THE HISTORICAL RELATIONSHIP BETWEEN THE U.S. FARM CREDIT SYSTEM, FARM SERVICE AGENCY AND COMMERICAL BANK LENDING

Calum G. Turvey
Cornell University
cgt6@cornell.edu

Jennifer Ifft
Cornell University
jifft@cornell.edu

Amy Carduner
Farm Credit Corporation
Canada[1]

Selected Paper prepared for presentation at the 2018 Agricultural & Applied Economics Association Annual Meeting, Washington, D.C., August 5-August 7

[1] This paper, including all analytics, elasticity measures, and regressions, is based largely on Amy Carduner's MS Thesis, *Farm Loan Demand Elasticities and the Relationship Between the Farm Credit System and Commercial Bank Lending,* Cornell College of Business, Dyson School of Applied Economics and Management, 2016

Introduction

Since 1916 there has been both private and public institutions for agricultural credit in the United States and how they compete, what their roles are, and how each responds to changes in demand (i.e. change in elasticity) is an important economic problem. The historical relationship between public and private lending institutions is, after 100 years, poorly understood and often contentious. For example the American Bankers Association (ABA), which represents commercial banks, has recently called for a referendum to remove the Farm Credit System (FCS) from legislation and open the market to commercial lending, *... "from the ABA's view, the hope is to get a congressional oversight hearing scheduled so that both lawmakers and the public can start to dig deeper and present a full view of the FCS' business practices. From there, the ABA would push for the FCS to scale back and focus on its core mission. Or, failing that, it would like to see agriculture banks — there are hundreds of banks focused primarily on farm country, he said — be granted tax advantages similar to the FCS. Or, of course, the FCS could give up its tax breaks. These latter moves, he said, would at least level the playing field."* (President of American Bankers Association, August 2015).

The ABA and its predecessors have been critical about the Government's involvement in farm credit for nearly 100 years since the 1916 Farm Credit Act established the land bank system and the right to this system to issue bonds on its behalf. To place the ABA's comments of the present into perspective, there is a need to better understand the interactions between the FCS and the commercial system in an historical context. This includes recognizing that it was imperfections in the commercial market wih respect to agricultural credit that gave rise to the FCS in the first place. Simply, put the FCS was designed as a cooperative system, secured by the strength of agricultural real estate to provide credit in good times and bad times, and to fill the void when, for

whatever reason, the commercial system reduced credit to agriculture. From Turvey (2016) a little known fact is that the 1916 Farm Credit Act actually dealt with issues raised by commercial banking interests by allowing joint-stock companies to be formed by deposit taking financial institutions. These joint-stock companies could also participate in the tax-exempt land bank bond markets with their own boards of directors, yet outside of the cooperative system. By 1933 , amidst a string of farm bank failures – to which the U.S. government did not intervene even though bonds issued were believed to be instrumentalities of the U.S. Government - and with financial markets in disarray, the Emergency Farm Mortgage Act initiated the orderly dissolution of the joint-stock banks. By 1936 all joint-stock banks were dissolved with their parent banks purchasing land bank bonds at significant discount and profiting by redeeming them at par (Bennett 1938). Nonetheless, in the present era the commercial banking system still argues that the tax-free status of Farm Credit bonds combined with an implicit guarantee gives the FCS an unfair advantage. Only a few scholarly papers have investigated land bank bonds and the effect of GSE status on bond yields and rates offered farmers (Stokes 1973, Lins and Barry 1984, O'Hara 1983, Jensen 2000, Lee and Irwin 1996, Peoples et al 1992). Turvey and Wang (2012) for example find that the best estimates of bond yield impact should the GSE status be lifted would raise yields by about 13.62 bps for short term notes and perhaps 68.81 bps for notes of 10 year or longer duration. This is driven by the differential between the implied volatility imbedded in FCFC bonds and the volatility of real estate land prices, the primary security for the bonds. This is viewed as an upper limit, especially when some studies such as Tauer and Weersink (1987) show also that there is also an inverse relationship between accumulated equity of the FCS and the risk premium required by bond holders. Jensen (2000) has also argued that GSE status likely has little effect on FCFC bond yields.

While there is great academic interest on whether GSE status impedes competition in the farm credit market in 2018, the greater academic interest is in whether the FCS has met its original goals of providing a stable supply of credit to farmers, in both good and bad years. The concern in 1916 was that credit supply to agriculture from commercial sources was unstable and unpredictable and Congress sought a system of credit based on sound principles that would provide continuity, stability and liquidity to farmers' credit needs. If over the long run evidence can be produced to show that the FCS indeed continued making loans in times when the commercial system was leaving agriculture or reducing loans to agriculture this would provide at least preliminary evidence that the system had functioned as originally proposed. However, if no differences are found between FCS and commercial lending across time and economic conditions, then claims that the FCS crowds out the commercial banking system may well be justified, or at least worthy of further investigation. We are unaware of any study that has fundamentally attempted to examine the historical lending patterns of the FCS , the Farm Service Agency (FSA) and the commercial banking system (CB) , and that is the purpose of this paper. We do this by evaluating loans made by FCS, FSA and CB since the late 1930s and incorporate control variables for macroeconomic conditions, as well as the elasticities for interest rates and land expense to show the sensitivity of the industry to changes in the cost of capital.

In order to test the effectiveness of the FCS, national data from the US is utilized. By incorporating national data into our model we can measure changes in lending between the FCS and the FSA relative to CB. We aim to test the effectiveness of the FCS by comparing the percentage change in relative lending of both the FCS and the FSA to the percentage change in relative lending of the Commercial Banks. To achieve this objective, we use general macro-economic indicative variables (such as GDP and Treasury Yield) as well as the short-run dynamic

elasticities for the short term interest, long term interest, and land price elasticities from the dynamic model described above. Although the elasticities are computed using cornbelt data, they are included to show how sensitivity of interest rates affects the lending patterns in agriculture. Thus, in a way that accounts for year-over-year change to the respective FCS (FSA) or CB loan portfolios, we are able to identify their effects on farm lending in the US agricultural sector.

Simple Assessment

In the following Figures and Tables we explore loans performance of real estate and non-real estate debt issued by commercial banks, the Farm Credit System and the Farm Services Agency. We are interested to establish any statistical patterns that could provide some evidence as to whether CB and/or FCS banks and/or the FSA lend in a complimentary way, that is compete, or operate in a countercyclical fashion or some combination of this. Figures 1-4 show the patterns of loans and changes in loans over the period. Tables 1-4 examine the changes in more detail by presenting the correlations for four subperiods; 1939/1940-1969/1970 , 1970/1971-1988/1989, 1989/1990-2012/2013, and 1939/1940-1912/1913. The subperiods cover from the beginning of the second world war through the beginning of the transformative grain sales in the early 1970s that are believed to have sparked the notion that land was an inflation hedge. The second period covers the years between 1970 and 1989 covering the inflationary period and the financial crisis. The third period is the period of reforms and controls following the financial crisis and to the present.

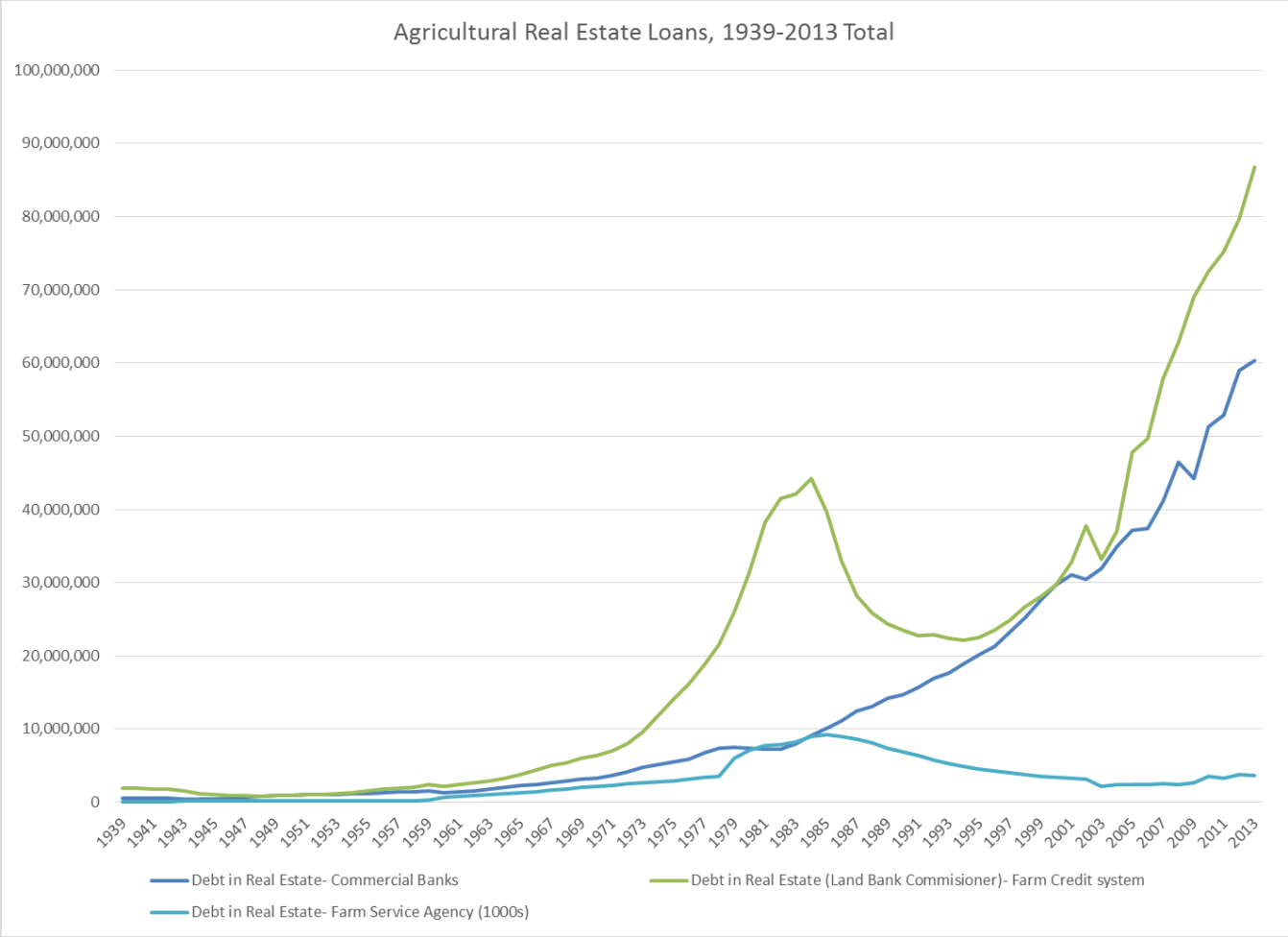


Figure 1: Agricultural Real Estate Loans, 1939-2013

Up until the mid to late 1960's loans mortgages issued by the FCS outpaced commercial banks by only modest amounts. This changed in the early 1970's as grain and soybean sales to the Soviet Union spurred demand. This combined with high inflation got bid into land prices which rose swiftly. The CFS responded in an historic way, lending based on the rising price of farmland rather than its cashflows. The commercial banks were far more prudent, and steady, in their lending activity. An aside to the structure of lending between commercial banks and the FCS is that the former were subject to capital controls on the loan to deposits ratio. After the wave of high wheat

prices subsided, the deposits at the commercial banks in rural areas would have been more closely proportioned to true cashflow. The FCS on the other hand had no such controls and little oversight at the time and could simply issue bonds to originate loans. The Farm Services Agency also increased its lending portfolio.

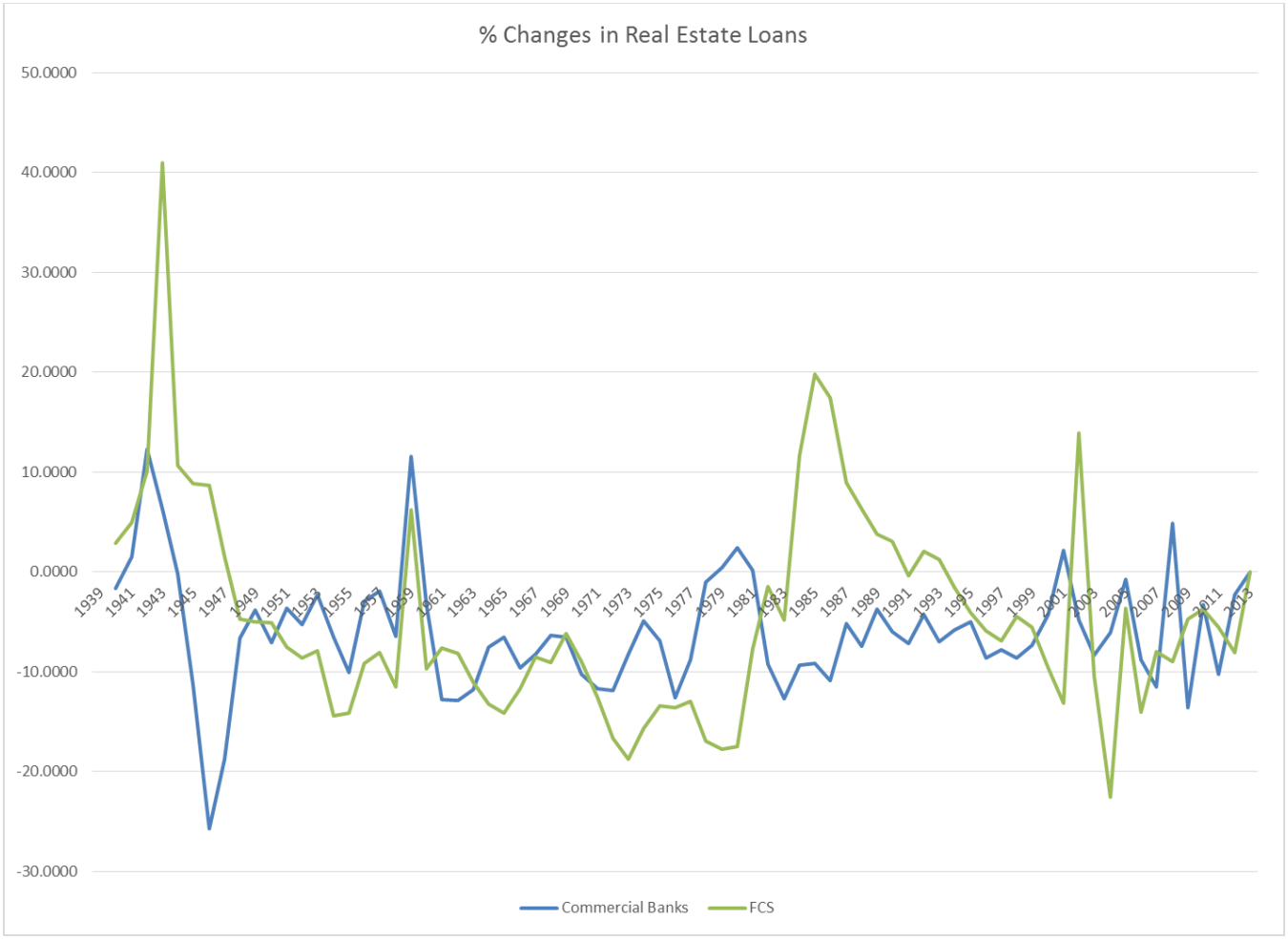


Figure 2: Percentage Change in Commercial Bank and Farm Credit System Loans, 1939-2013

Figure 2 represents the percent change in loans across years. Although farm credit increased throughout the period, the year over year changes would be more sensitive to agricultural conditions. Quite surprisingly, following an uptick in lending during the war years, and with an

exception around 1960, there was a general decline in agricultural lending. Starting around 1970 FCS became more aggressive into lending and the volume of loans increased rapidly over commercial banks. Following the crisis the patterns in loan origination changed to what appears to be a countercyclical pattern.

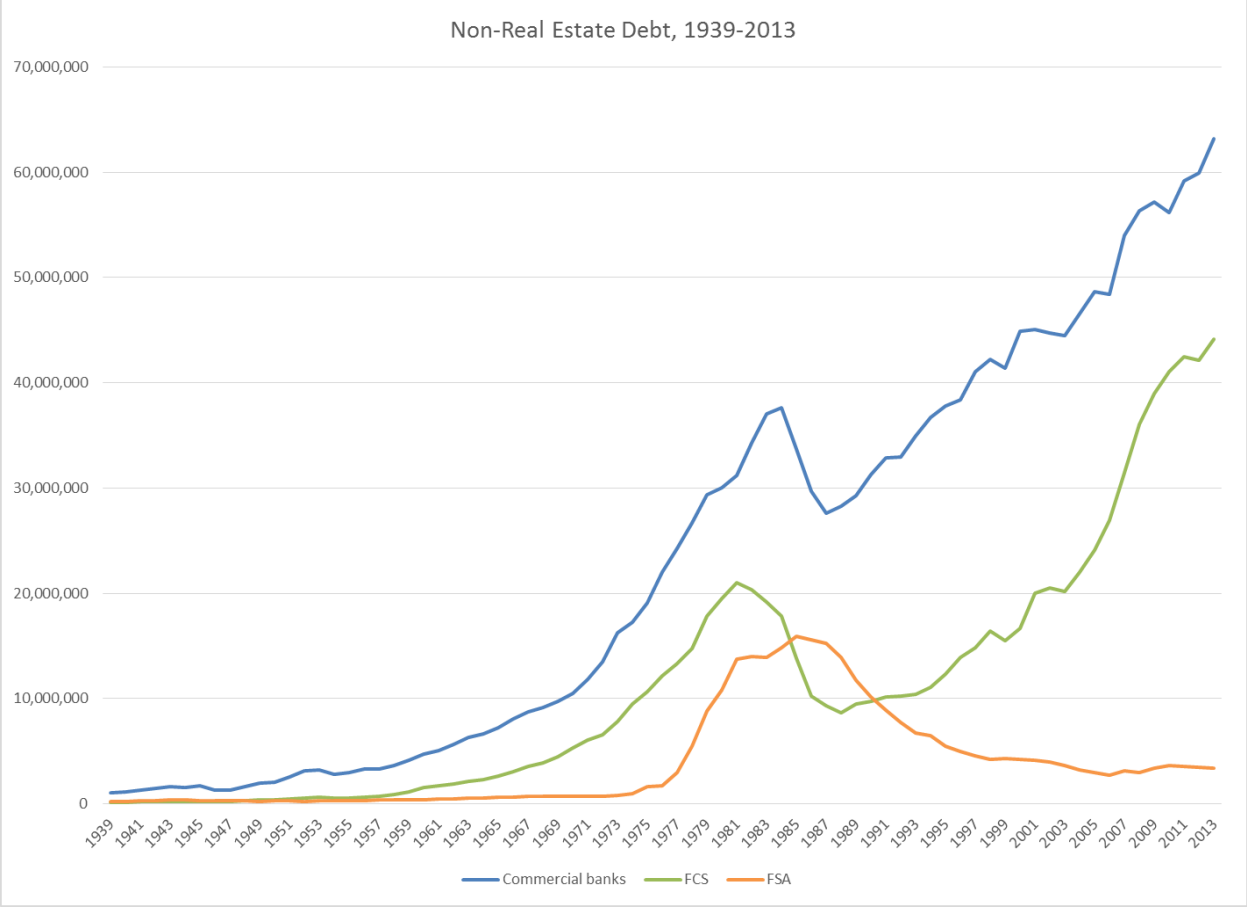


Figure 3: Non-Real Estate Debt, 1939-2013

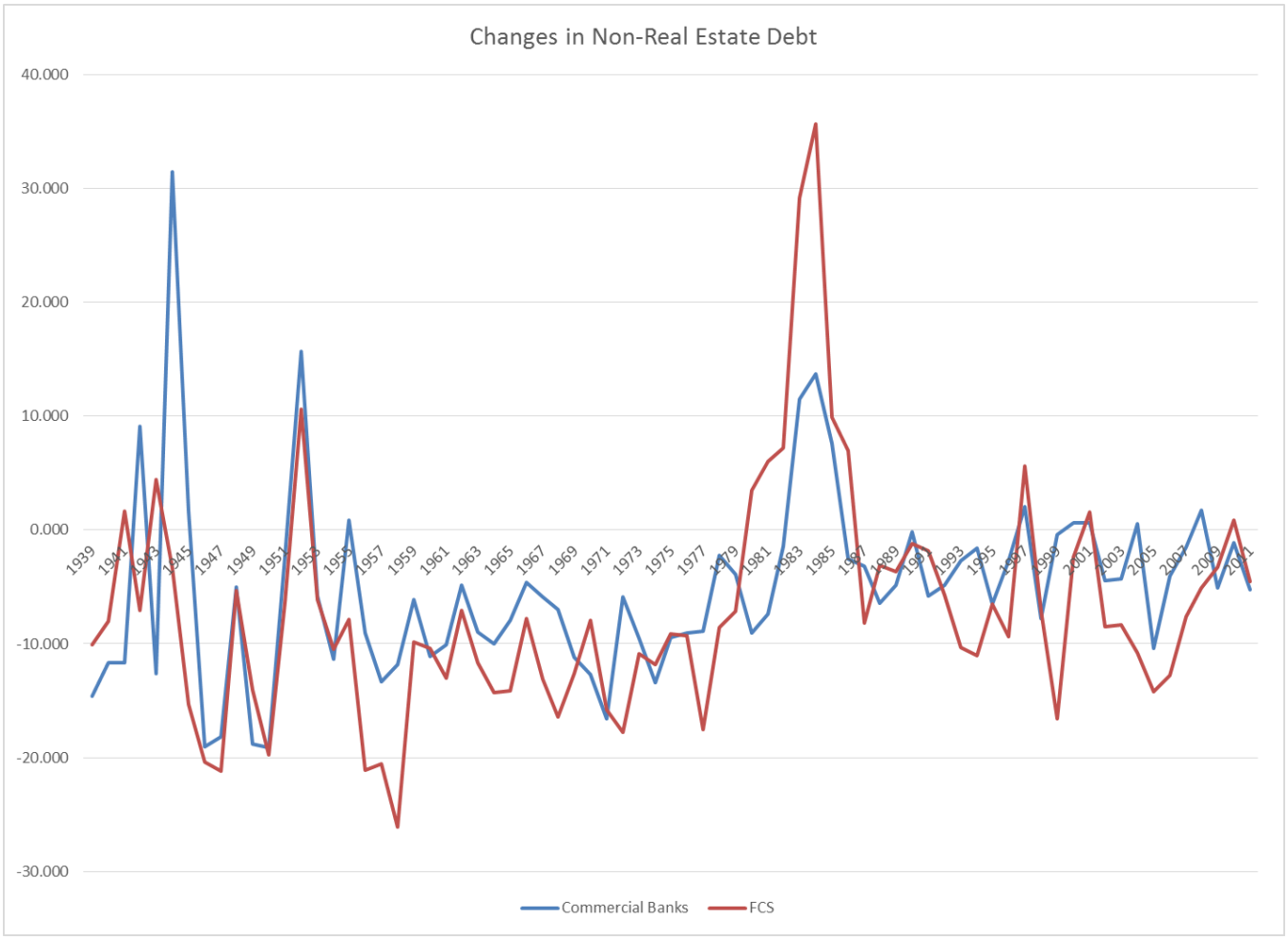


Figure 4: Percentage Change in Commercial and Farm Credit System Non-Real-Estate Loans

Figures 3 and 4 show the lending pattern and change in lending for non-real estate loans. Here the commercial banks have dominated the FCS, with either providing increasing lines of credit or operating loans during the financial crisis. Over this period the common practice was to provide short term credit to bring mortgage loans out of arrears and into compliance. This was taken up after the peak of the crisis by the FSA.

Also of interest is the parallel patterning of non-mortgage loans over the time period. In this market the FCS and commercial banks appeared to be competing, or at least using scoring functions and analytics to observe market signals and agricultural conditions in the same way.

Correlations

Tables 1-4 provide simple correlation analysis on the loan data. The upper left triangle captures the correlations between commercial bank, FCS and FSA real-estate or mortgage loans. The lower right triangle provides the correlations between commercial, FCS, and FSA non-real estate loans. The lower left 3x3 square captures the correlations between and among real-estate and non-real estate loans.

Over the 1939-2013 period there is not a strong correlation between commercial bank and FCS mortgage loans (P=0.14). It cannot be said that it has been overtly countercyclical, but it is not purely competitive. The correlation between CB mortgages and FSA is negative (-0.13) while that for the FSA is slightly positive (P=0.11). The FSA in fact should have a near zero correlation with either commercial banks or FCS because their mandate is to provide credit for young and underserved or other disadvantaged groups that are generally red-lined or rationed by the other lenders.

In contrast the correlation between operating loans is quite high between CB and FCS (P=0.58) suggesting that the CB and FCS have always been competitive in this market, or at least complementary in responding to market signals that warrant short run credit.

The correlation between CB mortgages and operating loans is negligible (P=-0.04) suggesting that there might be minimal bundling of long and short term credit, or perhaps borrowers obtain a mortgage from FCS and an operating loan at a different time period with the CB. The FCS on the other hand has a much stronger correlation between long and short term loans (P=0.45) as does the FSA (P=0.48).

Table 1:Credit Profile Correlations in % Changes, 1939-2013

	CB/RE	*FCS/RE*	*FSA/RE*	*CB/NRE*	*FCS/NRE*	*FSA/NRE*
CB/RE	1.00					
FCS/RE	0.14	1.00				
FSA/RE	-0.31	0.11	1.00			
CB/NRE	-0.04	0.40	0.30	1.00		
FCS/NRE	-0.01	0.45	0.27	0.58	1.00	
FSA/NRE	-0.06	0.42	0.48	0.18	0.14	1.00

For the 1939-1969 post war period there is evidence that indeed mortgage loans originating by CB and FCS were positively correlated (P=0.36). In other words, when commercial banks tended to reduce loans, the FCS would to some extent reduce loans, and when CB increased lending, the FCS also had a tendency to increase lending (P=-0.55). The FSA on the other hand was negatively correlated with both CB (P=-0.55) and FCS (P=-0.24). In other words, the FSA following its mandate was stepping in to provide credit when neither CB nor FCS were willing to provide credit. Again, the correlation between CB mortgage and operating loans were near zero and again positive (P=0.18) between FCS mortgage and FCS loans. The cross effects are also quite interesting. The correlation between CB real estate loans and non-real estate loans is weakly negative (P=-0.05) while the same for FCS is moderately positive (P=0.18). However, it seems that in an odd way the correlation between CD real-estate and FCS non-real estate (P=0.20), and FCS real estate and CB non-real estate (P=0.29) are even stronger. This may suggest some early predation and competition between CB and FCS, or it might have been purposeful that a borrower did not want to deal with a single lender and would take a mortgage with FCS and an operating loans with CB, or vice versa.

Table 2: Credit Profile Correlations in % Changes, 1939-1969

	CB/RE	*FCS/RE*	*FSA/RE*	*CB/NRE*	*FCS/NRE*	*FSA/NRE*
CB/RE	1.00					
FCS/RE	0.36	1.00				
FSA/RE	-0.55	-0.24	1.00			
CB/NRE	-0.05	0.29	0.27	1.00		
FCS/NRE	0.20	0.18	0.13	0.52	1.00	
FSA/NRE	-0.21	0.30	0.50	0.07	-0.15	1.00

This patterns seems to have changed in the 1979-1988 period. The correlation between CB and FCS, and CB and FSA real estate loans, was negative (P=-0.27, P=-0.28)). This is corroborating what was discussed earlier that as the FCS and FSA increased lending to agriculture, in relative terms the CB did not follow suit. We see again a strong correlation amongst non-real estate loans between CD and FCS (P=0.85) but as before we do not observe a strong correlation between CB real estate loans and non-real estate loans (P=-0.07). The correlation between CB real estate loans and FCS non-real estate loans is negative (P=-0.21) which results from a strong correlation between FCS real estate and non-real estate loans, while CB real estate loans were decreasing on a relative scale. Meanwhile there was a strong correlation between FCS mortgage loans and shorter term credit from CBs with a correlation of P=0.78. It is likely that many farmers, perhaps in financial distress, increased mortgages with the FCS but relied on the CB for shorter term credit. If we consider the strong correlation between FCS mortgage loans and FCS and CB non-real estate loans over the 1979-1988 period (P=0.83 and P=0.78) it suggests that the liquidity crisis and the demand for short term credit for expansion on one hand and emergency/liquid working capital on the other, farmers sought shorter term debt from all sources (including FSA)

Table 3: Credit Profile Correlations in % Changes, 1979-1988

	CB/RE	*FCS/RE*	*FSA/RE*	*CB/NRE*	*FCS/NRE*	*FSA/NRE*
CB/RE	1.00					
FCS/RE	-0.27	1.00				
FSA/RE	-0.28	0.62	1.00			
CB/NRE	-0.07	0.78	0.29	1.00		
FCS/NRE	-0.21	0.83	0.41	0.85	1.00	
FSA/NRE	-0.09	0.66	0.62	0.31	0.43	1.00

The post crisis period reveals a different pattern. Changes in real estate debt between CB and FCS is almost zero (P=-0.05) which suggests that both channels are moving quite independent of each other. Both CB and FCS are utilizing the FSA more, perhaps not so much in loan volume but in securing loans for targeted groups. It also appears that the lender-borrower relationship within CB was strengthening. A positive correlation between mortgage and non-mortgage loans (P=0.14) suggests that the CB system was focusing on customer retention and full service, with long and short term debt bundling. The FCS continued to do so as it had done since the late 1930's. The correlation between FCS and CB non-real estate loans is still positive (P=0.34) , but lower than it had been in 1939-1969 (P=0.52), and 1970-1988, (P=0.85) which is consistent with what is observed in the more recent credit markets that FCS real estate loans are increasing at a greater pace than CB real-estate loans, while CB shorter term credit is outpacing FCS shorter term credit.

Table 4: Credit Profile Correlations in % Changes, 1989-2013

	CB/RE	*FCS/RE*	*FSA/RE*	*CB/NRE*	*FCS/NRE*	*FSA/NRE*
CB/RE	1.00					
FCS/RE	-0.05	1.00				
FSA/RE	0.21	0.65	1.00			
CB/NRE	0.14	0.22	0.07	1.00		
FCS/NRE	-0.01	0.45	0.28	0.34	1.00	
FSA/NRE	-0.01	0.37	0.50	0.04	0.10	1.00

Analytical Framework

This paper incorporates a time-series data set stretching from 1939-2013 with two distinct portions. The first includes state level investment and expenditure data to determine long and short credit demand elasticities and also the land price elasticity. To accomplish this we compiled USDA data for the five corn-belt states: Illinois, Iowa, Indiana, Missouri, and Ohio, as well as an average of these 5 states. Following Weersink et al (1994)[2] we computed elasticities from a dual cost function Static, Partial Static and Dynamic models. The Static model assumes that inputs adjust immediately towards their equilibrium value in each time period. The Partial Static and the Dynamic models assume that some inputs only partially adjust in each period. The Partial Static model assumes some of the inputs are quasi-fixed, while the less restrictive Dynamic allows quasi-fixed inputs to adjust partially through the use of a partial adjustment matrix. Our interest in constructing these elasticities is to capture unobserved utility-centric sentiment by farmers towards

[2] We also refer to Berndt et al (1981), Beattie and Taylor (1985), and Tsigas and Hertel (1989).

short and long term credit across time. Ultimately we elected to use the elasticities generated from the dynamic model because of the length of our time horizon (1939-2013) which predates WWII. This approach allows us to capture dynamic adjustment in quasi-fixed assets, while accounting for endogeneity amongst the variable, quasi fixed, and fixed asset classes. Furthermore, since our loans data are national aggregates, we take the average of the dynamic elasticities

The Farm Credit portion of this paper uses national data for the lending patterns of commercial banks, the Farm Credit System, and the Farm Service Agency from 1939-2013. Tsigas and Hertel (1989) show that using state level panel data helps to avoid multicollinearity and simultaneity further than aggregate time-series data, due to the large number of observations. Using panel data will help to reduce bias and increase efficiency in the models.

Elasticity Measures

Our final model includes time series point estimates of credit demand elasticities. These elasticities are treated as covariates, but might also capture certain unobservable characteristics that are endogenous to the demand side factors affecting demand. Space does not allow a full explanation of our models but we follow the techniques presented in Weersink et al (1995) with complete methods and results available in Carduner (2016). The essential measures of elasticity are obtained from a dynamic adjustment model that allows for changes in fixed and quasi fixed assets as well as short term assets and inputs. The idea of deriving credit demand elasticities within a classical duality (and in our case translog) framework originates with Baker (1968) who illustrated the need for including credit as an input into the production function. He explains that the effects of credit, defined as borrowing capacity, are essential to liquidity value as increasing loans generates a cost from the loss of liquidity. This loss, which has value, combined with the interest charges on loans,

can have an impact on the production capabilities of a firm. Thus he explains, credit should be managed as an asset due to its important implications for production decisions..In a duality framework, the credit demand elasticities can be computed in the ordinary way if it is assumed that the credit, at least in the short term, is fungible. If it is fungible then it is also separable and homothetic.

We use three elasticity measures in this paper including the short run interest elasticity, the long run interest elasticity, and the land price elasticity. These were obtained from a translog cost function approach using seemingly unrelated regressions (Carduner 2016). The annual expenditure data was broken into nine categories: total production expenses; crop expenses (including seed, fertilizer, and lime plus pesticides purchased); feed purchases; livestock and poultry expenses; contracted and hired labor expenses; land expenses (including net rent to non-operator landlords plus property taxes); non-real estate interest expense; real estate interest expense; machinery expense (including depreciation, repairs, plus fuel purchased); and other expenses (including electricity, insurance, and miscellaneous). All of the expenditure data was obtained from USDA statistical summaries.

Output was divided into crops and livestock, measured in quantity indexes for the corn-belt region (USDA). The indices for hourly wage rates were also measured for the corn-belt region and the land values were measured by state as an index of average value per acre of farm real estate. Prices for all other inputs were collected at the national level from the USDA, as it was not available by state or region for the entire period.

Non-real estate interest expense used is the average cost of loans outstanding during the year through Production Credit Associations. The real estate interest expense is denoted as the average rate on new loans through the Federal Land Bank Associations (USDA). The other prices

were collected at the national level from the statistical summaries (USDA). These prices paid by farmers for all production include: feed; feeder livestock; seed; fertilizer; pesticides; and machinery. These are national rates, as the regional or state rates were also not available.

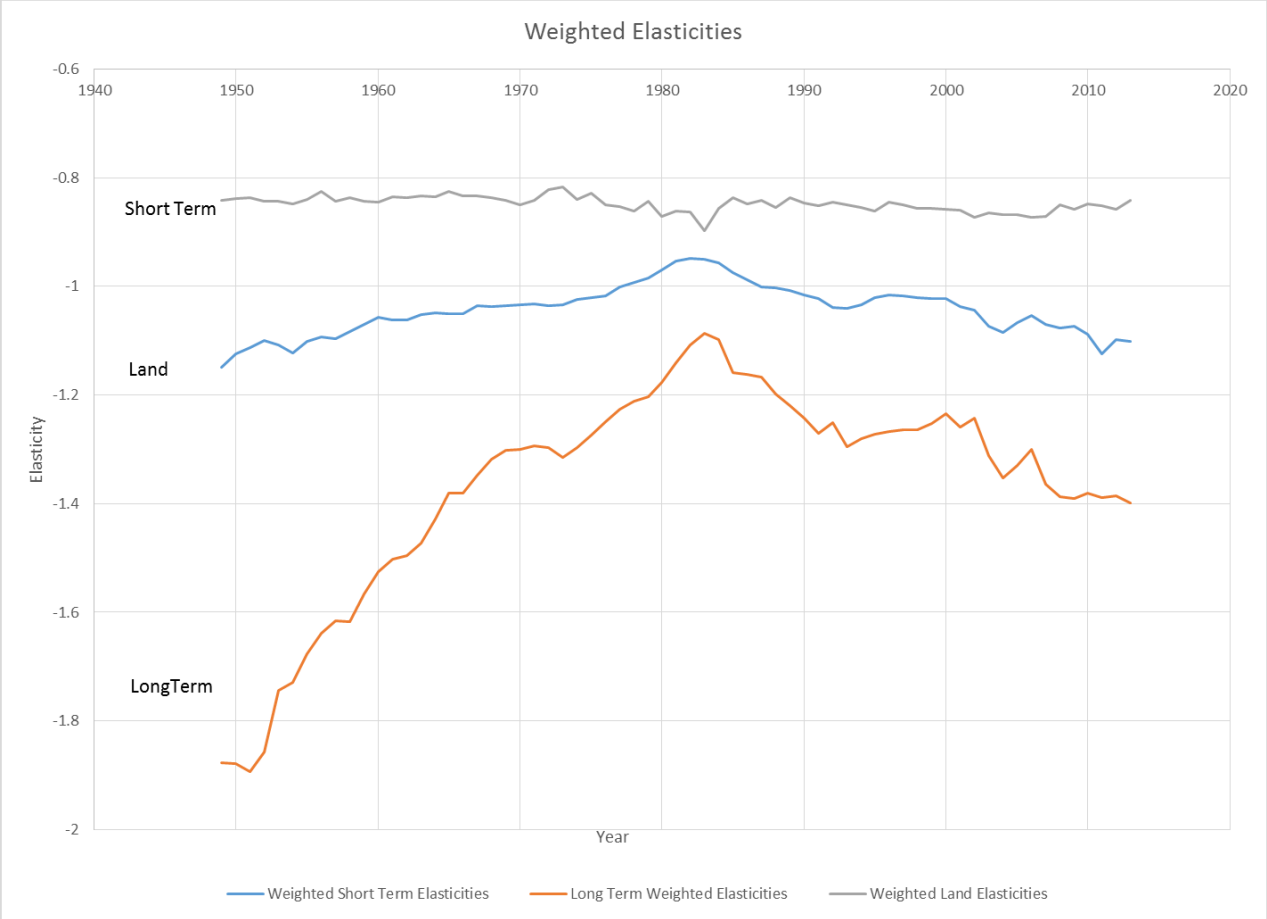
Table 5:Dynamic Model Short-Run Average Price Elasticity Estimates for the Cornbelt (Source: Carduner 2016)

	PRICE ELASTICITY (Eij)							
	Price (j)							
Input (i)	Feed	ST credit	Labor	Crop	Livest	LT credit	Land	Mach
Feed	-0.83	0.04	0.29	0.24	0.35	0.20	0.18	0.23
ST credit	0.03	**-0.96**	0.04	0.04	0.04	0.03	0.03	0.04
Labor	0.07	0.00	-0.90	0.08	0.12	0.07	0.04	0.08
Crop	0.02	-0.12	-0.11	-1.04	-0.20	0.03	0.05	-0.03
Livestock	0.05	0.06	0.06	0.05	-0.93	0.05	0.04	0.05
LT credit	0.15	0.14	-0.01	0.15	0.14	**-0.85**	0.15	0.15
Land	0.25	0.27	0.27	0.26	0.28	0.25	**-0.75**	0.26
Machinery	0.09	0.11	0.11	0.10	0.11	0.09	0.09	-0.90

The dynamic credit demand elasticity matrix is provided in Table 1. The three elasticities of interest are short term credit (ST credit = -0.96), long term credit (LT credit = -0.85) and Land (Land = -0.75). All are negative as expected, and while inelastic, are not extremely so. Short term credit is less inelastic than long term credit. The point elasticities we use in our farm credit regression are captured in Figure 1. Short term elasticities have become less elastic since 1939, becoming unitary-elastic around 1966 and remaining elastic from about 2002 to the present. The least elastic (-0.929) was in the midst of the farm crisis in 1983. Long term elasticities were relatively stable over our time frame. Between 1947 and 1968 the long term credit elasticities ranged between -0.96 and -0.97. The most inelastic measure occurred in 1984 with an elasticity of -0.905 which reflects the highly uncertain environment of the 1980s farm crisis. Although it is interesting to observe greater inelasticity in times of crisis, the scale of change was not as dramatic

as we would have thought. The land price elasticity is also quite stable varying between -0.75 to -0.9. Again, the most inelastic portion occurs in the years leading up to the farm crisis, and the most elastic values occur in the years following the farm crisis. The most inelastic observation was -0.897 in 1986.

Figure 1. Short Term Weighted Elasticities (from 1945-2013) for the corn-belt states



Farm Credit Data

We had available national level data for the years 1939-2013. In the regressions that follow the dependent variables used are the relative lending of the FCS and the FSA compared to the commercial banking (CB) system in both real estate lending and non-real estate lending. The independent variables include: farm income (in billions), US Real GDP, number of farm failures, US treasury yield on a one-year bond, farm population, and the three elasticities calculated from the dynamic duality model as presented above. The variables and their source are provided in Table 1:

Table 1: Regression Variables for Farm Credit

Variable	Description	Source
Farm Income	Farm Income (billions)	USDA
GDP	US Real GDP	BEA
Failures	Number of farms that files for bankruptcy in a year	USDA
Treasury Yield	Treasury Yield on a one year bond	US Department of the Treasury
Population	Farm Population (000s)	USDA
LT Interest Elasticity	Estimated long-term interest elasticity weighted by interest expense (absolute value)	Estimated, Carduner (2016)
ST Interest Elasticity	Estimated short-term interest elasticity weighted by interest expense (absolute value)	Estimated, Carduner (2016)
Land Elasticity	Estimated land interest elasticity weighted by interest expense (absolute value)	Estimated, Carduner (2016)

The elasticities used are averages of the individual corn-belt states' elasticities from the Dynamic Duality model and include the average short-term interest elasticity (weighted by state interest expense), average long-term interest elasticity (weighted by state interest expense), and the average land elasticity (weighted by state land expense).

Econometric Specification

In this section we develop the econometric model used to examine the hypothesis that the Farm Credit System is effectively meeting its mandate to provide farmers with credit in economic downturns? Effectiveness in this context refers to the differential in loans made by the FCS and the CB sector. Due to the importance of the Farm Services Administration to securing loans for young, risky and underserved farmers it is important that the FSA also be considered.

The effectiveness of the FCS is evaluated by comparing the changes in lending between the FCS (FSA) and the CB sector. Using variables that are indicative of economic performance to capture the effects of the economy, the econometric model takes the form of a difference in differences measure:

$$(1)\quad CRL = \left(\frac{FC_t - FC_{t-1}}{FC_{t-1}}\right) - \left(\frac{CB_t - CB_{t-1}}{CB_{t-1}}\right) = \alpha + \gamma T + \beta_1 Farm\,Income + \beta_2 GDP + \beta_3 Interest + \beta_4 Population + \beta_5 Failures + \beta_6 \varepsilon_{STcredit} + \beta_7 \varepsilon_{LTcredit} + \beta_8 \varepsilon_{Land} + e$$

Where, CRL= change in relative lending (for the FSA and FCS in real estate and non-real estate loans), Farm Income= farm income (billions); GDP= US real GDP; Interest= US treasury yield; Population= US farm population; Failures= Number of farm bankruptcies in one year (000s); $\varepsilon_{STcredit}$ = Short term weighted interest elasticity from the dynamic model; $\varepsilon_{LTcredit}$ = Long term weighted interest elasticity from the dynamic model; ε_{Land} = Land weighted interest elasticity from the dynamic model; T= Time, and $\alpha_0, \gamma_i, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8 are coefficients to be estimated.

The CRL variable is calculated as the percentage change in lending from the FCS (FSA) minus the percentage change in lending from the CB. Thus, in the regression results, when a coefficient is positive, it is reflecting an increase in relative lending of FCS (FSA) in comparison to the CB.

As well, when a coefficient is negative, it is reflecting a decrease in the lending of farm credit compared to CB.

In order to capture the differences of lending in different time periods, the regressions are broken into four categories: 1939-2013 with dummy variables for the years of World War II (1939-1945) and the farm crisis period (1970-1987), the years leading up to the farm crisis (1939-1969), the farm crisis period (1970-1987), and the years following the farm crisis (1988-2013). These results are calculated for the U.S. at the national level.

Table 2 shows the results of the regression for 1939-2013 including the dummies for the war and farm crisis years.

Table 2: Regression results for 1939-2013

	Dependent Variables			
Independent Variables	Debt in real estate FCS	Debt in real estate FSA	Debt in non-real estate FCS	Debt in non-real estate FSA
1939-1945	-10.20	-23.39*	-5.004	-30.82***
	(8.463)	(13.33)	(7.795)	(11.06)
1970-1987	-5.472*	0.0943	3.626	-4.420
	(3.227)	(5.084)	(2.972)	(4.218)
Farm Income	3.87E-05	0.00023	-6.24E-05	-3.00E-06
	-0.000113	-0.000177	-0.000104	-0.000147
GDP	-0.718	0.45	0.174	0.164
	-0.813	-1.28	-0.749	-1.062
Interest	-1.337***	-1.11	-0.0962	0.816
	-0.491	-0.773	-0.452	-0.642
Population	-0.00117*	-0.00300***	6.90E-05	-1.14E-05
	-0.000611	-0.000963	-0.000563	-0.000799
Failures	-0.000243	-0.00985***	0.00385**	0.00254
	-0.00176	-0.00277	-0.00162	-0.0023
Number of Farms	0.00933	0.0293***	0.00016	0.000454
	-0.0057	-0.00898	-0.00525	-0.00745
ST interest elasticity	14.62	-16.08	1.525	30.05**
	-10.25	-16.15	-9.439	-13.4
LT interest elasticity	-739.8***	-1,256***	-53.67	211.2
	-137.6	-216.7	-126.7	-179.8
Land elasticity	29.62	-228.4***	-4.138	-158.0**
	-51.96	-81.87	-47.86	-67.92
Constant	660.3***	1,349***	46.7	-100.5
	-138.2	-217.7	-127.3	-180.6
Observations	73	73	73	73
R-squared	0.54	0.519	0.319	0.202

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 shows that farm income is not a significant variable for either FCS or FSA lending, however the number of farm population is significant. When the number of famers increases by 1000 in a time period, we see a decrease in the relative lending for the FCS against the CB in real estate loans. Since the number of farmers has generally declined over this time period this is best interpreted in the negative form, that as farm populations decrease the year-over-year changes in farm credit loans has outpaced CB loans. The treasury yield is also significant in this model for FCS real estate lending at the 1% level. The negative coefficient attached to this variable suggest that when treasury yields increase, the CB system lends more in real estate loans relative to the FCS. The negative coefficient for the treasury yield is as expected. The FCS is funded by bonds, so that an increase in treasury yields would make the price of FCS lending more expensive. The results suggest that the complaints made by the ABA are asymmetric in the sense that in periods of tight monetary policy or inflationary periods where treasury yields increase the competitive advantage is to the commercial lenders; but in periods, such as the post 2007 period with artificially low treasury yields, the interest rate advantage favors the FCS.

The elasticity variables are interesting. For this time period, the long-term elasticities for interest are also significant for FCS and FSA real estate lending, even when we have controlled for the farm crisis years. When the long-term interest elasticity increases (in absolute value), we see a large decrease in FCS and FSA lending in real estate relative to the CB system. In this regression, the short-term interest elasticity has a less prominent effect on the relative lending. For FSA in non-real estate lending, the long term elasticity is positively significant at the 5% level, which suggests that when the long term interest becomes more elastic, FSA is lending relatively more. What this suggests is that as credit demand becomes more elastic, and farmers are therefore more sensitive in loan volume to changes in interest rates, the advantage seems to go to the CB

sector. The long-term credit elasticities can be seen in Figure 1 to be least elastic (in the negative domain) during the farm crisis period, which was also a period of high interest rates. The results seem to suggest that in times of instability the demand becomes more inelastic and it is in these periods that FCS and FSA loans dominate CB. This would suggest that in times of crisis, the FCS (and FSA) are more likely to make loans relative to the CB sector. Again, one of the key objectives to establishing the FCS in the first place was an assurance that credit would be made available to farmers in times of crisis.

The land value elasticity is also of interest, It is positive and significant in the real estate equations for FCS but negative for FSA. The land price elasticity is almost unitary elastic with far less variability than the long term credit elasticity. In Figure 1 is least elastic during the crisis years, suggesting that farmers in crisis are less sensitive to the price of land. Again we would argue that this is a reflection of underlying risk and uncertainty in the land markets, and again during this period it appears that the FCS, perhaps imprudently, increased its lending over the CB period. The FSA effect, however, is negative. The FSA is less independent as a financial institution than the FCS and so this may well capture political effects in times of distress where uncertain land markets discourage expansion of FSA loans.

The interest rate effect is negative as we would expect, but only for FCS and real-estate debt, but we must also keep in mind that the elasticity variables are also capturing interest rate effects so this result is merely stating that credit demand falls as interest rates rise. It is a curious thing which we cannot explain that this residual interest effect remains significant for FCS real-estate credit and no other, after controlling for an elasticity effect. We see no long term impact on economic growth as measured by GDP. The population effect is negative and significant for real-estate debt for both FCS and FSA which we suggest is capturing urbanization. Real estate in

agricultural lands rezoned to residential purposes due to increases in urban populations are more likely to originate with commercial banks. Farm failures is also interesting, The coefficients are not significant for FCS real-estate debt or FSA non-real estate debt, negative and significant for FSA real-estate debt, and positive and significant for FCS non-real estate debt. This suggest that while both FCS and CB change loans at the same rates when failures increase, the FSA appears to exit the market. The FSA is intended to promote lending for beginning, small and marginalized farmers, and is not intended to step in to provide mortgage loans in crisis. This is supported by the evidence. But we also see that the FCS does step in to provide additional liquidity in the form of non-real estate debt as farm failures rise. Because money is fungible, it is very likely that this result is capturing a tendency to increase operating loans in support of existing mortgages rather than refinancing the loan altogether. This might suggest that the FCS is more likely to extend lines of credit to avoid foreclosure than commercial banks in times of crisis, which again would be consistent with its objective to provide credit to agriculture in both good and bad times.

We also understand that both the FCS and CB sectors have evolved considerably over time. To investigate the strength of the results above we also ran three additional regressions, covering three periods, first leading up to the farm crisis, during the farm crisis, and following the farm crisis.

Table 3 presents results for the 30 years 1939 to 1969. The lead up to the farm crisis started with the rising land prices starting around 1970s, which we want to examine separately. Over this period we see FCS real estate debt rising with both farm incomes and GDP relative to the CB sector, but the FSA real estate loans decreased with rising farm incomes and were not affected by changes in GDP. The FCS also increased non real estate debt over this same time frame as GDP rose, but this diminished if interest rates also rose. FSA real-estate loans also fell as farm failures increased as

was seen for the entire 1939-2013 period, the FSA did not appear to increase its activities in time of crisis, but did step in when farm incomes fell.

Both the short and long run interest elasticities were positive for FCS real estate mortgages, suggesting that when farmers become more sensitive to interest rates (more elastic), the FCS tended to increase loans relative to CB. The FSA on the other hand, showed negative relationships between short and long run interest rate elasticities and real estate mortgages, As interest rates become more inelastic, farmers are less sensitive to the interest rate which suggest a tightening of money and a tightening of liquidity. Thus during period of illiquidity the FSA tends to step in and increase lending relative to CB.

There appears to be some distinctive differences across the three periods. In the 1939-1969 period the FCS would increase its real-estate lending relative to CB as farm incomes rose, but this reversed itself during the farm crisis in which the coefficient is negative. There are certain side issues of importance, the first being the rapid rise in grain and oilseed prices in the ealy to mid 1970s due to wheat failure in the Soviet Union in 1973 and expanded demand for soybeans. A rapid increase in land prices followed at it became a belief that he value of agricultural land would be increasing at the rate of inflation as an inflation hedge rather than fundamental value. As farm incomes declined into the 1980s, agricultural land could not hold its value, and many loans went into default. Thus the FCS was not only increasing real estate loans as farm incomes fell over this period, but as can be seen in Table 4 the FCS also increased loans as failures increased. Since the crisis years, between 1988 and 2013 there is no significance to the farm income variable, except for FSA non real estate debt which is negative. These results suggest that both the FCS and the CB system have increased (or decreased) lending to agriculture at the same rate. It appears from a comparison of the three time spans that during the prosperous years between 1939 and 1969 the

FCS grew it portfolio faster than the CB sector as farm income rose. During the farm crisis the CB system held the advantage, largely because during this period the FCS (and FSA) were dealing with farm failures. The CB system while taking advantage of years in which farm incomes rose during this period, backed off as the crisis worsened and foreclosures increased. Even in the current era (Table 5) it is the FCS and not the CB system that increases lending as foreclosures increase.

The short an long run interest rate elasticities can capture liquidity preferences in the market place. One can think of demand becoming more inelastic as liquidity in cash form decreases and credit reserves are diminished. Diminished credit reserves can result from prior debt use relative to available collateral, but also can adjust rapidly as the loan to value ratio increases as asset values decrease. Liquidity can also become constrained with external credit rationiong as agricultural conditions deteriorate. We can then view rising inelasticity as a consequence of diminished credit reserves and tightening liquidity, which places a significant premium on credit. As interest rates rise the farmer is willing to pay the rate, because the value of the additional liquidity is far greater than the cost. When liquidity becomes less constrained credit demand becomes more elastic so that farmers are more sensitive to the cost of debt. During the 1939-1969 period the FCS increased real estate lending over the CB as credit became more elastic. This was reversed during the crisis years for FCS real estate loans, and reversed again in the years since. The short term and long term elasticities negatively affected FSA loans during the 1939-1969 period which is consistent with its mandate to support credit in tightened credit markets that typically give rise to inelastic demand.

Table 3 displays the regression results for the years leading up to the farm crisis (1939 – 1969). In this table, the coefficient on Farm Income is positive suggesting that changes in making loans to farmers when farm incomes are rising is larger for the FCS than CB. The result is quite modest. For every $1 increase in farm income the percentage change between FCB and CB was

only 0.27%. While significantly different from zero, this result dispels the notion that the FCS is a lender of last resort and that its GSE status provided a significant advantage in loan origination over commercial banks. However, we do find a negative income relationship with the FSA that increases real estate lending in bad times while reducing loans in good times, again consistent with the perception that the FSA is a lender of last resort. As farm incomes increased the FSA reduced loan increases relative to commercial banks by 0.57%. In terms of macroeconomic forces we again find that the FCS leverages GDP growth relative to CB in both real estate and non-real estate debt, but we do not observe a macro effect for FSA loans, suggesting that the FSA – true to its goals – was focused on the sectoral agricultural economy independent of what was occurring in the general economy. In periods of rising farm failures we observe no statistical difference between changes in FCS and CB loans suggesting that the two, in times of rising crisis, were responding equally to the same market signals. Again we find that FSA loans were significantly reduced (B= -0.0187) as failures increased, suggesting perhaps that CB were more likely to issue new real estate loans to refinance existing mortgages. But it may also be the case that the commercial banks were more conservative than the FSA (or FCS for that matter) in originating real estate mortgages in the first place and were immunized against farm failures. We also find that the FCS issued more non-real estate debt with rising failures (B = 0.0133) than CB, perhaps reflecting again the fungibility argument previously made. In contrast the FSA reduced its non-real estate debt relative to commercial banks (B = -0.0143).

The short term elasticity measure is significant at the 1% level for both the FCS (B=85.64) and FSA (B= -142.9) for real estate lending, however, the FCS non-real estate lending is also significant and negative (B = in the opposite direction. The short-term elasticity measure is positive for real estate lending, suggesting when the price of interest is becoming more elastic, the

FSA lends more relative to CB in real estate, however, the more interest becomes elastic, the less the FSA lends compared to CB. Table 3 also shows that when the interest rates for long term lending become more elastic by one, there is a 1% significance to the FCS lending increase relative to CB by three thousand percentage points. However, the more elastic long-term interest rates becomes, it shows a decrease in the lending from the FSA compared to CB.

Table 3: Regression results before the farm crisis: 1939-1969

	Dependent Variables			
Independent Variables	Debt in real estate FCS	Debt in real estate FSA	Debt in non-real estate FCS	Debt in non-real estate FSA
Farm Income	0.00271**	-0.00543***	2.77e-05	-0.00129
	(0.00125)	(0.00170)	(0.00130)	(0.00101)
GDP	28.00***	4.432	29.29***	11.56
	(9.478)	(12.88)	(9.819)	(7.608)
Interest	1.929	-5.520	-11.68***	0.297
	(3.518)	(4.780)	(3.645)	(2.824)
Population	-0.000267	-0.00392**	-8.94e-05	-0.000307
	(0.00117)	(0.00159)	(0.00121)	(0.000938)
Failures	0.00794	-0.0187**	0.0133*	-0.0143***
	(0.00686)	(0.00932)	(0.00711)	(0.00551)
Number of Farms	0.0161	0.0544***	0.0208	0.0121
	(0.0134)	(0.0182)	(0.0139)	(0.0108)
ST interest elasticity	85.64***	-142.9***	-41.46*	6.176
	(24.32)	(33.05)	(25.20)	(19.52)
LT interest elasticity	3,116**	-6,162***	-2,227*	-622.3
	(1,262)	(1,715)	(1,307)	(1,013)
Land elasticity	127.6	38.66	51.72	0.661
	(92.83)	(126.1)	(96.17)	(74.52)
Constant	-3,425***	5,984***	2,011	526.6
	(1,259)	(1,711)	(1,304)	(1,011)
Observations	30	30	30	30
R-squared	0.768	0.771	0.488	0.661

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results for the years of the farm credit results are reported in Table 4

Table 4: Regression results for the farm crisis: 1970-1987

	Dependent Variables			
Independent Variables	Debt in real estate FCS	Debt in real estate FSA	Debt in non-real estate FCS	Debt in non-real estate FSA
Farm Income	-0.000394**	-0.000213	-0.000392*	0.000747
	(0.000191)	(0.000370)	(0.000208)	(0.000672)
GDP	-29.87***	-34.64**	-32.63***	-6.390
	(7.227)	(14.03)	(7.877)	(25.47)
Interest	-1.233***	-0.0905	0.280	1.967
	(0.376)	(0.729)	(0.409)	(1.324)
Population	-0.104	0.283	-0.282***	0.131
	(0.0914)	(0.177)	(0.0997)	(0.322)
Failures	0.0154***	0.0170**	0.0155***	0.0158
	(0.00445)	(0.00865)	(0.00485)	(0.0157)
Number of Farms	0.0627	-0.534*	0.320**	-0.141
	(0.144)	(0.280)	(0.157)	(0.509)
ST interest elasticity	390.7	-930.5	1,042***	-539.7
	(365.1)	(708.8)	(398.0)	(1,287)
LT interest elasticity	-1,091*	1,207	-1,713***	1,615
	(558.0)	(1,083)	(608.2)	(1,967)
Land elasticity	31.21	168.1	-22.08	49.29
	(91.62)	(177.8)	(99.85)	(322.9)
Constant	805.6***	656.5	464.8*	-916.1
	(225.1)	(437.0)	(245.3)	(793.5)
Observations	18	18	18	18
R-squared	0.952	0.743	0.848	0.408

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Due to the low number of observations, it must be established that the results need to be treated with great caution. In order to be complete in the results, this time period must be included, however, making assumption based on these years is ill-advised. When the farm income increases in this time period, there is a decrease in the lending of FCS in both real estate and non-real estate

(5% and 10% respectively). This supports the hypothesis of FCS lending in countercyclical business periods. During the crisis years, we see that the more farm failures that occurred, it was significantly associated to an increase in lending from the FCS and the FSA, which also supports the countercyclical lending hypothesis. The GDP follows a similar pattern; when the GDP is increasing (suggesting economic improvements) the FCS and FSA lend less relative to CB in real estate at 1% and 5% significance levels. When there is an increase in the short-term interest elasticity for non-real estate, it suggests an increase in FCS lending by over 1000 percentage points. Another considerable result of this regression is the 1% significance of long term interest elasticity. This result suggests that the FCS non-real estate lending decreases by more than a thousand percentage points when the long-term interest elasticity increases by 1.

Finally, Table 5 shows the results for the years following the farm credit crisis.

Table 5: Regression Results following the farm crisis 1988-2013

	Dependent Variables			
Independent Variables	Debt in real estate FCS	Debt in real estate FSA	Debt in non-real estate FCS	Debt in non-real estate FSA
Farm Income	1.17e-05	2.01e-05	-4.27e-05	-0.000142*
	(0.000131)	(0.000191)	(8.89e-05)	(7.82e-05)
GDP	-6.418**	-2.644	2.180	1.098
	(3.047)	(4.463)	(2.072)	(1.824)
Interest	-0.193	-0.0447	-1.294**	0.558
	(0.912)	(1.335)	(0.620)	(0.546)
Population	0.0641	0.0746	-0.0342	-0.0267
	(0.0529)	(0.0774)	(0.0360)	(0.0317)
Failures	0.0122**	0.00722	-0.00168	-0.00158
	(0.00567)	(0.00830)	(0.00385)	(0.00339)
Number of Farms	0.0760	0.0206	-0.0423	-0.0236
	(0.0539)	(0.0790)	(0.0367)	(0.0323)
ST interest elasticity	-360.2	-18.39	31.34	741.9***
	(365.6)	(535.4)	(248.6)	(218.8)
LT interest elasticity	1,510*	728.4	-666.7	-933.2*
	(835.6)	(1,224)	(568.2)	(500.2)
Land elasticity	-6.595	-353.8	-21.67	-264.1**
	(195.6)	(286.5)	(133.0)	(117.1)
Constant	-1,228*	-465.6	725.6	450.3
	(667.7)	(977.9)	(454.1)	(399.7)
Observations	25	25	25	25
R-squared	0.423	0.361	0.277	0.570

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In these results we do not find evidence of a countercyclical role for FCS or FSA, but the general trend during this entire period shows both increasing farm income and steady treasury yield rates. Due to the consistency of the past years it is unclear if this is an appropriate period to test the hypothesis for FCS lending counter cyclically. There is only weak evidence to suggest that the FCS has a countercyclical lending role.

As the coefficient on short-term non-real estate lending for FSA suggests (at 1% significance), when farmers become more sensitive to interest expenses, they move towards FSA lending and away from CB, which suggests countercyclical lending. In these results, the land elasticity also has a 5% significance in non-real estate lending for FSA. This suggests that when land price elasticity increases by 1 (becoming more elastic) the FSA decreases its lending by 264 percentage points relative to CB[3].

The third and final objective was to investigate the differential roles that the FCS and CB sectors have on the supply and demand of US agricultural credit. The changes in relative lending for the entire period generally suggest that the FCS and FSA are lending countercyclically. For example, when the number of farm failures increases, the FCS lends more relative to the CB in real estate loans. The elasticities from the Dynamic model are also shown to be significant, particularly, when the short-term interest elasticity becomes more elastic, the CB lends more relatively. The results from the changes in relative lending in the years leading up to the crisis show similar patterns. The short-term interest rate elasticity displays the same effect as described above, and when the long-term elasticities become more elastic, the FCS increases their lending relative to the CB In the years following the crisis, which can be characterized by low and stable interest rates, there was weaker evidence suggesting countercyclical lending. However, generally in each time period we see some evidence of countercyclical lending by the FCS and the FSA compared to the CB, which is what we aimed to achieve.

[3] In order to test alternative relationships and possible contradictions we also ran a number of additional regressions with a similar independent variable structure but with alternative dependent variables. These dependent variables included: the absolute value of lending, the share of lending, and the change in lending from the previous time period for each of the entities. As in the changes in relative lending regressions, the estimates are broken into sections to reflect the time period. In each of these robustness checks we found nothing to contradict the story presented in what has been presented.

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