

**Merger activities in the Farm Credit System:
2002-2020**

by

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ABSTRACT

The Farm Credit System (FCS or ‘The System’) has been in existence for over a century, fulfilling its mission to serve rural America through consistent stable access to credit and financial products for eligible and creditworthy borrowers. However, the Farm Credit System that existed in 1916 is not the same System that exists today, due to major legislative actions prompted by the agriculture credit crisis of the mid-late 1980s; this resulted in significant merger activity that has continued in the years since

The purpose of the research aims to analyze mergers that have occurred in the Farm Credit System over the past 25 years based on four key indicators following the last material structural and legislative changes to the Farm Credit Act that occurred in 1987 in the wake of significant disruption in agriculture and its primary financial support systems, the FCS notwithstanding. Asset size, operating expense ratio, return on equity and average spread are evaluated for statistical significance using a regression model and economic theory. This research is based on time series data from 2002 to 2020 procured from Farm Credit Administration (FCA) call reports comprised of consistently reported financial data by all System institutions on a routine basis to FCA, the regulatory authority for the Farm Credit System.

A total of two models with two permutations were estimated as part of this study, that yielded significant findings related to some, but not all of the key indicators. The first model is an individual analysis of each of the four key indicators characterized as strong or weak, a total of eight independent variables.. For the second model, the same 4 key indicators were analyzed on a differential basis within each ‘dyad’ (i.e. a pairing of two

unique associations), with a total of four independent variables. A numeric and percentage interpretation was estimated for each model. Statistically significant findings were identified for two of the four key indicators, and the concluding analysis will comprehensively explore each significant finding at length.

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DISCLAIMER

The author is an employee of CoBank, ACB, which is a Farm Credit System (FCS) institution. Findings and interpretations detailed within this research do not represent the views of the author's employer. The findings of this study are primarily derived from publicly available financial reporting data provided and certified by FCS institutions on the Farm Credit Administration (FCA) website, which provides comprehensive data reporting for the FCS. Detailed financial information for every entity in the FCS is accessible without limitation or credential requirements through the FCA website. For the purposes of this study, this information is classified as 'publicly available' meaning that the data is not confidential information. Conclusions derived from this study are being completed for academic purposes as a portion of the completion criteria of the Master of Agribusiness degree program at Kansas State University.

CHAPTER I: INTRODUCTION

The Farm Credit System ('System' or 'FCS') has generated a significant amount of economic value in the form of credit and financial services into rural America since its creation in 1916. However, the agricultural credit crisis of the 1980s indisputably reconfigured and shaped the Farm Credit System to its form that exists in today. The System suffered during and after credit crisis that plagued agriculture in the mid to late 1980s; hindsight indicates that both lenders and producers themselves rationally followed the market in terms of their respective lending and borrowing decisions. However, the System did lend into a commodity cycle and inflationary environment that included a complex mix of factors. Additionally, the FCS's lending practices of the time were focused more acutely on collateral rather than repayment capacity. Altogether, the System's lending activities ultimately contributed to depressed demand and catapulted interest rates to levels that were unsustainable for its customer's agricultural operations. Although tremendously disruptive to the entire agriculture industry, the crisis was not without a silver lining; farmers and lenders emerged with additional business acumen and more discipline around their respective lending and borrowing decisions, much of which prevails in their collaborative strategic decisionmaking today. Many customers who prevailed through this crisis attribute the relationship with their local farm credit association as the figurative buoy that kept their operations afloat through the worst of the crisis (Peoples 1992).

This research focuses on the merger activities occurring by and between Farm Credit System entities from 2002-2020. Although data exists further back in the publicly

available call report archives supported by FCA, this specific time period was selected due to the relative distance from the amendments that occurred to the Farm Credit Act in 1987 and subsequent repayment of government financial assistance to the FCS provided by the legislation. While a specialized assistance entity, called the Farm Credit System Assistance Board, was formed in the midst and aftermath of the 1980s crisis to comprehensively regulate distress at the bank level, it was dissolved on December 2nd, 1992 (Peoples 1992). Arguably, the System endured additional consolidation in the years following the closing of the assistance board. Thus, the beginning year of 2002 was selected to allow for additional merger activity subsequent to the credit crisis to, in essence, ‘wash out’ from a data perspective (i.e. UNINUM coding) to not unduly effect the findings of this research.

It is worth noting that in the current System, each prevailing association’s origin story is eminently unique, and based on individual institution facts and circumstances. Geography, portfolio composition and diversity, local marketplace trends, target market, funding mix, and board and management teams (among many other variables) lend themselves to an association’s unique identity and business philosophy. In addition to their shared mission as a lending institutions, many FCS institution also have a shared origin based on common corporate charters issued under the Farm Credit Act that impose the same statutory and regulatory expectations, limitations and requirements.

Within this network of FCS entities, a variety of viewpoints exist in terms of association scale. In general, small associations allow for more local control and highly responsive customer service, but have less resourcing to accommodate the ever changing regulatory and technology landscapes. Larger associations are generally able to scale

more efficiently and have more monetary resources to evolve their business in the modern-day financial services environment which is, undoubtedly riddled with more complexity on a variety of fronts than the System of 1916. This has the potential to place smaller associations at a competitive disadvantage, both with their commercial banking peers, and, in some cases, fellow Farm Credit associations whose chartered territory (known as a local service area or 'LSA') overlaps theirs. At the end of the day, the monetary hurdle for issues such as segregation of duties, administrative best practices and regulatory responsibilities become progressively more difficult for smaller associations to incorporate into their business model from a cost perspective, while larger associations are generally able to maintain a higher degree of business efficiency.

Understanding the drivers behind System merger activities is particularly relevant as these two divergent business philosophies continue, as there are benefits to both. By understanding the significance of the selected metrics and how they relate to merger activity may allow a more informed understanding of the future structure of the System.

The purpose of the research is explicitly not an assessment on the directional correctness of System entities increasing in relative asset size in the wake of their continued consolidation. It instead seeks to better understand the underlying component parts, utilizing a quantitative framework and scientific methods, both of which are sometimes overruled in favor of anecdotal evidence, which is simpler to procure and cite.

CHAPTER II: BACKGROUND AND LITERATURE REVIEW

2.1 System Purpose, Overview and Current State

The network of Farm Credit System ('FCS' or 'System') entities is highly complex, both from a historical perspective, and in its modern-day state. The System was created by the US Congress in 1916 to serve agricultural producers, agricultural cooperatives, and to provide a range of specified financial products and services to eligible borrowers. This disaggregated Government Sponsored Entity (GSE) is governed by the modern-day Farm Credit Act (The Act); its predecessor, The Federal Farm Loan Act was created in 1916 in conjunction with System creation. The iterative Farm Credit Act and has been modified and amended several times in the ensuing 106 years, with the current version based on the Farm Credit Act of 1971, as amended, which has not been exempt from changes in the years since (Manner 2014, Monke 2003). Unlike a commercial bank that is overseen by the United States House Financial Services Committee and the Senate Banking Committee, the FCS is overseen by the House Agriculture Committee and the Senate Committee on Agriculture, Nutrition and Forestry, Congressional Agriculture Committee, which is one reason System institutions are not regulated like traditional banks or other financial institutions.

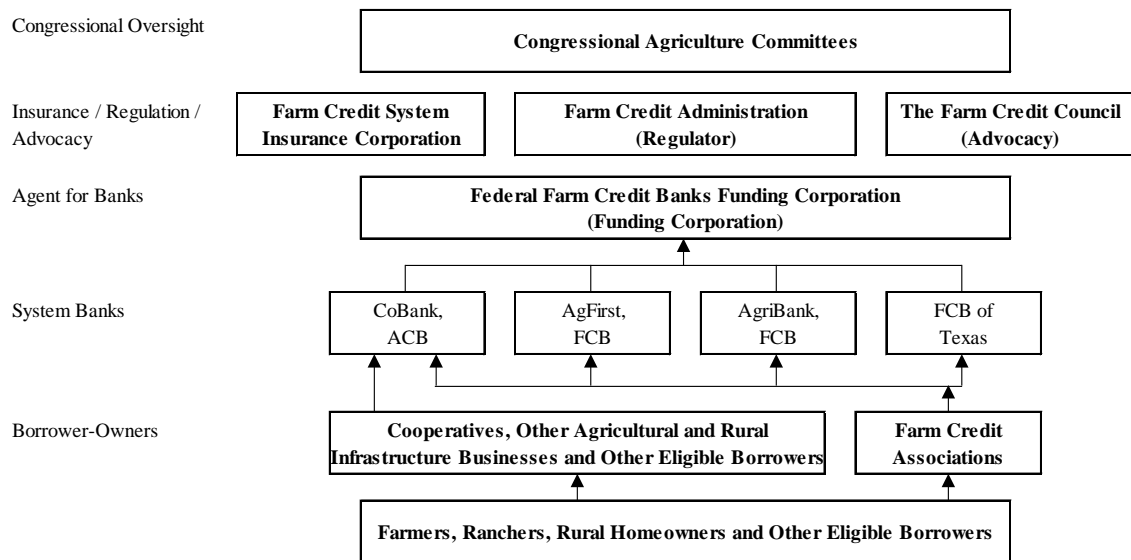
2.2 Types of FCS Institutions and Related Purposes

Many different types of lending and service-related entities exist in the FCS. The FCS is a Government Sponsored Entity (GSE), meaning entities are established by Federal law, but privately owned, and, in this case, dedicated to providing credit to rural

America nationwide. Given the nature of the FCS and its restricted industry concentration risk, it receives select tax benefits for portions of its lending activities, as is common with all GSE enterprises. The FCS is the only direct lender among modern GSEs vs. institutions like Farmer Mac, Fannie Mae, Freddie Mac and others, who are explicitly secondary lenders (Monke 2003).

Figure 2.1 provides an overview of select System institutions. For clarity, the institutions are divided into two types of groups: lending and other.

Figure 2.1: FCS System Structure



Source: Federal Farm Credit Banks Funding Corporation

2.2.1 Types of FCS Lending Institutions

There are five types of lending institutions that exist in the modern day System, either as a direct entity or a subsidiary. These entity types are Agriculture Credit Banks (ACBs), Farm Credit Banks (FCBs), Agriculture Credit Associations (ACAs), Federal Land Credit Associations (FLCAs), and Production Credit Associations (PCAs).

Additionally, the Bank for Cooperative (BC) structure is also an important historic construct, which is no longer in existence in form, but exists in substance in CoBank's direct lending authority. Monke states that it is important to note that the System is not designed to be a lender of last resort (Monke 2003). Each type of modern day System entity is subject to lending authorities that dictate the scope of their financing (Manner 2014).

Agriculture Credit Banks and Farm Credit Banks exist as 'banks' for the FCS. Historically, institutions were regulated in separate FCB and BC frameworks, known as 'district banks'; FCBs provided wholesale financing to specified association member-owners within their assigned service territory and BCs provided financing to eligible agricultural and infrastructure cooperatives and other eligible borrowers (Manner 2014, Monke 2003).

At the inception of this bank structure, there were 12 districts, that each housed a Federal Land Bank (FLB), a Federal Intermediate Credit Bank (FICB) and a Bank for Cooperatives (BC). FLBs and FICBs were predecessor organizations to a FCB. There was also a 13th national BC, that was the earliest iteration of a capital markets mechanism (Manner 2014). Over time, the banks consolidated, which was initially isolated within the BC and FCB structures separately. In 1989, 11 of the 13 BCs merged to form CoBank; two BCs continued to exist as standalone entities. In 1995, CoBank merged with the FCB of Springfield, and in 1999, the St. Paul Bank for Cooperative followed suit, which consolidated BC lending authorities into one nationwide footprint held by CoBank. Importantly, the merger between the FCB of Springfield and CoBank in 1995 led to the formation of the first ACB, a hybrid funding bank with capacity to finance all BC

business as well as a select portfolio of FCS associations based on assigned service territories (CoBank n.d.).

The creation of ACAs follows a similar framework trajectory, but was specially authorized by Statute. The original district structure lent itself to any number of Federal Land Bank Association (FLBA) and Production Credit Association (PCA) organizations, who often co-officed with each other or their district bank. In 1987, the Act was significantly retooled to accommodate the current needs of the System, leading to the creation of FCBs and ACAs. Importantly, the statutory changes mandated the merger of Federal Land Banks and Federal Intermediate Credit Banks to form FCBs and consolidate capital position. At the association level, standalone institutions remained in existence and FLBAs experienced a name change to FLCA to more accurately describe their capabilities as a long term only lender. This change to the Act further drove the consolidation of associations into a hybrid ACA structure, which was further supported by the FCS's regulator by allowing for an ACA holding company organizational structure with a wholly owned PCA and FLCA that preserved the tax exemptions Congress granted for agricultural mortgage lending. During this time the System experienced mass consolidation of like associations, that has led to many of the largest associations in the modern day FCS (Manner 2014).

2.2.2 FCS Shared Service Institutions

The System is and has been home to numerous non-financial institutions including, but not limited to service providing entities, trade organizations, regulatory bodies and others, the full breadth of which are not explored in detail in this thesis. Many

of the shared service organizations are reflected in Figure 2.1 (Federal Farm Credit Banks Funding Corporation n.d.), that include the following:

- Farm Credit Administration (FCA): The regulator of the FCSA and FAMC.
- Farm Credit System Insurance Corporation (FCSIC): The self-insurance function designed to protect bondholders who purchase Farm Credit Bank consolidated debt instruments, in the event of System debt default.
- Farm Credit Council (FCC): The trade organization that represents the System in Washington DC.
- Federal Farm Credit Banks Funding Corporation (Funding Corp): The fiscal agent for the Farm Credit Banks and CoBank, ACB and access to investors in System debt.

In addition, the FCS is home to a host of different institutions with varying purposes and ownership structures. These include technology and service providers e.g.: AgVantis, Financial Partners, Inc. and Sunstream. Farm Credit Leasing is a wholly owned subsidiary leasing company within CoBank. There are also specialized direct financing entities e.g.: AgDirect (point of sale equipment financing) and ProPartners (point of sale crop input financing).

2.3 FCS Consolidation Overview

Over time, the number of institutions has fallen dramatically (Table 2.1); an 18 year lookback from 2002-2020 represents a total decline in number of institutions by just over 71%, and a commensurate decline in ACA/FLCA/FLBA producer financing level entities by nearly 72%. This is due in part to the consolidation of FCS FLBA and PCA entities to

more expansive ACA entities, that was most evident in the early 2000s; this specific time series was selected due to the elimination of UNINUM codes that indicated a structure predating the credit crisis of the late 1980s.

Additional trends prior to the early 2000s are also discussed in various papers and publications. Estimated for association counts in the research examined for this paper include the following figures, that generally align with FCA reported data; variances are likely attributable to intra-year timing of data extracts.

- 1940's: About 2,000 lending associations were in existence (Monke 2003).
- 1970's: Over 900 lending associations were in existence (Manner 2014).
- 1983: Nearly 900 lending associations were in existence (Monke 2003).
- 1997: Less than 400 lending associations were in existence (Monke 2003).
- 1998: About 200 lending associations were in existence (Monke 2003).
- 2005: 96 lending associations were in existence (Monke 2003).

Monke (2003) notes the commensurate consolidation of district banks from the original 12 up until the 1980s to 5 in 2004; the 2012 US AgBank merger with CoBank brought the district bank count to the number in existence today, four (CoBank n.d.).

Figure 2.2 below depicts the consolidation trend by funding bank district over time from 1981 to 2011 (the time of the last merger at the funding bank level) and Figure 2.3 shown depicts the System as it exists as of January 1, 2022.

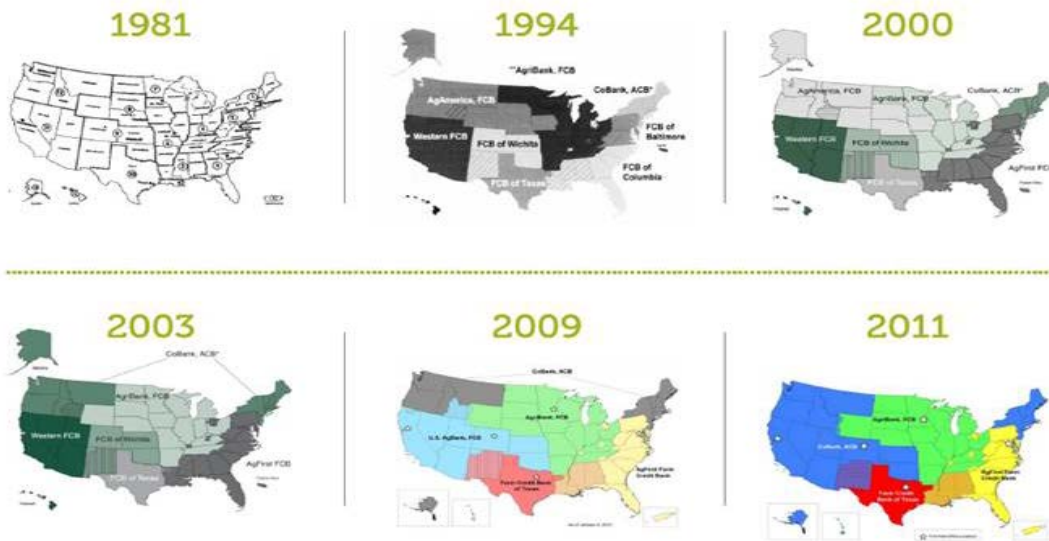
Table 2.1: Farm Credit System Entity Count – 1995 to 2020

Date	ACB	FCB	BC	ACA	FLCA*	PCA	Total
Mar 31, 1995	1	7	1	61	105	71	246
Mar 31, 2000	1	6	0	50	67	58	182
Jan 1, 2005	1	4	0	85	11	0	101
Jan 4, 2010	1	4	0	85	3	0	93
Jan 1, 2015	1	3	0	74	2	0	80
Jan 1, 2020	1	3	0	66	1	0	71

*FLCA and FLBA's combined

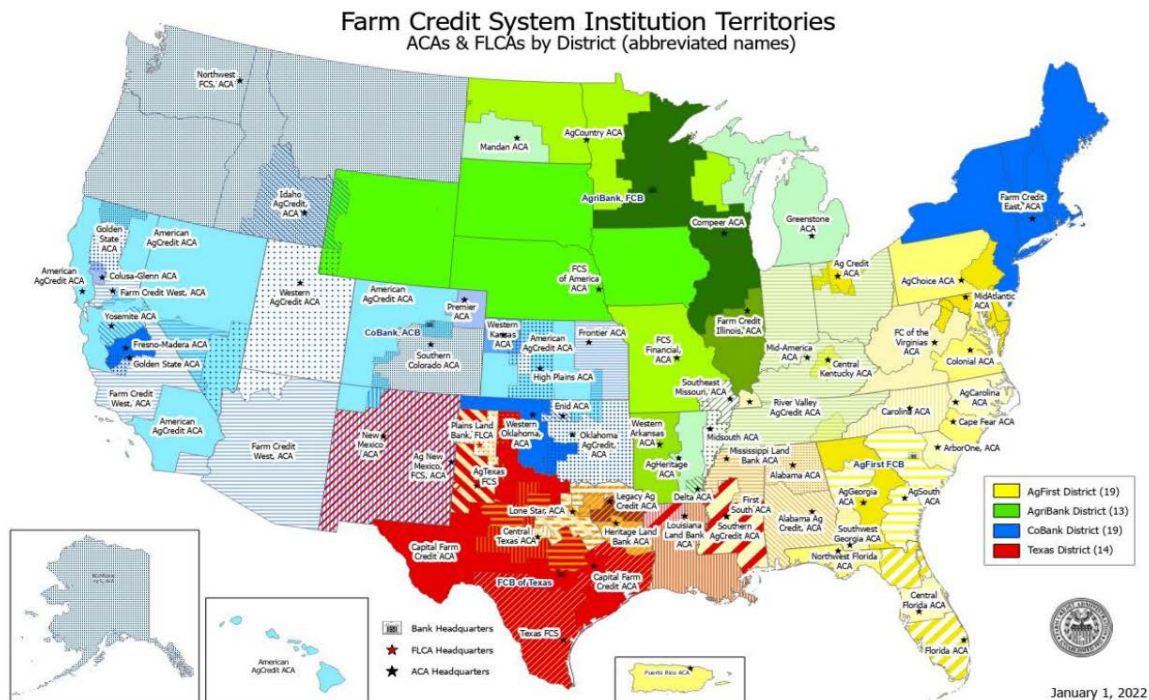
Source: Farm Credit Administration

Figure 2.2: System Consolidation Map at the Funding Bank Level



Source: Farm Credit Administration

Figure 2.3: System Map as of December 31, 2022



Source: Farm Credit Administration

2.3 Merger Application and Approval Process

In addition to merger support from customer-owners, a rigorous approval process accompanies any merger request within the System.. The process involves a robust and cross-functional due diligence process completed by the merging institutions, their bank(s) and the regulator to ensure that all risk factors are understood and mitigated where appropriate. The process follows the following steps:

- (1) Association boards approve pursuing a merger
- (2) Associations submit merger application and disclosure
- (3) FCB review and approval of the merger

- (4) Preliminary approval and clearance from FCA
- (5) Association shareholder vote is held
- (6) Rescission period starts
- (7) FCA provides final approval once rescission period ends

Within the Farm Credit Act of 1971, clear regulation exists in Title 7 of the Farm Credit Act. The Farm Credit Act specifies a complex and comprehensive process for the merger process that involves significant analysis and disclosure by the merging institutions as well as approvals from the merging institutions' boards of directors, the funding bank, and the regulator. The regulator has promulgated significant regulatory provisions to implement the merger requirements of the Farm Credit Act. Consistent with these provisions, the merged institution must address unique merging association characteristics and safety and soundness matters unique to the circumstances of their institution's merger. (US House Agriculture Committee, US Senate Committee on Agriculture, Nutrition and Forestry 2018). The approval process has standard prerequisites, although each merger has unique considerations. Additional mitigants and rules include merged entity capitalization, board representation, and other factors.

Drivers for merger activity are situational and unique, and Farm Credit entities have varying views on mergers as it relates to the resulting institution. Some institutions view local control and governance as the most important aspect of an association's business strategy, while others view broader geographies - and with that typically larger balance sheets - as a way to spread higher overhead costs, particularly in the IT and regulatory spaces. When a specific entity elects to entertain merger proposals, they may

seek out institutions that are similar to them in one or more aspects, or look to an institution that remediates an area that they believe needs to be strengthened within their own organization.

It is important to note that the regulatory requirements that merging institutions must address incentivizes alignment between the customer owners of all parties engaged in the merger request. This allows favorable partnerships that best align with the business objectives of the cooperative owners. Process rigor ensures that strategic discussions about organizational impact are thoroughly understood by all entities involved.

2.4 FCA Contextual Narrative on FCS Mergers

According to a statement released by FCA Board member Jeff Hall, on October 14, 2021, in the past 15 years, nearly one-third of Farm Credit System institutions have merged with other System institutions. Hall indicated that a disproportionate share of the mergers involved small institutions. During that same period, total System assets almost tripled to more than \$400 billion. In the subsequent remarks, Hall notes that small institutions are strongly committed to mission service, but many disproportionately struggle with shouldering increasing overhead costs related to IT and compliance services, among other costs. Hall concluded that consolidation and mergers are not necessarily ‘bad’ and that consolidation has been a trend in agriculture for many decades, and will continue into the future. He goes on to stress that the primary role of the regulator is to ensure that the Farm Credit System remains a safe, sound and dependable source of credit to all eligible borrowers, and that this responsibility extends to the safety

and soundness of each institution in the FCS. Hall commits that FCA will maintain a balanced approach in evaluating all business models (Hall 2021).

2.5 Application of Rochdale's 7 Cooperative Principles

According to the National Cooperative Business Association (CLUSA International), seven core values are widely accepted as general operations principles for cooperatives. Although these core values were not formalized until 1995, modern day cooperatives can trace the roots of these principles back to what is believed to be the first 'modern' cooperative founded in Rochdale, England in 1844 (National Cooperative Business Association, CLUSA International 2022). A comprehensive list of these principles can be found in Appendix C.

These principles are significant in this research, as each FCS merger is unique to the individual facts and circumstances of the merging associations, and is ultimately decided upon by the member-owners. In addition to many benefits of cooperative membership, democratic member-owner control, member owners economic participation and cooperation amongst cooperatives provide solid business rationale for member-owners to strategically guide an institution through a variety of business decisions including, but not limited to, a decision to merge with another organization or organizations. Ultimately, it is the the cooperative member-owners that decide what is in the best interests of the co-op.

2.6 Effective and Approved Pending Mergers from January 1, 2021 to Present

The Farm Credit System continues to experience significant merger activity in the ~24 months succeeding this study's time series of 2002-2020. A total of seven mergers (each comprised of two entities) are known to be completed or in progress between the time series conclusion date of December 31, 2020 and the publication date of this study. Although not included in the analysis, this activity anecdotally indicates that the trend of mergers continues to be a relevant theme in the consolidation trends in the FCS.

2.6.1 Farm Credit of Western Oklahoma and AgPreference, ACA, Effective January 1, 2021

According to Farm Credit of Western Oklahoma's 2020 Annual Report, the board of both Western Oklahoma and AgPreference agreed to merge in March of 2020 and were granted preliminary regulatory approval on October 16, 2020. Final approval for the January 1, 2021 effective date was granted on November 20, 2020. The resulting institution name is Farm Credit of Western Oklahoma. As of September 30, 2021 the resulting institution had an aggregated asset size of \$1.3 billion (Farm Credit of Western Oklahoma 2020, Farm Credit Administration n.d.)

2.6.2 AgCountry Farm Credit Services and Farm Credit Services of North Dakota: Effective January 1, 2022

On November 18, 2021, AgCountry Farm Credit Services published a press release indicating that Farm Credit Services of North Dakota would be merging with AgCountry, and the resulting name of the institution would be AgCountry Farm Credit Services. As of September 30, 2021, the two institutions had an aggregated asset size of

\$10.6 billion. This effective date for this merger is January 1, 2022 (AgCountry Farm Credit Services 2021, Farm Credit Administration n.d.).

2.6.3 Farm Credit East and Yankee Farm Credit: Effective January 1, 2022

On January 3, 2022, Farm Credit East merged with Yankee Farm Credit ,and the continuing institution's name was Farm Credit East. As of September 30, 2021 the two institutions had an aggregated asset size of \$9.5 billion (Farm Credit East 2022, Farm Credit Administration n.d.).

2.6.4 Farm Credit of Western Oklahoma and Farm Credit of Enid: Pending Effective Date of October 1, 2022

Subsequent to the merger of Farm Credit of Western Oklahoma and AgPreference on January 1, 2021, Farm Credit of Western Oklahoma and Farm Credit of Enid both indicated in their third quarter financial reports that they also had signed a letter of intent (LOI) to merge. As of September 30, 2021, the two institutions had an aggregated asset size of 1.6 billion. The anticipated effective date of this merger is October 1, 2022 (Farm Credit of Enid 2022, Farm Credit of Western Oklahoma 2021, Farm Credit Administration n.d.).

2.6.5 MidAtlantic Farm Credit and AgChoice Farm Credit: Pending Effective Date July 1, 2022

On September 24, 2021, MidAtlantic Farm Credit announced in a member letter to their customer stockholders that the institution intends to merge with AgChoice Farm Credit. As of September 30, 2021, the two institutions had an aggregated asset size of

\$5.6 billion. The anticipated effective date of this merger is July 1, 2022. (MidAtlantic Farm Credit 2022, Farm Credit Administration n.d.).

2.6.6 Farm Credit West and Northwest Farm Credit Services: Pending Effective Date January 1, 2023

On February 3, 2022, Farm Credit West and Northwest Farm Credit submitted a LOI to merge to the regulator for consideration. As of September 30, 2021, the two institutions had an aggregated asset size of \$27.1 billion (Northwest FCS 2022, Farm Credit Administration n.d.).

2.6.7 Cape Fear Farm Credit and AgCarolina Farm Credit: Pending Effective Date January 1, 2023

On April 11, 2022 Cape Fear Farm Credit and AgCarolina Farm Credit jointly announced that they had submitted an LOI to merge to the regulator. The resulting institution would have an aggregated asset size of over \$2.3 billion, with a planned effective date of January 1, 2023 (Cape Fear Farm Credit 2022, Farm Credit Administration n.d.).

2.6.8 Additional Upcoming Mergers

While it may be likely that other institutions in the FCS are considering future merger activities, the author relied on publicly available information to ascertain merger activities with an effective date after year end 2020. Any commentary on future merger activity that is not yet publicly announced would be considered speculative, and therefore was not included in this research.

2.6 Non Traditional ‘Merger-Like’ Structures: FCSA and Frontier Farm Credit

Although mergers between associations in different districts are technically hard to execute, alternative structures do exist. In 2014 Farm Credit Services of America and Frontier Farm Credit, affiliated with AgriBank, FCB and CoBank, ACB respectively, announced a ‘strategic alliance’, which enabled the two organizations to leverage synergistic business efficiencies overseen by one management team and two separate and independent boards. This example serves to indicate that synthetic merger-like business combinations may be a viable way to enhance two institution’s value proposition to their unique shareholders when a full formal traditional merger structure is not productive. As the FCS evolves and changes, it is plausible that additional structures that deviate from traditional merger structures may incidentally occur (Nygren 2014).

CHAPTER III: MODEL AND METHODS

3.1 Objectives

The objective of this research is to evaluate select key attributes of Farm Credit associations to determine if said attributes are statistically significant in predicting merger activities within the System. While the capacity of System institutions to engage in merger activity within the System has existed since the inception of the System in 1916, the agricultural credit crisis of the 1980s substantially accelerated this behavior (Monke 2003). In 1987, material structural changes were made to the Farm Credit Act, that allowed for the formation of ACAs, within the association framework which, in essence, allowed an association to finance all needs for a full-time farmer. While singular FLCAs and PCAs continued to exist, their scope of financing continued to be limited compared to their ACA peers (Manner 2014).

Through this empirical analysis, merger activity following both the post-agricultural crisis of the 1980s is evaluated, and accompanying amendments to the Farm Credit Act that occurred in 1987. The selection of the time series from 2002-2020 should allow for exclusion of side effects from the legislation, industry-wide distress from the 1980s, and the creation of ACA structure, thereby allowing for a higher level of accuracy of determining merger influence factors.

Throughout the duration of this paper, the term ‘dyad’ or ‘dyads’ will be used as a term to describe data pairings of associations. For this purpose, a dyad is a comparative measure of two individual associations Key Indicators for a given year, agnostic of all other pairings of those two institutions other Key Indicators.

3.2 Hypotheses

This thesis explores whether select key indicators influence merger activity within the FCS. Farm Credit Associations continue to decline in number, and if the working assumption is that this is based on one or more commonly measured key indicators, then the hypothesis can be validated using publicly available financial statements via FCA call reports. The following four key indicators and associated hypotheses are the main focus of the empirical analysis.

3.2.1 Hypothesis for Key Indicator A: Asset Size

The hypothesis for Asset Size is that larger ACAs are less likely to merge as a result of a self-fulfilling business need, and more likely to merge to gain scale and business efficiencies. ACAs within any given dyad that are relatively smaller in terms of asset size are believed to be more likely to merge due to smaller asset size being tied to other business operating factors, including economies of scale and the ability to bear more overhead expense.

3.2.2 Hypothesis for Key Indicator B: Operating Expense Ratio

The hypothesis for Operating Expense Ratio (OpEx) is that ACAs that operate with a leaner cost structure are less likely to be acquired in a merger scenario, while conversely, ACAs with higher OpEx ratios are more likely to merge as a mechanism to mitigate increasing cost structures. ACAs within any given dyad that are relatively higher in terms of OpEx Ratio are believed to be more likely to merge due to higher cost structures being difficult to justify over time.

3.2.3 Hypothesis for Key Indicator C: Return on Equity

The hypothesis for Return on Equity (ROE) is that ACAs that operate with a greater return on equity are less likely to be acquired in a merger scenario, while conversely, ACAs with lower return on equity are more likely to merge as a mechanism to return more business value to shareholders. ACAs within any given dyad that are relatively lower in terms of ROE are believed to be more likely to merge due to lower business returns that impact both qualitative and quantitative factors; i.e., stakeholder sentiment and perception of company value and ownership, as well as overall lower business returns. This is especially relevant within the cooperative structure, where the majority of profits are returned in the form of patronage or dividends, or reinvested in the business. While a case could be made for exploring patronage returns as a measure of success in lieu of ROE, ROE is a more robust measure to evaluate, as it directly measures how much income a company generates based on the investment of its owners – which in the case of a cooperative is its customers.

3.2.4 Hypothesis for Key Indicator D: Average Spread

The hypothesis for average loan spread is that ACAs that operate with a higher average spread are less likely to be consumed in a merger scenario, while conversely, ACAs with lower relative average spread are more likely to merge due to less overall profitability. ACAs within any given dyad that are relatively lower in terms of average spread are believed to be more likely to merge due to lower business returns that impact both qualitative and quantitative factors.

3.3 Dependent Variable and Independent Variables

The dependent variable in this study is whether an institution merged between 2002 or 2020 or not, and if any of the above independent variables showed a statistically significant influence on merger activity.

The independent variables are referenced as Key Indicators A-D for clarity; letters were used as opposed to numbers so as not to convey a preconceived notion of order dictating importance. Independent variables contemplated as part of this analysis are as follows:

- Key Indicator A: Asset Size
- Key Indicator B: Operating Expense Ratio
- Key Indicator C: Return on Equity
- Key Indicator D: Average Spread

3.4 Linear Probability Model

Two Linear Probability Models (LPM) were used to evaluate this data estimated by Ordinary Least Squares (OLS). For the purposes of this work, consideration of the merger is accounted for in the prior performance year, as the year of the merger effectively combines the predecessor entities into one set of Key Indicators that are not discernable individually.

Linear probability models (LPM) are useful as their coefficients can be directly interpreted as the marginal effects of the independent variables. Two concerns with the linear probability models are heteroscedasticity and the possibility of model

misspecification. The first concern can be addressed using robust standard errors. The second concern is less straightforward and suggest the need of exploring alternative nonlinear models. However, well-known non-binary models such as logit or probit can also suffer from model misspecification (e.g. whether the true data generating procedure follows a logistic function or not), the benefit of LPM outweighs the concern.

Furthermore, including high-dimensional fixed effects (which are dyad-specific and time-specific fixed effects in the context of this study) in nonlinear models can cause bias and inconsistency, the current study uses the LPM as its main specification. Logit models are estimated and presented in the appendix as a robustness check.

3.4.1 Model #1: Utilizing Comparative Key Indicators of Two Institutions

In Model #1, the dependent variable is a binary variable for whether a merger occurred (1) or not (0). The independent variables in this model were the four Key Indicators, that were compared in every permutation to establish which ACA was ‘strong’ and ‘weak’ in each dyad pairing for each year. “Strong ACAs” were considered to be the stronger measurement of each Key Indicator. For Asset Size, ROE and Average Interest Rate Spread, a higher figure was considered to be stronger, and for OpEx Ratio, a lower figure was considered to be stronger. The inverse is true for “Weaker ACA’s”. In sum, the following equation is the estimated equation:

$$\begin{aligned}
 Prob(Merger = 1)_{ijt} &= \beta_0 + \beta_1 Asset\ Size_{ijt}^{Strong} + \beta_2 Asset\ Size_{ijt}^{Weak} + \beta_3 ROE_{ijt}^{Strong} \\
 &+ \beta_4 ROE_{ijt}^{Weak} + \beta_5 Avg\ Spread_{ijt}^{Strong} + \beta_6 Avg\ Spread_{ijt}^{Weak} \\
 &+ \beta_7 OpEx_{ijt}^{Strong} + \beta_8 OpEx_{ijt}^{Weak} + \epsilon_{ijt}
 \end{aligned}$$

where subscript ij indicates a dyad between organization i and organization j , and t indicates year t .

In effect, this model estimates for each individual Key Indicator for any pairing of associations that were active in that year are ‘stronger’ or ‘weaker’, agnostic to the other three Key Indicators for the two comparative ACAs, and matches that pairing against whether or not the ACA merged. A holistic consideration of the total time series regresses each of those merger instances over the time period to establish a level of significance (or lack thereof) for analysis.

The equation was estimated by OLS with and without dyad-specific and time-specific fixed effects. The dyad-specific fixed effects control for time-invariant unobservable characteristics of each dyad. The time-specific fixed effects control for unobservable time-specific characteristics. Independent variables were also estimated in logs for further robustness. Due to the negative values of ROE, ROE variables are omitted in the equation with the independent variables in logs. Results are reported in Tables 5.1 and 5.2. The model was estimated using Logit and the results are reported in the appendix. Note that the results from LPM estimations are considered to be the main results as they are inclusive of dyad-specific and time-specific fixed effects which directly support the testing of the hypothesis that asset size, OpEx, ROE and average spread were significant factors for FCS association merger activity from 2002 to 2020.

3.4.2 Model #2: Model Utilizing Absolute Value of Key Indicator Difference Between Two Institutions

In Model #2, the dependent variable was reflected as a ‘1’ in the Merger Y/N column of the data table. The independent variables in this model were the four Key

Indicators, that were compared in every permutation in order to establish the difference between that ACA pairing for the given year. This absolute figure determined the disparity between the measured Key Indicators for each ACA in the dyad for the given year. The estimated equation is as follows:

$$\begin{aligned}
 Prob(Merger = 1)_{ijt} & \\
 &= \beta_0 + \beta_1 D.Asset\ Size_{ijt} + \beta_2 D.ROE_{ijt} + \beta_3 D.Avg\ Spread_{ijt} \\
 &+ \beta_4 D.OpEx_{ijt} + \epsilon_{ijt}
 \end{aligned}$$

where $D.$ is a difference operator that takes the difference between the greater and the smaller values of each variable for a given dyad.

In effect, this model allows for each individual Key Indicator the absolute relative difference between two associations that existed in that year, are stronger or weaker, agnostic to the other three Key Indicator differences for the two comparative ACAs., and matches that absolute figure up against whether or not the two ACAs merged. A holistic consideration of the total time series regresses each of those merger instances over the time period to establish a level of significance (or lack thereof) for analysis.

Similarly, the equation is estimated by OLS with and without dyad-specific and time-specific fixed effects. The equation was estimated with the independent variables in logs. Results are reported in Tables 5.3 and 5.4. The model was estimated using Logit and the results are reported in the appendix.

3.5 Exclusion of Patronage as a Key Indicator

The exclusion of patronage paid to shareholders – a key metric for customer-owners and an indicator of strong financial performance – was intentionally excluded

from this study. Patronage information is not reported similarly to other indicators explored in this work, and therefore this information is not easily accessible, especially over the 18 year timeseries. Furthermore, there are multiple interpretations that vary by institution regarding the calculation of patronage, which is not standardized through an FCA reporting aggregation process, rendering what data may be available as lower quality. However, ROE and OpEx ratio both have direct impacts on patronage paid, so indirectly, patronage paid is likely addressed indirectly within the existing scope of the study.

CHAPTER IV: DATA

4.1 Description of the Data Set

The research used publicly available call report data published by FCA. These reports provide a consistent view of financial performance for all System entities on a quarterly basis. This study will focus on year end metrics to base the analysis on. Due to the overarching complexity of the data, certain assumptions were made to allow for meaningful interpretation of the results. These include the following:

- Data by the numbers: January 1, 2002 to December 31, 2020
- Institution type counts from the FCA are accurate
- Subsequent derived calculations are completed correctly and accurately
- Assumptions made for a small number of observations (~ 1% of all observations, none of which included a '1' in the 'MergerY/N' field) that required manual research accurately reflect merger activity and Key Indicator calculations during the observation period
- Mergers that occurred intra-year versus year end are appropriately accounted for and calculations for periods following the intra-year mergers were accurate
- A small number of UNINUM numbers that were changed over time, but were not part of a merger were adequately researched and not included in the overall merger count.

4.2 Description of the Selected Time Series, UNINUM Numbers, and the Construction of Dyads

The dataset for this research was from year end 2002 through year end 2020. The primary reason for this time series selection relates back to the agricultural credit crisis of the 1980s, and the consolidation throughout the 1990s was driven in part by the financial distress experienced by many FCS institutions in the prior decade, but also the change from PCAs and FLCAs to ACAs, which have more expansive financial product capabilities and a more complex organizational structure with a parent ACA that wholly owns a FLCA and PCA subsidiaries.

As a result, six digit identified codes known as UNINUM codes with '4' and '8' prefaces (indicative of PCA and FLCA structures, respectively) were consolidated into codes starting with a '7' (indicative of ACA parent/subsidiary structure). This mass conversion to ACA structured entities occurred throughout the 1990s, and '4' and '8' initiated UNINUM codes were effectively eliminated effective January 1, 2001. To not unduly influence the findings of this research, this research used 2002 as the starting year. It is important to note that in reconciling year over year data, the earliest year that was fully considered was the year ending December 31, 2003. This allowed mergers with effective dates between December 31, 2002 and December 31, 2003 to be accounted for in this analysis.

As part of the data cleaning process, the data was configured into dyads, which combine all the possible combinations of mergers in the time series during which each individual ACA was an active FCS entity. Thus, dyad*time uniquely identifies each observation in the dataset. This, in combination with segregated and individualized Key

Indicator considerations allowed for each independent variable to be evaluated singularly, which greatly enhanced the prescriptiveness for the model.

4.3 Description and Calculation of Key Indicators

The structured dataset contains basic date and institution identifiers (known as a UNINUM number), as well as an indicator field for whether the institution has merged. Moreover, the data set includes 4 key indicator fields for each System institution that was active as of year-end in any given year. These fields are either available as is or require additional calculation as defined by FCA to derive. In the instances where a data calculation was required, the calculation was completed to conform with the FCA directive on calculation (Farm Credit Administration n.d.).

4.3.1 Definition of Key Indicator A: Asset Size

The asset size of a Farm Credit Association is defined as a sum of all aggregate parts of an association's assets, including lending and nonlending assets (use FCA definition). This figure is provided in each institution's call report as a straight figure, no additional calculation is required.

4.3.2 Definition of Key Indicator B: Operating Expense Ratio

An operating expense ratio indicates how much of an ACA's gross revenue is attributed to operating costs (less depreciation). For purposes of this research, operating expense ratio is defined as operating expenses divided by revenue, as defined by FCA.

4.3.3 Definition of Key Indicator C: Return on Equity (ROE)

ROE is typically established by understanding how efficient the company is utilizing shareholder equity and is represented by some form of net income after taxes divided by equity. For purposes of this research, ROE is defined as fiscal year net income divided by average shareholder's equity.

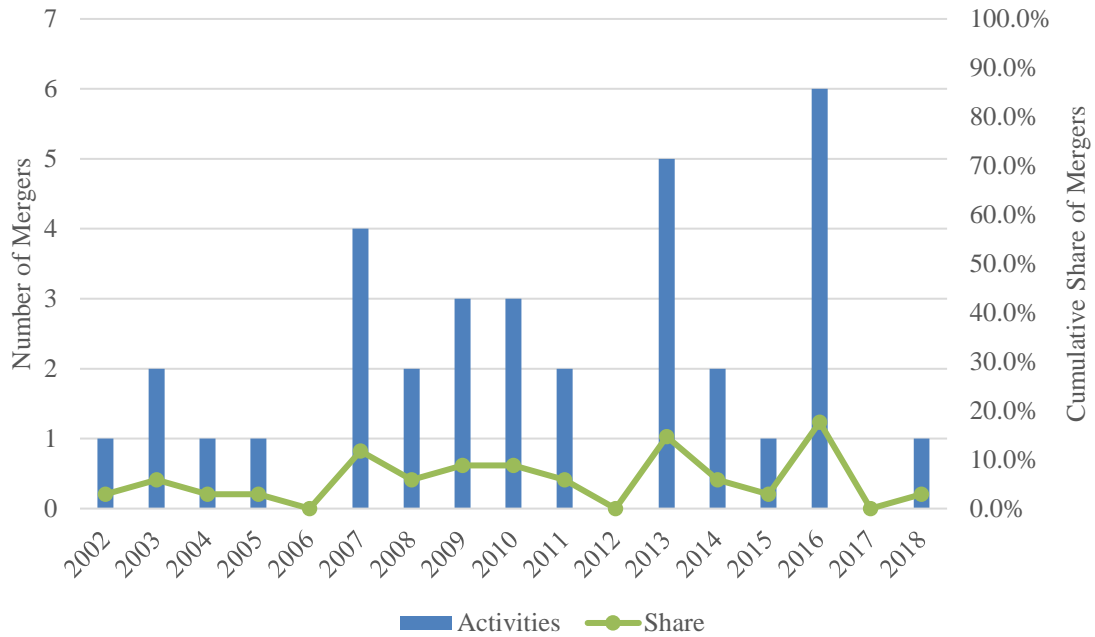
4.3.4 Definition of Key Indicator D: Average Spread

The average interest rate spread is determined by the difference between cost of funding and a loan's assigned interest rate.

4.3 Description of the Data and Summary Statistics

The dataset is comprised of over 67,000 observations (dyad-by-year combinations). There was a total of 10,435 dyads over the 19 years (2002-2020). About 25% of them are within the first three years and 50% of them are within the first five years. Only 5% of the dyads are observed beyond 2017, implying 95% of them are observed in the first 19 years. There were 34 merger activities identified by the dyads over the period and they occurred in 17 of the 19 years of the data, from 2002 through to 2018. The majority of the merger activities (17.65%) occurred in 2016, and the second highest annual activity (14.71%) occurred in 2013. There were no merger activities in 2006, 2012, and 2017. The distribution of merger activities by year is presented in Figure 3.1. A complete list of association mergers during the time period is listed in Appendix D.

Figure 4.1: Merger Activities and Cumulative Share of Merger Activities by Year (N = 34)



The distribution of the total dataset by merger activity is summarized in Table 4.1. Of the 67,391 observations, 67,357 possible observations (or 99.95%) did not result in a merger, while 0.05% had a merger outcome.

It is relevant to mention that while all of these dyads are technically feasible, the most likely combinations would be within each funding bank district, as fewer approval hurdles exist in that makeup; i.e. if two associations from different funding bank districts wished to engage in a merger, each of the two banks would have to approve the merger, an unlikely outcome given one of the banks would relinquish wholesale note volume and service territory, and their board and customer owners would be highly unlikely to approve such an arrangement. An example of this will be addressed in the conclusion.

Table 4.1: Distribution of Observations by Merger for Overall, Between and Within

Merger	Freq.	Percent
No	67,357	99.95
Yes	34	0.05
Total	67,391	100

(n = 10,435)

Table 4.2: Summary Statistics of Independent Key Indicator Variables Used in the Analysis

Variable	Mean	Std. Dev	Min	Max	Observations
Asset Strong (Million USD)	2.662	4.327	0.022	33.678	N = 67391
Asset Weak (Million USD)	0.584	0.882	0.015	26.279	N = 67391
OpEx Strong	0.394	0.077	0.000	0.832	N = 67376
OpEx Weak	0.511	0.108	0.000	0.973	N = 67376
ROE Strong	0.129	0.044	-0.182	0.386	N = 67376
ROE Weak	0.086	0.047	-0.229	0.344	N = 67376
Avg. Spread Strong	0.027	0.005	0.000	0.050	N = 67376
Avg. Spread Weak	0.023	0.004	0.000	0.045	N = 67376

Table 4.3: Statistics of Independent Key Indicator Variables for Merged Institutions

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset Strong (Million USD)	234	2.255	2.397	0.127	10.914
Asset Weak (Million USD)	234	0.908	1.126	0.030	5.958
OpEx Strong	234	0.509	0.118	0.209	0.973
OpEx Weak	234	0.403	0.092	0.149	0.799
ROE Strong	234	0.128	0.052	-0.182	0.386
ROE Weak	234	0.095	0.062	-0.229	0.307
Avg. Spread Strong	234	0.026	0.004	0.0142	0.040
Avg. Spread Weak	234	0.022	0.004	0.006	0.035

The total number of observations are 67,391, and the number of dyads is 10,435.

The overall and within are calculated over 67,391 dyad years and the between is calculated over 10,435 dyads and the average number of years a dyad was observed in the

data was about 6.5 years. Note that an additional correlation table for merged institutions is available for reference in Appendix E.

The ensuing section will provide an example of interpretation using asset size. In the first series of rows relating overall average total assets for strong members in the population is estimated at \$2.6 billion with a minimum of \$21.9 million and a maximum of \$33.7 billion and a standard deviation of \$4.3 million. This would suggest a greater variability in total assets in dyads of relatively weak combinations compared to strong total asset dyads.

CHAPTER V: ANALYSIS AND RESULTS

5.1 Summary of Analysis

The primary quantitative analysis tool used for this study was Stata. A LPM model using an OLS modeling approach, and a Log Model was used to convert to a percentage versus unit interpretation. A comparative analysis of these two models is discussed in this chapter.

5.2 Analysis of Model #1: LPM Regression Utilizing Comparative Key Indicators of Two Institutions

As described previously, Model #1 evaluates the relative ‘strong’ and ‘weak’ ACA on an individual basis for each dyad in each year of the dataset. Column (1) in Table 5.1 and 5.2 reports the results without the dyad-specific fixed effects and Column (2) in Table 5.1 and 5.2 reports the results with the dyad-specific fixed effects that control for unobservable dyad-specific characteristics. For the purposes of this analysis, the following remarks will focus largely on the fixed effects results in Column 2.

Table 5.1: Model #1 Absolute Individual Value for Merging Entities: Numeric Interpretation (Independent variables in levels)

Variable	Column 1: w/o Fixed Effects Merger (Yes = 1)	Column 2: w/ Fixed Effects Merger (Yes = 1)
Asset Strong	-1.04E-05 (-1.54E-05)	-8.66E-05 ** (-3.59E-05)
Asset Weak	0.000311 * (-0.000166)	0.0018 (-0.0011)
OpEx Strong	0.00265 ** (-0.00131)	0.00308 ** (-0.00151)
OpEx Weak	-0.000647 (-0.00167)	-0.00102 (-0.00204)
ROE Strong	-0.00238 (-0.0029)	-0.0103 (-0.00818)
ROE Weak	-0.00499 (-0.00409)	-0.00946 * (-0.00538)
Avg. Spread Strong	-0.0380* (-0.0202)	0.0168 (-0.0303)
Avg. Spread Weak	0.0734 *** (-0.0251)	0.035 (-0.0276)
Constant	-0.000639 (-0.001)	-0.000643 (-0.00239)
Observations	67,376	66,582
Dyad FE	No	Yes
Time FE	No	Yes

* indicates statistical significance at 10%, **indicates statistical significance at 5%, ***indicates statistical significance at 1%

Table 5.2: Model #1 Absolute Individual Value for Merging Entities: Percentage Interpretation (Independent variables in logs, ROE variables are excluded due to the negative values)

Variable	Column 1: w/o Fixed Effects Merger (Yes = 1)	Column 2 w/ Fixed Effects: Merger (Yes = 1)	
Asset Strong	6.39E-05 (-8.52E-05)	0.00179 (-0.00101)	*
Asset Weak	0.000256 (-0.000153)	0.00113 (-0.000599)	*
OpEx Strong	0.00196 (-0.000846)	0.00321 (-0.00119)	**
OpEx Weak	-0.000209 (-0.000671)	0.000957 (-0.000781)	
Avg. Spread Strong	-0.000485 (-0.000546)	0.00124 (-0.000884)	
Avg. Spread Weak	0.000856 (-0.0003)	0.000492 (-0.000281)	***
Constant	0.00341 (-0.00217)	0.0106 (-0.00429)	**
Observations	67,376	66,582	
Dyad FE	No	Yes	
Time FE	No	Yes	

* indicates statistical significance at 10%, **indicates statistical significance at 5%, ***indicates statistical significance at 1%

5.2.1 Discussion on the Results of Model #1 with Independent Variables in Levels

As we see from Column (2) in Table 5.1 there is a statistically significant relationship between the likelihood of merger and three variables; i) asset size of the strong institution, ii) OpEx of the strong institution, and iii) ROE of the weak institution. That is, for every million dollars' worth of assets a strong institution has, there was approximately a 0.009% point reduction in the likelihood of a merger for that dyad. For every 1% increase in OpEx of the strong institution, there was about 0.003% point higher likelihood of a merger. This indicates that associations that run cost effectively may be

desirable merger partners. Finally, for every unit increase in ROE of the weak institution, there was about 1% point reduction in the likelihood of a merger.

5.2.2 Discussion of the Results for Model #1 with Independent Variables in Logs

As we see from Column (2) in Table 5.2, there is a statistically significant relationship between the likelihood of merger and four variables; i) the the asset size of the strong institution, ii) the asset size of the weak institution iii) the operating expense ratio of the strong institution, and iv) the average loan spread of the weak institution. That is, for every 1% increase a strong institution has in assets, there is a nearly a 0.2% higher likelihood of a merger. Conversely, associations that were the relatively smaller institution within the dyad were also significant. For every 1% increase in assets held by the smaller institution , there was a 0.1% chance higher likelihood of a merger. Additionally, associations with a ‘strong’ operating expense level also reflected a level of significance, and for every 1% increase in an institution’s operating expense ratio, there was more than a 0.3% increased likelihood of a merger. Finally, associations with a ‘weaker’ average spread also showed significance when contemplating merger activity. For every 1% increase in average spread, there was a .05% likelihood of a merger.

5.3 Analysis of Model #2: Regression Utilizing Absolute Value of Key Indicator Difference between Two Institutions

As described previously, Model #2 evaluates the absolute value between two ACA’s on an individual Key Indicator basis for each dyad in each year of the dataset. Column 1 in Table 5.3 and 5.4 reports the results without the dyad-specific fixed effects and Column 2 reports the results with the dyad-specific fixed effects that control for

unobservable dyad-specific characteristics. For the purposes of this analysis, the following remarks will focus largely on the fixed effects results in Column 2.

Table 5.3: Model #2 Net Difference Between Merging Entities (Independent variables in levels)

Variable	Column 1: w/o Fixed Effects Merger (Yes = 1)	Column 2: w/ Fixed Effects Merger (Yes = 1)
Asset Size - Net Diff. (USD in Millions)	-2.97E-06 (-1.30E-05)	-5.75E-05 ** (-2.90E-05)
OpEx - Net Difference	0.00232 * (-0.00124)	0.00278 ** (-0.0014)
ROE - Net Difference	0.00123 (-0.00315)	0.00424 (-0.00346)
Avg. Spread - Net Difference	-0.0492 *** (-0.0186)	-0.00244 (-0.0164)
Constant	0.000424 * (-0.000222)	9.00E-05 (-0.000256)
Observations	66,718	65,932
Dyad FE	No	Yes
Time FE	No	Yes

* indicates statistical significance at 10%, **indicates statistical significance at 5%, ***indicates statistical significance at 1%

Table 5.4: Model #2 Net Difference Between Merging Entities (Independent variables in logs)

	Column 1: w/o Fixed Effects Merger (Yes = 1)	Column 2: w/ Fixed Effects Merger (Yes = 1)
Asset Size - Net Diff. (USD in Millions)	7.14E-05 (-4.47E-05)	2.22E-04 (-1.39E-04)
OpEx - Net Difference	0.000111 (7.34E-05)	0.000135 (8.45E-05)
ROE - Net Difference	-2.99E-05 (-7.51E-05)	7.70E-05 (-8.93E-05)
Avg. Spread - Net Difference	-0.000114 * (-6.65E-05)	4.42E-05 (-6.86E-05)
Constant	5.64E-05 (-0.000475)	1.46E-03 ** (-0.000592)
Observations	66,717	65,931
Dyad FE	No	Yes
Time FE	No	Yes

* indicates statistical significance at 10%, ** indicates statistical significance at 5%, *** indicates statistical significance at 1%

5.3.1 Discussion on the Results of Model #1 with Independent Variables in Levels

As we see from Column (2), there is a statistically significant relationship between the likelihood of merger and two variables: i) the net difference of the asset size of two institutions; and ii) the net difference in operating expenses between two institutions. That is, for every million dollars difference in assets there are between the two institutions in the dyad, there is approximately a -0.005% lower likelihood of a merger. Additionally, for every 100% increase in OpEx ratio between two institutions in a dyad, there is nearly a 0.3% higher likelihood of a merger occurring.

5.3.2 Discussion of the Results for Model #1 with Independent Variables in Logs

As we see from Column (2), there are no significant independent variables related to the difference between two institutions in a dyad within the log permutation of Model #2.

CHAPTER VI: CONCLUSION

6.4 Summary of Findings

To summarize the findings of this study in a straightforward manner, tables 6.1 and 6.2 were constructed to succinctly present the findings of each model. The percentage indicated in populated columns is the degree of significance related to the finding.

Table 6.1: Summary of the Signs and Statistical Significance (Independent Variables in Levels)

Variable	Model #1 Fixed Effects: Key Indicator - Strong	Model #1 Fixed Effects: Key Indicator - Weak	Model #2 Fixed Effects: Key Indicator - Net Difference
Key Indicator A: Asset Size	Negative, 5%	-	Negative, 5%
Key Indicator B: OpEx Ratio	Positive, 5%	-	Positive, 5%
Key Indicator C: ROE	-	Negative, 10%	-
Key Indicator D: Average Spread	-	-	-

Table 6.2: Summary of the Signs and Statistical Significance (Independent Variables in Logs)

Variable	Model #1 Fixed Effects: Key Indicator - Strong	Model #1 Fixed Effects: Key Indicator - Weak	Model #2 Fixed Effects: Key Indicator - Net Difference
Key Indicator A: Asset Size	Positive, 10%	Positive, 10%	-
Key Indicator B: OpEx Ratio	Positive, 1%	-	-
Key Indicator C: ROE	n/a	n/a	-
Key Indicator D: Average Spread	-	Positive, 10%	-

6.4.1 Findings from Independent Variables in Levels

In Table 6.1 the three columns represent the four key indicators compared in strong, weak and the relative difference within a given dyad. Five significant findings emerged. The asset size for the both the relatively larger association in a dyad, as well as the relative size of the difference between two associations in a given dyad both reflected a level of significance in a negative orientation. This means that both the smaller and ‘larger association’ is within a dyad, and the smaller the difference between a small and large association in a dyad, the higher the likelihood of a merger. This can be defended by the rationale that associations that are of comparable size are likely to merge.

Additionally, there were two significant findings for Key Indicator B: OpEx Ratio for the relatively ‘stronger’ association within a given dyad, as well as the relative difference between any two institutions in a dyad. Both of these were positively oriented. These findings are straightforward to justify, as an association who is stronger (i.e., has a lower operating expense ratio) would be a more efficient merger partner, and the larger the difference in operating expenses between two institutions, the higher the likelihood of a merger.

The final significant finding within the analysis that reflects independent variables in levels is Key Indicator C: ROE. For the relatively ‘weaker’ association within the dyad, significance was negatively oriented. This means that the lower the ROE, and the less efficient the institution is with their shareholders equity, the higher the likelihood of a merger. This finding is logical given basic business principles assessed with the ROE metric.

6.4.2 Findings from Independent Variables in Logs

Within the log model, there were four significant findings, all within the Model #1 construct; Model #2 (the relative difference between two institutions) did not generate any statistically significant findings.

Two of the significant results were tied to Key Indicator A: Asset Size, and both of these signs were positively oriented. For ‘weaker’ (smaller) associations, it is reflected that a positive percentage increase in size would result in a higher likelihood of merger; likely because the larger a merging institution, the more efficient the merger. For ‘strong’ associations, the positive correlation somewhat contradicts the prior section’s finding related to asset size, and indicates that a larger association may be likely to merge. However, this finding is attributable at a lower level of significance (10% in this context, versus 5% in Section 6.4.1), and as a result, the author is inclined to align with the finding in the prior section.

Additionally, Key Indicator B: OpEx Ratio was highly significant for relatively ‘strong’ organizations when utilizing the log methodology. In fact, this finding was the most statistically significant of the entire study. This correlates well with the prior section in emphasizing that associations with the relatively more efficient operating expense ratio within the dyad are more likely to experience a merger, likely as a result of being a strong merger partner.

Finally, Key Indicator D: Average Spread was significant for ‘weak’ associations, but with a positive orientation. While this is not necessarily a rational finding at face value (i.e., associations with higher average spreads are generating a higher return on a loan by loan basis), the author believes this could be attributed to the fact that many smaller institutions have a higher ratio of fixed rate mortgage loans in their portfolios,

which generate a high level of return, but may be weak in other key indicator areas.

Future applications of this study could focus on an element of multicollinearity when evaluating this type of finding.

6.4.3 Comprehensive Conclusions

Overall, the most defensible findings from this study are as follows, in unranked order:

- Finding A: There are significant ties between Operating Expense efficiencies (Key Indicator B) and the likelihood of a merger, and this occurs both in a positive way with more efficient ('stronger') associations, as well as with less efficient ('weaker') associations
- Finding B: Return on Equity (Key Indicator C) findings indicate that associations that generate a lower return for their shareholders are more likely to merge.

While statistically significant findings were generated for Key Indicator A: Asset Size and Key Indicator D: Average Spread, and those findings were discussed in the analysis, inconsistencies between permutations (Key Indicator A) and a need for more qualitative reasoning to support the finding (Key Indicator D) deprioritize these indicators as the primary findings from the study, and as such, for the scope and purposes of this study are not considered material factors in driving mergers.

6.5 Plausible Future Applications of the Study

The scope of this study has focused exclusively on historic influences on merger activity within the stated time series of 2002-2020 and utilized key indicators that were readily available and statistically comparable. Other factors like geography, politics, the regulatory environment and board and management dynamics all weigh on the timing of and decision to merge. However, underlying business dynamics play a significant role in the quantitative component of the decision to merge.

However, given the continued merger trend during 2021 and early in 2022, it may be of interest to create a future projection of this activity to better understand, interpret and utilize what the FCS may look like in the future to guide strategic decision making for FCS institutions and policymakers.

Additionally, a study that focuses on multicollinearity between variables could lead to interesting findings when layering these independent variables over one another. For example, an association that is smaller in asset size, but efficient in their operating expense methodology could have more longevity as a standalone entity than an association with a similar asset size but higher cost structure.

Another possible continuation of the study that may provide valuable insights would be the addition of patronage paid by an institution to their farmer customers over the years. However, this information is not available in a consistently tracked and reported format, and significant manual research may be required.

Finally, an analysis that contains a multi year assessment of key indicators leading up to a merger may prove interesting when it comes to the weakening or deterioration of

one or more key indicators. While not included in the scope of this study, such research may provide valuable information on business trends of an institution or institutions leading up to a merger event.

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APPENDIX A: DATA DICTIONARY

Table A.1: Description of Dataset Fields

Column	Title	Brief Description
A	dyad	Unique identifier for dyad comparison
B	Ida	UNINUM number for comparative institution 'A'
C	Idb	UNINUM number for comparative institution 'B'
D	time	Year
E	MergerYN	Indicator for merger activity: 1 =Y, 0 = No
F	TotalAssets_a	Key Indicator A: Total Assets for comparative institution 'A'
G	ROE_a	Key Indicator C: ROE for comparative institution 'A'
I	OpEx_a	Key Indicator B: OpEx ratio for comparative institution 'A'
J	TotalAssets_b	Key Indicator A: Total Assets for comparative institution 'B'
K	ROE_b	Key Indicator C: ROE for comparative institution 'B'
L	AvgSpread_b	Key Indicator D: Average Spread for comparative institution 'B'
M	OpEx_b	Key Indicator B: OpEx ratio for comparative institution 'B'
N	diffTotalAssets	Net difference between Column F and Column J
O	DiffROE	Net difference between Column G and Column K
P	DiffAvgSpread	Net difference between Column H and Column L
Q	DiffOpEx	Net difference between Column I and Column M

APPENDIX B: LOGIT ESTIMATION RESULTS

Table B.1: Logit Estimation Results of Model #1

VARIABLES	Column 1 Merger (Yes=1)	Column 2 Merger (Yes=1) Odds Ratio	Column 3 Merger (Yes=1)	Column 4 Merger (Yes=1) Odds Ratio
Asset Size - Strong	-0.0038	0.996		
(USD in millions)	(-0.0318)	(-0.0317)		
Asset Size - Weak	0.21 ***	1.233 ***		
(USD in millions)	(-0.0467)	(-0.0576)		
OpEx - Strong	3.655 **	38.68 **		
	(-1.515)	(-58.61)		
OpEx - Weak	-1.652	0.192		
	(-2.653)	(-0.508)		
ROE - Strong	-10.12 *	4.05E-05 *		
	(-5.533)	(-0.000224)		
ROE - Weak	-4.585	0.0102		
	(-3.178)	(-0.0324)		
Avg. Spread - Strong	-95.32 *	0 *		
	(-51.87)	0		
Avg. Spread - Weak	176 ***	2.87E+76 ***		
	(-57.65)	(-1.652E+78)		
ln(Asset Size - Strong)			0.127	1.136
(USD in millions)			(-0.166)	(-0.189)
ln(Asset Size - Weak)			0.499 *	1.647 *
(USD in millions)			(-0.275)	(-0.454)
ln(OpEx - Strong)			3.937 ***	51.27 ***
			(-1.363)	(-69.85)
ln(OpEx - Weak)			-0.0935	0.911
			(-1.207)	(-1.099)
ln(ROE - Strong)			n/a	n/a
(USD in millions)			n/a	n/a
ln(ROE - Weak)			n/a	n/a
			n/a	n/a
ln(Avg. Spread - Strong)			-2.393	0.0913
			(-1.602)	(-0.146)
ln(Avg. Spread - Weak)			3.820 **	45.6 **
			(-1.616)	(-73.68)
Constant	-9.009 ***	0.000122 ***	1.021	2.776
	(-1.648)	(-0.000202)	(-4.768)	(-13.24)
Observations	67,376	67,376	67,376	67,376

* indicates statistical significance at 10%, **indicates statistical significance at 5%,
***indicates statistical significance at 1%

Table B.2: Logit Estimation Results of Model #2

VARIABLES	Column 1 Merger (Yes=1)	Column 2 Merger (Yes=1) Odds Ratio	Column 3 Merger (Yes=1)	Column 4 Merger (Yes=1) Odds Ratio
Asset Size (USD in millions)	-0.00626 (-0.0277)	0.994 (-0.0275)		
ROE - Net Delta	1.602 (-4.261)	4.962 (-21.14)		
Avg. Spread - Net Delta	-123.8 ** (-56.94)	0 ** 0		
OpEx - Net Delta	3.704 ** (-1.476)	40.62 ** (-59.95)		
ln(Asset Size - Net Delta) (USD in millions)			0.145 (-0.0884)	1.156 (-0.102)
ln(ROE - Net Delta)			-0.0679 (-0.133)	0.934 (-0.125)
ln(Avg. Spread - Net Delta)			-0.191 ** (-0.0892)	0.826 ** (-0.0737)
ln(OpEx - Net Delta)			0.264 (-0.206)	1.302 (-0.268)
Constant	-7.651 *** (-0.396)	0.000475 *** (-0.000188)	-8.288 *** (-0.848)	0.000252 *** (-0.000213)
Observations	66,718	66,718	66,717	66,717

* indicates statistical significance at 10%, ** indicates statistical significance at 5%,
*** indicates statistical significance at 1%

APPENDIX C: ROCHDALE'S 7 COOPERATIVE PRINCIPLES

- 1) Voluntary and Open Membership: Anyone can join a co-op—they don't discriminate based on gender, social, racial, political or religious factors.
- 2) Democratic Member Control: Members control their business by deciding how it's run and who leads it.
- 3) Member's Economic Participation: All co-op members invest in their cooperative. This means people, not shareholders, benefit from a co-op's profits.
- 4) Autonomy and Independence: When making business deals or raising money, co-ops never compromise their autonomy or democratic member control.
- 5) Education, Training and Information: Co-ops provide education, training and information so their members can contribute effectively to the success of their co-op.
- 6) Cooperation Among Cooperatives: Co-ops believe working together is the best strategy to empower their members and build a stronger co-op economy.
- 7) Concern for Community: Co-ops are community-minded. They contribute to the sustainable development of their communities by sourcing and investing locally (National Cooperative Business Association, CLUSA International 2022).

APPENDIX D: LIST OF MERGERS, 2002-2020

Year Recorded	Effective Date	Names of Institutions	Name of Resulting Institution
2018	7/1/2019	American AgCredit, Farm Credit Services of Hawaii	American AgCredit
2016	7/1/2017	AgStar Financial Services, 1 st Farm Credit Services, Badgerland Financial	Compeer Financial* *Note: this three way merger was logged as multiple dyads to represent the additional party
2017	10/1/2017	High Plains Farm Credit, Farm Credit of Ness City	High Plains Farm Credit
2016	7/1/2017	AgCountry Farm Credit Services, United FCS	AgCountry Farm Credit Services
2016	1/1/2017	American AgCredit, Farm Credit of Southwest Kansas	American AgCredit
2015	1/1/2016	East Central Oklahoma, Chisholm Trail, ACA	Oklahoma AgCredit
2014	1/1/2015	AgTexas Farm Credit Services, Great Plains Ag Credit	AgTexas
2014	11/1/2015	Farm Credit West, FCS Southwest	Farm Credit West
2013	10/1/2014	Farm Credit of Central Oklahoma, Farm Credit of Western Oklahoma	Farm Credit of Western Oklahoma
2013	1/1/2014	Agriland Farm Credit Services, Texas AgFinance Farm Credit	Texas Farm Credit Services
2013	1/1/2014	Texas Land Bank, Lone Star	Lone Star
2013	1/1/2014	Federal Land Bank Association of Kingsburg, Northern California Farm Credit	Golden State Farm Credit
2013	1/1/2014	Farm Credit East, Farm Credit of Maine	Farm Credit East
2011	7/1/2012	Chattanooga ACA, Jackson Purchase ACA	River Valley AgCredit
2011	1/1/2012	American AgCredit, Farm Credit Services of the Mountain Plains	American AgCredit
2010	1/1/2011	Farm Credit of North Florida, Farm Credit of Southwest Florida, Farm Credit of South Florida	Farm Credit of Florida* *Note: this three way merger was logged as multiple dyads to represent the additional party

2009	12/1/2010	Louisiana Ag Credit, Southern AgCredit	Southern AgCredit
2009	1/1/2010	Farm Credit of Western New York, First Pioneer Farm Credit	Farm Credit East
2009	7/1/2010	Texas AgFinance, AgCredit of Southwest Texas	Texas AgFinance
2008	12/31/2008	Farm Credit of the Heartland, American AgCredit	American AgCredit
2008	1/1/2009	Valley Farm Credit, MidAtlantic Farm Credit	MidAtlantic Farm Credit
2007	12/31/2008	Federal Land Bank of Ponca City, Farm Credit Services of Central Kansas	Farm Credit of the Heartland
2007	10/1/2008	First Ag Credit, Capital Farm Credit	Capital Farm Credit
2007	5/1/2008	Sacramento Valley Farm Credit, Farm Credit West	Farm Credit West
2007	1/1/2008	Farm Credit Service of Grand Forks, AgCountry	AgCountry
2007	12/31/2007	Farm Credit Service of North Central Wisconsin, Farm Credit Service of Minnesota Valley	United FCS
2005	10/1/2006	Southwest Texas, Capital Farm Credit	Capital Farm Credit
2004	12/1/2005	AgCredit Financial, American AgCredit	American AgCredit
2003	1/1/2004	Brady Land Bank, Federal Land Bank Association of Texas	Federal Land Bank Association of Texas
2003	1/1/2004	AgSouth Farm Credit, Palmetto Farm Credit	AgSouth Farm Credit
2002	1/1/2003	Western Oklahoma, Clinton, Woodward PCA	Farm Credit of Western Oklahoma
2002	1/1/2003	Greenstone FCS, FCS Northeast Wisconsin	Greenstone FCS

Note: Some lags exist based on timing of year over year data and related timing that does not align with the standard calendar year, as well as many mergers occurring on December 31st or January 1st of two subsequent years. Impact on the overall findings of the study are believed to be negligible, regardless of the year in which the merger was recorded.

Source: Farm Credit Administration

APPENDIX E: CORRELATION OF VARIABLES, MERGED INSTITUTIONS

Table E.1: Correlation of Variables, Merged Institutions

	Asset Strong (Million USD)	Asset Weak (Million USD)	ROE Strong	ROE Weak	Avg. Spread Strong	Avg. Spread Weak	OpEx Strong	OpEx Weak
Asset Strong (Million USD)	1							
Asset Weak (Million USD)	0.419	1						
ROE Strong	-0.050	-0.010	1					
ROE Weak	0.035	0.098	0.562	1				
AvgSpread Strong	-0.078	-0.096	0.081	-0.001	1			
AvgSpread Weak	-0.024	0.020	0.063	0.091	0.541	1		
OpEx Strong	-0.180	-0.265	-0.180	-0.381	0.192	-0.044	1	
OpEx Weak	-0.206	-0.170	-0.282	-0.190	0.060	-0.070	0.480	1