 2009) and positively related to other conventional markets such as convenience stores and supercenters (Morland, et al., 2006; Jilscott et al., 2011; Salois, 2012; Courtemanche & Carden, 2011; Bonanno & Goetz, 2010). In an analysis of the link between obesity prevalence and supercenters researchers found that an additional Wal-Mart store per 100,000 residents was associated with increases in obesity prevalence (Courtemanche & Carden, 2011; Bonanno & Goetz, 2010).

Although the research on food market availability and accessibility mostly focuses on conventional markets as primary sources of healthy food, local food market development is a growing trend advocated to be a promising approach toward mitigating food access and related health issues (Jilscott et al., 2011, Schmidt et al., 2011; Beaulac, Kristjansson, & Cummins, 2009). Local food market development encompasses the creation and sustainability of locally owned and sourced food outlets (e.g. farmer’s markets, CSA, and road side stands). Research provides some evidence that the presence of these markets may contribute to higher fruit and vegetable consumption in low-income populations (Anliker, Winnie, & Drake, 1992; Jilscott et al., 2011; Zepeda, Reznickova, & Lohr, 2014). However, while the promotion and development of local food markets has proliferated over the last two decades, the research on examining the association between local food market availability and health risks such as obesity and diabetes is understudied (Jilscott et al., 2011). To my
knowledge there are only three studies to examine these relationships. In a study investigating the association between obesity and fruit and vegetable stands in New York City, researchers found that access to healthier food was inversely related to obesity (Rundle et al., 2009). In a national study, Jilscott and colleagues (2011) examined the county level associations between per capita farmer’s markets, grocery stores/supermarkets, and supercenters and obesity using a sample stratified by metropolitan and non metropolitan designation. They found that farmers’ market per 1,000 residents is associated with lower obesity; however these associations are only relevant to particular geographic contexts (i.e., non metropolitan counties). In another national study, Salois (2012) investigated the county-level association between both obesity and diabetes and the built food environment (i.e., eating-out environment, retail food environment, and the local food environment). Paying special attention to the local food environment he found a statistically significant inverse relationship between farmer’s markets availability and diabetes, however no significant link to obesity.

While existing research provides good insights on the relationship between health risks and food market availability (or food environments) to my knowledge there are no studies that examine whether these findings hold when testing these relationships in the context of food deserts compared to non food deserts. There are several benefits in conducting this type of analysis. First, modeling these relationships based on the USDA (traditional) conceptualization of food deserts will provide some insight as to whether these areas are actually lacking in availability of various healthy food outlets or just particular ones and whether this deficiencies further disadvantages them in terms of health risk. This type analysis may also provide some insight as to whether the food environments in food desert and non food deserts have similar levels of obesity and diabetes prevalence and whether these links support existing research. Another benefit of this type of research is that the findings from these comparisons may provide policy makers and even community/economic developers’ greater insight as to what development strategies and supporting policies may be helpful in promoting healthful behaviors in local communities.
This study examines county level associations between the local food environment\(^9\) and two food related health outcomes (obesity and diabetes). To test whether a food environment considered to be a food desert has a varied effect on these health risks, this study provides a comparative analysis of these relationships. While conventional market availability (e.g. per capita supercenters and grocery stores) is included in the models it is done to provide a more complete picture of the entire food environment. In this study, the associations between local food market availability and health risks are of most interest, especially in the context of food deserts. The focus of local food markets stems from the assumption that local food markets are great alternative sources of healthy food, thus developing these markets is a reasonable strategy toward mitigating the food availability and accessibility problems (Story et al., 2008; Larsen, Story, & Nelson, 2009; McCormack & Laska, 2010; Jilscott, 2011; Salois, 2012; Godette, paper 1), and thereby reducing health risk. Therefore, whether these markets are associated with more positive health outcomes in food deserts will have strong implications for local food, health and community development policies.

Following the view that there are disparities in diet and health related outcomes between food desert and non food deserts, the following hypothesis is tested:

_Hypothesis 1: There will be significantly higher obesity and diabetes prevalence in food desert counties compared to non food desert counties._

Given the assumption that the availability of food markets that sell healthy food options promotes more positive health outcomes in an area and that some markets provide greater varieties and quantities of nutritious foods, the following hypotheses are tested:

_Hypothesis 2: Local food market availability will be negatively related to obesity and diabetes prevalence_
Hypothesis 3: Conventional food availability will be negatively related to obesity and diabetes prevalence, with the exception of convenience stores and supercenters

Assuming that local food market availability is being developed in food deserts to counter the lack of conventional markets as means to decrease the prevalence of chronic disease, it is also hypothesized that:

Hypothesis 4: More farmers’ market availability will be associated with significantly less obesity and diabetes prevalence in the food desert counties.

Methods

Data collection. Data for this research was collected from several sources including the U.S. Economic Research Service Food Environment Atlas, CDC data based on the Behavioral Risk Factor Surveillance System (BRFSS), County Health Rankings Reports, and U.S. Census data. Table 1 shows the data that was collected, the variable it defines in the models and the source and year from which the data stems.

Method of Analysis. Robust multivariate regression analysis is promoted as a good approach to conduct comparative analysis in food access and availability studies. The first regression model in the study tests the relationship between obesity prevalence as the dependent variable and local and conventional market availability per 100,000 residents as the main independent variables. Model 2 represents the same model; however with diabetes prevalence as the dependent. The controls selected for this study (see Table 1) are based upon factors that previous literature has noted to be social and environmental determinants of food access, food deserts, and/or food related health risks. For example, while the food environment may be an important factor of health outcomes, physical activity and access to healthcare are other factors that should be considered.
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity Prevalence</td>
<td>Percent of population with Body Mass Index (BMI) over 30%</td>
<td>CDC data based on the Behavioral Risk Factor Surveillance System (BRFSS)</td>
</tr>
<tr>
<td>Diabetes Prevalence</td>
<td>Percent of population that have diabetes. Based on self-report</td>
<td>CDC data based on the Behavioral Risk Factor Surveillance System (BRFSS),</td>
</tr>
<tr>
<td><strong>Main Independent Variables</strong></td>
<td></td>
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<tr>
<td>Food Desert Binary</td>
<td>Food deserts are defined as at least 33 percent of people living in a county with low income\textsuperscript{10} living more than 1 mile from a supermarket or large grocery store if in an urban area, or more than 10 miles from a supermarket or large grocery store\textsuperscript{11} if in a rural area. All counties that met the USDA food desert definition (above) were coded 1 = Food Desert County; all other counties were coded 0 = Non Food Desert County</td>
<td>U.S. Food Environment Atlas</td>
</tr>
<tr>
<td>Farmers’ markets per 100,000 residents</td>
<td>The number of farmers markets available per 100,000 residents in the county.</td>
<td>U.S. Food Environment Atlas,</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>The number of convenience store available per thousand residents in the county.</td>
<td>U.S. Food Environment Atlas,</td>
</tr>
<tr>
<td>Large grocery store / supermarket availability per 100,000 residents</td>
<td>The number of grocery store/supermarkets available per thousand residents in the county</td>
<td>U.S. Food Environment Atlas,</td>
</tr>
<tr>
<td>Supercenter availability per 100,000 residents</td>
<td>The number of supercenters available per thousand residents in the county</td>
<td>U.S. Food Environment Atlas</td>
</tr>
</tbody>
</table>

\textsuperscript{10} Low-income is defined as annual family income of less than or equal to 200 percent of the Federal poverty threshold based on family size (USDA-ERS, 2012).

\textsuperscript{11} Markets fit within this definition if they reported at least $2 million in annual sales and contained all the major food departments found in a traditional supermarket, including fresh meat and poultry, dairy, dry and packaged foods, and frozen foods.
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic and Socioeconomic Control Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population</td>
<td>Total population in county</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>Median household income</td>
<td>Median household income</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>Percent population in poverty</td>
<td>Percent of population under poverty level</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>PSED</td>
<td>Percent of population with some college education</td>
<td>County Health Rankings Report</td>
</tr>
<tr>
<td>Percent population age 65 and older</td>
<td>Percent of population age 65 and older</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>Black population</td>
<td>Percent of Black residents in county</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>Hispanic population</td>
<td>Percent of Hispanic residents in county in 2010</td>
<td>U.S. Census</td>
</tr>
<tr>
<td>Rurality</td>
<td>Percent of county that is rural</td>
<td>Rural Atlas</td>
</tr>
<tr>
<td><strong>Geographic Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan binary</td>
<td>Whether a county is metropolitan county according the OMB standards, or a non-metropolitan county {1 = Metropolitan county; 0 = Non-metropolitan county}</td>
<td>U.S. Food Environment Atlas</td>
</tr>
<tr>
<td><strong>Health Care Behavior and Environment Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Inactivity</td>
<td>Percent of adults that report no leisure time physical activity</td>
<td>County Health Rankings Report</td>
</tr>
<tr>
<td>Access to health insurance</td>
<td>Percent of uninsured adults</td>
<td>County Health Rankings Report</td>
</tr>
<tr>
<td>Access to health care provider</td>
<td>Ratio of population to primary care physicians</td>
<td>County Health Rankings Report</td>
</tr>
</tbody>
</table>
To account for any lags in the availability of food markets and its possible impacts on health outcomes, both local and conventional market availability terms are lagged (at least t-1 year) in the regression models. The logic behind this modeling approach is that health outcomes such as obesity are emergent phenomena, meaning health status evolves over time. Therefore, factors such as food market availability and accessibility may be considered indirect antecedents of health risk as one must have access to food in order to consume it and must consume healthy foods in order to maintain good health.

**Findings**

*Descriptive Statistics.* Table 2 shows the descriptive statistics for the main dependent and independent variables by sample group. Contrary to what is traditionally stated in the literature, the food desert counties in this sample on average had slightly less obesity and diabetes prevalence than non food desert counties. Food deserts also had slightly greater average food market availability per 100,000 residents with the exception of supercenters per 100,000 capita. On average food desert counties earned marginally less median household income, had a higher poverty rate, lower proportion of residents with a college education, fewer African-Americans, more Hispanics, and were more rural. For the most part these conditions align with what is traditionally associated with food deserts, with the exception of the lower African-American population\(^\text{12}\).

*Food desert and non food desert obesity and diabetes prevalence.* Contrary to hypothesis 1, findings in this study indicate there are no statistically significant differences in obesity or diabetes prevalence in food desert and non food desert counties (Table 3).

\(^{12}\) Note the findings are different when observe these conditions in different geographic contexts. In urban contexts, there is larger proportion of African Americans that reside in food desert compared to non food deserts.
### Table 2. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity Prevalence</td>
<td>30.5%</td>
<td>4.29%</td>
<td>13.1%</td>
<td>47.9%</td>
</tr>
<tr>
<td>Diabetes Prevalence</td>
<td>10.7%</td>
<td>2.24%</td>
<td>3.3%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>3.51</td>
<td>6.74</td>
<td>0</td>
<td>68.2</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>7.39</td>
<td>24.3</td>
<td>0</td>
<td>477</td>
</tr>
<tr>
<td>Grocery stores/supermarket availability per 100,000 residents</td>
<td>4.9</td>
<td>24.3</td>
<td>0</td>
<td>584</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.034</td>
<td>0.181</td>
<td>0</td>
<td>7.11</td>
</tr>
<tr>
<td><strong>Food Desert Counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity Prevalence</td>
<td>30.5%</td>
<td>4.29%</td>
<td>13.1%</td>
<td>47.9%</td>
</tr>
<tr>
<td>Diabetes Prevalence</td>
<td>10.7%</td>
<td>2.24%</td>
<td>3.3%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>3.47</td>
<td>6.30</td>
<td>0</td>
<td>68.2</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>6.00</td>
<td>18.9</td>
<td>0</td>
<td>477</td>
</tr>
<tr>
<td>Grocery stores/supermarket availability per 100,000 residents</td>
<td>3.69</td>
<td>17.6</td>
<td>0</td>
<td>447</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.036</td>
<td>0.196</td>
<td>0</td>
<td>7.11</td>
</tr>
<tr>
<td><strong>Non Food Desert Counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity Prevalence</td>
<td>30.6%</td>
<td>4.03%</td>
<td>13.8%</td>
<td>44.7%</td>
</tr>
<tr>
<td>Diabetes Prevalence</td>
<td>10.6%</td>
<td>2.25%</td>
<td>3.9%</td>
<td>18.2%</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>3.79</td>
<td>8.32</td>
<td>0</td>
<td>96.6</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>13.06</td>
<td>38.9</td>
<td>0</td>
<td>473</td>
</tr>
<tr>
<td>Grocery stores/supermarket availability per 100,000 residents</td>
<td>9.90</td>
<td>41.3</td>
<td>0</td>
<td>584</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.023</td>
<td>0.098</td>
<td>0</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Previous research suggests that residents that live in low income neighborhoods lacking access to healthy food markets may also experience higher obesity prevalence (Jilscott et al.; 2011; Ghosh-Dastidar et al., 2014) and other chronic illnesses compared to residents in more
affluent neighbor-hoods (Salois, 2012). While this may be true in some cases, findings in this study suggest that counties that are most disadvantaged in terms proximity to grocery/supermarkets and income (so called food deserts) do not have a statistically higher percent of residents that are obese or have diabetes.

Table 3. County-level relationship between obesity prevalence and local and conventional market availability per 100,000 residents, adjusted for demographic, socioeconomic, and geographic, and health access and behavior characteristics

<table>
<thead>
<tr>
<th>Models</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-moderated Model</strong></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>-0.026</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>0.007</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>-0.006*</td>
</tr>
<tr>
<td>Grocery stores/supermarkets availability per 100,000 residents</td>
<td>-0.001</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.361^</td>
</tr>
<tr>
<td><strong>Moderated Model</strong></td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>0.033</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>0.008</td>
</tr>
<tr>
<td>Food Desert Binary * Farmers’ market availability per 100,000 residents</td>
<td>-0.014</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>-0.006*</td>
</tr>
<tr>
<td>Grocery stores/supermarkets availability per 100,000 residents</td>
<td>-0.002</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.361^</td>
</tr>
</tbody>
</table>

^N = 2917 ; R^2 = 0.615
\[N = 2917 ; \text{R}^2 = 0.615\]
\[d\] Regression models were adjusted for demographic, socioeconomic, and geographic, and health access and behavior characteristics outlined in table 1.
\[e\] Robust standard errors were used in the regression analysis to adjust for autocorrelation.

Association between local food market availability and obesity and diabetes prevalence.
Partially supporting hypothesis 2, farmers’ market availability is observed to have a significant negative link to diabetes prevalence, but no significant link to obesity prevalence. According to the results in table 4, an additional farmers’ market per 100,000 residents is
associated with 0.011 percentage point reduction in diabetes prevalence. This finding supports previous findings by Salois (2012) who found a significant inverse link between county level farmers’ market density and diabetes prevalence. Finding no statistical links between farmers’ market availability and obesity is in opposition to previous research that show inverse links between local food market economies and obesity prevalence (Jilscott et al., 2011; Salois, 2012).

Table 4. County-level relationship between diabetes prevalence and local and conventional market availability per 100,000 residents, adjusted for demographic, socioeconomic, and geographic, and health access and behavior characteristics

<table>
<thead>
<tr>
<th>Models</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-moderated Model&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>0.016</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>-0.011*</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>-0.003*</td>
</tr>
<tr>
<td>Grocery stores/supermarkets availability per 100,000 residents</td>
<td>-0.002*</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.015</td>
</tr>
<tr>
<td>Moderated Model&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Food Desert Binary</td>
<td>0.022</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>-0.011*</td>
</tr>
<tr>
<td>Food Desert Binary * Farmers’ market availability per 100,000 residents</td>
<td>0.002</td>
</tr>
<tr>
<td>Convenience store availability per 100,000 residents</td>
<td>-0.003*</td>
</tr>
<tr>
<td>Grocery stores/supermarkets availability per 100,000 residents</td>
<td>-0.002*</td>
</tr>
<tr>
<td>Supercenters availability per 100,000 residents</td>
<td>0.015</td>
</tr>
</tbody>
</table>

<sup>a</sup>N = 2917 ; R² = 0.696  
<sup>b</sup>N = 2917 ; R² = 0.696  
<sup>d</sup>Regression models were adjusted for demographic, socioeconomic, and geographic, and health access and behavior characteristics outlined in table 1.  
<sup>e</sup>Robust standard errors were used in the regression analysis to adjust for autocorrelation.
The differences in study outcomes may be attributable to the differences in methodology used to test these relationships. For instance, many researchers do not control for a number of other environmental factors that may impact health outcomes (e.g. physical activity, access to healthcare). In addition, others used alternative statistical methods such hierarchical linear modeling (aka multilevel modeling) to adjust for the non independence of counties within states (see Jilscott et al., 2011). In addition, sample stratification methods may explain the differences in findings. For example, Jilscott and co-researchers (2011) stratified the county sample by metro and non metro designation and found a significant inverse relationship between per capita farmers’ market availability and obesity prevalence only in non metropolitan counties\textsuperscript{13}. It is possible that while farmers’ market availability may not be good ‘predictor’ obesity prevalence in the entire population of counties, it may be well suited to explain this condition within certain sample groups. In opposition to hypothesis 4 results also show that farmers’ market availability did not have any significant moderating ‘effect’ on neither obesity nor diabetes prevalence in food desert counties. In other words there is not enough evidence to demonstrate that more farmers’ availability is linked to significant or differential health outcomes in food deserts compared to non food deserts at the county level.

**Association between conventional food market availability and obesity and diabetes prevalence.** The regression results also provide partial support for hypothesis 3. Convenience stores and supercenters per 100,000 residents were the only conventional markets found to have significant links to obesity. In opposition to hypothesis 3 the number of convenience stores per 100,000 residents was found to have a positive association to obesity prevalence. According to the results in table 3, an additional convenience store per 100,000 residents is associated with 0.006 percentage point reduction in obesity prevalence.

While these findings do not support most research focused on testing these links (Morland & Everton, 2009; Salois, 2012) it does support other research conducted by a recent study in Los Angeles County. In this study researchers focused on examining the associations between the number and type of food outlets in a neighborhood and dietary intake and body

\textsuperscript{13} Metro designation was used as a control in this study. According to the regression results metropolitan counties were found to have significant higher obesity and diabetes prevalence than non metropolitan counties.
mass index (BMI) of residents. Mejia and colleagues (2015) found a significant inverse link between the number of convenience stores within walkable distance (0.25 miles) and obesity prevalence.

In support of hypothesis 3 regression results also showed that an additional supercenter per 100,000 residents is linked to a 0.361 percentage point more obesity prevalence. This relationship was significant at the p < 0.10 level. This finding supports previous research examining the relationship between obesity prevalence and the presence of Wal-Mart supercenters (see Courtemanche & Corden, 2011; Bonano & Goetz, 2010; Jilscott et al., 2011). No significant links between grocery store / supermarket availability and obesity prevalence were observed, which is in contrast to previous research that show an inverse association between the two factors (Jilscott et al, 2011).

Significant inverse correlations were found between convenience stores and grocery stores/supermarkets per 100,000 residents and diabetes prevalence. According to Table 4, an additional convenience store per 100,000 residents was associated with a 0.003 percentage point reduction in diabetes prevalence; while an additional unit of grocery store/supermarket per 100,000 capita was linked to a 0.002 percentage point reduction in diabetes prevalence. These findings are partially in line with Salois (2012) research that shows a positive association between diabetes prevalence to convenience store availability and negative association to grocery store/supermarket availability. The differences in study outcomes may be also be attributable to the differences in methodology used to test these links (refer to previous section for more detail on these differences).

Discussion and implications

Areas with limited food accessibility (food deserts) may not be significantly linked to higher health risks. The findings in this study challenge normative views of the susceptibility to health risks in food deserts compared to food oases. Regression results showed that counties that have a significant proportion of residents with low incomes and limited access to grocery
stores/supermarkets (food deserts) did not have significantly higher rates of obesity or diabetes.

An important implication of these findings is that food market availability\textsuperscript{14} is an important aspect of the food environment that should be considered. While some researchers suggest that food security studies should ultimately focus on understanding food accessibility (McEntee, 2009) the findings in this study suggest that the simple presence of certain markets in a given county may be just as important to understanding shopping and diet habits and health outcomes. Other researchers have stressed the need for adoption of a standard measurement of both food availability and food accessibility to generate more unbiased analyses and to permit comparisons across different studies or contexts (Ahearn & Stern, 2013). Individual researchers also need to ensure that the level of analysis and concepts are clearly defined in terms of how they are being conceptualized and measured. This will help achieve a clearer understanding of how different environmental factors including food market availability and accessibility interact at different levels to affect the health of a community.

\textit{Both local and conventional market availability are important factors to consider when developing health polices/strategies.} The regression results suggest that the availability of both local and conventional markets are linked to obesity and diabetes. Availability of farmers’ market availability was inversely associated to diabetes prevalence, but not obesity. In contrast; availability of convenience stores and supercenters was inversely linked to both obesity and diabetes prevalence. These findings suggest that the availability of at least one type of market within areas can contribute to better outcomes. Selection bias is another reasonable interpretation: it is possible people who value and maintain their health through healthy eating habits may choose to live in counties that have farmers’ markets, grocery stores/supermarkets, and other healthy food outlets readily available. The inconsistencies between findings in this study and previous studies reemphasize the point that while there may exist significant connections it is still unclear how health is linked to or influenced by food market distribution.

\textsuperscript{14} Food market availability is the number of market availability, in this case the type and quality of market is important as availability to some markets may promote unhealthy eating behaviors (e.g. fast food restaurants).
Obesity and diabetes prevalence may follow a socioeconomic gradient. Significant associations were observed between socioeconomic and health conditions within counties. For instance, high poverty and lower average median income was associated with higher diabetes prevalence, while lower income was associated with higher obesity prevalence. The findings confirm the conclusions made by Drewnowski (2007) and Salois (2012) that obesity and diabetes “follow a socioeconomic gradient” with higher rates directly associated with residential areas that are poor or financially less endowed. Some researchers argue that while community level interventions such as local food system development should aim to benefit all members, greater attention should be given to those who may be susceptible to greater health risks such as the poor and less educated. Results on food accessibility and availability studies not only emphasize the need to target low-income areas but also suggest that effective interventions may help to improve access to healthy food (Salois, 2012).

Study Limitations. There are several other notable limitations to this study. One limitation in regression studies is the cross-sectional nature of the data used. The estimators in this study do not represent causality; they actually reinforce that there may be significant associations between the structure and design of local food environments and health conditions. To truly understand the nature of these relationships, longitudinal studies are needed to examine whether changes in the local food environment are linked to more positive health outcomes over time. This type of research will help us understand whether the association of these relationships reflects a trend period or remains linked over time. In other words, it is possible that local food market development may be a trend that has been adopted by residents in counties due to the mainstream attention and advocacy surrounding its benefits. Therefore, we may find that the development and sustainability of local food markets such as farmers’ markets may decline over time due to the reduction in time, attention, and resources allocated toward these systems. This may in turn reduce healthy food access, thereby possibly leading to increases in health risk such as diabetes. As mentioned previously, it is also possible that the findings in this study reflect underlying preferences that impact location decisions (Salois, 2012). There a plausible explanation is that healthy people choose to live in areas that have sufficient availability of markets that provide a variety of healthy food options. As
Salois (2012) suggested, if the impact of markets such as farmers’ markets is ultimately due to selection then policies to increase the availability of these markets will have little effect on obesity or diabetes.

Another limitation is associated with operating the study at the county level of analysis. Analysis at this level does not capture the individual-level factors that may influence health outcomes, such as self-motivation. While factors at the individual level may be important, ecological (i.e. aggregate level) analysis are common in the food environment literature (Chou et al., 2004; Maddock, 2004; Mehta & Chang, 2008; Pickett et al., 2005; Vandegrift & Yoked, 2004; Jilscott et al., 2011; Salois, 2012), providing analysis at the county, state, and country levels. Further, research shows that individual level interventions have been mostly unsuccessful in changing health behaviors. It is noted that the key problem with individual-level strategies is that “educational programs and treatments designed to reduce obesity and diabetes are likely to be ineffective in the absence of a supportive environment” (Salois, 2012:41). Therefore broader ecological studies operating at broader population levels may be a more appropriate approach to study health risks and the environmental factors that contribute to these risks (Salois, 2012). As Sallis and colleagues (1998:379) suggest, “environmental and policy interventions based on ecological models of behavior have the potential to influence entire populations.” (Sallis & Owen, 1998:379). There is also a growing body of medical and epidemiological research that suggests a linkage between obesity and diabetes (Barrett-O’Connor, 1989). Some suggest that obesity may cause diabetes, while others suggest that diabetes can lead to obesity (Sakurai et al., 1999; Abdullah, Stoelewinder, & Shortreed, 2010). While the findings on this linkage are mixed, others suggest the relationship may be reciprocal (Salois, 2012). While this study did not examine the links between diabetes and obesity, it is possible that these links exist. Further, this study did not examine links between the built food environment and other food-related disease such as heart disease and stroke. While research indicates that these are important health conditions to examine they were not examined in this study due to the variation in data collection time periods. Future research should examine the links between local and
conventional food market availability and heart disease and stroke in the context of food deserts.

Further there are limitations associated with model endogeneity including omitted variable bias. The research on social determinants of health suggests numerous environmental conditions that can explain existing health behaviors (Healthy People 2020, 2010; CDC, n.d.). For instance, there other forces that explain a counties’ food market structure including local culture and access to recreational parks or facilities. Cultural aspects such as local tastes and preferences can explain the types of markets available in areas, as well as explain the prevalence of food related diseases. Beyond simple racial classifications, households are guided by ancestral and regional ethnic traditions that influence the way people prepare and use food. How food is prepared and used is an important factor in determining the nutritional value of food (WHO, 2014). For instance, Blacks in the South are known to prepare dishes that tend to have high fat content and this population is known to have abnormally high levels of diabetes and obesity (CDC, 2014). In addition, some places in the U.S. are known to be more health conscious and oriented than others. For instance, County Health Rankings data counties within Colorado have some of the lowest inactivity rates, and Colorado is known to be one of the most active states in the union. In addition, residents of Colorado have a community oriented attitudes toward economic development as very few chain food stores located in counties within Colorado. Therefore, political or institutional culture may also explain food market structure and health conditions. Political attitudes toward whether or not to be involved personal matters such as health behaviors and existing policy to regulate factors that may influence such behaviors may significantly impact economic development policies associated with food market development in an area. For instance, many communities find it difficult to develop markets in their county due the inability to find parcels of land to operate on, which is often limited by zoning restrictions or the lack thereof (Salois, 2012). Further, the availability of natural spaces and recreational parks/facilities may promote greater physical activity in areas, thus contributing to less health risks (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009).
As previously noted in this paper the food environment can be organized into three groups: 1) local food environment; 2) retail food environment; and 3) fast food environment (Salois, 2012). This study models both the local and retail environments; however it did not examine the impact of the fast food environment on obesity and diabetes prevalence. Salois’ (2012) study reported negative links between fast food restaurant density and obesity and diabetes.

Despite these study limitations there are several benefits of this study. One, research rarely considers a complete set of food environment factors that may contribute to health, generally focusing on one or two (i.e. focus on just grocery stores or convenience stores, or both) (Salois, 2012). In addition, studies rarely control for a number of other environmental forces (e.g. education level, rurality, and physical activity) that may influence health outcomes. Obtaining estimated effects of environmental indicators on health outcomes in isolation can result in under- or over-estimated relationships (Black & Macinko, 2008; Salois, 2012); therefore comprehensive studies are important. In addition, research often focuses on how the food environment impacts the obesity levels in a given area, while overlooking the link to diabetes (Salois, 2012). As in Salois’ study (2012) this study provides evidence that the built food environments in conjunction with the socioeconomic and demographic factors that exist are all important explanatory factors of both obesity and diabetes.

**Policy Implications.** In this study I found that the availability of particular local and conventional food markets is inversely associated to obesity and diabetes prevalence, however differentially. Further while the links are still unclear, it is well established that there are significant links to between certain food markets and health risks. Given these findings policy to improve health should consider both local and conventional food markets. To the extent that social justice principles are embraced policies should be designed to reduce barriers that may impede certain individuals’ or groups’ access to these markets. Improvements in food access can be achieved through several channels. One approach is to increase the availability of local food markets through targeted economic development and zoning policies that focus on minimizing the existence of food deserts (Salois, 2012). Given that residents of food deserts might be disadvantaged socioeconomically policies could also
focus on reducing the economic challenges through vouchers to help pay for food at local food markets. Transportation strategies (e.g. public transit programs linked to food retailers or travel vouchers) may also be used to enhance food access (Mikkelsen & Chehimi, 2007; Salois, 2012). Further, given that healthcare access and behaviors (e.g. access to health insurance and physical activity) are found to be negatively linked to diabetes, community level interventions can focus on expanding the availability services that promote physical activity and access to healthcare. Such efforts may include the creation of more parks and recreation areas and/or programs that offer free/affordable medical screenings and consultations. When developing and implementing such programs decision makers should be mindful of the ability of low-income households to pay for such facilities and the funding needed from public taxes to support such efforts (Salois, 2012).

**Conclusions**

This paper gives credence to the view that the presence of local food markets can help promote better dietary choices and healthier eating habits (Jilscott et al., 2011; Salois, 2012). To the extent that this is true, community wide interventions should focus on developing a strong local food system by establishing new and developing existing local food markets such as farmers’ markets and CSAs. These interventions must be designed to address both multilevel and multi-stakeholder issues that impact food and health environments. Given the inconsistencies in findings across studies that examine the links local food environment and health additional research is needed. For example longitudinal studies are needed to examine the nature of the link between food environment and health over time.

While this study provides evidence that there are may be no disparity in health risk between food deserts and non food deserts, it does contribute to the growing body of research that suggests that local food systems do have the promise of contributing to the reduction of some health risks. The ripple effects of this reduction may ultimately lead to the reduction public health cost incurred by the U.S. in treating food related diseases such as diabetes. Given the recognized benefits of local food systems, community and government efforts to improve
public health should focus on developing strategies and policies that provide incentives for community members to create and support local food markets. Policy and strategies to improve health outcomes should be structured in a way that supports a multi-faceted food system. Food environments that consist of various food outlets may help meet the various buying power, tastes, shopping preferences, and needs households have. As suggested by the findings in this study local food market availability can significantly contribute to the health and well-being of communities; therefore should be seriously considered in economic development policy and planning.

References


Chapter 4: Examining the relationship between local food market availability and county level food system related economic outcomes.
Introduction

According to U.S. Agriculture Census data, the number of farms and farmland has steadily declined over the last 30 years (Webster, 2014). The decline in farmland and farms is a great concern for the U.S., especially given its strong connection to the economies of rural communities. Several factors have been linked to the decline in farms and farmland including: rising rates in land taxes; increasing age of farmers with no succession plan; increased pressure from real estate developers to sell land; competition with larger farms that can take advantage of economies of scale; and stringent arduous policies and standards (e.g. food safety standards) (Stevenson et al., 2011; Godette, Beratan, & Nowell, 2015). These factors are thought to be a product of the design of the conventional food system in which the supply structure is unevenly distributed in terms of the size of farms producing the goods.

The degradation of farm enterprise and their disparities in market access can be viewed as signs of market failure or inequities in the food system. A common response to market failure is government intervention. Price supports, subsidies, and tax breaks are traditional strategies employed by the government to ameliorate inefficiencies and inequities in the agriculture system. Over the years numerous policies and strategies have been developed and implemented as a means to increase and/or slow the decline in farm population, such as government supported capacity building grants, crop insurance, and extension services. A relatively recent strategy supported by agents and decision makers at the local, state, and federal levels is to develop and support local food systems. Local food system development consists of the creation and sustainability of markets (e.g. farmers’ markets and roadside stands) and other local outlets (e.g. community gardens) that provide locally produced food. While there is some research on the impacts of local food system development and community level economic outcomes (e.g. farm revenue from direct to consumer sales and farm sustainability) most studies are qualitative. For example there exist several case studies that focus on the impacts of local food markets on a particular farm, group of farms, community, city, state, or region (Lang & Mouillesseaux-Kunzman, 2008; Bregendahl & Enderton, 2013).
To my knowledge, there are no national level studies that examine the relationship between local food system development and food related local economic impacts such as farm and farmland retention, except for two descriptive reports commissioned by the USDA (see Martinez et al, 2010; Low & Vogel, 2011). To move beyond descriptive and anecdotal analyses of these relationships this study examines the relationship between the local food market availability, particularly farmers’ market availability and several community level economic outcomes/conditions including the proportion of direct to sales to total agriculture sales; the number of total farm small and mid-size farm retention; and total farmland. In addition, this study investigates the role of government intervention in local food system development and how it relates to the above economic outcomes. In doing so, this study may contribute to the research and practice of community food system development as a means to improve and sustain local economies.

**Literature Review**

*The decline in farm and farmland.* In the last 30 years the U.S. has suffered a loss of 72 million acres of farmland. Between the years 2007 and 2012, 4.3 percent of U.S. farms ceased to exist (Webster, 2014). While the loss encompasses farms of all scales, some farm groups have suffered greater loss than others. The number of small-scale and mid-size farms has declined sharply compared to larger-scale farms (Hoppe, MacDonald, & Korb, 2010; Stanton, 1990; Arita, Hemanchandra, & Leung, 2014). According to USDA statistics, larger farms of 1,000 acres or more remained steady at 173,483 (up 334 from five years earlier) while those of 10-999 acres had a statistically significant decline (Webster, 2014). These trends can be viewed to be a result of market failure in the conventional agriculture system. In the agriculture industry, market failure is usually associated with production externalities such as water and air pollution (Rocha, 2007). In this study market failure refers to the inequities that may be generated from existing conventional food market structure, such as systematic discriminate barriers to market entry. In the conventional food system, larger farms have fewer market barriers mostly because they are better suited to meet high levels of
demand due to their infrastructural and knowledge capacities. Large scale operations can produce more goods at a lower cost. This in turn generates lower prices for consumers and higher profits for the producers that generate these efficiencies. Moreover, the challenges and loss that some producers face in the agriculture can be viewed as a violation of the distributive justice principle of equality of opportunity. From the equality of opportunity principle market failure exists when economic frameworks are structured in way that they generate systematic barriers for certain individual and groups to participate and generate benefit. From the classical economic perspective, the decline in small and mid-size farms compared to larger farms is due to the economies of scale larger farms may provide in meeting demand. From this perspective one may question why we should be concerned with decline of small and mid-scale farms if they are not as efficient in production as larger farms? There are several reasons why all types/sizes of farms and farmland should be considered in terms of preservation and conservation goals. An overall decline in farms and farmland creates several perverse situations for communities including: reduced land resources toward food production, increased reliability of goods produced outside of the community, and loss of potential revenue to the community. In addition, farmland is often used as a buffer for important institutional assets, such as military installations (Beratan, 2012). The loss of this land will increase the vulnerability of these assets. From a public management perspective, loss of land can be viewed as a security risk. The logic behind this is that reduction and duplication of units and tasks is important to secure the production of goods because if a disturbance occurs in one unit then there are alternative units available to execute the same/similar tasks (Swiss, 2013). Applied to the case of farms, as the loss of farms decrease the more vulnerable communities become in terms of food and economic security. Figure 1 depicts the logic of this study guided by framework of market failure theory.

While the sustainability of all farms is important, the preservation of small/medium size farms is especially important. From a community development perspective, the presence of small and mid-scale farms contributes to the economy, culture, welfare and overall environmental sustainability of a community. While smaller farms are not viewed to be as efficient producers as larger farms, small and medium size farms are better suited to meet the
demand for specialized or niche food markets. Larger commercial farms are more efficient partly due to the homogeneity of goods they produce. Smaller farms, in part due to their size, are more flexible / nimble in terms of the variety and specialization of goods they produce. This flexibility allows these farms to produce goods that satisfy local tastes and preferences. Small and mid-size farms are also better suited to provide healthy food options to low-income community members through supplying local food market channels and outlets including farmers’ market and local food hubs (Schmidt, Kolodinsky, Desisto, & Conte 2011). Moreover, smaller-scale farms are more likely to be environmentally responsible. Small/medium farms tend to generate lower carbon footprints as they are better structure to follow conservation and sustainability practices than larger farms (O’Donoghue, Hoppe, Banker, and Korb, 2009).

Figure 1. Logic of market failure based on local food market availability and local economic outcomes
Policy and relief-giving efforts to support and sustain farms and farmland have existed since the New Deal; however these efforts have, in most part, been to the detriment of small and mid-size farms (Piven & Cloward, 1971; Donoghue et al., 2009). As Donoghue and colleagues (2009) illuminate in their work, small and mid-size farms are often overlooked or rendered unqualified because they do not meet the definitions or standards defined by the USDA – the administrative department for agricultural policy. In addition, this group of farms is disadvantaged in terms of the lack of information and social capital necessary to help them gain access to past/existing government assistance (Godette et al., 2015).

*Local food market development as a viable strategy toward contributing to community level agricultural and economic sustainability.* In recognition of the challenges that small/medium farms face, federal and state governments and communities have developed and implemented initiatives that are geared toward providing small/medium farms with greater access to capital resources and markets. Local food system development, in particular, is viewed as a viable strategy toward helping to stabilize local economies and support local food infrastructure (Andreatta & Wickliffe, 2001; Martinez et al., 2010; Stevenson et al; 2011; Schmidt et al; 2011). The general view of local system development advocates is that it will help retain money in local economies while gaining other social benefits from the preservation of agricultural land and increases in production (Arita et al., 2014). For example, Schmidt and colleagues (2011) found that farmers reported increases in production and sales due to their participation in a local food hub.

In the last two decades the demand, advocacy, research, and investment in local food system development has significantly grown. The demand for local food is evident in the growth in the number of local food markets such as farmers’ markets; which has grown over 364 percent (from 1,755 to 8,144) from 1994 to 2013. This support for local food market development is also evident in the assortment of research and community development grant opportunities offered through USDA sponsored programs such as Know Your Farmer Know Your Food (KYF2) initiative. Programs under these initiatives are targeted at developing and supporting localized food markets, such as farmers’ markets, community supported agriculture (CSAs), and food hubs for the purpose of improving food access and economic
well-being in disadvantaged communities (Ahearn & Sterns, 2013; USDA, n.d). Local food market development has been linked to several USDA priorities including enhancing the rural economy and the environment and strengthening agricultural producers and markets (Low et al, 2015). Support is apparent at the local level through the emergence of numerous local food markets (e.g. farmer’s markets) and locally driven initiatives such as the 10% campaign in North Carolina, focused on a mission to “build sustainable local economies from farm to fork” (Dunning et al., 2012).

Local food systems are believed to be community oriented systems that could contribute to increased market access and economic sustainability, especially for traditionally disadvantaged groups and communities (Fisher, 1999; Story, Kaphingst, Robinson-O’Brien, & Glanz, 2008; Larson, Story, & Nelson, 2009; McCormack & Laska, 2010; Jilscott, Keyserling, Crawford, McGuirt, & Ammerman, 2011). While there is a great deal of advocacy for local food development as a good strategy to improve the economic opportunities and well-being of disadvantaged farmers and communities, there are scholars who caution this thinking (Hinrichs, 2000; Feagan, 2007; Godette et al., 2015). Our caution is not to disregard the possibilities of what local food systems can provide for farmers and communities, but rather to encourage the agents part of this movement to make evaluations of the current progress toward the goals local food system development is meant to achieve. In addition, we encourage more assessments of what benefits are actually associated with local food systems and what groups or communities are benefiting the most from the existence of these systems (Low & Vogel, 2011).

There are few quantitative studies on the economic outcomes associated with the presence of local food systems. However, the existing research suggests that certain groups may be benefiting more than others. In a 2010 USDA-ERS report, Martinez and colleagues reported that from 2007 to 2012 the number of direct sales farms increased, but there was little change in direct to consumer sales nationally. They found that farms that generated income less than $75,000 made up 85% of local food farms, while farms that generated more than $350,000 farm, made up 67% of the direct sales in 2012 (Martinez et al., 2010). Given these findings and the aspired goals of the local food movement it is important to test whether there are any
significant links between the availability of local food markets and local food system related economic outcomes. To contribute to this knowledge base, this chapter investigates the following questions and associated hypotheses. Question one focuses on examining the relationship between local food market availability and four important local food system related economic outcomes: proportion of direct sales to total agriculture receipts; total number of farms, number of small and mid-size farms, and total farmland? (see Figure 2)?

_Hypothesis 1: There will be a positive relationship between the per capita local food market availability and the proportion of direct sales to total agriculture receipts, total number farms, the number of small and mid-size farms, and total farmland._

Figure 2. Relational model of the association between local food market availability and county level food system related economic outcomes
Given the level of attention and public investment in local food system development, evaluations of government action and policy toward this end is important to the public interest in terms of whether their tax dollars are allocated in just way and used effectively. Therefore this study examines the potential for government to help counties generate positive economic benefits through local food system development programs (see Figure 3).

*Hypothesis 2: More government assistance will strengthen the relationship between local food market availability and the four food related economic outcomes.*

Figure 3. Relational model of the association between local food market availability and county level food system related economic outcomes moderated by government grants to support local food system development
Methods

Data collection. To address the research questions outlined this study secondary data was extracted from various sources, including the U.S. Census of Agriculture, USDA-ERS Food Environment Atlas, Know Your Farmer Know Your Food database, and the U.S. Census. Data was then aggregated and transformed to meet model standards and requirements. See table 1 for the operationalizations and sources of the variables used in the models tested in this study.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
</table>
| Proportion of direct sales to total agriculture receipts | **Direct sales** represent revenue generated from local food markets (e.g. farmer’s markets and CSAs).  
**Total agriculture receipts** represent the total revenue from selling agricultural goods.  
**Proportion of direct sales to agriculture sales** = Total direct sales / Total agriculture receipts from a given year. | Census of Agriculture, 2012 |
| Total small and mid-scale farms                   | Small and mid-scale farms are defined as farms composed of 1 to 1000 acres of land. USDA defines small and mid-size farms by value of sales; defining them as farms with sales valuing less $250,000. Given the limitations in this definition (discussed in footnote below) in this study small and mid-size farms are defined on a base-acre standard. | Census of Agriculture, 2012 |

Proportion of direct to total agriculture sales was used as means to measure whether the presence of farmers’ markets may be contributing to increase in income from local purchases and consumption compared to income generated from exporting food (and other agriculture goods). Communities promoting a “local system” way of life should desire more sales deriving from local food production, rather from goods produced externally, especially if these goods can be grown locally.

The sales-based approach to defining farm size is limited in several ways. One, it is limited capturing the diversity of farms in terms of the type, scale, cycle, and cost of production. The type of products produced by a farm influences the gross income realized by the farm. For instance, the gross income for a farmer selling beef products will be significantly different from a farm selling produce. Also, some products take longer periods to grow or mature, thereby influencing when income is realized. For example, orchard and livestock...
Table 1. Model variables, definition, operationalizations, and sources continued

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables continued</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of farms</td>
<td>Farm retention is defined as the percent change in the number total farms from one point in time to another.</td>
<td>Census of Agriculture, 2012</td>
</tr>
<tr>
<td>Total farmland</td>
<td>The total number of acres considered to be farmland within a county.</td>
<td>Census of Agriculture, 2012</td>
</tr>
<tr>
<td><strong>Main Independent and Moderating Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>Farmer’s market availability is defined as the number of farmers markets available per 100,000 residents in the county. To adjust for lags in the effect of farmers’ market availability from year prior to the year of each outcome was used.</td>
<td>USDA-ERS Food Environment Atlas</td>
</tr>
<tr>
<td>Government intervention(^ {17} ) (independent and moderating variable)</td>
<td>Total local food market grant funds awarded within study observation period</td>
<td>Know Your Farmer Know Your Food Database, 2009 (year 1); 2010 (year 2); 2011 (year 3)</td>
</tr>
<tr>
<td></td>
<td><strong>Total grants awarded</strong> = $\sum$(total grants awarded in dollars (_{2009-2011}))</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total grants</strong> = Total grants awarded / $100,000</td>
<td></td>
</tr>
</tbody>
</table>

farms may not generate in the years the plants and animals are maturing. The gross sales screen is also limited due to the fact that it does not reflect the expenses associated with production. In the case of two farms generating the same gross income, one farm can generate twice as much expense (such as in case of poultry production) as another (such as in the case of apple orchard), thus causing one farm gaining much more net income. Moreover, USDA’s National Agricultural Statistics Service (NASS) includes government payments in agriculture receipt measurements, which inflates the reality of how much a farm is actually generating. For all of these reasons, the sales-based approach to defining farm size is limited in providing a more realistic picture of the distribution of farm types in terms of size. I argue that definitions of farms based on more fixed units, such as the number of acres owned or operated by farms, are better measurements of farm size. According to Donahue and colleagues (2009:12), the distribution of farm acreage is more even than sales for four reasons: 1) larger farm operations, such as livestock operations, often use a small proportion of land to produce larger volumes of sales; 2) modest farms may specialize in raising grazing livestock (e.g. goats or horses) which consider larger tracts of land, however generate less sales than other operations (e.g. chicken and cattle); 3) Operators often enroll entire fields in Conservation Resource Program (CRP) in addition to cropland and pasture-land. This means farms can own more acres than their limited sales and expenses would suggest; 4) Ownership of land may be more important to small- and medium-size farms than farm income.  
\(^ {17} \)Given that there may be lags in the impacts of policy or interventions years 2009 through 2011; 2012 grant data was not used because the impacts of this intervention were more than likely not realized in the year they were awarded.
### Table 1. Model variables, definition, operationalizations, and sources continued

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition / Operationalization</th>
<th>Source/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>Total population in county</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>Median household income</td>
<td>Median household income</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>Percent population in poverty</td>
<td>Percent of population under poverty level</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>PSED</td>
<td>Percent of population with some college education</td>
<td>County Health Rankings</td>
</tr>
<tr>
<td>Percent population age 65 and older</td>
<td>Percent of population age 65 and older</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>African American population</td>
<td>Percent of African American residents in county</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>Hispanic population</td>
<td>Percent of Hispanic residents in county</td>
<td>U.S. Census, 2010</td>
</tr>
<tr>
<td>Rurality</td>
<td>Percent of county that is rural</td>
<td>Rural Atlas,</td>
</tr>
<tr>
<td>Region</td>
<td>Geographic U.S. region county is located within.</td>
<td></td>
</tr>
</tbody>
</table>

Regional variables were coded as binaries (e.g. South regional binary: counties representing the South = 1; counties representing all other regions = 0. Four binaries were calculated for each region. Note: one regional binary was dropped from each model in order to reduce multicollinearity.

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**Method of Analysis.** To address research question 1, four robust regression models were developed to test the association between farmers’ market availability per 100,000 residents and four county level food system related economic outcomes including: proportion of direct sales to total agriculture receipts, total number of farms, total small and mid-size farms, and amount of farmland. All models were adjusted for several demographic, socioeconomic and
geographic conditions, which are defined in Table 1. To address the second research question, four more regression models were developed to test the moderating effect of government intervention on the association between farmers’ market availability and local economic outcomes.

**Findings**

*Descriptive results.* Table 2 shows the descriptive statistics for the main dependent and independent variables. According to the table, in the average county, 84 percent of the farms are small and mid-size farms, the share of total agriculture receipts that were direct sales was a little over 1 percent, had almost 300,000 acres of farmland, and 575 small and mid-size farms and received an average $85,000 in grant assistance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of direct sales to total agriculture receipts</td>
<td>1.19%</td>
<td>3.64%</td>
<td>0.0002%</td>
<td>81.8%</td>
</tr>
<tr>
<td>Number of small and mid-scale farms</td>
<td>575</td>
<td>485</td>
<td>18</td>
<td>5555</td>
</tr>
<tr>
<td>Total number of farms</td>
<td>686</td>
<td>554</td>
<td>1</td>
<td>5732</td>
</tr>
<tr>
<td>Total farmland in acres</td>
<td>297,909</td>
<td>387,306</td>
<td>12</td>
<td>5,515,557</td>
</tr>
<tr>
<td>Farmers’ market availability</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>127</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 residents</td>
<td>4.72</td>
<td>8.07</td>
<td>0</td>
<td>101</td>
</tr>
<tr>
<td>Total local food grant funds awarded ($)</td>
<td>$84,781</td>
<td>$420,581</td>
<td>$0</td>
<td>$10,100,000</td>
</tr>
</tbody>
</table>

*Association between farmers’ market availability per 100,000 residents and the four food system related economic outcomes.* Table 3 shows the regression results for the relationship between farmers’ market availability per 100,000 residents and the four food-related economic outcomes examined in this paper. According to the results, three of the four food-related outcomes had a statistically significant relationship with farmers’ market availability.
Supporting hypothesis 1 the results indicate a positive association between farmers’ market availability per 100,000 residents and the proportion of direct sales to total agriculture. As shown in table 3, a one unit increase in per farmers’ market availability per 100,000 capita is associated with an approximately 0.016 percentage point greater share of direct sales to total agriculture sales. This relationship is significant at the p < 0.05 level. These findings suggest that farmers’ market is important component in the local food system because it can help retain more agriculture revenue in a county. In contract to hypothesis 1 total number of small and mid-size farms and the total number of farms overall was found to be inversely related to the number of farmers’ market per 100,000 residents. As the results show, a one unit increase in farmers’ markets per 100,000 residents is associated with approximately two fewer small and mid-scale farms and total farms over all.

### Table 3. County-level associations between food related economic outcomes and per capita farmers’ markets adjusted for demographic, socioeconomic, and geographic characteristics

<table>
<thead>
<tr>
<th>Main Dependent Variables</th>
<th>Proportion of direct sales to total agriculture receipts</th>
<th>Number of small and mid-scale farms</th>
<th>Total number of farms</th>
<th>Total farmland in acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers’ market availability per 100,000</td>
<td>0.016*</td>
<td>-2.26*</td>
<td>-1.93*</td>
<td>39</td>
</tr>
</tbody>
</table>

*N = 2779 ; R² = 0.119
*N = 2993 ; R² = 0.114
*N = 3070 ; R² = 0.110
*N = 3048 ; R² = 0.279
*Significant at the p < 0.05 level
^Significant at the p < 0.10 level (trending towards statistical significance)

All regression models are adjusted for demographic, socioeconomic, and geographic conditions using robust standard errors.

Relative return to government local food development assistance in terms of the four food system related economic outcomes. Table 4 displays the regression results for the relationship between per capita farmers’ market availability and the four food-related economic outcomes moderated by government assistance toward local food development.
Regression results show that government assistance significantly moderates the relationship between farmers’ market availability per 100,000 residents and two of the four food system related economic outcomes examined in his study: the proportions of direct sales to total agriculture sales and total farmland in acres.

<table>
<thead>
<tr>
<th>Table 4. County-level associations food related economic outcomes and per capita farmers’ markets adjusted for demographic, socioeconomic, and geographic characteristics moderated by government intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Dependent Variables</strong></td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000</td>
</tr>
<tr>
<td>Total local food grant funds awarded (centered)</td>
</tr>
<tr>
<td>Farmers’ market availability per 100,000 * Total local food grant funds (in $100,000)</td>
</tr>
</tbody>
</table>

\(^a\)N = 2780; R\(^2\) = 0.122
\(^b\)N = 2993; R\(^2\) = 0.120
\(^c\)N = 3020; R\(^2\) = 0.115
\(^d\)N = 3048; R\(^2\) = 0.282
*Significant at the p < 0.05 level
^Significant at the p < 0.10 level (trending towards statistical significance)

All regression models are adjusted for demographic, socioeconomic, and geographic conditions using robust standard errors

According to Figure 4 the relative return to grants in terms of the share of direct sales to total agriculture receipts is greater in counties with higher farmers’ market density. Note that this interaction effect is significant at the p < 0.10 level. According to Figure 5, the relative return to grants in terms of total farmland in acres was also higher in counties with a higher density of farmers’ markets. In fact, according the table and figure additional government grant/loan dollars is associated with marginally less acres of farmland in counties that had lower farmers’ market density. While these findings suggest that government intervention leads to
perverse outcomes the cross-sectional nature of the data used in this study limits this type of causal explanation. Given this limitation, the best approach to interpreting these figures is to understand links as the conditions that existed in terms of the variables being analyzed. Following this rule of thumb, Figure 4 shows us that a greater share of direct sales to total agriculture sales was found in counties with higher farmers’ market density and government assistance. Figure 5 shows us that more government assistance was awarded in counties with a higher density of farmers’ markets and marginally more farmland.

![Figure 4. Interaction effects of farmers’ market availability per 100,000 residents and federal grants/loans awarded on the predicted value of the proportion of direct sales to total agriculture sales.](image-url)
Figure 5. Interaction effects of farmers’ market availability per 100,000 residents and federal grants/loans awarded on the predicted value of total farmland in acres

Discussion and implications

The potential for local food systems to contribute to the enhancement of a local economy.

The findings in the study show that higher farmers’ market availability is associated with higher shares of local food revenues, however also to fewer farms overall and even less small and mid-size farms. These findings suggest that farmers’ markets are developed in areas where there are fewer producers overall and small/medium farms in particular. This pattern of development has strong implications for how the benefits of local food markets are being distributed. Given that a stated goal of local food system development, and the support for it,
is to strengthen producers (USDA, n.d.), one would expect these systems to emerge in areas that have larger concentrations of producers, especially small-scale producers. This type of emergent pattern would suggest that local food systems are designed to provide opportunities for as many producers as possible to benefit. However, what we see is that local food system may be structured in a way that is very similar to conventional food systems, in this case designed to be reliant upon a smaller concentration of producers to meet demand. To the extent that this is true, food system policy and interventions may need to be designed to help increase local food market availability in places where there are larger concentrations of producers as a means to increase their opportunity to gain access to these markets. While this may be an ideal scenario, most likely the reality is that demand is driving the development of farmers’ market in these areas. The limitation in this view is that it is not clear whether the demand for farmers’ markets or local food is highest in counties that have lower concentrations of farms. More urbanized counties are more likely to have lower concentrations of farms and higher market density. Therefore although the findings in this study suggest that farmers’ market are being developed in areas where there are fewer farms it is more likely that they are developing in areas where there is significant demand for locally produced food. In previous work Godette and colleagues (2015) found that farmers often travel to farmers’ markets in adjacent counties to sell goods because there are no farmers’ markets or little demand for local food within their residing county. While not examined in this study, consideration of the extent to which farms rely on adjacent counties to sell their goods may be important in enhancing our understanding about local food development patterns and the distribution of benefits generated from it. Future research should explore these factors. While this study did not examine farms reliance on nearby county markets it does provide insight on the extent to which opportunities to access and benefit from farmers’ market are within a particular geographic level, the county level.

Small and mid-size farms may be benefiting less from the presence of farmers’ market availability than larger farms. An interesting aspect of the findings in this study is that farmers’ market availability was significantly higher in counties with relatively fewer small and mid-size farms compared to farms of all sizes/scales. It is possible that given that fewer
small/medium farms are associated to farmers’ market availability these farms are generating or capturing a lesser proportion of the local direct sales being generated in a county. This view is supported by previous research that show that smaller scale farms made up 85 percent of the local food farms, but only generated 13 percent of local food sales (Martinez et al., 2010).

These findings are concerning because the local food movement is based upon a mission to preserve local community and the natural resources unique to its environment (Hinrichs, 2000; Feagan, 1997). In addition, if local food systems are supposed to help create a more equitable food system, then this evidence demonstrates a divergence from that path. As previous stated the system of farms and farmland is important in helping to sustain local food security, culture, and economy. If local food systems are being developed in a way that does not benefit this population then these systems are failing to achieve the promise attached to them. More research is need to further explore the barriers and challenges small and mid-size farms face in gaining access and generating benefit from local food markets.

The potential for government intervention to help to enhance local food economies. The findings in this study suggest that local food market development on its own has the potential to enhance local economies, but also to exacerbate disparities in the food system. This finding is also true of government intervention. The relative return on government assistance, in terms of some of the economic outcomes (share of direct sales to total agriculture sales and farmland), was greater in counties that had high farmers’ market density. In other words, more assistance was given to counties that had high farmers’ density and higher shares of direct sales to total agriculture sales and fewer acres of farmland. These findings suggest that the level of farmers’ market development in a county may be significantly associated with the selection criteria for government assistance. Two implications can be drawn from these findings: 1) government intervention may be more successful in counties that have a higher density of farmers markets; or 2) government programs are targeting areas that have significantly high farmers’ market availability because

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18 `Success in this case may be defined as counties with a number of existing farmers’ markets that have operated over a period of time or demonstrated demand through direct sales reports.`
they are perceived to be more successful. To the extent that either of these cases is true, more research is needed to evaluate particular local food development projects funded through programs under the KYF2 initiative. Policy analysis methods such as cost benefit analysis (CBA) can be used to measure the actual benefit derived from government assistance in conjunction with the strategies used. Consideration of particular strategies in conjunction with government intervention is important because an agency’s selection decisions are usually highly based upon the innovative quality of strategies used to solve stated problems. Therefore the effectiveness of government assistance is also reliant on the recipients’ due diligence and the strategies used. More research is needed in order to flesh out these institutional and community level nuances and how they relate to community level economic well-being.

Given the finding that fewer small and mid-scale farms are found in counties with higher farmers’ market density, it is reasonable to suggest that government assistance may not target the areas in which these farms are in abundance. Given the observed patterns of farmers’ market development one would expect government programs to target areas most challenged in terms of farmers’ market availability and social welfare. However it seems that most of their efforts are tied to areas that are more advantaged in these ways. While this may be true it is also possible that particular projects funded by the KYF2 programs were focused on particular cities, census tracts or neighborhoods located in counties that had higher farmers’ market density overall. County level analysis creates limitations in making this determination; however it does provide us with a basis on which to build when conducting more micro-level analyses. Given the apparent multilevel interactions associated with food system and related outcomes, hierarchical or multilevel modeling techniques may be useful in enhancing our understanding about these interactions.

As discussed in previous sections, small and mid-scale farms are usually more disadvantaged than larger farms. Economies of scale and access to capital are commonly cited as creating advantages for larger farms to the detriment of small and mid-size farms. In addition, it is well known that many farms do not break-even (generate profits equal to or greater than the
cost of production), therefore many farm households depend mostly on income from external sources (Donoghue et al., 2009). Given these factors, small farms may be limited in gaining enough benefit from the presence of farmers’ markets because they lack availability or access to these markets. They may be limited by lacking the capital and resources to transport and maintain product quality or the labor to market and sell good at these outlets, or simply because they do not live in the counties where there is sufficient demand to justify their entrance into the local food market system (Godette et al., 2014). Lack of information (information asymmetries) about local food markets may also limit smaller farms access. The author found that small farm owners, especially small minority owners, are often unaware of existing local food market opportunities and programs that could assist them in gaining access to these opportunities (Godette et al., 2015; Beratan, Jackson, & Godette, 2014). Due to these information deficiencies these groups often missed out on lucrative opportunities to move product that sometimes went to waste.

If local food systems are meant to help create economies that improve the well-being of disadvantaged groups, in this case small and mid-size farms, then local food systems and policy/programs to support them should be designed in a way that will help mitigate the challenges these farms face in being competitive. For example, given the difficulties associated with developing farmers’ markets such as the lack of demand, land and labor concerns, city/county policies are needed to ensure that there is significant infrastructure to create these conditions. For example, a common misconception of places that lack local food markets (especially food deserts) is that the residents within it do not desire or welcome the presence of or products sold at these particular markets. Instead, researchers have found that most people want high quality nutritious food, but have limited access due to these conditions (Zepeda, Reznickova, & Lohr, 2014). Given the challenges associated with developing markets in socioeconomically disadvantaged areas, policies should be used to leverage existing resources such as the SNAP program to help reduce the financial constraints low-income residents face. In addition, community food development policies support zoning for these markets (Salois, 2012).
Given the labor and marketing challenges, small and mid-size farms have the managing
tility or board of farmers’ markets could help broker and organize cooperative collaborations
between these farms. One approach to providing this service is by offering aggregation and
attendant services to market and sell goods provided by a collection of small and mid-size
farms. Providing smaller farms with these types of services may help them to gain better
access to these markets because it will mitigate the labor, distribution, and marketing
challenges they face. In this way farmers’ markets become an agency that help these limited
resource farms build the resource and social capital they need to help sustain their operations
through local food market channels.

Study limitations. The findings in this study are limited in several ways. One limitation
highlighted in a previous section is the cross-sectional nature of the data restricts causal
conclusions. In addition, model endogeneity issues including omitted variable bias. Other
factors, not controlled for here, may also provide reasonable explanations for the decreases in
the number of farms and increases in farmland. Factors such as access to social and human
capital may directly impact the farm-related outcomes. For example, through field research I
learned that small and mid-size farms have challenges in taking advantage of farmers’
markets because of labor limitations. These farms barely generate profits from their business
and are usually family-owned and operated. The labor is already exhausted on these farms,
having additional labor to operate a stand at the farmers’ market is usually beyond the
capacity of these farms. Lack of market acumen among this farm group may also be an
explanation for why small and mid-size farms are declining and possibly not benefiting from
the presence of local food markets. Like all markets, farmers’ markets are competitive and in
most cases farms are responsible for the marketing and sells of their own goods, however in
many cases farmers lack the information and knowledge to develop and sustain production-
marketing strategies. Other federal and state level policies may also contribute to the decline
in small and mid-size farms; such as farms limited capacity in meeting food safety and
handling standards (e.g. Organics and GAP certification) (see Godette et al., 2015). In
addition, overall increases in operation cost, average age of farmers, and lack of succession
plans may have also contributed to the decline in farms. While this study did not control for
these conditions, future research should. Future research should also focus on conducting longitudinal analyses that examine the relationship between local food systems and economic outcomes.

**Conclusions**

This study demonstrates the potential for local food markets and government assistance to support the development of these systems to contribute to both positive and negative economic conditions. From a social justice perspective, local food systems should be designed to provide equal economic access to both producers and consumers. However, this study demonstrates the limitations in this view. Given that smaller farms have greater entropic risk, community strategies and policies should be focused developing food systems that are structured to eliminate the challenges and barriers that are beyond the control of these groups. The intrinsic value of creating alternate market channels to improve local food economies as well as the welfare of its most disadvantaged stakeholders (e.g. small- and mid-size farms) is linked to the welfare of an entire community and its residents. In addition, local food systems reduce communities’ reliance on external sources of food and other resources. From a resource dependency perspective, communities can reduce transaction cost associated with the distribution and marketing of food and agriculture goods which in turn may mitigate food security risks. Therefore, the preservation of local food supply chain, including small and mid-size farms, and should be of high priority.

**References**


Chapter 5: Overall Conclusions

Are local food systems are fulfilling their promise? The main purpose of this research is to assess whether local food systems are fulfilling the promise of mitigating food system-related disparities or whether they are susceptible to market failures similarly to conventional food markets. As noted in chapter one, local food systems are believed to contribute to the enhancement of a communities’ well being in several ways including:

1. Increase food access in areas underserved by traditional markets (i.e., food deserts) (Schmidt, Kolodinsky, Desisto, & Conte, 2011; Beulac, Kristjansson, & Cummins, 2009);
2. Promote community health in general by increasing availability and access to fresh healthy foods (Block, Scribner, & Desalvo; Walker, Keane, & Burke, 2010; Morland, 2009), and
3. Help stabilize local economies and support local food infrastructure by providing viable markets for small and mid-sized farmers (Andreatta & Wickliffe, 2001; Martinez et al., 2010; Stevenson et al; 2011; Schmidt et al; 2011).

While local food system development is prescribed as a reasonable strategy towards these goals, the collection of studies in this dissertation calls into question whether local food system developing is accomplishing these outcomes. The evidence that suggests that local food markets are emerging in counties that are relatively more socioeconomically advantaged than others. Significantly fewer farmers’ markets are found in suburban and rural food desert counties compared to non food desert counties (Chapter 2). A higher density of farmers’ markets in counties is associated with fewer farms and even less small/medium farms (Chapter 4).

Examining the perceived facilitators and barriers to local food market development in Southeastern North Carolina, Godette and colleagues (2015) highlighted several barriers and challenges to the development of farmers’ markets in urban, suburban, and rural counties.
These barriers include: lack of demand and competing local food outlets, low population density, and lack of farmer and consumer commitment to such markets. To the extent that these barriers exist in a given context, government or grassroots action is needed to mitigate them. The lack of farmers’ markets in a given area does not necessarily mean that there is a lack of demand; as discussed in previously building markets in areas such as food deserts may be cost-prohibitive. Low farmers’ market availability could also indicate a high level of resistance to building these markets due to a lack of political will and community awareness about the benefits these markets can provide. Policies designed to create incentives and support for local food market development may be necessary to reduce associated financial risks. Educational and outreach programs may also be needed to help increase political and community stakeholders’ awareness about the possible benefits that can be derived from local food systems, and how they can be achieved. While there is some evidence to suggest that local food systems are not meeting social justice objectives, this study found that farmers’ market availability was found to be associated with several desirable outcomes and conditions such as a lower prevalence of diabetes (Chapter 3). Additionally, a greater share of direct-to-consumer sales to total agriculture sales was found to be associated to counties with relatively high density of farmers’ markets.

In total these findings suggest that while local food markets have the potential to promote desirable social, health, and economic outcomes and conditions, these markets may not emerge in a way that reduces the inequities faced by traditionally disadvantaged groups. Local food systems are susceptible to market failure in a similar fashion to conventional food systems, more research and support is needed to reduce barriers to the development of these systems in areas with concentrations of traditionally disadvantaged populations.

*Is government intervention in local food system development helping to mitigate market failures in the food system?* Another major objective of this dissertation was to assess whether government intervention has the potential to help ameliorate market failures in the food system through local food development assistance. As highlighted in the 2008 Farm Bill and other USDA resources, government’s involvement in local food system development
is driven by three mission elements: 1) to increase healthy food access in food deserts, 2) to reduce health disparities, and 3) strengthen producers and local economies (USDA, n.d.).

The findings of this these studies do suggest that programs under the KYF2 did target disadvantaged populations in some ways and may have contributed to the generation of positive community benefits associated local food system development. Government programs seem to be targeting some disadvantaged counties (urban food deserts), while also targeting more advantaged counties (urban counties and counties with higher farmers’ market density). Higher levels of government assistance was directly associated with greater farmers’ market availability in urban counties, while more government assistance was associated with fewer farmers’ markets in rural counties. In addition more government investment in counties with a higher density of farmers’ markets contributed to greater shares of direct-to-consumer sales. These findings suggest that community food infrastructure such as the development of farmers’ markets may be a wise investment, although more information and research is needed to determine whether government intervention truly leads to positive community level outcomes over time. Organizational or systems-based studies may be necessary to understand the institutional forces that influence the decisions to fund certain proposals over others.

To the extent that government assistance for local food system development is meant to create more equitable food systems, government and community policy makers should continually ensure that supported projects focus on ameliorating the challenges faced by disadvantaged groups and areas (e.g. food deserts and small and mid-scale farms) when seeking to gain access to and benefit from these markets. Policymakers and other stakeholders should understand that there are several barriers beyond lack of financial capital that limit these groups’ access to local, institutional, and conventional retail markets. These include lack of information or awareness, labor limitations, lack of social capital, and/or business or technological acumen (Beratan, et al., 2014; Godette, et al., 2015). Strategies to mitigate these barriers include supporting educational and outreach programs and leveraging food assistance program resources to make markets more accessible to low income
households. Possible strategies to increase small and mid-size farm accessibility include increasing the availability of local food markets in areas where such households are most concentrated, educational and training programs to inform and train extension agents and local administrators on local food marketing strategies, and incorporating aggregation and marketing services in the design of farmers’ markets to increase small and mid-size farms access to them.

More policy implications. Given that positive benefits are associated with the presence of local food markets, the development of these types of food systems serve as a reasonable strategy to improve community social, health, and economic well-being. Unfortunately, local food system development seems to following a similar development trajectory as conventional food systems. If local food system development is to mitigate inequities in the food system then strategies and policy supporting the implementation of these systems must target the most disadvantaged.

A systems approach is needed to alter the current pattern of local food market system development. A systems approach prescribes both multilevel and multi-stakeholder strategies. In economic terms this means designing and implementing both demand- and supply-side strategies to increase local food availability and accessibility. Drawing from from previously publicized and field research there are several recommendations for mitigating barriers to local food development and success. It is usually assumed that a lack of local food markets in a given area means that there is a lack of demand for these markets and their products (Pine & Bennett, 2014). To the extent that this is true, educational and outreach programs may be helpful in increasing awareness and interest in local food markets. If demand is not the issue then there must be other factors that limit the development of these markets in certain areas. Barriers may include lack of capital (human, land, and financial) or political will to support the development of these markets. If this is the case, then community development and food system policies can be designed to allocate resources to support the creation and sustainability of local food markets. For example, zoning policies can set aside land for these markets (Salois, 2012). Socioeconomic status is another consumer-related barrier. Therefore, leveraging resources provided by existing food
assistance programs, such as the Supplemental Nutrition Assistance Program (SNAP) may help reduce barriers and increase demand for local food markets in areas where there is high concentration of households earning near or below the poverty level. For residents with poor transportation access in urban areas, public transportation voucher programs may be generated or expanded public routes can be instituted in under-served neighborhoods. For residents in rural communities car-pool programs or mobile farmers’ markets can be established to increase access. In addition, farmers’ market management may also develop voucher programs that help increase accessibility and generate more demand.

In terms of the supply side factors, markets and policies that govern local food systems should be designed to help mitigate challenges faced by limited resource farms and other local food suppliers of food, including limited information and lack of access to human and distribution resources and channels. Many small and mid-size farms are family owned and therefore do not have the luxury of marketing and management teams that cooperative and corporate farms have. Given this educational, outreach, and training programs may be necessary to inform farmers of the benefits in participating in local markets and to help build their capacities to compete in these markets. As recommended in Chapter 3, policies and initiatives focused on reducing barriers to market access should focus on helping farms deal with labor challenges. Small and mid-size farms are especially challenged in this way because they lack the capacity to support the production-marketing component needed to participate in farmers’ markets. Incorporating aggregation and marketing services at farmers’ markets may help eliminate this barrier.

Food systems are complex adaptive systems that involve proactive and reactive interactions between consumers, producers, brokers, processors, distributors, and policymakers. Sophisticated models, research, and policy to address the multifaceted nature of the problems that emerge are needed to resolve any issues that may be generated through these interactions. While government intervention can help support local communities’ efforts in building local food systems as a means to address food justice issues, it may be that long-term reliance on this support may jeopardize realization of the intended values derived by local food systems such as values of justice related to equal opportunity or access to quality
food markets for all. Given that government matters always have a political undertone it is possible that political shifts of administration or attitudes may impose unnecessary limits and challenges to the development of these systems. For example, local food systems can be viewed as being in competition with conventional food systems (Godette et al., 2015). Given that governments support both systems, there is room for political conflict which will ultimately hurt local communities. As some researchers suggest, there are challenges associated with institutional efforts to achieve food justice through strategies such as grant-making. It is argued that while organizations may have good intentions and their impact is usually thwarted by uninformed or redundant efforts and lack of engagement of the most critical stakeholders in the decision-making and grant-making processes (Scorza, Henderson, & Castillio, 2012). In order for organizations and communities to achieve food justice goals, strategies (e.g. policy- and grant-making) to increase healthy food access must target the most critical stakeholders. The most critical stakeholders in the food justice movement are residents that reside in food desert or socioeconomically disadvantaged communities (Scorza et al., 2012). In addition, strategies should be structured in a way the suits the contextual conditions that exist in those communities. This means organizational assistance efforts to increase healthy food access should support strategies that are community-based (Scorza et al., 2012; Godette et al., 2015). Community-based approaches may be more effective in achieving food justice goals because they are structured in a way that fits the local conditions (Godette et al., 2015).

Equitable food systems are ones that create opportunities for and do not impose barriers to certain groups’ capacity to generating benefits from the system. This research supports the idea that while an aspired goal of the local food movement is to create more equitable food systems, there is still more work to be done regarding how to accomplish this. In sum, these findings point to an important aspect of local food system development that is too commonly ignored-- that these markets are not being developed in a manner that target or support disadvantaged populations. These findings also reinforce the point that while local food systems have the potential to promote desirable health and economic outcomes, some groups and places may face difficulties in gaining much utility from local food markets. In order to
make progress towards the moral agenda behind local food system development, strategies and policies should be developed in ways that embody values embraced by social justice and equity principles.

References


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