

The Farm Credit System and Development of Agricultural Markets During the 2001-2010 Period

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Invited paper by
Valentina Hartarska and Xuan (Shelly) Shen¹

Abstract:

In this report, we set out to establish if there is a link between lending by the FCS institutions and measures of agricultural economic development on state and regional levels for the period 1991-2010. The motivation for this work comes from empirical studies showing a link between economic development and financial system development as well as from work which highlights the positive role of long-term finance provided by banks. Using two different datasets and estimation techniques, we find a positive association between lending by FCS institutions and farm output, agricultural GDP, and farm income with the positive association stronger during the first part of the study period. We caution that the weaker link may be driven by data limitations (since collection of state farm balance sheets data was discontinued in 2003) while additional data on state level lending by the FCS may be needed for a more precise analysis. We conclude, nevertheless, that during the period, the Farm Credit Systems has had a positive impact on agriculture in the US.

¹ Valentina Hartarska (contact author) is an Associate Professor in the Department of Agricultural Economics and Rural Sociology, Auburn University; Xuan Shen is a PhD candidate at the Department of Agricultural Economics and Rural Sociology, Auburn University. Contact author email: Hartarska@auburn.edu, Phone: 334 844 5666.

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The Farm Credit System (FCS) exists to improve the supply of funds in agricultural and rural finance markets. In particular, Sec. 1.1. (a) in Policy And Objectives of the Farm Credit Act of 1971 states that

“It is declared to be the policy of the Congress, recognizing that a prosperous, productive agriculture is essential to a free nation and recognizing the growing need for credit in rural areas, that the farmer-owned cooperative Farm Credit System be designed to accomplish the objective of improving the income and well-being of American farmers and ranchers by furnishing sound, adequate, and constructive credit and closely related services to them, their cooperatives, and to selected farm-related businesses necessary for efficient farm operations.”

The agricultural economics literature recognizes that alleviating credit constraints in agriculture is important because production is 3% lower in credit-constrained compared to non-constrained farm proprietors (Briggeman et al., 2009). Credit constraints persist in agricultural cooperatives, among new farmers, and continue to affect land values (Chaddad, et al., 2005; Hartarska and Nadolnyak, 2012; Mishra et al., 2008). The impact of the FCS on its members-clients and on the wider community is likely substantial but there has been little empirical work that quantifies its effects.

The lack of readily available empirical data on the contribution of the FCS to economic development leaves space for narrow theoretical models that focus mainly on distributional outcomes and possible deadweight loss from its existence as a Government Sponsored Enterprise (Jensen, 2000). To provide empirical evidence on the role of the FCS, we document economic impacts of lending by the FCS institutions on indicators of agricultural and rural development during the past two decades. Our work is motivated by the literature on finance and economic development documenting a strong association between the two (Levine, 2005; Clarke et al., 2006; Rajan and Zingales, 1998). Existing empirical studies find casual impact of the US financial development and banking, in particular on economic growth, capital allocation, and distributional outcomes (Jayaratne and Strahan, 1996; Dehejia and Lleras-Muney, 2007; Beck et al., 2010). Following this approach we study the link between lending by FCS institutions and indicators of agricultural economic development using panel state-level data for the period 1991-2010. We evaluate the impact of agricultural credit on several indicators of agricultural economic development (farm output, agricultural GDP, and farm income) because a recent evaluation of the USDA loan programs suggests that impact is best measured in time and with several outcome variables (Johnson, 2009).

Agricultural and rural financial markets remain constrained by geography and growth in agriculture and rural areas remain affected by location specific supply of credit by the FCS institutions and its competitors (Kilkenny and Jolly, 2005). According to Kilkenny (2010), agricultural economists’ understanding of what factors (including access to finance) benefit rural

areas remains limited for a variety of reasons including inadequate methods of analysis. We support our discussion with panel data analysis employing fixed effects and dynamic panel methods. These techniques control for the omitted variable bias (e.g., factors that we cannot measure), but also establish the causal effect of credit supply (with lagged explanatory variables) and incorporate growth dynamics (by properly handling inclusion of lagged dependent variables).

The focus on the past two decades is important because, during this period, FCS institutions were recovering from the crisis in the 80s and later functioned in an environment defined by changes in banking regulations affecting competing commercial banks. More recently, FCS institutions weathered a major financial crisis. In this work, we show that during these diverse economic conditions lending by the FCS institutions was associated with higher agricultural output, farm income and agricultural GDP, suggesting that the Farm Credit System can successfully face future challenges.

Methods

Conceptual Framework

From a theoretical perspective, government interventions in financial markets such as the support for the Farm Credit System (FCS) are justified by the existence of market failures. Classical reasons for market failure are monopoly power and externalities. In the 1980s, information asymmetries, especially those in financial markets, were identified and modeled which helped frame government interventions. Historically, market failures in agricultural financial markets led to excessively high interest rates, unfavorable terms on loans, and unnecessary foreclosures forced by lenders unfamiliar with the risk characteristics of agricultural production (Lee and Irwin 1996; Collender and Erickson, 1996). Market failures such as local monopoly and asymmetric information between borrowers and lenders continue to be relevant in agricultural financial markets and could cause private lenders to reassess their commitment to agriculture during periodic downturns (Freshwater ,1997).

The Farm Credit System was established by the Federal Farm Loan Act of 1916 as a government-sponsored enterprise (GSE) to address the failures in agricultural credit markets by creating a stable source of long-term funding with lower interest rates and terms more compatible with the unique qualities of agricultural production. Lending by the FCS institutions improves the supply of credit to agricultural producers, which are also served by commercial agricultural banks, life insurance companies, and other sources. The FCS institutions help mitigate the impact of market failures in many local markets and provide a more stable source of credit with less variability in interest rates.

Empirical evaluation of the role that the FCS has played throughout the years is difficult for a variety of reasons including lack of good data. In this report, we evaluate whether agricultural and financial market development and lending by the FCS in particular is associated with higher level of agricultural economic development. Theoretical work on the interaction of financial markets and economic growth as well as recent empirical work linking the two provide the framework for our analysis.

Theories that show the importance of credit markets in economic growth date back to Schumpeter (1911), who argued that entrepreneurs needed credit to finance the adoption of new technologies. Banks are viewed as key agents in facilitating the flow of capital and thus promote economic growth. Ang (2008) provides a recent survey on the evolution of these ideas in time.² For example, the “financial structuralist view” presented by Gurley and Shaw (1955), Goldsmith (1969), and Hicks (1969) argues that development of a financial system is crucially important in stimulating economic growth because under-developed financial systems retard economic growth. Thus, policies to foster growth should be aimed at expanding the financial systems by creating more financial institutions and promoting greater variety of financial products and services to generate a positive effect on the saving–investment process, and hence on economic growth.

The Keynesian “financial repression” comes next suggesting the need of interest rate controls, high reserve requirements and directed credit programs. It is challenged by McKinnon (1973) and Shaw (1973) who instead argue for financial liberalization to improve output growth. Neo-structural economists (van Wijnbergen, 1982, 1983; Taylor, 1983; and Buffie, 1984) have argued, however, that financial liberalization is unlikely to affect growth in the presence of what they call “efficiency curb” or alternative (and likely less formal) financial markets.

In the neoclassical theory of economic growth, finance has no role because growth depends only on capital stock, labor, and the level of technological progress. Higher level of capital accumulation (with better financial system) can only have a temporary effect on growth while long-term growth is only affected by technological progress.³ Lucas (1988) also argued that economists overemphasize the role of finance in economic growth (the “irrelevance of finance” hypothesis) while Modigliani and Miller (1958) famously show that with perfect markets, informational symmetry, and no transaction costs, real economic decisions are independent of the financial structure. With similar assumptions, Fama (1980) shows that, in a competitive banking sector with equal access to capital markets, a change in lending decisions by any individual bank will have no effect on price and real activity under a general equilibrium setting.

However, financial markets are characterized by asymmetric information; agricultural financial markets in particular are subject to (local) monopoly, have high transaction (screening and monitoring) costs and, therefore, the neoclassical models do not reflect the realities in these markets. In *the endogenous growth* models financial institutions are important, financial development is incorporated in these models and they focus on the role of financial intermediation in improving efficiency (quality) rather than the amount (quantity) of investment (e.g., Greenwood and Jovanovic, 1990; King and Levine, 1993; Pagano, 1993). For example,

² The description of these theories follows the chronological order in Ang (2008).

³ Economic growth is only dependent on the capital accumulation and technological advancement and finance is related to the input factor productivity. For technology to increase production and thus growth rate, firms’ capital stock must incorporate these advances which will require a supportive financing system. Interest rates equate savings and investments in equilibrium. Thus, the neo-classical theory suggests that the optimal growth rate equals the real interest rate and there is no role for the financial system.

Pagano shows that financial systems development increases the marginal productivity of capital, raises the proportion of savings channeled to investment, and influences the savings rate.

The literature on bank-based financial systems also offers insights into the possible mechanisms through which FCS lending likely affects rural economic development. This body of work emphasizes that, in bank-based systems, firms rely more on finance provided by banks rather than through financial markets (Allen and Gale, 1999, 2000; Beck and Levine, 2002; Ergungor, 2004; Levine, 2005). Banks tend to offer longer-term loans because they can more closely monitor firms characterized with few owners with large stakes and rarely changing ownership, which is typical for agricultural producers. Thus, bank-led finance likely promotes long-term growth.

Empirical approach

This analysis is motivated by the empirical literature on finance and economic development documenting a strong association between the two (Levine, 2005; Clarke et al. 2006; Rajan and Zingales, 1998). Most of this literature links financial sector development to economic growth using cross-country data and various econometrics techniques (cross country regressions, panel data techniques, or difference-in-difference analysis). Empirical studies on a country level also find causal impact of the US financial development and banking in particular on economic growth, capital allocation, and distributional outcomes (Jayaratne and Strahan, 1996; Dehejia and Lleras-Muney, 2007; Beck et al., 2010).

Within this approach, development outcomes are related to financial market indicators such as private bank loans, government controlled bank loans etc. Following this approach, we estimate the following model:

$$Output_{it} = \beta_0 + \sum_1^J \beta_j RECredit_{jit-1} + \sum_1^K \beta_k NRECredit_{kit} + \sum_1^M \beta_m Control_{nit} + \alpha_i + \varepsilon_{it}$$

where *Output* is the economic development indicator, *i* denotes the state, *t* denotes the time period or year, *RE Credit* is a category of real estate backed credit by group *j* (e.g. the FCS institutions and its competitors), *NRE Credit* includes *k* categories of non-real estate backed credit to farmers (including by the FCS institutions) and *Controls* includes various control variables as well as year dummies. Here, α_i is the unobserved state specific term which may be correlated with the explanatory variables and ε_{it} is the error term.

We measure output by several indicators of economic development in rural and agricultural areas, namely farm output, agricultural GDP, and farm income. Real estate backed credit categories enter the equation with a lag because these are typically long term loans and their impact is likely delayed. This specification also resolves possible contemporaneous endogeneity of long-term credit, that is, the possibility that long-term credit categories and endogenous to the current level output, and good times have both higher output and higher level of long-term credit.

We control for the overall farm debt to total asset ratio, the number of farms, the level of capital stock measured by long term farm assets (real estate assets and machinery), the impact of interest rate (price of capital), the impact of overall price level changes measured by the *Price index*

which is the ratio of the Index of Prices Received to the Index of Prices Paid. We also include the ratio of rural population to total population since more rural communities may demand more agricultural or rural credit.

We use the fixed effect and, as an extension, the dynamic panel econometric techniques. The fixed effects model removes the omitted variable bias associated with possible factors that we cannot measure and which may be correlated with the explanatory variables. Since our data exhaust a population - all states within the USA – the fixed effects model conditional on cross-section units is appropriate (Wooldridge, 2008).

An alternative method used to capture the dynamic aspects of farm output where previous period dependent variable is also included as an explanatory variable. This method, developed by Arellano and Bond (1991) and Arellano and Bover (1995) controls for the omitted variable bias (e.g., factors we cannot measure), but also establishes the causal effect of credit supply (with instruments by lagged dependent and explanatory variables) and incorporates growth dynamics (by properly handling inclusion of lagged dependent variables). This technique, however, does not work well with small panels and for few time periods.

Data

The dataset is assembled using several sources. The dependent variables measuring rural or agricultural economic development come from the Bureau of Economic Analysis database. These first variable is *Farm Output* (or cash receipts) which includes the value of gross revenues received from the marketing of agricultural commodities, both livestock and crops. The second dependent variable is *Agricultural GDP* which is the state level GDP from industries in the agriculture, forestry, fishing, and hunting.⁴ The third variable is *Farm Income*, which is comprised of the net income of sole proprietors, partners, and hired laborers arising directly from the current production of agricultural commodities, either livestock or crops.⁵

Farm balance sheet data, available from the USDA database, contain detailed information about all sources of debt for farmers (farmers' liability) which includes credit from Farm Credit System Institutions (ACAs, FLCAs and direct loans from the system banks), and from their main competitors including commercial banks. In this dataset, farm liabilities are classified as Real Estate and Non Real Estate credit allowing us to distinguish between the long-term and short-term financing by the FCS institutions and, thus, improve the empirical model specification by lagging the long-term liabilities.

⁴ Industries in the Agriculture, forestry, fishing, and hunting NAICS sector include establishments primarily engaged in growing crops, raising animals, harvesting timber, harvesting fish and other animals from a farm, ranch or their natural habitats. These establishments are often described as farms, ranches, dairies, greenhouses, nurseries, orchards or hatcheries. The sector includes two basic activities: crop and animal production (farms) and forestry, fishing, and related activities.

⁵ Farm Income is comprised of the net income of sole proprietors, partners and hired laborers arising directly from the current production of agricultural commodities, either livestock or crops. It includes net farm proprietors' income and the wages and salaries, pay-in-kind, and supplements to wages and salaries of hired farm laborers; but specifically excludes the income of farm corporations.

State level farm balance sheets are available only for the period 1991-2003. We use two alternative ways to use data for the more recent period of 2004-2010. First, the USDA continues to publish aggregate nationwide level balance sheet data. We compute the US growth rate of each of the variables in our dataset and use this growth rate to adjust the 2003 state level balance sheets. The main assumption behind such data construction is that each of these variables grew at the same rate as the aggregate US values, so we exclude the possibility that a variable grew faster in one state and slower in another.⁶ Clearly, since in 2008 there was a major financial crisis, it is likely that changes occurred. For example, commercial banks' lending to agriculture might not have been constant through the period – it might have shrunk (at least in some states) due to the economy-wide credit crunch or it might have grown more than lending by other sources because agricultural producers were having good years after 2008 as agricultural land prices were on the rise while commercial banks had fewer profitable lending opportunities and might have sought to lend more to farmers.

Another way to gain insights into the link between lending by the FCS institutions and agricultural development is to use the FCS's own data on lending (real estate and non-real estate) to agricultural producers and in rural areas, together with analogous data for competitors - commercial banks and other sources such as life insurance companies, farm suppliers, etc. While we were not able to find data on other sources of loans, we did find data on lending by commercial banks. In particular, we use data from the Federal Reserve Bank of Kansas City database on agricultural loans by commercial banks. The data is for the 10 USDA agricultural production regions: Northeast, Lake States, Corn Belt, Northern Plains, Appalachia, Southeast, Delta States, Southern Plains, Mountain States, and Pacific. We collected data on Real Estate Loans and Non-Real Estate loans for each region for the period 1991-2010. Figure 1 presents the growth in time of the explanatory variables and these credit categories on national level. As the FCS institutions started reporting real estate and non-real estate loans separately only after 2005, we cannot use these detailed (real estate and non-real estate) data in our panel with only 10 regions, because we do not have sufficient number of observations.⁷ Thus, analysis was conducted using only one category for the general FCS loans. Due to further data limitations, we could only use loans extended by ACAs and FLCAs and not loans extended to cooperatives and rural utilities by CoBank and ACB because we do not have regional identifier for these loans.

We chose to use regional level data rather than state level for several reasons. In the Farm Credit System dataset, it was not possible to match the lending volume by ACAs and FLCAs to the states they served during the period. These institutions served more than one state and the data on the allocation of dollars lent among different states are not available. If we used the headquarter state to classify the ACAs & FLCAs by the state served, some states would have to be dropped leaving us with only 39 states because some states do not have headquarters of ACAs and FLCAs. Analysis of these data would miss substantial FCS activity in states such as IN, IO, and OR where there were no headquartered ACAs.⁸ Therefore, we opted to aggregate the FCS

⁶ Calculations show that the ratio of individual state's liability category to that in the US must remain constant at the 2003 level to maintain this balance. These ratios indeed remained constant for the USDA data for the period 2000-2003). However, it is not clear if the same relation hold for the following period.

⁷ While FCS dataset contains data for the direct lending by the 4 main banks these data are not directly identifiable with the 10 production region in the commercial banks data.

⁸ Even with the restricted dataset, we obtain evidence for the positive impact of FCS lending but the results are not robust and thus are not reported here.

data to the production region level and to match them to the Federal Reserve Bank of Kansas City data on commercial banks to see if there is comparability by regional lending. Thus, the analysis on this level includes 10 producing regions (more aggregate level thus preventing the use of dynamic panel because of the small number of panels) but it is the best alternative given the data limitations. This method of data construction has its own shortcomings and it is perhaps too aggregate to capture the more localized impact of FCS institutions.

Price data come from the *Agricultural Prices* database produced monthly by the USDA's National Agricultural Statistics Service (NASS)⁹. The *Price of Interest* is the interest payable per acre on farm real estate loans with 1910-14 serving as a base. *Price Index* is an index measuring the ratio of prices received to prices paid calculated with the same base (1910-14). *Rural Population* is the state rural population to total population ratio representing a measure of the size of the rural sector in the state economy. *Farms* is the total number of farms reported in state farm balance sheets. Inflation data are on the 4 regional levels published by the Bureau of Labor Statistics.

All variables are measured in real terms (2010 equivalent) with the current dollars adjusted using the four regional inflation rates reported by the Bureau of Labor Statistics.

Results

The summary statistics of the variables used in the analysis is contained in Table 1. Table 2 contains the results from our main empirical analysis. In each column, we present the results from fixed effects panel regressions estimation with different measure of output used as the dependent variables. In the first column, the dependent variable is *Farm Output*, in the second column the dependent variable is *Agricultural GDP*, and in the third column it is *Farm Income*. The best overall fit for the model as indicated by the within R-squared is that for the farm output with a value of 0.34, followed by that for *Agricultural GDP* of 0.57, and 0.25 for the Farm Income regressions. These values indicate a good fit for a fixed effects panel model.

Estimation results from these specifications show that *Real Estate Credit* by the FCS is associated with higher levels of *Farm Output*, *Agricultural GDP*, and *Farm Income*. Non Real Estate Credit by the FCS has a positive association with *Farm Output* but not with the other two measures of economic development in rural areas. This is to be expected as the non-real estate credit is mostly for seasonal borrowing for input purchase financing. More specifically, we find that for the period 1991-2003 additional \$1,000 dollars in Real Estate Credit by the FCS institutions is associated with \$621 more and \$565 more in Farm Income in the following year. For the same period, additional \$1,000 in Non-real estate loans by the FCS institutions is associated with \$1,207 in farm output in the same year but this type of credit is not associated with higher agricultural GDP or farm income.

The effect of other variables: Our results also show a positive link between the (input-output) price index on all output measure and of the number on farm income. The sign on the interest rate is unexpected but positive only for the agricultural GDP but it may capture some pro-

⁹ Available at <http://usda.mannlib.cornell.edu/reports/nassr/price/pap-bb/>

cyclical impact rather than the impact of the price of capital. We also find that states with higher ratio of rural population had lower level of outputs. Of the previous year capital assets only machinery was associated with lower farm income.

To check the robustness of the results, we use regional data and estimate similar specification for the 1991-2003 period using credit data from the FCS database and that from the Kansas City Federal Reserve Bank. These results are presented in the last 3 columns of Table 2. We find somewhat comparable results with the alternative dataset. In particular, on the regional level, additional \$1,000 of FCS credit (both real estate and non real estate by ACAs and FLCAs) was associated with \$519 higher farm output. The results on the other output measures were close to but not statistically significant. This is not surprising since these data miss direct lending by the 4 system banks and because the loans are not separated by real estate and non-real estate loans and we saw that it was real estate backed loans that had impact on agricultural GDP and on farm income in the alternative dataset.

We next look at the results for the period 1991-2010 estimated with state farm balance sheet data (constructed using the procedure described above) and with data on regional level (Table 3). These results also show a positive association between credit by FCS institutions and farm output, agricultural GDP, and farm income but with comparable magnitudes. These data indicate that, for the 1991-2010 period, additional \$1,000 in real estate credit by the FCS institutions is associated with additional \$650 in farm output, \$319 in agricultural GDP and \$582 in farm income in the following period. These values very close to those for the 1991-2003 period and the only exception is that the coefficient on agricultural GDP is now statistically significant.

In Table 3, we also present the estimates for the 1991-2010 period with the regional level data but here we do not observe statistically significant association although the results on output farm and agricultural GDP is close to being statistically significant. It is important to keep in mind that regional level data do not distinguish between long-term and short term credit and exclude direct lending by the 4 system banks so measurement errors may be behind these results.

To further check the robustness of the signs and magnitudes of our estimates, we also estimate the more sophisticated Arellano-Bond model which permits dynamic relationship where lags of both dependent and independent variables are used in the estimation procedure with the state level farm balance sheet data because the method requires a large number of panels while our regional level panel only has 10 regions. Even the 50 state panels are relatively small number as are the 14 and 20 year period so we only provide general idea for the direction and magnitudes of these results. The estimates show some positive association between long term real estate lending by the FCS institutions and mostly agricultural GDP but the link to farm income and farm output is less clear.

When we compare the association between credit by the FCS institutions and outputs and that of credit by commercial banks and outputs, we note that in the first part 1991-2003, there is a predominantly negative or no association between lending by banks and outputs, while there is a positive association with FCS institutions lending. In the period after, however, there seem to be a positive association between bank lending and output in the period since 2004, while the link of FCS institutions and outputs at least in the regional FE results weakens. There may be several

reasons for these results. First, there may be a certain level of substitutability in lending between FCS institutions and banks but since we had to exclude direct lending to cooperatives and rural utilities by FCS banks, our results are likely under estimating the impact of FCS on regional level for this period. Next, some results from previous cross-country data shows negative results for developed countries. In addition, these studies find a threshold after which further deepening of the financial markets is unrelated to indicators of economic development, and such a possible threshold might have been reached after the Graham-Leach-Bailey Act or Financial Services Modernization Act of 1999. Finally, results might be driven by measurement error since even the regional level data published by Kansas City Federal Reserve Bank are estimates of agricultural lending since specific data are not collected.

Conclusions

In this report, we set out to establish if there is a link between lending by the FCS institutions and measures of agricultural economic development on state and regional levels for the period 1991-2010. The motivation for this work comes from empirical studies testing the link between economic development and financial system development which also highlight the positive role of long-term finance provided by banks.

We use two different datasets to study this link. First, we use farm balance sheet data published by the USDA and available on the state level for the 1991-2003 period. For the period 2004 - 2010, we adjust state level variables with the country level growth rates and use these data to estimate the relationship for the 1991-2010 period. Second, we construct another dataset with agricultural credit by the two main lenders, FCS institutions and commercial banks, on the USDA's production region level for the 1991-2010 period using data on commercial bank lending from the Federal Reserve Bank of Kansas City, and classified into 10 agricultural producing regions. We match these regional level data with regional level data on credit by the FCS institutions (only ACAs and FLCAs) for the same period. This new dataset is used for comparison purposes for the two periods: 1991-2003 and 1991-2010.

In our analysis, we deal with possible omitted variable bias and endogeneity of financial variables by using fixed effects estimation techniques and lag the long-term lending one period. We also use dynamic Arellano-Bond technique with the farm balance sheet data but this method is less reliable with the relatively small panel and time period data.

Our findings show that lending by the FCS institutions is associated with higher farm output, agricultural GDP, and farm income. Due to data limitations, our best estimates of the impacts are \$650 in farm output, \$391 in agricultural GDP, and \$582 in farm income for \$1,000 of previous year real estate credit during the 1991-2003. Future research may focus on assembling a dataset that contains better match between lending by all FCS institutions dollar lending on state level and by type of loans – real estate or non-real estate.

Figure 1 FCS and CB Credits and Agricultural Outputs (authors own calculations)

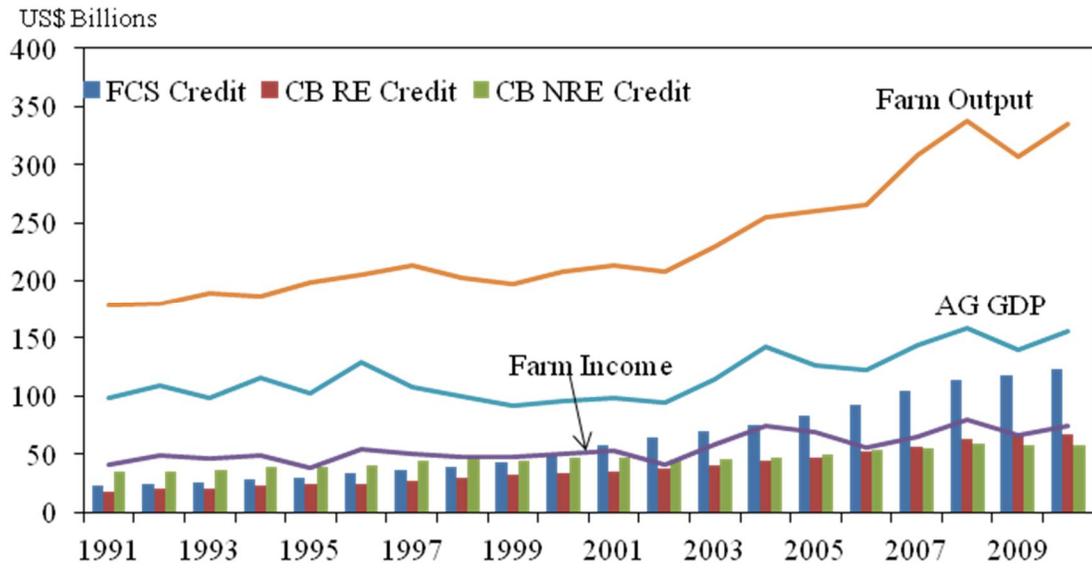


Table 1 Summary Statistics

Variable (US\$ Millions)	Mean	Std. Dev.	Min	Max
Farm Output	5,735	6,200	31	39,000
Agricultural GDP	2,911	3,835	69	29,300
Farm Income	1,377	1,786	-169	13,500
Real Estate	26,600	26,400	340	151,000
Machinery	2,410	2,110	25.5	9,237
Real Estate (RE) Credit by FCS	841	953	0.6	7,643
Real Estate (RE) Credit by Commercial Banks	742	835	0.6	4,608
Other Real Estate Credit	717	972	2.5	6,632
Non Real Estate (NRE) Credit by FCS	490	482	0	3,464
Non Real Estate (NRE) Credit by Commercial Banks	1,086	1,328	0	5,351
Other Non Real (NRE) Estate Credit	522	515	3.8	2,770
Farms (Thousands)	43.1	39.3	0.5	237
Loans Provided by FCS (ACAs and FLCAs)	1,919	2,474	2.4	15,500
RE Loans from Commercial Banks	4,196	3,888	729	21,400
Non-RE Loans from Commercial Banks	5,226	4,358	1,335	18,500
Debt to Assets Ratio (%)	13	4	2	23.2
Rural Population (% of total population)	27	18	0	70.4
Interest Rate (Index 1910-1914 =100%)	113	17	87	147
Price Index (1910-1914 =100%)	86.7	7.3	74	99
Inflation (%)	2.5	0.9	-0.3	4.4

Table 2 Fixed Effect Regression, Farm Balance Sheets Data, for the period 1991-2003

Variables	State Balance Sheet Data			Production Region		
	(1) Output	(2) AG GDP	(3) Farm Income	(4) Output	(5) AG GDP	(6) Farm Income
Capital				0.006 (0.021)	-0.045 (0.053)	-0.029 (0.029)
RE Capital ^a	-0.037 (0.024)	-0.018 (0.013)	-0.013 (0.009)			
Machinery ^a	-0.029 (0.152)	-0.253 (0.272)	-0.362*** (0.119)			
FCS Credit ^a				0.519** (0.197)	0.373 (0.268)	0.177 (0.108)
FCS RE Credit ^a	0.621** (0.259)	0.119 (0.275)	0.565** (0.226)			
FCS NRE Credit	1.207* (0.633)	-0.126 (0.560)	-0.205 (0.305)			
Bank RE Credit ^a	-1.761*** (0.489)	-2.107*** (0.471)	-0.788*** (0.267)	-2.180*** (0.554)	-1.150 (1.000)	-0.143 (0.747)
Bank NRE Credit	0.119 (1.002)	-2.267*** (0.461)	-0.987** (0.392)	-1.825*** (0.529)	-1.124 (1.212)	-0.157 (0.429)
Other RE Credit ^a	-0.229 (0.544)	-1.766*** (0.393)	-0.271 (0.264)			
Other NRE Credit	0.717 (0.477)	-1.251* (0.659)	-0.326 (0.421)			
Price Index	17,304** (8,223)	56,780*** (10,394)	8,968* (5,225)	57,265 (54,351)	340,598*** (76,336)	38,850 (51,695)
Interest	2,324 (4,808)	29,933*** (7,567)	7,396 (5,468)	17,096 (39,149)	165,172** (55,540)	38,468 (46,235)
No. of Farms	15.035 (14.065)	1.780 (15.325)	20.676* (10.505)	12.694 (25.328)	17.556 (36.616)	33.803 (27.791)
Rural	-81,002* (43,647)	-127,391* (66,074)	-35,313 (26,347)	-88,514 (518,237)	-191,403 (326,779)	607,503** (262,978)
Debt/Assets	-29,646 (26,623)	-16,932 (28,357)	-13,695 (15,615)	-210,896 (127,069)	-1147432** (403,777)	-456,010** (197,946)
Constant	6,357K** (2,887K)	5,293K** (2,250K)	2,891K* (1,442K)	37,666K (23,071K)	-1,574K (16,289K)	-10,880K (10,652K)
Yr. Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	600	600	600	120	120	120
R-squared	0.34	0.57	0.25	0.58	0.75	0.39
Number of panels	50	50	50	10	10	10

Robust standard errors in parentheses, ^a lagged one period, *** p<0.01, ** p<0.05, * p<0.1

Table 3 Fixed Effect Regression, Farm Balance Sheet Data, for the period 1991-2010

Variables	State Balance Sheet Data			Production Region		
	(1) Output	(2) AG GDP	(3) Farm Income	(4) Output	(5) AG GDP	(6) Farm Income
Capital				0.042*** (0.012)	0.006 (0.011)	0.008 (0.007)
RE Capital ^a	-0.016 (0.016)	-0.026 (0.017)	-0.018 (0.014)			
Machinery ^a	0.547** (0.235)	0.194 (0.244)	-0.099 (0.158)			
FCS Credit ^a				0.205 (0.140)	0.238 (0.175)	0.097 (0.106)
FCS RE Credit ^a	0.650*** (0.212)	0.391* (0.204)	0.582** (0.220)			
FCS NRE Credit	0.451 (0.469)	0.106 (0.541)	-0.069 (0.459)			
Bank RE Credit ^a	-0.271 (0.338)	-0.712 (0.431)	-0.061 (0.270)	1.773*** (0.343)	0.850*** (0.248)	0.895*** (0.184)
Bank NRE Credit	3.460*** (0.544)	-0.028 (0.502)	0.401 (0.287)	0.363 (0.327)	-0.203 (0.301)	-0.000 (0.181)
Other RE Credit ^a	-1.901** (0.767)	-1.276*** (0.332)	-0.737** (0.324)			
Other NRE Credit	-1.582*** (0.580)	-1.364 (0.814)	-0.062 (0.636)			
Price Index	57,284*** (10,383)	61,111*** (9,128)	45,533*** (8,450)	260,050*** (47,078)	370,871*** (72,981)	128,445* (61,991)
Interest	13,174*** (4,625)	8,739* (4,504)	10,432*** (3,887)	51,040 (53,426)	-85,171* (42,473)	-29,662* (15,428)
No. of Farms	-56.757* (30.766)	-47.258* (24.358)	-32.213 (19.329)	170.045 (116.671)	91.946 (53.022)	68.380 (37.984)
Rural	-76,318 (50,312)	-19,899 (37,972)	8,949 (29,539)	1,093,544* (484,565)	650,610 (389,651)	1,151,198*** (260,221)
Debt/Assets	38,634 (27,190)	-51,721 (36,727)	-38,162 (30,338)	-89,569 (305,602)	-780,390** (260,564)	-311,911*** (76,523)
Constant	363,916 (2,576,845)	1,975,149 (2,401,009)	-1,664,068 (1,869,294)	-77,330K (47,990K)	-36,300K (26,591K)	-42,910K** (16,601K)
Yr. Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	950	950	950	190	190	190
R-squared	0.66	0.40	0.25	0.75	0.63	0.51
No. of panels	50	50	50	10	10	10

Robust standard errors in parentheses, ^a lagged one period, *** p<0.01, ** p<0.05, * p<0.1

References

- Allen, F. and Gale, D. (1999) Diversity of opinion and financing of new technologies. *Journal of Financial Intermediation* 8: 68–89.
- Allen, F. and Gale, D. (2000) *Comparing Financial Systems*. Cambridge, MA, and London: MIT Press.
- Ang, J.B. (2008) “A survey of recent developments in the literature of finance and growth.” *Journal of Economic Surveys* 22(3): 536–576.
- Arellano, M. and Bond, S. (1991). “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations,” *Review of Economic Studies* 58(2): 277–297.
- Arellano, M. and Bover, O. (1995). “Another look at the instrumental variable estimation of error-components models.” *Journal of Econometrics* 68(1): 29–51.
- Beck, T. and Levine, R. (2002) “Industry growth and capital allocation: does having a market- or bank-based system matter?” *Journal of Financial Economics* 64: 147–180.
- Beck, T., Demirgüç-Kunt, A., and Levine, R. (2007). “Finance, inequality and the poor,” *Journal of Economic Growth* 12: 27-49.
- Beck, T., Levine, R. and Levkov, A. (2010). “Big bad banks? The winners and losers from bank deregulation in The United States.” *The Journal Of Finance* 65(5): 1637-1667.
- Briggeman, B.C., Towe, C.A., and Morehart, M.J. “Credit constraints: Their existence, determinants, and implications for U.S. farm and nonfarm sole proprietorships.” *American Journal of Agricultural Economics* 91(2009): 275–289.
- Buffie, E.F. (1984) “Financial repression, the new structuralists, and stabilization policy in semi-industrialized economies.” *Journal of Development Economics* 14: 305–322.
- Chaddad,F. , Cook, M. and Heckeley, T. (2005). “Testing for the Presence of Financing Constraints in US Agricultural Cooperatives: An Investment Behavior Approach,” *Journal of Agricultural Economics*, (56)3: 385-397.
- Clarke, G., Xu, L. C., and Zou, H. F. (2006). “Finance and income inequality: what do the data tell us?” *Southern Economic Journal* 72: 578-596.
- Cohen, A. (2004). “Market structure and market definition: the case of small market banks and thrifts.” *Economics Letters* 85:77-83.
- Collender, R. N., and Erickson, A.(1996). *Farm Credit System Safety and Soundness*, No. 722. Washington: U.S. Department of Agriculture, Economic Research Service.

- Dehejia, R. and Lleras-Muney, A. (2007) "Financial development and pathways of growth: State branching and deposit insurance laws in the United States, 1900-1940." *Journal of Law and Economics*, 50(2): 239-72.
- Ergungor, O.E. (2004) "Market- vs. bank-based financial systems: do rights and regulations really matter?" *Journal of Banking and Finance* 28, 2869–2887.
- Fama, E.F. (1980) "Banking in the theory of finance." *Journal of Monetary Economics* 6: 39–57.
- Freshwater, D. (1997) "Competition and consolidation in the Farm Credit System." *Review of Agricultural Economics* 19: 219–27.
- Goldsmith, R.W. (1969) *Financial Structure and Development*. New Haven, CT: Yale University Press.
- Greenwood, J. and Jovanovic, B. (1990) "Financial development, growth, and the distribution of income." *Journal of Political Economy* 98: 1076–1107.
- Gurley, J.G. and Shaw, E.S. (1955) "Financial aspects of economic development." *American Economic Review* 45: 515–538.
- Hartarska V. and Nadolnyak, D. (2012) "Financing constraints and access to credit in post crisis environment: Evidence from new farmers in Alabama," *Journal of Agricultural and Applied Economics* 44(4): 1-15.
- Hicks, J.R. (1969) *A Theory of Economic History*. Oxford: Oxford University Press.
- Jayarathne, J. and Strahan, P.E. (1996) "The finance-growth nexus: Evidence from bank branch deregulation." *Quarterly Journal of Economics* 111(3): 639–670.
- Jensen, F.E., 2000, "The Farm Credit System as a Government-Sponsored Enterprise." *Review of Agricultural Economics*, 22(2): 326–335
- Johnson, J. (2009) "Rural economic development in the United States: An evaluation of the U.S. Department of Agriculture's business and industry guaranteed loan program," *Economic Development Quarterly* 23(3): 229-241.
- Kilkenny, M. and Jolly, R. W. (2005) "Are rural credit markets competitive? Is there room for competition in rural credit markets?" *Choices* 20(1): 25-29.
- Kilkenny, M. (2010) "Urban/regional economics and rural development." *Journal of Regional Science* 50(1): 449–470.
- King, R.G. and Levine, R. (1993) "Finance, entrepreneurship, and growth: theory and evidence." *Journal of Monetary Economics* 32: 513–542.

- Lee, W., and Irwin, G. (1996) "Restructuring the Farm Credit System: A progress report." *Agricultural Finance Review* 56: 1-21.
- Levine, R. (2005) "Finance and growth: theory and evidence". In: Aghion, P., and Durlauf, S., (Eds.), *Handbook of Economic Growth*. Elsevier Science, Netherlands.
- Lucas, R.E., Jr (1988) "On the mechanics of economic development." *Journal of Monetary Economics* 22: 3-42.
- McKinnon, R.I. (1973) *Money and Capital in Economic Development*. Washington, DC: Brookings Institution.
- Modigliani, F. and Miller, M.H. (1958) "The cost of capital, corporation finance, and the theory of investment." *American Economic Review* 48: 261-297.
- Mishra, A, Moss, C., and Erickson, K. (2008) "The role of credit constraints and government subsidies in farmland valuations in the US: An options pricing model approach" *Empirical Economics* 34(2): 285-97.
- Pagano, M. (1993) "Financial markets and growth: an overview." *European Economic Review* 37: 613-622.
- Rajan, R. G. and Zingales, L. (1998) "Financial dependence and growth," *American Economic Review* 88: 559-587.
- Shaw, E.S. (1973) *Financial Deepening in Economic Development*. New York: Oxford University Press.
- Schumpeter, J.A. (1911) *The Theory of Economic Development*. Oxford: Oxford University Press.
- Taylor, L. (1983) *Structuralist Macroeconomics: Applicable Models for the Third World*. New York: Basic Books.
- van Wijnbergen, S. (1982) "Stagflationary effects of monetary stabilization policies: a quantitative analysis of South Korea." *Journal of Development Economics* 10, 133-169.
- van Wijnbergen, S. (1983) "Interest rate management in LDCs." *Journal of Monetary Economics* 12: 433-452.
- Wooldridge, J.M. (2008) *Introductory Econometrics: A Modern Approach*. 4th edition. Mason, OH: South-Western College.