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Competition in Local Food Markets

Cristina Connolly and H. Allen Klaiber

While local food production plays an increasingly prominent role in U.S. agriculture, there is growing concern about oversaturation. Using a national dataset, we identify locational attributes that are conducive to the establishment of direct-marketing operations and assess competitive behavior. Our model links firm-entry decisions to market size using reduced-form profit functions, which are characterized by the cost of agricultural land and demand variables. We find significant heterogeneity in the required population to support direct-marketing entrants and show that markets become perfectly competitive upon entry of the third direct-marketing establishment, with heterogeneous market potential for new entrants.

Key words: direct marketing, market entry, market structure

Introduction

The agricultural landscape of the second half of the twentieth century was characterized by an increase in average farm size and a corresponding decrease in the total number of farming operations (U.S. Department of Agriculture, 2014). This trend is partially explained by urban and suburban expansion, which led to higher property prices and thus increased farm costs. As part of the urban expansion over this period, improved transportation routes enabled food retailers to increase their market footprint while simultaneously centralizing operations (Roth, 1999). To remain competitive in the new food marketing environment, many small farms sought out new ventures, one of the most common being direct marketing to consumers (Payne, 2002).

Direct marketing entails bypassing intermediaries in the sale of farm products and transacting directly with the consumer, allowing smaller operations to augment their income as they no longer go through wholesale or intermediary markets. Benefits from direct marketing include consumer cost savings, increased education on the agricultural system, and community development (Farnsworth et al., 1996; Cooley and Lass, 1998; Ver Ploeg et al., 2009). There are a number of farm-based direct-marketing approaches to reach consumers, including community supported agriculture (CSA), farm stands, and agritourism, among others. Each of these direct-marketing approaches entails different demands on farmers and is likely associated with heterogeneous market opportunities, which vary depending on agricultural suitability and the demographic attributes of farm locations.

As direct-marketing approaches diversify and grow in numbers, local and direct-marketed food has simultaneously become increasingly popular with consumers. In a national survey, Bond, Thilmany, and Bond (2006) found that 30% of consumers preferred to purchase their produce from a direct-marketing operation, while Carroll, Bernard, and Pesek (2013) found a significant consumer willingness to pay for tomatoes marketed as local. Additionally, the number of direct-marketing farms in the United States increased from 116,773 in 2002 to 144,530 in 2012, and direct-to-consumer food sales grew from $1.3 billion in 2012 to $3 billion in 2015. Much of this growth

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likely reflects the behavior of producers who are actively seeking ways to expand the customer base through entering new marketing channels for their products. As producers seek new channels, the potential for monopoly power exists if there are limited entrants or barriers to entering those markets (Connolly and Klaiber, 2014; Lass, Lavoie, and Fetter, 2005).

Supporting growth in direct marketing, a number of public policies that encourage local produce consumption have recently been enacted. The Supplemental Nutrition Assistance Program (SNAP) has expanded redemption options for local food, with recipients using $21 million in benefits at direct-marketing establishments in 2014, including roadside stands and pick-your-own/U-pick operations (U.S. Department of Agriculture, 2017b). Projects funded by the U.S. Department of Agriculture (USDA) Agriculture and Food Research Initiative are studying how direct-marketing operations can improve nutritional outcomes (Kolodinsky et al., 2017). Nonprofit organizations are also developing programs, ranging from matching Women, Infants, and Children (WIC) funds used on local food to subsidizing Community Supported Agriculture (CSA) shares, with the dual goal of supporting both low-income citizens and small farmers (Black, 2009; Miller-Corcoran, 2017). These efforts are supported nationally through the USDA's Local Food Promotion Program, established by the 2014 Farm Bill, which provides grants for the development and implementation of projects that improve local and regional food systems, distributing over $13 million in funds in 2017 (U.S. Department of Agriculture, 2017a).

As the local foods industry matures and demand increases, it is important for farmers to understand the market structure they face. The majority of local food sales occur through intermediated channels, and the USDA advises that certain direct-marketing farmers could improve sales by moving to intermediated markets (U.S. Department of Agriculture, 2014). However, this marketing channel is dominated by larger farms; by comparison, 81% of farms that produce local foods are small operations that primarily market directly to the consumer, and over 71,000 farms sell only direct to consumers (Low and Vogel, 2011). Essentially, while more local food is sold through intermediated channels, direct-to-consumer marketing is relevant for a greater number of operations. Additionally, farms that sold directly to consumers were more likely to remain in business between 2007–2012 than their non-direct-marketing counterparts. However, they experienced slower growth, while overall growth in direct-marketing sales has remained constant, placing increasing pressure on small producers relying on direct-marketing channels (Low et al., 2015).

The degree to which markets serving the local direct-marketing community operate competitively is an open empirical question. Understanding the potential market size needed to support direct-marketing ventures, as measured by population, is a key piece of information sought by both producers and policy makers seeking to expand direct marketing and local food production. To provide insights into both the competitive environment and market potential for direct marketing, we analyze the competitive behavior of direct-marketing farms participating in the three most common farm-based direct-marketing operations by employing a national dataset of local food producers. Using these data, we identify heterogeneous population entry thresholds for new entrants into distinct direct-marketing ventures, specifically CSAs, on-farm/roadside stands, and U-pick operations. We further show that regardless of the direct-marketing channel, these markets are largely competitive upon entry of the third direct-marketing firm. These results provide a new window into the competitive structure of direct marketing while highlighting that slightly less than half of all counties in the United States appear to have the needed market base to support additional direct-marketing entrants.

Competitive Behavior and Direct Marketing Farms

Research on direct marketing of local foods is divided on the competitive behavior of producers. It is well known that the degree of competition in a market depends on a number of conditions, including free entry, low or negligible search costs, and limited product differentiation. While the degree of competitive behavior is ultimately an empirical question, there have been surprisingly few

empirical studies focused on measuring competition in the area of direct marketing. In one of the few formal analyses of direct-marketing competition, Lass, Lavoie, and Fetter (2005) began under the assumption that CSAs had the ability to exercise monopoly power due to their small numbers and then attempted to quantify this effect. Using survey data, they found that CSA farmers exerted approximately 2% of their potential market power, suggesting that they set prices to cover costs and a fair wage rather than maximize profits. In more recent work, Connolly and Klaiber (2014) applied an entry threshold framework and found that the CSA market became competitive upon entry of the third operation. However, their study focused on a limited spatial geography, consisting of four Mid-Atlantic States, and exclusively modeled CSA operations. To our knowledge, no research has considered the competitive behavior of farm stands or U-pick operations.

A larger body of research has focused on collusion within direct-marketing ventures, with a particular emphasis on farmers' markets. In surveys, farmers often expressed noneconomic reasons as the impetus for participating in direct marketing (Lyson, Gillespie, and Hilchey, 1995; Griffin and Frongillo, 2003; Hunt, 2007), which could potentially lead to a reduced emphasis on setting profit-maximizing prices. For instance, Hunt (2007) found that 62% of vendors felt relationships were the most important reason to participate in a farmers' market, relative to 36% for profit, which is not in line with the classical price-setting monopolist. Studies that directly assessed price-setting mechanisms have found conflicting results. Logozar and Schmit (2009) suggested that vendors set prices solely based on their input costs, while Griffin and Frongillo (2003) found that farmers in the same market tried to set prices together to maximize profits. Vendors also stated that younger, newer farmers were those most concerned with setting profitable prices, which has significant implications as newer operations continue to open.

Raising the possibility of noncompetitive pricing, the existing literature suggests a degree of price insensitivity on the part of direct-marketing consumers, who appear to be quality conscious. For example, Govindasamy et al. (1998) found that 63% of consumers stated they chose their market based on product quality and freshness, compared to 20% for convenience and 16% for price, while in a separate survey, price was ranked as one of the least important reasons for consumers shopping at a farmers' market (Hunt, 2007).

While much of the previous research is based on case studies and stated preference research, formal models of market power are well developed for the case of limited data settings, such as those in direct marketing of local foods. Bresnahan and Reiss (1987, 1990, 1991) provide a foundation to use data on firm entry to ascertain information on underlying competitive behavior. They develop a model of market demand in which individual demand is a function of demographic variables, population, and price, which work together to influence market demand. Characterizing the responsiveness of market entrants to changes in population provides a window into the underlying competitive structure of a market.

To illustrate this estimation strategy, consider a market with one entrant. There is a minimum population required for the first firm to enter, which is called an entry threshold. We can represent the minimum level of demand needed for one firm to break even using a minimum demand curve. Assuming that demand between markets differs only by population size, then in a scenario of perfect competition, the minimum demand curve for two firms will represent a parallel shift of the curve for one entrant. However, if the first entrant is a monopolist, then the minimum demand curves for subsequent firms will rotate rather than shift. If we assume S_n to be the population necessary to sustain n firms, then competitiveness may be measured by examining entry threshold ratios, defined as $\frac{\bar{S}_{n+1}}{\bar{S}_n}$. In a noncompetitive environment, there would need to be increasingly larger population expansions to support additional entrants, relative to a competitive framework, as monopolists would work to restrict market entry to maintain higher prices. As entry threshold ratios approach 1, there is a reduction in the degree of monopoly power as perfect competition arises.

Empirical Model of Competition

Our model of market power links structural shifts in market demand to the number of direct-marketing operations in a well-defined geographical area. More formally, suppose there are N firms in county C. Assume there is a minimum level of demand needed for a single firm to obtain nonzero economic profits. As the size of the market, S, grows, this increases not only the monopolist's profit but also a potential entrant's post-entry profits. Thus, continued demand growth will encourage entry while reducing incumbents' margins. Eventually, as market demand grows, firms' price-cost margins will reach competitive levels. Ideally, to measure the rate at which oligopoly margins decline toward 0, we would observe how quickly price-cost margins in a specific county fall as the number of incumbent firms, N, increases, where price-cost margins for a specific firm i are given as

$$M^i = P^i - MC\left(q^i\right). \tag{1}$$

However, as information on firm costs are difficult to obtain for direct-marketing firms, we instead use entry thresholds to draw inferences about latent price-cost margins.

An entry threshold is the minimum population necessary for a given number of firms to operate in a specific market. Our analysis begins with a reduced-form profit function first introduced by Xiao and Orazem (2011) and applied to local direct-marketing CSA markets by Connolly and Klaiber (2014). The reduced-form profit function for firm i entering into market c in state j is given as

$$\pi^i_{cj} = Pop_c\beta^{pop} + \boldsymbol{X}_c\boldsymbol{\beta} + \delta_j - \mu_n I[n] + \varepsilon^i_{cj}, \tag{2}$$

where a firm's revenue depends on total market size as well as a vector, $\boldsymbol{X}_c$, of market-level factors such as land price and consumer demographics and state level factors, indexed by j, captured by δ_j; μ_n is the effect of having n firms on a given firm's profit; $I[n]$ is an indicator function capturing market structure for the nth firm upon entry; and ε_c is normally distributed and represents the market-level idiosyncratic portion of profits that is unobserved by the researcher.

Defining S_1 as the population of a market with one firm, a monopolist m earns 0 profits when

$$\pi^m = S_1\beta^{pop} + \boldsymbol{X}\boldsymbol{\beta} + \boldsymbol{\delta} - \mu_1 + \varepsilon^m = 0. \tag{3}$$

Rearranging equation (3), setting the residual to 0, and subsuming the state level controls, $\boldsymbol{\delta}$, within $\boldsymbol{X}$ for simplicity, we solve for the minimum population needed to sustain one firm as

$$S_1 = \frac{\mu_1 - \boldsymbol{X}\boldsymbol{\beta}}{\beta^{pop}}. \tag{4}$$

Similarly, the minimum population required to sustain the nth firm can be calculated by

$$S_n = \frac{\mu_n - \boldsymbol{X}\boldsymbol{\beta}}{\beta^{pop}}. \tag{5}$$

Having solved for entry thresholds, it is then possible to derive a scale-free entry threshold ratio, $\frac{\bar{S}_n}{\bar{S}_1}$, which represents any decrease in profits per customer that occurs between entry of the 1st firm and the nth firm. A value of 1 denotes perfect competition as it suggests that the addition of the next firm did not affect the variable profits of the incumbents.

To estimate this series of entry thresholds we need data on market demand, S, and the number of firms in a market. The probability of observing a market with 0 firms is given by

$$\Pr\left(\pi_1 < 0\right) = 1 - \phi\left(\overline{\pi_1}\right), \tag{6}$$

where monopolist profit is $\pi_1 = \bar{\pi}_1 + \varepsilon$. Given our assumption of a normally distributed error term, $\phi(\cdot)$ is the cumulative normal distribution function. New firms will enter a market when there is an

expectation of nonnegative profits, and thus the probability of observing $n = 1, \ldots, (N-1)$ firms in equilibrium is given by

$$\Pr(\pi_n \geq 0 \text{ and } \pi_{n+1} < 0) = \phi(\bar{\pi}_n) - \phi(\bar{\pi}_{n+1}) \tag{7}$$

and the probability of observing $n = N$ firms can be calculated as

$$\Pr(\pi_N \geq 0) = \phi(\bar{\pi}_N). \tag{8}$$

Given this empirical framework, we proceed by specifying a reduced-form profit function using an ordered probit model containing population, demographic, and market attributes, given by

$$\pi_n = \pi_{\mathrm{n}}(Pop, \boldsymbol{X}, \boldsymbol{\theta}) + \varepsilon_n, \tag{9}$$

where profit is a function of both demand and supply factors. $\boldsymbol{X}$ includes demand values (such as consumer income) and cost variables (such as the value of agricultural land) as well as state-level controls, Pop represents county population, and $\boldsymbol{\theta} = [\beta_{Pop}, \beta_X, \mu^n]$ are our primary model parameters. With estimated coefficients from the ordered probit model in equation (9), we solve for the minimum population required to maintain n firms as

$$S_n = \frac{\widehat{\mu^n} I[n] - \hat{\boldsymbol{\beta}} \boldsymbol{X}}{\hat{\beta}_{pop}}, \tag{10}$$

where $\hat{\mu}$ are the ordered probit cutoff values, $\bar{X}$ are averages across markets, and $\hat{\beta}_{pop}$ is the estimated coefficient on population. We standardize S_n to the nth entrant by calculating $\bar{s_n} = \frac{S_n}{n}$. Entry thresholds are evaluated as the ratio between the nth and the $(n+1)$st entrant as $\frac{\bar{S}_{n+1}}{\bar{S}_n}$. A value of 1 implies perfect competition, as that suggests that the minimum population to support an additional firm increases by the same amount for the $(n+1)$st entrant as for the nth entrant, while a ratio greater than 1 implies that the first n firms exert market power.

Data

Our study makes use of a unique dataset encompassing the U.S. local food environment. Data on farms was obtained from Local Harvest, a national database that contains listings for 21,693 farms (as of 2015) in the continental United States that market directly to consumers. All data are entered by the farms themselves, and the date of the most recent update is known. The data contain geocoded locations for every farm as well as information on whether they participate in one of three farm-based direct-marketing operations: CSA, farm stand, or U-pick.[1] Though the data do not systematically identify farm offerings, in addition to meat and specialty crops, products could include value-added options such as jam and honey, as well as bread and eggs.

To assess the representativeness of our data, we compare the Local Harvest database to USDA values. While this is not possible on a county level, the U.S. Department of Agriculture (2015) Local Food Marketing Practices Survey includes the number of direct-marketing operations in 30 states. Comparing this to our data, we find a correlation of 0.81 across these states. While our data are unlikely to capture all direct-marketing ventures, this high level of correlation suggests that it is a good representation of the direct-marketing landscape.

[1] We exclude farmers' markets from the analysis for several reasons. First, the decision-making process of a third-party organization opening a market differs from that of a farmer choosing whether to participate in a specific direct-marketing channel. Additionally, there is usually significant spatial separation between the farm and the location of farmers; while vendors normally travel 20–70 miles, some studies have found distances of up to 200 (Logozar and Schmit, 2009; Lohr, Diamond, and Dicken, 2011). This differs in practice from U-pick, CSA, and farm stand operations, which are normally colocated on the farm. For further reading, Bonanno, Berning, and Etemaadnia (2017) recently undertook work on farmers' markets.

Table 1. Distribution of Local Farms

State	Farms	CSA	U-Pick	Farm Stand	State	Farms	CSA	U-Pick	Farm Stand
Alabama	173	52	40	54	Nebraska	66	27	8	15
Arizona	144	33	23	40	Nevada	51	19	5	19
Arkansas	125	24	24	28	New Hampshire	209	78	28	114
California	924	246	116	286	New Jersey	207	87	27	100
Colorado	270	101	36	94	New Mexico	77	19	15	25
Connecticut	233	109	27	136	New York	874	347	112	396
Delaware	35	11	3	13	North Carolina	638	187	115	214
District of Columbia	4	3	0	1	North Dakota	26	18	3	8
Florida	520	97	102	142	Ohio	692	188	94	251
Georgia	424	136	57	132	Oklahoma	114	24	17	40
Idaho	166	58	21	48	Oregon	489	196	77	178
Illinois	419	153	43	157	Pennsylvania	638	249	87	287
Indiana	316	106	38	146	Rhode Island	34	18	6	9
Iowa	236	86	33	70	South Carolina	185	43	24	65
Kansas	174	44	33	51	South Dakota	39	20	7	8
Kentucky	270	90	28	66	Tennessee	322	118	46	97
Louisiana	89	17	10	29	Texas	621	139	108	168
Maine	224	100	28	111	Utah	71	34	10	22
Maryland	279	115	48	110	Vermont	214	94	33	115
Massachusetts	353	182	52	194	Virginia	590	146	88	181
Michigan	781	247	106	274	Washington	566	180	88	203
Minnesota	375	150	59	95	West Virginia	117	26	18	32
Mississippi	83	19	19	24	Wisconsin	521	214	66	168
Missouri	414	77	63	114	Wyoming	42	12	8	13
Montana	95	33	9	15					

Notes: This is over the 14,529 farms with updated information.

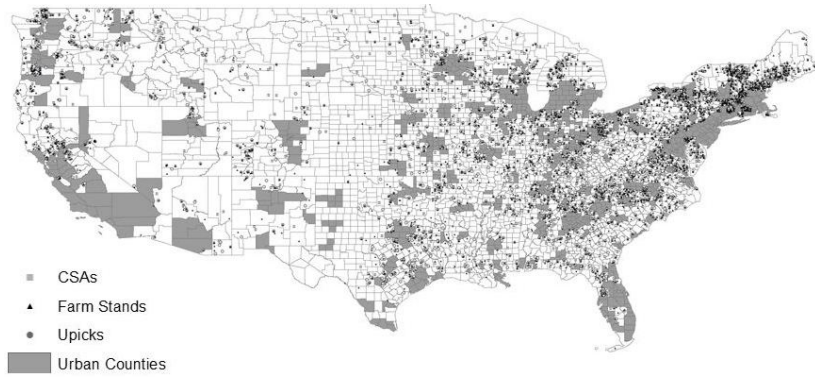

Figure 1. Study Counties with Direct Marketing Firms

Table 2. Direct Marketing Decisions (N = 4,685)

Direct Marketing Combinations	Number	Percentage
CSA only	1,384	29.54%
U-pick only	537	11.46%
Farm stand only	1,520	32.44%
CSA and U-pick	110	2.35%
CSA and farm stand	650	13.87%
U-pick and farm stand	294	6.28%
Participates in all three operations	190	4.06%

To ensure that we only include active farms, we exclude all observations with update dates prior to 2011, resulting in 14,529 remaining farms. Of the total sample, 9,089 ran a CSA, U-pick, or farm stand. Activities of the remaining 5,440 establishments included consumer plots, restaurant and specialty-market supply, livestock sales, or participation in a farmers' market. Table 1 provides a state by state breakdown of the direct-marketing outlets and highlights large spatial variation in the number of direct-marketing farms, ranging from 4 in the District of Columbia to 924 in California. To mitigate for spillover impacts from farms likely operating in large geographical markets, we follow the suggestion of Bresnahan and Reiss (1987, 1991) and focus on rural locations. In our analysis, we exclude "urban farms" by restricting our analysis to nonmetro counties with fewer than 250,000 residents.[2]

Our final sample of direct-marketing farms spans 2,449 counties and contains 4,685 farms that operated at least one direct-marketing establishment. Figure 1 shows a map of the included counties with all direct-marketing channels overlaid. This local food environment displays clear spatial differences, as there are relatively fewer establishments in the Southwest and West, potentially due to significant regional differences in population and growing conditions.

Examining the diversity of marketing channels across these farms (Table 2), we find that 73% operated just one farm-based direct-marketing establishment. Of these 3,441 farms, the most common marketing channel was a farm stand, followed closely by a CSA. Conversely, very few farms concentrated solely on U-pick operations. Approximately 23% of farms were involved in two direct-marketing operations, with the majority participating in a CSA in addition to a farm stand. Farm stands are most similar to traditional retail operations and are perhaps a more intuitive option for farms transitioning to direct marketing. CSAs are more likely to be observed in the data relative

[2] A Metropolitan Statistical Area (MSA) is defined as an urban center of 50,000 people with surrounding counties that share social and economic ties. We explored a number of alternative "urban" threshold definitions and our results were qualitatively unchanged using alternative definitions. These results can be found in Appendix A.

Table 3. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Population (thousands)	34.93	41.52	0.08	247.34
Population density	0.09	0.12	0	1.65
Population change (thousands; 2010–2014)	0.38	2.32	−6.26	27.90
Cropland value (includes buildings)	$3,068.67	$2,015.11	$192.00	$26,659.00
Mean household income ($thousands)	$56.17	$10.69	$31.65	$136.47
Male (%)	50.14%	2.31%	43.20%	72.10%
Residents under 18 (%)	23.19%	3.27%	9.10%	40.10%
Residents over 65 (%)	16.66%	4.02%	3.70%	43.40%
Residents with at least a bachelor's degree (%)	17.79%	7.01%	3.20%	56.80%
Residents, white (%)	84.42%	16.33%	2.90%	99.20%
Residents, Hispanic (%)	7.55%	12.84%	0.00%	95.70%
No. of farmers' markets	1.48	2.02	0	19
No. of produce wholesalers	0.32	1.99	0	84
No. of CSAs	0.96	1.88	0	24
No. of U-pick establishments	0.46	0.98	0	10
No. of farm stands	1.09	2.14	0	26

to U-pick operations, potentially because many types of agricultural products are not easily adapted to agritourism. Only 4% of farms participated in all three direct-marketing channels.

Table 3 reports summary statistics for both local food practices as well as underlying demographics of the counties used in our study. Examining the local food environment, the average county had 1.09 farm stands and 0.96 CSAs, with only 0.46 U-pick operations. There is significant heterogeneity in local foods market entrants across counties. While the average county had fewer than two farm stands, some had as many as 26. Similarly, CSA availability ranged from 0 to 24, while the largest concentration of U-picks was 10. Our model combines population with other demographic variables to identify the drivers of this heterogeneity.

Demographics have previously been shown to be an important determinant of direct-marketing utilization. Consumers that are white and have children are more likely to visit an agritourism operation (Carpio, Wohlgenant, and Boonsaeng, 2008), as are those with higher levels of education and income (Govindasamy and Nayga, 1997). Meanwhile age, gender, education, and income were all shown to impact roadside stand patronage (Govindasamy and Nayga). We obtained county-level data on demographics from the U.S. Census Bureau (2014). The average rural county in our sample had 34,930 residents in 2010. Population, a key variable for our analysis, varied substantially and ranged from 8,000 to nearly 250,000 individuals (Figure 2). Average population density, which has been shown to impact demand for direct-marketing operations (Lass, Lavoie, and Fetter, 2005), was 0.09 people per acre. The average value of an acre of land in 2012 was $3,068.67, and the mean of household income in 2013 was $56,170. 23% of residents were children, while 17% were greater than 65 years of age. 18% had at least a bachelor's degree, 84% were white and, only 7.5% were Hispanic.

To control for the outside marketing options available to vendors, we include the number of farmers' markets in our model, as selling in this channel is an alternative to the farm-based operations we are studying. Using data from the USDA's National Farmers Market Directory (https://www.ams.usda.gov/local-food-directories/farmersmarkets), we find that the average county had 1.5 farmers' markets, though this ranged from 0 to 19. Similarly, to account for the importance of marketing through intermediated channels, we include the number of fruit and vegetable wholesalers as a potential opportunity for farmers considering direct marketing. According to the 2012 County Business Patterns release (U.S. Census Bureau, 2014), the average county only had 0.32 wholesalers, though there was significant variation.

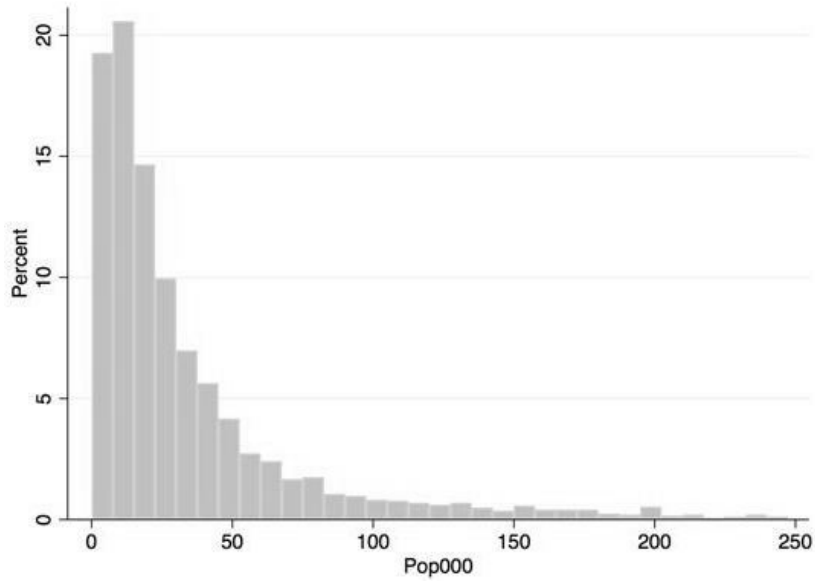

Figure 2. County Populations

Table 4. County Statistics by Type of Direct-Marketing Establishment

Entry Population by Establishment				Market Counts by Establishment			
	County Population (thousands)				County Totals		
No. of Entrants	CSA	U-Pick	Farm Stand	No. of Operations	CSA	U-Pick	Farm Stand
0	21.924	24.629	20.741	0	1,456	1,773	1,407
1	38.756	49.056	37.627	1	501	428	516
2	49.072	68.382	52.393	2	197	148	211
3	69.449	83.501	65.163	3	135	44	100
4	77.028	111.445	79.160	4	53	32	65
5+	101.377	136.937	93.299	5	107	24	150

Table 4 provides additional evidence of the relationship between the size of market and the number of firms by showing the average county population in counties with different numbers of market entrants. Across all three direct-marketing operations, total population increased with the number of entrants. However, this comparison reveals substantial heterogeneity in the empirical distribution of population and market entrants across direct-marketing channels. Additionally, county-level counts of direct-marketing operations show that the majority of rural counties in the United States have no farm-based direct-marketing establishments.

Results

Table 5 reports the primary estimation results for a series of ordered probit models in equation (9), one for each direct-marketing channel. These estimates are used to calculate the market entry thresholds in equation (10) as well as the corresponding entry ratios. The dependent variable in each of our ordered probits is the number of direct-marketing outlets, shown previously in Table 4, which represents the level of market entry in each county. The ordered probit results indicate that the determinants of entry differ by direct-marketing operation, reflecting their distinct formats.[3] The key

[3] An analysis of simple correlations between the covariates found that the majority of correlations were low and generally under 0.5.

Table 5. Firm Entry Ordered Probit

	Coefficients		
Variable	**CSA**	**U-Pick**	**Farm Stand**
Population (thousands)	0.01***	0.01***	0.01***
Population density	−1.68***	−1.91***	−1.98***
Population change (thousands; 2010–2014)	−0.01	−0.02	−0.03
Cropland value (includes buildings)	0.62***	0.49***	0.55***
Mean household income ($thousands)	−0.27	−0.23	0.27
Male (%)	−0.02	−0.01	−0.01
Residents under 18 (%)	0.03	2.99	4.26**
Residents over 65 (%)	−3.90***	−1.15	−1.01
Residents with at least a bachelor's degree (%)	2.03**	1.01	0.77
Residents, white (%)	0.80**	0.80**	0.83***
Residents, Hispanic (%)	−1.64***	−1.32***	−1.50***
No. of farmers' markets	0.08***	0.04	0.12***
No. of produce wholesalers	−0.01	0.02***	0.00
State-level fixed effects	Yes	Yes	Yes
$\mu 1$	1.59	2.43	8.60
$\mu 2$	2.46	3.35	9.50
$\mu 3$	3.00	4.03	10.08
$\mu 4$	3.60	4.44	10.49
$\mu 5$	3.97	5.00	10.87

Notes: Standard errors are clustered at the state level. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% levels.

estimates needed to construct market entry thresholds are calculated by combining the population coefficients and μ values.

Examining the estimation results, we find the expected positive coefficient on population, which demonstrates that increases in population size lead to an increased number of entrants. Areas with higher population density experience fewer new market entrants, potentially due to the competitive effects of housing developments reducing the number of small farms available for direct marketing in these areas. We find that higher land values lead to increased entry, which is not surprising, as increased land prices are one of the drivers of farms entering direct marketing to maintain profitability. County-level income was not significant for any of the direct-marketing operations.

Counties with higher proportions of female residents have more direct-marketing operations, corroborating results from Govindasamy and Nayga (1997), though the results were not statistically significant. Counties with more children saw increases in farm stands, while there was a negative relationship with CSAs and counties with more elderly consumers. Education, as measured by a bachelor's degree, was positively associated with CSAs. Increases in white residents had a positive relationship with all three operations, while there was a negative effect for locations with greater numbers of Hispanic residents. The number of farmers' markets was significantly positive, suggesting a complementary relationship with farm-based direct-marketing operations. Unsurprisingly, the number of wholesalers has no significant impact, perhaps due to the nature of the small farms that primarily sell direct-to-consumer, which likely differ from larger farms that pursue intermediated channels; however, there was some complementarity with U-picks.

Combining the results from the ordered probit models with the population information contained in Table 3 allows us to construct the entry thresholds from equation (10). These calculated threshold values are reported in Table 6. The estimated minimum population needed to support the first CSA entrant is 23,950. A farm stand is observed with only 11,260 residents, while a U-pick operation requires a much larger population base of 55,540. This most likely reflects how the structure of both

Table 6. Entry Thresholds and Competition

	Population (thousands)		
Entry Thresholds	**CSA**	**U-Pick**	**Farm Stand**
S1	23.95	55.54	11.26
S2	109.63	127.53	87.24
S3	162.53	181.11	136.48
S4	221.53	212.84	170.89
S5	257.67	257.05	202.49
	Ratio Values		
Threshold Ratios	**CSA**	**U-Pick**	**Farm Stand**
s2/s1	2.29	1.15	3.87
s3/s2	0.99	0.95	1.04
s4/s3	1.02	0.88	0.94
s5/s4	0.93	0.97	0.95

CSAs and farm stands allows for relatively small-scale operations, while U-pick establishments require additional upfront costs.[4]

Having established entry thresholds, the final step in our analysis is to examine ratios of entry thresholds, which provide a gauge on the competitive structure of each marketing channel. We see that across all direct-marketing channels, our results indicate competitive behavior upon entry of the third firm,[5] consistent with the CSA results of Connolly and Klaiber (2014). This has significant implications for producers considering direct-marketing endeavors, as this provides insight into where markets are saturated and what markets potentially have room to expand with new direct-marketing entrants.

Robustness

We performed a series of sensitivity tests to examine the robustness of our results to different market assumptions. In our preferred model, we followed the Census Bureau's designation of 250,000 as our population-based cutoff to define an urban area. In Appendix Table A1 we report results when using a lower population threshold of 200,000. Using this definition, we see few qualitative differences from our primary specification; the only changes are that population change is significant for U-picks and farm stands and the number of farmers' markets is significant for U-picks.

Discussion

Direct marketing represents a significant revenue stream for small farms in the United States and is often touted as a way for small farms to maintain viability in the face of a changing agricultural landscape. In recognition of the benefits to both farmers and consumers, there are an increasing number of national public policies geared toward supporting small farmers. As examples, the USDA microloan program provides funds to beginning farmers while the Farmers Market Promotion Program and the Local Food Promotion Program support development of direct-marketing activities. However, the success of these programs is predicated on the ability to properly target and assist local farmers. Thus, it is essential to understand the underlying market forces driving direct-marketing entry.

[4] The data do not include information on operation size, only type.

[5] Entry threshold ratios of 1 merely demonstrate a lack of change in competitive behavior between successive entrants. Thus, we could theoretically see consecutive values of 1 if firms were exerting perfect collusion, leading to no decrease in prices, and thus no need for an increased number of consumers. However, that is unlikely to be the case here as there was a decrease in ratios between the first few entrants.

Table 7. Market Potential

No. of Operations	CSA	U-Pick	Farm Stand
0	56.07%	69.33%	54.04%
1	20.74%	18.46%	21.30%
2	8.77%	6.98%	9.61%
3	5.89%	2.56%	4.67%
4	2.63%	1.40%	3.09%
5	5.89%	1.26%	7.30%
Counties that have no entrants and meet the minimum population			
No. of counties	398	166	753
Percentage	37.65%	38.97%	44.50%

Notes: The number of counties differs by operation as they have different minimum population thresholds.

Our study uses a novel dataset of small farms across the country to assess the competitive environment of these emerging markets. We find that while the local population was a significant determinant of a farm's entry into a specific market, other supply and demand factors also influenced a firm's profit function. Using these results to develop entry thresholds demonstrated that the market needs of direct-marketing firms differed significantly by operation. However, all exhibited competitive behavior upon entry of the third firm. These results suggest that any policy interventions seeking to spur local direct-marketing entrants must be careful of the areas they target.

While competitive forces are at work in direct-marketing channels, this concept is often ignored in policy discussions and surveys of local farmer motivations. Though a farmer may choose to market directly to the consumer for reasons beyond profit, they face a competitive landscape that can have real implications for the success of their venture. As shown in Table 7, 86% of counties currently have fewer than three CSAs, 95% have fewer than three U-pick operations, and 85% have fewer than three farm stands, suggesting there may be U.S. counties with potential room for growth for new entrants. Looking specifically at counties that meet the minimum population threshold for each operation, 35%–45% have no entrants. In Figures 3–5, we illustrate the spatial dispersion of these potential markets. Counties that lack local CSA access are distributed throughout most of the South and West (Figure 3). Meanwhile, the Northeast appears relatively saturated in terms of CSA entrants. Counties with no farm stands are concentrated in the South and in some large counties in the West (Figure 4). There is limited scope for new farm stand entrants in the Northeast. Turning to U-picks, there are few counties large enough to support a U-pick operation that do not already have one (Figure 5), and these are distributed throughout the country. This information can help policy makers and producers identify markets that will not support additional entry, allowing for a potential reduction in the number of failed farming ventures. Similarly, identifying saturated areas can lead to an emphasis on new, intermediated options.

These results also have implications for consumer-oriented policies, as partnerships with local food producers are viewed as a way to increase food access to the 23.5 million residents of low-income food deserts (Ver Ploeg et al., 2009; White House Task Force on Childhood Obesity, 2010). There has been a particular emphasis on encouraging healthy eating habits in children, and the White House Task Force on Childhood Obesity has recommended that the USDA incorporate local food into school lunch programs and use direct marketing to promote fruit and vegetable consumption in low-food-access areas. These proposals impact over 30 million students in the United States who participate in the National School Lunch Program, which was created to reduce food insecurity by providing healthy meals to low-income children. Additionally, farm to school programs, which link local producers to school cafeterias, combine regional procurement with these educational initiatives to improve the diets of school children.

The USDA has provided millions of dollars in funding to programs that incentivize produce consumption in low-income households through grants such as the Food Insecurity Nutrition

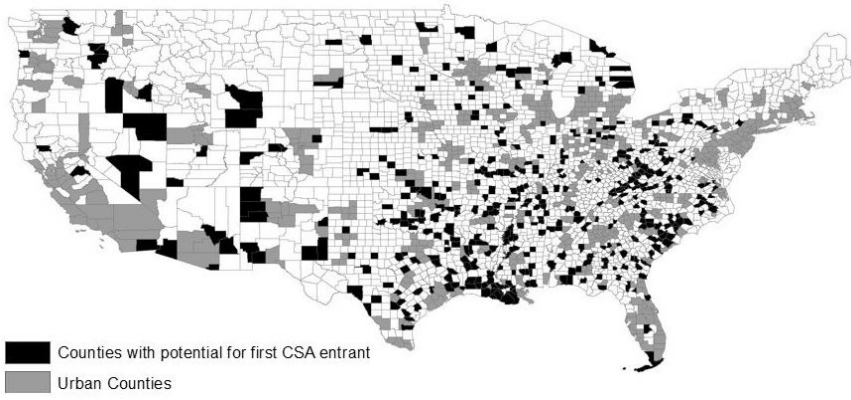

Figure 3. Study Counties That Meet CSA Population Threshold with No CSAs

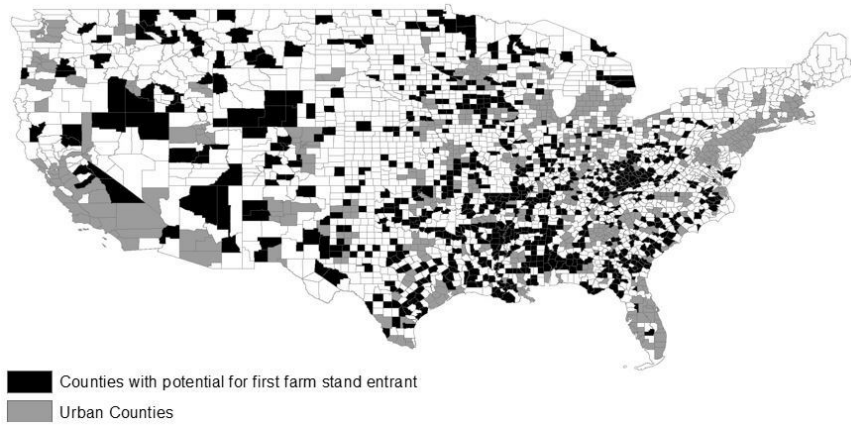

Figure 4. Study Counties That Meet Farm Stand Population Threshold with No Farm Stands

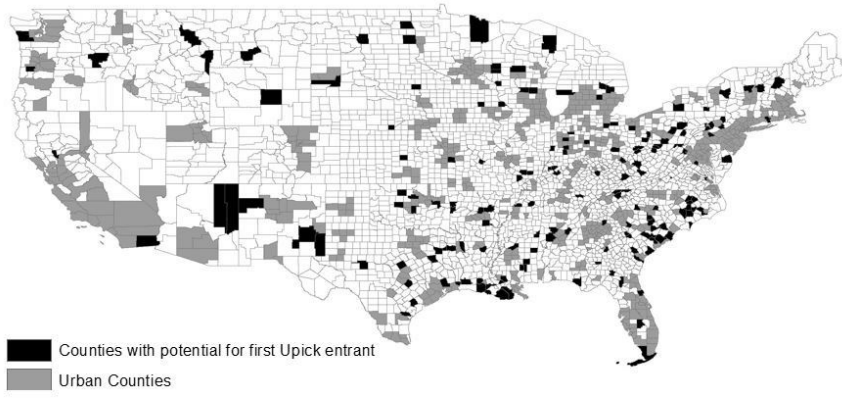

Figure 5. Study Counties That Meet U-Pick Population Threshold with No U-Picks

Incentives program and the Agriculture and Food Research Initiative (Kolodinsky et al., 2017). Projects that subsidize access to local food operations such as CSAs have been found to increase fruit and vegetable intake (Hanson et al., 2017) and are significantly more costly to implement without a steady supply of local food, which often arise from local direct-marketing ventures. To the extent that these types of initiatives spur new demand for direct marketing, it is possible that new entrants may become successful in areas already saturated with direct-marketing ventures. However, the risk remains that potential new entrants in these areas may not be viable, even with new sources of demand. If the goal of policy makers is to expand local food availability, then our results identify counties that currently lack direct-marketing operations, despite the ability to potentially support these firms. However, caution is warranted to the extent that preexisting market distortions and current policies may have potentially unintended impacts on the outcomes of additional policies targeted to these areas.

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Appendix A

Table A1. Firm Entry Ordered Probit (200,000 threshold)

	Coefficients		
Variable	**CSA**	**U-Pick**	**Farm Stand**
Population (thousands)	0.010***	0.014***	0.013***
Population density	−1.388**	−1.825***	−1.529***
Population change (thousands; 2010–2014)	−0.023	−0.036*	−0.048***
Cropland value (includes buildings)	0.603***	0.478***	0.521***
Mean household income ($thousands)	−0.259	−0.236	0.268
Male (%)	−0.016	−0.011	−0.012
Residents under 18 (%)	0.009	2.901	4.213**
Residents over 65 (%)	−3.737***	−0.704	−0.664
Residents with at least a bachelor's degree (%)	2.016**	0.960	0.880
Residents, white (%)	0.787**	0.746**	0.764**
Residents, Hispanic (%)	−1.572**	−1.350***	−1.467***
No. of farmers' markets	0.079***	0.050**	0.123***
No. of produce wholesalers	−0.032	0.016***	−0.001
State-level fixed effects	Yes	Yes	Yes
$\mu 1$	1.561	2.462	8.439
$\mu 2$	2.431	3.386	9.349
$\mu 3$	2.967	4.073	9.943
$\mu 4$	3.583	4.472	10.351
$\mu 5$	3.952	5.042	10.728

Notes: Standard errors are clustered at the state level. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% levels.

Table A2. Entry Thresholds and Competition

	Population (thousands)		
Entry Thresholds	**CSA**	**U-Pick**	**Farm Stand**
S1	43.38	225.23	22.96
S2	253.99	533.28	211.16
S3	375.63	752.20	321.13
S4	496.48	888.98	398.03
S5	567.78	1059.58	459.08

	Ratio Values		
Threshold Ratios	**CSA**	**U-Pick**	**Farm Stand**
s2/s1	2.93	1.18	4.60
s3/s2	0.99	0.94	1.01
s4/s3	0.99	0.89	0.93
s5/s4	0.91	0.95	0.92