Transaction Costs and Organic Marketing: Evidence from U.S. Organic Produce Farmers

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Abstract

We develop a conceptual framework that integrates quality of output and transaction costs in the choice of marketing channels. We estimate a reduced-form Tobit model and a semi-reduced logit model using a farm-level cross-sectional dataset to measure the effects of transaction costs in farmer's ability to make sales to indirect markets (retailers and wholesalers). We find strong empirical evidence that existing organic retail and wholesale markets impose considerable barriers to entry on individual organic farmers. The effects of transaction costs are asymmetric between farmers, those who transitioned from conventional farming and those who did not. Those who did are overall favored, and those who did not are constrained by more types of transaction costs and are constrained more severely than those who did. We argue that an effective policy should target the least favored farmers by encouraging or mandating distributors and retailers have a more transparent and objective process in selecting organic suppliers, such that all farmers would have an equal opportunity to be successful in selling to indirect markets.

Introduction

Relying on biologically and ecologically based practices, organic farming virtually excludes the use of chemicals such as synthetic fertilizers and pesticides of all kinds, antibiotics, and hormones in crop production; it prohibits the use of antibiotics and hormones in livestock production[i]. A farmer must be inspected and certified by an accredited certification agency after farming under the organic farming standards for at least three years. Only after being certified organic can farmers market their agricultural products as “organic”.

Organic farming is one of the fastest growing segments of U.S. agriculture. Certified organic farmland for corn, soybeans, and livestock sectors doubled from 1992 to 1997, and doubled again between 1997 and 2001. There were *2.3* million acres of cropland and pasture dedicated to organic production in 2001. (Greene 2001)

Consumer demand for organic food has been rising steadily. The organic food market is among the fastest growing categories in U.S. food industry. While the sales of the food industry has grown *1%* or less annually in the last decade, retail sales of organic food products have grown more than *20%* annually over the same period. Organic sales grew from *$1* billion in 1990 to *$7.8* billion in 2000. Organic food is available in *73%* of mainstream grocery stores, and more than half of the total organic sales take place in traditional retailers[ii].

Irrespective of the high growth rates, organic production remains an inconsequentially small fraction of U.S. agriculture: *0.3* percent of all farmland is certified organic, and organic food sales represent *1.3* percent of total food expenditure[iii]. An interesting question to explore is why organic farming is still so small relative to the conventional farming. USDA has identified several obstacles of adopting organic farming, including high managerial costs, risks of shifting to a new way of farming, limited awareness of organic farming systems, lack of organic marketing and infrastructure, and inability to capture price premiums[iv]. Organic Farming Research Foundation confirms these obstacles in a recent survey, and the most severe barriers to transitioning indicated were lack of information and experience in organic production and an inability to identify markets for organic products (Waltz 2002).

Selling organic produce incurs transaction costs. Transaction costs of selling in organic markets may be significantly high because the organic markets are thin, and necessary institutions and infrastructure are not yet fully developed[v]. If the barriers to entry to organic markets are prohibitively high for many organic farmers, the expansion of organic production and markets may be severely constrained.

There is a scarce body of literature on organic marketing[vi]. This paper intends to apply the transaction costs economics framework (Williams and Hobbs) to the choice of marketing channels for the organic produce farmers in the United States. We focus on identifying and measuring the barriers to entry to retail and wholesale markets, because penetrating these markets is essential to sustain and expedite the growth of organic farming. We ask two questions: (i) What kinds of transaction costs do the existing retail and wholesale markets impose to organic farmers? Which transaction costs are more significant than others? (ii) Do these transaction costs affect all organic farmers in the same way?

The rest of the paper is organized as follows. Section 1 provides a brief literature review. Section 2 describes the data and preliminary data analysis. Section 3 develops a theoretical model that motivates the econometric specifications. Section 4 is the econometric analysis, and section 5 concludes the paper.

1. Literature Review

Market transactions do not occur in a frictionless environment. Transaction costs are economic equivalent to frictions in physical systems. Transaction costs are often categorized into ex ante and ex post transaction costs. Both types of transaction costs are interdependent, and their relative importance depends on the nature and frequency of transactions (Williamson).

1.1 Transaction Costs and Agricultural Marketing

Transaction costs are not available on financial records, and inherently difficult to measure or quantify. There are a number of empirical studies on the effects of transaction costs on agricultural marketing despite the measurement difficulty.

The effects of transaction costs in marketing agricultural products are well studied in transition and developing economies where markets are thin and fledging, and necessary infrastructure is missing or embryonic. Goetz (1992), Omamo (1998), and Key, Sadoulet and de Janvary (2000) use the agricultural household model and investigate the effect of transaction costs on the joint decisions of market participation and supply responses. Hobbs (1997), Bailey and Hunnicutt (2002), and Ferto and Szabo (2002) analyze the role of transaction costs in agricultural market selection in both transition economy and developed economy.

Hobbs is an influential work in applying the transaction cost economics framework to the choice of marketing channels in agricultural products. Hobbs identifies three types of transaction costs in agricultural marketing: information costs, negotiation and bargaining costs, and monitoring and enforcement costs. A form of ex ante transaction costs, information costs are the costs of identifying markets and trading partners, and costs of obtaining price and product information. Negotiation costs are the costs of physically carrying out the transaction, including the costs of physically negotiating, bargaining and formally drawing up the terms of exchange. A form of ex post transaction costs, monitoring and enforcement costs are the costs of ensuring that the trading partners follow the terms of the transaction, such as quality standards or payment arrangements.

Recognizing the difficulty of obtaining transaction costs data, Hobbs demonstrates a method for measuring the influence of transaction costs on the choice of cattle marketing between live-ring auction and direct-to-packers. She uses a survey of UK cattle farmers and a two-limit Tobit model to estimate the relative importance of various transaction costs and farm characteristics on channel selection. She found that information costs are not statistically significant, but negotiation and monitoring costs are significant in the UK cattle auction market.

1.2 Organic Agricultural Policy

There are several studies on organic agriculture policy. Lampkin and Padel (1994) attribute the high conversion levels in the European Union countries to government's intervention such as developing consumer education initiatives and providing conversion subsidies.

Pietola and Lansink (2001) use an optimal stopping model and estimate the effect of conversion subsidy on the adoption of organic farming in Finland between 1994 and 1997. They find that decreasing output prices and increasing direct subsidies trigger the switch to organic farming, furthermore, the switch is more likely for farmers that have large land areas and low yields, and the switch is less likely for farms with intensive livestock production and labor-intensive production.

Lohr and Salomonsson use an random utility model to compare farmers in Sweden in 1990 who converted before and after the subsidy. They find that greater livestock diversity and more sales outlets are significant conversation factors without subsidies. Their results suggest that a marketing and technical information infrastructure designed to support conventional agriculture restrict the potential effect of a conversion subsidy in the United States.

Intervention by USDA on organic agriculture has focused primarily on market facilitation, such as establishing federal standards and labels including the release of Nation Organic Program in 2002, and adding several initiatives to assist organic farmers in the 2002 Farm Act. There has no conversion subsidy at the federal level until recently several states – Minnesota and Iowa in particular – have begun subsidizing the adoption of organic farming systems (Greene 2003). The subsidies provided by these states are very small as they typically cover a portion of the certification costs, unlike the subsidies in European policies. The effects of these subsidy programs are yet to evaluated.

2. The Data

<u>2.1 The Survey</u>

The dataset we use in this study is the 1997 nationwide organic farmers survey conducted by Organic Farming Research Foundation[vii]. The survey is a cross-sectional farm-level data on production, marketing and demographics. The survey was sent to *4,638* certified organic farmers from fifty-five organic certification organizations[viii]. *1,192* surveys were returned from organic farmers in forty-five states. Samples contain farmers who grow one or more types of the three major agricultural products: fresh produce and herbs, field crops, and livestock animals. The samples we use are those for-profit farms that grow produce only. After discarding samples that produced livestock animals or field crops, we have *360* usable samples.

The survey contains data on how farmers allocate their output to a number of channels, and we aggregate into two broad categories: direct and indirect channels. The proportion of output sold to the indirect channels is the key variable of interest in our analysis. We use farmers' responses to the organic marketing constraints as their perception of the marketing transaction costs. Following Hobbs, we categorize transaction costs data into information costs, negotiation costs, monitoring costs, and market characteristics. Definition and measurement of the variables are described in Table 1.

We use the following variables as proxies for information costs: costs of finding organic markets, of obtaining access to existing markets and of searching for best prices. Variables that can be used as proxies for negotiation or monitoring costs are limited in this survey. We use the distance between producer and market or delivery point as the proxy for negotiation cost, and failure of buyers to honor commitment and reliable or prompt payment as two proxies for monitoring costs.

As a form of ex ante transaction costs, market environment data measures the level of opportunity and frictions to transact (Hobbs). The market characteristics we consider include lack of acceptance of certification documents in certain markets, oversupply of legitimate organic products in existing markets, and lack of consumer understanding about organic food. In addition, we construct an index of total available markets for direct and indirect channels. We use the number of farmers' markets in each state as an index for direct market infrastructure[ix]. We use the number of organic retailers, processors and manufacturers, and wholesalers in each state as an index for indirect market infrastructure[x]. Since indirect markets are often accessible across states, we take account for the effect of cross-state spillover, which is calculated as half of the weighted average of the indexes of the adjacent states.

We also use a set of socioeconomic and farm characteristics data, and its definitions and measurement are described in Table 2. There are four reasons to include these variables in the analysis. First, we wish to investigate the heterogeneity of preferences and risk attitudes by individual characteristics such as gender, age, education, and experience of the farmer, as well as farm characteristics such as business structure and land size. Second, we allow for the heterogeneity of quality distribution of the output, which in turn allows for the heterogeneous transaction costs, by using individual characteristics as proxies. Third, there is non-response (response rate is 26 percent), which may be correlated with individual differences as well as channel allocation decisions. Covariates can be used to adjust for these differences[xi]. Fourth, the inclusion of control variables can improve the precision of the estimates.

2.2 Summary Statistics

There are two types of organic farmers: the transitioners are the farmers who transitioned to organic farming from conventional farming, and the beginners are the farmers who started organic farming without prior conventional farming experience. The transitoners and the beginners differ in a number of substantial ways – reasons for adopting organic farming, experience in agricultural production, and experience in agricultural marketing. For this reason, we investigate the difference between these two sub-groups of organic farmers in more detail throughout the paper.

Table 3 presents the summary statistics of all the variables used in the analysis. The transitioners sell significantly greater proportion of their output to indirect markets than the beginners (*80%* versus *51%, t*-stat is *6.94*). Transactions cost variables do not differ significantly between the transitioners and the beginners with the exception of oversupply. The transitioners reported more difficulty than the beginners in all transaction costs except for distance and lack of consumer understanding. In addition, the transitioners are located closer to the markets; they are also located in states with better organic marketing infrastructure, both for direct markets and indirect markets, than the beginners, though none of the differences are statistically significant.

Most socioeconomic characteristics differ significantly between the transitioners and beginners subsamples. In terms of the production characteristics, the beginners, on average, grow more varieties of produce (*7.2* versus *3.3, t*-stat is *7.89*) and make more value-added products (*0.63* versus *0.30, t*-stat is *3.45*) than the transitioners. In terms of farm characteristics, the beginners also have more experience (*10.35* years versus *8.56* years, t-stat is *2.30*) in organic farming and have been certified organic longer (*5.92* years versus *4.62* years, t-stat is *2.92*) than the transitioners. The transitioners own more land (*135.55* acres versus *45.03* acres, t-stat is *3.62*), though the beginners have more land dedicated to organic farming (*128.62* acres versus *98.40* acres) but the difference is insignificant.

3. A Theoretical Model

Farmers make production and marketing decisions. The former concerns the portfolio of crops, land allocation and input uses for each crop; the latter concerns finding and obtaining access to the markets, and allocating and selling output to relevant marketing channels. Both decisions are inter-related and should be simultaneously determined. In this study, we model farmers' marketing decisions assuming the production decisions are pre-determined, as we are constrained by the data.

We focus on the organic produce sector for two reasons: fresh vegetable and fruits are the top selling organic category, and many produce farmers use both direct and indirect channels. Furthermore, we focus on farmers who grow produce only and do not grow any field crops or livestock animals. We want to control for the potential spillover effects of marketing field crops or livestock to the marketing of fresh produce.

We start with a brief description of buyers' preferences in direct and indirect markets. Then we develop a framework that integrates production quality and marketing transaction costs. The framework provides a partial explanation of a farmer's choice of channels in marketing their output, and motivates the econometric specification, which is discussed in a later section. Based upon the analysis in the conceptual framework, we develop several hypotheses.

3.1 Background

We assume that transaction costs of marketing organic produce are channel specific and farm specific. Reflecting frictions in exchanges in the economic environment, transaction costs vary in kinds and magnitudes with characteristics of the market where the transaction occurs. Following Hobbs, we categorize transaction costs into information and search cost, negotiation costs, and monitoring and enforcement costs. Some transaction costs are fixed as they are invariant with quantities of exchange, and others are variable as they vary with quantities of exchange.

Direct markets are direct to consumers, including farmers market and community supported agriculture. Indirect markets are retails and wholesales, where retails include local supermarkets, natural food stores and restaurants and wholesales include distributors, processors and packers and handlers. Direct and indirect markets differ in a number of ways that would affect farmers' marketing choices.

Buyers in direct markets value freshness of produce and convenience of shopping. They prefer varieties that are heterogeneous in quality and other qualitative attributes such as size, color, shape and weight. Information on direct markets such as farmers' markets is readily available. Virtually any organic farmer can access farmer's markets with a small fee, and in some places there may be a long waiting list because of the limited number of spaces. Direct markets are usually concentrated in dense populations areas while farms are remotely located. Transportation costs to farmer markets are often substantial.

Buyers in indirect markets have distinctive preferences because of the nature of their business. The business model of retail and wholesale is high throughput rates; that is, they operate by moving a large quantity of homogeneous goods from producers to consumers quickly. Stated in another word, they prefer large quantity and consistency of quality. This business model is applicable where the retailers or wholesalers carry only conventional produce, only organic produce, or both.

3.2 A Framework of Quality and Market Selection

The quality of fresh vegetable and fruits refers to the level of desirable qualitative characteristics of the produce, namely, nutritional quality, taste such as flavor and texture, and appearance such as size, shape, color and speckles. Because of the inherent variability of the biological processes in agricultural production, the quality of output exhibits a distribution density function. The presence of random environmental effects aggravates the quality variability.

The quality distribution of output depends on the farmer's skill and experience, quality of seeds and other inputs, soil and other natural resources, effort in organic pest and crop disease management and weed control, and random effects. It is thus appropriate to denote quality distributing as $f(q; w, \varepsilon)$ where q is the quality of output, w is a vector of farm- and farmer-specific exogenous factors and ε is the random shock. The support of $f(q; w, \varepsilon)$ is $[\underline{q}, \overline{q}]$.

We make some assumptions on the demand. We assume that retail and wholesale markets impose a quality requirement, such as a cut-off point of quality, denoted as q_0, such that only produce with quality q_0 or better can be marketed to retail and wholesale. In addition, we assume a uniform price in indirect markets. Stated in another word, indirect markets offer a single price p_0 for all quality above q_0, and no price premiums for higher quality than q_0.

We assume there is sufficient heterogeneity in buyers in direct markets such that quality of all levels are marketable to consumers directly. To simplify the analysis, we assume a two-tier pricing structure in direct markets: consumers pay $\underline{p}$ for all quality levels between $\underline{q}$ and q_0, and $\overline{p}$ for all quality levels between q_0 and $\overline{q}$. Further we assume $\underline{p} < p_0 < \overline{p}$. All farmers take prices as given, and receive the same prices regardless of quantities sold.

Let y^{id} and y^d denote the proportion of output sold to indirect and direct markets, respectively. In the absence of marketing transaction costs, a farmer would sell all his produce to the direct markets, a direct implication of our assumption $\underline{p} < p_0 < \overline{p}$.

Now consider transaction costs of selling to both markets in terms of fixed and variable transaction costs. Normalize the fixed transaction costs to direct market to zero. Let T denote the fixed transaction costs to indirect markets. Fixed transaction costs are farm-specific, and thus is denoted as $T(z, w)$ where w is a vector of farm- and farmer-specific characteristics as in the quality distribution $f(q; w, \varepsilon)$, and z is a set of transaction costs variables.

For simplicity, we assume constant variable costs. Let t^{id} and t^d denote the per-unit transaction costs in indirect and direct markets, respectively. Variable costs depend on the quality of produce marketed, as better quality produce may require better care and hence higher costs (Parker and Zilberman 1993). Variable costs also depend on farm characteristics such as distance between the farm and the delivery points, whether the farmer owns or rents transportation vehicles, etc. Denote those characteristics as w[xii], we write the variable costs as $t^{id}(q; z, w)$ and $t^{d}(q; z, w)$ where q is the quality level. Let τ denote the variable transaction cost differential at the point q where $\tau(q; z,w) = t^{d}(q; z,w) - t^{id}(q; z,w)$.

We assume farmers solve sequential optimization problem in which the per-period profit function is additively separable in marketing channels, that is, there are no spillover effects between channels during the current period. We want to point out that the per-period separability assumption does not preclude the effects of outcomes from previous periods. It is conceivable that a farmer who has been successful in consumer markets would have lower transaction costs entering the indirect markets. Scale and reputation are two possible sources of this kind of cross-channels spillover. The scale effect would lower variable transaction costs in both channels and the reputation effect would lower fixed transaction costs in indirect markets. We account for those lagged effects by denoting the current period's transaction costs as functions of exogenous factors including farm characteristics. This is consistent with the theoretical model because variables of previous periods are pre-determined in static optimization problems.

Under the above assumptions, a profit-maximizing price-taking farmer solves the following static optimization problem:

$$\pi^* = \max\left\{\pi^{id}, \pi^{d}, \pi^{b}\right\} \text{ where}$$

[3.1a] $$\pi^{id} = \int_{q_0}^{\bar{q}} \left[p_0 - t^{id}(s;z,w)\right] f(s;w,\varepsilon)ds + \int_{\underline{q}}^{q_0} \left[\underline{p} - t^{d}(s;z,w)\right] f(s;w,\varepsilon)ds - T(z,w)$$

[3.1b] $$\pi^{d} = \int_{q_0}^{\bar{q}} \left[\bar{p} - t^{d}(s;z,w)\right] f(s;w,\varepsilon)ds + \int_{\underline{q}}^{q_0} \left[\underline{p} - t^{d}(s;z,w)\right] f(s;w,\varepsilon)ds$$

[3.1c] $$\pi^{b} = \max_q \left\{ \begin{array}{l} \int_{q_0}^{q} \left[p_0 - t^{id}(s;z,w)\right] f(s;w,\varepsilon)ds + \int_{q}^{\bar{q}} \left[\bar{p} - t^{d}(s;z,w)\right] f(s;w,\varepsilon)ds \\ + \int_{\underline{q}}^{q_0} \left[\underline{p} - t^{d}(s;z,w)\right] f(s;w,\varepsilon)ds - T(z,w) \end{array} \right\}$$

Optimization problem [3.1a] – [3.1c][xiii] reflects the fact that a farmer faces three discrete choices: (a) sell all high quality produce (produce that has quality q_0 or above) to indirect markets, and the profit of this choice is denoted as π^{id}, (b) sell all produce to direct markets, and the associated profit is denoted as π^{d}, and (c) sell to both channels by choosing the optimal allocation between the two channels, and the resulting profit is denoted as π^{b}.

Assuming an interior solution to maximization problem [3.1c], we characterize the solution by the following first-order condition:

[3.2] $$\left.\frac{\partial \pi^b}{\partial q}\right|_{q^*} = \left[p_0 - t^{id}(q^*;z,w)\right] f(q^*;w,\varepsilon) - \left[\bar{p} - t^d(q^*;z,w)\right] f(q^*;w,\varepsilon) = 0$$

If the quality density at q^* is non-zero, solving for q^*, we have an expression of q^* as a function of z and w, and consequently, the proportion sold to indirect markets, y^{id}, is a function of z and w:

[3.3] $$\begin{aligned} q^* &= q^*(z,w) \\ y^{id} &= \int_{q_0}^{q^*} f(q;w,\varepsilon)dq = \int_{q_0}^{q^*(z,w)} f(q;w,\varepsilon)dq \end{aligned}$$

The effects of transaction costs on the optimal market selection can be described as follows:

[3.4] $$\begin{aligned} \pi^* = \pi^d &\Leftrightarrow \pi^d > \max(\pi^b, \pi^{id}) \Leftrightarrow T \geq \max\left\{\delta(q_0, q^*), \delta(q_0, \bar{q})\right\} \\ \pi^* = \pi^b &\Leftrightarrow \pi^b > \max(\pi^d, \pi^{id}) \Leftrightarrow T < \delta(q_0, q^*) \ \& \ \delta(q^*, \bar{q}) < 0 \\ \pi^* = \pi^{id} &\Leftrightarrow \pi^{id} > \max(\pi^b, \pi^d) \Leftrightarrow T < \delta(q_0, q^*) \ \& \ \delta(q^*, \bar{q}) > 0 \end{aligned}$$

Where $\delta(q_1, q_2) = \int_{q_1}^{q_2} [p_0 - t^{id}(q;z,w)] f(q;w,\varepsilon)dq - \int_{q_1}^{q_2} [\bar{p} - t^d(q;z,w)] f(q;w,\varepsilon)dq$.

Condition [3.4] formalizes two main results. First, fixed and variable transaction costs jointly determine the entrance into indirect markets. When T is sufficiently high, or when the profit differential between indirect markets and high end direct market is sufficiently low, a farmer is rationed out of indirect markets and sells all output to direct markets. Second, the proportion sold to indirect markets, conditional upon obtaining the access to indirect markets, is determined by variable transaction costs, and other exogenous factors such as prices and quality distribution. Specifically, fixed transaction costs do not affect the proportion sold to indirect markets, conditional on the market access [xiv].

We summarize the conditions for three observed choices $y^{id} = 0$, $0 < y^{id} < 1$, and $y^{id} = 1$ as follows:

[3.5] $$\begin{aligned} y^{id} = 0 &\Leftrightarrow \pi^* = \pi^d \\ y^{id} = 1 &\Leftrightarrow \pi^* = \pi^{id} \ \& \ F(q_0) = 0 \\ y^{id} \in (0,1) &\Leftrightarrow \pi^* = \pi^b \cup \left\langle \pi^* = \pi^{id} \ \& \ F(q_0) \neq 0 \right\rangle \end{aligned}$$

Where F is the cumulated density function. This condition also makes explicit the role of quality distribution in determining the extreme cases $y^{id} = 0$ and $y^{id} = 1$. A very low quality production where $F(q_0) = 1$ is sufficient for $y^{id} = 0$. A very high quality production where $F(q_0) = 0$ is necessary for $y^{id} = 1$.

3.3 Comparative Static

Let z_1 denote a transaction cost variable of interest. Our previous analysis shows that a farmer may be rationed out of indirect markets when fixed transaction costs are sufficiently high. We assume that the probability of indirect market access is a function of fixed and variable transaction costs, and that lowering fixed transaction costs increases the chance of entering indirect markets. The effect of a transaction cost on the probability of market access is inversely proportional to its marginal effect on the fixed transaction cost:

[3.6] $$\frac{\partial \Pr(y^{id} > 0)}{\partial z_1} \propto -\frac{\partial T(z,w)}{\partial z_1}$$

Where the symbol $\propto$ stands for *proportional to*; $a \propto b$ means that a and b have the same sign.

Conditional upon indirect market access, a farmer's ability to sell her entire output to indirect channel depends on the profit differentials δ for the high quality output, seen from conditions [3.5]. We assume that the probability of indirect market penetration is a function of this profit differential, and that raising this differential would increase the probability of indirect market penetration. The marginal effect of a transaction cost on the probability of indirect market penetration is as follows:

[3.7] $$\left.\frac{\partial \Pr(y^{id} = 1)}{\partial z_1}\right|_{y^{id} > 0} \propto \int_{q^*(z,w)}^{\bar{q}} \left[t_{z_1}^{d}(q;z,w) - t_{z_1}^{id}(q;z,w) \right] dq$$

Conditional on the farmer being able to access but not penetrate the indirect markets, the marginal effect of a transaction cost variable on the proportion is positively related to its marginal effect on the variable transaction cost differentials evaluated at the optimal solution[xv]:

[3.8] $$\left.\frac{\partial y^{id}}{\partial z_1}\right|_{0 < y^{id} < 1} \propto t_{z_1}^{d}(q^*;z,w) - t_{z_1}^{id}(q^*;z,w)$$

3.4 Testable Hypotheses

We use the comparative static analysis to develop three hypotheses that we wish to investigate empirically in addition to the two main questions we are interested in. We consider the effects of the following transaction costs: market infrastructure variables such as total number of distributors in the state; market condition variables such as lack of acceptance of organic certification and lack of consumer understanding; and specific transaction costs variables such as distance and reliable payment.

Hypothesis 1: We hypothesize that better indirect market infrastructure and market environment would improve the probability of market access by lowering the fixed transaction costs.

Intuitively, measures of infrastructure and market condition can be thought of as positive supply shifters in farmers' access to indirect channels. Specific variables of interest are the effect of the lack of acceptance of organic certification documents in certain markets (*LACKCERT*), and a measure of marketing infrastructure, such as number of distributors and retailers available (*TAMID*).

Hypothesis 2: We hypothesize that, conditional upon market access, distance to markets (*DISTANCE*) would adversely affect the probability of making all sales to the indirect markets, and that the effect of the total number of distributors and retailers available (*TAMID*) is positive.

Intuitively, market infrastructure can be thought of as positive supply shifters in market access, and distance can be thought of as a negative supply shifter in market penetration. Distance and market infrastructure are related, such that distance decreases with the measure of the marketing infrastructure. The total number of organic retailers and wholesalers located at reasonable distances limits sales to retail and wholesale channels. Distance is an important factor in a farmer's profit function as fresh vegetables and fruits are highly perishable and easily damageable in some qualitative attributes such as appearance. To increase indirect sales, farmers have to reach more retail and wholesale markets located at further distance; as a result, farmers must incur higher costs of transportation, both because of longer travel distance and because of the additional costs, such as better packaging and cooling technologies, to ensure the quality of produce during the longer travel.

Analytically, let z_3 denote the distance to markets (*DISTANCE*), substituting them into [3.7], we have:

[3.9] $$\left.\frac{\partial \Pr(y^{id}=1)}{\partial z_3}\right|_{y^{id}>0} \propto \int_{q^*(z,w)}^{\bar{q}} \underbrace{t_{z_3}^{d}(q;z,w)}_{(1)} - \underbrace{t_{z_3}^{id}(q;z,w)}_{(2)} dq < 0$$

Particularly, we hypothesize that while distance, for example, increases variable costs of direct sales, it increases the variable costs of indirect sales by a greater amount, since it would cost more to transport higher quality (or more easily perishable or damageable) produce to distributors who have strict standards on quality inspection than to farmers' markets.

We can apply the same argument to variable z_2 = *TAMID*, where having a greater number of distributors and wholesalers would reduce the variable costs of indirect sales, and have little change on the variable costs of direct sales, formally, we have:

[3.10] $$\left.\frac{\partial \Pr(y^{id}=1)}{\partial z_2}\right|_{y^{id}>0} \propto \int_{q^*(z,w)}^{\bar{q}} \underbrace{t_{z_2}^{d}(q;z,w)}_{(1)=0} - \underbrace{t_{z_2}^{id}(q;z,w)}_{(2)<0}\, dq > 0$$

Hypothesis 3: Organic farmers who have no conventional farming history face substantially higher fixed transaction costs in entering the indirect markets than those who do, and as a result, they are less likely to sell to indirect channels.

This hypothesis is motivated by the nature of retailers and wholesalers business model. Logistics is the most important part of any retailing and wholesaling business, and more so for fresh produce because of the perishable nature of the produce. The profitability of retailers and wholesalers critically depends on supply channel relationships. Successful supply channel relationships mean low logistic and operational costs. As a consequence, retailers and wholesalers prefer stable long-term relationships with their suppliers.

Trust and reputation are essential to a long-term business partnership. Building trust and reputation, however, is a gradual and iterative process, as well as time- and resource consuming. In addition, retailers and wholesalers do not prefer switching partners, and they would accept new partners only when the new suppliers have repetitively and demonstrably much better than the existing ones. This "stickiness" imposes additional barriers to entry to many organic farmers who try to make their inroads to the retail and wholesale markets.

We suppose organic farmers who transitioned from conventional farming could leverage the relationship they established through the conventional farming periods, that is, the farmer's personal trust and reputation can be carried over from conventional to organic production. Those who started organic farming from beginning and had no conventional farming experience would need to go through the highly competitive and costly relationship-building phase. In addition, new entrants are risk averse and they may trade quantity for quality, where they only sell the best quality of produce to demonstrate their reputation as a high quality supplier. This trade-off further reduces the proportions of their sales to the indirect markets.

4. Econometric Analysis

4.1 Reduced Form Specification

Conditions [6a]-[6c] suggest that the observed proportion sold to indirect markets, y^{id}, can be expressed as a function of transaction costs, farm- or farmer-specific characteristics, and random shock to the production.

An important characteristic of the dependent variable is that it is censored at both an upper and lower limit. Nearly fifty percent (*178* out of *390* samples) observations are limit observations, with either *0* or *100* percent of produce sold to indirect markets. An econometric model that is appropriate for this kind of data is two-limit Tobit limited dependent variable model with maximum likelihood estimation. The dependent variable in the Tobit model is continuous. We check this assumption by visually examining the histograms of the dependent variable, which are shown in Figure 1. The histograms suggest that there is sufficient variation in the dependent variable within the limits so that it can be modeled as a continuous variable.

A two-limit Tobit model is specified as follows (Maddala):

[4.1]
$$y^* = x\beta + \mu$$
$$y = \begin{cases} L_1 & \text{if } y^* \le L_1 \\ y^* & \text{if } L_1 < y^* < L_2 \\ L_2 & \text{if } y^* \ge L_2 \end{cases}$$

Where y^* is the latent variable, x is a vector of exogenous variables, and μ is the disturbance term independently distributed with zero mean and constant variance σ^2. β is the vector of parameters of interest. In this case, the lower limit $L_1 = 0$ and upper limit $L_2 = 1$.

Substituting x for vectors of transaction costs and farm characteristics variables in the Tobit model [4.1], the following is our estimation equation:

[4.2] $$PROPID = \alpha + IC\beta + MKT\gamma + NC\delta + MC\lambda + SOC\varphi + \mu$$

Where dependent variable *PROPID* is the proportion sold to the indirect markets. *IC* = [*FINDMKTS, OBTACCS, NOTFINDP*]; *NC* = [*DISTANCE*]; *MC* = [*RELPMT*], representing information, negotiation, and monitoring transaction costs, respectively. *MKT* = [*LACKCONS, LACKCERT, OVERSUP, TAMID, TAMD*], a vector of market characteristics; *SOC* = [*BUSSTYPE, ORGLAND, LANDOWN, YRSCERT, VARIETY, VALUEADD, TRANORB, TOTYRS, ORGYRS, AGE, EDUC, GENDER*], a vector of socioeconomic characteristics; μ is the error term, assumed to be identically independently (normally) distributed with mean zero and variance σ^2. $\alpha, \beta, \gamma, \delta, \lambda$, and φ are parameters to estimate.

Most of the transaction cost variables in [4.2] is exogenous with possible exception of *RELPMT*. *RELPMT* measures the reliability and promptness of payments. Payments are usually instantaneous in direct markets as consumers pay on the point of purchase. Payments in indirect markets can be an issue where payments are usually delayed, and schedule of payments may be part of the contract if there is one. It is usually the characteristics of the buyers in indirect markets, such as the cash flow management practices, that result in particular patterns of payments to the farmers. In another word, individual farmers have no influence on how retailers and wholesalers would make their payments.

The Tobit maximum likelihood estimates of [4.2], allowing for heteroskedasticity and clustering effects, are presented in the first column in Table 4, and the marginal effect is listed in second column[xvi]. Except for inability to find best prices (*NOTFINDP*), all transaction cost variables are found to be statistically significant at *1%* or *5%*, and coefficients range from *.06* to *.10* for the *5*-point variables. We can explain the positive signs of reliable payment and over supply as follows: issues of payment and over-supply are likely to occur after the farm has an initial access to the indirect channels. The farmers who experience more problems with payment and competition are likely to be those who have gone further into the indirect channels. Among the characteristics variables, we find *VARIETY*, *GENDER* and *TRANORB* are highly significant. It is to note that *TRANORB* has the largest coefficient among all regressors.

4.2 Heterogeneity of Effects

Specification [4.2], when estimated using the whole sample, assumes that the effects of transaction costs and other variables of interest are the same for the transitioners and beginners subsamples, after controlling for whether the observation is a transitioners or beginner.

A flexible specification would allow for heterogeneous effects and test for whether the effects are homogeneous, rather than assuming the homogeneity in the specification. There are two approaches one can model heterogeneous effects in this setting. One approach is to interact every variable of interest in [4.2] with the indicator whether the sample is a transitioner or beginner (*TRANSORB*) and regress over the whole sample. The heterogeneity of effect is reflected in the coefficients on the interaction terms.

A second approach, which we use here, is to regress the specification [4.2] (with the absence of the term *TRANSORB*) on two subsamples separately. The coefficients estimates for the two subsamples are presented in columns 3 to 6 in Table 4. We find the results quite revealing. First, for all the transaction costs variable that are significant in the regression with the whole sample, if a particular transaction cost is significant for one subsample, it is not for the other subsample, and vice versa.

Second, while two transaction costs variables – finding markets and obtaining access, are significant for the transitioners, the beginners incur many more types of entrance barriers: distance, reliable payment, lack of consumer understanding, lack of acceptance of certification, over-supply, and total available indirect markets and direct markets. Particularly, all the market characteristics (*LACKCONS, LACKCERT, OVERSUP, TAMID* and *TAMD*) impose barriers to entry to the beginners, and *only* to the beginners.

Third, the two subsamples do not differ much in the production characteristics. Produce variety is significant at *1%* and negatively correlated for both subsamples, and the marginal effects for both subsamples are similar. Number of value-added products is positively correlated but not significant for two subsamples. Fourth, the error term of the beginners is smaller than that of the transitioners. This suggests that the beginners are more homogeneous than the transitioners.

We perform a Hausman test for the null hypothesis that all coefficients for the two subsamples do not differ systematically. We reject the null with the test statistics $\chi^2(21) = 178.49$, and p-value = *.0000*. This lends evidence that our specification should allow the heterogeneity of effects.

4.3 Do Transaction Costs Matter?

We turn to our two primary questions: do transaction costs matter? and do they matter differently for different segments of farmers? We do so by testing the joint significance of all or a subset of transaction costs variables using the estimates in Table 4, and the hypothesis tests are presented in Table 5. We make three comments. First, all transaction costs variables are jointly significant at *1%* for all three samples. This suggests that transaction costs contribute to explaining farmers' indirect sales.

Second, how well certain subsets of transaction costs explain farmer's indirect sales differ considerably and consistently between the transitioners and the beginners. We perform hypothesis tests on a number of subsets of transactions costs such as hypothesis (2) to (6), we find that transaction costs in each subset are jointly statistically significant for the beginners but not for the transitioners. Subsets of transaction costs tested include: market conditions (*LACKCONS, LACKCERT, OVERSUP*), market infrastructure (*TAMID, TAMD*), market conditions and infrastructure (*LACKCONS, LACKCERT, OVERSUP, TAMID, TAMD*), all non-infrastructure transaction costs (*FINDMKTS, OBTACCS, NOTFINDP, DISTANCE, RELPMT, LACKCONS, LACKCERT, OVERSUP*), and lastly all specific transaction costs (*FINDMKTS, OBTACCS, NOTFINDP, DISTANCE, RELPMT*). This suggests that the existing organic markets impose more severe barriers to entry for the beginners than for the transitioners. Stated differently, the transaction costs framework provides a better explanation of the indirect sales for the beginners than for the transitioners.

Third, test results for three sets of non-transaction costs variables – production characteristics (*VARIETY* and *VALUEADD*), farm characteristics (*TOTYRS, ORGYRS, AGE, EDUC*, *GENDER*) and farmer characteristics (*BUSSTYPE, ORGLAND, LANDOWN, YRSCERT*) are the same for all three samples at *1%* significance level. We reject the null for the production characteristics. We fail to reject the nulls for the farm and farmer characteristics, although the p-values for the transitioners subsample is much greater than those for the whole sample or the beginners.

4.4 Semi-Reduced Form Estimates

In previous analysis, we have estimated a Tobit model to examine the reduced form relationship between the proportion of indirect sales and transaction costs. We look into an alternative econometric model with two motivations. First, our theoretical model suggests that the optimal marketing decision can be partitioned into two parts: market entrance and channel allocation; the former concerns with which markets to enter, direct market only, indirect market only, or both markets; and the latter concerns how much to sell in each market if both markets are used. If the two parts are affected by different transaction costs, or affected by the same transaction costs but in different ways including differing signs or magnitudes, we should allow the heterogeneity of the effects of transaction costs in the specification.

Second, our data is highly censored with *15%* of the observations censored at zero and *34%* censored at one. There is no prior reason to believe that the truncation at both limits points are symmetric, that is, the same exogenous factors affect the truncation at upper limit and lower limit in the identical way. The concentration and asymmetry suggest that a discrete-continuous model, such as a sequential logit model, may be an appropriate alternative specification.

Suppose that x_1 and x_2, vectors of transaction costs and characteristics variables, determine the market entrance and penetration, respectively, as follows:

[4.5]
$$\begin{aligned} I_1^* &= x_1\delta_1 + e_1, \quad I_1 = I(I_1^* > 0) \\ I_2^* &= x_2\delta_2 + e_2, \quad I_2 = I(I_2^* > 0) \end{aligned}$$

where I is the indicator function; I_1^* and I_2^* are latent variables; I_1 and I_2 are observed such as $I_1 = I(y^{id} > 0)$, and $I_2 = I(y^{id} == 1)$; the error term e_1 and e_2 have standard logistic distributions. δ_1 and δ_2 are parameters to estimate.

Suppose that x_3 determines the optimal channel allocation given that both markets are used. We use the fractional logit regression (Wooldridge p. 661) where the conditional expectation is modeled as a logistic function:

[4.6] $$E(y|\ 0 < y < 1, x_3) = \exp(x_3\delta_3)/\left[1 + \exp(x_3\delta_3)\right]$$

where δ_3 are parameters to estimate. Seen as an extension of the binary logit model, the fractional logit model can be estimated using the quasi-MLE, similar to the binary logit model.

We estimate [4.5] and [4.6] independently and present the results in Table 5, where the estimates of market entrance and penetration are shown in column 1 and 2, respectively. We include all the transaction costs and characteristics variables in estimating [4.5], because both fixed and variable transaction costs are determinants implied by the economic model. We include over-supply as the main transaction cost variable in estimating [4.6]. The signs of the estimates as well as the significance level are generally consistent with the Tobit estimates.

We find that lack of acceptance of organic certification imposes the most severe barrier to enter the indirect markets, with a coefficient of *-.528* and *1%* significance. Reliable payment is positively and significantly correlated in both market entrance and market penetration. Over-supply is positively and significantly correlated in market entrance and channel allocation. We find that distance imposes a substantial obstacle to penetrate the indirect markets, with a coefficient of -*.403* and *1%* significance level. We find that transitioners are considerably favored in both entering and penetrating the indirect markets, with coefficients of *.955* and *.823*, and 1% and 5% significance levels, respectively.

The semi-reduced logit estimates allow us to test the three hypotheses we have developed earlier. Our hypothesis 1 states that better market infrastructure (such as number of distributors and retailers, *TAMID*) and better market condition (such as the lack of acceptance of organic certification, *LACKCERT*) would lower fixed transaction costs and increase the likelihood of market entrance. *TAMID* in column 1 has a coefficient of *.011* and *10%* significance level. *LACKCERT* in column 1 has a coefficient of *-.526* and *1%* significance level. We fail to reject hypothesis 1, at least for the market condition part.

Our hypothesis 2 states that distance to markets (*DISTANCE*) presents an obstacle in penetrating the indirect channel and that better market infrastructure (such as *TAMID*) would improve the chance of market penetration. *DISTANCE* in column 2 has a coefficient of -*.403* and *1%* significance level. *TAMID* in column 2 has a coefficient of *.016* and *10%* significance level. We fail to reject hypothesis 2, at least for the distance part. Our hypothesis 3 states that the transitioners have a lower fixed transaction costs and more likely to access the indirect markets. *TRANS* in column 1 has a coefficient of *.995* and *1%* significance level. We fail to reject hypothesis 3.

5. Conclusion

We develop a conceptual framework that integrates quality of output and transaction costs in the choice of marketing channels; based upon which, we estimate a reduced-form Tobit model and a semi-reduced logit model on a farm-level cross-sectional dataset.

We find strong empirical evidence that existing organic retail and wholesale markets impose considerable barriers to entry to individual organic farmers. Lack of marketing infrastructure such as small numbers of organic distributors, market condition such as lack of acceptance of organic certification, and prohibitively great distance between the farm gate to the markets resulted from immature market infrastructure are shown to be barrier to entry as well as penetrate to indirect channels.

We also find that the effects of transaction costs are asymmetric between the two types of farmers, those who transitioned from conventional farming and those who did not. Those who did are overall favored, and those who did not are constrained by more types of transaction costs and are constrained more severely than those who did. For example, lack of acceptance of organic certification is found to have the single most negative effect on those who did not, but statistically insignificant on those who did; similarly, market infrastructure adversely and significantly affects who those did not, but is insignificant on those who did.

Implications for potential organic agricultural policy are based upon our findings. While a policy that improves the overall market infrastructure to all organic farmers would encourage the market growth, an arguably more effective policy should target to specific segments of organic farmers, such as the least favored farmers those who did not transition from conventional farming. Discrimination where history of the organic farmers has the most decisive power in obtaining access to indirect markets, if found to exist, should be strongly discouraged. In another word, an effective policy would encourage or mandate distributors and retailers have a more transparent and objective process in selecting organic suppliers, such that all farmers would have an equal opportunity to be successful in selling to indirect markets.

Extension work would address measurement errors, particularly of the categorical transaction cost variables, and sample selection where the non-transitioners may be over-sampled.

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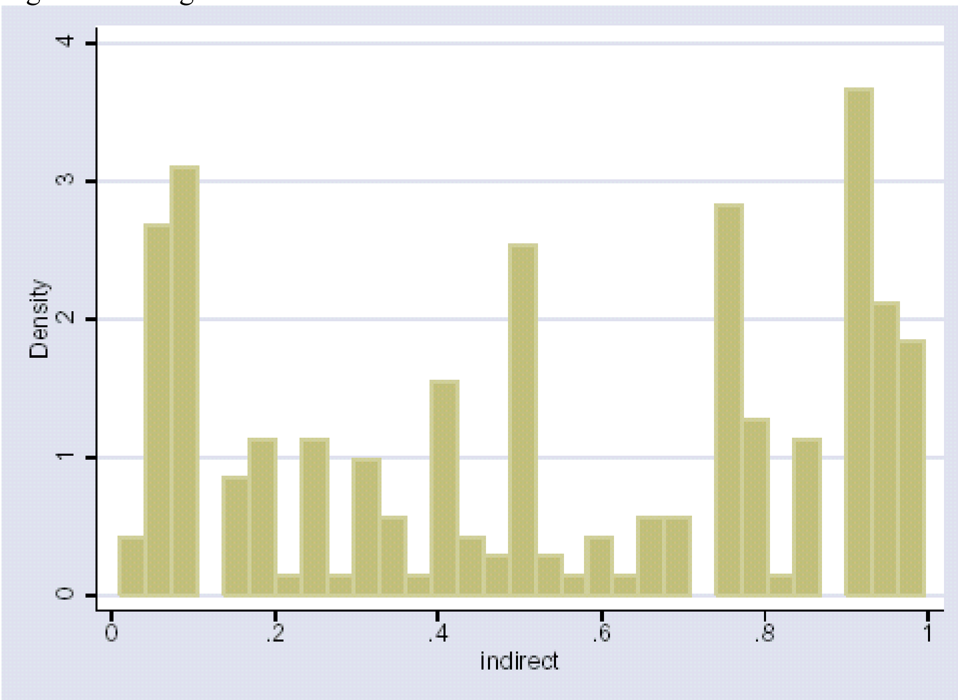
Figure 1: Histogram of within limits observations



Note: *0<y^{id}<1, N = 223*, mean = *0.5272*, standard deviation = *0.3335*, min = *0.01*, max = *0.995*

Table 1: Description of transaction cost variables

Variable Description	Variable Name	Measurement
Dependent Variable		
Proportion sold to indirect markets	PROPID	Proportion of produce sold into indirect markets (retail and wholesale)
Transaction Costs		
Information Costs		
Finding organic markets	FINDMKTS	How severe is "finding organic markets" a constraint to your marketing your organic products?
Obtaining access to existing markets	OBTACCS	How severe is "obtaining access to existing markets" a constraint to your marketing your organic products?
Inability to find best prices	NOTFINDP	How severe is "inability to find best prices" a constraint to your marketing your organic products?
Negotiation Costs		
Distance between producer and market or delivery points	DISTANCE	How severe is "distance between producer and market or delivery points" a constraint to your marketing your organic products?
Monitoring Costs		
Failure of buyers to honor commitment	FAILCOMM	How severe is "failure of buyers to honor commitment " a constraint to your marketing your organic products?
Reliable or prompt payment	RELPMT	How severe is "reliable or prompt payment" a constraint to your marketing your organic products?
Market Characteristics		
Lack of organic marketing network	LACKNWK	How severe is "lack of organic marketing network" a constraint to your marketing your organic products?
Lack of consumer understanding about organic food	LACKCONS	How severe is "lack of consumer understanding about organic food" a constraint to your marketing your organic products?
Lack of acceptance of certification documents in certain markets	LACKCERT	How severe is "lack of acceptance of certification documents in certain markets" a constraint to your marketing your organic products?
Oversupply of legitimate organic products in existing markets	OVERSUP	How severe is "oversupply of legitimate organic products in existing markets" a constraint to your marketing your organic products?
Total available indirect markets	TAMID	Number of retailers, processors and manufacturers, wholesalers in farm's state
Total available direct markets	TAMD	Number of farmer's markets in farm's state

Notes: Except for PROPID, TAMID and TAMD, all variables are measured in 1-5 scale where 5 is the most severe.

Table 2: Description of farm and farmer characteristics variables

Variable Description	Variable Name	Measurement
Farm Characteristics		
Type of business structure	BUSSTYP	Which of the following business structures describes your farm operation? [a]
Organic farming land	ORGLAND	How many acres do you farm organically?
Land owned	LANDOWN	How many acres do you own?
Years of the farm being certified organic	YRSCERT	How many years has your farm been certified organic?
Production Characteristics		
Number of varieties of vegetables and fruits	VARIETY	Number of types of vegetables and fruits produced and sold
Number of value-added products	VALUEADD	Number of types of value-added products produced and sold
Farmer Characteristics		
Transitioned from conventional farming	TRANS	Organic farmers can be classified as either starting from "scratch" as an organic producer (0) , or as "transitioning" from conventional agriculture (1). How did you start farming organically?
Full time or part time?	FULLORP	Do you farm full-time (1) or part-time (2)?
Total years of farming	TOTYRS	What is the total number of years you have been farming?
Years of farming organically	ORGYRS	How many years have you been farming organically?
Age	AGE	What is your age?
Education	EDUC	What is your level of formal education? [c]
Gender	GENDER	Your gender 1 = female, 2 = male

Notes: [a]: 1 = single family or family partnership, 2 = partnership other than family and cooperative, and 3 = corporation
[b]: We add up number of managers and workers hired, halved if part-time, halved if seasonal only.
[c]: 1 = no formal education, 2 = some high school, 3 = completed high school, 4 = some college, 5 = completed college, 6 = graduate work, and 7 = graduate degree.

Table 3: Summary statistics

Variable	All Mean (SD) N = 390 (1)	Transitioners Mean N_1 = 111 (2)	Beginners Mean N_2 = 249 (3)	[t-stat] (4)
PROPID	.60 (.41)	.80	.51	6.94
FINDMKTS	2.34 (1.37)	2.58	2.24	2.12
OBTACCS	2.33 (1.35)	2.59	2.27	1.94
NOTFINDP	2.78 (1.29)	2.91	2.72	1.25
DISTANCE	2.55 (1.42)	2.40	2.62	-1.42
FAILCOMM	1.96 (1.22)	1.96	1.96	0.03
RELPMT	2.09 (1.27)	2.13	2.06	0.40
LACKCONS	3.02 (1.38)	2.93	3.05	-0.81
LACKCERT	1.45 (0.93)	1.51	1.42	0.88
OVERSUP	2.08 (1.27)	2.30	1.98	2.24
TAMID	22.91 (29.67)	25.45	21.78	1.06
TAMD	150.68 (126.12)	155.18	148.68	0.45
BUSSTYP	1.15 (0.51)	1.21	1.13	1.17
ORGLAND	119.30 (468.27)	98.40	128.62	-0.73
LANDOWN	72.94 (161.21)	135.55	45.03	3.62
YRSCERT	5.52 (4.23)	4.62	5.92	-2.92
VARIETY	6.03 (5.47)	3.28	7.26	-7.89
VALUEADD	0.53 (0.96)	.31	.63	-3.45
TRANS	0.31 (0.46)	1	0	n/a
TOTYRS	14.84 (10.65)	15.63	14.50	1.01
ORGYRS	9.78 (7.44)	8.56	10.35	-2.30
AGE	47.15 (10.54)	47.36	47.06	0.27
EDUC	4.77 (1.40)	4.88	4.73	0.95
GENDER	1.79 (0.45)	1.81	1.79	0.45

Notes: The first column reports the sample average and standard deviation for the entire sample of 360. The second and third columns report the sample averages for the transitioners and beginners subsamples, respectively. The fourth column is the t-statistics for the null hypotheses that the averages for the transitioners and beginners are identical.

Table 4: Estimates of [4.2] by sample types

Variables	whole sample coef. (1)	whole sample mfx. (2)	transitioners coef. (3)	transitioners mfx. (4)	beginners coef. (5)	beginners mfx. (6)
FINDMKTS	.081** (.036)	.039**	.184*** (.074)	.070***	.041 (.039)	.022
OBTACCS	-.075** (.036)	-.036*	-.218* (.129)	-.083*	-.030 (.043)	-.016
NOTFINDP	.039 (.036)	.019	.095 (.059)	.036	.013 (.039)	.007
DISTANCE	-.081*** (.026)	-.039***	-.121 (.076)	-.046	-.073** (.033)	-.039***
RELPMT	.100*** (.022)	.048***	-.005 (.071)	-.002	.122*** (.033)	.066***
LACKCONS	-.061** (.030)	-.029**	-.061 (.087)	-.023	-.063** (.026)	-.034**
LACKCERT	-.080*** (.032)	-.038***	.073 (.087)	.028	-.115*** (.041)	-.063***
OVERSUP	.083*** (.030)	.040***	.120* (.068)	.046*	.065** (.034)	.035**
TAMID	.004*** (.001)	.002***	.002 (.004)	.001	.005*** (.001)	.003***
TAMD	-.001*** (.000)	-.0005***	.000 (.001)	.000	-.0016*** (.0001)	-.001***
BUSSTYPE	.126* (.068)	.061*	.350* (.189)	.133*	.047 (.063)	.026
ORGLAND	.000 (.000)	.000	-.000 (.000)	-.000	.000 (.000)	.000
LANDOWN	.000 (.000)	.000	-.000 (.000)	-.000	.001 (.001)	.001
YRSCERT	.020 (.014)	.009	.028 (.018)	.011	.022 (.014)	.012
VARIETY	-.049*** (.007)	-.024***	-.074*** (.020)	-.028***	-.041*** (.014)	-.022***
VALUEADD	.061** (.025)	.029**	.114 (.107)	.043	.054** (.025)	.029**
TRANS	.353*** (.091)	.171***	---	---	---	---
TOTYRS	-.001 (.005)	-.000	-.005 (.009)	-.002	.001 (.008)	.001
ORGYRS	.000 (.009)	-.000	.000 (.018)	.000	-.001 (.001)	-.000
AGE	-.005 (.004)	-.002	.003 (.011)	.001	-.005 (.004)	-.003
EDUC	-.005 (.029)	.002	-.105 (.080)	-.040	.019 (.028)	.010
GENDER	.165*** (.059)	.080***	.180 (.172)	.068	.171*** (.062)	.093***
CONSTANT	.613*** (.266)		.812 (.699)		.633* (.346)	
error term	.584		.645		.541	
N	360		111		249	
(Wald) ch2	1030 (22)		769(21)		241(21)	
P-value	.0000		.0000		.0000	
log-l	-295		-75		-207	

Notes: ***: 1% significant; **: 5% significant; *: 10% significant. All estimates account for heteroskedasticity and clustering effect by state of operation. Robust standard errors are in parenthesis. Column (1) and (2) are reproduced from last two columns in Table 5. Column (3) and (4) are coefficients estimates and marginal effects of specification [19] for the transitioners subsamples, respectively. Column (5) and (6) present the coefficients estimates and marginal effects of specification [19] for the beginners subsamples, respectively.

Table 5: Do transaction costs matter?

Null hypotheses	**all** **test stat** **p-value** **reject?**	**transitioners** **test stat** **p-value** **reject?**	**beginners** **test stat** **p-value** **reject?**
(1) H_0: The coefficients of all transaction costs are jointly zero.	**112.83(10)** **.0000** **reject**	**28.40(10)** **.0016** **reject**	**65.37(10)** **.0000** **reject**
(2) H_0: The coefficients of market infrastructure(*TAMID, TAMD*) are jointly zero.	**18.67(2)** **.0001** **reject**	3.84(2) .1468 fail to reject	**21.44(2)** **.0000** **reject**
(3) H_0: The coefficients of market condition (*LACKCONS, LACKCERT, OVERSUP*) are jointly zero.	**18.76(3)** **.0001** **reject**	5.92(3) .1154 fail to reject	**13.00(3)** **.0046** **reject**
(4) H_0: The coefficients of market condition and infrastructure(*TAMID,TAMD, LACKCONS, LACKCERT, OVERSUP*) are jointly zero.	**16.33(5)** **.0000** **reject**	8.61(5) .1256 fail to reject	**27.00(5)** **.0001** **reject**
(5) H_0: The coefficients of all non-infrastructure transaction costs (*FINDMKTS, OBTACCS, NOTFINDP, DISTANCE, RELPMT, LACKCONS, LACKCERT, OVERSUP*) are jointly zero.	**91.39(8)** **.0000** **reject**	**19.45(8)** **.0126** **reject**	**42.08(8)** **.0000** **reject**
(6) H_0: The coefficients of all specific transaction costs (*FINDMKTS, OBTACCS, NOTFINDP, DISTANCE, RELPMT*) are jointly zero.	**77.88(5)** **.0000** **reject**	8.21(5) .1450 fail to reject	**30.91(5)** **.0000** **reject**
(7) H_0: The coefficients of all production characteristics (*VARIETY, VALUEADD*) are jointly zero.	**45.80(2)** **.0000** **reject**	**15.12(2)** **.0005** **reject**	**33.34(2)** **.0000** **reject**
(8) H_0: The coefficients of all farm characteristics (*TOTYRS, ORGYRS, AGE, EDUC, GENDER*)are jointly zero.	9.46(5) .0919 fail to reject	3.76(5) .5846 fail to reject	12.65(5) .0268 fail to reject
(9) H_0: The coefficients of all farmer characteristics (*BUSSTYPE,ORGLAND, LANDOWN, YRSCERT*) are jointly zero.	7.84(4) .0976 fail to reject	5.57(4) .2334 fail to reject	8.32(4) .0805 fail to reject

Notes: All test statistics are χ^2 with the degree of freedom in the parenthesis. The cells are highlighted when the corresponding null hypothesis is rejected at 5% significance level using estimates in Table 3

Table 6: Logit estimates of [4.5] and [4.6]

Variables	(1)	(2)	(3)
FINDMKTS	.337 (.211)	.251* (.142)	---
OBTACCS	-.188 (.130)	-.289 (.192)	---
DISTANCE	-.147 (.151)	-.403*** (.132)	---
RELPMT	.387** (.163)	.317*** (.107)	---
LACKCONS	-.050 (.168)	-.308** (.134)	---
LACKCERT	-.526*** (.145)	.185 (.180)	---
OVERSUP	.347** (.182)	.063 (.157)	.212*** (.066)
TAMID	.011* (.007)	.016* (.009)	---
TAMD	-.003** (.001)	-.004* (.002)	---
BUSSTYPE	.808** (.417)	.265 (.275)	.224* (.132)
ORGLAND	.001 (.001)	.000 (.000)	-.0003*** (.000)
LANDOWN	-.001 (.001)	.004*** (.0015)	.003* (.0017)
YRSCERT	.115** (.195)	.005 (.060)	.042** (.020)
VARIETY	-.094*** (.028)	-.219*** (.052)	-.079*** (.020)
VALUEADD	.580*** (.195)	-.029 (.153)	.019 (.051)
TRANS	.955*** (.363)	-.823** (.360)	-.452 (.362)
TOTYRS	-.006 (.021)	-.006 (.018)	.026** (.012)
ORGYRS	.010 (.030)	.007 (.030)	-.037** (.017)
AGE	-.044** (.019)	.009 (.016)	.010 (.014)
EDUC	.048 (.165)	-.073 (.100)	.035 (.070)
GENDER	.354 (.336)	.449 (.291)	.289* (.164)
CONSTANT	1.575 (1.118)	.031 (1.262)	-1.624*** (.823)
N	360	304	182
Wald chi2	143.41(21)	654.38(21)	
p-value	0.0000	0.0000	
Pseudo R2	0.1871	0.3075	

Notes: ***: 1% significant; **: 5% significant; *: 10% significant. OR = odds ratios. MFX = marginal effects. All estimates account for heteroskedasticity and clustering effect of the state of operation. Robust standard errors are in parentheses. Column (1) and (2) present the coefficients estimates and odd-ratios of specification [4.19], respectively. Column (3) and (4) present the coefficients estimates and odd-ratios of specification [4.21], respectively. Column (5) lists the coefficients estimates of specification [4.23]. Column (6) lists the marginal effects of specifications [4.19],[4.21] and [4.23], with simulation size 1000 for each stage and covariates at sample means.

[i] Agriculture Marketing Service, United States Department of Agriculture, “The National Organic Program”, 2002, available online at http://www.ams.usda.gov/nop/NOP/standards/FullText.pdf
[ii] By various sources: *Greene 2003, Nutrition Business Journal, November 2002*, Organic Trade Association at http://www.ota.org.
[iii] Furthermore, The United States is not a leader in the worldwide organic farming conversion. Farmers in 130 countries produce organically grown food and fiber on over 7 million hectares worldwide. Consumers worldwide spend $22 billion a year on organic products. (Worldwatch Institute, 2000). The United States ranked fourth in organic farmland, behind Australia (19 million acres), Argentina (6.9 million acres), and Italy (2.6 million acres). In terms of percentage of total farmland, the U.S. was much behind and was not among the top 10, which included Switzerland (9 percent), Austria (8.64 percent), Italy (6.76 percent), Sweden (5.2 percent), the Czech Republic (3.86 percent), and the United Kingdom (3.3 percent). (Greene 2003).
[iv] http://www.ers.usda.gov
[v] This is true in most parts of the country with an exception of states like California where organic markets have been developed for decades. At the federal level, USDA tracks weekly prices at all market channels for a large number of conventionally grown commodities, however, the price information of the organics gathered by USDA is minimal.
[vi] Lohr et al. uses a matching approach and tests the likelihood of expansion for several market sectors based on the similarities between counties with and counties without organic markets based upon county-level data. They find that sales projections are overstated and that regional growth imbalance will continue.
[vii] Survey instruments are available from the author upon request. It is also available on http://www/ofrf.org.
[viii] Out of total 64 certification organizations identified. Several certification agencies like Quality Assurance International, Farm Verified Organic and Kauai Organic did not participate in releasing their member directory.
[ix] Data on farmers’ markets is available at http://www.ams.usda.gov/farmersmarkets/map.htm.
[x] Data source is *National Organic Directory, Guide to Organic Information and Resource Worldwide*, 2001, published by Community Alliance with Family Farmers, http://www/caff.org.
[xi] See Hausman and Wise, 1985.
[xii] The characteristics vector w that affect the transaction costs may overlap with, or be identical to, the characteristics vector z that affect the production quality distribution.
[xiii] It is to note that each term in all three profit functions must be positive at the optimal solution. As a consequence, it is possible that farmers may find it cheaper to discard the low quality produce than to sell to direct markets.
[xiv] The main results implied by condition [8] are similar to those in Goetz and Key et al.
[xv] Detailed proof of results [3.6]-[3.8] is available upon request. Analogous results apply to the effect of characteristics variables.
[xvi] Interpretation of the regression coefficients in a Tobit model differs from that in the ordinary least square regression because of the censoring nature of the dependent variable. The marginal effects of changes in individual explanatory variables are smaller than the coefficients, because they take into consideration of the probability of the sample’s being within the lower and upper limits. The scaling factor of $Prob\ (0 < y^* < 1)$ is *0.4846*. The marginal effects are The magnitude of the scale factor depends on the number of observations that are at either limit. Our data has *49.3* percentage of observations that are censored, and this highly censored data effectively reduces the marginal effects to half of the regression coefficients.