Corn and Soybean Marketing Contract Adoption and Site-Specificity

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Introduction:

The percentage of Midwest Corn and Soybean farms that reported their production under marketing contracts increased from approximately 20% in 2000 to roughly 40% by 2010[1]. Marketing contracts determine the quantity, marketing outlet, and period of delivery between the producer and user or handler for a specified price, or pricing formula, and usually before the produce is harvested. Adoption of marketing contracts represents a subtle evolution from spot markets to more formal coordination using classical bilateral contracts. The increase use of marketing contracts for corn and soybeans has been observed within the context of a changing landscape to marketing outlets. Since 2000, there has been consolidation, changes in ownership of grain merchants and processors, and an unprecedented emergence of processors for domestic bioenergy. In this study, we assess the effect site-specificity has on a given farms location in the marketing contract adoption decision. Our preliminary results indicate support for site-specificity as an important factor to marketing contract adoption.

The theoretical framework for explaining the marketing contract adoption decision can be viewed through two conceptual approaches: the risk-sharing and transactions cost approach (Macdonald et al., 2004; 2011). The existing empirical research on marketing contract adoption has examined variables that may be more associated with a risk-sharing approach (e.g. risk preferences, farm characteristics, and producer characteristics (Katchova and Miranda, 2004)). The conceptual framework of risk-sharing for marketing contract adoption is when there are differences in risk preferences between producers, where a risk-averse producer is more likely to adopt a market contract because they receive more utility from a certain return than a return with a given probability. Previous studies have well documented that marketing contract adoption has generally been more prevalent with larger farms whom presumably would be less risk averse assuming risk preference level are correlated with wealth. However, larger farms may have a larger percentage of their income at risk than a smaller producer that has supplemental non-farm income. Thus, the risk-sharing theoretical framework may be somewhat counter-intuitive with the expectation that risk aversion is inversely correlated with wealth and farm size. Alternatively, site-specificity may give producers incentive to adopt marketing contracts, regardless of their risk preferences, because of a potential hold-up situation. Therefore, we build from the existing empirical research to incorporate site-specificity of the production to understand the marketing contract adoption decision for corn and soybeans in the Midwest. Site-specificity is an important variable that is frequently cited in the transaction cost approach framework to understand contract adoption.

Empirical analyses that identify the importance of site-specificity and risk-sharing factors in marketing contract adoption informs researchers, industry, and policy makers on the market structural conditions that exist in the agriculture production sector, and the organizational responses to those conditions to reduce transaction costs and/or facilitate risk-sharing. More broadly, the empirical research may shed light on the impact policy changes may have on organizational changes within an economic sector (i.e. incentives for bio-refinery development).

The objectives of this research are threefold. First, measure site-specificity for corn and soybean production in the Midwest. Second, determine if the site-specificity a farm experiences can explain marketing contract adoption while controlling for risk-sharing factors. Third, examine the potential

[1] Authors' own analysis of USDA-ARMS data not weighted.

redundancy of marketing contract adoption with other methods of contractual integration that are relevant to the transaction cost approach, such as cooperative ownership.

Conceptual Framework:

Conceptually, site-specific assets are costly to transport, thus parties are limited in the number of alternative parties to transact the asset with to capture the highest-value that economizes on transportation costs. Further, site- specificity of assets, with few buyers that offer the best value, may cause a holdup situation where rents can be expropriated from a party that has greater market power. The determination of contractual choices that can most efficiently reduce holdup depend on the level of site-specificity, the frequency of the transaction, and the uncertainty of contingencies surrounding the transaction (Williamson, 1981).

Producers of corn and soybeans can experience site-specific holdup when they make an investment to produce and store crops and then there are limited buyers for the production when the crop is ready to be delivered. Producers can also experience site-specific holdup when there are large quantities of local production relative to the local storage, handling, or processing capacity, and/or when there is a higher value at a specific location, during a specific period, compared to an alternative location where there are more buyers. The best value that can be obtained by a producer at a given location is a minimization in the cost of freight, storage costs, and basis costs. Basis being the difference between the prices offered by Merchants and Processors in a local area and a futures market. Basis typically includes the transportation and storage costs that the Merchant would need to incur to transport the production to distant markets, a local Processor, or a futures market delivery location where more alternative buyers are available.

Users of corn and soybeans can also experience site- specific holdup when they make sunk investments to use or handle producer production and then there becomes too much storage and processing capacity relative to local production. This is particularly relevant when there are high costs to processing or handling capacity that is underutilized. As a result, users can offer local higher prices to attract production from more distant sellers where more efficient modes of transportation may be necessary to obtain the necessary production to maximize capacity utilization. This may entail unexpected costs, however, because it may require additional storage, handling capabilities, and equipment to receive production from alternative, distant sources. A user response to site-specificity is that users can seek contractual assurances *ex ante* to reduce potential counter-party opportunism *ex post* and smooth the coordination of asset supply that most efficiently utilizes the sunk asset investment they make.

Examples of opportunism that can be observed in corn and soybean transactions could be refusal to purchase/sell production, altered terms of delivery, changes in costs and pricing of the transaction at a given period when it better suits a single party, changes in the required quality attributes of the production, etc.

The transaction cost rationale for an evolution to marketing contracts from a pure market transaction occurs in corn and soybean production because the circumstances surrounding a future transaction may change that can empower one party over the other to expropriate the other party's rents if the parties relied solely on a spot market. As a result, contracting of the crop becomes more desirable *ex ante* from a producer and/or user perspective so that they can efficiently maximize their expected rents given the sunk investments they have made in an *ex post* transaction. Besides marketing contracts, producers or users can also integrate to increase their bargaining position, and prevent holdup, that gives them greater control of a future transaction. As an example, producers have integrated through cooperatives and other LLCs to create firms that offer alternative locations to sell, and/or store and market

crops. These producer integrated firms can be engaged in storage, processing, and bulk transportation of the production, but the effect is the same- an increase in the potential number of buyers for their produce, a buyer they possess some control over behavior in future transactions, and a reduction in potential holdup resulting from site-specificity.

Method and Data:

Following from prior research by Katchova and Miranda (2004), we will estimate a hurdle model (Cragg, 1971) where a producer makes a two-step decision. In the first step, a probit model will be estimated that explains marketing contract adoption. If a producer has adopted a marketing contract, then a truncated regression will be estimated explaining how much production to contract. The marginal impacts for the explanatory variables for the models are reported with the significance of coefficient estimates and model fit.

This empirical research uses a novel method to measure site-specificity based on the geographic location of farms that are engaged in corn and soybean production. We estimate the site-specificity of corn and soybean production for a particular farm location (geo referenced by the zip code the farm resides) by the freight plus basis cost between the first, second, and third best location at different time periods during the year. We also measure site-specificity by the time it takes to deliver to the first, second, and third location. Further, we examine the number, capacity, and governance relationship of storage, processing, and transportation facilities that would likely purchase a particular farms' corn and soybean production in the Midwest.

The explanatory variables for both models include operation and producer characteristics (as used in previous empirical research), our proxies for site-specificity from a network analysis, and facility organization type. The explanatory variables we use are whether the farm is specialized in crop production, whether the farm has adopted crop insurance, the debt to asset ratio of the farm, the year of analysis, risk preference, total cost of basis plus freight to first, second, and third best location for the month of July and December, the time to drive to first, second, and third location for the month of July and December. In our model, we combine correlated variables included in previous research related to operator age, operator education, size, and farm organization type into a composite risk preference variable. Our analysis of these variables show strong correlation with farmers own reported risk preferences in the 2001 ARMS study-- where producers were asked to rank their preference for risk on a scale of 1 to 10.

We use USDA-ARMS data, the USDA NASS Cropland Data Layer (CDL), USDOT national highway network, DTN and CGB Cash Grain Bid Data, and elevator and processing facility location, capacity, and organization type in an ARC-GIS network analysis. First, we develop an origin-destination cost matrix from farm to facility using road maps and posted speed limits. The origins for our matrix are the centers of a zip code region that a farm resides. The destinations and corresponding historical basis price is obtained from cash grain bid data from DTN and CGB. We calculated monthly basis values to be included in our total cost site-specificity variable. The cost of freight we assume is $2.50 mile, and for corn transportation we assume 1000 bushels per load, or .0025 cents per bushel-mile. Second, we develop service areas for corn and soybean storage, transportation, and processing facilities based on assumptions of transportation costs and distance from facility. We also estimate the percentage of local production to local processing and storage capacity using the USDA-NASS CDL and USDA-NASS county yields. In the capacity analysis, we include elevator and processing location that do not publish a cash grain bid through CGB or DTN and were omitted in the cost analysis.

Preliminary Results:

An initial model was run in order to obtain preliminary results for further analysis. We report our initial findings here prior to more extensive review, model testing, and model modifications and an expanded data frame. The initial findings suggest that marketing contract adoption for corn was significantly related to our site- specificity variable freight plus basis cost of the second best location for both the months of December and July (See Table 2). We also find that risk aversion is significant in explaining marketing contract adoption, in the opposite way we would expect, but consistent with what others previously have found. Our risk preference variable is a proxy for farm size and wealth, and operator age and education, thus we did not control for the proportion of income related to a gamble. As such, we find it positively significantly related to marketing contract adoption. Further model modifications may be necessary to obtain the expected sign for risk preference on marketing contract adoption where we control for the proportion of income related to a gamble. We did not observe a significant effect of our site-specificity measures on intensity of marketing contract adoption in the second model. More model specifications may be necessary to fully understand the impact of site-specificity on marketing contract adoption intensity. Future model specifications and variables will include alternative measures of site specificity, and the controls for other forms of integration by producers and Merchants and Processors.

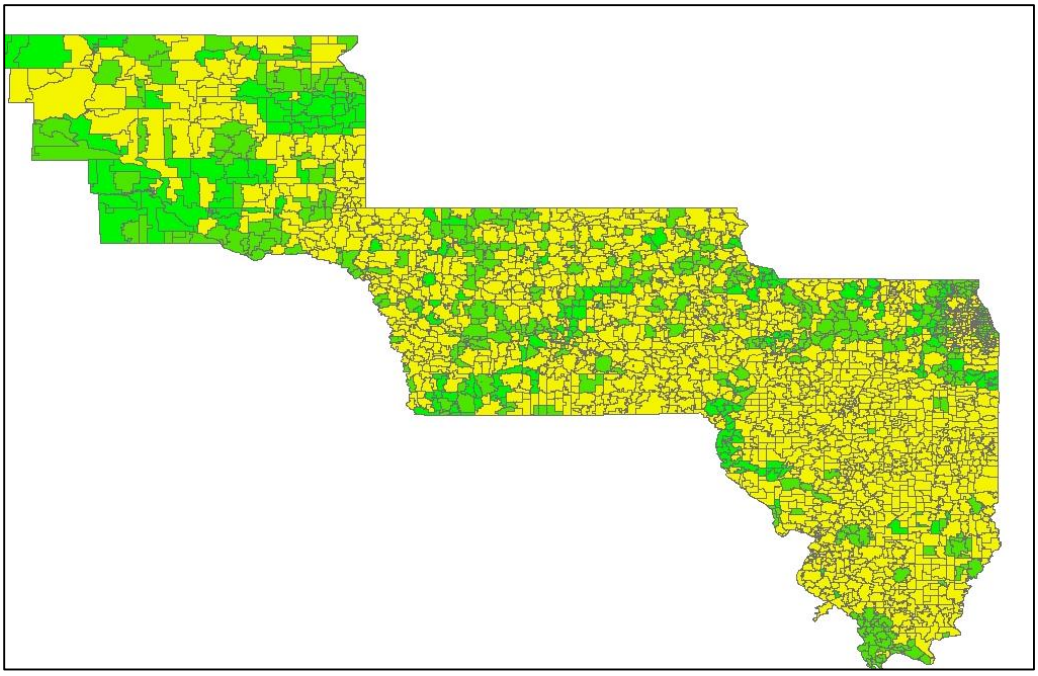

Figure 1. Green areas indicate time to deliver to first and second best location differ by more than 30 minutes, yellow areas indicate less than 30 minute difference between first and second best location.

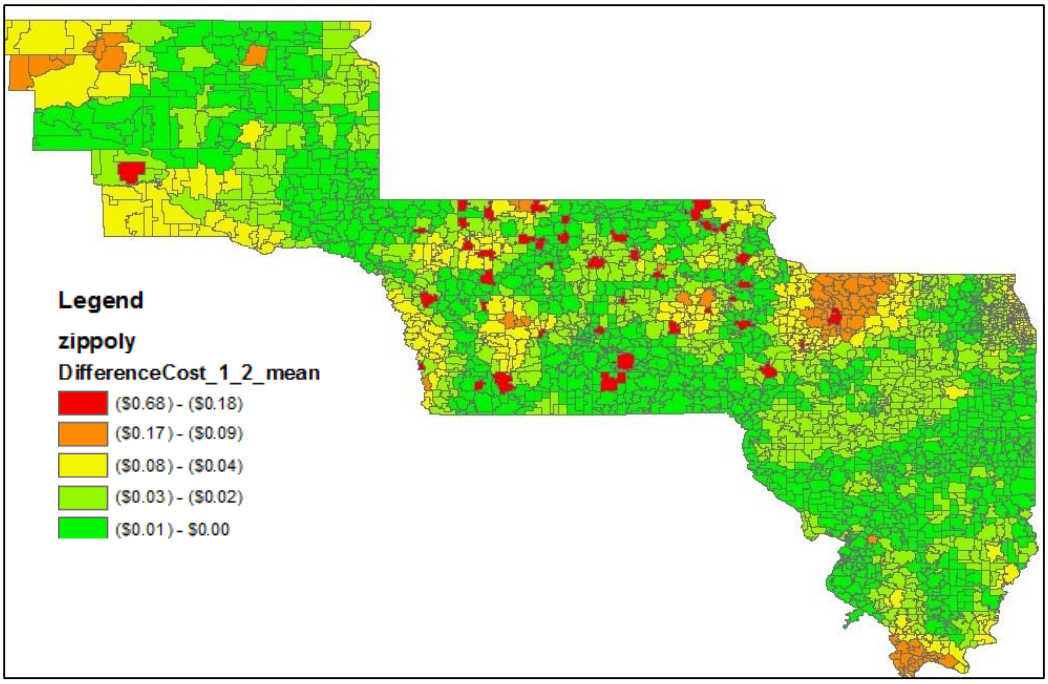

Figure 2. Difference between the first and second best location for basis and freight cost for Corn in the month of December between 2009-2011 (cents per bushel). Green areas indicate little difference between first and second best locations.

Table 1. Summary Statistics and Model Fits

Model	**Number of observations**	**AIC**	**Log Likelihood**	**Dependent Discrete Frequency and Mean**	
				# Adopt	# No Adopt
Marketing Contract Adoption	4021	5112	-2543	1594	2427
Marketing Contract Intensity	1509	-284.5	156.25	.403	

Table 2. Marketing Contract Adoption Model Coefficients and Marginal Effects

Marketing Contract Adoption Model (month of July)				

Parameter		Estimate	Std Error	T Ratio	Marginal Effects
Int		-.947***	0.097	-9.74	
cropsp		0.417***	0.077	5.36	.151
Adarat2		0.723***	0.113	6.40	.242
Year09		-0.332***	0.057	-5.76	-.111
Year10		-0.131**	0.063	-2.07	-.044
cropins		0.503***	0.055	9.11	.168
Risk		0.162***	0.023	6.93	.054
Total_Cost1		-0.531	0.446	-1.19	-.177
Total_Cost2		1.52**	0.767	1.98	.507
Total_Cost3		-.982	0.674	-1.46	-.327
Total_Minutes1		0	0	.14	.000
Total_Minutes2		0	0	-0.78	.000
Total_MInutes3		0	0	0.7	.000

Table 3 Marketing Contract Intensity Model Coefficients

Marketing Contract Intensity of Adoption (Month of December)				
Parameter		Estimate	Std Error	T Ratio
Int		.36***	.066	5.53
cropsp		-.1088**	.054	-2.00
Adarat2		.073	.044	1.63
Year09		-.137***	.040	-3.36
Year10		.004	0.03	.13
cropins		.0337	.041	.81
Risk		.039***	.015	2.66
Total_Cost1		-.402	.314	-1.28
Total_Cost2		.274	.481	.57
Total_Cost3		.150	.405	.37
Total_Minutes1		0	0	.14
Total_Minutes2		0	0	-0.78
Total_MInutes3		0	0	0.7

Preliminary Conclusions:

We find support that site-specificity is a factor in marketing contract adoption. Including measures of site-specificity in adoption models will be beneficial to understanding market contracting and improve model accuracy. Further research is necessary to fully understand and measure the effect of site- specificity in corn and soybean production. In addition, more research is needed to understand the effect site-specificity has on contracting and integration decisions.

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