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Direct Sales Performance of Local Food Marketers: Evaluation of Multivalued Treatment Effects

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We explore the impact of direct marketing on farm sales applying a treatment effect generated by a multinomial selection process. Producers engaged in direct marketing using diversified outlets experience significant sales gains as do producers who market primarily to consumers. The direct marketing effect is apparent even after controlling for operator demographics, farming and marketing experience, characteristics of the farm operation such as crop choices and diversification across commodities, and geographic effects. Using data from the Local Food Marketing Practices Survey (LFMPS), direct sales are higher by 31 percent for marketing in diversified channels and 148 percent for the marketing primarily to retailers, an effect that is relative to those marketing to consumers. We distinguish between experience in farming and experience in direct marketing. Both types of experience contribute to higher sales but the effect is stronger for experience in marketing. The LFMPS samples only producers who are involved in local food marketing and avoids selectivity issues related to participation in direct marketing.

Key words: treatment effects, local food marketing, direct sales, mixed multinomial logit model, positive selection

Introduction and Plan of Paper

Local foods represent a small but growing share of the U.S. food system—one reflection of consumers' increasing influence on food production. Local food producers sell their goods directly to consumers at places such as farmers markets, on-farm stores, or pick-your-own stores. They also sell to retailers such as restaurants or grocery stores, institutions such as schools, universities, or hospitals, and intermediaries such as processors or wholesalers. Local and regional food systems provide significant income for many farmers, which supports rural communities, beginning farmers, and small-scale farmers.

Agricultural policy makers, USDA agencies, along with academic researchers and extension experts have recognized the potential benefits of direct marketing to enhance farm operations and their long-term survival. In 2012, the USDA "Know Your Farmer, Know Your Food" initiative explicitly commented on the role of local marketing in driving job growth, keeping farmers and on the land, and keeping wealth in rural communities. A specific area of concern was that local

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sales could support the survival of family farms and stem the decline of the "disappearing middle" defined as farming operations with sales between $10,000 and $500,000. (USDA, 2012).

The USDA Local and Regional Food Systems Resource Guide (USDA, 2024) cited an expanded interest in local and regional food systems in the wake of the COVID-19 public health pandemic and sudden and severe food supply chain disruptions. The resource guide promotes local and regional food sales that could promise producers a greater share of the food dollar, a measure of the annual expenditure that is spent domestically for the food people eat. Selling local is mentioned as a way to "allow producers to retain more of the profit and dollars attributed to food within a community."

The local food sector has received growing attention as the National Agricultural Statistics Service (NASS) has fielded the LFMPS in 2015 and 2020. The 2017 Census of Agriculture special study provides data on the marketing of locally and regionally produced agricultural food products, as directed under the 2018 Farm Bill. In addition, the annual Agricultural Resource Management Survey (ARMS) is jointly sponsored by USDA's Economic Research Service (ERS) and NASS and collects data on marketing practices and direct sales efforts. These USDA initiatives and the expanded survey and research interest in local food has uncovered some conflicting trends that merit closer attention. In 2020, farmers produced and sold $9 billion of local edible food commodities directly to consumers, retailers, institutions, and intermediaries. Although direct farm sales of food increased by 2.3 percent from 2015 and the number of operations selling locally produced food decreased by 12 percent. Drilling down to specific marketing channel revealed that direct farm sales to consumers and retailers actually declined, posting decreases of 3.3 percent and 17.4 percent respectively across these channels.

Our research is designed to explore the impact of participation in direct marketing on direct sales with a close study of the marketing channels that are available and chosen by farmers. The NASS surveys develop a comprehensive set of channels that we outline below and we account for how farmers select into the channels that most closely align with their farm structure, management skills, and the marketing environment in which they operate. We develop new information on choice of marketing outlets from the Local Food Marketing Practices survey (NASS, 2015) highlighting the distinct advantages and the flexibility of accounting for the multiple direct marketing channels available to farmers. We document higher sales effects for producers in specific direct marketing channels and provide scenarios to predict sales for farmers considering entry to a given market.

The plan for the paper is to begin with literature review that examines three research strands. Our econometric model builds on a literature for evaluating multi-treatment programs so we review the main findings in this area. Then we summarize the extensive literature on direct marketing by agricultural producers with close attention to the use of government surveys. We briefly review relevant research findings from the marketing science literature that are relevant to direct marketing efforts. The paper follows with the econometric model, the specification of marketing options, and a detailed description of the variables and data that appear in the model. We discuss the key variables and marginal effects that influence sales in direct markets. The treatment effects associated with the choice of direct marketing outlets are presented showing how direct sales change in response to the choice of direct marketing outlets for specific groups of farmers or for chosen scenarios.

Literature Review

Our econometric model builds on a literature for evaluating multi-treatment programs. Most current research on program evaluation has focused on the evaluation of a single program or policy choice, even as many public policies or market options offer a variety of choices. Lee (2018) argued that treatments take on multiple values such as when participants in active labor market programs receive different periods or types of training such as vocational training, apprenticeship, or wage subsidies. Example of multi-treatment programs include household

eligibility for varying transfer levels in anti-poverty programs, the opportunities for farmers to enroll in a variety of agricultural programs, and producer choices to allocate planting decisions across a portfolio of crops. Multi-valued treatment effect models are designed to identify the impact of a treatment variable on an outcome variable, recognizing that the treatments can take on multiple values and are rarely discrete. Cattaneo (2010) noted that multi-valued treatments may be discrete or continuous, as well as ordinal or cardinal and concluded that a correctly specified model requires the joint estimation of all treatment effects. Lee and Salanié (2018) emphasized the importance of developing econometric methods to estimate multivalued treatment model to identify the effects of different training programs and allowing for the effects of selection on unobservables. Ao, Calonico, and Lee (2019) argued for the importance of accounting for how labor market outcomes such as earnings (here, sales by firms) are influenced by multivalued treatment effects such as type of employment services (here, marketing outlets used). Forcing a multivalued treatment into a binary framework cannot capture the economically significant differences across the treatments that we identify.

Our approach follows this guidance and is more consistent with observed choices that producers make than alternative models that evaluate each treatment effect separately. The treatment and outcomes may be both non-normal and the approach accommodates multinomial, count, discrete, or truncated data. The treatment is endogenous and the model accounts for producer selection of marketing outlets. Our model explicitly accounts for latent, unobserved factors that influence the treatment and outcome. In our results we discuss the role of positive selection as producers sort into the marketing option that yields the highest returns to their production and marketing skills.

The literature on direct marketing by agricultural producers is quite extensive and develops deep implications for the impacts of direct marketing on financial performance to assist stakeholders and policymakers in contributing the viability of successful local food markets. We choose to focus our literature on a few areas, highlighting conflicting results. A number of reports have suggested that farmers could benefit from direct sales or alternatively they could face the declining farm sales by participating in these markets. Uematsu and Mishra (2011), use the nationwide 2008 Agricultural Resource Management Survey (ARMS) to show that the number of different types of direct marketing outlets used had no significant impact on farm income. Specific types of direct marketing outlets had different effects on quantiles of the income distribution. Participation in farmers markets was negatively correlated with farm income at all quantiles, while sales through farm stores had a positive effect on income for all but the 90th quantile. Park, Mishra, and Wozniak (2014) found that farmers selling only through direct-to-consumer (DTC) (such as farmers markets and on-farm stores) outlets had significantly lower earnings than those selling only through intermediated market outlets. Intermediated markets included outlets such as direct sales to grocery stores and distributors.

Park (2015) used data from the 2008, 2009, and 2010 ARMS to examine the impact of direct marketing on the entire distribution of farm sales. Compared with traditional marketing channels, participating in direct marketing was found to have a negative impact on farm sales, which lessens as farm sales increase. This relationship was found even after controlling for demographic factors and farm experience. Park, Paudel, and Sene (2018) exploited the ARMS data to show that the impacts of direct marketing efforts are negative when farmers market to consumers only and for marketing through a portfolio of both consumer and retail outlets. After correcting for self-selection, the earnings decline is 36.8 per cent for the diversified marketing decision and 71.3 per cent when marketing direct to consumers only.

Bauman, Thilmany-McFadden, Jablonski (2018) used the 2013 Phase III ARMS to explore how participation in direct marketing outlets affected the financial performance of farms. They

found that participation in direct and intermediated markets may allow farms at any scale of sales volume to be profitable. Participation in direct markets appears to be less scale-biased than traditional agricultural markets. The ARMS is not designed to specifically collect data on agricultural sectors such as direct marketing and provides a relatively small sample of direct market producers.

The 2015 Local Food Marketing Practices Survey (LFMPS) was the first survey conducted by NASS to produce benchmark data about local food marketing practices (NASS, 2020b). The LFMPS provides a better opportunity to analyze how direct marketing choices influence financial performance given the bigger sample size of local food producers and a more specific breakdown of types of direct marketing channels. The larger sample size allows for segmentation by farm size, farming experience, race/ethnicity and operator gender measures.

Several studies have used the 2015 LFMPS to examine various aspects of local food producers' marketing efforts. Martinez and Park (2021) analyzed the marketing practices and financial performance of local food producers with varying levels of farming and direct marketing practices. Plakias, Demko, and Katchova (2019) examined factors affecting farmers' choice of specific direct marketing channels. They estimate separate binary logit models for the choice of four marketing channels -- direct-to-consumer, direct-to-retailer, direct-to-institution and direct-to-intermediary and participation is measured. A multinomial logit model is specified to identify factors influencing the decision to participate in one of six direct marketing channels including direct-to-consumer only, direct-to-consumer and direct-to-retailer, direct-to-intermediary only, direct-to-consumer and direct-to-intermediary, and direct-to-retailer only. The sixth option is the decision to use all other channels. The selectivity issues that are central to our analysis are not assessed. In addition, the participation decision is recorded a dichotomous choice so that all sales levels (from zero to millions of dollars) are treated as equivalent. The treatment effects that identify the sales effects from participation in a channel that are central to our analysis are not available from these approaches.

O'Hara and Lin (2020) estimated how proximity to potential customers at successively further distances from the farm influences the market channels that local farmers use and sales at these channels. They develop a double-hurdle model to examine factors that influence both the decision to enter a market channel and the level of sales after the market channel choice. Again, the model does not account for selectivity effects that we emphasize are of prime importance in choosing across a portfolio of marketing channels.

Jablonski, Bauman, and Thilmany (2020) highlight the role of human capital in enhancing the performance of farms and ranches that sell in local food markets. They use data from the ARMS to demonstrate the local food producers rely more heavily on human capital compared to producers who lack a local emphasis. Human capital is measured as the total expenditures to labor. We show how our results also support these findings.

Key (2024) uses farm-level panel data from the Census of Agriculture (2007, 2012, 2017) to show that farms engaging in direct to consumer (DTC) sales have significantly lower net returns, returns on assets, and sales-to-assets. Weaker financial performance leads to fewer financial resources to invest back into the farm. Key (2024) concludes that DTC marketing is associated with less farm size growth.

We briefly review a strand of the literature from marketing science that is relevant to direct marketing efforts, yet may be relatively unknown to agricultural economists. Chiang, Chhajed, and Hess (2003) showed that direct sales indirectly increase the flow of profits through the retail channel and improve the overall profitability of the manufacturer by spurring demand in the retail channel. Arya, Mittendorf, and Sappington (2007) demonstrated that direct marketing (or supplier encroachment) benefits suppliers and retailers by inducing lower wholesale prices and expanded downstream competition. Li, Xie, and Zhao (2015) examined supplier encroachment in

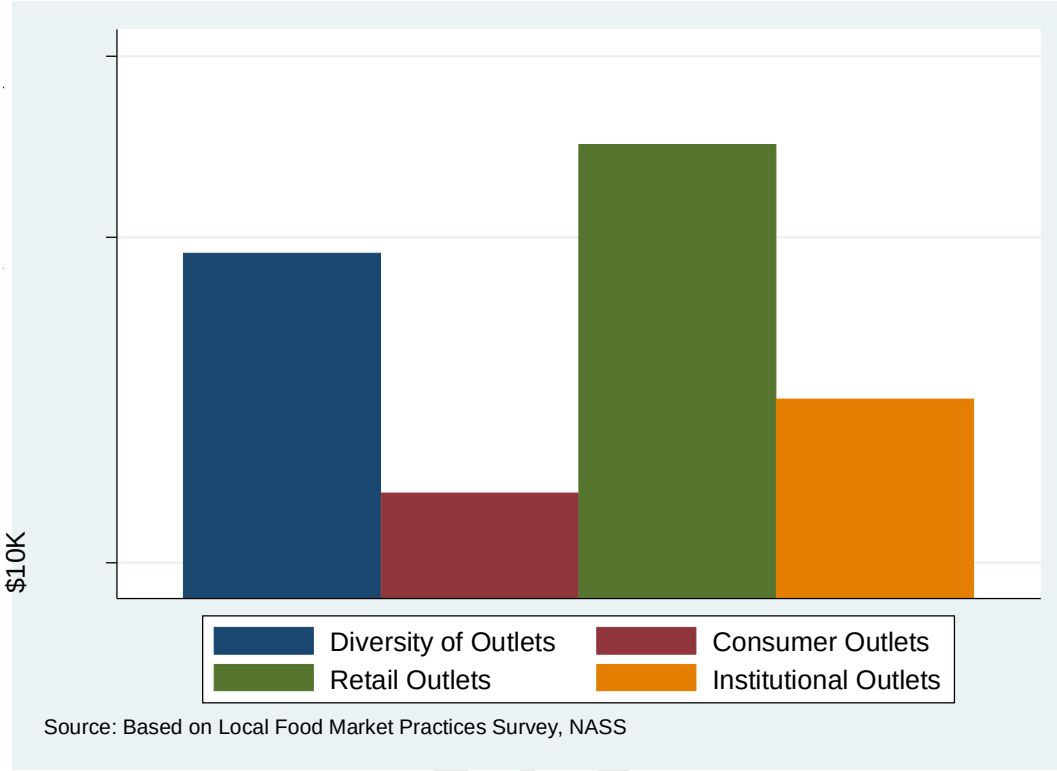

Figure 1. Direct Sales by Direct Marketing Outlet
Note: Dominant market identified for a producer when the share of sales to a market is higher than the average share reported across the sample of producers. Diversity of outlets identifies producers with no market share higher than the average share in the sample.

competitive supply chains featuring products that are homogeneous and completely substitutable, such as food commodities. The analytical results show that encroachment may lead to a "lose–lose" outcome for the suppliers and the retailers as the profits of both decline. These outcomes would tend reduce entry to direct marketing efforts. Huang, Guan, and Chen (2018) examined the case when retailers or downstream marketing entities may choose to share demand information with suppliers. We see two conflicting outcomes where the information sharing may create a "win-win" scenario for both entities in the marketing channel. Alternatively the downstream entity such as the retailer may strategically share information to deter the supplier from entering the direct marketing channel. These potentially conflicting scenarios highlight the usefulness of our empirical approach to discover the impact of direct marketing on sales by agricultural producers.

Econometric Model and Specification of Marketing Options

Our research is designed to identify direct sales impacts that producers incur when they choose from a portfolio of direct marketing options so we initially discuss the sales measure and the set of direct marketing choices. We identify four broad categories of marketing choices based on the Local Food Marketing Practices survey (NASS, 2015). Farmers can choose to market through direct-to-consumer outlets, such as a roadside stand, on-farm facility, on-farm store, farmer's market, or community supported agriculture. A second choice is to rely on retail outlets for sales, a category that includes direct sales to local grocery stores or regional food distributors. The

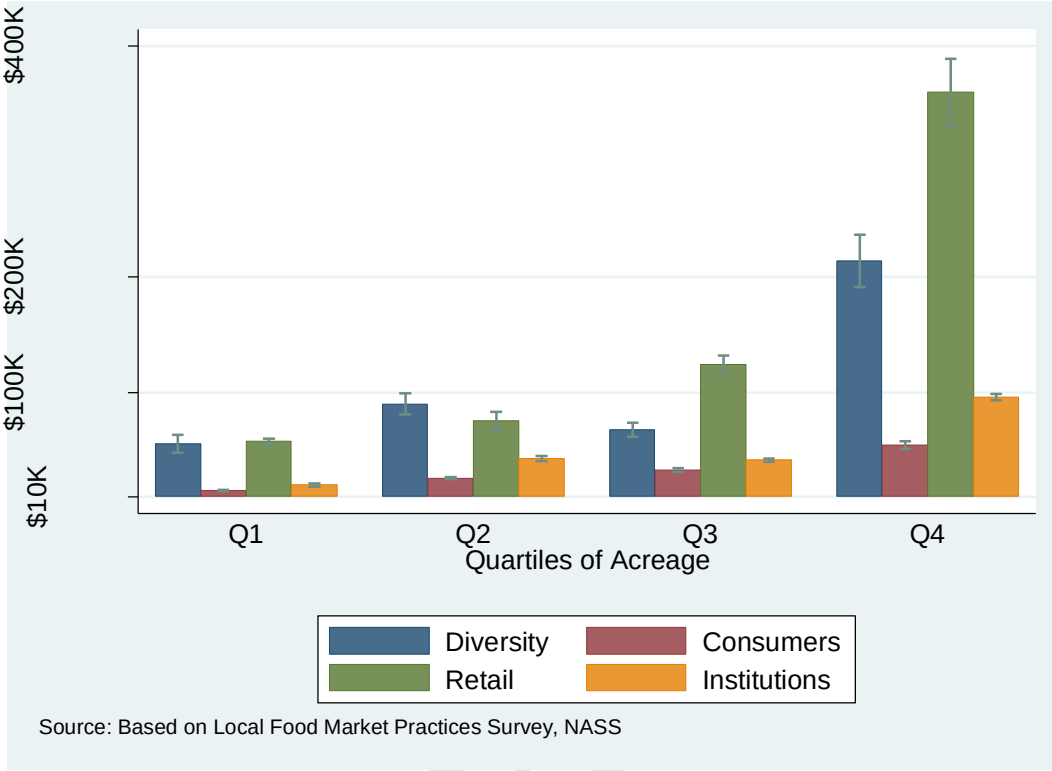

Figure 2. Direct Sales by Direct Marketing Outlet and Acreage
Note: There are considerable differences in sales associated with size of operation by acreage. Sales of diverse producers and producers with a retail emphasis both rise. We also see significant relative changes in sales for marketing channels across acreage quartiles.

survey also gathers information about sales to intermediate markets. Intermediate markets include businesses or organizations in the middle of the supply chain marketing locally or regionally-branded products, food hubs, brokers, auction houses, wholesale and terminal markets, and food processors. Data on sales directly to institutions such as K-12 schools, colleges and universities, hospitals are incorporated. Other institutional sources are workplace cafeterias, prisons, and senior care facilities. We combine the intermediate and institutional markets together as the institutions are a small percentage of total sales.

We identify the dominant market used by a producer when the share of sales to a market is higher than the average share reported across the sample of producers. If a producer does not identify a dominant market then we label them as a diversified producer. In summary, the market options will be identified for convenience as diversified, consumer, retail, or institutional. The important point is that these are the dominant marketing options for each producer but they can still generate sales in the other markets channels.

Figure 1 shows the total value of direct sales for producers engaging in each of the direct marketing options. There are significant differences in sales observed across the marketing choices and there is substantial heterogeneity based on farm size. Farmers who market to retail outlets report the highest sales levels on average at $127,154 while those relying primarily on consumer outlets have the lowest sales at $29,107. Retail-oriented producers account for about 9.2 percent of operations and 22.9 percent of total sales across the outlets. Consumer sales are 50.6 percent of the operations and 29.1 percent of total sales. However, we do emphasize that food hubs are sampled in the LFMPS and additional information on the viability and operational

characteristics of these outlets is available from the National Food Hub Surveys (see Bielaczyc et al, 2020 as an example). In the LFMPS, the sales to intermediate markets channel (which include food hubs) reported average sales of about $57,000 which was about 55 percent higher than average sales in the consumer channel.

Even within a given marketing channel we see significant variation in direct sales as revealed in Figure 2. We sort the producers by the quartiles of acres for each operation and look at producers by each marketing choice across the acre size quartiles. Producers identified as primarily using retail or a diversified set of outlets show the largest sales across each size class. Sales grow as operation size expands across each marketing option. Retail oriented and diversified sellers are relatively equal in sales for the two lower quartiles. The size advantage of operations with a retail emphasis expands across the quartiles. Retail sales are 168 percent higher compared to diversified operations in the fourth quartile.

Our analysis of selectivity effects is motivated by these substantial differences both in direct sales across the marketing outlets and the changes associated with size of operation. There are three main forms of selection bias that may be present in the choice of marketing channel. First, self-selection arises as optimizing producers select marketing channels based on knowledge of their business operations, expertise in marketing, and managerial resources available to the farm operation and household. Second, selection bias is linked to the economic behavior of supply chain entities such as retailers, brokers, and marketing agents. Iyer and Villas-Boas (2003) pointed out that managers frequently choose between using a single distribution channel or a mix of several types of channels and emphasized the role of unobserved factors such as bargaining and negotiation in coordinating marketing channels. Food hubs have emerged as local business ventures linking distribution of local foods from farmers to wholesale customer including institutions, restaurants, and grocery stores and provide essential local information linking producers and consumers (Barham, Tropp, and Schaffstall, 2014).

Supply chain entities have various levels of expertise and capacity to provide information, develop transportation and distribution channels, expand brokerage services, and manage technical assistance and producer development opportunities to induce entry by producers. Grocery stores and big-box retailers are aggressively expanding their locally grown offerings even as many food hubs promote a non-profit mission. These entities emphasize products that are valued by their consumer base even if they are more expensive to source and verify, such as organic and fair trade products (Matson, Sullins, and Cook, 2013).

Li, Xie and Zhao (2015) noted that retailers often have a marketing advantage compared to suppliers as the retailers have superior knowledge of customer preferences and have developed close relationships with consumers. A critical factor in Costco's success is its decentralized organization with buyers spread out across a network of regional offices "enabling it to procure more local and exclusive items" ensuring high quality and retaining quality suppliers. Sam's Club is trying to duplicate this model by developing a team of regional U.S. buyers to bring in more local and organic groceries (Layne, 2016). Whole Food Market employs "foragers" tasked with finding and growing to scale the most efficient and high-quality local producers from towns and municipalities near Whole Foods stores (Strailey, 2020).

Third, customer choice also influences the access, growth, and profitability of direct marketing channels. Producers must adapt to buying and sourcing patterns of local foods consumers. Montaguti, Neslin, and Valentini (2016) noted that multichannel consumers often choose to purchase across a portfolio of outlets. These consumers are recognized as more profitable for producers since these consumers generate more revenue, purchase a greater variety of items across more categories, and purchase more frequently. Producers would see the value in developing marketing campaigns to induce consumers to buy through multiple channels.

The general form of the econometric model recognizes the potential impact of these selectivity effects and has two components based on the generating process of the treatment variables and the outcome equation. The choice of marketing outlet is the treatment and the direct sales variable is the observed outcome measure. Each producer i makes the marketing decision

from a set of four treatments ($j = 0, 1, 2, 3$). Let EV_{ij}^{*} represent the indirect utility function associated with the j[th] treatment

$$EV_{ij}^{*} = z_i^{'} \alpha_j + \sum_{j=1}^{J} \delta_{jk} l_{ik} + \eta_{ij} \quad (1)$$

where the z_i are the exogenous covariates with associated parameters α_j and the error term η_{ij} is an independently and identically distributed random shock. The indirect utility function EV_{ij}^{*} contains the latent factors l_{ik} which encompass the unobservable characteristics common to individual i's treatment choice and outcome such as awareness of marketing channel outlet options and the producer's human capital and entrepreneurial skills. The l_{ik} are assumed to be independent of η_{ij}. Without loss of generality we let $j = 0$ represent the base group which is category 1, the decision to sell primarily to consumer outlets. We normalize the indirect utility function to zero for the base choice so that $EV_{ij}^{*} = 0$. Since l_{ik} is unobservable, we use the binary variables d_j to represent the observed treatment choices or marketing options. The d_j measures follow a mixed multinomial logit (MNL) structure and $d_i = \lfloor d_{i1}, d_{i2,}, \ldots . d_{iJ} \rfloor$. The probability function for the marketing choice is modelled by a latent class MNL:

$$\Pr(d_i \mid z_i, l_i) = \frac{\exp(z_i^{`} \alpha + l_{ij})}{1 + \sum_{k=1}^{J} \exp(z_i^{`} \alpha_k + l_{ik})} \quad (2)$$

and $j = 0, 1, 2, .. J$. The equation for the expected outcome (sales) is

$$E(y_i \mid d_i, x_i, l_i) = \exp\left(x_i^{'} \beta + \sum_{j=1}^{J} \gamma_j d_{ij} + \sum_{j=1}^{J} \lambda_j l_{ij} \right) \quad (3)$$

where x_i is the set of all exogenous covariates within z_i with the associated parameter vector β and γ_i's are the treatment coefficients relative to the base group. $E(y_i)$ is a function of each of the latent factors l_{ij} when the outcome variable (sales) is linked to unobservable effects which also influence the choice of the direct marketing channel. Factor loading coefficients λ_j are estimated for each marketing options.

We apply the endogenous multinomial treatment effect model developed by Deb and Trivedi (2006a, 2006b), accounting for selection on unobservables and a continuous outcome variable. The treatment variable is the direct marketing choice and the outcome measure is direct sales by the operation. The latent factors account for idiosyncratic influences in the marketing channel that influence sales, allowing the model to account for both selection on unobservables and selection on observables. The latent factors are unknown but given specific assumptions about the distributions for both the latent variables and the error term in the treatment equation, the composite error term and its moments can be estimated, conditional on those distributions.

Estimation is carried out by maximum simulated likelihood (MSL) techniques based on the joint distribution of the outcome and treatment variables. We use 1,000 Halton draws to ensure that maximization of the simulated log likelihood is equivalent to maximizing the log likelihood, yielding estimates that are consistent and asymptotically normal.

The mixed multinomial logit model does imply the independence of irrelevant alternatives (IIA) property that places restrictions on the underlying preferences structure of the producer choosing across the direct market options. The IIA property would be a constraint to test if the research objective was to examine the structure of preferences across these options. In our case

the main objective in the first stage is to use a discrete choice model that generates accurate predictions of the choice probability while explicitly controlling for the endogeneity of the marketing choices. We follow Dow and Endersby (2004) in noting the advantages of the multinomial logit model over the multinomial probit for the sample size that we rely on. The IIA property is most appropriate when the research goal is to estimate the impacts of hypothetical changes in choice sets, such as new marketing outlet, and we do not face that research issue.

The choice of an alternative discrete choice model does not offer any additional advantages in the flexible specification of the model. We did estimate a multinomial probit model and compared predictions from the multinomial logit model and find no significant differences. These results are available upon request.

Variable Description and Model Interpretation

The model is based on data from the 2015 Local Food Marketing Practices Survey (LFMPS) collected by the National Agricultural Statistics Service (NASS). The LFMPS provides information about agricultural production, resources, and the environment as well as about the characteristics and financial conditions of farm households, marketing strategies, input management strategies, and off-farm income. Data are collected from one respondent per farm, the senior operator making the management decisions.

Variables in the Sales Equation

Table 1 shows the variable descriptions and summary statistics for the direct farm sales along with the complete set of explanatory variables that are discussed in more detail in the following section. Natural logs of the continuous variables were used as indicated in the model specification. Producer variables that are plausibly related to participation in direct marketing include the operator's experience in farming and in direct marketing, familiarity with and use of the farm and business management practices, and the genders of the major decision makers in the operation. These variables control for the management ability and technical expertise applied to the marketing decision.

A unique feature of the LFMPS is the availability of two separate measures of experience that can influence sales. The first is the total number of years that the main survey respondent has operated a farm and this variable is discussed as farming experience. The total value of direct sales is highest in the first and last quartiles of the farm experience variable. In the first quartile where operators have about 7 years of experience, average sales are $51,817. Sales in the fourth quartile are only about 10 percent higher where farm experience averages about 42 years. The second measure of experience is based on the number of years the operation has sold food in their dominant marketing channel. The pattern here is distinctly different as sales rise across the quartiles of selling experience. The youngest quartile of farmers in terms of selling experience with 3 years reports the lowest sales of $30,255 while the quartile with the most experience (40 years) recorded $71,046 in sales, a figure that was 135 percent higher than the lowest quantile.

About 47 percent of farms in the sample are jointly managed by males and females. We use survey information that gathered demographic information on up to four individuals who were involved in operation decisions combined with an indicator that the person spent more than 50 percent of work time in the farm or ranching occupation. The survey design reflects a change in Census of Agriculture emphasis in asking specific questions about up to four individuals who are involved in decisions on the operation. Across each of the marketing channels, operations that are jointly managed by males and females report higher sales than farms without this management structure. Another interesting effect is a difference in the variability of sales for males and females associated with participation in direct marketing. The riskiness of sales for jointly managed farms is lower across each marketing option. The survey also assessed the use of USDA Market News

price information and separately an indicator of whether price information from private sources was gathered. Across all marketing options operators tend to use private sources more frequently.

The total acreage for the farm operations is included and the mean acreage levels are fairly similar across the marketing channels. The retailer-oriented operations report the lowest average at 130 acres while operations selling to institutions are at 230 acres. The survey also provides information on acreage rented or leased from others and we include a measure of the proportion of rented acreage in the specification. Across each marketing option around a quarter of the

Table 1. Variable Definitions and Descriptive Statistics [a, b]

		Diversity of Outlets	Consumer Outlets	Retail Outlets	Institutional Outlets
Variable	**Description**	**Mean (Std. Dev.)**	**Mean (Std. Dev.)**	**Mean (Std. Dev.)**	**Mean (Std. Dev.)**
Direct Sales	Total value of direct sales in (in $1,000's)	94,035 (236,661)	29,107 (99,637)	127,154 (322,321)	55,605 (134,478)
MaleFem	Operation is jointly managed by males and females (1 = Yes, in %)	62.9 (48.3)	46.8 (49.9)	59.8 (49.0)	43.1 (49.5)
ProdExp	Experience in farming (years)	20.6 (11.99)	23.0 (13.8)	22.6 (15.3)	24.0 (13.9)
MarkExp	Experience in direct marketing (years)	14.1 (13.86)	16.2 (15.7)	13.8 (12.4)	17.3 (12.9)
USDANews	Operator uses USDA Market news price information (1 = Yes, in %)	29.5 (45.6)	24.5 (43.0)	26.9 (44.3)	22.7 (41.9)
PrivNews	Operator uses private news price information (1 = Yes, in %)	46.7 (49.9)	35.6 (47.9)	35.8 (47.9)	33.0 (47.0)
FarmManag	Farm and business management practices adopted (count of 6 activities):	2.2 (1.1)	1.6 (1.2)	1.7 (1.3)	1.5 (1.2)
	Balance sheet (1 = Yes, in %)	72.8 (44.5)	51.7 (50.0)	54.2 (49.8)	55.2 (49.7)
	Income statement (1 = Yes, in %)	76.6 (42.3)	56.3 (49.6)	62.1 (48.5)	51.2 (50.0)
	Cash flow projection (1 = Yes, in %)	40.0 (49.0)	27.5 (44.7)	32.7 (46.9)	18.1 (38.5)
	Business plan (1 = Yes, in %)	19.7 (39.7)	15.4 (36.1)	22.0 (41.4)	15.7 (36.4)
	Marketing plan (1 = Yes, in %)	11.7 (32.2)	9.9 (29.9)	16.7 (37.3)	7.8 (26.8)
	Uses online business products (1 = Yes, in %)	52.6 (49.9)	33.4 (47.2)	41.8 (49.3)	26.2 (44.0)
Acres	Total acres farmed	151.0 (386.4)	168.0 (518.4)	126.7 (353.0)	233.4 (418.6)
RtUseRatio	Proportion of rented acres (%, based on rented acres over total acres)	24.3 (33.7)	16.7 (32.0)	20.0 (35.8)	15.3 (30.0)

Expenses	Marketing expenses ($ value, includes hired labor, transportation and distribution costs, market promotion and equipment and supply)	24,513 (48,253)	13,299 (32,418) .	29,086 (63,164)	18,892 (36,655)
HerfDist[b]	Herfindahl index for sales shares across three categories:	0.9 (0.1)	1.0 (0.1)	0.9 (0.1)	0.9 (0.1)
	Sales within 100 miles (%)	93.3 (18.3)	93.7 (19.2)	90.4 (24.3)	86.0 (31.7)
	Sales within 100-400 miles	5.2 (16.0)	4.4 (15.2)	6.5 (19.8)	11.6 (28.6)
	Sales more than 400 miles away	1.5 (7.7)	1.9 (10.0)	3.0 (11.4)	2.4 (11.9)
WgtAvgPr[b]	Price of food away from home, weighted average of meals from: full-service restaurants, limited-service restaurants, cafeterias, buffets, & grill buffets (in dollars)	11.5 (2.2)	11.1 (2.2)	11.7 (2.3)	11.0 (2.0)
CvCtyGDP[b]	Coefficient of Variation for Gross Domestic Product, county level for ten years from 2009-2015	0.09 (0.05)	0.08 (0.05)	0.094 (0.06)	0.08 (0.05)
Sample size		6,952	71,174	12,922	49,568

Notes: [a] Descriptive statistics of raw data reported while model is estimated using total value of direct sales (in logarithms) as the dependent variable. Data from NASS Local Food Marketing Practices Survey.
[b] Instruments for the model denoted in *bold underlined italic*.

operators rent acreage with the percentage of rented acreage hovering around 20 percent. Operations marketing in a diverse set of outlets are more involved in renting acreage (53 percent rent a positive amount) and rent a higher percentage of their acreage (24 percent share of rented acreage).

An important and unique variable featured in the LFMP survey is the information on marketing expenses paid for food produced and sold directly through the direct marketing outlets. We include a measure for total marketing expenses that incorporates elements such as hired labor, transportation and distribution costs, market promotion and equipment and supply expenses associated with market channel outlets. The survey explicitly excludes expenses not associated with food sold to direct markets. Marketing expenses are generally highest for the retailer-oriented operations averaging $29,000 with operations selling to consumers showing lower average expenses of $13,300. The expenses are more strongly correlated with long term acreage decisions compared to the short term adjustments associated with rented acreage. The pattern of relative correlations linking acreage and expenses is apparent across each marketing option chosen by the operator. Total expenses are also positively linked to farm operation and diversification choices, discussed in more detail below.

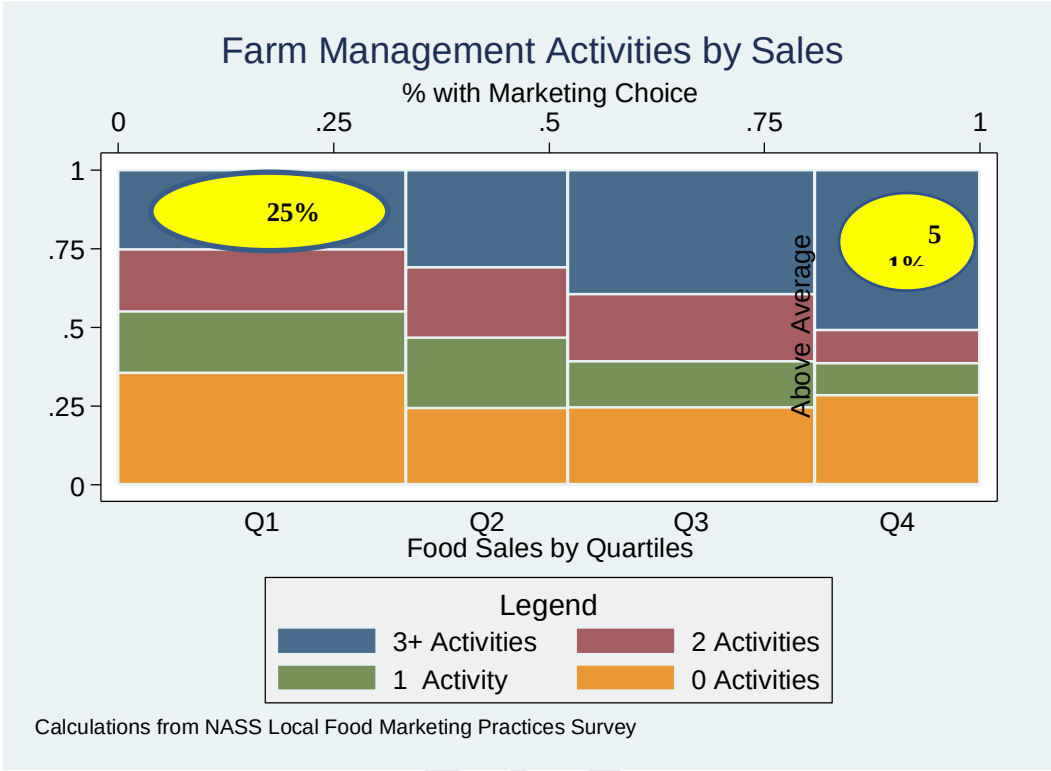

Figure 3. Farm Management Activities by Direct Sales Quartiles
Note: Adoption of farm and business management practices are linked to direct farm sales. Larger operations tend to adopt more practices: 51 percent of operations in the highest quartile adopt 3 or more practices while only 25 percent of operations in the lowest quartile meet this standard.

The farmer's administrative and managerial skills in marketing and selling are included to control for unobserved factors that are related with the propensity to join direct marketing opportunities. We identified a set of 6 activities related to farm and business management that indicate business acumen. The activities include preparing a balance sheet, an income statement, or a cash flow or budget projection, using a written business plan, developing a separate marketing plan, and using online business products and services for planning, accounting, legal, or banking activities. The producers who sell across a diverse set of marketing outlets tend to adopt these practices more frequently and access a greater number of practices. Only 14 percent of diverse marketers do not adopt any practices and 56 percent of these operators use three or more practices.

The spine plot in Figure 3 reveals the significant variability in the propensity of producers to seek out and apply advanced farm and business management practices across farm size. Farm size is measured by quartiles of reported direct sales. For the larger farms we see an enhanced propensity to adopt more of the management practices. The share of operations that adopt 3 or more practices rises from 25 percent for the lowest quartile of sales to more than 50 percent in the largest quartile. In the largest quartile over 8 percent of operators use all six practices, an adoption rate that is about double that for any other quartile. We examine whether participation in these activities influences sales after controlling the choice of marketing options. Li, Xie, and Zhao (2015) showed that the operational advantages of suppliers expand opportunity for supplier encroachment or entry into direct marketing channels. We measure operational advantage using the adoption of advanced farm and business management practices.

We include regional effects for the six geographic production regions developed by ERS that account for regional differences in farm structure, marketing constraints, agronomic conditions, and the availability of farm extension resources. A dichotomous variable was created for each region, equal to one if the respondent's farm was in that region, and zero otherwise. The highest rate of participation in direct marketing was for farmers in the Atlantic region at 28.6 percent with Plains farmers showing the lowest level of direct marketing at about 11 percent. Producers in the Mountain region report the highest mean level of sales given direct marketing efforts ($74,356) with Plains farmers the lowest at $21,308. The regions that report the highest sales levels also focus more intensively on sales to the direct to consumer outlets. The West region and the Atlantic region report direct to consumer sales shares of 50 and 74 percent respectively. The model includes controls for the impact of farm specialization and cropping choices using information on the commodities produced and marketed resulting in eight farm types. The farm types are as grains, vegetables, fruits, nursery, other crops, hogs, milk, and cattle, and diversified operations. Inputs such as acreage and the labor management decisions of the operator are also included.

Variables in the Marketing Option Equation and Exclusion Restrictions

The determinants of the marketing choice include all of the producer variables and farm characteristics that determine the direct sales outcome defined above. The parameters of the outcome equation for the structural model of sales are identified through the nonlinear functional form even if all the variables from the sales equation are included in the marketing choice. We also apply exclusion restrictions to ensure a robust identification of the model and describe variables that are excluded from the sales equation in the following analysis. We propose three instruments that are most closely associated with the marketing choice and can plausibly affect the sales only indirectly via their impact on the marketing channel. The instruments are identified in Table 2 and that these instruments appear only in the mixed multinomial logit model.

The survey develops information for percentage of direct sales based on the distance from the farm operation. The three categories include the sales shares within 100 miles, sales shares to buyer between 100 to 400 miles, sales shares to buyers more than 400 miles away. Producers using a diversity of marketing outlets and those marketing to consumers report the largest sales shares on average to establishments within 100 miles of their location. Producers who focus most intensively on retail outlets gain the largest sales shares on average to establishments beyond 400

Table 2. Parameter Estimates for Mixed Multinomial Logit Model of Direct Marketing Choices [a, b, c]

	Diversity of Outlets	Consumer Outlets	Retail Outlets	Institutional Outlets
Variable	**Estimate (T-value)**	**Estimate (T-value)**	**Estimate (T-value)**	**Estimate (T-value)**
Constant	3.92 (18.79)		-2.81 (-17.68)	-3.24 (-26.02)
MaleFem	0.38 (12.17)		0.29 (11.97)	-0.41 (-22.87)
ProdExp	-0.13 (-10.50)		0.18e-02 (2.11)	0.39e-02 (5.98)
MarkExp	-0.01 (-7.68)		-0.12 (-18.68)	0.07e-02 (1.19)
USDANews	-0.22 (-5.63)		0.20 (31.18)	-0.08 (-3.91)
PrivNews	0.20 (5.51)		-0.10 (-3.60)	0.20 (10.02)
FarmManag	0.16 (19.00)		0.07 (9.64)	-0.13 (-25.12)
Acres	0.04 (3.81)		-0.02 (-1.92)	0.28 (48.00)
RtUseRatio	0.54 (13.23)		-0.04 (-1.17)	-0.39 (-14.81)
Expenses	0.07 (8.68)		0.20 (31.18)	0.13 (32.14)
HerfDist [c]	-0.29 (-2.94)		-0.50 (-6.60)	1.11 (18.65)
WqtAvqPr [c]	0.03 (3.91)		0.06 (10.00)	0.06 (12.85)
CvCtyGDP [c]	-0.04 (-0.29)		-0.91 (-8.91)	-1.34 (-16.09)

Notes:
[a] Single asterisk * indicates asymptotic t-values with significance at $\alpha = 0.10$ or higher level.
[b] Model includes regional effects and farm effects, omitted from table.
[c] Indicate the instruments (*bold underlined italic*) that appear in the mixed multinomial logit model for direct marketing choices.

miles. Among the retail dominant producers about 12 percent focus entirely on sales beyond 400 miles, the largest share across the marketing choices.

The first instrument summarizes the information on marketing across distance and calculate the Herfindahl index for the share of sales across the three distances categories. The marketing expertise leading to allocations across distance is established prior to the sales outcome,

supporting the case for its exogeneity in the sales equation. Empirically we find that the Herfindahl

index measure shows a minimal correlation with farm sales and instead reflects long term investments in establishing marketing channels. We also find that the Herfindahl index has a slight correlation with shifts in marketing costs while sales are closely linked to these costs.

We develop a second instrument based on state-level measure of the price of food away from home drawn from the Accommodation and Food Service Series of the Economic Census for the years 1997 through 2012. These food prices are exogenous to the direct marketing decision as the prices reflect regional supply channels and demand factors for food away from home. The series records the prices of meals at various kinds of sources including full-service restaurants, limited service restaurants, and cafeterias, buffets, & grill buffets along with sales measures from each outlet. We develop a weighted average price across these purchase sources by consumers, weighting the price by the share of sales in the type of restaurant. Higher food away from home prices provide an inducement for entry of farmers who offer direct marketing opportunities to consumers, retailers, institutional buyers who may be searching for alternative food sources. Retail and institutional outlets may be willing to pay higher prices for food also when they are located in areas with higher food away from home prices. We find that direct marketing efforts for retail and diverse outlets are associated with the highest food away from home (FAFH) prices. The FAFH prices show little variation across the size of the operation, as measured by food sales. We also find no evidence that larger firms are located in areas with higher food prices after controlling for the choice of marketing channel. The evidence confirms that the marketing channel decisions are more closely related to food away from home prices than are the food sales outcome variable, justifying using this variable as an instrument.

A third instrument is drawn from historical measures of gross domestic product representing the total value of goods and services produced within a county. We access gross domestic product (GDP-CA) measures by county that were recently developed by the Bureau of Economic Analysis (BEA, U.S. Department of Commerce). We use data for 10 years prior to the LFMPS and calculate the mean and standard deviation of county GDP to form the coefficient of variation. The coefficient of variation is a unitless measure of relative variation or dispersion formed as a ratio of the standard deviation over the mean. Greater variation or uncertainty in the economic base of the local economy may induce operators to diversify into local marketing channels. We find that farmers using local marketing channels exhibit the highest levels of uncertainty in county measures of gross domestic product. The pattern is reinforced after stratifying by ERS production region.

Results

Parameter estimates for the mixed multinomial logit model of direct marketing choices appear in Table 2. Our main interest is identifying the impact on direct sales when producers actively sort into preferred direct marketing option appearing in Table 3. The key findings are the estimated coefficients on the marketing outlets variables and factor loadings associated with the latent factors for farm sales in Table 3. The coefficients are positive and significant across all marketing options. The proportional impact of the discrete direct marketing choice indicator on direct sales is measured as $p_i = 100 * [\exp(\gamma_i - 1)]$ from the log linear model where γ_i is the coefficient of the direct marketing variable, following Thornton and Innes (1998). After correcting for self-selection, the earnings increase is 31 percent for the diversified marketing decision and 148 percent when primarily marketing direct to consumers. These effects are statistically significant and are relative to the option of direct marketing primarily to consumers. The direct marketing effect is apparent even after controlling for operator demographics, farming and marketing experience, characteristics of the farm operation such as crop choices and diversification across commodities, and geographic effects.

Table 3. Parameter Estimates for Direct Sales from Multinomial Treatment Effects[a, b, c, d]

Variable	Estimate	T-value[c]
Constant	5.63*	203.58
Diversity of Outlets	0.27*	16.26
Retail Outlets Dominant	0.91*	57.14
Institutional Outlets Dominant	1.51*	16.80
MaleFem	0.68*	92.81
ProdExp	-0.53-02*	-18.24
MarkExp	0.96e-02*	37.70
USDANews	0.06*	6.61
PrivNews	0.05*	6.09
FarmManag	0.09*	41.98
Acres	0.12*	49.33
RtUseRatio	0.52*	48.11
Expenses	0.22*	124.18
Factor Loading		
λ-Diversity of Outlets	0.62*	70.76
λ-Retail Outlets Dominant	-0.17*	-15.73
λ-Institutional Outlets Dominant	-0.93*	-127.36
Number of Observations	140,616	

[a] Dependent variable is total value of direct sales (in logarithms). Data from NASS Local Food Marketing Practices Survey. Regional effects and farm effects in model are omitted from table.
[b] Factor loadings (λ's for each marketing option) represent the impact of unobservable factors influencing the probability that a given marketing option is selected.
[c] Single asterisk * indicates asymptotic t-values with significance at $\alpha = 0.10$ level.
[d] Instruments for the model do not appear in the outcome equation for direct sales.

The coefficients of the latent factors capture the effect on direct sales of unobserved characteristics that are related to the choice of marketing outlets. A distinct advantage of this model is that the factor loadings have a natural interpretation as proxies measuring the impact of unobserved covariates on the observed sales. The factor loading coefficients are significant for all marketing options. We see positive value on the factor loadings for producers using a diversity of outlets. A positive value indicates that unobserved factors that increase the relative probability of selecting a given marketing option lead to higher sales than if a producer was randomly assigned to a direct marketing option. We see evidence of negative selection on unobservables for the option of marketing primarily to retailers.

Positive selection indicates that producers are sorting into the diverse marketing option and that choice yields the highest returns to their entrepreneurial and sales skills. These skills are unobserved in the econometric models that neglect selection effects, leading to outcomes that systematically underestimate the expected sales a random producer would experience for a given marketing option.

We perform a likelihood ratio test to determine if the choice of marketing outlets is exogenous by testing the joint hypothesis that the coefficients for the latent factors in the earnings equation are jointly equal to zero. The constrained likelihood is calculated as the sum of the log-likelihood values from the mixed multinomial logit model and the log-linear model for farm earnings. The likelihood-ratio statistic for exogeneity follows a chi-square (χ^2) distribution, where the number

of parameters is three or the number of estimated outlet parameters. The results from the test lead to a rejection of the hypothesis that the choices of direct marketing outlets are exogenous. The calculated χ^2 statistic was well above the critical value at any conventional significance level. The null hypothesis of exogeneity is overwhelmingly rejected, supporting the proposed model.

We implement a test developed by Oster (2019) to assess how significant the impact of selection on observable characteristics would have to be in order to invalidate our results. Oster's approach evaluates the robustness of results to omitted variables bias, assuming that the relationship between the treatment and the unobservables can be recovered from the relationship between the treatment and the observables. A key number in the test is the relative degree of the selection on observed and unobserved variables summarized by δ. A δ greater than 1 implies that unobservables are more important than all the observables in explaining the selection of marketing outlets, an unreasonable assumption given that a valid model that has been carefully specified.

The negative δ that is estimated provides even stronger information to support our model. A negative δ implies that two conditions jointly hold. If the observables are positively correlated with the treatment, then the unobservables variables are both negatively correlated with the treatment **and** the unobservable variables are simultaneously more important than the observables. This feature is implausible for a well-specified model as a reasonably informed modeler would be able to identify the key variables (observables) in the model.

Marginal Effects for Direct Marketing Sales

A primary objective is to identify the causal effect of the marketing choice on direct sales, recognizing the marketing choice is an endogenous multinomial treatment effect. The coefficients from the multinomial treatment effect model show that operations jointly managed by males and females incur a sales premium associated with direct marketing of about 97 percent. This effect is identified even after a comprehensive set of controls is included in the model. The unconditional sales premium from the survey data shows a premium that is about 200 percent higher than the amount implied by our model. We see the importance of controlling for sample selection in providing an accurate assessment of the premium these operations can expect from direct marketing. The unconditional value is a substantial overestimate.

We distinguish between experience in farming and experience in direct marketing. Marginal effects from the sales equation suggest that both types of experience contribute to higher sales but the effect is stronger for experience in marketing. An additional year of marketing experience is associated about 2.2 percent greater sales than one more year in farming. We look more closely at the role of different kinds of experience by distinguishing respondents with high experience in both categories and those respondents with lower experience. Producers with a high level of experience in both farming and marketing are identified as those with years of experience in the 4th quartile for both years of production and years in direct marketing activity. This group consists of farmers with more than 35 years in farming and more than 23 years in direct marketing and this group consists of about 12 percent of the sample. The dual high experience producers report higher sales (about 38 percent higher) and manage more acreage. More than 63 percent of this highly experienced group is managed by a diverse team of males and females. We confirm the impact of marketing experience: an additional year of marketing experience raises sales by 20 percent more than one more year of farm experience.

By contrast, producers with low levels of experience in both farming and marketing are identified as those with years of experience in the 1st quartile for both years of production and years in direct marketing activity. These farmers have less than 11 years in farming and less than 5 years in direct marketing, making up about 14 percent of the sample. The relative premium for additional marketing experience is again confirmed but is smaller at 2 percent. All effects mentioned here are statistically significant. The positive effects on sales from consulting for price information from private sources (11 percent) or from USDA Market News price information (4 percent) are also apparent.

Our results here are consistent with the findings from Plakias, Demko and Katchova (2019) who also showed that direct selling experience is associated with the decision to use direct-to-intermediary channels. They find that that beginning farmers (farmers with less than 10 years of farming experience) are more likely to use the direct-to-consumer channel. Our model treats the farming experience and the marketing experience variables as continuous measures so we are able to evaluate the impact of an additional year of each kind of experience on direct sales and weigh the relative importance of each type of experience.

O'Hara and Lin (2020) commented on the positive role of selling experience on sales across each of the marketing channels they define. Their model does not include a measure of production experience so the selling experience effect is much larger than in our model. Other farm variables such as farm size, use of management practices, and the choice of renting land are neglected in their model

Park, Paudel, and Sene (2018) documented that farmers who use the internet to gather information for farm-related news or commerce are able to limit the amount of the sales decline. We draw out the impact of specific farm business management practices on sales. The most common number of practices adopted is three from the set of 6 activities. The most common three-element portfolio of practices is to use a balance sheet, an income statement, and online business products and services for banking activities. The impact of adopting one additional practice beyond this typical three element portfolio is associated with sales that are higher by 28 percent. Producers who adopt the most common three practice portfolio are typically larger in terms of sales and farmed acreage and also have greater propensity of being managed jointly by males and females. These farmers may have the human capital and financial resources to take on an additional management practice. Our results here align with Jablonski, Bauman, and Thilmany (2020) in highlighting the role of human capital to enhance the performance of producers who engage in direct sales.

The approach in the LFMPS to gather information on practices adopted is useful since farmers may be able to accept the adoption of a specific practice. By contrast the data from ARMS is gathered in terms of hours of time in specific internet activities and farmers may not recall their investment in these activities.

Treatment Effects of Direct Marketing Outlets

The model offers policy relevant findings by demonstrating how direct sales change in response to the choice of direct marketing outlets for specific groups of farmers or for chosen scenarios. We consider three scenarios but stress that extension agents along with farm management and market specialists can use the model to consider scenarios for other specific groups of farmers unique to their region. The average treatment effects are calculated for various values of the explanatory variables in the model. The baseline case is the average individual where the exogenous covariates are set equal to the mean of the values in the sample for continuous variables and at the mode (most common value) for the discrete variables. The average producer is predicted to experience expanded sales across each channel after accounting for self-selection into the preferred marketing outlet. The treatment effects are highest for the retail outlets at $23,916 followed by higher sales of $6,924 in the diversified outlet. Both effects are statistically significant.

The second scenario assesses the impact of direct marketing on farm operations with both males and females involved in management decisions. We call this scenario the shared management scenario. Positive and significant treatment effects are shown with expanded sales for retail outlets of $38,166 and $11,050 for diversified outlet sales. Shared operations account for about 47 percent of the sample and generally report higher sales in each marketing outlet,

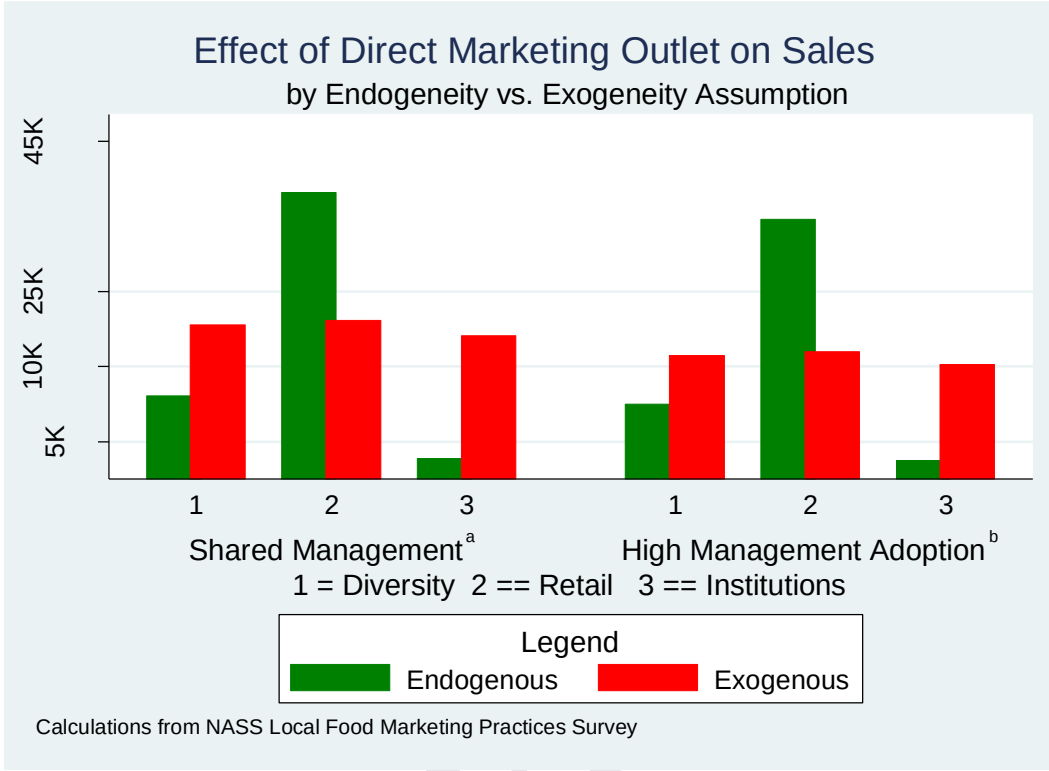

Figure 4. Direct Marketing and the Exogeneity Assumption

[a] The shared management scenario identifies operations with both males and females involved in management decisions.

[b] The high management adoption scenario identifies operations with intensive adoption of management practices (three or more practices).

Note: Model with exogeneity assumption (in red) predicts direct sales that are too high for selling in a diversity of outlets and institutional outlets but too low for retail outlets. The exogeneity model does not capture observed variability in sales across outlet. The omitted category is consumer outlets.

typically about 27 percent higher for marketing to diverse outlets and retail outlets. Operations with shared management tend to be more experienced in both production and marketing as the years of experience that are about 5 years and 4 years higher respectively. These operations also show greater facility in using business management practices as 44 percent adopt 3 or more practices compared to 28 percent of the other types of operations (led by all males or all females) and this may contribute to the estimated sales premiums.

A third scenario examines the role of the business management practices in assisting producers in their sales. We identify farmers who are intensive adopters of management practices (three or more practices) and compare their sales with those who are not high adopters. The treatment effects are highest for the retail outlets at $25,125 followed by higher sales of $12,981 in diversified outlets. Adoption of these practices by operations jointly managed by males and females is much higher compared to other of farms, even as the jointly managed operations are less experienced in both farming and direct marketing.

We evaluate sales from a model which incorrectly assumes the marketing decision is exogenous. The results shown in Figure 4 are highly variable and reinforce the utility of the endogenous marketing choice model. We examine the scenarios for shared management in the operation (both males and females share in decision making) and the scenario of producers who

score high on adopting management. First, we see that the model assuming exogeneity delivers values that can both over overestimate and even underestimate of direct sales across the marketing outlets. The estimated sales are uniformly too low from the model neglecting endogeneity for both the retail marketing option and the diversified option. Sales estimates are about 50 percent too low for both scenarios. Producers will systematically underestimate the sales based on the incorrect exogeneity model, overlooking opportunities to allocate resources to new marketing outlets.

Second, sales estimates from the exogeneity model are relatively constant across the options as shown in the set of orange bars. The exogeneity model does not account for the significant differences in sales that can occur as farmers sort into the marketing options that best align with the crop production and marketing and human capital skills of the operator along with the marketing environment available in their geographic regions.

Conclusions

Our results assess how the sales of farmers are influenced by involvement in direct marketing using the first survey of direct marketing operations. We develop information on choice of marketing outlets from the Local Food Marketing Practices survey (NASS, 2015) which samples only producers who are involved in local food marketing and avoid selectivity issues related to participation in direct marketing. Our results are new but are typically obscured when researchers use data from ARMS where participation in direct marketing represents a very small proportion of the sample. The effects on direct sales are positive and significant when producers engage in direct marketing across diverse outlets and when focusing on sales to retail outlets. After correcting for self-selection, the earnings increase is 31 percent for the diversified marketing decision and 148 percent when primarily marketing directly to retailers. The direct marketing effect is apparent even after controlling for operator demographics, farming and marketing experience, characteristics of the farm operation such as crop choices and diversification across commodities, and geographic effects.

One surprising finding is that direct marketing is associated with higher direct sales for operations jointly managed by males and females, highlighting a distributional impact that has not been discussed. Positive and significant treatment effects are shown for jointly managed operations selling to retail outlets of $38,166 and $11,050 for diversified outlet sales. We develop this finding by using new information from NASS surveys on multiple individuals involved in farm operation decisions.

The model captures the effect on farm sales of unobserved characteristics that are related to the choice of marketing outlets. We find that unobserved factors that increase the relative probability of selecting a given marketing option lead to higher sales than if a producer was randomly assigned to a direct marketing option. This positive selection implies that producers may systematically underestimate the expected sales they would experience if choosing a given marketing option and this is a disincentive to choosing that marketing channel. Survey data can be examined in more detail to provide additional information about the demographic and farm characteristics of these producers. Working with extension experts, targeted surveys can be developed to elicit more detailed data about the marketing strategies of producers or their managerial and entrepreneurial skills.

We uncover new findings on the link between business management practices and the sales impacts for farmers participating in direct marketing. Previous work has focused on internet activity and the choice of marketing outlet. We find that producer effort to adopt and use a precise set of practices has a stronger impact on sales. We exploit survey information on specific farm business management practices such as using a balance sheet or an income statement. Our results draw out clearly how a portfolio of three readily identifiable practices influence farm sales. Additional research could be directed at extracting a wider set of indicators from producer surveys (such as ARMS) and identifying management and marketing skills that contribute to alleviating

declines in farm sales associated with direct marketing operations. One indicator is the type of off-farm business that the operator or spouse may be involved in. Survey information is available from the ARMS for businesses such as wholesale trade, warehousing, transportation along with retail trade or personal services and these businesses may provide managerial skills that can be applied to direct marketing efforts. The impact of expertise of the spouse or non-primary operator on direct marketing can also be investigated. We plan to investigate these variables and explore linking the ARMS survey to the LFMPS to clarify factors that influence direct marketing sales.

Retailers promoting local foods such as Whole Foods Markets and Wal-Mart are interested in understanding how participation in direct marketing is related to farm sales since positive sales effects may induce more farmers to join these efforts. We estimate impacts of direct marketing efforts on direct sales of agricultural producers for four marketing options. However, the model can be adapted to drill down into specific options within a marketing channel. One approach would be to examine sales impacts for producers who market to retailers who are supercenters and this information is potentially available in the LFMPS.

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References

Ao, W., Calonico, S., and Lee, Y-Y. 2019. "Multivalued Treatments and Decomposition Analysis: An Application to the WIA Program." *Journal of Business and Economic Statistics* 39(1): 358-371.

Arya, A., B. Mittendorf, and D.E.Sappington. 2007. "The Bright Side of Supplier Encroachment." *Marketing Science* 26(5):651-659.

Barham, J., D. Tropp, and S. Schaffstall. 2014. "Food Value Chains Creating Shared Value to Enhance Marketing Success." U.S. Dept. of Agriculture, Agricultural Marketing Service, March 2014. Available online as of April 2024 at https://www.ams.usda.gov/reports/food-value-chains-creating-shared-value-enhance-marketing-success.

Bauman, A., D. Thilmany-McFadden, and B.B.R. Jablonski. 2018. "Implications of Differential Marketing Strategies: Exploring Farms that Pursue Local Markets as a Core Competitive Advantage." *Agricultural and Resource Economics Review* 47(3):477-504.

Bielaczyc, N., Pirog, R., Fisk, J., and Sanders, P. 2020. "Findings of the 2019 National Food Hub Survey. Michigan State University Center for Regional Food Systems and the Wallace Center at Winrock International. Available online as of March April 2024 at http://foodsystems.msu.edu/resources/2019-food-hub-survey

Cattaneo, M.D. 2010. "Efficient Semiparametric Estimation of Multi-valued Treatment Effects Under Ignorability." *Journal of Econometrics* 155(2):138–154.

Chiang, W.K., D. Chhajed, and J.D. Hess. 2003. "Direct Marketing, Indirect Profits: A Strategic Analysis of Dual-Channel Supply-Chain Design." *Management Science* 49(January):1-20.

Deb, P. and P.K. Trivedi. 2006a. "Specification and Simulated Likelihood Estimation of a Non-Normal Treatment-Outcome with Selection: Application to Health Care Utilization." *Econometrics Journal* 9(2):307–331.

———. 2006b. "Maximum Simulated Likelihood Estimation of a Negative Binomial Regression Model with Multinomial Endogenous Treatment." *The Stata Journal* 6(2):246–255.

Dow, J.K. and J.W. Endersby. 2004. "Multinomial Probit and Multinomial Logit : A Comparison of Choice Models for Voting Research." *Electoral Studies* 23:107–122.

Huang, S., X Guan, Y-J. Chen. 2018. "Retailer Information Sharing with Supplier Encroachment." *Production and Operations Management* 27(6):1133-1147.

Iyer, G., and J.M. Villas-Boas. 2003. "A Bargaining Theory of Distribution Channels." *Journal of Marketing Research* 40(February): 80-100.

Jablonski, B.B.R., A. Bauman, and D. Thilmany. 2021. "Local Food Market Orientation and Labor Intensity." *Applied Economic Perspectives and Policy* 43(3):916-934.

Key, N. 2024. "Direct-to-Consumer Marketing and the Survival and Growth of Beginning Farms." *Journal of Agricultural and Resource Economics* 49(1):81-101.

Layne, N. 2016. "Sam's Club Hires Regional Buyers, See 'Local' Food as Key in Upscale Shift." Reuters Business (Tuesday March 1, 2016). Available as of April 2024 at https://www.reuters.com/article/us-walmart-buying/sams-club-hires-regional-buyers-sees-local-food-as-key-in-upscale-shift-idUSKCN0W34EE

Lee, Y-Y. 2018. "Efficient Propensity Score Regression Estimators of Multivalued Treatment Effects for the Treated." *Journal of Econometrics* 204(July):207-222.

Lee, S. and B. Salanie. 2018. "Identifying Effects of Multivalued Treatments." *Econometrica* 86 (6):1939-1963.

Li, T., J. Xie, and X. Zhao. 2015. "Supplier Encroachment in Competitive Supply Chains." *International Journal of Production Economics* 165(July):120-131.

Martinez, S. and T. Park. 2021. Marketing Practices and Financial Performance of Local Food Producers: A Comparison of Beginning and Experienced Farmers. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Economic Information Bulletin No. (EIB-225).

Matson, J., M. Sullins, and C. Cook. 2013. The Role of Food Hubs in Local Food Marketing. USDA Rural Development Service Report 73, January 2013. Available online as of April 2024 at https://www.rd.usda.gov/files/sr73.pdf

Montaguti, E., S.A. Nelsin, and S. Valentini. 2016. "Can Marketing Campaigns Induce Multichannel Buying and More Profitable Customers? A Field Experiment." *Marketing Science* 35(March-April):201-217.

O'Hara, J.K., and J. Lin. 2020. "Population Density and Local Food Market Channels." *Applied Economic Perspectives and Policy* 42(3):477-496.

Oster, E. 2019. "Unobservable Selection and Coefficient Stability: Theory and Evidence." *Journal of Business & Economic Statistics* 37(2):187-204.

Park, T. 2015. "Direct Marketing and the Structure of Farm Sales: An Unconditional Quantile Regression Approach." *Journal of Agricultural and Resource Economics* 40(2):266–284.

Park, T., A.K. Mishra, and S.J. Wozniak. 2014. "Do Farm Operators Benefit from Direct to Consumer Marketing Strategies?" *Agricultural Economics* 45(2):213–224.

Park, T. K. Paudel, and S. Sene. 2018. "Sales Impacts of Direct Marketing Choices: Treatment Effects with Multinomial Selectivity." *European Review of Agricultural Economics*. 45(3):433-453.

Plakias, Z.T., I. Demko, and A.L. Katchova. 2019. "Direct Marketing Channel Choices Among US Farmers: Evidence from the Local Food Marketing Practices Survey." *Renewable Agriculture and Food Systems* 1-15.

Strailey, J. 2020. "How Whole Foods Became a Leader in Local." WinSight Grocery Business. Available as of April 2024 at https://www.winsightgrocerybusiness.com/retailers/how-whole-foods-became-leader-local.

Thornton, R.J. and J.T. Innes. 1989. "Interpreting Semilogarithmic Regression Coefficients in Labor Research." *Journal of Labor Research* 10(4):443-47.

Uematsu, H., and A.K. Mishra. 2011. "Use of Direct Marketing Strategies by Farmers and Their Impact on Farm Business Income." *Agricultural and Resource Economics Review* 40(1):1–19.

USDA. 2012. Know Your Farmer, Know Your Food: Compass. Washington, DC: U.S. Department of Agriculture. Available online as of April 2024 at https://feedva.org/wp-content/uploads/2019/02/Know-Your-Farmer.pdf.

USDA. 2024. Local and Regional Food Systems Resource Guide. Washington, DC: U.S. Department of Agriculture, Agricultural Marketing Service, Available online as of April 2024 at Local and Regional Food Systems Resource Guide (usda.gov).

Appendix on the Local Food Marketing Practices Survey

The 2015 Local Food Marketing Practices Survey (LFMPS) was designed to collect data related to the marketing of foods directly from farmers to consumers, retailers, institutions, and intermediate markets, which then sell directly to consumers. The primary purpose of the survey was to produce benchmark statistical data on the number of operations that sell using direct marketing channels, the value of these foods sales, and the marketing practices used. The survey was administered in all 50 States. Producers selected to participate in the 2015 LFMPS were identified through USDA's National Agricultural Statistics Service (NASS) List Frame and an independent list derived from public web sources. The survey sampling frame was comprised of two independent frames to enable a measure of coverage. The NASS List Frame included all farms on the list frame and entities on the list frame that were identified as potentially being in the target population. The second frame was produced by the Multi-Agency Collaboration Environment (MACE). The MACE Local Food Marketing Practices Survey sampling frame comprised potential local food operations collected from public information on the web. The MACE list was used to measure NASS's List Frame under coverage. All farms and potential farms on NASS's List Frame and the MACE sampling frame were eligible for sampling. Farms were stratified into one of the following groups: (1) farms in the target population that had a local food marketing practice sales measure of size; (2) farms in the target population that did not have a local food marketing practice sales measure of size; (3) entities in the target population that did not have a local food marketing practice sales measure of size (not part of groups 1 or 2); and (4) all other farms (not part of groups 1, 2, or 3). Records in group 1 were stratified by State and local food marketing practice sales. Records in group 4 were stratified by State and the likelihood to engage in local foods marketing practices. Groups 2 and 3 and MACE records were stratified by State. After the NASS and MACE samples were selected, U.S. sample size, after adjusting for an expected 70 percent response rate, totaled 44,272. Surveys were sent to 24,907 farms from the NASS list with a response rate of nearly 58 percent. Another 19,365 operations from MACE were surveyed, with a response rate of nearly 52 percent. A paper questionnaire was considered the master; web and telephone interview instruments modeled the paper instrument. A NASS survey methodologist conducted cognitive interviews before finalizing the questionnaire, and all data collection instruments were tested prior to the start of actual data collection. Respondents received a pre-survey postcard in March 2016. NASS mailed the questionnaire to the 44,272 producers, along with a cover letter and instructions for web reporting in early April 2016. Respondents who did not return their survey by the end of May 2016 were sent a follow-up mailing. In June 2016, NASS began face-to-face and telephone enumeration for remaining non-respondents. Data collection concluded in August 2016. Most data were collected by mail (42 percent), followed by phone (39 percent), face-to-face (13 percent), and internet (6 percent) responses. NASS reviewed reported data to determine the validity and representative quality of completed questionnaires, then summarized the data to produce final estimates. Estimates were adjusted for nonresponse, misclassification—inadvertent erroneous data reporting by the respondent, and coverage—incomplete sampling frame due to continuous entry, and exit of operations from the farming business. The weighted sample size represented by the survey is 167,009 farms. Results were published on December 20, 2016.