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Benefits, Challenges and Trade-Offs: Buyer and Contract Characteristics Valued by Small Farm Suppliers to Wholesale Marketing Channels

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There is increasing interest in accessing local food products through "conventional" food marketing systems. This study identifies and quantifies key contract characteristics and buyer attributes valued by small-scale produce farmers who are currently or are considering marketing into wholesale channels. Overall, produce farmers are receptive to entering into contracts with wholesale buyers. Substantial heterogeneity, however, is found among farmer attitudes toward the specific contract terms and in the trade-offs farmers are willing to accept between contract terms and buyer characteristics. Insights offered will enable produce buyers to more efficiently target potential suppliers and will facilitate more effective contract design.

Key words: fruits, mixed logit, specialty crops, vegetables, wholesaler, willingness to accept, willingness to pay

Introduction

Fruit and vegetable farms have numerous channels through which they can market their products. Most common among these options are direct-to-consumer sales (e.g., farmers' markets, roadside stands), direct-to-institution outlets (e.g., schools, hospitals, other institutional food service operations), and intermediated outlets (e.g., wholesalers, distributors, restaurants, or grocers). Among these options, smaller fruit and vegetable farms often prefer the marketing flexibility and per unit sales prices available through direct-to-consumer outlets.

There is, however, growing interest among supply chain stakeholders for small-scale produce farmers to increase participation in traditional, intermediated channels (Clark and Inwood, 2016; Feenstra et al., 2011). Accommodating these requests can be challenging, requiring buyers to integrate smaller farms into their supply chain network and develop strategies to manage the frequently more-varied quantities, quality, and production practices from these farms. Despite these marketing challenges, use of contracts to facilitate transactions between small-scale farms and wholesalers can offer important benefits to both parties. From the perspective of produce buyers, purchases of produce through contracts offer a way to ensure a secure supply of produce from in-demand small-scale farmers and improve the stability of their purchase prices over those available

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through spot markets. From the perspective of small-scale farmers, marketing through contracts reduces per unit transaction costs; reduces price, sales-completion, and other forms of risk; offers the ability to negotiate terms of sale; and, as a result, improves their ability to develop plans for their operation (Boys and Fraser, 2018).

At present, limited information is available concerning the preferences and specific factors that affect contract use among small-scale specialty crop (SSC) producers.[1] Contracts involving specialty crops (SCs) can differ greatly in their terms and conditions, such as volume and quality requirements, price, payment mechanisms, delivery requirements, penalty clauses, contract length, requirements to use particular inputs or production practices, and the amount or type of technical assistance provided by the buyer. Buyer characteristics such as their commitment to social or sustainability values, size and length of time in business, and ownership status (e.g., family-owned; locally owned) may also affect SSC producers' willingness to enter into contractual agreements.

This empirical study investigates the relative importance of contract attributes and buyer business characteristics on the willingness of SSC farms to enter into contractual agreements. With increasing consumer demand to access local, small-scale food products through "conventional" food systems, additional information concerning supply chain partner and contract preferences is needed. Using a choice experiment (CE) approach, this study (i) identifies key contract characteristics and buyer attributes valued by SSC producers, (ii) quantifies the trade-offs these producers are willing to make between buyer characteristics and contract attributes when establishing a new contractual relationship, and (iii) identifies and assesses the factors influencing these trade-offs. In doing so, buyers may use these findings to modify contract designs and more accurately target their procurement efforts, potentially leading to positive outcomes for suppliers, buyers, and consumers.

This topic is examined from the perspective of SSC farmers in the neighboring U.S. states of Virginia and North Carolina, which share many similarities in their agriculture production environment, types of agricultural output, and production and marketing practices.[2] Currently, contract use between SSC producers and food buyers is very limited in both states.[3] This circumstance is similar to that found in many other U.S. states and international regions with diversified SSC production.

This study contributes to the literature in several substantive ways. First, we fill a void in the literature regarding which specific contract features facilitate and deter produce farmers from entering into contractual marketing relationships. Second, this study extends usual analyses of CE results by quantifying factors which drive producers' willingness to accept contract attributes. The insights generated through this analysis will be of particular value to those seeking to enter into contracts with these farm operations and those organizations that seek to facilitate transactions in this marketing channel. Given its area of geographic focus, findings of this study will be most relevant to the U.S. South Atlantic region and other regions with small-scale, diversified SC production.

Review of the Literature

Contracts can offer benefits to both buyers and sellers. Buyers can require certain traits be present in the product under contract and help ensure their firms have a steady supply of products. Sellers can reduce and share price risk with buyers and reduce marketing risk of nontraditional crops which,

[1] The USDA defines specialty crops as fruits, vegetables, tree nuts, dried fruits, and horticulture and nursery crops (Johnson, 2014). The remainder of this paper considers only fruits and vegetables for human consumption. "Small-scale" farms are defined by the USDA Economic Research Service as those with less than $350,000 in gross annual sales (Hoppe and MacDonald, 2013).

[2] From 2007 to 2012, the market value of SC products sold by farms in these two states rose by approximately 10% to $1.6 billion (NC: $1.17 billion; VA: $0.42 billion). Over this same period, national SC sales increased nearly 30%, to $42.8 billion (Johnson, 2014).

[3] This information was gathered through discussions with SSC producers, Cooperative Extension personnel, and industry experts from each state. Verbal contracts and handshake agreements are observed between SSC producers and food retailers and restaurants, and "contract" style agreements exist in the form of Community Supported Agriculture (CSA) programs.

without a contract, may otherwise not be grown (Du, Liang, and Zilberman, 2013). Other seller benefits potentially gained through contracts include access to credit and additional markets such as retail and institutional foodservice buyers (e.g., hospitals, schools, prisons), brokers, and distributors; greater income stability; better resource management; higher rates of improved technology adoption; and quality price premiums (Du, Liang, and Zilberman, 2013; Hu, 2012; MacDonald and Korb, 2011; Hudson and Lusk, 2004). Evidence also suggests that contract farming can increase a farm operation's average returns compared to cash/spot market sales in both domestic and international settings (Wang, Wang, and Delgado, 2014; Bellemare, 2012; Hu, 2012).

However, small-scale producers in particular may face additional barriers to entering contractual relationships. Due to their large volume requirements, it is common for SC buyers to contract primarily with larger producers (Clark and Inwood, 2016), overlooking smaller farms, which are often perceived as unable to meet quantity requirements (Harper, Kime, and Dunn, 2009). Perceptions about increased production and food safety risk and transaction costs associated with aggregating products from numerous small-scale producers are additional causes for bypassing small farm suppliers (Boys and Fraser, 2018). Location and distance between producer and buyer can also play a significant role. While SC buyers want to source products that meet their definition of "local," they are less likely to purchase from small-scale producers located in isolated areas (Harper, Kime, and Dunn, 2009). Similar benefits and challenges have also been found in use of contracts among small-scale farmers in developing countries (Abebe et al., 2013; Barrett et al., 2012; Bellemare, 2015; Bellemare and Novak, 2017).

While sales-completion risk and time required for marketing activities would be reduced, many SSC producers are hesitant to enter into contractual agreements. In a qualitative study of SSC producers and institutional foodservice buyers in the U.S. Southeast, Boys and Fraser (2018) found that standard contractual clauses and arrangements significantly limit interest in and use of contracts. SSC producers cited prices received, payment terms, quantity stipulations, and product attribute requirements as major concerns. Additional contract concerns included delivery challenges and food safety and insurance requirements (Boys and Fraser, 2018).

Recent studies have also used stated preference approaches to examine farmers' contract enrollment decisions (Van den Broeck et al., 2017; Peterson et al., 2015; Blandon, Henson, and Islam, 2009). By asking respondents hypothetical questions regarding scenarios of interest, this approach allows attitudes toward a particular good or service and its attributes to be measured, without requiring the respondent to have used the good or service in question. Choice experiments, which we use in this analysis, are one method of stated preference valuation.

In this vein, *vassalos2016* evaluated how contract choice among wholesale tomato producers in several U.S. Midwestern states is affected by four characteristics: price, volume requirements, food safety certification costs, and penalties (percentage price reduction for failing to satisfy contractual terms regarding volume or quality standards). As economic theory suggests, the cost of certification and the potential for a penalty were found to significantly reduce the probability of accepting a contract. While producers reported that satisfying volume requirements was a major deterrent, results indicated that volume requirements had no significant effect on contract enrollment rates. Surveying a broad array of farmers, Hudson and Lusk (2004) found that contract length (number of years), asset specificity (percentage of total assets that can be used only for production of the good under contract), and loss of autonomy significantly decrease the acceptance of a contract. Unsurprisingly, in both studies, producers exhibited significant heterogeneity in preferences for contract characteristics.

Research Design

Market opportunities for small fruit and vegetable farmers continue to evolve. Small fruit and vegetable farmers have historically relied on sales through local, direct-to-consumer markets. But sales growth through these markets is slowing, while intermediated markets are increasingly being

used to market and source locally produced food (Low et al., 2015). The infrastructure and policy constraints to small farmers of effectively marketing through intermediated channels are well recognized (Boys and Fraser, 2018; Vilsack, 2016) and have been the focus of considerable government program effort and funding support (Thilmany and Woods, 2018). Largely unaddressed, however, is the mismatch between buyer and seller requirements in contract-based sales transactions. Like food system infrastructure, features of produce sales contracts need to be appropriately scaled and tailored to accommodate the business and production realities of small farmers if they are going to be effectively integrated into intermediated markets. This study offers new and important insights into small fruit and vegetable farmer preferences for specific contract terms, and trade-offs between these terms, as they evaluate contracts with wholesaler produce buyers. The unique dataset and analytical approach used in this study were devised to address these complex issues.

We used a mixed-methods approach consisting of a qualitative (phase I, interviews) and a complementary quantitative (phase II, survey) approach to collect data for this study. As an initial step, interviews were conducted with small-scale fruit and vegetable farmers to collect information regarding producers' experiences with contracts and perceived issues and informational needs when selecting and establishing new business partnerships through contracts. To ensure that we gathered input from a wide variety of producers, we used a systematic approach to identify and recruit participants. From an inventory of Virginia farmers' markets that we developed, we randomly selected five regions and nine markets for interviews. At each site, an inventory of producers present on that market day was taken (through a walk-through of the market); producers were randomly selected from this list. We completed a total of 28 in-depth producer interviews across nine sites.

We used results from phase I interviews, discussions with Cooperative Extension personnel, industry experts, and a review of agricultural contract literature to develop the survey administered in phase II of the data collection. The survey was administered using both paper and online formats between January and May 2015. While this survey would ideally have been sent directly to all SSC producers in the study area, a complete list of individuals in this population and their contact information are not available. As such, we made extensive efforts to distribute the survey to as broad and comprehensive a group as possible. Members of the research team distributed and collected hard copies of surveys at a variety of events attended by SSC farmers, such as Cooperative Extension events, on-farm consultations, producer organization meetings, food system organization seminars, and other producer-oriented events in both states. The online version of the survey was administered using Qualtrics. Invitations to participate in the surveys were emailed to members of major organizations and mailing lists of SSC farmers including state farmers' organizations, Cooperative Extension and Farm Bureau mailing lists, membership lists of regional and state food system organizations, farmers' market members, and others.[4] As an incentive to help increase participation rates, farmers had the option to enter a raffle to win one of five $150 prepaid Visa gift cards.

Of the 797 paper surveys distributed, 213 were returned, of which 163 had participated in the CE, for a response rate of 20.5%. The population count for those receiving the online survey is unknown. However, of the 171 producers that began the survey, 97 participated in the CE for an online response rate of 56.7%. Completed paper and online surveys were combined;[5] Table 1 reports descriptive characteristics for the 260 respondent farmers.

[4] Due to privacy concerns, worries by producer association personnel about inundating their inboxes with multiple survey notifications, and a reliance on the voluntary co-operation of producer associations, a single email was sent to each producer association's mailing list.

[5] Applying the Swait–Louviere log-likelihood ratio test, we fail to reject the null hypothesis that regression parameters are equal across survey modes (paper, online) and states (VA, NC); as such, we were able to pool the datasets. In addition, no significant differences were found in WTP estimates across survey modes or states.

Table 1. Demographic and Farm Operation Characteristics of Participants and the Study Area

Characteristics of the Farm Operator	Study Participants	Virginia & North Carolina[a]	United States[a]
Gender: male (%)	72.6	83.3	84.0
Age (years)	53.9	58.0	59.3
Education (%)			
Some high school	1.2	–	–
High school degree	14.2	–	–
Some college/university	20.1	–	–
College/university degree	64.4	–	–
Farming as primary occupation (%)	69.8	50.1	52.5
Years in business	37.4	20.1	21.9
Characteristics of the farm operation			
Farm size (acres)	199.7	99.2	157.1
Farm gross income (%)			
< $50,000	51.7	76.4	68.7
$50,000–$349,999	27.9	12.3	20.1
$350,000–$999,999	13.7	5.1	5.6
> $1,000,000	6.6	6.2	5.5
Farm gross income (% of total)			
< 25%	28.0	70.1	62.0
25%–49%	9.5	8.9	9.8
50%–74%	16.7	9.1	11.3
75%–99%	15.1	6.0	9.2
100%	30.6	5.9	7.7
Specialty crop production (1 = yes)			
Fruits	72.3	–	–
Vegetables	73.5	–	–
Both	46.1	–	–
Production practices (1 = yes)			
Organic, certified	8.6	–	–
Organic, not certified	21.0	–	–
Integrated pest management (IPM)	35.4	–	–
Good agricultural practices (GAP)	30.7	–	–
Willing to become GAP certified	31.1	–	–
Distribution of sales across marketing channels[b] (%)			
On-farm sales	32.9	–	–
Farmers' market	28.2	–	–
Wholesaler/distributor/broker	22.3	–	–
Direct sales to restaurant	4.2	–	–
Other	12.4	–	–
Producers surveyed	260		

Notes: [a]USDA NASS, 2012 Census of Agriculture; Fruit and vegetable farms excluding those with yearly sales of less than $1,000.
[b]Respondents were asked to estimate the percentage of their sales through each marketing channel.

Table 2. Choice Experiment Contract Attribute Description and Levels

Attribute	Description	Levels
Guaranteed buyer[a]	There is a guaranteed buyer for your produce	Yes No
Price paid	The per unit average cash price you typically receive	Average 10% below average 15% below average 20% below average 25% below average 30% below average
Payment terms	The timing of payment after delivery of produce	Cash on delivery 30 days 60 days
Potental penalty	The price penalty only if you fail to satisfy contract terms	15% price decrease 30% price decrease Shipment refusal
Contract length	The length, in years, of the contract	1 year 3 years 5 years
Buyer location	The location of the produce buyer from the farm gate	Local (<200 miles) Not local (>200 miles)

Notes: [a]A guaranteed buyer is assigned to act as the alternative specific constant (ASC), which reflects the change in utility of selecting a contract option over the status quo.

Choice Experiment Design

In this study, the CE asked producers to choose from among two options of different contractual agreements (alternatives) and the status quo (neither alternative). The contract options varied with respect to both contract features and buyer characteristics.[6] The specific attributes and their respective levels assessed in the CE were determined using results from the phase I data collection and the other previously noted sources. Table 2 summarizes the attributes, which include (i) price paid, (ii) payment terms, (iii) potential penalty, (iv) contract length, (v) buyer location, and (vi) guaranteed buyer.[7]

To obtain welfare measures of the nonprice contract attributes, a price term is needed. To reduce potential farm scale or crop production issues that could arise from surveying a diverse producer population, we set six relative levels for price paid using producer responses obtained during the qualitative interviews: average price and 10%, 15%, 20%, 25%, and 30% below average price.

[6] Hereafter these are referred to as "contract attributes."

[7] The guaranteed buyer attribute was included as a reminder that selecting a contract guaranteed a buyer for their produce. For both contract options in the CE, the level for guaranteed buyer was always "Yes." This attribute can be viewed as a pseudo-alternative-specific constant for the two contract options.

Payment terms describe the timing of payment once the product has changed ownership from the producer to the buyer. A majority of SSC farm sales occur through direct-to-consumer channels—such as on-farm sales, roadside stands, and farmers' markets (Low et al., 2015)—where producers are immediately paid for their produce. Deferring payment to a future period injects additional transaction and time costs as well as risk. We used three levels to describe payment terms: cash on delivery, 30 days, and 60 days.[8]

Agricultural intermediaries (e.g., business buyers) also face difficulties entering into contractual agreements since they have imperfect information about the seller and the production process. The potential for adverse selection and moral hazard on the part of the producer places additional and unknown risks on the intermediary (Wu, 2014; Hueth and Ligon, 1999). To reduce such risks, contracts typically include produce quality, volume, or delivery date specifications, with penalties applied if they are not met. These requirements, in turn, place additional risk and potential costs on the producer. This analysis includes a potential penalty to represent such a mechanism. Due to the broad range of possible contract violations, the specific nature of the penalty was left ambiguous but was treated as a deviation from the baseline contract outcome. Three levels were used to reflect a potential penalty: 15% price decrease, 30% price decrease, or shipment refusal.

Contract length specifies the period for which the contract is binding. As arguments could be made about contract length having either a positive or a negative effect on participation, the *a priori* impact of this attribute was uncertain. Contracts may introduce additional risks to producers by requiring long-term capital and infrastructure investments (MacDonald et al., 2004); the willingness to engage in a contract in which such investments are necessary is smaller for shorter-term contracts. Conversely, participating in a long-term contract restricts management flexibility. The overall effect of a contract's length is likely to be heterogeneous and vary by producer attributes. We considered contract lengths of 1, 3, and 5 years.

Traditionally, small-scale producers have sold directly to consumers in local or direct markets (Low et al., 2015). With a rise in consumer demand for locally grown produce, buyers wanting to capture a portion of this new market demand will be required to integrate these smaller producers into their business strategy. Therefore, it is to the buyer's benefit to better understand how producers value interacting with local versus nonlocal buyers. A buyer is defined as "local" if they are less than 200 miles away from the producer.

Using the CE design software Ngene (version 1.1.2), we generated a Bayesian efficient design utilizing the D-optimality criterion (S/'andor and Wedel, 2001), creating 16 choice scenarios. To reduce possible response fatigue, scenarios were randomly blocked into two choice sets of eight choice scenarios each. Producers were randomly assigned a choice set, thus generating a sequence of eight responses from each producer (i.e., a panel data structure).[9]

Empirical Analysis

To quantify the trade-offs producers are willing to make among buyer characteristics, contract attributes, and the price received when establishing a new contractual relationship, we first estimated a mixed logit model (Revelt and Train, 1998), which allows us to analyze producers' choices from the CE. We subsequently used parameter estimates to calculate willingness-to-pay (WTP) values for the nonprice contract attributes (i.e., the trade-off measures). Finally, using regression analysis

[8] The three levels (0, 30, and 60 days) were selected based on responses from the phase I survey, in which producers expressed concerns about the length of time it would take to receive payment after delivery. Respondents overwhelmingly indicated 30 days as the length of time that they felt most comfortable with waiting to receive payment. We therefore chose to use 0 days (equivalent to cash on delivery), 30 days (results from phase I results), and 60 days (double the level of 30 days).

[9] For the pilot survey, the five CE attributes were assigned vague prior assumptions, with price paid constrained to be positive, payment terms, potential penalty, and buyer location constrained to be negative, and contract length allowed to fall on either side of 0. Using conditional logit estimates obtained from 22 pilot surveys, informed priors were applied to the final CE design, with each attribute prior assigned a uniform distribution. To ensure no dominant alternatives exist, a dominance restriction was applied during the design process.

techniques, we evaluated the effect of producers' characteristics on the WTP values for contract attributes.

More flexible than the conditional logit, the mixed logit model allows for individual taste variation, unrestricted substitution patterns, and correlation in unobserved factors over choice scenarios (Train, 2009). For data analysis, the indirect utility function can be stated as:

$$U_{nit} = \beta_{\mathbf{n}}^{'}\mathbf{X_{nit}} + \varepsilon_{nit} \tag{1}$$

where β_n is the producer's specific parameter vector, $\mathbf{X_{nit}}$ is a combination of contract attributes and producer specific characteristics for contract i in choice scenario t, and ε_{nit} is a stochastic portion. Assigning ε_{nit} to be *i.i.d.* with an extreme-value (Gumbel) distribution, the conditional probability of producer n choosing marketing method i in choice scenario t is

$$L_{nit} = e^{\beta_{\mathbf{n}}^{'}\mathbf{X_{nit}}} / \sum_{j \in C} e^{\beta_{\mathbf{n}}^{'}\mathbf{X_{njt}}}. \tag{2}$$

To gain a more complete understanding of contract preferences, each respondent was asked to answer eight choice scenarios. Letting $i(n,t)$ denote the contract that producer n chooses in scenario t, a producers' unconditional probability of a given sequence of choice scenarios is

$$P_n(\theta) = \int \prod_{t=1}^{T} L_{ni(n,t)t}(\beta_{\mathbf{n}})\, \mathrm{f}(\beta|\theta)\, d\beta \tag{3}$$

where θ are coefficients (e.g., mean, standard deviation) describing the distribution of β that follows the density function $\mathrm{f}(\beta|\theta)$ (Hole, 2007). Following Revelt and Train (1998), the coefficients in equation (3) are estimated using the log-likelihood function:

$$\ln L(\theta) = \sum_{n=1}^{N} \ln P_n(\theta) \tag{4}$$

Because no closed-form solution to equation (4) exists, we used a simulation method (Hole, 2007):

$$\mathrm{SLL}(\theta) = \sum_{n=1}^{N} \ln \left\{ \frac{1}{R} \sum_{r=1}^{R} P_n(\beta^{\mathbf{r}}) \right\}, \tag{5}$$

where SLL is the simulated log-likelihood function and $\beta^{\mathbf{r}}$ is draw r from density $\mathrm{f}(\beta|\theta)$.[10]

An advantage of the mixed logit model is the capacity for attribute parameters to vary across the population, allowing individual heterogeneity to be identified. In this study, the coefficients corresponding to all contract attributes were designated as random and assigned a log-normal distribution, with the exception of the alternative-specific constant (ASC), assigned a normal distribution.[11] The assigned distributions are based on a preliminary analysis of the CE results using a conditional logit model, in which all attributes were found to have significant effects in a single direction. The ASC is similar to the constant term found in other regression types and measures the change in utility received when choosing one of the two contract alternatives over the status quo.

The mixed logit model also allows for the testing of correlated versus independently distributed coefficients. Examining interdependence among the attributes can provide a deeper understanding

[10] We used 500 Halton draws, which have been shown to provide more uniform distributional coverage than random draws by inducing a negative correlation across observations, leading to a distribution's density represented more equally as the number of draws increase (Train, 2009).

[11] To ensure the proper sign and allow attributes to follow a log-normal distribution, payment terms, potential penalty, contract length, and buyer location were multiplied by -1.

of the relationship (i.e., correlation) between attribute preferences. Allowing for correlation, the randomly drawn vector of β coefficients from equation (5) is expressed as

$$\beta_n = \mathbf{b} + \mathbf{L}\mu_n, \tag{6}$$

where $\mathbf{L}$ is the lower triangular Cholesky factor of variance–covariance matrix ■, $\mathbf{b}$ is a vector of population means, and μ_n is a vector of independently standard normal deviates (Revelt and Train, 1998).[12]

To gain deeper insight into the factors that drive producers' WTP for contract attributes (or attribute levels), we used a random effects regression model similar to Campbell (2007). Exploiting the panel nature of the CE, an individual's WTP estimates for the ascribed contract attributes are pooled together, with the random effects model being (Campbell, 2007)

$$WTP_{na} = \alpha + x_{na}^{'}\gamma + \varphi_n + \varepsilon_{na}, \tag{7}$$

where the WTP of producer n for contract attribute a is determined by α, an intercept; $\mathbf{x}_{na}^{'}$, a K-dimensional row vector of explanatory variables; γ, a vector of producer and farm-level parameters to be estimated; φ_n, a producer-specific random effect; and ε_{na}, an idiosyncratic error term.[13] Individual-level WTP estimates were obtained using the procedure proposed by Train (2009) and Campbell (2007). We used Stata12 to estimate all models (StataCorp, 2011).

A recent vein of CE literature has focused on respondent heuristics, such as ignoring one or more attributes when choosing from among alternatives. This approach is known as attribute non-attendance (ANA), and it can cause biased CE welfare estimates. To test whether ANA had an effect on the overall WTP estimates, producers were asked after completing the CE: "What contract features did you take into account when making your choice between contracts?"[14] A binary variable (*Ignored Attribute*) was included to represent whether a producer ignored one or more of the five contract attributes. While ignoring an attribute is a violation of the principles of rational preferences, this variable indicated no significant differences in WTP estimates.

Results and Discussion

Findings indicate that food safety and product attribute certifications are important and generally well-adopted among SSC farmers. A notable number of participants (30.7%) reported that their farm is currently Good Agricultural Practices (GAP) certified,[15] with an additional 31.1% indicating a willingness to become GAP certified if required by a buyer. A small number of participants (8.6%) are certified as organic, with an additional 21.0% indicating that while not certified, they do produce organically.[16]

Table 3 reports descriptive information concerning producers' perceptions regarding buyer and contract characteristics and their experiences using contracts. The contract and buyer characteristics identified as being most important are price paid, payment terms, buyer location, contract violation penalties, and quantity requirements. It is worth noting that the standard deviations for many of these characteristics are the lowest among those examined, implying significant agreement among producers. Also, the perception among SSC farmers that using contracts would require them to

[12] A reviewer suggested the use of cluster-adjusted standard errors with clustering based on online/in-person surveys and also on attendance at extension events. To explore this issue, we used STATA cluster-robust standard errors for panel data (StataCorp, 2018). For the mixed logit model, no change of significance occurred. For the random effects model, standard errors were marginally reduced for the majority of variables. Taking a conservative approach to this issue, we only report panel robust (unclustered) standard errors for model estimation.

[13] To ensure a balanced panel, nine producers were removed for failing to answer all eight choice scenarios.

[14] Producers indicated that price paid, payment terms, potential penalty, contract length, and buyer location were considered in their choice decision 88.8%, 64.8%, 66.7%, 67.5%, and 65.2% of the time, respectively.

[15] Certification verifies management practices for production, packaging, handling, and storage are in place.

[16] Many uncertified organic producers cited certification costs and regulatory burden as reasons for not becoming certified.

Table 3. Producer Contract Use and Perceptions of Buyer Attributes and Contract Benefits

		Mean[a]
Do you use contracts to sell any of your produce?	Yes	0.19
	No, but I did previously	0.06
	No, but I am interested in doing so	0.31
	No, and I am not interested in doing so	0.43
Overall, what is your perception of how produce contracts would affect your farm?	Greatly beneficial	0.18
	Somewhat beneficial	0.43
	Neither beneficial nor harmful	0.26
	Somewhat harmful	0.08
	Greatly harmful	0.05
If you were to enter into a contract, to what extent would the following **buyer attributes** be important to you?	Buyer is a large business	1.97 (1.14)
	Buyer is located less than 200 miles from your farm	3.92 (1.25)
	Buyer has been in business 5 years or longer	3.07 (1.27)
	Buyer is locally owned	3.28 (1.28)
	Buyer is committed to employee health and safety	3.51 (1.18)
	Buyer is committed to the environment	3.55 (1.21)
If you were to enter into a contract, how important would the following potential **contract benefits** be to you?	Less price risk	3.63 (1.01)
	Security of a guaranteed buyer	3.88 (0.97)
	Access to credit	2.58 (1.25)
	Access to education and training	2.71 (1.15)
	Support in understanding food safety legislation	3.12 (1.21)
	Support in implementing food safety requirements	3.21 (1.20)
How important would the following **contract characteristics and potential outcomes** be in preventing you from entering into a contract?	Price paid	4.29 (0.76)
	Payment terms	4.00 (0.86)
	Quality requirements	3.80 (0.91)
	Quantity requirements	3.90 (0.86)
	Contract violation penalties	3.94 (1.08)
	Required to grow a specific plant variety	3.44 (1.17)
	Required to use harvesting instructions	3.46 (1.12)
	More intensive production	3.42 (1.09)
	Less ability to pursue other markets	3.50 (1.17)
	Less control of farm decisions	4.07 (1.07)

Notes: Numbers in parentheses are standard deviations.
[a]Producers were given the option of choosing "not important" (=1), "slightly important" (=2), "moderately important" (=3), "very important" (=4), or "extremely important" (=5).

relinquish control over farming decisions was an important concern. This result follows Key (2005) and Hudson and Lusk (2004), who found that the potential loss of autonomy to significantly decrease the acceptance of a contract scheme.

Approximately 20% (19.6%) of producers stated they currently use contracts to sell some or all of their produce and, importantly, another 30.7% indicated they would be interested in doing so. Nearly two-thirds (60.9%) responded that contracts would be at least somewhat beneficial. When asked about the price discount they would be willing to accept in exchange for the security of a

Table 4. Panel Mixed Logit Estimation Results

Attribute	Mean Coefficient	Standard Deviation
ASC	3.601*** (0.407)	3.938*** (0.429)
Price paid	−2.636*** (0.154)	1.249*** (0.116)
Payment terms	−5.731*** (0.521)	1.718*** (0.257)
Potential penalty	−4.574*** (0.205)	1.310*** (0.160)
Contract length	−1.989*** (0.303)	2.337*** (0.225)
Buyer location	−1.249*** (0.270)	1.068*** (0.121)

	Cholesky Matrix					
ASC	3.938***					
Price paid	0.689***	1.042***				
Payment terms	0.308	−1.023***	1.345***			
Potential penalty	0.448***	−0.198	−0.037	1.215***		
Contract length	0.370***	−0.404***	0.237**	0.756***	2.129***	
Buyer location	−0.625***	0.002	−0.128	0.164*	0.016	0.840***

Observations	6,117
Individuals	260
Log-likelihood	−1,476.727
Pseudo-R^2	0.24

Notes: Panel Mixed Logit model with correlated attribute coefficients using 500 Halton draws. Attributes assigned as random to follow a lognormal distribution, with exception of ASC that was designated to follow a normal distribution. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

guaranteed buyer, responses ranged from 0% to 65.0%, with an average of 11.4%. Only 8.1% of respondents stated that they would be willing to accept more than a 25.0% price discount. This outcome is not surprising given the thin profit margins typically generated by SSC farms and the relatively high fixed costs that they often carry. In both phases of this study, conversations with producers invariably led to pricing issues and, in particular, concern about receiving "fair" prices.

WTP Estimates

Table 4 presents results estimated from equation (5). Since the parameters for all attributes but ASC are assumed to have log-normal distributions, these mean and standard deviation estimates do not have a direct interpretation as effects on the indirect utility function.[17] Instead, these results can be used to generate more empirically useful information by calculating WTP estimates for each attribute.

[17] The ASC coefficient indicates that having a guaranteed buyer increases, on average, producers' indirect utility by 3.601 utils. The marginal effect on utility of all other attributes can be calculated using the formula $\exp\left(\beta_{Payment} + \frac{1}{2}\left(\mu_{Payment}{}^2\right)\right)$, where β and μ represent, respectively, the attribute's mean coefficient and standard deviation estimated from the mixed logit model and shown in Table 4.

Table 5. Marginal Willingness to Pay Estimates

Attribute	WTP Calculation[a]	Mean WTP	95% Confidence Interval for the Mean[b]
Payment terms	$\exp\left(\beta_{Payment} + \frac{1}{2}\left(\mu_{Payment}{}^2\right)\right) / \exp\left(\beta_{Price}\right)$	-0.17^{***}	$-0.24 \sim -0.11$
Potential penalty	$\exp\left(\beta_{Penalty} + \frac{1}{2}\left(\mu_{Penalty}{}^2\right)\right) / \exp\left(\beta_{Price}\right)$	-0.24^{***}	$-0.37 \sim -0.12$
Contract length	$\exp\left(\beta_{Length} + \frac{1}{2}\left(\mu_{Length}{}^2\right)\right) / \exp\left(\beta_{Price}\right)$	-15.73^{***}	$-24.94 \sim -8.30$
Buyer location[c]	$2 \times \exp\left(\beta_{Local} + \frac{1}{2}\left(\mu_{Local}{}^2\right)\right) / \exp\left(\beta_{Price}\right)$	-14.00^{***}	$-18.23 \sim -10.29$

Notes: β and μ represent, respectively, the attribute's mean coefficient and standard deviation estimated from equation (5). Triple asterisks (***) indicate significance at the 1% level.

[a]Following Carson and Czajkowski (2019), when both monetary and non-monetary attributes follow a lognormal distribution and constraining the standard deviation of price paid = 0. Each attribute's WTP estimate was multiplied by −1 to offset the previous adjustment of modeling the negative of the attribute, allowing for the lognormal attribute assignment.

[b]95% confidence intervals found using the Fieller (1954) method.

[c]Buyer location is effects coded, with "local" assigned as the base.

Table 5 presents attribute WTP coefficients derived from the mixed logit model. As levels for the price attribute are defined in relative rather than absolute terms, WTP estimates are interpreted as the percentage change in the contract price producers are willing to pay (accept) for a 1-unit increase in the attribute. All four nonprice attributes had statistically significant mean WTP. The extent of attribute preference heterogeneity is indicative of a high level of WTP heterogeneity; this reinforces that WTP estimates should be viewed as an average result rather than reflective of any single producer's preferences. As the nonprice attributes negatively affect utility, the WTP estimate can be interpreted as a willingness-to-accept (WTA) value. These values reflect the "premium" that the producers would have to be paid to accept contract terms, such as requiring more days to wait for payment, a larger penalty, a longer contract, or contracting with a nonlocal relative to a local buyer.

A majority of SSC producer sales are currently through direct-to-consumer sales, which are settled quickly through cash or credit transactions. Delaying payment increases risks associated with receiving the payment and reduces often needed liquidity. The mean WTA for delaying payment an additional day was a 0.17% increase in the per unit price. This implies that a contract with a 30-day payment term would require a price markup of 5.1% versus one in which payment is received upon delivery.

The mean WTA for a potential 1% penalty increase was a 0.24% increase in the per unit price. This result is lower than the 0.4%–0.5% reported by Vassalos et al. (2016). This estimate would reasonably lie between 0% and 1.0%, dependent on the producer's expected likelihood of violating their contract. While a contract penalty was found to be a highly important component of the contract structure, this result suggests that producers are not overly concerned about violating their contract terms. This finding is consistent with information shared during the qualitative interviews and other survey questions, in which producers report being most concerned with penalties regarding quantity requirements, and less so about quality requirements, produce delivery dates and locations, and other criteria that trigger penalties.

Results also indicate that, on average, producers are willing to accept a contract extension of 1 additional year for a 15.73% increase in their per unit price. In discussions with producers, a contract which extended over more than one growing season was seen as a risk to potential future income and a possible encroachment on farm autonomy. This sentiment was especially held among producers of vegetables, which are simpler to substitute and rotate between crops over multiple years than fruits. The high WTA value for increases in contract length suggests that reaching a contractual agreement becomes less likely for longer contract periods.

Sales to a nonlocal rather than a local buyer require a 14.0% increase in the mean per unit sales price. Conversely, this also suggests that SSC producers would be willing to accept a 14.0% decrease in price to sell to a local buyer. SC buyers typically demand freshness and appearance, and

they apply price or other forms of penalties for the lack of either quality attribute. As many SCs are susceptible to bruising and other transportation-related damage, further shipping distances increase the possibility of damage which can impact the price received. Among interviewed producers, 76.9% indicated that they preferred to travel less than 100 miles to sell their produce, with 14.3% stating that they would not be willing to travel to deliver their produce. In both study phases, SSC producers who currently use or have previously used contracts found that buyers were unwilling to travel to their farm to collect contracted produce because of the relatively small quantity. Many SSC farmers do not own sufficient (refrigerated) trucking capacity and thus would incur additional expenses to meet this contract commitment.

Random Effects Regression Results

Table 6 reports results from the random effects model. In this specification, the dependent variable are the slopes of the curves for each individual relating their WTP to the attribute levels; coefficients in the random effects model thus measure the effects of the explanatory variable on the slopes (marginal WTP values).[18] As an individual does not "pay" for a contract but rather agrees to "accept" a set of certain terms and conditions, a variable's effect on marginal WTA values is opposite in sign of its coefficient value in these WTP results. For example, a variable with a positive marginal WTP coefficient indicates that an increase in the value of the attribute decreases the contract price that the producer is willing to accept.

Designating sales to a nonlocal buyer as the base contract attribute, payment terms, potential penalty, and contract length entered the random effects model as binary variables. Results for these contract terms are all statistically significant. All else being equal, producers' average marginal WTA due to changes in payment terms, potential penalty, and contract length is lower relative to their marginal WTA for selling to a nonlocal buyer.

Importantly, significant differences in willingness to accept contract terms are also found among farmers with different demographic characteristics. On average, male producers' WTA is 2.6% less for a 1-unit increase in an attribute level. This result indicates that, relative to females, males are willing to accept 2.6% less for each additional year of the contract, an additional day for buyers to pay, or a 1.0% increase in the contract penalty. Overall, the premiums required for increases in contract attribute levels are larger for females than for males.

Farmer's age (and age squared) was also found to significantly reduce their marginal WTA values. While the estimated coefficients are small, they are statistically significant and indicate that marginal WTA coefficients decrease with age for most farmers in the sample (the minimum is reached at 72.5 years). This implies that a 40-year-old farmer would require a 3.4% higher price than a 60-year-old farmer would to accept a 1-unit increase in the contract terms (e.g., to be willing to accept an additional 1% penalty). This result suggests that, all else being equal, older SSC farmers would be more willing to sell their products through a contractual agreement. This result is perhaps due to the lower burden of marketing produce through this channel than through direct-to-consumer marketing or other options. Further validating the pooling of producer surveys, no significant differences were found across states and survey modes for the average contract price producers were willing to accept.

We included gross farm income as a categorical variable assessed against a baseline income of less than $150,000. Farmers with a gross farm income of $150,000–$349,999 and greater than $350,000 were willing to accept a 2.4% and 1.5% lower contract price for increases in attribute levels, respectively. We also evaluated the effect of share of sales from fruits and vegetables, which was found to be statistically significant. An additional 1.0% increase in share of sales from fruits and vegetables increased producers' marginal WTA for increases in the attribute levels by 0.02%.

[18] This marginal interpretation of WTP values is not strictly correct for the "local buyer" attribute, as it only has two levels; however, to simplify the discussion, we maintain this interpretation for all tributes. A 1-âĂIJunit" change for the local buyer attribute implies a change in the value of the variable from 0 (no local buyer) to 1 (local buyer).

Table 6. Random Effects Model WTP Estimation Results

Variables	Coefficient	Std. Error
Constant	−18.162***	5.699
Contract characteristics		
Payment terms (days)	13.371***	1.621
Potential penalty (%)	13.262***	1.621
Contract length (years)	7.790***	1.686
Ignored attribute(s)	−0.668	0.654
Producer characteristics		
Age	0.291*	0.157
Age × age	−0.002*	0.001
Gender; male = 1	2.573**	1.238
Education; college or higher = 1	−1.051	0.772
Vegetable producer	−0.187	0.714
Virginia producer	−0.919	0.673
Farm income (base = less than $150,000)		
$150,000–$349,999	2.369***	0.843
≥ $350,000	1.461*	0.778
Share of sales from fruit & vegetables (%)	−0.019*	0.011
Share of sales made direct to consumer (%)	−0.012*	0.007
Contract use, perception, and information source		
Not interested in using contracts	−0.589	0.939
Negative contract perception	−1.775*	0.958
Received information from market middlemen[a]	1.598**	0.698
Insurance and certifications		
Food product liability insurance	−0.909	0.909
GAP certified	1.133	0.881
Willing to become GAP certified	1.735*	1.019
Organic certified	0.165	1.417
Organic noncertified	−0.118	1.413
Online survey	0.413	0.687
σ_{μ}^2	0	
σ_{δ}^2	12.366	
R^2	0.195	
Wald χ^2 (22)	345.34	
Observations	872	

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.
[a]Produce wholesalers, brokers, etc.

This implies that a producer whose fruit and vegetable sales account for 100.0% of their gross farm income would require a 1.0% higher price to accept a 1-unit increase in the contract terms relative to a producer whose sales of fruit and vegetables make up 50.0% of their gross farm income. As is the case for many small-scale producers, study participants reported that the bulk of their farm revenue is derived through direct-to-consumer sales. Results show that a 1.0% increase in total direct-to-consumer sales increases producers' marginal willingness to accept 0.01% per 1-unit increase in attribute levels.

To test the stability of producers' general attitudes toward contracts, we included a binary variable to reflect respondent perceptions of using marketing contracts. Producers who believed

contracts would be harmful to their farming operation (negative contract perception) were found to have a 1.8% higher marginal WTA an increase in the values of the contract attributes. This result is important and is of the expected sign. While a lack of significance of this variable would not necessarily raise concern, a significant positive coefficient on negative contract perception might suggest that producers were either randomly selecting alternatives or that their attitudes toward contracts were unstable across questions. Finally, in what could be viewed as a "payback" for wholesalers, brokers, and distributors who have provided farmers information about agricultural contracts, producers who received information from these firm types had a 1.6% lower marginal WTA changes in contract attribute levels than those who had not received information from these sources.

As food safety and product attribute certifications are quite important to many produce consumers, we specifically explored the impact of GAP and organic certification on willingness to accept contracts. Producers who are willing to become GAP certified have a 1.7% lower marginal WTA for changes in contract attribute levels. No significant difference in marginal WTA values were found between conventional and certified/noncertified organic growers. This result is somewhat surprising. Higher production costs and regulatory procedures are significant challenges in the organic certification process. Given strong market demand for their products, certified organic growers have little incentive to accept a lower price to enter into a contractual relationship. Those who are producing organically but have not become certified as such (who are in the either the 3-year transition period or who are producing organically but who do not wish to become certified) face most of the same expenses of certified operations but sometimes have difficulty marketing their products (Stolze and Lampkin, 2009) and are often unable to command organic market prices. These farmers may particularly welcome the assurance of a guaranteed buyer. In addition, for those who are in the process of transitioning to organic and plan to become certified, such contracts may offer a strategic opportunity to establish a relationship with a buyer who may continue to purchase their products after certification.

Overall, we found that all examined producer characteristics that have statistically significant coefficients matter from an economic perspective. This is true even in cases such as the share of direct-to-consumer sales, which had the smallest coefficient value (-0.01). In this case, there is a -0.2% ($-0.01 \times 20\%$) difference in the marginal WTA values between a farmer with a 10.0% share of direct-to-consumer sales relative to one with a 30.0% share of direct-to-consumer sales. Cumulatively, this indicates that to be amenable to a change from cash on delivery to a 30-day payment window, a farmer with a 30.0% share of direct sales to consumer would require a 6.0% higher price (0.2% *times*30 days) than would a farmer with a 10.0% share of direct-to-consumer sales.

For context, it is also worth considering these changes in WTP (WTA) relative to small farm earnings. The operating profit margin (OPM), a commonly used measure of farm profitability, is calculated as the ratio of operating profit to gross farm income. If a farm's operating profit is less than 10.0% of its gross cash farm income (GCFI), a farm is considered to be in a "critical zone" and at risk of financial problems (Hoppe, 2014). Among small farms with "moderate sales,"[19] 52.4% fell within this critical zone, and an additional 12.3% of these farms earned an operating profit margin between 10.0%–19.9%. Thus, even the relatively small estimated impacts on WTP (WTA) that would be required by small farmers to enter into a contract can be quite important given the slim (or negative) operating margins they generated.

[19] Each small farm in this group earns $150,00–$349,999 GCFI. It is expected that among small farms, this group would be the most likely to entertain entering a contract due to their relatively larger capacity. Within this group of farms, 40.1% earned a negative operating profit margin in 2011 (the most recent year for which these data are available) (Hoppe, 2014).

Summary and Conclusions

This study explores the relative importance of and trade-offs among contract attributes and buyer business characteristics for SSC farms' willingness to enter into contractual agreements. Information concerning farmers' use of contracts, preferences for specific contract terms and buyer attributes, and perceptions regarding contract use were collected through surveys. Findings indicate that the surveyed farmers in Virginia and North Carolina had mixed attitudes regarding the use of contracts. While they expressed concern about specific aspects of contracts, producers were overall receptive to the idea of using contracts as a viable marketing alternative. For SSC farmers, the security offered by contracts of a guaranteed buyer comes with important trade-offs. Primary among these are concerns about price and payment terms. Farmers who market through direct-to-consumer outlets, such as farmers' markets, are used to selling at retail prices and receiving immediate (frequently cash) payment. Producers who currently market through wholesaler channels, where prices are typically lower, were the most open to using contracts. Despite these and other concerns, however, producers overwhelmingly reported that using marketing contracts would be benefit their farming operations.

Information gained from this study can improve understanding of SSC farmer–buyer relationships. By identifying the contract terms and buyer characteristics that are important to SSC farmers and identifying the types of producers that are more open to using contracts, produce buyers can more efficiently target potential suppliers while also designing contract conditions that better meet both parties' demands and goals. The potential benefits of this are considerable. Despite lower per unit selling prices, when time, marketing expenses, and management skills are taken into consideration, it can be more profitable to market fruits and vegetables through wholesale channels (Park, Mishra, and Wozniak, 2014; Hardesty and Leff, 2010). More efficiently marketing SSC products into wholesale channels can help assure buyers of the reliability and increase the appeal of purchasing from SSC suppliers, which can ultimately strengthen demand among SSC buyers. Small farms' use of contracts can also offer incidental benefits in helping to support the sustainability and resilience of these operations, which indirectly benefit their rural communities and increase access to small-farm products.

Findings from this study can also benefit researchers and Cooperative Extension personnel who help to inform market development strategies for SSC farmers. Both the number of SSC farms and demand for their products has significantly increased in recent years. While the increasing number of farmers' markets help meet this demand, these typically operate seasonally. Farmers with extended-season or year-round production and those who prefer not to invest in marketing through direct-to-consumer channels could particularly benefit from sales through contracts. Through both public and private funding, significant research, outreach, and market coordination effort has been invested in proposing, implementing, and analyzing alternative marketing models for these products. For example, the USDA's Specialty Crop Block Grants and the Farmers Market and Local Food Promotion Programs have supported many projects to increase the competitiveness and market availability of small-scale fruit and vegetable products.

Findings from this study offer new and important insights into an emerging marketing alternative for SSC farmers. Results demonstrate that SSC farmers are open to using contracts and suggests which, and to what extent, specific terms in these contracts are valued by farmers. The approach developed here can be adopted to examine this issue in other U.S. and international settings. Future research will examine this topic from the perspective of wholesale buyers to determine their preferences for contract terms and farmer characteristics and their willingness to accept the contract terms preferred by SSC farmers.

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