Producer Willingness to Supply Biomass: the Effects of Price and Producer Characteristics

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Abstract

This paper presents research results based on data from two biomass producer surveys collected from mid Missouri and southern Illinois. Specific topics of interest include the effect of price and producer characteristics on willingness to supply, assets producers currently own and services they may be willing to provide if bioenergy industries develop. A series of censored tobit regressions are utilized to analyze willingness to supply results under three price scenarios. Marginal effects of a one dollar change in the biomass price are shown to increase the willingness to supply by 0.5 to 2 percent.

1.0 Introduction

Bioenergy and other industrial products produced from agricultural biomass have increasingly become the focus of both physical and social science research where there are numerous research perspectives. For example, the physical characteristics, processing technologies, environmental consequences and potential volume of biomass have been studied. As technologies near commercialization economic perspectives become paramount.

Among the economic topics, the biomass producers' willingness to supply is critical to the commercialization process and ultimately the feasibility of the industry, regardless of the specific technology. Thus, the purpose of this paper is to investigate the impact of price variability and producer characteristics on agricultural producers' willingness to supply biomass (wheat straw, corn stover and hay) to emerging renewable energy industries. These industries

include biopower, cellulosic transportation fuels such as ethanol, and biorefineries, where a range of additional products can be produced. This article relies on local primary data collected in two separate surveys in mid Missouri and southern Illinois, two areas with highly productive agricultural land usually planted to traditional agricultural crop, such as corn and soybeans.

In this paper we analyze biomass producer responses to new bioenergy industries. These responses include the willingness to supply biomass, the services (i.e. harvest, transportation, storage services) they may be willing to provide and their current physical assets that could be used to support new biomass based industries. A key focus will be on how price and other producer specific factors influence their willingness to supply.

One of the key assumptions in any feasibility study is that biomass producers will respond to price incentives in order to supply their products. This study will reveal and analyze what proportion of their biomass producers are willing to supply under three different price scenarios while also taking into account other pertinent producer socio-economic and farm characteristics. Regression results utilize a series of censored tobit models that show price along with some producer characteristics are statistically significant.

2.0 Literature Review

A key area of research in the biomass and bioenergy literature is technological feasibility studies that analyze and compare the costs of bioenergy process technologies. The various general process technologies include: biological, chemical, thermal and physical processing of biomass (Brown, 2003), or some combination of these processes. In the mid-1990s biological pathways such as enzymatic hydrolysis had been shown to be cost competitive with corn ethanol and more

environmentally sustainable than leading chemical path ways using acidic hydrolysis (Lynd, 1996 and Wyman, 1994). Physical processes have been shown to be most effective in pretreatment stages in combination with biological, chemical and thermal processes for final conversion of the biomass. Thermal processes tend to be more mature technologies and are the basis of the current biopower industry (Altman and Johnson, 2009).

Even with the technological advances in biological and chemical processes the emergence of a cellulosic fuel industry has lagged behind corn ethanol (Altman, Johnson, Moon, 2010). For the most part, growth in cellulosic industries has been limited to demonstration facilities subsidized with public funding. Thus, the various economic barriers to full commercialization become important.

Non-technical barriers are less well understood than technical challenges. Among these logistics, market organization and producer willingness to supply questions are relevant. Altman and Johnson (2009) investigate organizational structure of current and future biomass industries and consider the impact of scale on organizational decisions in the current biopower industry (Altman, Klein and Johnson, 2007). Supply chain development, an oft-overlooked aspect of the biopower industry--is considered by Altman, Sanders, and Boessen (2007), who also find that the nature of supplier contracts may also impact the development of the industry (Altman, Boessen, and Sanders, 2008).

While the physical quantity of potential biomass supply is important to studying the feasibility of bioenergy production (Klass, 1998), here we expand this area of research by considering the broader willingness and ability of producers to supply cereal straw, corn stover and surplus hay to new bioenergy processors. In more aggregated state level analysis, Gallagher et al., 2003, takes an indirect approach to model producer's costs of production in various

regions and estimates prices needed by producers to cover their opportunity costs. Other indirect approaches model the profitability of producers for typical farms if they convert to biomass production under various assumptions such as risk and contract type (Larson, et al. 2008). We analyze direct local data and compare willingness to supply responses of producers in two areas, mid-Missouri and southern Illinois, and at different potential price levels. In addition, we analyze the assets and services producers may be willing to provide to serve the new bioprocessing facility to understand the ability of producers to actually supply the biomass.

Industries based on first generation biofuel produced from corn and soybeans have matured over the last ten years. The costs of bioproducts from cellulosic sources will invariably depend on the cost of the underlying biomass feedstock. We focus on second generation biomass, corn stover, cereal straw and low protein grass hay, that farmers are currently producing but not necessarily selling every year. While other research considers producers' willingness to convert land to third generation energy crops like switch grass and miscanthus (Jensen et al., 2007), in this article we focus on potentially more available second generation biomass.

While there is much research investigating technological feasibility, willingness to supply topics remain under-researched. Unlike traditional starch to ethanol, from corn, where well developed supply chains existed before corn ethanol industries developed, biomass supply channels will have to develop in order for there to be successful commercialization of new cellulosic conversion technologies. Willingness to supply is one significant area to study. This type of research is critical in the early stages of commercialization of new technologies and industry development.

3. Survey Data

The data set for this article utilizes two separate mail surveys of producers in mid Missouri and southern Illinois conducted by the Southern Illinois University and the University of Missouri. The Missouri survey was administered in January and February 2007, while the Illinois survey was administered in January and February 2009. Both surveys were similar in structure, breaking questions down into sub-sections covering production practices, assets and activities, marketing, and demographics. Survey procedures were also similar; producers were mailed a survey in January followed by a replacement/reminder survey two weeks later in early February. This procedure was followed to allow biomass producers time to respond when they were expected to be the least busy with their farming operations and to increase the response rate.

The surveys were mailed out to 2,500 producers in Missouri and 3,000 producers in Illinois based on a random sample of farms from the list of farmers managed by the USDA, National Agricultural Statistics Services (NASS). Producers were randomly selected based on the condition they produce hay, corn and/or cereals. About 600 producers responded to the Missouri survey and about 960 to the Illinois survey for a response rate of 24% and 32%, respectively. These response rates are similar to other mail surveys administered by USDA-NASS in the study region. Some producers who responded to the survey did not complete the entire survey and/or did not provided consistent responses to questions that were used to derive the dependent and explanatory variables used in the model.

Asset variables were attained by asking producers whether they currently owned various assets like balers and trucks and trailers for biomass transport while service variables were gathered by asking producers if they would be willing to provide services such as at biomass

harvest, storage and transport. Willingness to supply biomass was assessed by asking producers about their willingness to supply wheat straw, corn stover or hay under a typical year considering weather, soil structure and fertility under 3 different pricing scenarios: $10, $15 and $20 per dry ton priced in the field (not baled). Demographic and farm characteristic variables such as age, farm income, amount of land rented, education level achieved, and crop acreages were collected, as well. Summary statistics for the variables collected and used in the study are provided in Table 1.

Table 1: Summary Statistics for Dependent and Explanatory Variables

Variable Name	Description	Illinois Mean (Standard Deviation) *N = 517*	Missouri Mean (Standard Deviation) *N = 325*
	Dependent Variables		
WTS – Straw	Percentage of wheat straw respondent is willing to supply at $10/$15/$20	$10 – 7.3 (22.3) $15 – 10.1 (23.8) $20 – 25.2 (33.6)	$10 – 11.2 (26.4) $15 – 14.4 (28.7) $20 – 33.2 (38.8)
WTS - Stover	Percentage of corn stover respondent is willing to supply at $10/$15/$20	$10 – 8.3 (22.5) $15 – 11.4 (24.7) $20 – 28.3 (33.2)	$10 – 10.1 (24.9) $15 – 14.7 (28.9) $20 – 30.1 (37.4)
WTS - Hay	Percentage of hay respondent is willing to supply at $10/$15/$20	$10 – 1.8 (11.5) $15 – 2.6 (12.9) $20 – 7.9 (22.3)	$10 – 3.7 (15.1) $15 – 5.5 (18.7) $20 – 13.7 (28.3)
	Explanatory Variables		
Corn Acreage	Number of acres planted to corn	585 (642)	209 (323)
Wheat Acreage	Number of acres planted to wheat	200 (291)	71 (134)
Hay Acreage	Number of acres planted to hay	78 (306)	120 (244)
Baler	Equal to ‘1’ if owns a baler, ‘0’ otherwise	0.46 (0.50)	0.64 (0.48)
Transport	Equal to ‘1’ if owns a vehicle that can transport biomass, ‘0’ otherwise	0.82 (0.39)	0.77 (0.42)
Conservation Tillage	For Illinois equals percent of land under at least minimum tillage/For Missouri equal to ‘1’ if use no-till, ‘0’ otherwise	61 (28)	0.72 (0.45)
CRP[a]	Equal to ‘1’ if participate in the Conservation Reserve Program (CRP), ‘0’ otherwise	0.38 (0.48)	---
Age > 50	Equal to ‘1’ if farmer is over 50 years of age, ‘0’ otherwise	0.50 (0.50)	0.66 (0.48)

Table 1 continued.

Variable Name	Description	Illinois Mean (Standard Deviation) *N = 517*	Missouri Mean (Standard Deviation) *N = 325*
Off Farm Income	Percentage of household income from off-farm	34 (35)	61 (33)
Percent Rent	Percentage of farm land that is rented	53 (29)	36 (34)
College[a]	Equal to '1' if farmer has a college degree, '0' otherwise	0.55 (0.50)	---
Sold Biomass[a]	Equal to '1' if sold biomass before, '0' otherwise	0.62 (0.49)	---
Windrowing	Equal to '1' if willing to put biomass in windrows, '0' otherwise	0.60 (0.50)	0.48 (0.50)
Baling	Equal to '1' if willing to bale biomass, '0' otherwise	0.54 (0.50)	0.60 (0.49)
Storage	Equal to '1' if willing to store biomass on-farm, '0' otherwise	0.49 (0.50)	0.45 (0.50)
Delivery	Equal to '1' if willing to deliver biomass to processor, '0' otherwise	0.60 (0.49)	0.57 (0.50)

[a] Data was not collected on the Missouri survey conducted in 2007.

4.0 Model

Consider a farmer or producer who is deciding whether or not to harvest their biomass to sell to a biorefinery or other intermediate processor. Biomass harvesting is likely a value-added enterprise to corn or wheat production and an alternative to selling hay as a feedstock for livestock. The farmer will undertake the enterprise if it yields positive net returns. The amount of biomass that would be harvested can be determined by solving the following farmer-enterprise level optimization problem: maximize $py - \mathbf{wx}$, subject to $y = f(\mathbf{x},\mathbf{z})$. In this problem, p is the price received for the biomass by the farmer ($/dry ton); y is the quantity of biomass harvested, which is a function of a vector of inputs $\mathbf{x}$; $\mathbf{w}$ is a vector of input costs; $f(\mathbf{x},\mathbf{z})$ is the production function,

which is assumed to be concave and twice differentiable; and **z** is a vector of socio-economic and environmental variables that may affect biomass harvesting and production (e.g. crop rotation, equipment used, etc.). At optimality, the farmer would produce y^* using $\mathbf{x}^* = \mathbf{x}(p,\mathbf{w})$. Thus, a farmer would be willing to supply $y = f(\mathrm{x}(p,\mathbf{w}),\mathbf{z})$. Given that this is a cross-sectional study in a similar geographical location, it is assumed that input costs do not vary across farmers in the study region. While this assumption may affect estimates in the model presented below, cost data was not collected at the farmer level to be able to capture variation in production costs, but this variation is likely to be small.

For the purpose of this study, willingness-to-supply is modeled as:

$$y_i = \beta_0 + \beta'(p_i, \mathbf{z}_i) + \varepsilon_i \quad (1)$$

where y_i represents the percentage of biomass the farmer is willing to supply following the question format in the survey; **w** is held constant and absorbed by the intercept β_0; β is a vector of parameters to be estimated; p_i is the price of biomass per dry ton; $\mathbf{z}_i$ is a vector of other explanatory variables; and ε_i is a mean zero normally distributed error term capturing non-systematic characteristics not captured in the model. The price variable represents the response to three price levels ($10, $15 and $20 per dry ton) by a respondent. Thus, there are three observations per respondent in the model. To estimate equation (1), the data was stacked to include the price variation in the model for each biomass source. Thus, the number of observations used to estimate each model is three times the number of respondents, but the numbers of unique observations for explanatory variables other than price are equal to the number of respondents, as they only vary across respondents in the model.

A number of explanatory factors can affect a farmer's willingness to supply biomass. A significant factor will be the prevalence of the biomass source or amount of land planted to corn, wheat or hay. Another significant factor are the assets owned by the farmer. That is, if the farmer owns a baler and/or vehicle that can be used for harvesting and transporting biomass market, which can affect how the farmer may participate in the market (Williamson, 1985). Furthermore, the willingness of a farmer to undertake the needed operations to produce the biomass will affect the optimal quantity they will produce. This includes developing windrows in the field, baling the biomass, potentially storing biomass on-farm until sale, and delivering biomass to the needed location (e.g. edge of field or processing facility). Another significant factor will include farmer's environmental stewardship efforts. Use of conservation tillage requires more intensive residue management on-farm and producers conducting this practice may be less willing to harvest their crop residues for biofuel production (Anand et al., 2008). Further indication of environmental stewardship may be captured by participation in conservation programs, such as the Conservation Reserve Program (CRP). Producer demographic variables, such as age, education level, off-farm income, land tenure and experience with selling biomass in the past are likely to impact a producer's willingness to supply. These demographics help to capture differences in preferences of farmers due to different situational circumstances (Pannell et al., 2006).

Given that the dependent variable is a percentage with values between 0 and 100 and a significant amount of the observed respondent values stack up at 0 or 100 in the model, equation (1) was estimated as a tobit regression model following Greene (2003). Given the censoring of the dependent variable in the model, the beta coefficients do not represent the observed marginal effects of a one unit change in an explanatory variable on the dependent variable. Thus, marginal

effects for the explanatory variables are estimated following Greene (2003) and standard errors are estimated using the delta method. Separate models were estimated for each biomass source for each state. LIMDEP 9.0 was used to estimate all model and corresponding statistics.

5.0 Results

Two sets of results are presented here. First, summary results from the data are discussed to highlight differences among the farmer populations in southern Illinois and mid Missouri. Second estimation results for the tobit regression models are presented. These results will provide insight into the affect of biomass price and other producer related factors on farmers' willingness to supply different source of biomass to market.

Summary Results

In comparing these two areas first the assets will be compared followed by the services they may be willing to provide as well as their willingness to supply the three existing biomass crops: straw, stover and hay. The existing assets in the areas are somewhat different. Round baler ownership, baling experience and truck and trailer were statistically different; however the economic difference may not be significant enough for potential bioenergy processors to differentiate based on existing assets. Round baler ownership was 4 percent higher in Missouri, and 9 percent more Missouri producers stated they had baling experience. While truck and trailer ownership was 8 percent higher in Illinois, indicating they have more of the assets to participate in the transport of biomass. Tractor ownership and square baler ownership were not statistically different between these two areas at around 90 percent and 10 percent respectively. Based on these data, Missouri has slightly higher bailing assets while Illinois has more capability in transportation. Table 2 presents these data along with significance tests.

Table 2: Producer Asset Ownership Comparison

Variable	Missouri Percent	Illinois Percent	T-value	P-value
Round baler ownership	61.71	57.6	-7.316	0.001
Tractor ownership	89.96	89.9	0.523	0.601
Square baler ownership	10.83	10.6	-0.076	0.939
Baling experience	86.42	77	-3.937	0.001
Truck and trailer ownership	66.18	74.4	3.583	0.001

The services producers are willing to provide are similar. Producers' willingness to provide baling, storing and delivery services were not statistically different between the Illinois and Missouri samples. The willingness to provide windrowing was the only variable that had a significant difference with Illinois having about 12 percent more producers willing to provide windrowing. The economic significance here is uncertain. Potential bioenergy processors may or may not be sensitive to these differences. Still, they may be able to use this information to compare and contrast with other potential production areas.

Producers' maximum willingness to supply biomass may show more meaningful differences between the two areas. This data represents farmers' maximum willingness to supply under "ideal circumstances" in the survey. Illinois producers had an 8 percentage point higher willingness to supply than Missouri producers for straw and stover, and the hay difference is not statistically significant. Table 3 displays these comparisons. These results may be more economically significant than the asset and services variables. Again, this will hinge on the bioenergy processor's willingness to supply or participation requirement needed to support a processing facility. The questions must be further refined by examining willingness to supply under alternative price scenarios, which is examined in detail in the next section.

Table 3: Producers Maximum Willingness to Supply Biomass - Comparison

Variable	Missouri Mean	Illinois Mean	T-value	P-value
Straw	38.09	46.47	3.257	0.001
Stover	32.52	40.89	3.481	0.001
Hay	21.45	22.19	0.289	0.773

Tables 4, 5 and 6 present the comparisons at the 3 price levels for the 3 biomass crops. At the price levels of $10, $15 and $20 per ton priced in the field (not baled) the mid-Missouri producers tended to have higher willingness to supply. For straw, the mid-Missouri producers' willingness to supply was 4 per cent, 5 percent and about 10 percent higher at the $10, $15 and $20 price levels, respectively. Similarly for stover, mid-Missouri producers had a 4, 5 and 6 percent higher willingness to supply at the respective price levels. The difference for willingness to supply hay was less pronounced at 2,4 and 5 percent at the different price levels examined. Given these results, mid-Missouri may have the advantage in terms of having a higher willingness to supply at lower price levels.

Table 4: Price and Willingness to Supply (WTS) Wheat Straw - Comparison

Price	Missouri WTS	Illinois WTS	T-value	P-value
$10/ton	12.68%	8.24%	-2.478	0.013
$15/ton	15.88%	10.04%	-2.579	0.010
$20/ton	35.59%	25.27%	-2.479	0.013

Table 5: Price and Willingness to Supply (WTS) Corn Stover - Comparison

Price	Missouri WTS	Illinois WTS	T-value	P-value
$10/ton	12.43%	8.15%	-3.095	0.002
$15/ton	16.35%	10.99%	-2.818	0.005
$20/ton	33.16%	26.86%	-2.900	0.004

Table 6: Price and Willingness to Supply (WTS) Wheat Straw - Comparison

Price	Missouri WTS	Illinois WTS	T-value	P-value
$10/ton	4.44%	2.05%	-4.167	0.001
$15/ton	6.15%	2.91%	-2.503	0.012
$20/ton	14.86%	9.35%	-3.041	0.002

Willingness-to-Supply Estimation Results and Marginal Effects

Estimation results for the marginal effects for the explanatory variables and fit statistics for the tobit regression models are presented in Table 7. Parameter estimates are not presented to conserve space, but are available from the authors upon request. Model fit statistics seem to indicate that the model fit relatively well, given the data available. Psuedo-R^2 values range from 0.38 to 0.50 for each of the tobit regression models estimated.

For wheat straw, price was a highly significant variable. A $1 increase in the price of wheat straw per dry ton would increase the percentage a farmer is willing to supply biomass by 1.73 and 1.95 percent in Illinois and Missouri, respectively. Other factors that impacted producers' willingness to supply wheat straw in Illinois included number of acres planted wheat, involvement in CRP, off-farm employment, a history of selling biomass, and willingness to put straw in windrows and store it on-farm. Farmers that are more environmentally conscious (i.e. CRP involvement) and who work more off-farm were less likely to supply straw. The other factors had a positive impact on farmers' willingness to supply straw. In Missouri, farmers with more wheat acres would supply more straw, while farmers with higher amounts of corn acreage are less likely to supply straw. This may be indicative of management concerns related to crop rotations and planting into crop residues (given the high amount of conservation tillage in the study area in Missouri).

Table 7: Marginal Effects of Explanatory Variables on Willingness to Supply Wheat Straw, Corn Stover and Hay from Estimated Tobit Models and Associated Fit Statistics

Variable	Marginal Effect (Standard Error)					
	Wheat Straw		Corn Stover		Hay	
	Illinois	Missouri	Illinois	Missouri	Illinois	Missouri
Price ($/dry ton)[a]	1.73*	1.95*	2.00*	0.885*	0.499*	0.673
	(0.159)	(0.589)	(0.162)	(0.402)	(0.079)	(0.382)
Corn Acreage	-0.002	-0.018*	-0.001	-0.001	-0.000	-0.008
	(0.001)	(0.007)	(0.001)	(0.002)	(0.001)	(0.005)
Wheat Acreage	0.008*	0.029*	-0.001	-0.005	-0.000	0.008
	(0.003)	(0.011)	(0.003)	(0.004)	(0.001)	(0.005)
Hay Acreage	-0.002	-0.003	0.001	0.001	0.002*	0.001
	(0.002)	(0.004)	(0.002)	(0.002)	(0.001)	(0.002)
Baler	-2.29	-0.677	1.17	-2.19	0.277	0.315
	(1.47)	(2.12)	(1.51)	(1.37)	(0.675)	(0.928)
Transport	0.457	0.615	-0.175	2.27*	1.19	0.561
	(1.83)	(1.91)	(1.86)	(0.148)	(0.985)	(0.555)
Conservation Tillage	-0.019	0.013	-0.048*	0.006	-0.001	0.005
	(0.025)	(0.012)	(0.024)	(0.006)	(0.011)	(0.005)
CRP[b]	-0.013*	---	-0.013	---	-0.003	---
	(0.006)		(0.007)		(0.003)	
Age > 50	-0.271	-1.07	1.77	-0.355	-0.396	1.25
	(1.31)	(2.10)	(1.33)	(1.02)	(0.627)	(1.09)
Off Farm Income	-0.001*	0.039	-0.000	0.006	-0.000	-0.032
	(0.000)	(0.033)	(0.000)	(0.015)	(0.001)	(0.022)
Percent Rent	-0.028	0.046	-0.011	0.021	-0.020	-0.023
	(0.023)	(0.031)	(0.024)	(0.016)	(0.011)	(0.018)
College[b]	-1.70	---	-3.39*	---	-0.484	---
	(1.32)		(1.33)		(0.626)	
Sold Biomass[b]	3.36*	---	-5.60*	---	3.96*	---
	(1.53)		(1.53)		(0.779)	

Table 7 continued.

Variable	Marginal Effect (Standard Error)					
	Wheat Straw		Corn Stover		Hay	
	Illinois	Missouri	Illinois	Missouri	Illinois	Missouri
Windrowing	5.47*	8.12*	5.52*	3.99*	-0.590	3.33
	(1.44)	(3.05)	(1.47)	(1.99)	(0.666)	(1.37)
Baling	-0.752	0.162	3.14*	-0.159	1.38	0.467
	(1.58)	(2.09)	(1.62)	(1.03)	(0.735)	(0.921)
Storage	3.26*	-0.699	0.385	-0.682	-1.20	-0.963
	(1.61)	(1.95)	(1.63)	(0.967)	(0.720)	(0.952)
Delivery	-1.39	1.22	0.177	-1.11	-0.283	1.46
	(1.64)	(2.25)	(1.65)	(0.987)	(0.749)	(1.37)
			Fit Statistics			
Log-Likelihood	-2673.97	-1779.41	-2965.14	-1782.14	-970.98	-1079.73
Psuedo-R^2	0.42	0.48	0.38	0.50	0.49	0.50
AIC	3.47	3.68	3.85	3.69	1.28	2.25

* Denotes significance at the 10 percent level.

[a] Price represents the $ per dry ton offered to the farmer for harvested biomass.

[b] Data was not collected on the Missouri survey conducted in 2007.

For corn stover, price was still highly significant. A $1 increase in the price of corn stover per dry ton would increase the percentage a farmer is willing to supply of biomass by 2.00 and 0.885 percent in Illinois and Missouri, respectively. More factors impacted producers' willingness to supply corn stover in Illinois than in Missouri. In Illinois, farmers concerned with residue management who practice conservation tillage were willing to supply less stover. In addition, an unexpected result was that farmers with a college education and who had prior experience selling biomass were willing to supply less stover, as well. This may be due to practical knowledge of logistical and management difficulties in undertaking this enterprise. Farmers in Illinois who are willing to put corn stover into windrows and bale it were willing to supply more stover. In Missouri, farmers who owned transport equipment and who are willing to put corn stover in windrows were willing to supply more stover.

The results for hay are less pronounced, possibly given the lower prices used in the study. Price was only a significant effect for farmers in Illinois, who were willing to supply 0.5 percent more hay for each $1 increase in price. In addition, farmers with more hay acreage and who have prior experience selling biomass were more likely to supply more hay biomass to market. None of the explanatory factors were significant in the tobit regression for hay for Missouri.

6.0 Conclusions

This paper investigated the willingness and ability of producers to supply biomass in two regions of the U.S. Midwest, mid Missouri and southern Illinois. Summary statistics show that the regions are fairly similar in terms of the assets producers own with southern Illinois producers have more capabilities in hauling and mid Missouri producers having more assets for baling. The

willingness to supply in Missouri is higher for the price ranges proposed to producers, although, southern Illinois producers had a higher willingness to supply under ideal conditions.

Regression results from censored tobit regressions showed that price is a significant explanatory variable in most cases and lead to an increase in the willingness to supply of 0.5 percent-2 percent per dollar of biomass in the price range of 10-15 dollars per dry ton. Price was not a significant variable in the regression for mid Missouri hay, perhaps because the price scenarios were too low to be relevant to producers. Some producer characteristic variables were also significant in explaining willingness to supply as well. In Illinois acres planted wheat, involvement in CRP, off-farm employment, a history of selling biomass, and willingness to put straw in windrows and store it on-farm were significant for straw willingness to supply. An interesting tradeoff resulted for the Missouri results where farmers with more wheat acres would supply more straw, but farmers with higher amounts of corn acreage had a lower willingness to supply straw. This could reflect soil management considerations.

For regressions where willingness to supply stover was the dependent variable more factors impacted producers' willingness to supply in Illinois than in Missouri. In Illinois, farmers who practice conservation tillage were willing to supply less stover and an unexpected result showed that farmers with a college education and who had prior experience selling biomass were less willing to supply stover. In Missouri, farmers who owned transport equipment and who are willing to put corn stover in windrows had a lower willingness to supply.

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