Information Rigidities and Farmland Value Expectations

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Abstract

This study examines the degree to which information inefficiency influences farmland price expectations. Using expectations and observed values of Iowa farmland from 1964 to 2021 and the empirical test of Coibion and Gorodnichenko (2015), this study estimates the degree to which information rigidities hold explanatory power for information inefficiency. Our results suggest Iowa farmland professionals infrequently update their information set or underweight new information. This study provides a necessary step toward a better understanding of the role of information in farmland market efficiency, furthering the discussion of development of additional public information in farmland markets.

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Introduction

Farmland markets are typically associated with high transaction costs, private valuations, and low and seasonal turnover.[1] These potential inefficiencies are concerning for two reasons. One, farmland accounts for a large share of the value of the sector's assets (U.S. Department of Agriculture, Economic Research Service, 2024). Two, the US farmland market experienced pronounced periods of boom and bust in the 1910's and 1980's. As a result, farmland owners are frequently concerned about the potential for another large scale decline in farmland market prices (Zhang and Tidgren, 2018). Sherrick and Barry (2003, pp. 46) suggest that "Government policy could play a role in enhancing market efficiency in farmland markets through information channels...". The authors argue that market inefficiencies could be overcome by "...more extensive and higher-quality publicly available information..." The goal of this paper is to examine the degree to which information inefficiency influences farmland market dynamics. We follow the empirical approach of Coibion and Gorodnichenko (2015), who examine how economic agents incorporate new information in updating their expectations of inflation. They show that agents may not fully incorporate new information into their inflation expectations because (i) agents are unable to distinguish the signal from the noise or (ii) agents update their information sets infrequently.

Coibion and Gorodnichenko (2015) examine a series of repeated expectations of inflation for various economic agents. The authors argue that the agents' expectations in aggregate should become more accurate over time due to increased information. Their empirical test examines the correlation between expectation accuracy and the degree to which agents adjust their expectations over time. When this correlation is statistically significant and positive, agents fail to fully incorporate all new information efficiently. Coibion and Gorodnichenko (2015) label this positive correlation as "information rigidity" because agents fail to fully adjust their expectations to new information or update their information sets infrequently. The key to this approach is the observation of repeated expectations of the same terminal event.

We exploit a series of repeated price expectations of Iowa farmland market professionals since 1964. We apply the testing framework of Coibion and Gorodnichenko (2015) to examine the degree to which information inefficiency influences farmland price expectations, which according to theory are a key determinant of realized market prices (Just and Miranowski, 1993). This research represents an important step toward a better understanding of the role of information in farmland market efficiency.

Our results detect the presence of information rigidities in price expectations of Iowa farmland professionals, in the sense that they either update their information sets infrequently or under-weight new information. Further, we show that the degree of information rigidities varies by location and throughout time. However, the accuracy of the expectations of Iowa farmland professionals is not fully explained by information rigidity. These findings, however, should be interpreted with the following limitations in mind. First, farmland market professionals who attend Iowa State University's Soil Management and Land Valuation conference (SMLV) are the source of our farmland expectations. SMLV participants have on average more than 20 years of experience in Iowa farmland markets (Zhang et al., 2021), yet we do not know whether they purchased or sold farmland in any given year. Second, we measure observed farmland market prices using the subjective values collected by the Iowa Land Value Survey (ILVS), rather than aggregate market transaction prices. While these survey values may differ from market transaction prices,[2] Stinn and Duffy (2012) find no statistical difference between average Iowa farmland transaction prices and the aggregate valuations of ILVS. Additionally, ILVS county land values are the only annual estimates available each year, and are used widely by county assessors in reviewing property tax assessments. Nonetheless, our results should be interpreted as suggestive evidence for the role of information in farmland market expectations.

This study may have direct implications for our understanding of how information, through expectations, effects farmland prices. Consistent with prior studies, we find that farmland market professionals may not fully incorporate new information when forming farmland price expectations (Kuethe and Ifft, 2013; Kuethe and Hubbs, 2017; Kuethe et al., 2021; Tegene and Kuchler, 1991). Within the information rigidity framework, we find that farmland market professionals may be unable to differentiate the signal from the noise or may update their information set infrequently. The information rigidity framework suggests a muted response to information shocks. As a result, information shocks are unlikely to lead to widespread mispricing. However, in the event that farmland market prices exceed market fundamentals, new information is unlikely to correct market prices quickly. In the spirit of Sherrick and Barry (2003), our results point toward the continued need for market information. The information rigidities framework suggests the need for “higher quality” information so that market participants can better distinguish signal from noise and “more extensive” and timely information to encourage frequent updating.

The rest of this paper is organized as follows. First, we describe our data, the survey-based measures of Iowa farmland price expectation and valuation. We highlight the co-timing of the survey collections which allow us to calculate expectation updating and accuracy. We then present the information rigidity test of Coibion and Gorodnichenko (2015) that exploits the expectation updating and accuracy measures of Iowa farmland prices. This section combines the methodology and results of our baseline estimation. The following three sections examine additional dimensions of information rigidity, the role of contemporaneous prices conditional on information rigidity, state dependence, and regional heterogeneity. Each of these sections presents methodology and results. We conclude with suggestions for future research and policy implications.

Data

Iowa's farmland market has been studied extensively by agricultural economists (Falk, 1991; Falk and Lee, 1998; Just and Miranowski, 1993; Lence and Miller, 1999; Miranowski and Hammes, 1984; Zhang et al., 2021). The Iowa farmland market is the largest of all Midwestern states, valued at $216 billion in 2020 (U.S. Department of Agriculture, National Agricultural Statistics Service, 2021). Further, Iowa State University maintains the longest expert opinion survey of farmland market conditions dating back to 1941.

Since November of 1941, Iowa State University's Iowa Land Value Survey (ILVS) collects subjective valuations of contemporaneous, county-level farmland values from land market professionals, including agricultural lenders, realtors, rural appraisers, and farm managers.[3] Beginning in May 1964, Iowa State University collects expert land value expectations from the farmland market professionals who attend the Soil Management and Land Valuation Conference (SMLV). SMLV is an annual extension and outreach event for land market professionals started in 1927. Iowa State extension educators conduct a voluntary survey of participants. The voluntary respondents provide their subjective expectation of Iowa farmland market prices six months later, in November of the current year which corresponds to the collection period of ILVS. In addition, the respondents also provide their subjective expectation of Iowa farmland market prices eighteen months later for the subsequent November.[4]

The repeated expectations follow the same structure as those studied by Coibion and Gorodnichenko (2015). We can examine the relationship between the accuracy of the six month farmland price expectations and how the expectations evolved between the eighteen and six month horizons to test for the presence of information rigidity in the price expectations of farmland market professionals. Coibion and Gorodnichenko (2015) stress that their regression-based test must be applied to aggregate expectations of individuals. Thus, our analysis is able to consider the expectations collected at the SMLV, as only the aggregate expectations are available dating back to 1964. There are some important differences between the expectations of SMLV and the market outcomes of ILVS that we must consider. As documented in the survey instruments provided in the appendix, the SMLV survey collects respondents' subjective expectations for farmland prices that are *representative* of their county. These expectations are aggregated by the mean of all respondents across the state of Iowa and within four regional quadrants. In contrast, the ILVS collects respondents' subjective current valuation for farmland prices that are *representative* of their county across three quality bands: high, medium, and low.

Respondents provide the percentage of their county that represents all three quality grades. These percentages are used as weights to create a weighted average of farmland prices *representative* of their county. We measure aggregate realized farmland prices as the weighted average of the subjective prices, as this value is likely to correspond to the mean across individual responses. Additionally, these weighted averages are representative of the county-level average land values that are published by Iowa State University annually since 1950.

While the sample of respondents may differ between the ILVS and SMLV surveys, we are relatively confident that the expectations correspond to the assumed outcome measure. SMLV is an extension event designed to provide the continuing education of land market professionals. As shown in appendix figure A3, the participants report six- and 18-month expectations for the land values in their primary county. Participants receive the brief, five minute survey in their registration package. Since 2016, the voluntary expectation survey also asks for the years of professional experience in the Iowa farmland market. This question was introduced to mirror a similar question in the ILVS. As shown in table 1, the mean experience of SMLV participants closely corresponds to that of ILVS respondents. The bottom panel of table 1 compares the number of respondents by occupation for both SMLV and ILVS. As expected, SMLV has a larger share of respondents who are frequently involved in land market transactions, including farm managers, rural appraisers, brokers, and lenders. The ILVS includes additional professions including farmers and landowners, as well as government professionals.

[Table 1 about here]

The solid line in figure 1 plots the *representative* farmland price for Iowa from the ILVS between 1964 and 2021, using the same previously described weighted average. The dotted line represents the aggregate expectations of the same year collected from the SMLV participants in the previous year, at an eighteen month expectation horizon. The dashed line represents the aggregate expectations collected from the SMLV participants during the same year, at a six month expectation horizon. For example, the aggregate 18 month expectation peaked for 2014 at \$10,042 per acre, collected in May of 2013. In May of 2014 the aggregate expectation of November 2014 land prices fell to \$8,568 per acre. Finally, the November ILVS reported an aggregate value of \$7,943 per acre for farmland across Iowa. The empirical test of Coibion and Gorodnichenko (2015) examines the correlation between the expectation error at the shortest horizon and the revision of the expectations across horizons. In our case, the expectation error would be represented by the percentage difference between the dashed and solid lines in figure 1. The revision of expectations would be represented by the percentage difference between dotted and dashed lines. The intuition of this empirical test is the expectations should be more accurate at shorter horizons than at longer horizons, as a result of information gains. The resulting correlation is therefore expected to be positive.

[Figure 1 about here]

Baseline Estimation of Information Rigidity

Coibion and Gorodnichenko's (2015) regression-based test of the correlation between expectation revision and error is as follows:

$$(A_t - F_{t-6}) = \alpha + \beta(F_{t-6} - F_{t-18}) + \varepsilon_t. \quad (1)$$

This test examines the role of information across the expectations formation process, beginning at the longest horizon. The first iteration of expectations is represented by F_{t-18}, which is expected percentage change from the most recently observed farmland price ($F_{t-18} = \ln \frac{f_{t-18}}{a_{t-24}}$, where f_{t-18} is the expected price in levels and a_{t-24} is the most recently observed farmland price in levels). The second iteration of expectations is similarly calculated at the sixth month horizon ($F_{t-6} = \ln \frac{f_{t-6}}{a_{t-24}}$), and the subsequently observed or actual farmland price is represented by $A_t = \ln \frac{a_t}{a_{t-24}}$. Thus, the left-hand side of (1) represents the percentage expectation error at the shortest horizon, and the right-hand side represents the revision in expectations between the 18-month and 6-month horizons. The correlation between the expectation revision and error is captured by β.

Our baseline estimation of (1) using ordinary least squares are reported in table 2. Coibion and Gorodnichenko (2015) show that when $\beta > 0$ agents do not incorporate new information efficiently when revising their expectations. As shown in table 2, $\hat{\beta}$ is statistically significant and positive.

[Table 2 about here]

Coibion and Gorodnichenko (2015) offer two ways to interpret $\hat{\beta}$. One, given a particular time period, agents update their information set every λ, where ($\hat{\lambda} = \hat{\beta}/(1 + \hat{\beta})$). Our estimation results suggest that Iowa farmland professionals update their information sets approximately every four months ($\hat{\lambda} = 0.363$). Two, new information is given a weight of G percent when agents are updating their information set, where ($\hat{G} = 1/(1 + \hat{\beta})$). Our estimation results suggest that Iowa farmland professionals place nearly two-thirds weight on new information ($\hat{G} = 0.637$). It is important to note that Coibion and Gorodnichenko (2015) stress that these interpretations of β are only valid when the expectations fail conventional tests of information efficiency. To provide a concise presentation of our results, the efficiency tests of Nordhaus (1987) are reported in the appendix table A1. These tests show that Iowa farmland professional's expectations meet the necessary condition of inefficiency.

It is important to note that there are alternate interpretations of $\beta > 0$. As highlighted by Nordhaus (1987), $\beta > 0$ can be interpreted at "forecast smoothing". The Coibion and Gorodnichenko (2015) interpretation of smoothing is the intentional dampening of revisions for the sake of reputation, and the use of aggregated expectations should alleviate intentional smoothing by individual respondents. This interpretation was also applied for USDA forecasters by Goyal and Adjemian (2023) in response to prior evidence of smoothing by USDA forecasters (Isengildina et al., 2006, 2013; Isengildina-Massa et al., 2017). Goyal and Adjemian (2023) suggest that $\beta > 0$ is more likely related to information rigidity than forecast smoothing. Alternatively, $\beta > 0$ could be interpreted as evidence of "asymmetric loss", where respondents place a different penalty on over-prediction relative to under-prediction (Capistrán and Timmermann, 2009). Previous research suggests that farmland market professionals in Indiana may place a greater weight on over-prediction relative to under-prediction for farmland price expectations (Kuethe et al., 2021). Further, previous research suggests that there are a limited set of circumstances under which asymmetric loss leads to $\beta > 0$ (Capistrán and Timmermann, 2009). We can not rule out the presence of asymmetric loss, yet asymmetric loss would be conditional on information rigidity.

Additional Dimensions of Information Rigidity

Given the finding of information rigidity in the farmland price expectations of Iowa farmland professionals, we examine three additional dimensions under which information rigidity may vary. First, we examine whether information rigidity fully explains information inefficiency in farmland price expectations. Information efficiency implies that all contemporaneous information is contained in expectations. As a result, conditional on information rigidity, contemporaneous information should hold no relationship with expectation errors (Coibion and Gorodnichenko, 2015). We therefore examine the degree to which expectation errors are related to contemporaneous information which should be part of the information set of farmland market professionals. Second, we examine the degree to which information rigidity is state dependent. Coibion and Gorodnichenko (2015), for example, show that information rigidity in professional forecasters' inflation expectations is higher during periods of low US GDP volatility. We suspect a similar relationship may be observed among farmland market professionals with respect to volatility in key drivers of farmland market prices, such as commodity prices, interest rates, and whether farmland prices are appreciating or depreciating. Lastly, we examine the degree to which information rigidity varies by location. Given that farmland prices vary by local market dynamics, agents' relationship with information may also vary by location.

Contemporaneous Prices

As highlighted by Coibion and Gorodnichenko (2015), information rigidity may not fully explain information inefficiency. Information inefficiency implies that some information is associated with expectation errors. The model established by (1) suggests that agents' behavior with respect to information acquisition and processing can fully explain expectation errors. However, some information that is associated with expectation errors may not fully be reflected in the revision process as captured by (1). As a result, Coibion and Gorodnichenko (2015) suggest adding any information that is correlated with expectation errors to (1) to examine the degree to which information rigidity may not fully explain information inefficiency.

Following Coibion and Gorodnichenko (2015), we first examine the correlation between expectation errors and a number of economic factors which theory suggests play an important role in farmland price determination: corn price, soybean price, interest rate, and inflation.[5] The commodity prices are chosen because Iowa is the largest US producer of corn and second-largest producer of soybeans (U.S. Department of Agriculture, National Agriculture Statistics Service, 2021). Interest rates are chosen because of their indirect relationship to farmland prices through costs of farmland mortgages (Featherstone and Baker, 1987). Finally, inflation is positively correlated with farmland market prices (Feldstein, 1980; Just and Miranowski, 1993).

If the correlation between expectation error and any of these variables is statistically significant, we add them as an additional regressor in (1) as follows:

$$(A_t - F_{t-6}) = \alpha + \beta(F_{t-6} - F_{t-18}) + \delta x_{t-1} + \varepsilon_t, \qquad (2)$$

where x_{t-1} represents the additional regressor. The parameter δ captures the correlation between contemporaneous information and expectation error. When $\delta \neq 0$ the contemporaneous information (x_{t-1}) holds predictive power for expectation error and information rigidity does not fully explain information inefficiency.

It is important to note that Coibion and Gorodnichenko (2015) stress that this interpretation of δ is only valid when the expectations fail the conventional test for full information efficiency. To provide a concise presentation of our results, the full information efficiency tests suggested by Coibion and Gorodnichenko (2015) are reported in appendix table A2. These tests show that corn prices, soybean prices, and interest rate are not correlated with farmland price expectation errors, and as a result, we do not estimate (2) for these variables.[6] The only variable that is correlated with expectation errors is inflation as measured by Personal Consumption Expenditure (PCE).

Table 3 therefore reports estimation results of (2) when PCE is represented by x_{t-1}. Our estimate $\hat{\delta}$ is statistically significant, which suggests an increase in general price levels in the year prior to SMLV is associated with under-predicting farmland price changes. This finding is consistent with a positive correlation between farmland prices and inflation (Feldstein, 1980; Just and Miranowski, 1993). Thus, the inefficiency of farmland price expectations of farmland market professionals may not be fully explained by information rigidity.

[Table 3 about here]

State Dependence

Coibion and Gorodnichenko (2015) show that professional forecasters update their information sets or place weight on new information differently based on broader economic conditions. Specifically, during “The Great Moderation” (1980’s to early 2000’s) professional forecasters updated their information sets infrequently or only partially used new information. Coibion and Gorodnichenko (2015) use a variety of empirical techniques to show that β in (1) my vary over time.

We suspect that farmland market professionals also update their information sets or place weight on new information differently based on economic conditions in the agricultural sector. We similarly test whether β in (1) differs between periods of high and low volatility with respect to corn prices, soybean prices, and interest rates, as well as between periods when farmland prices are rising or falling. During periods of high volatility or falling farmland prices, information may be more valuable. As a result, farmland market professionals may be expected to update their information sets more frequently or place a greater weight on new information. We test the degree to which information rigidity is state dependent with:

$$(A_t - F_{t-6}) = \alpha + \beta_1((F_{t-6} - F_{t-18}) * D) + \beta_2((F_{t-6} - F_{t-18}) * (1 - D) + \varepsilon_t, \qquad (3)$$

where D is a dummy variable that takes the value of one for periods with high volatility or increasing farmland prices. State dependence in information rigidity is evaluated using the Wald test ($H_0 : \beta_1 = \beta_2$).

Table 4 reports our estimates of (3). Each column represents a test for state dependence across five measures of economic conditions in the agricultural sector. The dummy variable D takes the value of one when (i) the standard deviation of monthly percentage changes in corn prices[7] for the 12 months prior to the SMLV conference (May) is greater than the median annual standard deviation of corn prices for 1964 to 2021, (ii) the standard deviation of monthly percentage changes in soybean prices for the 12 months prior to the SMLV conference (May) is greater than the median annual standard deviation of soybean prices for 1964 to 2021, (iii) the standard deviation of monthly interest rate[8] for the 12 months prior to the SMLV conference (May) is greater than the median annual standard deviation of interest rate for 1964 to 2021, (iv) the annual change in farmland price in the previous year was positive, and (v) the annual change in farmland price is greater than the average annual change in farmland price from 1964 to 2021.[9] Using these five defined states, we examine whether the ordinary least squares estimates of β_1 and β_2 are distinguishable from one another.

[Table 4 about here]

The only variable for which information rigidity differs between periods of high and low volatility is the Effective Federal Funds rate. Our empirical estimates suggest that Iowa farmland market professionals are more responsive to new information during periods of low interest rate volatility. Iowa farmland professionals update information about every six months ($\lambda = 0.473$) or weight new information by about 50% ($G = 0.527$) for periods of high interest rate volatility. In periods of low interest volatility, Iowa farmland professionals update information about every two and half months ($\lambda = 0.219$) or weight new information by about 80% ($G = 0.781$).

Farmland market professionals may perceive interest rates as a key driver in farmland price determination, as farmland is frequently purchased through mortgages.[10] Thus, our results suggest that during periods of volatile interest rates new information may be particularly valuable.

Regional Heterogeneity

Lastly, we examine the degree to which information rigidity varies by location. Given that farmland prices vary by local market dynamics, agents' relationship with information may also vary by location. Beginning in 1995, SMLV began reporting expectations aggregated across four regional quadrants in Iowa, which gives us the ability to test the degree to which β in (1) varies by location.

Table 5 reports the estimates of (1) from 1995 to 2021. The first column reports the coefficient estimates across the entire state of Iowa for shorter observation period. Compared to our baseline estimation, table 5 suggests Iowa farmland professionals update their information more frequently and place greater weight on new information in the more recent time frame. During the period 1995 to 2021, Iowa farmland professionals update their information about every two months ($\lambda = 0.180$) or weight new information by about 80% ($G = 0.820$). The difference between our shorter time period and our baseline may stem from lessons learned of the farm financial crisis of the 1970s and 80s, changes in information technology, and broader structural changes in the agricultural sector.

[Table 5 about here]

The only region for which our estimate of β is statistically significant and positive is the Northwest. Table 5 suggests that farmland market professionals in Northwest Iowa update their information set about every two and a half months ($\lambda = 0.205$) or weight new information by about 80% ($G = 0.795$), which roughly corresponds to state level aggregates. Thus, farmland market professionals' relationship with information may vary by location.

Conclusion

This paper examines the degree to which information inefficiency influences farmland market dynamics. Sherrick and Barry (2003, pp. 46), for example, argue that farmland market inefficiencies could be overcome by "...more extensive and higher quality publicly available information...". Following Coibion and Gorodnichenko (2015), we test the degree to which Iowa farmland market professionals incorporate new information in updating their expectations of farmland price changes. We show that these professionals may not fully incorporate new information into their farmland price expectations because they (i) are unable to distinguish the signal from the noise or (ii) update their information sets infrequently. Thus, our findings suggest the need for "higher quality" information so that market participants can better distinguish signal from noise and "more extensive" and timely information to encourage frequent updating.

Our results suggest a muted response to information shocks. Specifically, our baseline estimate imply that Iowa farmland professionals update their information sets every four months or weight new information by two-thirds in forming farmland price expectations. These findings suggest that information inefficiency likely plays an important role in farmland price dynamics.

information shocks are unlikely to lead to widespread mispricing. However, in the event that farmland prices exceed market fundamentals, new information is unlikely to correct market prices quickly. It should be noted that our empirical estimates do not rule out the potential that this muted response is driven by farmland market professionals placing a great weight on either under- or over-prediction, conditional on information rigidity. In addition, as argued by Coibion and Gorodnichenko (2015), by examining aggregated expectations of many professionals, we limit the potential that this muted responses is the result of intentional smoothing of expectations (see also Goyal and Adjemian, 2023).

Our baseline estimation offers a necessary step toward a better understanding of the role of information in farmland market efficiency. In subsequent analyses, we outline additional dimensions of information rigidity that suggest the need for further study. First, we find that the inefficiency of farmland price expectations of farmland market professionals may not be fully explained by information rigidity, as additional sources of information have explanatory power. Second, farmland market professionals response to new information varies based on economic conditions within the agricultural sector and more broadly. Third, farmland market professional response to new information may vary based on local farmland market conditions and dynamics.

These preliminary findings all point toward the continued need for research on the role of information in farmland markets. We identify the degree to which information rigidity influences farmland price expectations through a novel dataset. However, it is important to note that this novel dataset was not collected for research purposes. As a result, future studies would benefit from a more intentional design to better identify the role of information in farmland market dynamics. Case and Shiller (1990), for example, limit their analysis to the stated expectations of individuals who recently purchased a home. As such, future research would benefit from a more explicit measure of respondents' farmland market participation or limit the analysis to only respondents who have recently purchased farmland. A more intentional survey design could also control the flow of information "treatments" among respondents. For example, Coibion et al. (2018) and D'Acunto et al. (2018) provide a framework to better argue causal identification through random assignments of information shocks. This approach would greatly strengthen the internal validity of potential findings of information inefficiency in farmland market dynamics. In addition, the external validity of future research could be strengthened by examining farmland market participants in a variety of locations.

This study is a step toward a better understanding of the role of information in farmland market efficiency and also offers a number of potential implications for policy. As Sherrick and Barry (2003, pp. 46) ague "Government policy could play a role in enhancing market efficiency in farmland markets through information channels...". Our findings suggest that farmland market professionals likely update their information sets infrequently, so information may be more impactful if it is timely or encourages more frequent updating. Alternatively, our findings may suggest that farmland market professionals place limited weight on new information because new information is noisy. Thus, information may be more impactful if it can be more easily interpreted by farmland market professionals. The need for higher quality information within the agricultural sector is also highlighted in a similar study of USDA forecasts by Goyal and Adjemian (2023). There are two potential routes toward providing more timely and easy-to-interpret information on the farmland market, (i). more frequent and consistent surveys of farmland market professionals, especially for states outside of the Corn Belt or (ii). aggregating and reporting publicly available farmland transaction data. Survey efforts are costly in identifying and engaging a representative sample of farmland market participants. However, reporting aggregated survey-based farmland prices can be straightforward. Reporting aggregated farmland market transactions necessitates modeling choices and identifying arms-length transactions, but recently, several private firms have emerged that aggregate transaction data reported at the local government level (Grant and Zhang, 2019; Lu et al., 2023). Government investment in either option could provide farmland market participants more timely and easy-to-interpret information and may further alleviate the adverse effects of farmland market inefficiency.

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Table 1: Summary Statistics for Iowa State Soil Management and Land Valuation Conference from 2016 to 2021

Average Experience	2016	2017	2018	2019	2020	2021
ILVS	26.0	25.2	25.3	26.5	26.0	22.4
SMLV	22.0	21.8	25.6	30.8	25.6	26.3
Occupation	Iowa Land Value Survey					
Farm Manager	116	129	101	79	94	101
Rural Appraiser	129	119	122	60	77	75
Broker/Realtor	138	122	129	98	120	76
Ag Lender	211	340	293	213	250	222
Other	13	35	14	25	14	16
Farmer/Landowner	44	65	60	48	59	51
Government	54	64	61	58	58	59
Not Identified	6	0	11	43	0	50
Total	711	874	791	624	672	650
	Soil Management and Land Valuation					
Farm Manager	60	46	44	35	24	27
Rural Appraiser	16	19	19	13	15	15
Broker/Realtor	25	20	15	19	18	24
Ag Lender	29	28	64	54	62	41
Other	43	20	16	26	15	17

Not Identified	10	3	2	2	1	4
Total	183	136	160	149	134	128

Table 2: Ordinary Least Squares estimates of Information Rigidity in Expectations of Iowa Farmland Value 1964 to 2021

Information Rigidity *Coibion and Gorodnichenko (2015)*	
(1) $(A_t - F_{t-6}) = \alpha + \beta(F_{t-6} - F_{t-18}) + \epsilon_t$	
α	–0.019
	(0.014)
β	0.569^{***}
	(0.128)

Heteroskedastic and Autocorrelation (HAC)

Standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 3: Ordinary Least Squares estimates of Inflation (PCE) and Information Rigidities in Iowa Farmland Price Expectations 1964 to 2021

Information Rigidity	
(4) $(A_t - F_{t-6}) = \alpha + \beta(F_{t-6} - F_{t-18}) + \delta x_{t-1} + \epsilon_t$	
α	-0.083^{***}

	(0.018)
β	0.473***
	(0.112)
δ (PCE)	0.019***
	(0.005)

Heteroskedasticity and autocorrelation (HAC) standard errors in parentheses

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table 4: Ordinary Least Squares estimates of state dependence of Information Rigidities in Iowa Farmland Value Expectations 1964 to 2021

	States				
	Corn	Soybean	Fed Funds Rate	Land Value 1	Land Value 2
$(A_t - F_{t-6}) = \alpha_4 + \beta_1((F_{t-6} - F_{t-18}) * D_{\text{High Volatility}}) + \beta_2((F_{t-6} - F_{t-18}) * (1 - D_{\text{High Volatility}}) + \epsilon_t$					
α_2	–0.018	–0.020	–0.018	–0.011	–0.017
	(0.014)	(0.014)	(0.013)	(0.016)	(0.017)
β_1	0.551***	0.703***	0.899***	0.479**	0.553**
	(0.204)	(0.163)	(0.170)	(0.195)	(0.250)
β_2	0.597***	0.314**	0.281**	0.730***	0.587***
	(0.110)	(0.133)	(0.106)	(0.194)	(0.119)
Observations	56	56	56	56	56

R^2	0.351	0.390	0.461	0.362	0.348
$H_0 : \beta_1 = \beta_2$					
F-Value$_{(1,53)}$	0.040	3.33*	7.83***	1.190	0.01
p-value	(0.848)	(0.074)	(0.007)	(.280)	(0.910)

Newey-West Standard errors (Newey and West, 1987) in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5: Ordinary Least Squares estimates of Information Rigidities by Regional Quadrants of Iowa Farmland Expectations 1995 to 2021

	Iowa	Northwest	Northeast	Southwest	Southeast
Information Rigidity					
(2) $(A_t - F_{t-6}) = \alpha + \beta(F_{t-6} - F_{t-18}) + \epsilon_t$					
α	–0.059***	–0.017	–0.057***	–0.067***	–0.069***
	(0.011)	(0.017)	(0.020)	(0.017)	(0.015)
β	0.220***	0.258**	–0.265	–0.247**	0.050
	(0.050)	(0.108)	(0.190)	(0.107)	(0.060)

Heteroskedastic and Autocorrelation (HAC) standard errors in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Notes

[1](see: De Fontnouvelle and Lence, 2002; Deaton and Lawley, 2022; Chavas and Thomas, 1999; Falk, 1991, 1992; Falk and Lee, 1998; Featherstone and Baker, 1987; Just and Miranowski, 1993; Lence and Miller, 1999; Melichar, 1984; Sherrick and Barry, 2003; Shiha and Chavas, 1995)

[2](see: Scott Jr and Chicoine, 1983; Barnard and Wunderlich, 1984; Zakrzewicz et al., 2012; Bigelow et al., 2020)

[3]While the delivery method has adjusted over time, the survey is currently delivered through a combination of mail, email, and online.

[4]The SMLV survey instrument is included in appendix figure A2.

[5]Coibion and Gorodnichenko (2015) suggest the traditional regression based test of full information efficiency: $e_t = \eta + \zeta f_{t_6} + \delta x_{t-1} + \varepsilon_t$, where x_{t-1} represents information variables available at the time of formation. Iowa farmland professionals using all available information would imply that both ζ and δ are expected to be zero.

[6]Appendix Table A5 reports summary statistics for the variables representing corn price, soybean price, interest rate, and PCE.

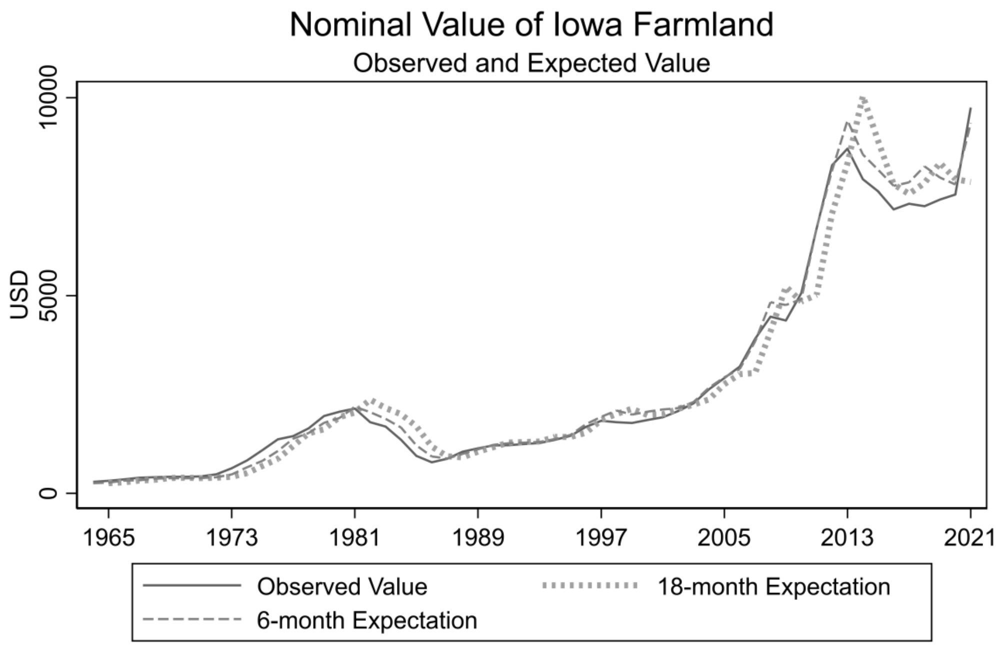
[7]The corn and soybean prices are represented by cash prices received by Iowa farmers compiled by Iowa State University's extension website *Ag Decision Maker* (Iowa State University Extension and Outreach, 2021)

[8]The interest rate is represented by the Federal Funds Effective Rate compiled by https://fred.stlouisfed.org/

[9]Appendix Table A5 reports summary statistics for the variables representing corn price volatility, soybean price volatility, interest rate volatility, larger than average annual change in land values, and land values increasing.

[10]Real estate debt makes up nearly 70% of farm sector liabilities (U.S. Department of Agriculture, Economic Research Service, 2024)

Figure 1: Observed and expected value of Iowa farmland



Source: Iowa State University Soil Management and Land Valuation Conference and Iowa Land Value Survey