Land Quality Perceptions in Expert Opinion Surveys: Evidence from Iowa

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Abstract (100 words or less)

While many opinion-based surveys ask land values for different land quality classes, little is known how survey respondents perceive the land quality. Using the 2015 Iowa Land Value Survey, this article examines how respondents perceive land quality in their responses to land value questions. Our results show agricultural professionals seem to perceive land quality with respect to specific regions, and high, medium and low land quality should be interpreted locally within a crop reporting district. This case study suggests that it is difficult to generalize uniform yield or soil productivity index ranges for land quality questions in all opinion-based surveys.

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Introduction

Land is the most valuable asset in the U.S. farm sector. Valued at 2.31 trillion U.S. dollars in 2016, farm real estate (land and structures) accounted for 85% of total U.S. farm assets (USDA ERS 2016a). Because it comprises such a significant portion of the balance sheet of U.S. farms, changes in the value of farm real estate have an important bearing on the farm sector's financial performance. Farm real estate also represents the largest single item in a typical farmer's investment portfolio. Land is a principal source of collateral for farm loans and a key component of many farmers' retirement funds. Changes in land values affect the financial well-being of landowners.

Many view farmland transaction prices as the best measure of farmland market trends. However, when solely relying on transaction prices, there are several challenges to understanding farmland market trends. First, the farmland sales market is very thin—the amount of farmland sold each year typically only represents 1%–2% of all farmland in the U.S. (Zhang, Ward, and Irwin 2014), and even less for arm's length transactions. Second, the farmland market tends to be localized and heterogeneous in crop-livestock mix, land use types, and land quality, even within a state. Third, farmland owners tend to hold onto land, especially top-quality land, for a long time—more than half of all farmland owned by Iowa landowners was bought more than 20 years ago (Duffy 2014). While it does not necessarily suggest that appraisers do not have enough land sales available to establish credit market value of the land, it does make it difficult to keep up with recent trends in any particular localized farmland market, especially for those professionals and investors who do not track individual auction sales from multiple companies. In addition to farmland transactions, opinion-based surveys often provide consistent and complimentary information on farmland market trends at the county, district, and state-level.

In lieu of transaction data, many land grant universities across the Midwest, the U.S. Department of Agriculture (USDA), the Federal Reserve Bank system, and many agricultural professional associations conduct annual or quarterly opinion surveys to gauge the pulse of the farmland markets. These opinion surveys of market participants and farmers (in the case of USDA) or agricultural professionals otherwise, are often directly based on recent land transactions and provide valuable, complimentary information on farmland markets. Previous empirical analyses have suggested that survey data are a good indicator of the historical and current path of land values (Zakrzewicz et al. 2012; Stinn and Duffy 2012). The results of these opinion surveys are widely used in farmland investment, rural property appraisal, agricultural consulting, farm management and estate planning.

Initiated in 1941, the Iowa Land Value Survey represents the longest running annual opinion survey of farmland markets in the U.S. and is widely used by agricultural stakeholders in Iowa, the Midwest and across the country (Zhang 2015a).

Many farmland value surveys cover several different land use types such as cropland, pastureland, and timberland. In addition, cropland is often categorized into top, average, and poor quality classes (for examples, see surveys conducted in Indiana, Ohio, Illinois, North Dakota, Iowa, and Nebraska). Table A1 in the appendix provides a description of other surveys, especially how they ask land quality questions, which varies from explicitly defined crop yield ranges to respondent-reported values on soil quality or crop yields, and non-specified in many cases. While land quality is one of the most significant characteristics for farmland values, we lack a clear understanding on how land quality is subjectively defined or perceived by participants of many of these opinion surveys.

This article analyzes how the respondents to opinion-based surveys perceive land quality in their answers to land value questions. We also investigate whether or not they view high, medium, and low quality with state-wide yield ranges or as relative to their service area. We will use the 2015 Iowa State University Land Value Survey as an example. However, the findings are informative and useful to understand the survey methodology and interpretations of all opinion-based surveys, especially those conducted by other land grant universities.

Unique to our study region, Iowa started a process to change its soil productivity system that has been used since the early 1970s. In addition to understanding how agricultural professionals or producers perceive land quality in opinion-based surveys, this study analyzes how accurately the respondents understand the change from the original Corn Suitability Rating (CSR) to a new Corn Suitability Rating 2 (CSR2) in 2013, especially the correlation between reported CSR values with land values and the consistency of reported values with empirical soil data evidence.

Background on the CSR System[i]

Introduced by Thomas Fenton of Iowa State University in 1971, the corn suitability rating (CSR) is a soil productivity rating for Iowa soils ranging from a low of 5 to a high of 100. Since its inception, CSR has gained widespread use by farmland owners, tenants, and other land professionals (Jensen 2013; Burras et al. 2013). CSR values are often used when figuring farmland indexes such as land values and cash rents, as well as individual real estate property taxes. The CSR values are designed to measure inherent soil productivity under average management. The correlation with long-term corn yields is shown in Figure A1 in the appendix.

Iowa State University Extension and Outreach introduced an updated rating system in 2013. The new system is simply named Corn Suitability Rating 2 (CSR2). A major difference between the two systems is climatic considerations. The original CSR index was developed using weather data from the 1950s to 1970s. At that time, western Iowa had a relatively drier climate. As a result, the original CSR had adjustments to compensate for the difference in climate as you moved across Iowa from the southeast to the northwest. When compared to southern and eastern Iowa, these adjustments resulted in lower ratings for soils with similar properties located in the northern and western parts of the state. The climate, especially precipitation patterns, has changed noticeably since the 1970s with a 5–7-inch increase in normal rainfall across central, northwestern, and western Iowa. The new CSR2 uses the last 30 years of weather data, from 1981 to 2010, and as a result, the climatic adjustments have been eliminated from the new calculations.

The new CSR2 is designed to be transparent in how soils are rated. CSR2 was developed for Iowa but it could be calculated for soils anywhere in the world with similar soil data available. At the present time, Iowa is the only state that uses a CSR indexing system.

As explained above, the most significant change in the new CSR2 system is that the new CSR2 no long has an adjustment for climate. The lighter areas in Figure 1 below clearly show that northwest, west-central, and north-central parts of Iowa saw a greater increase in the county weighted average CSR2 values relative to the average CSR values. In addition, the CSR2 now assigns the same CSR2 values to all soils of the same types rather than making adjustments at the county level. For more details regarding the CSR system and the transition into CSR2, please read Jensen (2013).

[Insert Figure 1 Here]

Land Quality Questions in the Opinion-based Surveys. Many opinion-based surveys conducted by Midwestern land grant universities, USDA, and the Federal Reserve bank ask land quality questions. However, how land quality is defined, and how the question is posed, varies significantly across various opinion-based surveys. Table A1 in the appendix shows how land quality questions are presented in more than ten opinion-based surveys of land values throughout the Corn Belt. For example, quality definitions range from statewide pre-specified ranges of crop yields in the Illinois Farmland Value Survey, to pre-specified ranges based on Land Capacity Classifications in the Nebraska Real Estate Market Survey, to subjective average crop yields reported by respondents, such as in surveys conducted by Ohio State University and Purdue University. In contrast, USDA solicits land value estimates from producers for a spatially delineated parcel, while the Federal Reserve Bank of Chicago does not offer specific land quality definitions. Given the substantial variability across the surveys, we use Iowa State University Land Value Survey as a case study to offer some insights on how these land quality questions are perceived by agricultural professionals.

Sponsored annually by Iowa State University (ISU) Extension and Outreach and ISU Center for Agricultural and Rural Development (CARD), the Iowa State University Land Value Survey is intended to provide information on general land value trends, geographical land price relationships, and factors influencing the Iowa land market. The survey is not intended to provide an estimate for any particular piece of property. The survey is based on reports by licensed real estate brokers, farm managers, appraisers, agricultural lenders, and selected individuals considered to be knowledgeable of land market conditions. The Iowa Land Value Survey is the

only consistent data source that provides an annual land value estimate for each of the 99 counties in Iowa (Zhang 2015a).

Participants in the survey are asked to estimate the value of high, medium, and low quality land in their county as of November 1st each year. These individual land value responses are used to calculate not only average land values at the crop reporting district and state level,[ii] but also district- and state-level estimates for high, medium, and low quality land. County-level estimates are not directly from the survey itself, but rather derived from a procedure that combines the ISU survey results with data from the U.S. Census of Agriculture. Specifically, the ISU survey responses are first used to derive an unadjusted average for one county, which will then be adjusted using the ratio of land values for that county relative to the district average from the last five rounds of U.S. Census of Agriculture (Harris 1980). This procedure also takes into account the effects of neighboring counties from districts delineated using similar spatial land quality patterns following the work by Walker (1976).

Previous research has shown that the state land value estimates from the ISU survey are consistent with the survey results from USDA, the Federal Reserve Bank of Chicago, and the Realtors Land Institute, which can be seen through a newly developed web-portal accessible at www.card.iastate.edu/farmland/ (Zhang 2015b). Stinn and Duffy (2012) compared the ISU survey results with arm's length farmland sales prices from 2005 to 2011,[iii] and found sale prices are not statistically significantly different from the ISU survey averages. The Iowa Land Survey is a well-respected, widely-used, and consistent source of information for farmland values in Iowa and across the Midwest.

[Insert Figure 2 Here]

Figure 2 presents the land quality questions from the 2015 Iowa Land Value Survey. In particular, we asked the average CSR and CSR2 for high, medium, and low quality land for a particular county. Survey respondents who provided estimates are given their past year's estimates as a reference.

Survey Results

Table 1 shows the different categories depending on whether or not the respondents reported some quality measure of the CSR and/or CSR2 value associated with the land value estimates. As shown in Figure 2, respondents were given the choice of reporting the CSR and/or the CSR2 value corresponding to their estimated land value. The CSR measures were used in lieu of crop yields in terms of bushels per acre because the CSR is a measure of soil quality whereas yields can also reflect weather, management, and other factors.

CSR and CSR2 are valued from 5 to 100. There were 38, or 6%, of the responses with incorrect numbers for CSR or CSR2 values (i.e., greater than 100). Thus, we categorize these responses as misinformed about the system—it is hard to interpret someone who reports using an index but then gives a number not possible using that index.

Table 1 shows that the majority of the responses, 75%, reported using one or both of the soil quality indices. Most of the responses reported the value for both indices in their determination

of high, medium, and low quality land. Over half of the responses using an index value used both CSR and CSR2 values.

As shown in Table 1 almost one-fifth, 19%, of the responses did not report an index value. It is not possible to tell from the data if some other method was used to distinguish between high, medium, and low quality farmland. These responses provided estimates based on quality of the land determined on a personal basis.

[Insert Table 1 Here]

Impact of Primary Occupation

The discussion to this point has focused on the responses to the land value survey. Survey respondents were able to provide value estimates and CSR ratings for more than one county. As a result, the number of responses is greater than the number of respondents. We used the number of responses for Table 1 because the respondents provided different land value estimates and CSR or CSR2 values for each county in their responses.

Table 2 presents the breakdown of the respondents by their primary occupation and type of quality measure they reported using with their land value estimates. Respondents are used instead of responses because a person responding for more than one county will only have one occupation. Including all responses could have introduced a bias towards those who reported for more than one county.

Agricultural lenders were the most frequent respondents to the land value survey, representing 38% of the respondents. Lenders also represented 46% of respondents who did not list a measurement value.

The top four occupations represented 81% of all the survey respondents, with appraisers, lenders, farm managers, and sales accounting for 14%, 38%, 16%, and 13% of respondents, respectively. Over 85% of the appraisers and farm managers reported an index value used for the quality of land. These results reflect that farm managers and rural appraisers routinely use farmland transactions data, which typically has parcel-level CSR or CSR2 information. In contrast, agricultural lenders may be more familiar with the financial aspects of farmland transactions.

[Insert Table 2 Here]

Summary Statistics on CSR and CSR2 Responses

Table 3 presents the summary statistics for the CSR and CSR2 values reported by land quality. To construct Table 3, we combined the responses for those who gave both indices with those who only provided CSR or CSR2 values. The results for those who reported both the CSR and CSR2 values were not significantly different from those who reported either only CSR or CSR2, so we combined the estimates.

[Insert Table 3 Here]

The CSR values reported are lower than the corresponding CSR2 values. This is to be expected because of changes in how the two indices are calculated. Dropping the climatic factor increased the values for northern and western Iowa, which generally have higher productivity than the southern areas of the state. This suggests that agricultural professionals are familiar with the change in the CSR system and their reported soil productivity indices are consistent with the objective measures published by Iowa State University agronomists.

Table 3 shows the expected results with respect to the index values. The values are the highest for the high quality land and lowest for the low quality land. In Table 3 we also present the coefficient of variation, the standard deviation divided by the mean, which provides a unitless measure that could compare the relative variability of index values across land quality classes. Table 3 shows that the coefficient of variation increases from high to medium to low quality land. On one hand, this may result from more limited supply for higher quality land, and on the other hand, the greater dispersion for index values for low quality land may reflect the mixing of pasture and less productive cropland in this category. The coefficient of variation for CSR and CSR2 is similar for all three land categories.

Many growers and people working within the Iowa land market use the “dollars per point” as a measure to compare different land sales. The dollars per point is simply the dollars per acre divided by the weighted average CSR or CSR2 for a particular property. This heuristic measure assumes that the fundamental soil productivity of land is the primary factor for driving farmland values, especially in the Corn Belt. Discussing the desirability and pros and cons of using this measure is beyond the scope of this paper. Suffice it to say, people do compare based on dollars per soil quality point. Readers interested in learning more about this measure could read Seifert and Sherrick (2016) for a discussion of this measure in Iowa, Indiana, and Illinois.

Table 4 shows the dollars per point for the two land quality indices and the three land quality measures. Similar to Table 3, the reported values follow the expected pattern for decreasing dollars per point with lower land quality. This suggests that survey respondents feel that high quality farmland in Iowa is worth more for one unit in the inherent soil productivity compared to lower quality land. This, again, likely reflects a limited supply of high quality farmland. In addition, notice that the dollars per point are higher for the CSR measure than the CSR2 measure. This reflects the higher CSR2 values shown in Table 3. A constant dollar estimate for the land value divided by a lower number gives a higher dollar per point.

[Insert Table 4 Here]

The coefficients of variation are higher as the quality of the land decreases (similar to Table 3). More importantly, the coefficient of variation is much larger for the dollars per point relative to the absolute index value. The lower quality land shows a much wider CV for both the CSR and CSR2. This may reflect that land value estimates could be influenced by a host of other factors beyond soil productivity, including distance to population centers and potential development pressure, recreational opportunities of the land, and distance to grain markets.

[Insert Table 5 Here]

We also investigated the correlation between the reported CSR2 values with land value, dollars per CSR2 point, as well as with reported CSR values. Table 5 presents the estimated correlation coefficients for various measures in the land value survey and land quality designations. The correlation coefficient is a measure of the relationship between two random variables. The coefficients shown in Table 5 were produced in Excel. First, note that there is a strong correlation between reported CSR responses and reported CSR2 values for all three quality classes. It is also obvious that the correlation between these two soil quality measures are lowest for high quality land, which may result mainly from a large increase in soil quality index values for high quality soils in northwest Iowa due to the shift to the CSR2 system. The strong correlations between the reported CSR2 responses and land value and dollars per CSR2 point indicate that soil quality indexes, such as CSR2 in Iowa, are a useful and valid indicator in farmland management, appraisal, and valuation. The higher correlation between CSR2 and dollars per CSR2 point, especially for high quality land, confirms our earlier discussions that survey respondents feel that high quality land is worth more for one unit of soil productivity index compared to low quality land. This finding, consistent with Seifert and Sherrick (2016), again reflects the limited supply for high quality land as well as the large quality variations for low quality land.

Land Quality Perception Differences across Districts

The USDA divides Iowa into nine crop reporting districts (CRD). The CRDs contain approximately the same number of counties; and, for the most part, they have similar land quality and land use patterns.

Table 6 shows the average and standard deviation for each CRD and for both the CSR and CSR2 responses. The numbers for the State of Iowa are similar to the ones presented in Table 3.

[Insert Table 6]

Table 6 illustrates the difficulty with using specific yield ranges or soil quality measures to define high, medium, and low quality land for all farmland in Iowa. Our results seem to suggest that agricultural professionals perceive high, medium, and low quality with respect to their area or district. Note that the average CSR2 for high quality land in the Southwest and South Central districts are less than the average CSR2 for the medium quality land in Northwest district. In addition, comparing across the CRDs shows a difference of 19% between the high and low CSR for the high quality land. Comparing medium quality land there is a difference of 28% between the high and the low average CSR. Low quality land shows a difference of 39% between the high and low CRD values.

The pattern of higher average CSR or CSR2 for the higher quality land continues to exist for all CRDs. The pattern for the higher CV going from high to low quality land also continues for all CRDs. In some CRDs the CV is triple for the low quality land relative to the higher quality land.

Differences between Response Values and the Actual Calculated Values

The original CSR values were developed and maintained by Iowa State University. CSR2 was developed by Iowa State University but it relies on values provided by the USDA National

Resource and Conservation Service (NRCS). The estimates are publically available. The official values are available in the Iowa Soils Properties and Interpretations Database (ISPAID).

Table 7 shows a comparison between the average CSR and CSR2 responses for medium quality land to the survey and the calculated weighted average CSR and CSR2 values from ISPAID. The average from ISPAID was calculated by averaging the CSR and CSR2 values weighted by USDA NRCS acres.

[Insert Table 7 Here]

The difference in the reported and the actual weighted average values were not statistically significantly different at the 90% level in 5 of the 9 CRDs for CSR and in 6 of the 9 CRDs for the CSR2 estimates. Table 7 shows that the reported CSR2 values are significantly higher for the ISPAID actual weighted average especially in East Central, South Central and Southeast districts. This could likely be resulting from the fact that ISPAID includes all soils, even soils that are not farmed, when calculating the weighted-average CSR and CSR2 values. In other words, a weighted average for soils used for agricultural production excluding non-farmed acres would yield a higher value than the current weighted average, which will shrink the gap between reported CSR and CSR2 values.

Discussion

Opinion surveys have been the mainstay for providing estimates for changes in land values for many years by a variety of different groups and institutions. There are different classifications of survey respondents, different time periods, different questions asked and so forth. However, all opinion surveys solicit the opinion of the respondent. While these opinions cannot be directly used to infer land value for a particular parcel, they provide useful benchmarks on general farmland market trends at the county, crop reporting district, and state level.

This paper focused on the perceptions of land quality differences when people respond to the opinion-based surveys of land value. Some surveys, like the one conducted by the University of Illinois, provide explicit and common crop yield ranges for the respondents in completing the survey. Other surveys simply use a high, medium, and low quality or some other opinion categorization rather than a specific measure. While the land value for different land quality classes are commonly used by agricultural professionals, there is no clear evidence on how land quality is subjectively defined or perceived by the respondents in many of these opinion surveys. To our knowledge, this paper provides the first empirical evidence on land quality perceptions in opinion surveys using the ISU Land Value Survey as the case study.

We found that 75% of the ISU Land Value Survey respondents do have some quantitative measure in mind when they record a value estimate based on land quality. Another 6% reported using an ISU soil ranking system, but they reported a number outside the range of possible values. What this means is subject to speculation, however, in general, we treated these respondents as misinformed and did not use their responses in the analysis. The remaining respondents, 19%, did not report using an Iowa soil productivity index as a measure for their responses. This does not mean they did not use some type of scaling mechanism when estimating their land values but they didn't report using the CSR system, the most common Iowa system.

The lending community represented 38% of the respondents but almost half (46%) of those who didn't report using a soil productivity value. Appraisers and farm managers were 30% of the respondents and represent 15% of those who didn't report a soil productivity value. It is quite likely people had some yield level in mind when they made their distinction between land qualities.

A significant finding is how the survey respondents perceive high, medium, and low land quality with respect to their region. For example, the reported soil productivity value for high quality land in south-central Iowa is lower than the average productivity value for medium quality in northwest Iowa. This illustrates a difficulty using statewide pre-specified yield or soil index ranges when asking quality-specific land value questions in opinion surveys. In addition, this regional heterogeneity is also revealed from the range in values for the productivity measure reported throughout the state. The difference between the highest average soil productivity estimates by area of the state for each land classification was significant. The differences ranged from approximately 20% for high quality estimates, to 30% for medium quality estimates, to 38% difference between the high and the low average reported value for the low quality land.

The variation in responses increases going from high, medium, to low quality land. This result is similar to the increasing differences within a land class between regions. The primary reason for the wider dispersal of estimates as land quality decreases is the increasing amount of land farmed in the lower quality. In other words there is more variability in land falling into the lower quality.

This study also showed the adaption process for converting from the CSR to CSR2 land rating system. Both measures, CSR and CSR2, were given in 42% of the responses; and, over half (55%) reported using the CSR2, suggesting that many agricultural professionals have embraced

371 the CSR2 system. The CSR system has been in place for almost 40 years and the conversion to
372 the CSR2 started in 2013.

373 This paper has several important implications for professional farm managers, rural appraisers,
374 agricultural consultants and investors, as well as those interested in the farmland market. First,
375 using the 2015 ISU land value survey as an example, we find that the majority of agricultural
376 professionals who responded to the survey have a quantifiable measure in mind when they make
377 the distinction among land classifications. This suggests that a soil quality index, such as CSR
378 and CSR2 employed in Iowa, is a salient measure used by agricultural professionals when
379 evaluating farmland market trends and individual investment opportunities. This finding is
380 consistent with the fact that farmland auctions highlight average CSR2 or other soil quality index
381 as one of the most important characteristic for a farmland parcel for sale.

382 A second finding is that the perceptions of land quality vary significantly across regions—the
383 average soil productivity measure in southern Iowa for high quality land is lower than that for
384 medium quality in northwestern Iowa. This wide spread in the average value between regions
385 suggests that if a specific range for each of the land classes is pre-specified, the ranges would
386 have to be wide or else tailored for specific regions. This finding sheds light on the interpretation
387 of land quality and land value for all opinion-based surveys. In particular, our analysis suggests
388 that land quality, even not explicitly specified in opinion surveys, tends to be perceived relative
389 to a specific region as opposed to conforming to uniform statewide ranges of crop yields or soil
390 quality indexes. Practically, this mean that agricultural professionals are encouraged to employ
391 region-specific soil quality values for high, medium, and low quality land classes, and explore
392 spatial variations in the marginal contribution of land quality improvement in land values.
393 Similarly, researchers are encouraged to incorporate regional fixed effects in hedonic analyses of

farmland markets and explore regional-specific capitalization impacts of land quality in farmland values.

Finally, our paper revisits the tradeoffs between farmland transaction prices and opinion surveys of farmland market participants. Previous research has established that opinion surveys of agricultural professionals, which are often indirectly relying on recent farmland sales, are good indicators of farmland market trends and on average, and not statistically different from farmland transaction prices (Stinn and Duffy 2012). However, previous studies argue that appraised values or opinion surveys could estimate the value of natural amenities (Ma and Swinton 2009), which may imply more caution is warranted when analyzing survey data in regions with lakes or streams or greater hunting presence. In addition, in times of rapidly changing land values, the differences across different surveys at different times, and the deviation of opinion surveys from the transaction prices may fluctuate more widely (Stinn and Duffy 2012). Given the low turnover ratio and localized nature of farmland market, the opinion surveys of agricultural professionals, such as the ISU land value survey examined in this paper, provide valuable insights in gauging the pulse of farmland market across the Midwest.

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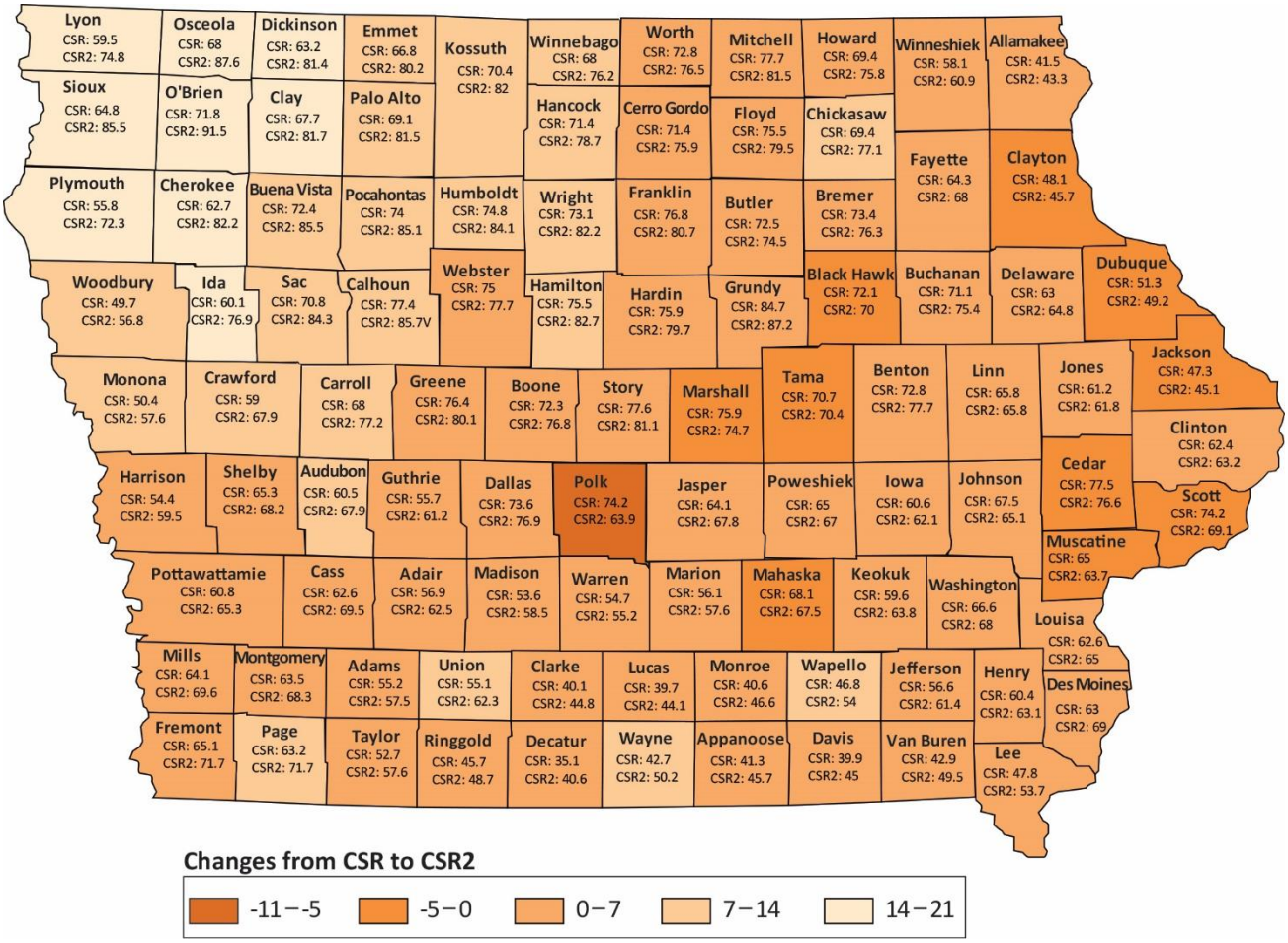
Figures

Figure 1. Changes from the CSR system to the CSR2 system in Iowa



472 Figure 2. Land Quality Questions in the 2015 Iowa Land Value Survey

Farmland values in your primary county as of November 1, 2015

1. Land values for average-size farms in PRIMARY County are:

	Your reported values last year ($/acre)	Your present estimates ($/acre)	Your estimated average CSR	Your estimated average CSR2
High quality land	2014 HIGH VALUE			
Medium quality land	2014 MEDIUM VALUE			
Low quality land	2014 LOW VALUE			

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Tables

Table 1. Number and Percentage of Responses by Type

		# Responses	Percent
Misinformed (reported value > 100)		38	6%
Provided valid responses	**Both CSR and CSR2**	290	42%
	CSR only	136	20%
	CSR2 only	91	13%
No values		134	19%
All responses		689	100%

481 Table 2. Respondents by Response Types and Primary Occupation

Primary Occupation	# Respondents Who are Misinformed	# Respondents that Provided Valid CSR2 or CSR Responses	# Respondents Who did not report CSR or CSR2 values	# Respondents
Appraiser	3	60	6	69
Ag Lender	14	135	46	195
Farm Manager	5	63	11	79
Farmer	1	29	10	40
Extension		4	1	5
FSA	1	4		5
Non-FSA Government		18	4	22
Sales	8	47	14	69
Other		13	7	20
Blank	2	3	2	7
Total Number of Respondents	25	220	272	511

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Table 3. Summary Statistics on Reported Average CSR and CSR2 by Response Types

Variable	CSR Responses			CSR2 Responses		
	Mean	Std dev	CV	Mean	Std dev	CV
Reported Average Value for High Quality Land	79	9	0.12	84	8	0.10
Reported Average Value for Medium Quality Land	67	11	0.17	72	11	0.16
Reported Average Value for Low Quality Land	55	14	0.26	58	15	0.26
# Respondents	314			282		
# Responses	430			393		

487 Table 4. Summary Statistics on Land Value per CSR or CSR2 Point by Response Types

Variable	CSR Responses			CSR2 Responses		
	Mean	Std dev	CV	Mean	Std dev	CV
Calculated Dollars per Index Point for High Quality Land	$122	$27	0.22	$115	$19	0.17
Calculated Dollars per Index Point for Medium Quality Land	$109	$24	0.22	$103	$19	0.19
Calculated Dollars per Index Point for Low Quality Land	$97	$47	0.49	$90	$47	0.52

# Respondents	314	282
# Responses	430	393

488

Table 5. Correlation Coefficient between Land Values, $/CSR2 and CSR with CSR2

	Reported CSR2 for high quality land	**Reported CSR2 for medium quality land**	**Reported CSR2 for low quality land**
Land Value	0.58	0.58	0.55
$/CSR2	0.87	0.74	0.58
Reported CSR Values	0.76	0.87	0.91

Note: The land value, $/CSR2, and CSR values are corresponding to respective land quality classes, e.g., the estimate correlation coefficient between land value for high quality land and reported CSR2 values for high quality land is 0.58.

Table 6: Summary statistics of reported average CSR and CSR2 and the standard deviations from the 2015 Iowa Land Value Survey

	High		Medium		Low		#
	CSR	**CSR2**	**CSR**	**CSR2**	**CSR**	**CSR2**	**Responses**
Iowa	79 (9)	83 (8)	67 (11)	72 (11)	55 (14)	58 (15)	426
Northwest	76 (7)	89 (6)	69 (5)	81 (8)	59 (10)	67 (13)	58
North Central	81 (5)	85 (5)	72 (8)	76 (7)	62 (9)	66 (13)	53
Northeast	80 (6)	83 (7)	68 (9)	71 (11)	54 (14)	55 (14)	54
West Central	75 (8)	81 (7)	64 (10)	70 (11)	55 (18)	59 (13)	44
Central	84 (6)	87 (4)	74 (9)	76 (8)	60 (13)	63 (13)	67
East Central	84 (6)	87 (5)	71 (6)	74 (6)	55 (11)	60 (13)	52
Southwest	73 (10)	79 (7)	61 (10)	66 (9)	49 (12)	52 (11)	40
South Central	68 (13)	71 (14)	53 (14)	56 (15)	38 (11)	42 (13)	36
Southeast	80 (9)	80 (7)	67 (11)	67 (10)	49 (11)	53 (13)	36

Note: the standard deviations of reported CSR and CSR2 are shown in the parentheses.

499 Table 7. Differences between reported average CSR2 values for medium quality land and the
500 actual average CSR2 from ISPAID

Crop reporting district	Average CSR Difference		Average CSR2 Difference	
	# Responses	Average Difference	# Responses	Average Difference
Northwest Iowa	47	-2.6**	56	1.8*
North Central Iowa	41	-2.9**	53	-1.0
Northeast Iowa	52	3.6*	49	2.8*
West Central Iowa	44	0.9	42	-0.3
Central Iowa	59	-0.2	67	0.3
East Central Iowa	47	6.6**	51	3.5**
Southwest Iowa	41	0.4	35	2.4
South Central Iowa	25	3.9	36	4.9**
Southeast Iowa	35	5.5**	36	7.8**
State of Iowa	391	1.5**	391	2.1**

501

502 Note: The t-statistic is for the student's t-test whether the difference between reported average
503 CSR2 and ISPAID actual average equals to zero. * and ** suggest that the t-statistic is
504 significant at 10% and 5% level, respectively.

505

Appendix

Table A1. Land Quality Questions in Midwestern Expert Opinion Surveys of Land Value

Survey Source	Land Quality Questions	Note	Data Source
U.S. Department of Agriculture June Agricultural Survey	The respondent is asked to provide the best estimate of the market value of agricultural land by cropland and permanent pasture with the value of all dwellings and buildings excluded for acres within the area-sampled boundary.	The reported market value estimate is provided at the parcel level, while no specific land quality information is provided.	USDA NASS (2016)
Federal Reserve Bank of Chicago City	The agricultural lender is asked to provide the present market value of good farmland in his/her area? And the respondent is asked to exclude the best farmland as well as that of below average productivity from his/her considerations.	No specific land quality classes are provided.	Oppedahl (2016)
Iowa Land Value Survey	Farmland quality classes are broken into high, medium and low quality classes, and the respondents are asked to provide corresponding average crop productivity index for each quality class. Specifically, the respondent is asked to provide the average Corn Suitability Rating and Corn Suitability Rating 2 for each of the three land quality class.	Subjective average crop productivity indexes are reported by respondents.	Zhang (2015a)
Realtor Land Institute Iowa Chapter	The farmland is divided into several land quality classes, including high quality cropland, medium quality cropland, low quality cropland, pasture land, non-tillable timber land, and CRP land.	No specific explanations for the land quality classes.	Hansen (2016)
Michigan Land Values and Leasing Rates Survey	Non-irrigated field cropland tiled for drainage; non-irrigated field cropland not tiled; irrigated field cropland; sugar beet; fruit trees-bearing; acreage suitable for tree fruit	Land Use Type	Wittenberg and Wolf (2015)
Illinois Farmland Value Survey	Farmland quality classes are determined by objective expected corn yields: excellent: > 190 bu/acre; good: 170-190 bu/acre; average: 150-170 bu/acre; and fair: <150 bu/acre	Explicit objective yield ranges	Schnitkey (2016);

Ohio Cropland Values and Cash Rents Survey	Farmland quality classes are broken into top, average and poor classes, and the respondents are asked to provide the long-term average (5 year) corn/soybean yields with typical farming practices for each quality class.	Subjective average corn and soybean yields are reported by respondents.	Ward and Shrinkle (2016)
Indiana Land Value and Cash Rents Survey by Purdue University	Farmland quality classes are broken into top, average and poor classes, and the respondents are asked to provide the long-term average (5 year) corn yields with typical farming practices for each quality class.	Subjective average corn and soybean yields are reported by respondents.	Dobbins and Cook (2016)
South Dakota Farm Real Estate Market Survey	Farmland is broken into several land use types, and with each land use type the respondent is asked provide land value for average value, lower value and higher value agricultural land, which "usually has average yields, below-average yields, and above-average yields".	The survey provided descriptive yield-based explanations for land quality classes.	Janssen (2015)
North Dakota NASS Land Rent and Value Survey	The respondent is asked to provide average market value for the following land use types, including cropland rented for cash and pasture land.	No specific instructions are provided for each land quality class.	ND Trust Lands (2016)
Nebraska Real Estate Market Survey	Farmland is broken into several different land use categories such as dryland cropland, grassland, hayland, irrigated land. And the survey asks for information about the range in current average per acre values of these types of farm or ranch real estate. For example, high grade cropland would be Class I while low grade cropland would be Classes III & IV.	Land quality class is determined using Land Capacity Classifications, but rather than 8 levels defined by USDA, this survey seems to classify land quality into 4 classes.	Jansen and Wilson (2016)
Missouri Farmland Value Survey	Cropland is broken into good, average and poor, but with no specific explanations for these categories. Instructions are provided:" include only tracts larger than 40 acres not being converted to development or commercial uses. Land in CRP should be considered cropland".	Category not specifically explained in the questionnaire.	Plain and White (2015)

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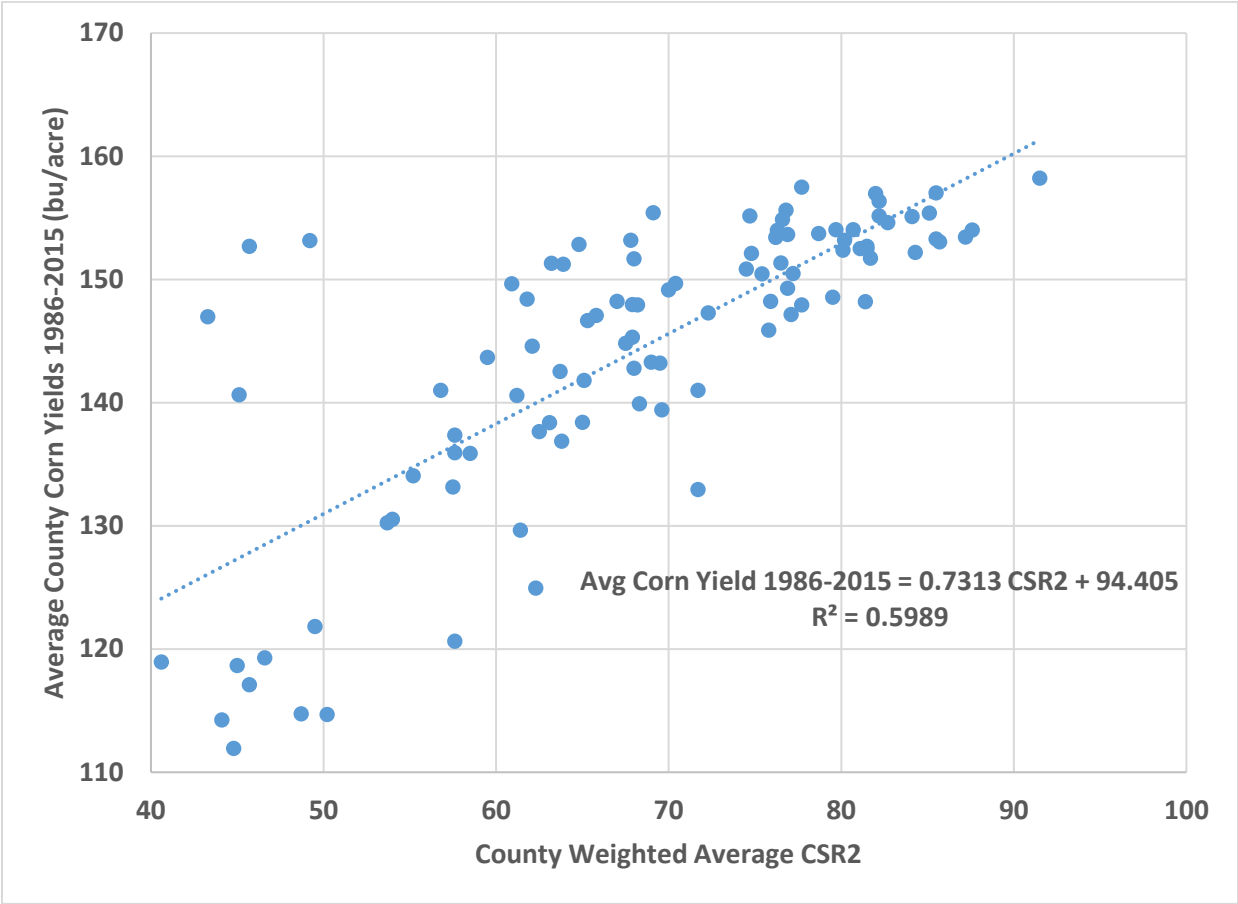
509

510 Figure A1. Scatterplot of County Average Corn Yields 1986-2015 vs. Average CSR2

511



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513

514 **Grouped Footnotes**

[i] The main text of this section is adapted from Jensen (2013).

[ii] Iowa has nine crop reporting district with each district approximately covering nine neighboring counties.

[iii] Arm's length means that the transaction occurs in which buyers and sellers of the farmland act independently and have no relationship to each other (e.g., they are not relatives).