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Examining the Relationships between Land Values and Credit Availability*

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Abstract

Given the changes made to the agricultural lending system since the 1980s farm crisis, we investigate the current effects of credit availability on land values. Using data from Federal Reserve Agricultural Credit Surveys, we measure credit availability and perform county-level panel fixed effects estimations controlling for land value determinants, credit availability factors, and county and macroeconomic factors. We build an indicator of increased credit availability and find that estimating farmland values with different factors of credit availability separately could mask combined effects. When conditions for credit availability increase or remain unchanged from the previous year, land values may increase by up to 25%. While higher credit availability may facilitate land acquisition, it can also put upward pressure on land values.

Keywords: Ag Credit Survey, farm loans, fixed effects, interest rates, land values

JEL Codes: G21, Q14, Q15

1. Introduction

Credit constraints can limit land investments and farm productivity (Pederson, Chung, and Nel 2012). Increased credit availability, though, can have both favorable and unfavorable consequences. While increasing credit access may facilitate land acquisition, more credit can put upward pressure on land values making it harder for farmers to acquire land. Since the 1980's farm crisis, the lending system has gone through a number of changes (Zhang and Tidgren 2018). First, agricultural lenders are required to rely on cash flows instead of only collaterals. Second, loan-to-value ratios below 85% are required. Third, lenders estimate collateral values with multi-year cash flows instead of current market prices. Finally, bankers put greater emphasis on repayment capacity. In light of these changes, we investigate the current impact of credit availability on land values.

Although previous research has explored the relationship between land values and debt, studies, in general, have limited their measurement of credit to the total amount of liabilities extended to or held by farmers. We provide a new look at the effects of credit availability on land values by arguing that credit availability is a broader concept than total debt. Therefore, we measure credit through changes in bank markets at the county level as in Rajan and Ramcharan (2015) and by considering agricultural lenders' responses to changes to collateral requirements, available funds, and repayment rates[i].

Federal Reserve Surveys of Agricultural Credit Conditions, henceforth referred to as Ag Credit Surveys survey agricultural lenders and capture changes in credit conditions and lending requirements at agricultural banks. In each quarter, agricultural lenders indicate whether collateral requirements, repayment rates, and available funds are higher, lower, or remained unchanged relative to the same period in the previous year. We combine these factors into an indicator for increased credit availability. If we consider credit factors separately, we would be less likely to capture the total effects from the combined credit conditions on land values.

Results point to increases in land values if more bankers perceive favorable credit conditions, which may increase the challenges facing those wishing to acquire land. We contribute to the literature on the relationship between credit and land values by introducing a new way of assessing credit availability and by showing that, even after the regulatory changes incurred to the lending system, credit still has a considerable effect on land values.

2. Measuring credit: a look at past studies

Agricultural credit conditions can affect economic growth (Hartarska, Nadolnyak, and Shen 2015), as well as farm productivity (Ciaian, Fałkowski, and Kancs 2012) and investments (Pederson, Chung and Nel 2012). Studies analyzing the effects of credit on investments and farm productivity generally represent credit by total debt or total loan amount (Table 1). Nevertheless, there are a number of studies that rely on surveys or the development of credit classifications from secondary

data to describe credit. Another way to proxy credit is described in Rajan and Ramcharan (2015), where elements that affect credit supply are considered (e.g. number of banks and bank deposits).

Devadoss and Manchu (2007) find that credit, in the form of loans granted through the Farm Service Agency, increases land values by 1.4%. They model credit as one of the determinants of land values and estimate a fixed effects panel regression using county-level data from Idaho. Agricultural loans are also used in Hartarska, Nadolnyak, and Shen (2015) to examine the effects of agricultural credit on the economic growth of U.S. states and regions. They represent agricultural lending by using lagged information on loans conceded by commercial banks and by the Farm Credit System. Following Hartarska, Nadolnyak and Shen (2015) we also use lagged credit variables and interest rates to account for possible endogeneity issues.

A more in-depth analysis of the relationship between debt accumulation and land values can be found in Shalit and Schmitz (1982, 1984). Shalit and Schmitz (1982) built a model to illustrate the effects of debt accumulation on land values. They aggregate the individual farmer's demand for land, derived from the utility maximization problem, to arrive at the total demand for land. By applying national data to their conceptual model, Shalit and Schmitz (1984) conclude that loan extensions based on collaterals can inflate land prices in the short run. As a measurement for credit rationing, authors also use information on agricultural lenders' expectations on future land values. Currently, land value, when used as collateral, is estimated taking into account various years and not current market prices. As such, we believe that other variables such as repayment rates, available funds and changes to required collateral may be more appropriate measures of credit availability. By using these variables we hope to provide variables that can better explain credit rationing, as suggested by Shalit and Schmitz (1984).

Rajan and Ramcharan (2015) use a novel form of measuring credit. With a dataset ranging from the 1900s to 1930s, the authors run a number of regression models and perform graphic analysis using deposits and bank branches as proxies for credit availability. They argue that these variables explain credit supply through: 1) increased competition and greater proximity to borrowers and 2) liquidity and lending capacity. Rajan and Ramcharan (2015) argue that since lending was local in the 1920s, the use of these variables as a proxy for credit availability is viable. Hence, in our study we account for online banking by adding a variable on the number of farm operations with internet. When considering the long-run effects from credit availability, Rajan and Ramcharan (2015) conclude that larger declines in land values occurred in counties which, in the 1920s, had more credit availability.

Greater credit access and availability can influence capital investment decisions. Ciaian, Falkowski, and Kancs (2012) find a positive relationship between credit, input use, capital investments, and total factor productivity. They employed a matching estimator method, and farm credit is represented by total farm liabilities. As such, a limitation of Ciaian, Falkowski, and Kancs (2012) is that their data include loans used but not credit access. They split the sample into eight credit classifications ranging from no loans (i.e. no credit) to a debt-to-output ratio of over 100%. Likewise, Briggeman, Towe, and Morehart (2009) examine credit use and availability by building credit classes from the Survey of Consumer Finances and the Agricultural Resource Management

Survey. Categories range from one, where credit is extended without obstacles to five where credit is denied.

Measurements for credit restrictions and its effects are explored in Pederson, Chung, and Nel (2012) and Cole (1998). Pederson, Chung, and Nel (2012) investigate how credit availability can benefit non-credit rationed farmers. By using matching methods, they compare credit rationed to non-credit rationed farmers and find that with a 1% increase in loans, credit-constrained farmers can experience an increase of 0.5% in their income and 0.3% increase in investments. Cole (1998) examines the effects of the borrower-lender relationship on the lending decision by using a binary dependent variable for whether credit was denied or not and exogenous variables (e.g. checking or savings account, loans or financial services with the bank) to represent the relationship that the borrower may have with the lender. Cole (1998) finds that pre-existing borrower-lender relationships increase the potential for a lender to extend credit to a borrower.

Fletschner (2008), and Hartarska and Nadolnyak (2012) design surveys to investigate credit access. Fletschner (2008) examines the importance of the gender of the person who received credit in the household efficiencies (i.e. technical, allocative and economic). To account for credit access, respondents were asked whether they took on a loan, if the amount requested was extended in full, or whether they were denied a loan. When examining the effects of the 2008 financial crisis on farmer's credit access, Hartarska and Nadolnyak (2012) find that although financial constraints were not associated with the financial crisis, loans were extended through collateral. To account for credit, they consider the shares of the respondents that received or applied for a loan, as well as those that did not have access to certain loans. They also have a measurement for whether the collateral requirement was an obstacle or not.

In this study, the terms credit access and credit availability are used interchangeably. Although these terms may not mean the same thing, here we assume that there is greater access to credit if more credit is available. Credit availability as defined by "the complex of noninterest - rate lending terms prevailing in the market" (Guttentag 1960, p. 222). As such, greater credit availability comes by lenders relaxing their requirements to extend a loan (e.g. collateral requirements). We assume lenders may reduce restrictions to extend loans if available funds are higher and repayments rates are lower. We also assume that credit supply is greater in counties with a greater number of bank companies and/or with a larger amount of bank deposits. Currently, the Farm Credit System and commercial banks originate the majority of farmland loans (about 80%). We use an array of variables to represent credit availability and access, such as responses of agricultural lenders to the Federal Reserve Ag Credit Surveys, and data on deposits and bank branches from Federal Deposit and Insurance Corporation (FDIC) Summary of Deposits (SOD). We also control for possible loans granted online, which to the best of our knowledge has not been accounted for previously. Furthermore, we account for factors at the county level that could influence the conditions for credit such as per capita income, education and unemployment. Lastly, inspired by studies that use secondary data to build classifications of credit availability, we build an indicator for increased credit availability.

3. Data

This study uses a county-level, panel dataset for the years of 2002, 2007, 2012, and 2017 (Table 2). County-level data on returns to agricultural production, government payments, number of farms with internet access, and land in farms are from the Census of Agriculture. All monetary variables are divided by the total land in farms in each respective county such that values are in dollars per acre. Returns to agricultural production are estimated by subtracting total operating expenses of all agricultural commodities from total sales. Information related to population and housing come from the U.S. Census, while that on unemployment rates and household debt-to-income are from the U.S. Bureau of Labor Statistics. Data on farm income per capita come from the Bureau of Economic Analysis. Data on the percentage of the population with incomplete high school come from the United States Department for Agriculture (USDA)[ii]. The dummy Metro, indicating whether the county is a metropolitan county or not, is built using the 2003 and 2013 Urban-Rural Continuum Codes from the USDA[iii]. Credit availability and access data come from: the Ag Credit Survey and the Summary of Deposits from the Federal Deposit Insurance Corporation[iv].

The Ninth and Tenth Federal Reserve Districts administer Ag Credit Surveys to banks in their regions (Figure 1). The survey asks banks' respondents questions regarding the average price for irrigated and non-irrigated cropland and ranchland, as well as, the behavior of collateral requirements, rate of loan repayments, interest rates charged and the availability of funds, among other questions. Respondents report an actual value for the land values and interest rates. For the information on collateral requirements, available funds and rate of loan repayments, bankers respond whether, in the previous three months, these variables were lower, higher or remained unchanged in comparison to a year ago. During the study period, there has been an increase in the number of bankers responding with a decrease in available funds, and more of decreased repayment rates, with respect to the previous year (Figure 2). A greater number of bankers have also identified increased collateral requirements, with respect to the year before, in the years of 2002 and 2017 (Figure 2). The Ag Credit Survey is conducted quarterly, while the Summary of Deposits is reported annually. In order to account for endogeneity issues we match annual data from the Census and the Federal Deposit Insurance Corporation with data from the second quarter of the Survey of Agricultural Credit Conditions.

Although around 30-40% of real estate loans are conducted through the Farm Credit System (FCS) we are unable to consider the impact of those loans in our model. The FCS call reports only provide information on agricultural loans at the association headquarter level. Information on the agricultural loans awarded to each county are not recorded, and FCS institutions can serve more than one state (Nadolnyak, Shen and Hartarska 2017). Additionally, information on agricultural loans for real estate[v] are only available from 2005 onwards (Nadolnyak, Shen and Hartarska 2017). Given these limitations, FCS loans are used only to test sensitivity of credit availability when accounting for FCS loans. By assuming that Farm Credit associations only grant loans within the state they are in, we weigh the total agricultural real estate loans by the total amount of farmland in each county.

In order to assess the total effect of credit availability on land values, an indicator for increased credit availability was created. Figure 3 provides an insight into the number of times increased credit availability occurs. It represents bankers' views factors that could support higher credit availability. It is equal to one if the respondent answered that, in comparison to the previous year, repayment rates were higher, collateral was lower, and available funds were higher than in previous three months. Otherwise the indicator is zero.

3.1 Area of Study

The area for this study comprises the Ninth and Tenth Federal Reserve Districts. The Ninth District encompasses the states of Minnesota, Montana, North Dakota, South Dakota, the Upper Peninsula of Michigan and northwestern Wisconsin. The Tenth District encompasses the states of Wyoming, Oklahoma, Colorado, Kansas, Nebraska, in the northern half of New Mexico, and in the western third of Missouri (Figure 1). The study is restricted to this area since the data on credit availability come from the Ag Credit Survey applied to the Ninth and Tenth Federal Reserve Districts. The area contains a greater concentration (~60%) of agricultural banks (i.e. those with at least 15% of their loans in agriculture) (Koenig 2016). According to FFIEC call reports, close to 45% of total agricultural loans in the U.S. come from banks in these two districts.

4. Conceptual Framework and Empirical Strategy

Land value models generally are rooted on the basic definition of farmland price as the sum of its discounted future returns (Moss and Katchova 2005). The idea being that farmland value would be equivalent to its future returns:

$$Land\ Value_0 = E\left[\sum_{t=1}^{\infty} \frac{Returns_t}{(1+discount\ rate)^t}\right] \quad (1)$$

Research, however, has shown that land values are affected by other factors than solely its discounted future returns. Newer variations to equation (1) include the addition of factors such as government payments and housing values (Goodwin, Mishra and Ortalo-Magné 2003; Goodwin, Mishra and Ortalo-Magné 2011), urbanization pressures (Kuethe, Ifft and Morehart 2011), as well as financial factors such as inflation and loans (Devadoss and Manchu 2007; Just and Miranowski 1993). In this paper, we expand the financial factors considered previously to include credit availability. We argue that credit availability extends beyond the total amount of loans used in the past. Therefore, we proxy credit availability by lending terms and market expectations of bankers. We assume that increased credit availability will increase demand for land adding pressure to land values.

Our empirical strategy, explained in the following section, is based on equation (1) plus the variables used to determine land values found in previous studies along with other variables that represent credit availability. As such, we estimate the impact of credit availability on land values by running a log-linear estimation of the natural logarithm of land values against land value determinants $\boldsymbol{X}_{it}$, credit availability factors $\boldsymbol{Z}_{it}$ and county and macroeconomic factors $\boldsymbol{W}_{it}$:

$$\ln land\ value_{it} = \alpha_i + \beta \boldsymbol{X}_{it} + \delta \boldsymbol{Z}_{it} + \theta \boldsymbol{W}_{it} + \delta_i + \tau_t + \varepsilon_{it} \tag{11}$$

We also control for county-level fixed effects (δ_i) and year fixed effects (τ_t). ε_{it} denotes the error term which has a mean of zero. Although we have split the control variables into three categories (land values determinants, credit availability factors and, county and macroeconomic factors) some variables could belong to more than one category.

Land value determinants X_{it} are returns, interest rates, government payments, and urbanization pressures. Following the capitalization model, land values are the sum of the expected future returns for the land discounted using a discount factor (e.g. interest rate). Hence, returns and interest rates are considered the fundamental variables (Featherstone and Baker 1987). Apart from the fundamental variables we also account for other factors which may determine land values. These are government payments and population density. Following Goodwin, Mishra and Ortalo-Magné (2003) we represent urbanization pressures using population per square mile and account for the impact from government payments[vi].

Credit availability factors Z_{it} encompass variables from the Ag Credit Survey conducted by the Federal Reserves in the 9th and 10th Districts and from the Federal Deposit Insurance Corporation Call Reports. Control variables from the Ag Credit Survey are responses from agricultural lenders on whether loan repayment rates are lower, collateral requirements higher and whether funds available have increased in comparison to past three months. These variables provide insight into lending practices[vii] and expectations of agricultural lenders. Following Rajan and Ramcharan (2015) we also control for the number of different banks and for bank deposits. Although online banking is becoming more and more common, having a bank in a county allows for the establishment of a greater lender-borrower relationship affecting the amount of loans granted (Rajan and Ramcharan 2015; Keeton 1996; Cole 1998). Nevertheless, we consider online banking by controlling for the number of farm operations with internet. We assume that farms with internet access have a higher probability of making a loan online than those without.

We also control for county and macroeconomic factors, which may affect land values, and the variables related to credit availability (e.g. creditworthiness of a county). County and macroeconomic factors (W_{it}) are population growth, housing permit values, unemployment rates, farm income per capita, percentage of the population with incomplete high school, debt-to-income ratio and whether the county is urban or rural. Population growth, unemployment rates, education and income controls for the economic development of a county. For example, Drescher and McNamara (1999) use unemployment as a measure future economic growth. A county, which is growing quickly, may pressure land values upwards because of higher non-agricultural capital

gains to farmland. Economic growth can have an effect on the banking market, affecting the number of banks and deposit levels. The potential for economic growth of a county can also affect lenders' perceptions on repayment rates and available funds.

4.1 Endogeneity and identification issues

When dealing with land values and agricultural real estate loans, there are issues that can compromise the correct identification of the coefficient on the credit availability variable. For instance, increases in collateral could affect land values, but reverse causality also could be present. Increases in land values could motivate lenders to increase collateral requirements to reflect the changes land values market. In order to avoid reverse or even simultaneous causality, information on land values and on credit availability are from different times. Information on land values are from responses given in the 4th quarter, while information on credit availability variables from the Ag Credit survey reflect results from the 2nd quarter of the same year. Additionally, credit availability variables from the Ag Credit survey reflect agricultural lenders' opinion about the variations in credit availability from three months prior. As such, information on credit availability reflects conditions at the beginning of the year while that on land values reflect market conditions at the end of the year. Similarly, we use the lagged interest rate to account for possible reverse causality.

Furthermore, we control for county-level factors in order to account for other variables that could explain the greater credit availability in a county. By running fixed-effects models, we account for characteristics associated with counties and land in these counties that are fixed through time or suffer very small changes (e.g. soil type). We also control for year fixed effects, to control for factors occurring in a given year affecting all counties. For example, year dummies control for the increased crop receipts, which occurred in 2012-13 and may have affected land markets. By controlling for county and year fixed effects we expect to remove the majority of unobserved heterogeneity present in counties or in a given year (Bellemare and Nguyen 2018).

The decision to use fixed effects rather than random effects was based on the Hausman test. At a critical value of χ^2=328.15 the null hypothesis of the use of a random effects model was rejected with a 1% level of statistical significance. Additionally, we assess the fit of our model by examining the R-squared, which are 0.8 or higher. A large proportion of the variation is explained by the individual-specific terms, as indicated by a ρ of 0.89 or higher. In other words, 10% or less of the variation is due to the idiosyncratic error.

Our estimation strategy to identify the effects of credit availability on land values is composed of various steps. First, we consider each factor associated with credit availability separately. Then we form an indicator for increased credit availability, which takes on the value of 1 when credit is more readily available and 0 otherwise. The indicator for increased credit availability has the advantage of controlling for possible collinearity issues that may arise between the credit variables, by combining them into one variable. Increased credit availability is set to be equal to 1 when the following combination of factors occur: a) more bankers declare available

funds to have increased or remained unchanged in the past months; b) more bankers declare repayment rates to have increased or remained unchanged in the past months, and; c) more bankers declare the amount of collateral required to have decreased or remained unchanged in the past months, than the number of bankers stating that these conditions have deteriorated. We use a diffusion index of these variables to determine whether the majority of lenders responded higher or lower. Values above 100 in the diffusion index refer to a greater number of lenders responding of increases, while values below 100 relate to the majority of lenders responding of decreases. Bankers are asked about changes (a) to (c) in comparison with the same time in the previous year.

The majority of agricultural loans are provided by commercial banks and through the Farm Credit System (FCS). Data from FDIC and Ag Credit Surveys only consider commercial banks. In order to test for the effect of loans made through the FCS on the indicator for high credit availability we estimate a regression with agricultural loans awarded through the FCS. The objective is to check whether the coefficient associated with increased credit availability was sensitive to the inclusion of this other source of credit. Lags of the amount of real estate agricultural loans made through the FCS are used to control for endogeneity issues.

We address any remaining endogeneity issues between increased credit availability and land values by running a two-stage least square estimation (2SLS) (Wooldridge 2013). We use up to three instrumental variables: expected demand for loans, quality of land, and future corn prices. Expectations on future demand for loans, quality of the land, and future corn prices may impact credit available today. For instance, if demand for loans is expected to increase in the upcoming months, agricultural lenders may decide to reduce the number of loans made today in order to offer more loans in the future. A higher quality of land in the future may affect collateral requirements and indicate higher repayment capacity. A land of higher quality may be easier to sell in case of foreclosure, potentially reducing loan collateral risk. A higher land quality can also indicate that higher profits may be achieved through farming affecting repayment rates. Lastly, increased future corn prices can indicate higher repayment capacity in the future or future demand for loans as farmers seek to expand their business. Since all these variables are forward-looking, we do not expect future events to impact past land values, making us confident that the instrument is uncorrelated with the error term.

5. Results and discussion

Panel estimation models are used to estimate the effects of credit availability on land values. Results also follow the expected effects from land value determinants found in the literature. Increases in returns have a positive effect on land values, but the effect of interest rates on farmland values was not significant. Overall results point to positive effects from increased credit availability on land values. Effects from credit availability can be underestimated when factors affecting credit are considered individually. For instance, a 1% increase in the share of lenders expecting increased availability of funds is associated with an increase land values by 0.09% (Table 3). In turn, when conditions for credit availability increase (e.g. lower collateral requirements, higher availability of funds, greater deposits) or remain unchanged from the

previous year, land values may increase by up to 25%. This effect remains positive and even increases when accounting for other major lending sources such as the Farm Credit System. Even when instrumenting increased credit availability by loan demand expectations, quality of the land and future corn prices, the effect of increased credit availability on land values remains positive and greater than 25%. Therefore, using loans as a proxy for credit may be underestimating the effects from credit availability.

In general, results from the estimations (Tables 3 – 6) show that the determinants of land values have similar effects as those found in previous literature. Returns to land per acre have a positive effect on land values (Featherstone and Baker 1987). Furthermore, results show that land values are driven by factors beyond the present value of expected returns, as discussed in Borchers, Ifft and Kuethe (2014) and Goodwin, Mishra and Ortalo-Magne (2003). Economic growth and urban pressure, represented in our model by total population, population growth variables, farm income and the housing market, have positive effects on land values. Likewise, a higher unemployment rate has a negative effect on land values.

Table 3 contains a number of specifications to account for the isolated effects from factors related to credit availability (i.e. variables from the Ag Credit survey and from FDIC). An analysis of these results suggests that increases in credit availability positively impacts land values. If banks have more liquidity (i.e. higher availability of funds) then they can grant more loans to farmers, therefore increasing the supply of credit. An increase of a million dollars in bank deposits increases land values by 0.04% while a 1% increase in the number of lenders who believe fund availability increased with respect to the previous three months, causes an increase in land values by 0.1%. These impacts are slightly smaller than the effects found by Rajan and Ramcharan (2015) for land values during the 1920s which, ranged between 0.06% and 0.07%. Analogously, a 1% increase in lender's responses that the collateral required has increased with respect to the previous three months causes a 0.07% decrease in land values. Increases in the collateral required to take on a loan may limit the number of farmers who can meet these new requirements to gain access to loans. Consequently, this could reduce demand for land, putting downward pressure on land values. The relationship between collateral requirements and land values is not surprising. Hartarska and Nadolnyak (2012) find that, in Alabama, loans were, collateral-driven, even with the consideration of the borrower's profitability and cash flows. The authors found that farmers with insufficient collateral were 16% less likely to be extended a loan.

In Table 3, we find no significant relationship between repayment rates and farmland values. A possible explanation could be that, since these loans were extended with collateral, lenders are not restricting credit based solely on repayment rates. Given that real estate loans are longer in length, it may be that lenders may be forgiving or even expect there to be periods of lower repayment rates. Table 3 shows the effects on land values by factors that may influence credit availability separately (i.e. available funding, bank deposits, collateral requirements and repayment rates). The effects of these factors on land values vary from 0.03% to 0.7%, which are lower than the effect estimated by Devados and Manchu (2007) of 1.40% of increases in loans on land values.

An unanswered question, though, is what the effect would be if there were favorable conditions for credit availability? In this scenario, borrowers face a lending environment where more bankers report lower collateral requirements, higher repayment rates, increased available funds for loans than in the previous year. We investigate how the accumulation of these reports affect land values by creating an indicator for increased credit availability. It takes on the value of one if the majority of the lenders responded that: 1) repayment rates were higher; 2) collateral was lower, and; 3) available funds were higher in the previous three months, in comparison to the previous year. All three things must occur for the indicator to be one. It takes on the value of zero otherwise. The base case of 0 includes the status quo and decreased credit availability. Credit supply would also be affected by the lower deposits in banks and lower loan funds available.

Favorable conditions for credit availability may have higher effects on land values than when slight changes occur in one of the variables associated with credit availability. Table 4 shows that when the three credit availability variables are combined into increased credit availability, the effect of credit on land values increases. For example, a combination of favorable credit conditions (decreased collateral requirements, increased availability of funds, and increased repayment rates) is associated with an increase in land values of 18%.

As a further step, we check for the sensitivity of the increased credit availability indicator to the amount of loans awarded through the Farm Credit System (FCS). Given the limitations of the data available from the FCS call reports (see data section), our intent is to check whether accounting for FCS loans will decrease the effect from the scenario of high credit availability. Table 5 shows that is not the case, as the effect increased to 23% in comparison to estimations conducted without FCS loans variable of 18%

As a last precaution, we instrument the high credit availability indicator using the lenders' expected demand for loans. We expect that the lenders expectations of loan demands will impact the amount of credit they may decide to make available in the market. Table 6 shows the results from the instrumental variable estimation. The Kleibergen-Paap test is above 10 indicating a strong instrument (Boberg-Fazlić and Sharp 2015). We find that moving from an environment of udecreased credit availability to one of increased credit availability could result in a 25% increase in farmland values. The size of the impact varies according to the instrument used.

6. Conclusion

Using panel data from the Ag Credit Survey and from the FDIC Summary of Deposits, we analyze the relationship between land values and credit availability. Fixed-effects estimations were performed at county level, controlling for land value determinants, credit availability factors and county and macroeconomic factors from several secondary data sources. We find that if the factors influencing credit availability individually increase by 1%, they have a positive effect on land values that is below 0.5%. To measure the effects of a favorable credit environment, we build an indicator of high credit availability. Transitioning from an unchanged or decreased credit

availability environment to an increased credit availability environment can increase land values by up to 25%.

Estimation results point to a positive effect of credit availability on land values. It appears that as credit supply increases it puts upward pressure on land values as demand for land increases. This study though, has some limitations. As mentioned, we could not fully account for credit extended through other lenders when examining the effects of credit availability on land values. Nevertheless, we are confident that the perceptions of lenders from the Ag Credit Survey will likely mirror those in other lending agencies. Our findings highlights how even with the changes undergone in the lending system (e.g. greater consideration of cash flow and profitability and loan-to-value requirements), increases in credit availability can put upward pressures on land values.

We also show how the combination of increased reports from lenders of a favorable credit environment can have greater effects than changes in a single factor associated with credit availability. This result points to the need for studies to not only consider total liabilities when seeking to estimate credit availability, but also to consider credit availability as a combination of factors. Using only liabilities to proxy credit may underestimate the effects of credit availability, especially since it usually portrays the accumulated total amount of loans at a bank rather than the actual amount loaned in a given year or quarter.

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Table 1: Definitions or proxies for credit availability found in previous studies

Source	Credit Variable	Further comments
Hartarska, Nadolnyak and Shen (2015)	Loans granted by commercial banks and FCS	
Rajan and Ramcharan (2015)	Number of banks	More competition for depositor funds and greater credit supply
	Amount deposited in banks	Proxy for liquidity and lending capacity
Cole (1998)	Denied or extended credit	
Shalit and Schmitz (1984)	Amount of debt	
Fletschner (2008)	Questions eliciting access to credit status	Questions such as if they took on a loan, whether they were denied a loan, whether they received the full amount they had applied for
Penderson, Chung and Nel (2012)	Farm liabilities	
Briggeman, Towe and Morehart (2009)	Examines credit access by categories ranging from applied for a loan and received it, to denied a loan.	
Hartarska and Nadolnyak (2012)	Share of respondents with(out) loans. Share of respondents where having a collateral was an obstacle to receive the loan.	
Devadoss and Manchu (2007)	Amount of loans through the Farm Service Agency	
Ciaian, Falkowski, Kancs (2012)	Total farm loans	

Table 2: Summary statistics

Variable	Decription	Mean	Standard Deviation	Source
Land value	Land value per acre of non-irrigated farmland	2,285.86	2,032.34	FED KC and MN
	Determinants of land value			
Return	Value of production per acre minus cost of production per acre	53.54	261.26	Agricultural Census
Government payments	Total government payments received per acre without conservation payments	7.96	5.96	Agricultural Census
Population	Total population per sq. mile	60.28	259.55	U.S. Census Bureau
Lag fixed interest rate	Fixed interest rate on farm real estate loans lagged a year	7.88	1.97	FED KC and MN
	Determinants of credit access and credit availability			
Increased Credit Availability	Dummy indicating whether more bankers report increasing credit availability conditions	0.12	0.32	Designed by authors
Lower repayment rate	Percentage of replies that the repayment rate was lower in the previous three months	19.96	27.13	FED KC and MN
Lower availability of funds	Percentage of replies that the availability of funds was lower in the previous three months	20.26	26.05	FED KC and MN
Higher collateral require	Percentage of replies that the collateral required was higher in the previous three months last year	16.35	23.57	FED KC and MN
Farm Credit System Loans	Real estate loans per county* in Thousands of Dollars	43.53	59.34	FCA
Company	Number of different bank companies in a county	1.10	2.24	FDIC
Deposits	Total deposits in banks in the county per $1Million/sq. mile	0.57	22.50	FDIC
Number of operations with internet	Number of farm operations with internet access or use in a county	435.12	276.76	Agricultural Census
	Macroeconomic factors at the county level			
Population growth	Percentage change in population from one year to the next	-0.08	1.55	U.S. Census Bureau
House value	Total value housing permits in $10 Million	3.22	12.30	U.S. Census Bureau
Unemployment rate	Percentage of the population 16 years and over that is unemployed	4.50	1.92	U.S. Bureau of Labor Statistics
Farm income per capita	Farm income per capita in Thousands of dollars	3.21	4.89	Bureau of Economic Analysis
Incomplete high school	Percentage of population that did not complete high school	13.19	6.11	U.S.D.A
Metro County	Dummy constructed using rural-urban continuum codes with 1 for metro county and 0 otherwise	0.18	0.39	U.S.D.A
Debt to income ratio	Ratio of debt to income at the household level	1.56	0.83	U.S. Bureau of Labor Statistics

Abbreviations: FED refers to the Federal Reserve Bank of Kansas City and that of Minneapolis data from the Ag. Credit Survey applied to the 9th and 10th Federal Reserve Districts. FDIC refers to Federal Deposit Insurance Corporation. FCS: Refers to call reports from the Farm Credit System. USDA: U.S. Department of Agriculture. All values are in 2017 US$. *Real estate loans from Farm Credit System are from 2006, 2011, and 2016 were estimated by dividing the loans reported at the headquarters weighed by the farmland area in each county.

Table 3: Effects of credit related variables on land values

	Log Land Value (1)	Log Land Value (2)	Log Land Value (3)	Log Land Value (4)
Return	0.0004**	0.0004**	0.0004*	0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Increased availability of funds	0.0009*			0.0009*
	(0.0006)			(0.0006)
Higher collateral required	-0.0007*			-0.0007*
	(0.0006)			(0.0006)
Lower repayment rate	0.0004			0.0004
	(0.0006)			(0.0006)
Government payments	-0.0093**	-0.0104**	-0.0106**	-0.0089**
	(0.0041)	(0.0042)	(0.0042)	(0.0043)
Population	0.0009	0.0007	0.0006	0.0009
	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Fixed interest rate	-0.0079	-0.0093	-0.0098	-0.0076
	(0.0140)	(0.0139)	(0.0139)	(0.0140)
Number of operations with internet	-0.0001	-0.00009	-0.0001	-0.00009
	(0.0003)	(0.0003)	(0.0002)	(0.0003)
Population growth	0.0319***	0.0310***	0.0311***	0.0315***
	(0.0075)	(0.0074)	(0.0074)	(0.0074)
House value	0.0070*	0.0072*	0.0070*	0.0073*
	(0.0049)	(0.0047)	(0.0050)	(0.0046)
Metro County	0.0111	0.0065	0.0070	0.0136
	(0.0673)	(0.0673)	(0.0679)	(0.0665)
Debt to income ratio	0.0312*	0.0294*	0.0291	0.0326*
	(0.0253)	(0.0254)	(0.0253)	(0.0254)
Unemployment rate	-0.0188*	-0.0195*	-0.0189*	-0.0197*
	(0.0148)	(0.0147)	(0.0148)	(0.0147)
Farm income per capita	0.0124***	0.0126***	0.0128***	0.0124***
	(0.0041)	(0.0040)	(0.0040)	(0.0041)
Incomplete high school	-0.0017	-0.0020	-0.0020	-0.0019
	(0.0074)	(0.0072)	(0.0073)	(0.0073)
Company		-0.0057		-0.0062
		(0.0065)		(0.0064)
Deposits			0.0004***	0.0004***
			(0.00004)	(0.00008)
Constant	6.3893***	6.4360***	6.4464***	6.3847***
	(0.2706)	(0.2613)	(0.2609)	(0.2717)
Observations	1436	1436	1436	1436
R-squared	0.6199	0.6175	0.6174	0.6209
County fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Counties	550	550	550	550
Rho	0.8207	0.8224	0.8221	0.8201

Notes: *10%, **5% and ***1% levels of statistical significance. Standard errors clustered at the county level.

Table 4: Effects of credit availability on land values

	Log Land Value (1)	Log Land Value (2)
Return	0.0006***	0.0006***
	(0.0002)	(0.0002)
Increased Credit Availability	0.1790***	0.1790***
	(0.0293)	(0.0293)
Dummy above the average number of bank companies in county		-0.0127
		(0.0270)
Deposits	0.0005***	0.0005***
	(0.00004)	(0.00003)
Government payments	-0.0086**	-0.0086**
	(0.0040)	(0.0040)
Population	0.0003	0.0003
	(0.0012)	(0.0012)
Fixed interest rate	0.0060	0.0061
	(0.0140)	(0.0141)
Number of operations with internet	0.00009	0.00009
	(0.0002)	(0.0002)
Population growth	0.0254***	0.0253***
	(0.0074)	(0.0074)
House value	0.0076*	0.0076*
	(0.0045)	(0.0045)
Metro County	0.0544	0.0542
	(0.0841)	(0.0839)
Debt to income ratio	0.0127	0.0131
	(0.0241)	(0.0242)
Unemployment rate	-0.0289**	-0.0293**
	(0.0119)	(0.0117)
Farm income per capita	0.0120***	0.0120***
	(0.0038)	(0.0038)
Incomplete high school	0.0019	0.0019
	(0.0070)	(0.0069)
Constant	6.2033***	6.2051***
	(0.2518)	(0.2499)
Observations	1557	1557
R-squared	0.5759	0.5760
County fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Counties	574	574
Rho	0.8081	0.8081

Notes: *10%, **5% and ***1% levels of statistical significance. Standard errors clustered at the county level.

Table 5: Checking for the sensitivity of high credit availability dummy to loans from the Farm Credit System

	Log Land Value
	(1)
Increased Credit Availability	0.2314***
	(0.0265)
Farm Credit System Loans	0.0012*
	(0.0007)
Constant	6.5641***
	(0.3900)
Determinants of land values	Yes
Macroeconomic factors	Yes
Observations	866
Counties	399
R-squared	0.6201
County fixed effects	Yes
Year fixed effects	Yes
Rho	0.9054

Notes: *10%, **5% and ***1% levels of statistical significance. Standard errors clustered at the county level.

Table 6: Impact of credit availability on land values. Credit availability is instrumented by the expected demand of loans.

	Log Land Value (1)	Log Land Value (2)	Log Land Value (3)
Return	0.0013***	0.0013***	0.0018***
	(0.0003)	(0.0003)	(0.0004)
Increased Credit Availability Index	0.2473*	0.2204*	1.0778***
	(0.1906)	(0.1888)	(0.2114)
Government payments	0.0035	0.0032	0.0132**
	(0.0054)	(0.0053)	(0.0066)
Population	0.0035***	0.0036***	0.0010
	(0.0012)	(0.0012)	(0.0012)
Fixed interest rates	-0.0618***	-0.0623***	-0.0475***
	(0.0093)	(0.0093)	(0.0112)
Number of operations with internet	0.0013***	0.0013***	0.0013***
	(0.0003)	(0.0003)	(0.0003)
Population growth	0.0185**	0.0182**	0.0290**
	(0.0081)	(0.0081)	(0.0103)
House value	0.0064*	0.0064*	0.0078*
	(0.0051)	(0.0051)	(0.0049)
Metro county	0.1048	0.0987	0.2913**
	(0.1003)	(0.0994)	(0.1507)
Debt to income ratio	0.0279*	0.0282*	0.0170
	(0.0251)	(0.0252)	(0.0289)
Unemployment rate	-0.0100	-0.0098	-0.0141
	(0.0122)	(0.0122)	(0.0143)
Farm income per capita	0.0229***	0.0233***	0.0107**
	(0.0046)	(0.0046)	(0.0050)
Incomplete high school	-0.0285***	-0.0287***	-0.0223***
	(0.0052)	(0.0052)	(0.0055)
Observations	1488	1488	1488
R-squared	0.5104	0.5103	0.2945
Counties	505	505	505
Kleibergen-Paap rk LM statistic	25.458***	26.198***	43.978***
Kleibergen-Paap rk Walk F statistic	27.800	17.601	23.694
RMSE	0.37	0.37	0.4441
Instrument used			
Expected loan demand	X	X	X
Land quality		X	X
Corn future prices			X

Notes: *10%, **5% and ***1% levels of statistical significance. Standard errors clustered at the county level. Instrumental variable is 4th quarter diffusion index on expected demand for loans in the coming 3 months. Diffusion Index = [bankers responded higher (%) – bankers responded lower (%)] + 100. The average and standard errors of the series are 114.2 and 22.1 respectively.

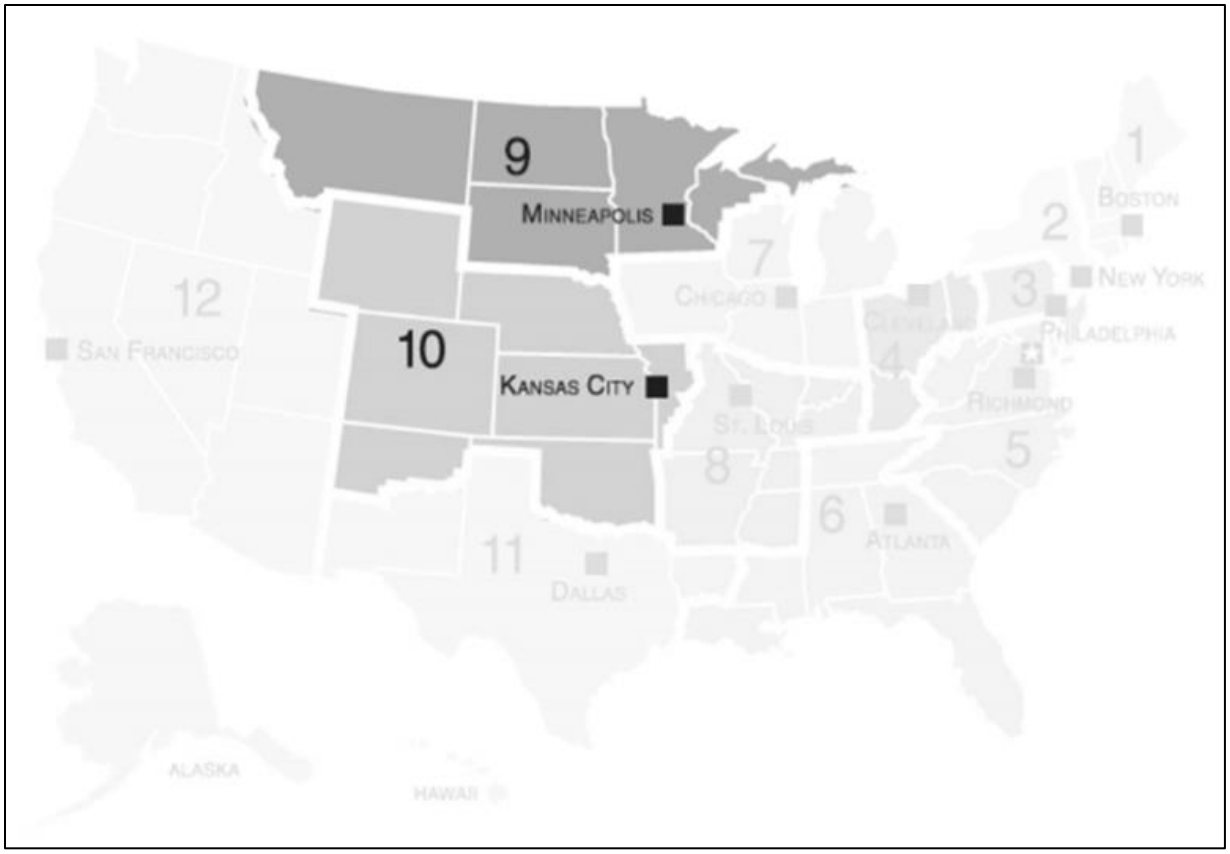

Figure 1: Area that represents the Ninth and Tenth Federal Reserve Districts. Source: Federal Reserve Bank city; Board of Governors of the Federal Reserve System, Washington, D.C.

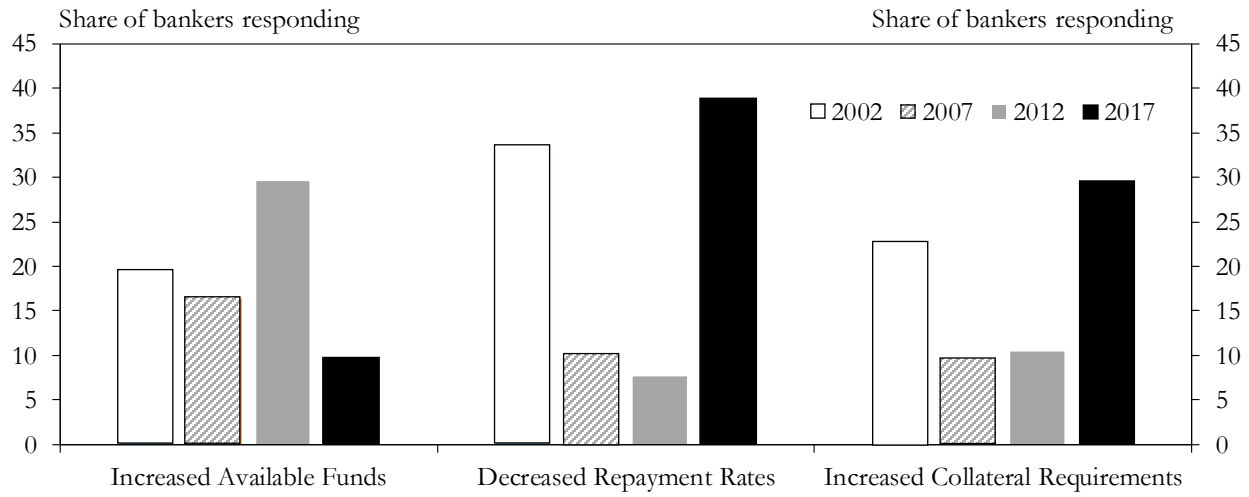

Figure 2: Determinants of Credit Availability from Ag Credit Survey Respondents

Sources: Federal Reserve Banks of Kansas City and Minneapolis

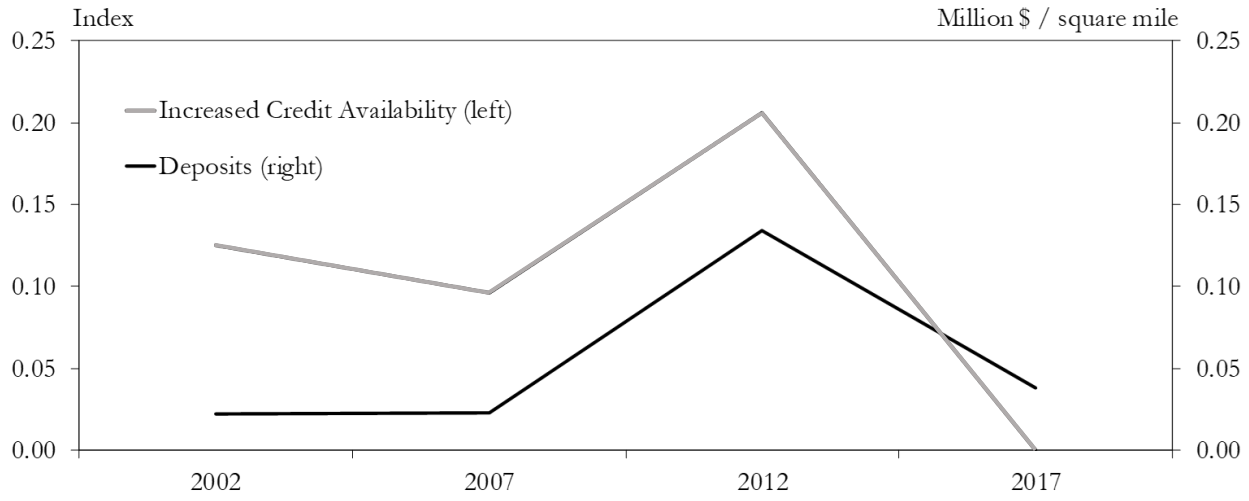

Figure 3: Credit Availability and Deposits

Sources: FDIC, Federal Reserve Banks of Kansas City and Minneapolis and author calculations

[i] Collateral requirements are the amounts necessary to secure a real estate loan. Available funds refer to the amount of deposits in a bank. Repayment rates provide information on whether loans are being repaid on time and/or in full.
[ii] Given that the USDA reports this information for only a select number of years, we use data from the year 2000 as a proxy for 2002 and data from 2012-2016 as a proxy for 2012 and 2017. The average of the 2000 and 2012-2016 data is used as a proxy for 2007.
[iii] Metro counties are considered to be those in categories 1, 2 and 3. Data for 2003 are used as a proxy for 2002 and for 2007, while data for 2013 are used as a proxy for 2012 and 2017. For further information on the categories of the Urban-Rural Continuum Codes from the USDA please read through the documentation files at https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation/
[iv] We do not use information on agricultural loans since these are informed at the bank headquarter level. Information and bank location and deposits are available at the branch level.
[v] Prior to 2005 FCS call reports inform the total amount in agricultural loans (i.e. production loans plus real estate loans).
[vi] In this study we do not control for each government payment program separately as is done in Goodwin, Mishra and Ortalo-Magne (2003).
[vii] For example, when studying farmers in Alabama Hartarska and Nadolnyak (2012) find that lending was primarily collateral driven.