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Agricultural credit and economic growth in rural areas

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Abstract

Purpose – In this paper, the authors set out to establish if there is a link between finance and economic growth in rural areas. The purpose of this paper is to evaluate the relation between credit by major lenders in rural areas – commercial banks and Farm Credit System (FCS) institutions – and economic growth for the period 1991-2010.

Design/methodology/approach – 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. The authors use two alternative panel data sets and fixed effects models to estimate the causal effect of credit supply (with lagged explanatory variables) on agricultural GDP growth per rural resident.

Findings – The authors find a positive association between agricultural lending and agricultural GDP growth per rural resident with additional billion in loans (about a third of the actual average) associated with 7-10 percent higher state growth rate with this association stronger during the 1990s. Regional data confirm these results. The results point to a positive link between credit and economic growth in rural areas during that period, attributable to the lending by FCS institutions and by commercial banks.

Research limitations/implications – Data availability limits the scope of this paper. The authors use state level balance sheet data available for the 1991-2003 period and annual data for 2003-2010 period. An additional regional data set is constructed for 1991-2010 with more aggregated data for the ten USDA agricultural production regions. The small number of panels limits the ability to use more sophisticated econometric models and the choice of dependent variables that captures economic growth.

Practical implications – By provides evidence that agricultural finance and in particular lending contribute significantly to the growth of US agriculture, this paper contributes to the policy debate on weather support for agricultural finance initiatives is justified.

Originality/value – The authors are not aware of another study that has linked agricultural lending by commercial banks and FCS institutions to growth in rural areas in the USA.

Keywords Economic growth, Agricultural finance

Paper type Research paper

The agricultural economics literature recognizes that alleviating credit constraints in agriculture is important. For example, research finds that production is 3 percent 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 agricultural finance on its clients and on the

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wider rural community is likely substantial but there has been little empirical work that quantifies its effects.

We evaluate the possible link between agricultural lending and economic growth in rural areas using panel state – and region – level data for the period 1991-2010. Our work is motivated by the literature on finance and economic growth documenting a strong association between the two (Clarke *et al.*, 2006; Levine, 2005; Rajan and Zingales, 1998). Existing empirical studies find 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).

Agricultural and rural financial markets remain constrained by geography and growth in agriculture and rural areas remain affected by location-specific supply of credit; thus these markets remain somewhat separate type of financial market (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 data limitations and inadequate methods of analysis. We use two alternative panel data sets and fixed effects models to estimate the causal effect of credit supply (with lagged explanatory variables) on rural economic growth.

The focus on the past two decades is important because, during this period, agricultural lenders were recovering from the crisis in the 1980s and later functioned in an environment defined by changes in banking regulations affecting all credit markets. More recently, agricultural lenders weathered a major financial crisis. In this paper, we show that during these diverse economic conditions agricultural lending was associated with several percentage higher economic growth in rural areas, suggesting that the agricultural lenders could successfully face future challenges.

Literature review

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[1]. 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 (Buffie, 1984; Taylor, 1983; van Wijnbergen, 1982, 1983) 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[2].

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. 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 (Collender and Erickson, 1996; Lee and Irwin, 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). Identifying the relationship between economic growth and credit for rural areas remains important for policy purposes which may include various types of support of rural and agricultural lending initiatives.

Financial institutions and intermediation matter in the endogenous growth models. Financial development is incorporated in these models which 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, 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 agricultural 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 (Clarke *et al.*, 2006; Levine, 2005; 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 (Beck *et al.*, 2010; Dehejia and Lleras-Muney, 2007; Jayaratne and Strahan, 1996).

Within this approach, development outcomes such as GDP growth are related to financial market development indicators such as private bank loans, government controlled bank loans, etc. Following this approach, we relate the rural growth rate to agricultural and rural credit. We estimate the following model:

$$Ag\ GDP\ Growth_{it} = \beta_0 + \sum_{1}^{j} \beta_j Cradit_{jit-1} + \sum_{1}^{m} \beta_m Controls_{mit} + \alpha_i + \varepsilon_{it}$$

where the dependent variable *Ag GDP Growth* is the GDP growth per rural resident (in real terms) and is our measure of economic development in rural USA; i denotes the state/region, t is the time period or year. Here α_i is the unobserved state/region-specific term which may be correlated with the explanatory variables and ε_{it} is the error. Credit is one period lagged measure of loans granted by commercial (agricultural) banks and by Farm Credit System (FCS) institutions. Credit enters 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.

Controls consist of various control variables including year dummies. 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 to total population since more rural communities may demand more agricultural or rural credit.

We use the fixed effect model to remove 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)[3].

Data and results

The data set is assembled from several sources. The dependent variables measuring the agricultural GDP growth comes from the Bureau of Economic Analysis database. Specifically, *Ag GDP Growth* is the state/regional GDP from industries in the agriculture, forestry, fishing, and hunting[4]. It is divided by the non-metropolitan population in the state/region.

We also use farm balance sheet data, available from the USDA database, containing detailed information about all sources of debt for farmers (farmers' liability) which includes credit from the two main sources to credit to rural areas: commercial agricultural banks and Credit System Institutions (ACAs, FLCAs and direct loans from the system banks). Together these suppliers provide over 80 percent of credit to agriculture in the USA.

State-level farm balance sheets are available only for the period 1991-2003. For the more recent period of 2004-2010, we employ the following procedure. Since the USDA continues to publish aggregate nationwide-level balance sheet data, we compute the US growth rate of each of the variables in our data set 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[5]. 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 the same in all states through the period – it might have shrunk (at least in some states) due to the economy-wide credit crunch. Alternatively, 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 (Hartarska and Nadolnyak, 2012).

We also construct regional-level data for lending by commercial bank and by FCS institutions and the respective regional-level variables for the 1991-2010 period. These data are for the ten USDA agricultural production regions: Northeast, Lake States, Corn Belt, Northern Plains, Appalachia, Southeast, Delta States, Southern Plains, Mountain States, and Pacific. We use the Federal Reserve Bank of Kansas City database of agricultural loans by commercial banks for each region for the period 1991-2010. In addition, we collected data for loans from FCS institutions using FCS own database and identified them for each of the ten regions. We use one category agricultural loans (not separate real estate backed and non-real estate, typically shorter agricultural loans) due to data limitations[6]. From the FCS own data set we use loans extended by ACAs and FLCAs but cannot use loans extended to cooperatives and rural utilities by CoBank and ACB because we do not have regional identifier for these loans[7]. Another limitation imposed by these data is that with only ten producing regions we cannot use dynamic panel methods because of the small number of panels but we believe that the effect is well captured by the fixed effects model that we use.

Price data come from the Agricultural Prices database produced monthly by the USDA's National Agricultural Statistics Service[8]. The Interest is the interest payable per acre on farm real estate loans with 1910-1914 serving as a base; this is annual national-level index and thus it is less likely to be correlated with the state/region-specific level of lending. Price Index is an index measuring the ratio of prices received to prices paid calculated with the same base (1910-1914). 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. 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 I for the state-level data and in Table II for the regional-level data. Table III contains the results from our econometrics estimation. In each column, we present the results from fixed effects panel estimation for a specific period and data set. In all specifications we observe a relatively good fit of the data with adjusted R^2 ranging from 0.44 for the state – data to 0.69 in the regional-level data.

We estimate several specifications for the 1991-2003 and 1991-2010 period with the two data sets. For each sample we estimate first a model where the dependent variables interest rate and debt-to-assets ratio are non-linear and another specification with added interaction of the two variables. First, we present results with actual state-level balance sheet data for 1991-2003 in columns 1 and 2 and next for the 1991-2010 period with actual and adjusted data in the models in columns 3 and 4. We further investigate

the role of agricultural credit using our regional-level data and estimate the model for the 1991-2010 period using data from the FCS database and that from the Kansas City Federal Reserve Bank. These results are presented in columns 5 and 6.

Estimation results show that overall credit extended by agricultural lenders is associated with positive economic growth. More specifically, we find that for the period 1991-2003 additional one billion dollars in credit (which is about a third of the actual level of the average state-level credit) by FCS institutions and commercial banks is associated with about 10 percent higher growth rate per rural resident according to Models 1 and 2. Models 3 and 4 show that for the longer 1991-2010 period the impact is 7 percent higher growth rate. The difference in magnitude between the sub-period and the overall period may be related to our data construction or possibly the existence of a threshold after which further deepening of the financial markets is unrelated to indicators of economic development which would be consistent with findings in the literature (Herwartz and Walle, 2014). Such a threshold could have been reached after the Grahm-Leach-Bailey Act or Financial Services Modernization Act of 1999.

Columns 4 and 5 contain the results with the regional data. With these data we also find that on regional-level credit by commercial banks and by FCS institutions is associated with higher agricultural GDP growth per rural resident for the study period. Specifically, an additional billion of credit (which is slightly more than a tenth of the regional average of $11.1 billion) is associated with 3-4 percent higher regional agricultural GDP growth per rural resident.

Our results also show a positive link between the output-input price index and the *Ag GDP Growth* in four out of the six specifications (columns 3-6). Current-level land values are not linked to the growth rate of the GDP but the current value of other fixed assets has a negative relation to current rate of economic growth possibly due to delayed effect.

Variable	Obs.	Mean	SD	Min.	Max.
Growth in Ag GDP per RR, %	912	0.41	20.00	−63.53	90.64
Land, billion $	950	18.83	21.97	0.91	102.06
Other long-term capital, billion $	950	1.89	2.62	0.05	18.53
Credit by FCS and commercial banks	950	3.5	3.9	0.05	23.9
Output/input price index ratio, %	950	86	6.9	74	98
Interest, $/acre	950	113	17	87	147
Farms ('000)	950	43	39	0.54	237
Rural population, %	950	27	18	0	70
Farm debt/assets, %	950	13	4	2	23

Table I. Summary statistics of state-level data

Variable	Obs.	Mean	SD	Min.	Max.
Growth in Ag GDP per RR (real term), %	190	0.83	18.44	−43.69	68.55
Long-term capital, billion $	190	17.83	15.29	2.46	66.41
Bank and FCS loans, billion $	190	11.5	7.08	4.2	42.7
Output/input price index ratio, %	190	86	6.91	74	98
Interest, $/acre	190	114	17	87	147
Farms ('000)	190	215	93	113	443
Rural population, %	190	22	11	6	45
Farm debt/assets, %	190	14	3	7	20

Table II. Summary statistics of regional data

Model/sample Period	(1) State 1991-2003	(2) State 1991-2003	(3) State 1991-2010	(4) State 1991-2010	(5) Region 1991-2010	(6) Region 1991-2010
Bank and FCS loans$_{(t-1)}$	10.436**	10.287**	7.152***	7.225***	3.641***	3.098**
	(4.466)	(4.493)	(2.652)	(2.605)	(0.877)	(1.296)
Land	−0.981	−0.980	−0.203	−0.205		
	(0.694)	(0.691)	(0.233)	(0.234)		
Other long term Capital	−5.559***	−5.838***	−5.450***	−5.529***		
	(1.613)	(1.687)	(0.855)	(0.851)		
Long-term capital (Incl. land)					−0.689**	−0.601**
					(0.246)	(0.250)
Price ratio	−0.028	−0.016	1.956***	1.957***	1.869***	1.887***
	(0.149)	(0.152)	(0.206)	(0.207)	(0.461)	(0.450)
Interest	28.029***	28.077***	4.992***	5.049***	6.348***	6.020***
	(3.671)	(3.682)	(0.843)	(0.830)	(1.620)	(1.739)
Interest^2	−0.137***	−0.136***	−0.018***	−0.018***	−0.024***	−0.023***
	(0.018)	(0.018)	(0.003)	(0.003)	(0.006)	(0.006)
Farm debt/asset	−2.742*	−1.590	−2.287***	−1.820	−9.351***	−11.949***
	(1.364)	(1.880)	(0.718)	(1.300)	(1.487)	(2.777)
(Farm debt/asset)^2	0.047	0.053	0.050**	0.043	0.227***	0.261***
	(0.045)	(0.044)	(0.024)	(0.027)	(0.053)	(0.047)
Farm debt/ asset × interest		−0.012		−0.003		0.016
		(0.012)		(0.007)		(0.020)
Number of farms	0.077	0.053	0.240	0.234	−0.004	0.003
	(0.230)	(0.237)	(0.209)	(0.214)	(0.088)	(0.094)
Rural population	2.911***	2.864***	1.013**	1.012**	2.852**	2.360
	(0.952)	(1.036)	(0.438)	(0.436)	(1.155)	(1.359)
Constant	−1,467***	−1,476***	−521***	−526***	−539***	−496***
	(183)	(185)	(68)	(67)	(127)	(148)
Observations	576	576	912	912	190	190
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.446	0.447	0.444	0.444	0.595	0.595
No. of states/regions		48	48	48	10	10
Optimal interest*	102	*103*	139	*140*	132	*131*
Optimal debt ratio	29		23		21	

Notes: Robust standard errors in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table III.
Fixed effect regression, state and regional data; for 1991-2010, and 1991-2003

The interest rate has a non-linear inverted U shape relation to economic growth. This suggests that suggesting that agricultural GDP grew more in periods associated with higher level of economic activity up to a point where the interest rate becomes so high that it starts hurting to growth. This point varies depending on the specification and data period (presented at the bottom of Table III) but it is clear that any interest expense above 130 per acre has a negative impact on economic growth. Similarly we find that non-linear link between farm debt-to-assets ratio and economic growth in three out of the six specification. Farm Debt-to-Assets ratio above 21 for state level and 23 for the regional level is associated with negative link to economic growth. This link is especially pronounces with the regional data where and the inflection point at 23 impact. We also find that states with higher proportion of rural population grew more, and specifically that an additional percent point of (state level) rural population was associated with one to three percent higher agricultural GDP growth rate.

Conclusions

In this paper, we set out to establish if there is a link between lending by the major lenders in US agriculture – commercial banks and the FCS institutions – and agricultural economic growth 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 highlights the specific positive role of long-term finance provided by banks.

We use two different data sets to test 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 data set with agricultural credit by the two main lenders, FCS institutions and commercial banks, grouped by the USDA's production region level for the 1991-2010 period. This data set was constructed from data on commercial bank lending published by the Federal Reserve Bank of Kansas City classified into ten agricultural producing regions. We match these regional-level data with regional-level data on credit by the FCS institutions (ACAs and FLCAs) for the same period. We deal with possible omitted variable bias and endogeneity of financial variables by using fixed effects estimation techniques and lag the lending variable one period.

Our findings show that credit by commercial banks and by FCS institutions is associated with higher agricultural GDP growth rates. We find that, on state level, an additional billion in loans (about a third of the state average) is associated with about 10 percent higher growth rate of agricultural GDP for the 1991-2003 period and with 7 percent higher growth rate for the overall 1991-2010 period. On regional level, we find similar results in that an additional billion of agricultural credit (about a tenth of the actual credit) is associated with 3-4 percent higher agricultural GDP growth in the region. We conclude that our evidence points to a positive link of credit and economic development in rural areas attributable to the lending by commercial banks and FCS institutions.

Notes

1. The description of these theories follows the chronological order in Ang (2008).
2. 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 neoclassical theory suggests that the optimal growth rate equals the real interest rate and there is no role for the financial system.
3. An alternative method used to capture the dynamic aspects of GDP growth 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 period.
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. 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.
6. 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 ten regions, because we do not have sufficient number of observations.
7. This limitation to a large extent also determines the choice of the dependent variable.
8. Available at http://usda.mannlib.cornell.edu/reports/nassr/price/pap-bb/

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