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Farm Impacts of Farm-to-Grocer Sales: The Case of Hawai'i

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Abstract

There are scant studies that examine farm-retailer dynamics, despite growing interest in local food markets and the fact that most local food is sold to intermediaries (like retailers). To address this gap we conducted a case study in Hawai'i, the state with the highest percentage of farms selling direct to retail in the United States. Results show a statistically significant relationship between the number of farms from which a grocery store purchases product and the grocery store's average markup for food products, rather than with the store's gross sales as one might expect.

Keywords: food retail, local food, Good Agricultural Practices (GAP), market channel, profitability, Hawai'i, direct-to-retail

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Introduction

Federal support for local and regional food systems has grown tremendously under the Obama Administration. Though these initiatives are purported to support a variety of positive economic, environmental, social, and health outcomes, much of the language from the White House Rural Council and the USDA justifying these expenditures focuses on their potential for economic development and enhanced farm viability (McKalip 2014; USDA 2013). Strong local food systems, for example, are one of USDA Secretary Vilsack's four pillars to revitalize rural economies (USDA 2014).

Despite the increased interest in supporting these initiatives, there have been few empirically-driven analyses of the effectiveness of local food systems as a strategy to support local economic development or economic growth (Brown et al. 2013; Gunter and Thilmany 2012; Henneberry et al. 2009; Hughes et al. 2008; Jablonski et al. 2016; Mansury and Hara 2007; Sadler et al. 2013; Schmit et al. 2016), and even fewer that assess farm-level impacts by market channel (Ahern and Sterns 2013; Brown et al. 2006; Detre et al. 2011; Feenstra et al. 2003; Hardesty and Leff 2010; LeRoux et al. 2010; Park et al. 2014; Shilling et al. 2014). Of the studies that assess the farm-level impacts by local food market channels, all but two (Park et al. 2014; Silva et al. 2014) focus on the impact of direct-to-consumer sales. Yet, there is clear evidence that most local food is sold to an intermediary business (e.g., aggregator, distributor, wholesaler, retailer) rather than direct-to-consumer (Low et al. 2015; Low and Vogel 2011).

Given that customers purchase the vast majority of their food-at-home from grocery stores (retail food and nonfood sales were $571 billion in 2011) (USDA–ERS 2014), and that recent research demonstrates growing interest in locally-grown food through this market channel (Oberholtzer 2014; Rushing 2013; Rushing and Goldblatt 2014), this study examines farm-level impacts that result from grocery stores' purchasing of locally-grown farm products in two counties in Hawai‘i.

Farm Impacts of Local Food System Participation

Few studies have examined the farm impacts resulting from sales in local food markets (e.g., farm-to-school, farm-to-restaurant, Community Supported Agriculture, farmers' markets). Part of the reason why there is limited research in this area is due to the lack of requisite data for a complete analysis. The USDA, for example, has historically focused its data collection by commodity rather than market channel (Jablonski 2014).

There are a handful of studies that examine farm impacts resulting from direct sales (Brown et al. 2006; Detre et al. 2011; Shilling et al. 2014; Ahern and Sterns 2013), however Park et al. (2014) and Silva et al. (2014) provide the only two studies that fully incorporated intermediated channels. Park et al. (2014) find that farmers selling only through direct-to-consumer outlets report earnings that are significantly lower than earnings from intermediated market channels. Similarly, Silva et al. (2014) report farmers selling into farmers' markets and through Community Supported Agriculture marketing arrangements are significantly less satisfied with profitability than those selling through wholesale markets, whereas farmers selling through wholesale markets and restaurants/institutions are significantly more likely to be dissatisfied with their quality of life compared to those using direct channels.

Several additional studies provide evidence of the differential cost structure associated with sales through different types of local food market outlets. Importantly they note these sales channels often require producers assume additional supply chain functions (e.g. processing, distribution) that can require additional labor (Jablonski and Schmit 2016; Hardesty and Leff 2010; King et al. 2010; LeRoux et al. 2010).

Grocery Stores and Local Food

US retailing has undergone rapid changes over the last twenty years, including but not limited to an increase in nontraditional stores, consolidation and concentration among the largest retailers and their supply chains, and expanded availability of organic and locally-grown foods (Martinez et al. 2010; Oberholtzer et al. 2014; Sexton 2010). Martinez et al. (2010) documented that in 2009, seven of the top ten food retailers had some reference to local food on their website. Rushing (2013) reports that Supervalu, owner of many grocery store chains throughout the US, estimates that it buys between 25–40% of its produce locally. In 2010, Wal-Mart Stores, Inc. (Walmart) pledged to increase its share of local produce to 9% by 2015, and by 2013 had exceeded its goal, reaching 11% (Clifford 2010; Swanson 2013). These shifts to local purchasing reflect the well documented consumer demand and willingness to pay a premium for these products (Carpio and Isengildina-Massa 2009; Costanigro et al. 2011; Darby et al. 2008; Loureiro and Hine 2002; Moser et al. 2011; Onken et al. 2011; Onozaka et al. 2010; Schneider and Francis 2005; Zepeda 2009).

Since grocery stores are where most consumers buy food consumed at home, the grocer-farmer relationship merits particular examination. Oberholtzer et al. (2014) write that that "although traditional food retailers can have a potentially significant impact on the sales of organic and local food, as most consumers purchase their food at these stores, there is a dearth of literature exploring retailers' procurement of local foods direct from farmers…in fact, most discussions relegate local food to direct-to-consumer markets" (Oberholtzer et al. 2014, 347). Part of the challenge is that 'local' is not defined by the USDA, making grocers' purchases of these products more difficult to track (Martinez et al. 2010).

Many researchers have also pointed to the challenges working through existing supply chains to scale up the availability of local food in grocery stores; conventional supply chains require products with consistent quantity and quality – often difficult for small and mid-scale producers that dominate local food markets (Bloom and Hinrichs 2011; Dunne et al. 2010; Ekelund and Tjarnemo 2009; Guptill and Wilkins 2002; McCallum et al. 2014). Bloom and Hinrichs (2011) identified challenges coordinating supply and demand in their case studies focused on moving local food through conventional supply chain infrastructure. Barrentine et al. (2010) found that packaging and labeling can cause conflict between producers and retailers. McCallum et al. (2014) note the challenges coordinating transport and aggregation, as well as extending product shelf-life.

In spite of the challenges, there is evidence that in situations where there are strong trust relationships, farm-retail partnerships can exist. Case studies by Diamond et al. (2014), Dreier and Taheri (2008), and Guptill and Wilkins (2002), for example, provide evidence of opportunities for farm-to-retail collaboration. However, none of these studies examine the farm profitability impacts of these channels. To address this gap, this study explores the dynamics of the farm-to-retail relationship and the potential to support farm viability.

Methodology

This study uses a case study of farm-grocer relations in two counties in the state of Hawai‘i. Hawai‘i provides an interesting example as it is the top state in direct sales to retailers, when measured in terms of the percent of farms selling through this market channel (see Table 1) (USDA Ag Census 2014).

Table 1. Top States in Direct Sales to Retailers

State	Percent of total farms
Hawai‘i	18
Vermont	16
Alaska	15
Rhode Island	14
New Hampshire	14
Massachusetts	13
Maine	13
Connecticut	10
New York	7
New Jersey	7

Source: USDA Ag Census 2014

In some respects Hawai‘i’s small average farm size (161 acres, compared to 434 acres in the United States.) (Arita et al. 2012), its sloped and dramatic topography (making it difficult to scale up farms), high costs of agricultural real estate (50% of agricultural land in Hawai’i is rented), as well as higher average costs for labor, electricity, fertilizer and transportation relative to their US mainland and Japanese market competitors make it an anomaly (Arita et al. 2012; Parcon et al. 2011). However, it arguably reflects—perhaps a heightened version of—the general barriers to financial success that farmers face in many parts of the United States.

Hawai‘i is also an interesting example due to the State’s concern about its high levels of food imports, and thus its statewide food self-sufficiency goals. Given the State’s geographic isolation and increasingly prevalent natural disasters, the Government is concerned about disruptions to its supply chains. Recent research shows that Hawai‘i imports almost 90% of its food (Loke and Leung 2013b). Though Hawai‘i does have a vibrant agricultural industry, with about 1.1 million acres under agricultural production, $661,347,000 market value in 2012 (US rank 45), most of Hawai‘i’s agricultural products are export crops – including tropical fruits, macadamia nuts and coffee (2012 market value of $179,699,000, 27% of the value of total agricultural production) (USDA Ag Census 2012).

The State’s food self-sufficiency goals have translated into several concrete plans with ample public and private support. The Hawai‘i State Constitution, the Hawai‘i 2050 Sustainability Plan, the New Day Plan, the Hawai‘i Comprehensive Economic Development Strategy (CEDS) and other state documents all explicitly support strengthening Hawai‘i’s local food system in order to promote food self-sufficiency (Abercrombie 2010; Hawai‘i Office of Planning 2010, 2012; Higa 2008). The State also incentivizes local food purchases by retail stores through its two branding

programs (Island Fresh and Hawai‘i Seals of Quality) and a Buy Local, It Matters campaign (Loke and Leung 2013a; Ulupono 2011).

Grocery Store Interviews

We used ReferenceUSA's business database to develop a list of grocery and health food stores in Hawai‘i. ReferenceUSA (2014), an infogroup company, has a database of over 24 million US businesses and claims to be the most accurate and comprehensive in the industry. It is increasingly used by researchers to obtain business information by: sales volume; number of employees; date established; and, North American Industry Classification System (NAICS) (Jilcott et al. 2011; McGuirt et al. 2011; O'Connell et al. 2011). Retailers were defined as those businesses that classify primarily as grocery stores (NAICS code 445110) or health food stores (NAICS code 446191). Accordingly, 702 businesses were identified, representing 412 unique companies (i.e., several grocery stores have multiple locations in Hawai‘i and thus appeared multiple times in the database).

Once we identified the grocery and health food stores, we split them into two groups: those that explicitly made an effort to purchase local products; and those that did not. Of the 412 unique companies, 150 of them had websites, thirty-nine of which included a statement about local foods. We made the assumption that if the website did not mention an effort to purchase local products that the store did not. For the 262 without websites (412 minus 150), we called the stores and asked the person who answered the phone if the store purchased local food. Of the ninety-one stores that we were able to reach, fifty-one replied affirmatively that they purchased local food.

Of the ninety stores that we identified that purchase local products (thirty-nine via the stores' website, and fifty-one from the phone survey), twenty-eight are located in Hawai‘i county, thirty-five in Honolulu county, thirteen in Kaua‘i county, and fourteen in Maui county. Given that the majority of the state's population and agricultural land are in the counties of Honolulu and Hawai‘i respectively, and that we had limited resources to conduct the interviews, we determined it more effective to focus our attention on farm-grocer dynamics in the two counties.

We conducted interviews with twenty-eight of the fifty-three grocery stores in the two counties (52.8%) between March and May of 2014 (we were unable to reach the remaining twenty-five stores). Figure 1 provides information on the location of the stores and farms interviewed. Each interview was conducted with a store manager over the phone and lasted approximately twenty minutes.[1] Questions pertained to how the store defines local, how they price and advertise local items, percent of total expenditure (or Cost of Goods Sold, COGS) on local items, perceived consumer demand for these items, farm regulatory requirements (i.e., does the store require farms to have specific food safety protocol in place), and supply chain logistics (i.e. how do products get from farm-to-grocer). At the end of each interview, the manager was asked to provide contact information for its store's farm-vendors.

[1] Interview protocol is available upon request from the corresponding author.

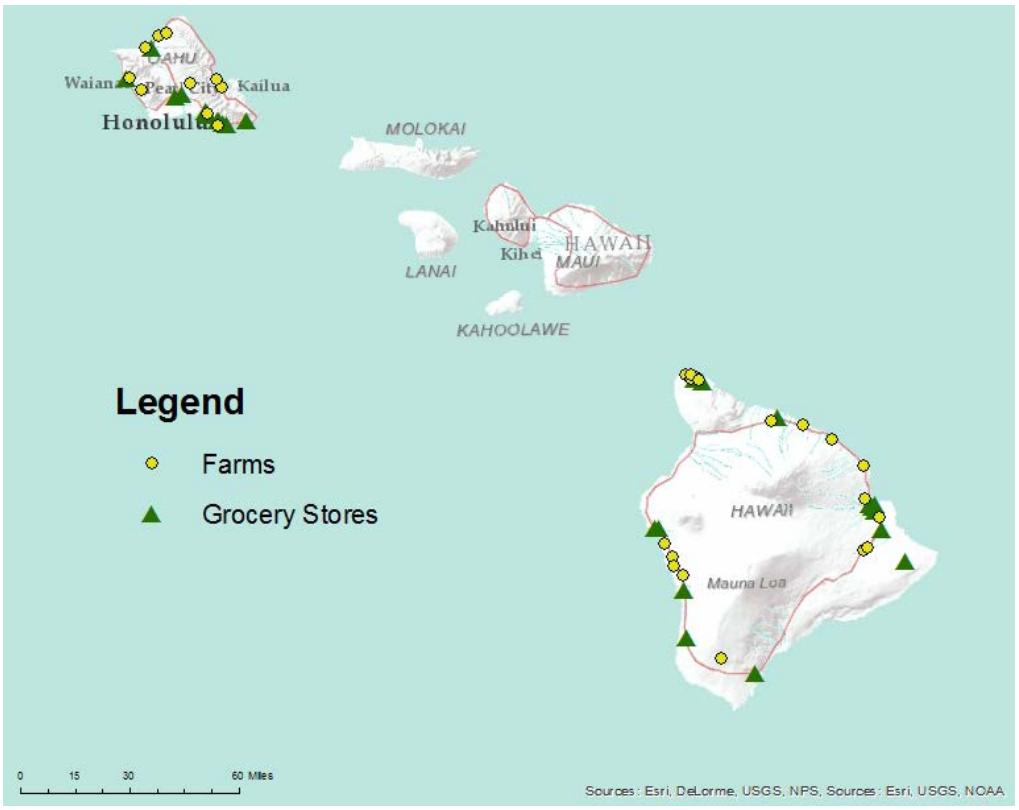

Figure 1. Map of the locations of the interviewed farms and grocery stores

Full descriptive statistics of the twenty-eight grocery stores interviewed are available in Table 2. The twenty-eight grocery stores had average annual sales volume per location of $6,844,034 (median of $1,278,000),[2] and an average of forty-two (median of seven) employees per location. The year of store establishment ranged from 1915 to 2012. On average, the stores sourced directly from twenty-three local farm vendors, however, these local vendor numbers do not account for the local vendors whose products were distributed by an intermediary, rather than direct from the farm-to-grocer. According to the data in ReferenceUSA, eight of the stores identified "health food store" as their primary NAICS (ReferenceUSA 2014). On average, stores reported average expenditure of 62% of total expenditure on the COGS, and an average markup on all food items of 31%. An average markup of 31% translates to a 24% gross profit margin, calculated as the difference between sales and the costs of goods sold divided by revenue, and representing the percentage of each dollar of a company's revenue available after accounting for COGS, in this case 0.31/(1+0.31). Stores also reported that the markup on local food products was lower than on comparable nonlocal items. Only 17% of stores included a formal definition for 'local', and 55% reported increased consumer demand for these local products. Thirty-four percent of the stores reported specific requirements for how product(s) must arrive to the store (e.g., packaging), and 55% of stores had regulatory requirements that farms had to meet in order to sell product(s) (e.g., GAP certification). Very few grocers (17%) met with farms in advance of the season to help with planning.

[2] Though ReferenceUSA does provide location sales volume for each of the stores (ReferenceUSA 2014), during the interviews we asked whether or not the information was accurate. Though in most cases the information was accurate, in others it was not and the manager would not provide updated figures.

Table 2. Summary Statistics for Key Grocery Store Variables (n=28)

Variable Name	Description	Mean	Standard Deviation
Grocery store location sales volume	In US 2013 dollars	6,844,034.00	0.00
Category grocery store location sales volume	0 = less than $1,000,000 1 = $1,000,000 to $4,999,999 2 = $5,000,000 to $14,999,999 3 = $15,000,000+	1.24	0.94
Number of employees	In terms of full-time equivalents	42.02	101.21
# of local farm vendors selling direct to store	Actual number	22.72	39.70
# of local nonfarm vendors selling direct to store	Actual number	18.17	28.43
Grocer markup on food products	Percent	0.31	0.19
Grocery markup on local food products compared to nonlocal average	0 = lower; 1 = same; 2 = higher	0.72	0.45
Cost of local items compared to nonlocal equivalent	0 = less; 1 = same; 2 = local costs more	1.00	0.77
Store advertises 'local'	1 if yes, 0 if no	0.34	0.48
Store has point of purchase labeling for 'local'	1 if yes, 0 if no	0.70	0.47
Store expenditure on COGS	In US 2013 dollars	630,125.00	2,296,449.00
Store expenditure on COGS as % of total expenditure	Percent	0.62	0.33
% of COGS expenditure from 'local' sources	Percent	0.21	0.24
Store has formal definition of local	1 if yes, 0 if no	0.17	0.38
++Store has increased demand for 'local' products?	1 if yes, 0 if no	0.55	0.51
Store has specific requirement for how product(s) must arrive to store (e.g., packaging requirements)	1 if yes, 0 if no	0.34	0.48
Store has regulatory requirements that farms must meet in order to sell product(s) (e.g., GAPs certification)	1 if yes, 0 if no	0.57	0.50
Store has planning meetings with farmers in advance of season	1 if yes, 0 if no	0.17	0.38

Farm Surveys

As this research aims to understand the farm impacts of sales to grocery stores, our farm surveys were limited to farms that have existing buyer-seller relationships with grocery stores. Farm information was obtained from a variety of sources, including: farm-vendor lists from interviewed grocery stores; publically available lists of farms in Hawai‘i that are GAPs certified; buy local campaign farm directories; the Kohala Center, a community-based nonprofit; and a local food hub website. In total we collected valid contact information for eighty-eight farms that included sales to grocery stores in their market portfolio. Every farm on the list was initially emailed with details about the survey, and subsequently called and invited to participate. From March to May 2014, we surveyed forty-seven of the eighty-eight farms. Survey questions focused on information about the farm (ownership structure, primary commodity, total sales), and sales from and satisfaction with market channels divided into three categories: direct-to-consumer markets; grocery stores; and, wholesale non-grocers. Building off a survey protocol designed and tested by the Cornell Small Farm Program, we asked producers about their level of satisfaction (very dissatisfied, dissatisfied, neutral, satisfied, or very satisfied) in eight categories for each of the three market channels:

- Profit earned through the channel;
- Labor (i.e., harvest, processing and packing, travel and delivery, and sales time) required to sell through the channel; volume of product sold through the channel;
- Lifestyle preferences (i.e., personal reward, enjoyment, fulfillment and convenience) that selling through the channel provides;
- Risk (i.e., customer turn-out, price, variability, competition) specific to selling through the channel;
- Associated costs (i.e., packaging supplies, special certifications) required to sell through the channel;
- Physical infrastructure (i.e., buildings, facilities, internet) specific to this channel; and,
- Social infrastructure (i.e., relationships or organizations that support this channel).

Full descriptive statistics from the farm interviews are available in Table 3. Of the forty-seven farmer respondents, 70% were small scale (under $350,000 gross cash farm income), 10% medium scale ($350,000–$999,999), and 20% large (greater than $1,000,000).[3] Two-thirds of farmer respondents produced fruit or vegetables, 9% meat or livestock, 13% other crops, 6% dairy, 11% value added or processed products (meaning that they added value to the raw product produced on the farm), and, 11% other (e.g., tea, eggs, and coffee) – note that many farmers produce multiple commodities. On average, the farm had been in operation for twelve years, with 15% of the farms in operation less than five years, 25% between five and fifteen years, and 60% for over fifteen years. Additionally, 77% of respondents reported that they own the farm (though not necessarily the land, which may be leased). On average, farm respondents reported selling to 2.63 grocery stores (23% sold to one store, 34% sold to two or three, and 43% sold to four or more).[4] Fifteen percent of farms reported being GAPs certified.

[3] The scale classification follows the USDA ERS revised farm typology (Hoppe and MacDonald 2013)
[4] Note that the number of stores does not include stores that have multiple locations, thus each chain would be considered one location.

Table 3. Summary Statistics for Key Farm Variables (n=47)

Variable Name	Description	Mean	Standard Deviation
Farm years in operation	In years	12.23	4.49
Gross farm sales	0 = under $350,000 1 = $350,000-$999,999 2 = $1,000,000-$4,999,999 3=$5,000,000+	0.49	0.81
% of gross sales to grocery stores	Percent	24.21	30.58
Own farm	1 if yes, 0 if no	0.77	0.43
Primary commodity produced - fruit or vegetable	1 if yes, 0 if no	0.66	0.48
Commodity produced - meat or livestock	1 if yes, 0 if no	0.09	0.28
Commodity produced - dairy	1 if yes, 0 if no	0.06	0.25
Commodity produced - crops	1 if yes, 0 if no	0.13	0.34
Commodity produced - value added	1 if yes, 0 if no	0.11	0.31
Farm is Good Agricultural Practice (GAPs) Certified	1 if yes, 0 if no	0.15	0.36
# grocery stores to which farm sells product	Actual number	2.63	1.26
Farm satisfaction with profit earned through sales to grocery stores	1 = very dissatisfied; 5 = very satisfied	3.5	1.16
Farm satisfaction with labor (i.e., harvest, processing, and packing, travel and delivery, and sales time) required to sell to grocery stores	1 = very dissatisfied; 5 = very satisfied	3.84	1.11
Farm satisfaction with the volume of product that can be moved through sales to grocery stores	1 = very dissatisfied; 5 = very satisfied	3.4	1.13
Farm satisfied with lifestyle preferences (personal reward, enjoyment, fulfillment and convenience) that selling to grocery stores provide	1 = very dissatisfied; 5 = very satisfied	3.88	1.04
Farm satisfaction with risk (customer turn-out, price variability, competition) selling to grocery stores	1 = very dissatisfied; 5 = very satisfied	4	0.98
Farm satisfied with associated costs (packaging supplies, special certifications) required to sell to grocery stores	1 = very dissatisfied; 5 = very satisfied	3.75	1.11
Farm satisfied with physical infrastructure (buildings, facilities, internet) required to sell to grocery stores	1 = very dissatisfied; 5 = very satisfied	3.75	1.08
Farm satisfied with social infrastructure (relationships or organizations that support this channel)	1 = very dissatisfied; 5 = very satisfied	3.88	1.08

Statistical Analysis

In the statistical analysis, we first examined farm responses about satisfaction with various items by market channel (profit, labor, volume of product, lifestyle preference, risk, associated costs, physical infrastructure, and social infrastructure). Each of these questions was asked in the context of a five-choice Likert scale. Each farmer respondent *i* had five options (very dissatisfied, dissatisfied, neutral, satisfied, and very satisfied) to indicate their farm's satisfaction with eight variables. As each farmer could only mark one of the ordered responses for each answer, and the continuum of options signal relative ratings, an ordered choice model is appropriate to utilize for the analysis. Each of the eight questions was modeled individually using an ordered probit model and following Silva et al. (2014).

An ordered probit model includes each farmer's reported choice y_{ij}, and incorporates the unobserved yet continually varying strength of preferences $U^*_{i,j}$. The ordered probit model for the eight equations about satisfaction by market channel can be expressed as follows:

$$
\begin{aligned}
U^*_{i,1} &= \beta_1^{'} X_{i,1} + \varepsilon_{i,1} \\
U^*_{i,2} &= \beta_2^{'} X_{i,2} + \varepsilon_{i,2} \\
U^*_{i,3} &= \beta_3^{'} X_{i,3} + \varepsilon_{i,3} \\
U^*_{i,4} &= \beta_4^{'} X_{i,4} + \varepsilon_{i,4} \\
U^*_{i,5} &= \beta_5^{'} X_{i,5} + \varepsilon_{i,5} \\
U^*_{i,6} &= \beta_6^{'} X_{i,6} + \varepsilon_{i,6} \\
U^*_{i,7} &= \beta_7^{'} X_{i,7} + \varepsilon_{i,7} \\
U^*_{i,8} &= \beta_8^{'} X_{i,8} + \varepsilon_{i,8}
\end{aligned}
$$

Here $X_{i,j}$ is the vector of explanatory variables for farmer *i*'s satisfaction with profit ($X_{i,1}$), labor ($X_{i,2}$), volume of product ($X_{i,3}$), lifestyle preference ($X_{i,4}$), risk ($X_{i,5}$), associated costs ($X_{i,6}$), physical infrastructure ($X_{i,7}$), and social infrastructure ($X_{i,8}$). y_{ij}, each farmer's observed choice, is determined by $U^*_{i,j}$:

$$
\begin{aligned}
y_{ij} = \quad & 1 \text{ if } \infty < U^*_{i,j} \leq u_{i2} \\
& 2 \text{ if } u_{i2} < U^*_{i,j} \leq u_{i3} \\
& 3 \text{ if } u_{i3} < U^*_{i,j} \leq u_{i4} \\
& 4 \text{ if } u_{i4} < U^*_{i,j} \leq u_{i5} \\
& 5 \text{ if } u_{i5} < U^*_{i,j} \leq \infty
\end{aligned}
$$

u_{kj} provides thresholds dividing the range of the unobserved utility $U^*_{i,j}$ into five ordered choices that map y_{ij}. The error terms ε_{ij} follow a normal distribution N[0,1].

The vector $X_{i,1}$ includes variables on farm years in operation (continuous variable defined in terms of years), farm ownership (1 if yes, 0 if no), gross farm sales (categorical variable where 0= <$350,000; 1= $350,000-$999,999; 2= $1,000,000-$4,999,999; 3=≥$5,000,000), percent of gross sales to grocery stores (continuous variable from 0 to 1), commodity produced – fruit and vegetable (1 if yes, 0 if no), farm is GAPs certified (1 if yes, 0 if no), and number of grocery stores to which farm sells product (maximum value = 4). The ordered probit model was estimated by using *oprobit* in StataIC 12.0.[5]

Next we used ordered probit models to examine three ordered questions asked of grocers:

1. Is your store mark-up of local food items lower, the same, or higher compared to other food products?;
2. On average, are items marked 'local' more expensive than non-locally grown or labeled items?; and,
3. In 2013, in which category did your grocery store's sales volume fall?

The theoretical framework is identical to what is described above, except here, in questions one and two, grocer *i* has three possible responses from which to choose: y_{ij}=0, the grocer indicated that the store's mark-up of local items is lower than other food items or items marked local are less expensive than non-locally grown or labeled items; y_{ij}=1, the grocery responded that the store's mark-up of local items is the same as other food items or items market local are the same cost as non-locally grown or label items; or y_{ij}=2, the grocer indicated that the store's mark-up of local items is higher than other food items or items marked local are more expensive than non-locally grown or labeled items.

For these questions, the vector $X_{i,1}$ varies from the farm-based models and includes variables on the number of producers from which the store purchases product (whole number greater than zero), whether the store advertises local offerings (1 if yes, 0 if no), whether the store has point of purchase labeling for local items (1 if yes, 0 if no), percent of COGS expenditure on local sources (continuous variable from 0 to 1), whether the store has a formal definition of local (1 if yes, 0 if no), whether the store has experienced increased demand for local products (1 if yes, 0 if no), whether the store has regulatory requirements that farms must meet in order to sell products (1 if yes, 0 if no), and the grocery store's sales volume by location (continuous variable). Again, the ordered probit model was estimated by using *oprobit* in StataIC 12.0.

Finally, we used a tobit model to analyze grocers average retail markup on food products. Tobit models assume that the dependent variable has a notable share of its values clustered at a limiting value, usually zero, given the nature of the question. The model supposes that there is an unobservable variable y_i^* that linearly depends on X_i via parameter β (vector of unknown coefficients), which determines the relationship between the independent variable X_i and y_i^*. Additionally, there is an independently distributed error term u_i to capture random influences in the relationship (McDonald and Moffitt 1980).

[5] For a more in-depth explanation of ordered choice models, please see Greene and Hensher (2010): Greene, W. and Hensher, S. 2010. *Modeling Ordered Choices: A primer*. 1st ed. Cambridge University Press, Cambridge. UK.

$$y_i^* = \beta X_i + u_i$$

In the tobit model, the vector X_i includes variables on the number of producers from which the grocer purchases product (whole number greater than zero), whether the store advertises local (1 if yes, 0 if no), whether the store has point of purchase labeling for local items (1 if yes, 0 if no), percent of COGS expenditures paid to local sources (continuous variable from 0 to 1), whether the store has a formal definition of local (1 if yes, 0 if no), whether the store perceives increased demand for local products (1 if yes, 0 if no), whether the store has regulatory requirements that farms must meet in order to sell products (1 if yes, 0 if no), whether the store has specific requirements for how products must arrive to the store (1 if yes, 0 if no), whether the store has production planning meetings with farmers in advance of the season (1 if yes, 0 if no), and the grocery store sales volume (continuous variable). The tobit model was estimated by using *tobit* in StataIC 12.0, and a maximum value (ul) of 1 was applied.

Results

Statistical Analysis

Full results from our ordered probit model analyzing farmer satisfaction with sales through grocery stores are available in Table A1 (see Appendix). Results show that for the volume of product, lifestyle preferences, risk, associated costs, physical infrastructure, and social infrastructure equations, the coefficient gross farm sales is positive and statistically significant. This means that the larger the farm, the more likely they are to be satisfied with all aspects of sales to grocery stores except profit and labor (which are not significant). The other two statistically significant coefficients are farm is GAPs certified and commodity produced-fruit or vegetable. For the equations volume of product, lifestyle preferences, risk, associated costs, physical infrastructure, and social infrastructure, farm is GAPs certified is negative and significant. Therefore, farms that are GAPs certified are less likely to be satisfied with the volume of product, lifestyle preferences, risk, associated costs, physical infrastructure, and social infrastructure associated with sales to grocery stores. Similarly, for the equations associated costs, physical infrastructure, and social infrastructure, the coefficient commodity produced-fruit or vegetable is negative and significant. Fruit and vegetable growers are therefore significantly less likely to be satisfied with the associated costs, physical infrastructure, and social infrastructure associated with sales to grocery stores. None of the other equations (profit or labor) yielded statistically significant results.

We did not find any significant results in our equation grocers' average cost of local items compared to nonlocal items, and we found only one significant coefficient in our grocer's markup for local food products compared to other food products equation. Stores with point of purchase labeling for local products were likely to have lower markups for local food products compared to other food products. Full results from these models are available in Table 4.

Table 4. Coefficient estimates, grocers' responses to measure perceptions on local food procurement

Variable	Grocer's markup for local food products compared to other food products	Grocer's average cost of local items compared to nonlocal items
# farm producers	0.0095 (0.0177)	-0.0178 (0.0154)
Store advertises 'local'	-0.8800 (0.6545)	-0.6560 (0.6820)
Store has point of purchase labeling for 'local'	-2.3943* (1.380)	1.4778 (0.9152)
% of COGS expenditure from 'local' sources	-0.9955 (1.8649)	0.2695 (1.8755)
Store has formal definition of local	-1.5489 (2.3262)	1.5795 (1.3858)
Store has increased demand for 'local' products?	1.1682 (0.8951)	1.0152 (0.8148)
Store has regulatory requirements that farms must meet in order to sell product(s) (e.g., GAPs certification)	1.1919 (0.8527)	-0.2538 (0.7144)

Note. Standard errors in parentheses.

Finally, the tobit model results show grocers' average markup of food products and the coefficient number of farm producers is positive and significant. As a store retains a larger share of the retail dollar, they are significantly more likely to work with a larger number of local farms. Three other coefficients were also significant in this equation. Store has point of purchase labeling for local was negative and significant. Store has planning meetings with farmers in advance of the season was negative and significant. And store has regulatory requirements that farms must meet in order to sell products was positive and significant. Full results for the tobit model are presented in Table 5.

Table 5. Coefficient estimates for tobit model, grocers' average markup of food products

Variable	Grocers' average markup of food products
# farm producers	0.0034** (0.0014)
Store advertises 'local'	0.0197 (0.0765)
Store has point of purchase labeling for 'local'	-0.1567* (0.0803)
% of COGS expenditure from 'local' sources	-0.1142 (0.1433)
Store has formal definition of local	-0.0586 (0.1593)
Store has increased demand for 'local' products?	0.0794 (0.0746)
Store has specific requirement for how product(s) must arrive to store (e.g., packaging requirements)	0.0146 (0.0696)
Store has regulatory requirements that farms must meet in order to sell product(s) (e.g., GAPs certification)	0.0669*** (0.0661)
Store has planning meetings with farmers in advance of season	-0.3961*** (0.1267)

Note. Asterisks indicate significance at: *α = 0.1; **α = 0.05; ***α = 0.01. Standard errors in parentheses.

Discussion

Farm Scale, Commodity, and GAPs

Our results demonstrate that as producers get larger, they are significantly more likely to be satisfied with the volume of product, lifestyle preferences, risk, associated costs, physical infrastructure, and social infrastructure associated with sales to grocery stores. This finding is in line with previous literature, which finds it is often difficult for small and mid-scale producers to work with grocery stores (Bloom and Hinrichs 2011; Dunne et al. 2010; Ekelund and Tjarnemo 2009; Guptill and Wilkins 2002; McCallum et al. 2014).

GAPs certified farms, as well as producers of fruits or vegetables, however, are significantly less likely to be satisfied with the associated costs, physical infrastructure, and social infrastructure associated with sales to grocery stores. Given the additional costs and regulatory hoops associated with GAPs certification, and the fact that it is mainly farms that produce fruits or vegetables that would be GAPs certified, it is possible to see why these farms might be less likely to be satisfied with sales to grocery stores. Further, the US lacks a unified food safety standard (the Food Safety Modernization Act, FSMA, was signed into law on February 4, 2011, but when we were conducting this survey the details for most aspects of the act were still to be determined) (Holcomb et al. 2013). In the absence of a unified standard, many grocery stores developed their own independent requirements, for which the burden of compliance is borne by producers wishing to sell through these markets. "Producers [are] required to comply with whatever food safety-based standards their buyers require if they wish to be active market participants." (Paggi et al. 2013, 462). Though the majority of grocery stores in our study did not require farms to be GAPs certified, it is easy to see why producers that do have GAPs certification are less satisfied.

As Congress debated the FSMA throughout the 2010 session, one of the points of contention focused on whether the costs of complying with the additional regulatory requirements of the new food safety law would place a disproportionately large burden on small producers (Hassanein 2011). Our results show that as the scale of the farm operation increases, farmers are significantly more satisfied with the volume of product, lifestyle preferences, risk, associate costs, physical infrastructure and social infrastructure associated with sales to grocery stores. This finding supports the contention that it is more difficult for smaller producers to comply with these requirements.

Indicators of Successful Grocer-Farmer Relationships

Our results show only one statistically significant relationship between the size of the store (in terms of annual revenue by location) and the buying-selling relationship between grocers and farmers: store advertises local. Given that the larger the grocery store the more money they likely have for advertising (as well as a market research team advising them on current retail trends), this is not surprising. However, the lack of other significant relationships stands in contrast to previous research that generally uses a categorical scheme based on total revenue to analyze grocery stores (Guptill and Wilkins 2002).

We find that a significant predictor for grocer's average markup on total COGS is their working with a greater number of producers. To illustrate why this might be important in farmer-grocer relations, we can take a closer look at Whole Foods Market, Inc. (Whole foods) and Walmart. Whole foods has an average gross profit margin around 35%, whereas Walmart has an average gross profit margin around 25% (YCharts n.d). This means that Whole Foods has more money available to spend on non-COGS expenditures than does Walmart. It therefore stands to reason that Whole Foods is able to have a lower revenue per employee rate. As of June 2015, Whole Food's revenue per employee was $171,456, compared to $220,690 for Walmart (CSI Market n.d.). Though the revenue per employee rates indicate that Whole foods is less efficient than Walmart, they also imply that Whole Foods' employees may have more time available to work directly with individual local food producers than might a Walmart employee.

Conclusion and Future Research

One key area for additional research is in understanding the farm profitability impacts not just from sales to grocery stores, but to other non-commodity market channels generally. Employing a more data-intensive method of data collection – i.e., market channel assessments (Hardesty and Leff 2010; LeRoux et al. 2010) – to more fully capture expenditures (including unpaid labor) and returns by market channel would be informative for policymakers, researchers, and practitioners alike. The fact that our farm questions asked about farm perception of satisfaction poses some limitations that a more in-depth market channel assessment in conjunction with these more subjective responses could address.

While we acknowledge that generalizing from our Hawai‘i -focused study to the broader US poses challenges given Hawai‘i's unique agricultural profile and distance from trading partners, there are still some interesting findings from our research that warrant additional examination in other contexts. First, our study provides evidence of the importance of classifying grocers' current or potential relations with farms in terms of gross average markup on food or gross profit margin rather than scale. We recommend that future research moves beyond the scale classification when considering the impact of farm-to-grocery sales, and more fully considers the impact of the store's gross profit margin. This is also an important point for practitioners interested in facilitating additional farm-to-grocery initiatives; the easiest to access stores may be those with higher gross profit margins and not a priori independent or health food retailers. Second, the impact of food safety regulations, namely GAPs, and farm scale on grocer-farm relations was significant in our study. As the FSMA is implemented throughout the country, studies that assess the farm-level impacts – and particularly the market opportunities that these requirements hinder or facilitate –are welcome. Will grocers, for example, adopt a more unified food safety protocol, or will they continue to have similar, but divergent, requirements? Will food safety exemptions at certain gross revenue levels or by market channel impact the markets to which producers decide to sell?

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Appendix

Table A1. Coefficient estimates for ordered probit model, farmer satisfaction with sales through grocery stores

Variable	Profit	Labor	Vol. of product	Lifestyle preferences	Risk	Associated costs	Physical infrastructure	Social infrastructure
Farm years in operation	-0.0329 (0.0535)	-0.0065 (0.0510)	-0.0715 (0.0518)	-0.0285 (0.0565)	-0.0348 (0.0531)	-0.0110 (0.0532)	-0.0544 (0.0535)	0.0299 (0.0535)
Own farm	0.9437 (0.7943)	0.9468 (0.7952)	0.0781 (0.7526)	1.2574 (0.8362)	0.3888 (0.8348)	0.6573 (0.8004)	0.2605 (0.7780)	0.7421 (0.7906)
Gross farm sales	0.2302 (0.4773)	0.6942 (0.5116)	0.8563* (0.4958)	1.5330** (0.6304)	1.5994** (0.6667)	1.4588** (0.6199)	1.3697** (0.5815)	1.5432*** (0.6142)
% gross sales to grocery stores	0.0402 (0.0288)	0.0280 (0.285)	0.0226 (0.0277)	0.0334 (0.0308)	0.0241 (0.0286)	0.0004 (0.0278)	-0.0016 (0.0279)	0.0131 (0.02829)
Commodity produced - fruit or vegetable	-0.8285 (0.5672)	-0.0072 (0.5550)	-0.3259 (0.5457)	-1.0268 (0.6433)	-0.7978 (0.6422)	-1.5955** (0.6532)	-1.6949*** (0.6411)	-1.3786** (0.6316)
Farm is GAPs certified	-0.2372 (0.7540)	-1.2446 (0.8000)	-1.4090* (0.7978)	-1.7429** (0.9028)	-2.3214** (0.9987)	-2.5327*** (0.9423)	-2.4361*** (0.8953)	-2.1954** (0.9032)
# grocery stores to which farm sells product	-0.2905 (0.4074)	-0.2875 (0.4103)	-0.1200 (0.3973)	-0.1293 (0.4305)	-0.7400* (0.4537)	0.0226 (0.4102)	0.2166 (0.4123)	-0.1008 (0.4126)

Asterisks indicate significance at: *$\alpha = 0.1$; **$\alpha = 0.05$; ***$\alpha = 0.01$.
Standard errors in parentheses.