AN ANALYSIS OF FINANCIAL RISK MEASURES WITHIN AGRICULTURAL COOPERATIVES

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An Analysis of Financial Risk Measures within Agricultural Cooperatives

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ABSTRACT

Agricultural Cooperatives have been facing times of low financial risk in the previous years. This is soon expected to change and become an increasing concern. A review of the risk balancing hypothesis literature shows that previous research has not fully defined financial risk.

The objective of this research is to better define financial risk and analyze whether academic literature or the lending industry has found ways to measure financial risk. This is done by utilizing a stochastic simulation model of an agricultural cooperative comparing low and high financial risk scenarios. The results of the simulations are analyzed using coefficients of variations and contributions to variations for selected ratios.

The results show that the ratios used by the lending industry have larger contributions to the variation than those used in academic literature. This suggests that future research should work to more specifically define sources and measures of financial risk.

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DEDICATION

This thesis is dedicated to Dr. Frayne Olson, who made this all possible.

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1. INTRODUCTION

Many researchers have used the risk balancing hypothesis (Gabriel & Baker, 1980, Barry, 1984) to analyze research questions facing a variety of industries. However, many of the researchers who have used this hypothesis for research purposes have yet to agree on how to measure the different components of risk. In order to analyze the risk balancing hypothesis, a researcher must have a way to measure financial, business, and total risk. Risk is inherent to any business and can not be ignored and cooperatives are not exempt to such risks. Cooperatives are a unique kind of business structure that has special implications when it comes to research. This thesis will look into how risk can be measured more accurately in regards to cooperatives specifically. As will be seen in the coming chapters, there is a discrepancies in how previous literature measures the alternative sources of risk. The previous research regarding business and financial risk have been shown to define business risk rather in depth whereas the definition of financial risk is less clear which becomes especially apparent in Parliament and Lerman (1993). This research aims to see if there is a better way to measure financial risk specifically, identify past inconsistencies and ways that these issues can be improved upon with this and future research. It is important to note that whenever cooperatives are referred to in this project, the term is specifically referring to traditional agricultural cooperatives in the United States. This project dealt specifically with farm supply and marketing cooperatives and therefore, will only focus on the unique characteristics and analysis of such cooperatives.

1.1. Problem Statement and Study Objectives

Risk can be broadly defined as an exposure to danger, harm, or loss. Business risk is more precisely defined as the variability or uncertainty of the firm's operating income (Zeuli, 1999). The farmer member is sometimes motivated to join a cooperative by its ability to mitigate

its farm's risk. Risk management is especially crucial to the cooperative sector as the members are not only exposed to the risks of their own farming operating but also to those facing the cooperative that they patronize. The cooperative by definition is funded by its farmer members and therefore, when the cooperative loses money the farmer members' investment is also affected. Farm profits are linked to cooperative profits by virtue of the fact that farmers have invested in the cooperative (Zeuli, 1999). Cooperatives are like any other business and are concerned with making a profit but because of the cooperative nature of the business this is not their only objective. It is important to keep the farmer members of the cooperative in order to thrive. Therefore, it is important for the cooperative to have plans in place to deal with riskier environments, especially since it affects its own profitability and that of its members.

The major issue that has been found in previous literature is that there is a vague definition of financial risk provided by researchers. Whereas, business risk has been defined by many. In research it is important to be able to define and understand what an issue is so that it can then be measured and dealt with. Therefore, one of the main objectives of this study is to more precisely define financial risk so that it may then be measured. The intention by doing so is that cooperatives may be able to better understand their exposure to financial risk and implement better financial risk management techniques, and by extension the farmer members' income as well.

After the financial risk component is more accurately defined this research project will attempt to measure it using indicators previous researchers have used as well as those used by lenders. This will hopefully provide insight for future research regarding ratios which are useful for financial risk analysis. Financial risk itself has not been considered to be directly measurable by many of the previous research articles written. It is important to note that most researchers use

the same ratios found in previous research to analyze investor owned firms (IOFs), which may lead into its own set of problems as well. It is important to only compare cooperatives to other cooperatives when using these ratios. The unique ways that cooperatives operate make it difficult to directly compare IOF performance using the same ratios. While cooperatives can and do perform well, their unique characteristics mean that their performance will be captured better in different ways. Agricultural based lender ratios will be analyzed as well because they are trying to directly measure financial risk as it relates to cooperatives. While this hasn't been used for research purposes in the past it could be a useful tool that has been overlooked in the past and that could contribute valuable insights for future research.

The research question this project aims to answer is whether or not commonly used financial performance measures are capturing the effects of financial risk on cooperative performance. The hypothesis of this project is that there is not a significant difference in ability to measure financial risk whether using ratios found in the academic literature or those used by agricultural lenders.

1.2. Unique Cooperative Characteristics

"A cooperative is a user-owned and user-controlled business that distributes benefits on the basis of use" (Cobia, 1989). To understand why cooperatives are unique compared to their IOF counterparts it is important to understand some of the unique characteristics of the cooperative business model. One of the first distinctions is that while cooperatives are considered profit focused businesses this is not their only concern. The primary objective of a cooperative is rather the economic benefits for members. Historically, cooperatives were started as a response to a market imperfection and had certain benefits to members that enticed them to become a

member of a cooperative rather than to continue to do business with an IOF that wasn't serving their needs.

The principles that cooperatives employ are the first thing that make it unique relative to other business structures. The traditional set of cooperative business have been in place for almost 200 years. These include; voluntary and open membership, democratic member control, member's economic participation, autonomy and independence, education, training and information, cooperation among cooperatives and concern for community. The primary purpose of these principles is to guide members, managers, and directors on how to conduct themselves as part of the cooperative business model. An in depth description of these principles can be found in Cobia (1989).

The principles of the cooperative are the underlying motivation for how the cooperative uniquely operates compared to its IOF counterparts. The main differences are typically found within governance, finance, taxation and the benefit components of the cooperative model. The purpose of this project is not to teach the reader about cooperative businesses therefore, these topics will only be briefly touched upon. However, the reader can get a greater understanding of the cooperative business model from Cobia (1989), Frederick, et al.'s USDA publication (1997) and the University of Wisconsin-Madison, Center for Cooperatives website (2017).

The governance of cooperatives is provided by the members of the cooperative. Anyone can be a patron of a cooperative but to become a member a person must have an equity investment in the cooperative. Cooperatives are owned by the members who have an equity investment within the cooperative and choose to be a patron of the cooperative. Anyone may be a patron of a cooperative but that does not mean they are a member. Members have democratic control over the cooperative as they vote directly on the articles of incorporation, bylaws,

mergers, dissolution and which fellow members will serve on the board of directors. Voting in cooperatives is one member, one vote not by equity as is typically found in IOFs.

Finance and taxation will be described in greater detail in Chapter 3. Therefore, discussion of these unique characteristics will be omitted in this section.

As previously was stated, cooperatives have historically been created as a response to imperfections in the marketplace. Because equity investments are required of members it is important that some distinction in the benefits received is made clear to members to get them to make an equity investment and patronize the cooperative. Benefits can include but are not limited to; local control, competitive yardstick effect, missing services being provided, increased market power, market supply assurance, returns of profits (patronage refunds), coordination of inputs and risk reduction. This is a small sample of benefits found by being a member of a cooperative and these benefits look differently for every member. These are also expanded on in the previous resources listed.

1.3. Organization of the Thesis

This thesis is separated into six chapters. Chapter I is an introduction to the study containing a brief description of what makes cooperatives unique and the motivating factors for this study. Chapter II presents a review of literature providing insight into previous studies related to this thesis. Chapter III discusses the methodology that is used to analyze the ratios affected by business and financial risk faced by cooperatives. Chapter IV describes the data used to acquire our results described by the previous chapter. Chapter V presents the results of the study. Chapter VI provides the summary and recommendations for future research.

2. LITERATURE REVIEW

The purpose of this chapter is to analyze the previous research that has been done relating to risk measures and agriculture cooperatives. Cooperative research is typically not as extensive as research related to other areas of agriculture, therefore, it was necessary to analyze previous research done relating to risk and agriculture in a more general sense. However, helpful insights were also gained through this avenue.

2.1. Risk Balancing

Cooperatives have typically been considered as an extension of the farm as they provide the services that farmers require to run their farm efficiently. There are also added incentives to join a cooperative because of the added ownership that comes with being a member of a cooperative. Risk can typically be categorized into two major categories: business and financial risk. Five major sources of business risk are defined by Barry (1984) and include; production or technical, market or price, technological, legal and social and human sources of risk. The only financial risk definition offered by Barry (1984) is that the financial risks are only those associated with debt financing. Therefore, it can be assumed that this would refer to changes in interest rates and terms of credit. The author goes on to explain that financial risk is immeasurable and can only be found by dividing total risk by business risk. This is where the problem of defining financial risk begins. To control for business risk cooperatives will attempt to adjust their financial risk leading to the concept of the risk balancing which will be discussed in this section. While the objective of this research is not to find the optimal mix of financial and business risk, these concepts are the driving forces behind this research. As will be seen in the next section, business risk is relatively well defined whereas financial risk is not. As stated before, to begin to measure something one must first be able to define that variable.

2.1.1. Concepts of Business and Financial Risk

Gabriel and Baker (1980) first introduced the risk balancing concept. This article defined business risk as the risk inherent to the firm, independent of how the business is financed (Van Horne, 1974) and is reflected in the variability of net operating income. Financial risk is then defined as the added variability of net cash flows to the owners of equity that results from the fixed financial obligation associated with debt financing and cash leasing (Barges, 1963). Total risk is not specifically defined by rather viewed as the business and financial risk. The article was able to find support of the hypothesis at the individual farm level, an increase in the business risk would cause a decrease in the financial risk and vice versa. This was found by examining how an exogenous shock affected the level of the farm's business risk. The producers then responded to the business risk with offsetting financial adjustments leading to an increase or decrease in financial risk. However, the research was unable to capture the hypothesis' presence in the aggregate data. The authors concluded that this could be attributed to characteristics such as risk aversion, farm size, or farm type. The authors believed that further research could improve on the aggregate data research. However, observing how business risk decisions affect individual farm's decision making processes over time may be a difficult data set to obtain. The presence of the hypothesis at the farm level should not be ignored however as this has considerable importance.

2.1.2. Expected Utility, Debt-Equity Structure, and Risk Balancing

Collins (1985) provided an alternative approach on the research of Gabriel and Baker to the risk balancing hypothesis. Collins defines the business risk as the variance of the rate of return on assets (ROA). The financial risk is defined as the magnitude of the leverage multiplier, which is the variance of the rate of return on equity (ROE). Total risk is not explicitly defined.

This paper was written to help understand how financial risk and business risk were related at the farm level when there are changes in regards to the implementation of agricultural policy. This theoretical model includes a significant contribution because it provides a way for producers to calculate their optimal leverage decision. These findings supported the previous study finding that a decrease in business risk would produce a response to increase financial leverage for the farm.

2.1.3. Optimal Capital Structure in Centralized Agricultural Cooperatives

Barton, et al. (1996) expanded on the Collins Risk Balancing Hypothesis paper. This paper applied the Risk Balancing hypothesis analysis at the cooperative level. The paper used the same measures for business and financial risk as the previous article. The question of equity and optimal solvency becomes more complicated in a cooperative because of members decision to patronize or not. This has a large effect on the amount of equity a cooperative has. Also, it is not reasonable to assume non-stochastic interest rate at the cooperative level. Adding the stochastic interest rate also gave a better model of exogenous risk. The study found that a .5% increase in interest rates caused the optimal solvency ratio to double whereas a similar percentage change in the variance of interest rates had a much less dramatic effect. This research was performed on cooperatives during a time when interest rate concerns were high among the agriculture sector (1984 -1992) and provides useful insights even in times when interest rates are less of a concern for agriculture.

2.1.4. The Paradox of Risk Balancing: Do Risk Reducing Policies Lead to More Risk For Farmers?

Cheng and Gloy (2008) took a new approach to the risk-balancing paradox in regards to risk-reducing farm policies. Similar to the previous article, the authors argued that previous

research looking into the risk-balancing paradox with government intervention failed to take into account stochastic interest rates. Business risk is not explicitly defined but can be assumed to be the variability in net income as the financial risk is defined as the variability of ROE as the previous articles state. The authors felt that a stochastic interest rate would have too large of an effect on the financial leverage of the farm to be ignored and assuming it was non-stochastic wasn't realistic for farmers. The authors analyzed how stochastic ROA and interest rates would affect the risk balancing equation and found results that didn't agree with previous studies. However, when the authors performed a numerical example the risk-balancing hypothesis was found to hold true in all but three years of the study. The authors concluded that risk-reducing farm policies may increase the risk of farm failure by inducing increased leverage adjustments causing an increase in the income volatility.

2.1.5. Risk and Equity in Agricultural Cooperatives

Parliament and Lerman (1993) examined how risk affects the proportion of equity held by agricultural cooperatives. Equity has an important role in determining lending opportunities for any type of business structure. The authors asked if traditional measures of risk would have an effect on the proportion of equity held by the cooperative. Cross-sectional time-series data from the financial statements for fifty-nine agricultural cooperatives from 1973 to 1987. The model was determined to be a function of business risk, financial risk and size to determine the proportion of equity capital held by the firm. Business risk was measured by the variability of the earnings before interest and tax. More precisely, this paper measured business risk as the standard deviation of ROA. Financial risk was considered to be immeasurable so total risk was calculated as the ROE before tax minus business risk. This was an important finding as this begins to show the discrepancies in measuring business and financial risk. The model also took

into consideration the type of commodity handled and whether pooling was used or not. This research provided incentives to find ways to better understand financial risk faced by cooperatives and ratios that would measure this type of risk. It was felt that using more cooperative specific analysis for the risk components could lead to useful advances in cooperative research.

As expected, risk was found to have an effect on the proportion of equity held in cooperatives. The researchers hypothesized correctly that the business risk coefficient would be significant and negative, whereas the financial risk coefficient would be significant and positive. The size variable was found to have a negative effect on the proportion of equity but was only statistically significant at the 15-percent level of significance.

2.1.6. Economic Risk and the Structural Characteristics of Farm Businesses

Barry, et al. (2001) looked at the effect that farm size, financial structure, and other structural characteristics of farms had on the variability of net farm income. The question was posed because of the 1996 Farm Bill decoupling production and price supports, which was expected to cause greater variability in farm net income. The goal of the project was to discover how "economic risks are distributed across farms with different business and structural characteristics" (Barry, et al., 2001). To do so, financial and business risk measures were taken into consideration. Business risk was again defined as the variance of ROA. The only statement made by the authors about financial risk was that it "may substantially influence the variability of returns on equity and the stability of farm equity" (Barry, et al., 2001). Farm level data of farms enrolled in the Illinois Farm Business Farm Management Association was used. This allowed the researchers to gain access to the certified income statements for 213 farms over the time period of 1980-1996. The total risk was determined to be measurable by the coefficient of

variation (COV) of real net farm income, which then became the dependent variable. The dependent variable became a three year moving COV after running the time series model to achieve better results. The independent variables were; farm sizes, relative prices and yields, farm type, life cycle (farmer's age), financial structure, and location. This paper ties in with the research being presented in this thesis because it gives ideas on how to measure both business risk and financial risk as it relates to the farm. Cooperatives are considered an extension of a farmers' own enterprise so this provides useful insight into what is affected by total risk and how to measure such things as business and financial risk.

After redefining the model to include a three year moving COV on the real net farm income the results showed many statistically significant results with the independent variables. It was discovered that there was an inverse relationship between farm size and farm income variability, which was an expected result. Yield and price indices both had a negative and significant effect. This means that high income variability is associated with farms having lower relative yield indices as well as farmers' receiving higher crop prices would be associated with lower vulnerability in the variability of their net farm income. The age variable also had a significant effect on the dependent variable. However, if was difficult for the researchers to establish the systematic influence this had on the income variability. A higher level of enterprise diversity was found to be associated with less income variability but this risk-reducing effect could be reduced by the advantages of having specialization and therefore comparative advantage. Therefore, lenders and farmers tend to place less emphasis on diversity as a type of risk management. The geographic regions had different implications on each variable. This research shows the importance of considerations for structural and demographic variables when making policy decisions in regards to the Farm Bill.

2.2. Measuring Risk Related to Agriculture and Cooperatives

While the risk balancing hypothesis is a major contributor to the literature review, this paper will start by looking into how other researchers have attempted to measure risk as it relates to agricultural cooperatives in the past. This sections provides the background for which academic literature ratios were used in this project.

2.2.1. Financial Ratio Analysis of Agricultural Cooperatives

Messina, et al. (1994) performed financial ratio analysis specifically related to agricultural cooperatives. The authors recognized that cooperatives operate very differently from their IOF counterparts and therefore should not be analyzed in the same way. If a cooperative plans to use financial ratios to analyze their performance it is important the cooperative only compares itself to other cooperatives and that the cooperative compares the performance to itself over time. It is relevant for cooperatives to use the same ratios that IOFs use but it is not accurate to compare those results with one another because these ratios fail to account for the member benefits a cooperative provides. The paper analyzed cooperative performance in four main categories: liquidity, activity, leverage and profitability. The ratios included in each category were as follows: liquidity included the current and sales to working capital ratios; activity included the asset turnover and sales to receivable ratios; leverage included the debt to total assets, times interest earned, and debt service coverage ratios; and finally, profitability included the ROA and ROE ratios. After the ratios had been calculated over the ten year period for the seventy-six agricultural cooperatives a trend analysis was also performed. The authors used this analysis to emphasis how important it is to not rely on only one or two ratios to tell the whole story. This article stresses the importance of using many financial ratios to analyze different aspects of cooperative performance.

2.2.2. Size and Industry Effects in the Performance of Agricultural Cooperatives

Lerman and Parliament (1991) evaluated whether size and industry had a significant effect on the financial performance of cooperatives. Finding accurate ways to evaluate the financial performance of cooperatives has continued to be a topic of interest. However, because there haven't been many advances in methods to fully capture the benefits of cooperatives, this research used the four generally accepted financial measures for IOFs. The four measures were as follows: leverage, as a debt to equity ratio; efficiency, as an asset turnover ratio; liquidity, as a quick ratio; and profitability, as a rate of return on equity ratio, with profit measured before tax. The cooperatives were categorized into their respective sizes based on their assets. To account for the industry effect the forty-three cooperatives in the sample were separated into four categories: dairy, supply, food marketing and processing, and grain and cotton marketing cooperatives. The financial ratios were found in the cooperatives' annual reports from 1970 to 1987. The researches performed the nonparametric Kruskal-Wallis test to detect significant differences among industry and size categories. Furthermore, linear regression analysis was performed to identify trends by size and industry and predict future changes. This study found that while large cooperatives may be able to capture economies of scale, efficiency doesn't necessarily translate into higher profitability. Liquidity and profitability were found to be significantly higher for smaller cooperatives. The trend analysis showed an increasing trend for all categories in the large cooperatives, whereas the small cooperative experienced a decreasing trend over time. However, the model was unable to detect significant differences between capital structures of the different size cooperatives. This coupled with the trend analysis indicates that large cooperatives can be expected to have higher leverage than their smaller counterparts in the future.

2.2.3. New Risk-Management Strategies for Agricultural Cooperatives

Zeuli (1999) analyzed the new risk management techniques that were being implemented by cooperatives at the time. Zeuli recognized that risk management, while important for all agribusinesses, becomes especially crucial in the cooperative sector because of the relationship that the cooperative's income has with the members' net farm income. A major motivation to become a member of a cooperative is typically found to be the cooperative's ability to manage risk, yet some fail to realize that because the members are the ones funding the cooperative they are now exposed to these risks at both the farm and cooperative levels. The amount of business risk is considered to be mainly composed of price and throughput uncertainty, therefore, this paper focuses on ways to mitigate, but not completely eliminate, these uncertainties. If a company were to completely eliminate price and throughput uncertainty there would be no opportunity for profits so they must balance the amount of business risk that they are able to mitigate. The research specifically analyzed ways that cooperatives could use contingent claim contracts in the capital market, area yield contracts and weather indexes for throughput risk, and segmenting yield risk to further manage the risk of the cooperative. While the research didn't present a model it recognized that if cooperatives were to use any, or a combination, of these risk management techniques, it would diminish the profits of the cooperatives. The research emphasized that the members must approve the risk management the cooperative provides in relation to the potential loss of profits as well.

2.2.4. Informing Measurement of Cooperative Performance

Franken and Cook (2015) took a new approach to analyzing the performance of cooperatives. The authors recognized that cooperatives have a dual objective function and research that only took the financial performance of cooperatives into consideration may not be

the proper approach for analysis as compared with their IOF counterparts. This dual objective function would not only consider profitability but also the member benefit objective, which should not be discredited when evaluating cooperative performance. Many researchers recognize the importance of the member benefits that cooperatives provide but commonly apply readily available financial measurements to analyze cooperatives (Franken and Cook, 2015). A reason for adopting the readily available financial measurements can partially be attributed to the criticisms of cooperatives as inferior organizations by authors such as Furubotn (1976). The authors believed there may not be a strong correlation between financial statistics and patron members' satisfaction. Therefore, a survey was added to their analysis in an attempt to capture more of the cooperatives' dual objective. While the members weren't directly surveyed, the board chairs were surveyed which conceptually should capture the members' satisfaction as they are elected by the members to represent them. The study performed a correlation analysis and then a confirmatory factor analysis that developed a broader measure of cooperative performance, reflecting financial and other aspects of performance.

The research attempted to include global performance construct, competitive position, the ability to achieve vision and patron satisfaction. The authors found significant relation among these various measures in U.S. agricultural cooperatives. The authors also found a relatively strong relationship among the alternative performance measures when managers felt that strong financial performance was equated with good overall performance. Cooperatives that used cost of goods sold accounting measures were found to be more consistent with IOFs and this was evidenced by the fact that these cooperatives experienced relatively higher correlations between measures of financial performance and other performance measures. The correlations between financial and other performance measures led the authors to suggest that depending on the

purpose of future research, adding the non-financial measures may not be necessary. The authors recognize that other measures may be out there for better measurement of member benefits and suggest this as an area for future research.

2.2.5. Sources of Financial Stress in Agricultural Cooperatives

Moller, et al. (1996) analyzed what factors, inadequate profitability, excessive debt or high interest rates played the most significant role in causing financial stress for a cooperative. The research analyzed local U.S. grain marketing and farm supply cooperatives that were under financial stress from the research years of 1987-1992. The research defined financial stress as having a negative average rate of return on equity during the defined research years. After determining this, the study estimated how much of the ROE was attributable to the return on assets, leverage, and interest rates using a regression analysis.

As could be expected, the stressed cooperatives that were analyzed for this study were found to have a lower ROA, higher leverage, and higher borrowing costs than their non-stressed counterparts. The regression found that for the 226 financially stressed cooperatives, on average, 54.3 percent of the financial stress could be attributed to an ROA problem, 22 percent to leverage problems, and 23.8 percent to interest rate problems. The study then analyzed the financially stressed cooperatives by size and found that the sources of financial stress were distributed differently and the percent of firms financially decreased as size increased. Product mix was also taken into consideration and it was found that cooperatives that heavily relied on grain sales tended to have a higher percentage of financially stressed cooperatives. For all cooperatives it was found that ROA tends to contribute the most to financial stress compared to leverage and debt financing.

3. METHODOLOGY

The purpose of this chapter is to describe the methodology used for this project. The methodology includes stochastic simulation which will be discussed in great detail in the next chapter. Comparative statics analysis using coefficients of variance (COVs) and the contributions to variation between the inputs and outputs will be analyzed after the model simulations are run. This will be done to analyze the research question of whether or not commonly used financial performance measure are capturing the effects of financial risk on cooperative performance. The hypothesis is that there is not a significant difference in ability to measure financial risk whether using the academic literature or the lender ratios.

The previous chapter reviewed the research on and explanation of business risks faced by agricultural businesses. However, financial risk has not been evaluated in as much detail and this project aims to make a contribution towards the measurements and effects of financial risk. This section will begin with a review of cooperative finance to help the reader gain a greater understanding of the unique cooperative finance characteristics that will have an effect on the results of this study. The theoretical framework of the model will then be presented.

3.1. Cooperative Finance Review

Cooperatives have many unique characteristics that make them different from other business models. People join a cooperatives for a variety of reasons and one of them may include the financial benefits of being a member of a cooperative. Examples of some financial benefits that may entice people to join a cooperative include price differentials, service differentials and competitive yardstick effects. However, benefits such as these become difficult to measure for a variety of reasons. Therefore, this section will focus on two financial benefits that are reflected on the financial statements of the cooperatives - income allocation and equity redemption. This

will only provide a brief overview; however, and if the reader is interested in learning more about the subject the following resources will be helpful include Cobia (1989), Frederick, et al. USDA publication (1997) and the University of Wisconsin-Madison, Center for Cooperatives website.

3.1.1. Income Allocation

When the cooperative has a positive net income for the fiscal year the management has several choices regarding the distribution of income. This decision usually begins with whether or not to distribute net income as patronage refunds, dividends or unallocated equity. According to Cobia (1989), dividends on equity is not commonly used by cooperatives. Therefore, we will only discuss how cooperatives use either patronage refunds or unallocated equity.

If patronage refunds are chosen by the cooperative as the income allocation decision further decisions must also be made. These patronage refunds can be either qualified or non-qualified. The qualified or non-qualified decision is related to the taxation faced by the cooperative. If the patronage refunds are qualified, the member then must claim the cooperative's entire income allocation on their taxable income. This is commonly referred to as pass through taxation. Once this decision is made the board and management must decide how much to retain as equity and how much to give back to the members as cash disbursement. If the patronage refunds are qualified, the cooperative is required to pay at least 20% back to the member in cash.

Non-qualified allocations are considered taxable income to the cooperative. The cooperative retains this equity within the cooperative and credits the appropriate amount to each members' equity account within the cooperative. Non-qualified allocations have no requirement for how much or how little must be paid to the member in cash. However, once the equity from

these accounts is paid out to the member, the member must claim the cash allocation as part of their own taxable income and the cooperative claims a tax credit. These income allocations are normally made proportional to patronage, not equity.

Cooperatives are not required to allocate their net income back to their members and can choose instead to retain it within the cooperative. This is referred to as unallocated equity. Unallocated equity is not assigned to any specific member like qualified equity. This type of allocation is taxed at the cooperative level because it is not credited to any specific member. Cooperatives may choose not to allocate certain types of income such as income from non-member business, rents, interest earned on various funds and excesses over book value from sales of property. Unallocated reserves are seen as a potential reserve against future losses but also reduce the realized return of the member (Cobia, 1989).

3.1.2. Equity Redemption

The unique structure of a cooperative's equity means that the cooperative will return a member's allocated equity back to them at some point. There are many challenges in cooperative equity redemption because over time some members become overinvested while others become underinvested relative to the patronage of other members. While equity redemption is another benefit that members receive this is not a requirement for the cooperative. There may be periods where the cooperative is unable to redeem equity. The equity redemption plans usually fall into two categories, systematic or specialized programs (Cobia, 1989). Systematic programs are plans that redeem equity through a recurring processing that keeps equity investment in the hands of active members as much as possible. Specialized programs are plans that redeem equity only when a special event in the life of the member occurs, such as, a member's death. There are four plans to redeem equity for the cooperative, (1) the revolving fund plan, (2) the base capital plan,

(3) the percentage-of-all-equities plan, and (4) the specialized plan. The first three of these plans are systematic. Cooperatives may also use combinations of any of these plans.

The revolving fund plan redeems equity on a first-in, first-out basis. Once the cooperative has accumulated a predetermined amount of equity it can begin to redeem old equities to members. The amount redeemed will be paid out to the member in accordance with the member's use of the cooperative. The revolving periods range from 18 months to more than 30 years. Farm supply cooperatives have historically had the longest periods while service cooperatives have had the shortest revolvement periods. This plan can also be implemented using an age trigger. The member will receive their equity, typically 100 percent, at a certain age.

The base capital plan attempts to balance the investment of members. This plan determines a member's equity investment annually and is upon their historic patronage. Once the target annual investment is determined, under invested members will be required to continue investing in the cooperative while the over invested members will receive a partial or full refund if the cooperative can provide it. Once a member has invested to their required amount, patronage refunds are returned to members in cash. Only under invested members will continue to have some of their patronage refunds retained. This type of plan is expensive to implement because of the requirement to determine every member's required investment in the cooperative. Another difficulty with this type of plan is that some members, such as new farmers, may have a difficult time providing their fair share of equity right away.

The percentage-of-all-equities plan will retire a percentage of all outstanding equity, regardless of issue date. The cooperative reduces the equity investment of every member by the same percentage using this plan. This is a good approach for cooperatives with stable membership and patronage. The policy is easy to understand and administer and can be readily

adjusted based on operating results. It also rewards new patrons by prompt equity redemption but also extends the transfer of ownership from overinvested members to currents patrons and actually is never transferred until the equity accounts of former members are completely closed out.

A specialized plan requires the cooperative to redeem the equity of a member when a special event occurs, such as death, leaving the trade territory, etc. For specialized plans, the cooperative accumulates equity until the predefined situation occurs and upon verification will redeem the equity either in the full amount or over a number of years. This plan is by far the most common but this is thought to be due to extenuating circumstances rather than choice. Therefore, this plan is typically used in combination with one of the other plans as well to achieve equity redemption (Cobia, 1989).

3.2. Theoretical Background

After completing a model cooperative, this project will perform a stochastic simulation analysis on how well the financial ratios capture changes in financial risk faced by a cooperative. An econometric analysis will not be used as in previous research because a reasonable amount of historical data was not able to be collected for the purposes of this research. The stochastic simulation approach is useful as it will allow the project to maintain better control of business risk and allow for financial risk to be measured alone. In this project, financial risk is defined as the base interest rate, terms of credit and accounts receivable risks.

The ratios that will be discussed in the theoretical results will be broken into two sections; academic literature ratios and lender ratios. The academic literature ratios include the return on equity, return on assets, return on equity minus return on assets, total asset turnover, sales to accounts receivable, debt service coverage, current and debt to equity ratios (Lerman and

Parliament, 1991; Messina, et al., 1994). The lender ratios include the debt service coverage, current, working capital to sales, interest coverage, local return on sales, and long term debt to equity ratios. The formal calculations for all these ratios are included in the Appendix A. By performing the stochastic simulation this project will test the hypothesis that there is not a significant difference in the ability to measure financial risk in traditional agricultural cooperatives between ratios found in the academic literature or by lenders.

3.2.1. Stochastic Simulation using Monte Carlo Simulations

The Stochastic Forecasting Model, which will be described in the next chapter, will provide an analysis of our model cooperative under financially risky conditions to provide a simulation that would be more telling of real world conditions. The stochastic variables will include those that will allow the model to add business and financial risk into the model. The specific stochastic variables will be discussed in greater detail in the next chapter. This stochastic simulation uses Monte Carlo simulations which pulls random numbers from a defined distribution to model risk. After running a simulation model comparative statics analysis will be performed by creating alternative conditions to represent a high risk financial environment. The project will then look into the contributions to variation between the stochastic simulation inputs and the ratio outputs identified to see if these capture the changes in financial risk. Business risk will be held constant throughout all of our models to ensure financial risk is being captured and business risk isn't being mistaken to be captured instead. Another reason for leaving business risk constant is to prevent the changes in business risk from overshadowing the financial risk and provide inaccurate results.

This research is especially concerned with the net income (or profit) the cooperative makes for its comparative statics comparison because of inconsistencies within the previous

literature. The literature has previously defined total risk as the standard deviation of ROE (Parliament & Lerman, 1993), the COV in real net farm income (Barry, et al., 2001), and total risk is not clearly defined by the other researchers (Gabriel and Baker, 1980; Collins, 1985; Barton, et al., 1996; and Cheng and Gloy, 2008). As can be seen from this small sample, there isn't consensus yet on how to properly measure total risk and further problems arise when financial and business risk need to be measured separately. This project is going to assume the viewpoint of the cooperative management and since cooperatives are not publicly traded and the concern is not as much on investment activities the research will look at the variability in net income of the cooperative as its total risk because that is what a management team will be most concerned with.

This project assumes that the cooperative uses the variability of net income, or profit, as the measure of total risk; therefore, a profit equation for the firm must be defined:

$$(1)\ \pi = (P * Q) - TC$$

Where π is profit, P is prices, Q is quantity, and TC is total costs. The profit equation is then expanded to include enterprise mixes (i) and years (t):

$$(2)\ \pi = (P_{it} * Q_{it}) - (VC_{it} + FC_t)$$

Where VC is variable costs and FC is fixed costs. The equation is then expanded again to include the distributions that were added into the model to account for the uncertainty of the real world:

$$(3)\ \pi = \left[\left(f(P_{it)} * f(Q_{it})\right) + OI_t\right] - [f(VC'_{it}) + FC_t + f(I_{it})]$$

Where OI is other income, f(x) denotes if a variable is utilizing a stochastic component, and I is for the interest expense. The business risk is calculated using a stochastic simulation for the price and quantity variables of the model. The financial risk is included in the variable costs and the interest expense. The equation is then expanded again to include the stochastic component of the

bad debt expense so that the financial risk is separated completely out of the variable costs component.

$$(4)\ \pi = \left[\left(f(P_{it)} * f(Q_{it})\right) + OI_t\right] - \left[(VC_{it}^{"} + FC_t + \ f(I_{it}) + f(BD_t)\right]$$

Where BD stands for bad debt expense. After the bad debt expense is separated out from the variable costs, there is no longer any stochastic simulation components in the calculation of variable costs. The stochastic variable distributions will be explained in more detail in the data chapter.

Once the profit of the cooperative has been simulated for both cases a comparative statics analysis will be performed using the COVs for the ratios in the base case and severe financial risk case. Then contributions to variation, which are calculated by analyzing how the stochastic simulation variables affect the output variables, will be analyzed. This will help provide analysis as to whether or not the literature or lending industry found accurate ways to capture the effects financial risk has on a cooperative.

4. DATA

The purpose of this chapter is to describe the data used to analyze how the financial and business risks of the cooperative affect a model cooperative that has been created for the purposes of this research. A description of the simulation model used in this research will first be presented. Then, a discussion of the data sources used for the creation of the model cooperative. The final section of this chapter will discuss the assumptions and stochastic variables used in the model cooperative to analyze business and financial risks faced by a cooperative.

4.1. Stochastic Forecasting Model

A general deterministic forecasting simulation model was created by Mr. Edward Janzen and Dr. Frayne Olson as a way to create pro forma financial statements for cooperatives. This spreadsheet was originally intended for New Generation Cooperatives but this research is analyzing risk in traditional cooperatives. Therefore, the model had to be modified for the purposes of this study. The model was also changed to include stochastic variables to provide an analysis of risk. These stochastic variables will be discussed in detail in the next section. This section will explain the inputs required to create the model cooperative used in this research.

4.1.1. Input Section

The input section contains all input variables which include past and present values for various parameters. The pro forma format of this simulation requires some inputs to either have a steady growth rate over the years or an input for every year into the future. These are typically allowed to be chosen by the user. The input sheet is broken into the following eight subsections:

1) General Data
2) Production / Sales / Price Data
3) Operating Costs Data

4) Investment / Depreciation Data

5) Sources of Funds (Other than from Operations)

6) Income Allocation

7) Initial Balance Sheet Values

8) Other Management Parameters

The General Data section includes a section for the name of the cooperative, the products the cooperative deals with, the starting year, and the number of months in year one. The product lines allows the labels for the units and margins to be changed as well.

The Production / Sales / Price Data allows data to be entered in one of two ways. The data can be entered with a starting amount and a percentage increase that will be added uniformly over the years or the data can be entered individually for all years. This section includes annual sales volume, price, sales commission, and cost of goods. The sales commission is not needed for the purposes of this study so they have all been set to 0%. This section was identified as business risk component of the cooperative. It is important to note here that these inputs were converted from deterministic variables to allow for stochastic simulation. The stochastic nature of these inputs will be discussed in the next section.

The Operating Costs Data subsection includes a similar format as the previous section. Again, numbers can be calculated by annual percentage increase or entered manually for every year. The budget costs included in the spreadsheet can be changed for the purposes of simulation. This study has included salaries, payroll taxes/benefits, supplies, property taxes, repairs and maintenance, utilities and other expenses. These were chosen based on the breakdown of expenses from the available financial statements that were used to create the model cooperative.

The Investment/Depreciation Data subsection includes inputs for beginning values of land, land improvements, buildings, and equipment. The equipment is broken down into production, packaging, transportation and office. Each of these inputs are allowed to have different depreciation schedules. There are also pre-production expenses which includes consulting, legal, organizational expense, startup costs, intangible assets and additional intangible assets. There is also additional equipment input for all years which must be inputted individually. This additional equipment includes tax depreciation and book depreciation life. This is because the income statement is calculated on both a tax and book basis and the user may decide which is more useful for their research purposes.

The Sources of Funds subsection contains the funds obtained from sources other than operations. The first input is the beginning balances for shareholder equities which include the qualified allocations, non-qualified allocations, and unallocated reserves. Next, is the initial shareholder equity which includes both membership stock and equity stock with inputs for share price at dollars per share and the number of shares. There is a section for new shareholder equity which was included in the model for new generation cooperatives. Therefore, this study will leave these values as zero because it is only analyzing traditional cooperatives. The next input is debt financing, referring to the long-term debt the cooperative takes on. There are inputs for the purpose, amount, interest rate, terms, number of payments per year and what year the loan becomes available for use. Finally, there is an input for the revolving line of credit that includes the initial balance and an interest rate that must be entered individually for all years. The interest rates faced by the cooperative were identified to be one of the financial risks that could became a stochastic variable for further analysis of its effect on the cooperative. Therefore, it is important to note here that the interest rates for the debt financing and revolving line of credit were

converted from deterministic to stochastic variables to allow for simulation. The stochastic nature of these inputs will be discussed in the next section.

The Income Allocation subsection allows the type of income allocation the cooperative uses to be changed to match that of the desired strategy. The income allocation strategy must be entered for every year, therefore, it can allow for different strategies to be used in certain years if needed. The first step is to choose the percentage of income allocation that will be designated to qualified (cash or retained), non-qualified, and unallocated reserves. Then, the dollar amounts for redeemed allocations must be entered for all years. For the purposes of this study, another line was added so that a percentage of the income would be redeemed rather than an arbitrary number. This was done to reflect the performance of the cooperative in any given year.

The Initial Balance Sheet Values subsection includes inputs for starting values for several variables. Those included are accounts receivable, operating note, accounts payable and undistributed deficit. These provide a starting point for variables so that the model cooperative can be simulated has one that has been in operation rather than as a cooperative that has just started.

The Other Management Parameters subsection includes components that would affect management decisions. The first consideration is whether or not there was a net operating loss to be carried forward. The minimum cash balance is inputted as a proxy for the operating note so the cooperative will continually maintain this value. There is a section for accounts receivable, interest rate for accounts receivable, accounts payable and interest rate on accounts payable. Each of these components is broken down into different time periods as well. These are 0 to 30 days, 31 to 60 days, 61 to 90 days and over 90 days. The accounts receivables over 90 days were identified as another one of the financial risks that could be manipulated for further analysis of

its effect on the cooperative. Therefore, it is important to note here that the accounts receivable section was converted from a deterministic to stochastic variable to allow for simulation of the bad debt expense, as a percentage of the accounts receivables over 90 days, which will be discussed in more detail in the next section. There is an input for the member marginal tax rate for the qualified allocations. The inventory input section includes a beginning inventory, inventory buildup and days in inventory section. These inventory inputs are broken down by product. The inventory buildup and days in inventory has inputs for every year to allow for changes in management decisions.

4.2. Data Sources

The financial statements, assumptions and stochastic variables will be discussed in more detail in this section. These all contributed to the creation of the model cooperative in different ways. The data for this research came from financial statements and discussions with CoBank personnel in the Fargo, N.D. regional office.

4.2.1. Financial Statements

The first step in creating the model cooperative was performed by analyzing historical data from selected cooperatives in the North Dakota region. The financial statements were provided to the Quentin Burdick Center for Cooperatives for research purposes. Cooperatives that didn't have any gaps in their historical data were first identified. Then, traditional cooperatives that were agricultural with business units in grain, fertilizer, agronomy and petroleum were identified. From this analysis, a total of three traditional agricultural cooperatives were chosen to build the model cooperative.

Averages of historical data from the financial statements that were identified were used as the beginning benchmark for what the model cooperative would be based on. After this data

was in hand, Preston Kranz, the Regional Vice President of CoBank was contacted to further discuss how to make the model more realistic. Mr. Kranz was able to provide valuable input to help make the simulation models as realistic as possible.

4.2.2. Assumptions and Stochastic Variables

When creating the model cooperative there were several key assumptions that had to be made in order to make the stochastic variables realistic. This was done by using both historical data and visiting with Mr. Kranz at CoBank to make the model cooperative as close to realistic as possible. The key assumptions that were made in regards to the stochastic variables are presented and discussed in the following tables.

Table 4.1 presents the business risk component of the model cooperative. The production, sales and price data were considered to be business risk because these values are outside of the management's control. While the management may try to minimize the uncertainty of these values there is no way to completely eliminate variability. Therefore, these inputs were determined to be more valuable to the research if they were to be stochastic in nature rather than deterministic.

Table 4.1: Production / Sales / Price Input Assumptions

Category	*Distribution*	*Min, Most Likely, Max*
Sales Volume		**% change**
Grain (bushels)	Triangular	(-0.4,0,0.4)
Fertilizer (tons)	Triangular	(-0.3,0,0.3)
Agronomy (% margin)	Triangular	(-0.25,0,0.25)
Petroleum (gallons)	Triangular	(-0.1,0,0.1)
Misc. Income ($)	Triangular	(-0.1,0,0.1)
Price		**$ per unit**
Grain (bushels)	Triangular	(0.05,0.25,0.55)
Fertilizer (tons)	Triangular	(30,50,75)
Agronomy (% margin)	Triangular	(0.05,0.15,0.25)
Petroleum (gallons)	Triangular	(0.15,0.35,0.55)
Misc. Income ($)	Triangular	-
Cost of Goods		**$ per unit margin**
Grain (bushels)	Triangular	(-0.5,0,0.5)
Fertilizer (tons)	Triangular	(-50,0,50)
Agronomy (% margin)	Triangular	(-0.15,0,0.15)
Petroleum (gallons)	Triangular	(-0.2,0,0.2)
Misc. Income ($)	Triangular	-

The assumptions made regarding the sales volume, price and cost of goods sold were all based on triangular distributions with different distributions depending on the type of product being considered. The distributions found in Table 4.1 will not change from the base case, which represents low financial risk, to the severe case, which represents high financial risk, simulations. This is because the business risk variables were unchanged throughout both simulation cases to try to provide analysis into the effects financial risk had on the cooperative only.

The financial risk components were broken into the interest rate and accounts receivable portions. The interest rate category was further broken down to include a variability of base interest rate that would raise the interest rate a specified amount based on how the cooperative scored in regards to certain ratios. The base interest rate was based on the prime interest rates found in the lending industry and the credit rating score provides the additional interest rate. This additional interest rate premium added to the base interest rate is determined by a credit rating

score given to the cooperative based on certain criteria of given ratios. These two categories were identified because they could be manipulated by the simulation model to measure different aspects of financial risk faced by a cooperative. These categories will be presented and discussed in the following tables.

Table 4.2: Interest Rate Assumptions

Type of Interest	***Scenario***	***Distribution***	***% Interest Rate Dist.***
Revolving Credit	Base	Triangular	(0.03,0.04,0.05)
Revolving Credit	Severe	Triangular	(0.03,0.08,0.13)
Long Term Debt	Base	Triangular	(0.03,0.04,0.05)
Long Term Debt	Severe	Triangular	(0.03,0.08,0.13)

The interest rates that were used in this study for the base case were developed considering the current interest rate environment. The triangular distribution was used again to prevent values from becoming negative or too large. The severe case was made to be more volatile to provide analysis for a riskier interest rate environment similar to conditions during the farm financial crisis of the 1980s. The interest rates for the severe case were established because interest rates are expected to become more volatile in the coming years. However, the research does not expect the interest rates to become as high as was seen in the 1980s. Therefore, the interest rates were less volatile than that time period. These numbers were chosen with help from CoBank as well. In Table 4.2, the base and severe case have the same interest rate distribution for both the revolving credit and long term debt interest rates. Table 4.3 shows the credit rating score that determines the additional interest rate premium summed with the base rate the cooperative receives.

Table 4.3: Credit Rating Scoring

Ratio	***Criteria***	***Score***
Local Savings / Total Sales	> 2%	0
Term Debt / Net Fixed Assets	≤ 0.5	0
Working Capital / Total Sales	> 4%	0
Total LT Debt / Total Members' Equity – Regional Investment	≤ 50%	0
Debt Service Coverage Ratio	> 2	0
Local Savings + Interest Expense / Interest Expense	≥ 3	0
Current Assets / Current Liabilities	> 1.5	0

Following discussions with CoBank, a credit rating scoring system was developed for the simulation model. The credit rating score that the cooperative received added a specified percentage to the base interest rate that the cooperative received from the lender. This added percentage is presented in Table 4.4. Cooperatives, surprisingly, employ an average of less than 20% of their term loans are fixed interest rates (Kranz, 2017). Therefore, this project assumes stochastic variables for all of the interest rates calculations. This distinction is important because the annual principal payments change as a result of the stochastic interest rates.

To calculate the credit rating, the cooperative was assigned a value of zero or one for each ratio. If the cooperative was within the range specified by the literature received from CoBank (2017), the cooperative received a score of zero for that ratio. If the cooperative fell outside of the satisfactory range it received a score of one. These values were then summed to establish the credit score, which was then used to establish the interest premium added to the base rate. The interest rates that were based on the credit scoring system increased in an exponential fashion and were as follows:

Table 4.4: Credit Rating Scoring System

Score	***1***	***2***	***3***	***4***	***5***	***6***	***7***
	+ 0%	+ 0.50%	+ 0.75%	+ 1.00%	+ 1.50%	+ 2.50%	+ 4.00%

The next component of financial risk that was incorporated into the simulation model dealt with the accounts receivable over 90 days, which is presented in Table 4.5.

Table 4.5: Accounts Receivable Assumptions

Type	***Scenario***	***Distribution***	***Min, Most Likely, Max***
AR over 90 days	Base	-	1% of total net sales
AR over 90 days	Severe	-	3% of total net sales
Bad Debt Expense	Base	Triangular	(0.01,0.02,0.03) % of AR in Bad Debts
Bad Debt Expense	Severe	Triangular	(0.05,0.10,0.15) % of AR in Bad Debts

As can be seen in Table 4.5, the accounts receivable over 90 days was not a stochastic variable but it is included in this table because it is connected to the bad debt expense which is a stochastic variable. For the base case, 1% of total net sales would be expected to be found in accounts receivable over 90 days. From there, a stochastic simulation variable was added to estimate the amount of the accounts receivables over 90 days that would be written off by the cooperative as a bad debt expense. In the severe case, the cooperative is expected to have 3% of total net sales in accounts receivable over 90 days. From there, the volatility of the bad debt expense was increased to simulate a riskier financial environment where farmer member may be less likely to pay off their accounts receivable over 90 days.

It is important to remember that the cooperative is an extension of the member's business. Therefore, if the cooperative is facing more difficult times, the farmer member is likely also facing difficult times.

5. RESULTS

After performing a simulation with base and severe scenarios with the stochastic simulation model the following results were obtained. It is important to note here that five years of pro forma financial statements were estimated because the management decisions regarding income allocation and equity redemption were held constant regardless of net income. Therefore, the focus on the results will be in the third year. The research is not ignoring the results found beyond this but to ensure proper analysis is being performed it is more realistic to assume these numbers will be indicative of what the research is trying to find. First, coefficient of variation (COV) comparative statics analysis will be discussed followed by the contributions to variation results and then the conclusions from these results.

5.1. Comparative Statics Results

After the base case and severe case were simulated the COV was calculated for all the identified variables. The results tables that will be presented will separate the literature ratios from the lender ratios. Those variables that are included in both have been identified. First, Tables 5.1 and 5.2 will be presented which include the base case and severe case COVs to analyze the changes that were found.

Table 5.1: Literature Ratio Coefficients of Variation

BASE CASE					
Variable	***2017***	***2018***	***2019***	***2020***	***2021***
Net Income	0.4620	0.5401	0.7120	0.8513	1.2250
ROE	0.4404	0.5161	0.6861	0.8260	1.2410
ROA	0.4595	0.5295	0.6898	0.8217	1.2118
ROE – ROA	0.4280	0.5079	0.6864	0.8338	1.2714
TAT	0.0071	0.0595	0.0831	0.1012	0.1165
DSC*	0.2436	0.2710	0.3026	0.3336	0.3761
CR*	0.0192	0.0285	0.0401	0.0511	0.0703
D/E	0.0333	0.0808	0.1039	0.1226	0.1420
SEVERE CASE					
Net Income	0.7259	0.8795	1.4732	1.7484	5.0002
ROE	0.7140	0.8732	1.5491	1.9232	11.2377
ROA	0.7241	0.8723	1.4817	1.7889	6.3925
ROE - ROA	0.7082	0.8752	1.5977	2.0214	19.0668
TAT	0.0069	0.0570	0.0795	0.0968	0.1114
DSC*	0.2857	0.3045	0.3271	0.3521	0.3942
CR*	0.0206	0.0309	0.0466	0.0619	0.0872
D/E	0.0417	0.0909	0.1237	0.1559	0.2109

Notes: Net Income is included in both tables because it is the measure of total risk in this project. The ratios that have a * are utilized by both the academic literature and lenders. ROE stands for return on equity, ROA stands for return on assets, TAT stands for total asset turnover, S/AR stands for sales to accounts receivable, DSC stands for debt service coverage, CR stands for current ratio and D/E stands for debt to equity.

Table 5.1 summarizes the COVs from the academic literature ratios. The COVs became increasingly larger over the five year period for both the base and severe cases. This was to be expected based on the cumulative effect that the stochastic simulation had on the different variables, such as net income, that had risk outputs. The severe case saw a higher started points compared to the base case for all of the ratios.

It is important to note here that some variables in the severe case have high numbers in the last year. The cumulative effect of all the risk factors in the model resulted in a drop in net income, especially in year five. This can be explained by the model not allowing for management intervention. The management decisions made by the cooperative would be rather complicated to model because decisions depend on many factors. Because of the unique business

structure and involvement of membership in management decisions, via the board of directors, would make it very difficult to model these decisions appropriately. Therefore, certain management decisions were built into the model and were not allowed to change. These decisions were income allocation decisions and equity redemption strategies. Another reason for these jumps is the loan decisions built into the model. The model specified continuous financing requirement that was not changed from the base case to the severe case so that the interest rate risk was captured rather than the financing decision. There were larger loans taken out in year one, three and five. If management decisions had been allowed these wouldn't have necessarily happened as the cooperative would have adjusted financing decisions based on their performance. The risk accumulated over the five year period and can be seen as the COVs continually increased. These same assumptions are represented in Table 5.2 because the variables are generated from the same model, just separated into the literature and lender ratio tables to aid presentation of results.

Table 5.1. shows ROE and ROA ratios all significantly increase in year three and five when the larger loans are taken out. As was expected, the variability of the ratios increased from the base case to the severe case for most ratios. However, the total asset turnover ratio decreased from the base case to the severe case in all five years. In the severe case the net income, ROE and ROA were all at least double the base case values by 2019 and on. The remaining ratios all increased from the base case to severe case but not as drastically.

Table 5.2: Lender Ratio Coefficients of Variation

BASE CASE					
Variable	***2017***	***2018***	***2019***	***2020***	***2021***
Net Income	0.4620	0.5401	0.7120	0.8513	1.2250
DSC*	0.2436	0.2710	0.3026	0.3336	0.3761
CR*	0.0192	0.0285	0.0401	0.0511	0.0703
WC/S	0.1897	0.3302	0.2273	0.5000	0.6811
ICR	0.3803	0.4449	0.5365	0.6602	0.8517
LROS	0.4511	0.5016	0.6555	0.7909	1.2349
LTD/E	0.0266	0.0401	0.0542	0.0747	0.1030
SEVERE CASE					
Net Income	0.7259	0.8795	1.4732	1.7484	5.0002
DSC*	0.2857	0.3045	0.3271	0.3521	0.3942
CR*	0.0206	0.0309	0.0466	0.0619	0.0872
WC/S	0.2486	0.5626	0.4149	2.2767	61.7829
ICR	0.4662	0.5204	0.6164	0.7497	0.9782
LROS	0.7188	0.8569	1.5236	1.9187	12.0944
LTD/E	0.0396	0.0593	0.0831	0.1162	0.1730

Notes: Net Income is included in both tables as that is the measure of total risk in this research. The ratios that have a * are utilized by both the literature and lenders. DSC stands for debt service coverage, CR stands for current ratio, WC/S stands for working capital to sales, ICR stands for interest coverage ratio, LROS stands for local return on sales and LTD/E stands for long term debt to equity.

Table 5.2. summarizes the model results for the lender based ratios COVs. As was expected, the COVs increased steadily over the five year period for both the lender ratio cases as well. Again it is important to note the large increase in the final year of analysis for the lender ratios as well. The explanation that was provided in the previous section applies to Table 5.2. These variables were all calculated from the same simulations but were separated for easier readability.

The ratios in Table 5.2 all increased from the base case to the severe case of scenario. In the severe case net income, working capital to sales and local return on sales were the ratios that more than doubled from the base case by 2019 in this set of ratios. The other ratios increased as well by varying amounts but never to double the base case amount. Working capital to sales was extremely sensitive to the loans taken out in years three and five. These loans were used for

capital acquisitions so the large increase in current assets without a significant matching increase in current liabilities could contribute to this significant jumps.

5.2. Contributions to Variation

The contributions to variation is an analysis found in @Risk that can be used to see the contributions each designated input (stochastic variable) has on the specified @Risk outputs using Monte Carlo simulations. The stochastic inputs included the business and financial risk components. This analysis tool then ranked each input's effect on the output being analyzed. The complete results for the contributions to variation for every ratio analyzed can be found in Appendix B. This type of analysis was chosen because it provides percentage contributions in a consistent format across ratios. This section presents the graphs with the sources of financial risk and their contributions to the variation in net income. The tables of the contribution to variation are included in Appendix B. In every table, the variables are ranked on their contribution to variation in order from one to ten. The top ten were only included because the numbers found beyond that point had minimal contributions.

It is understood that using this type of analysis for a simulation where inputs were provided by the researcher requires careful interpretation. It is also understood that this cooperative is not a real world cooperative but attempts to represent cooperatives in the region. However, this type of analysis is still was useful to show which sources of financial risk contributed to the variation in our chosen ratios.

The graphs in this section show the contributions to variation from the sources of financial risk in a stacked bar graph. The figures are organized in order based on the source of the information. The order is academic literature specific ratios, ratios found in academic literature and lending industry and finally lending industry specific ratios. Figures 5.1, 5.2 and

5.3 are the academic literature specific ratios. The total asset turnover (which is an academic literature specific ratio) had no contributions to variation from the sources of financial risk. Therefore, a graph was not included for this ratio but the table for this ratio is included in Appendix B. Figures 5.4 and 5.5 are the ratios found in both the literature and the lending industry. Figures 5.6, 5.7, 5.8 and 5.9 are the ratios that are specific to the lending industry.

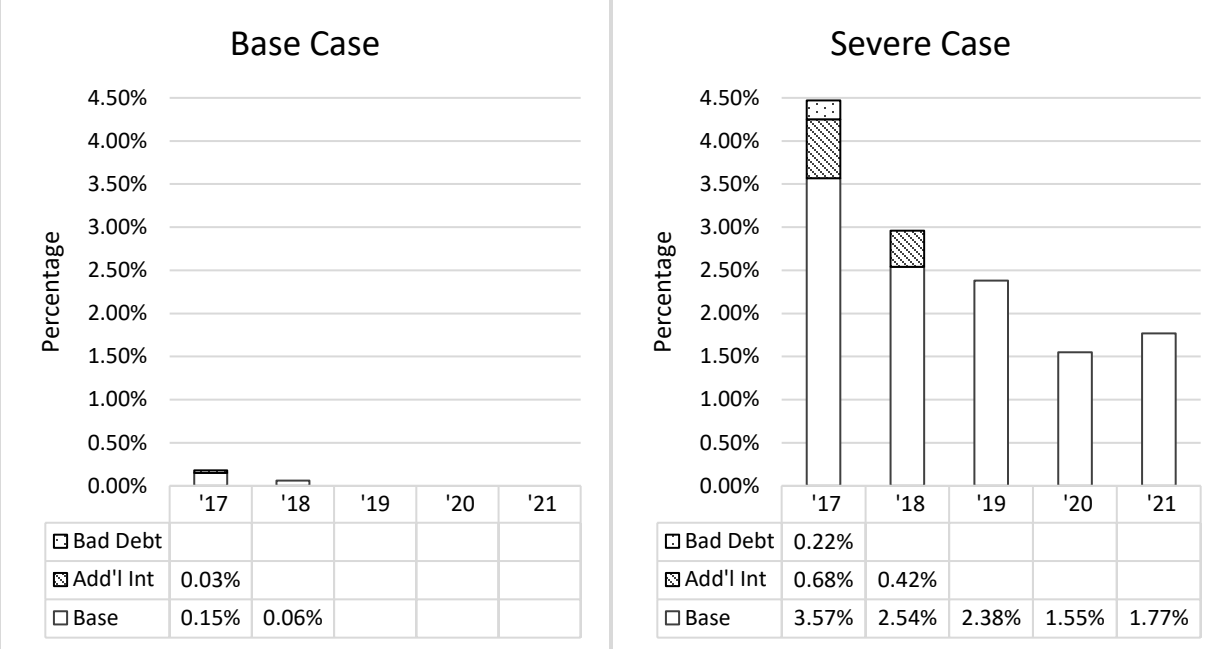

Figure 5.1: Return on Equity Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.1 summarizes the contributions to variation for the return on equity. This ratio was used by one of the previous academic literature authors. Other authors used ROE – ROA or ROE/ROA. As can be seen there is minimal contributions to variation by the sources of financial risk in both the base and severe financial risk cases. Less than 4.5% of the variation in this financial ratio can be attributed to financial risk sources in 2017 for the severe case. This is the largest contribution to variation for ROE from financial risk. The contributions to variation by sources of financial risk continues to decline over the next four years. Therefore, it can be seen

why previous academic literature had inconclusive findings when using ROE as a measure of financial risk or some variant of the ROE.

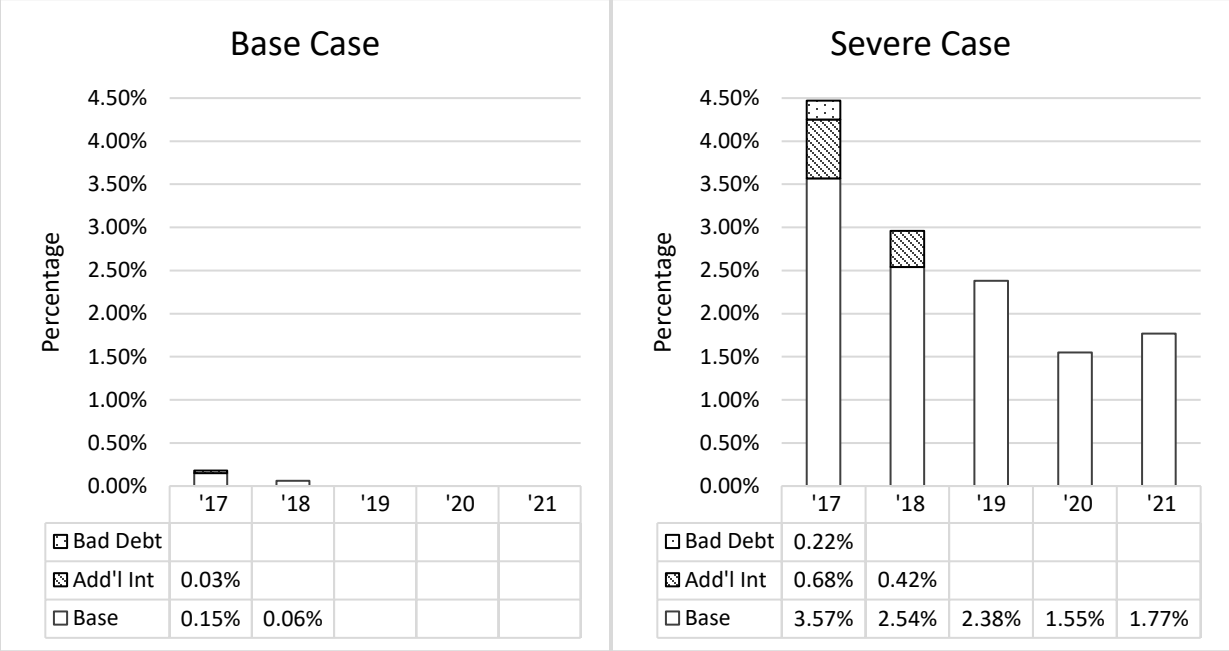

Figure 5.2: Return on Asset Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.2 shows the ROA contributions to variation by the sources of financial risk. This ratio was used by the academic literature as the definition of business risk. There is very little difference in the contributions to variation by the sources of financial risk from the ROE to ROA ratio. ROA also had less than 4.5% contribution to variation for the severe case in 2017 with steady declines for four years until a slight increase in 2021. This makes sense for a ratio that is used to capture business risk rather than financial risk.

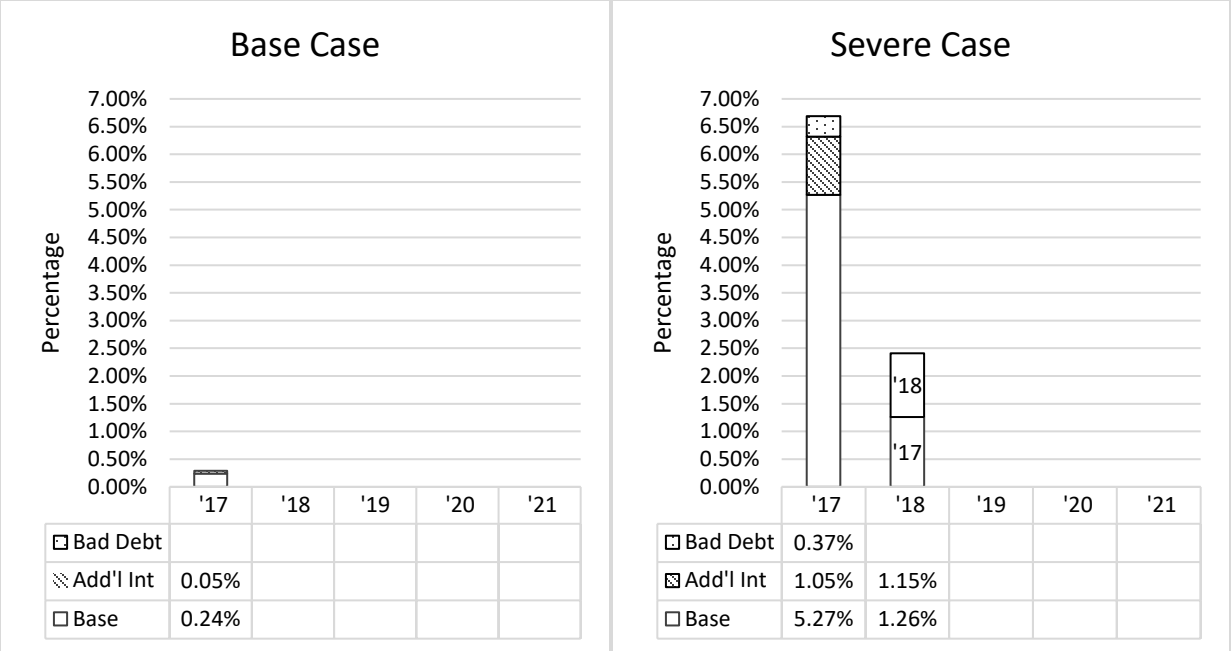

Figure 5.3: Debt to Equity Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

In Table 5.3 the contributions to variation for debt to equity are presented. In the severe case for 2018, it is important to note that the base interest rate for 2017 and 2018 were the contributors to variation rather than the base interest rate and the additional interest rate for that year. This may be because of the compounding nature of the model simulation. The debt to equity ratio seems to be the best academic literature specific ratio that captures sources of financial risk, coming in at about 6.6% in 2017 for the severe case. In the following figures, it will be seen that the other ratios have higher contributions to variation by sources of financial risk.

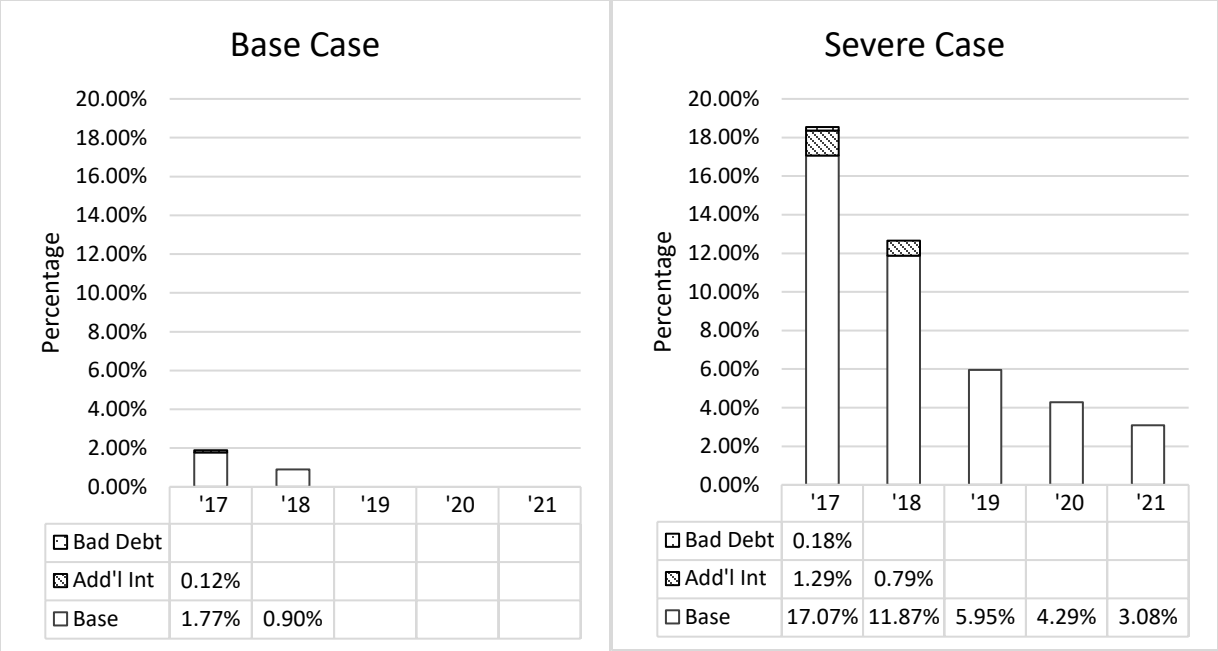

Figure 5.4: Debt Service Coverage Ratio Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.4 shows that the debt service coverage ratio has over 10% higher contributions to variation than any other ratio discussed so far. The contributions to variation by sources of financial risk in 2017 for the service case are about 18.5% with steady decreases over the next five years. This is an expected result as the debt service coverage ratio directly measures debt in the calculations. This can also be attributed to the stochastic nature of the interest rates on the loans. This had a significant impact on the interest rates paid by the cooperative. Again, this is a ratio used by both the academic literature and the lenders.

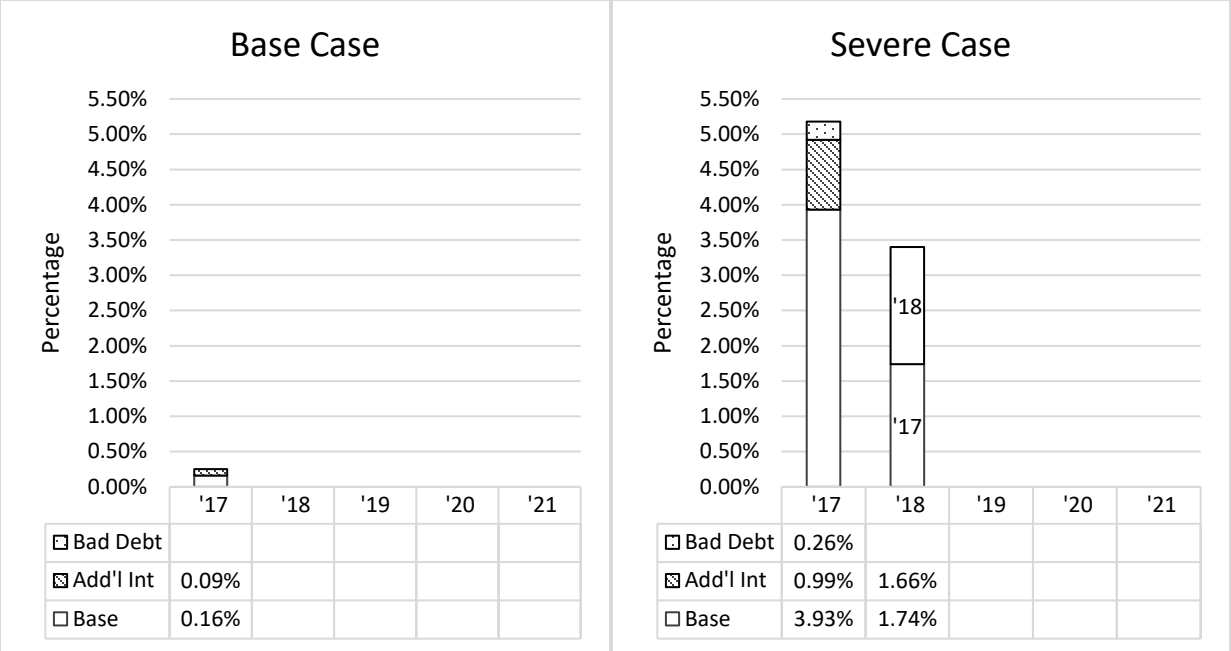

Figure 5.5: Current Ratio Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.5. summarizes the results for the contributions to variation for the current ratio. The current ratio has a little over 5% contribution to variation by sources of financial risk in the severe case for 2017, slightly less than 3.5% in 2018 and nothing the following years. The current ratio is similar to the debt to equity ratio in Figure 5.3 in that the severe case has contributions to variation by the base interest rate from the current and previous year for 2018. It is interesting to see this happen again when current liabilities is used for the ratio calculation. The debt to equity uses the total liabilities for its calculation so it may be concluded that the current portion of liabilities is affected more by the base interest rate.

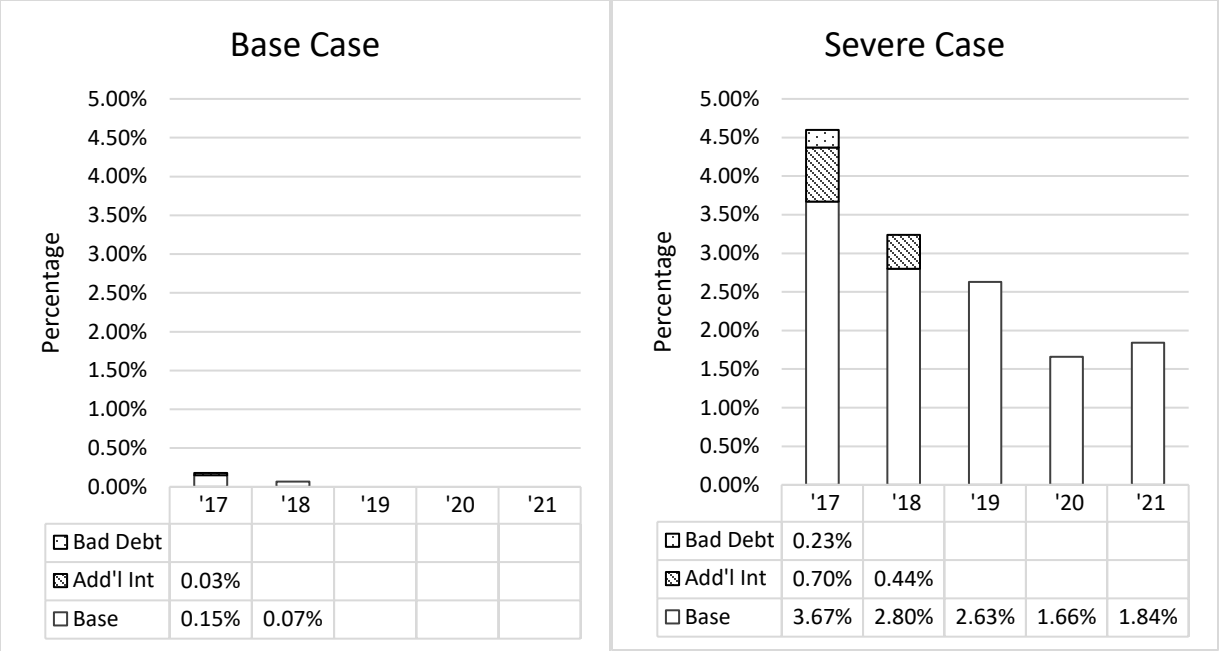

Figure 5.6: Local Return on Sales Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.6 is the beginning of the lender specific ratios. The local return on sales has similar contributions to variation as the ROE and ROA ratios, about 4.6% contribution to variation in 2017 for the severe case. This is reasonable as the net income is the numerator in all three ratios. However, it is important to note here that the model only analyzed local savings. Therefore, a cooperative that had regional savings as well may have different contributions to variation as the net income would be different from the local savings. However, this model does not have a distinction between regional and local savings.

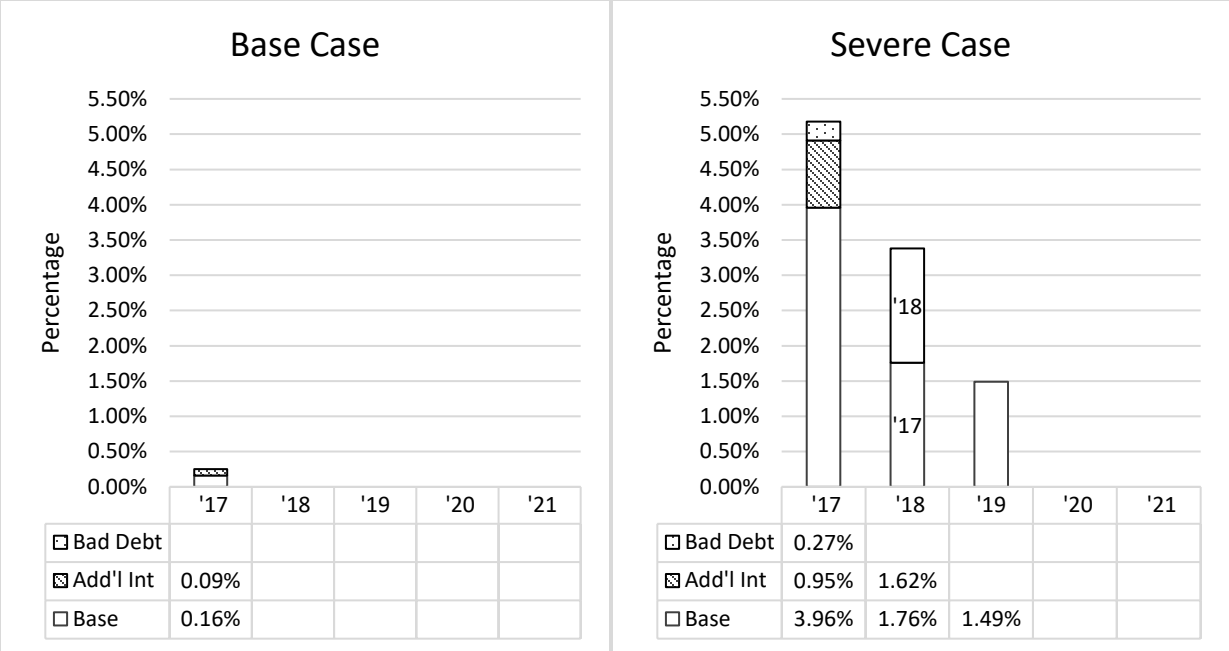

Figure 5.7: Working Capital to Total Sales Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.7 shows a severe case similar to those found in Figures 5.3 (debt to equity ratio) and 5.5 (current ratio) in that the severe case has contributions to variation by the base interest rate from the current and previous year for 2018. The contribution to variation in 2019 was from the base interest rate in 2019 as well. The contributions to variation from sources of financial risk for this ratio was similar to that found in the current ratio at about 5.2% for the severe case in 2017.

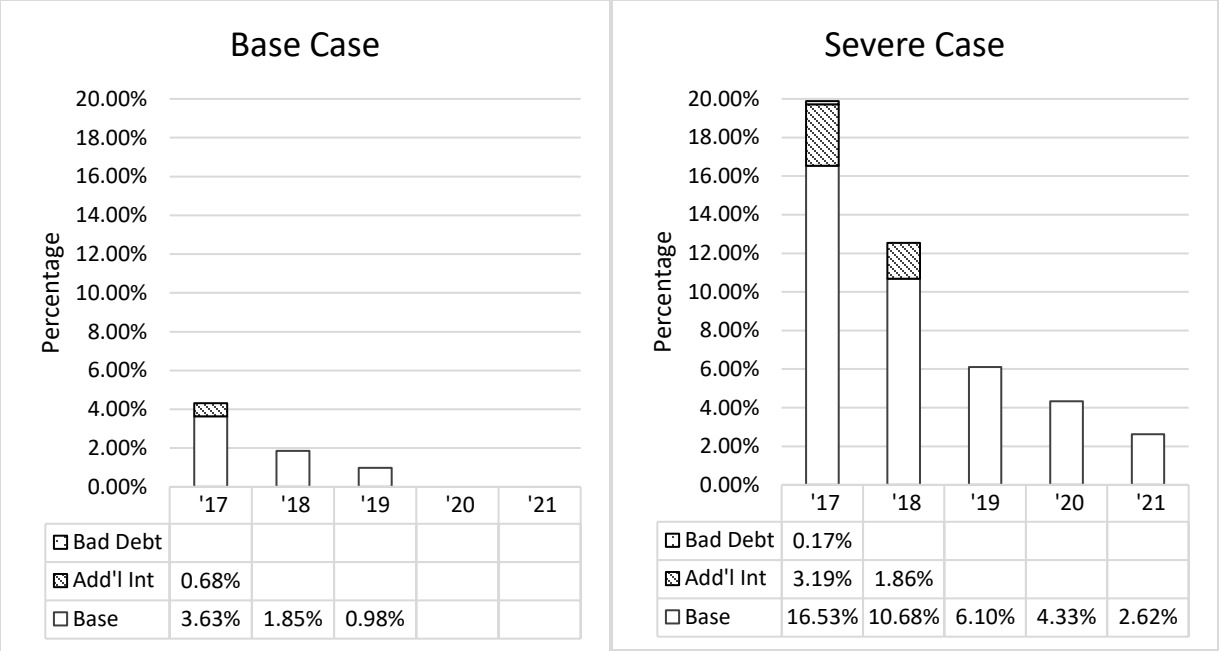

Figure 5.8: Interest Coverage Ratio Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.8 shows the interest coverage ratio which has a relatively high amount of contributions to variation by sources of financial risk. There is almost 20% contribution to variation by sources of financial risk in the severe case for 2017. This is the second highest contribution of all the ratios. This relatively high contribution to variation is an expected finding as it directly measures the interest expense faced by the cooperative. This is also the only ratio to have a contribution to variation by a source of financial risk in the third year for the base case. The ratio with the highest contribution to variation will be seen in the last ratio analyzed.

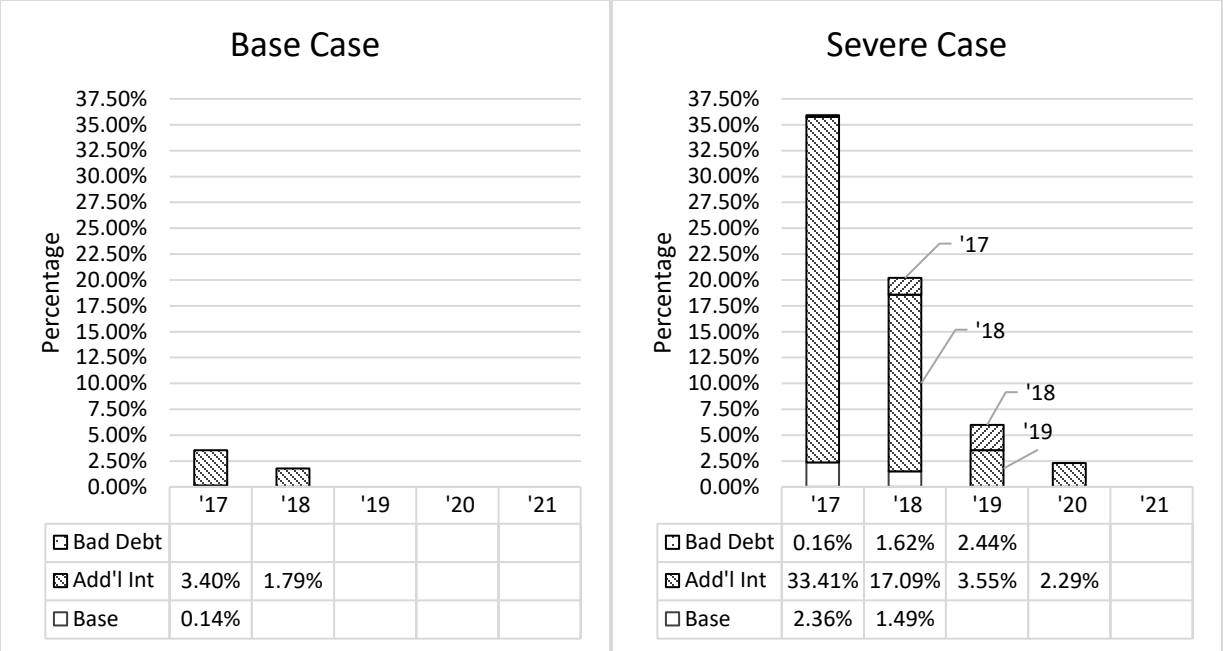

Figure 5.9: Long Term Debt to Equity Contributions to Variation
Notes: Base stands for the base interest rate; Add'l Int stands for the additional interest rate added due to the risk credit rating of the cooperative; and Bad Debt stands for the bad debt assumption given to the cooperative.

Figure 5.9 shows the ratio that saw the highest amounts of contribution to variation by sources of financial risk in the severe case. This goes back to the discussions with CoBank that approximately 20% of cooperatives fixed term interest rates are variable. There is a shift to the additional interest rate having a higher contribution than the base interest rate with this ratio. In 2018 and 2019, there is a contribution to variation by the previous year's additional (or premium) interest rate. Please note, these are seen in the bad debt category for years 2018 and 2019 but are labeled in the graph. For example, in 2018 there is a 1.49% contribution to variation by the base interest rate, a 17.09% contribution to variation from the additional interest rate premium added to the base interest rate from 2018 and a 1.62% contribution to variation from the additional interest rate premium added to the base interest rate from 2017. This is because the variable interest rate causes a recalculation of the principle payments for the cooperative. These changes caused the principle payments to go up which is why such a high contribution to variation by the

additional interest rate is seen for this ratio. A similar situation is seen in 2019 and in 2020 we only see a contribution to variation from the additional interest rate premium from that year.

5.3. Conclusions

This chapter began with the COVs to show that there was a difference in the risk from the base case to the severe case. Once it was established that the changes in financial risk were being captured it was reasonable to then look at the contributions to variation in net income caused by the different sources of financial risk. As was seen the ROE and ROA ratios were very similar with no differences or differences of under 0.05% were found. This shows that using ROA in any capacity, as has been done by academic literature, as a measure of financial risk is unreasonable and may have contributed to inconclusive findings in the previous literature. The last academic literature specific ratio showed an increase of about 2.5% over the ROE and ROA contributions to variation but was still only around 7%. Therefore, it can not be suggested that these academic literature ratios should be used for analysis of financial risk for future research.

The lender specific ratios show rather significant increases in the contributions to variation, specifically in the interest coverage ratio at about 20% and the long term debt to equity with over 35%. The lender ratios have the second two highest contributions to variation and the third highest is found by a shared ratio with the academic literature, the debt service coverage ratio. While the lender ratios do a significantly better job of capturing the variability in the sources of financial risk, there was still the local return on sales that had small contributions to variation. The other shared ratio with the academic literature, the current ratio, had only about 5.2% contribution to variation. Therefore, lenders may need to reconsider how they are measuring the riskiness of a cooperative when they are deciding how much interest to add to the base rate.

6. CONCLUSIONS

The purpose of this chapter is to provide conclusions to the project. This chapter will restate the purpose of the study as well as the research objectives. Then, a summary of the methodology will be presented. Finally, results will be discussed as well as the conclusions that came with them.

6.1. Summary of the Project

6.1.1. Purpose of the Project

The purpose of this study was to contribute to the ability of cooperative management teams to understand and measure financial risk faced by the cooperative. This was necessary to do as it has not been clearly defined in the past. If businesses expect to do a good job of managing risk, it is important to first be able to define that risk and then measure it. If these two things can't be done, it would become extremely difficult to manage the risk. While financial risk has not been a major concern to those seeking financing options in today's environment it is expected to become more of a concern in the coming years. It is better to prepare for financial risk management in times where there is not as much financial stress rather than wait to create a plan when things have gotten bad.

6.1.2. Objective of the Project

There were three main objectives in this project regarding financial risk. First, the project had to more accurately define the components of financial risk. Financial risk was defined as base interest risk, additional interest determined by a credit rating score and bad debt. Once the variables that contribute to financial risk were defined the ratios used in previous literature and by agribusiness lenders were analyzed to determine if they captured these changes in financial risk by using coefficients of variation. Finally, the contributions to variation were analyzed to

compare ratios used by academic literature and agribusiness lenders. These analyses were used to determine if there was a significant difference in ability between literature and lender ratios measuring financial risk.

6.1.3. Methodology of the Project

The data used in this research project was generated using a stochastic simulation model that created pro forma financial statements for a model cooperative facing two different financial risk scenarios. The methodology was used by incorporating financial and business risk into an Excel based model which used the @Risk add-in for the Monte Carlo simulation. The business risk of the cooperative was modeled by adding distributions to the sales volume, price and cost of goods sold components of the model. The financial risk in this project was defined as the base interest rate, credit rating and bad debt. These were modeled with the base interest rates for both the revolving line of credit and long-term debt, the credit rating was included by a credit rating score that added an additional interest rate to the base interest rate and a bad debt expense was included as a component of the accounts receivable over 90 days. The project then analyzed the coefficients of variation and the contributions to variations of the specified ratios used by previous literature and agribusiness lenders. The model controlled the ability to measure the contributions of financial risk by holding business risk constant. This was done to increase the ability to analyze which sources of financial risk were being captured without having business risk overshadow the effects of the changes in financial risk from the base case to the severe case. This methodology enabled the testing of whether or not commonly used financial performance measures are capturing the effects of financial risk on cooperative performance.

6.2. Conclusions

Business risk has been a widely discussed topic within academic literature and has been defined by many authors. The results from this study confirmed that business risk is an important attribute to be studied. However, financial risk has not received as much attention and has discrepancies in how it is defined and measured. While researchers have not focused on this in the past, it may not be as easy to overlook in the future. The potential for increasing interest rates in the future requires lenders, agribusinesses and farmers alike to be prepared for such changes before they occur. The contributions of this project aims to help those involved understand and measure financial risk so they may be prepared for future changes in the financial risk environment. While this project doesn't provide all the answers, it's objectives to make progress on the subject was attained.

It was interesting to note that bad debt was only captured in the first year for any of the ratios. This shows an area where improvements could be made for ratios used by lenders and academic literature. Academic literature may consider looking to the lender literature when deciding how to measure financial risk in the future. However, it will be important to also incorporate some ratio that has a more accurate measure of bad debt expenses. Also, the fact that ROE and ROA had extremely similar results for their contributions to variation shows that using ROE – ROA, ROE/ROA or ROE for measures of financial risk would not reasonably be capturing all financial risks. This may have been a contributing factor to previous research having inconclusive findings.

Based on the contributions to variation there are important differences between the ability of ratios found within the academic literature and those used by lenders to measure financial risk. The literature ratios were impacted less by the financial risk measures than were the lender

ratios. The highest contribution by a literature specific ratio was 5.27% for the debt to equity ratio. It is also interesting to note how small of an effect the financial risk measures impact the variation of ROE because this has typically been used as a financial risk measure in the past by literature. There was also one literature specific ratio that didn't capture any components of financial risk. Whereas, the lender specific ratios had contributions from financial risk for every ratio. Those contributions ranged from 3.63% for the interest coverage ratio up to 33.41% with the long term debt to equity ratio. However, this isn't to say that the lender ratios do a perfect job and future research can continue to improve upon how financial risks are defined and measured.

So, as was seen in Chapter 5, the lender ratios were able to better capture sources of financial risk in their ratios. Two of the lender specific ratios, interest coverage ratio and long term debt to equity, were in the top three for contributions to variation and ratio with the second largest contribution to variation was found in the debt service coverage ratio was used by the lenders and academic literature.

6.3. Suggestions for Further Research

Future research should begin by attempting to more accurately define sources of financial risk. To be able to measure something it is important that it is first defined. While this research attempts to make progress at defining the sources of financial risk, it is understood that these may not include all sources of financial risk faced by cooperatives. However, the findings of this research can help researchers better expand and define sources of financial risk as well as refine their measurements.

This research project not only assists the academic literature but the lenders as well. The lenders can use these finding to decide whether or not to refine their ratio analysis for credit rating scores. The research project may help lenders decide if they are capturing what they intend

to when assessing the riskiness of a certain cooperative. Future research could assist in refining these credit rating score ratios in the future.

A simulation model was a useful starting point to analyze financial risk measures within cooperatives. However, if the data could be obtained, future research could analyze how financial risks were measured in cooperatives that survived the farm financial crisis and how financial risks have continued to be captured past that crisis. Further studies could be conducted to find ratios that are able to capture all of the defined financial risks.

Future research should attempt to focus on the ability to measure the probability of bad debt as this can have a large negative effect on the ability of the cooperative's operations. More precise definitions of financial risk would still be useful as there may be some sources of financial risk that this project failed to identify. Empirically testing the lender ratios on historical data could provide a better answer to the question posed in this project.

If the model is used again for future research it may be useful to analyze how sources of financial risk affect the cooperative when simulated as multivariate variables. It would also be interesting to see how a cooperative with regional savings would compare with a cooperative with only local savings.

Once a more accurate measure of financial risk is found it would be helpful for future researchers to empirically test the risk balancing hypothesis with this better defined measure. This may help to find conclusive results in regards to the risk balancing hypothesis and cooperatives.

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APPENDIX A: FINANCIAL RATIO CALCULATIONS

Table A.1: Ratio Calculations

Ratio	***Calculation***
Return on Assets	Net Income / Total Assets
Return on Equity	Net Income / Net Worth
Debt to Equity	Total Liabilities / Total Equity
Total Asset Turnover	Sales / Total Assets
Local Return on Sales	Local Savings / Total Sales
Working Capital to Sales	Working Capital / Total Sales
Long-Term Debt to Equity Ratio	Total Long Term Debt / (Total Members' Equity – Regional Investment)
Debt Service Coverage Ratio	(Net Savings + Interest + Depreciation) / (Term Loan Payments + Interest)
Interest Coverage Ratio	(Local Savings + Interest Expense) / Interest Expense
Current Ratio	Current Assets / Current Liabilities

APPENDIX B: CONTRIBUTION TO VARIATION TABLES

Table B.1: Return on Equity Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	81.88	G $ ‘18	66.53	G $ ‘19	58.68	G $ ‘20	49.57	G $ ‘21	43.68
A $ ‘17	9.32	G SV ‘18	13.10	G SV‘19	10.47	G SV ‘20	10.07	G SV‘21	8.63
F $ ‘17	5.34	A $ ‘18	7.58	G SV‘18	9.08	G SV ‘19	8.23	G SV ‘20	7.89
P $ ‘17	3.19	F $ ‘18	4.45	A $ ‘19	6.37	G SV‘18	8.10	G SV ‘18	7.58
C ‘17	0.15	P $ ‘18	2.58	F $ ‘19	3.65	A $ ‘20	5.84	G SV ‘19	7.54
B ‘17	0.03	F SV ‘18	1.99	P $ ‘19	2.22	F $ ‘20	3.50	A $ ‘21	5.13
B ‘17	0.00	A SV ‘18	1.09	F SV ‘19	1.63	P $ ‘20	1.89	F $ ‘21	2.97
B ‘17	0.00	M SV ‘18	0.81	F SV ‘18	1.63	F SV ‘20	1.65	P $ ‘21	1.70
BD ‘17	0.00	C ‘18	0.06	A SV‘19	0.96	F SV ‘19	1.49	F SV ‘19	1.35
B ‘17	0.00	G $ ‘17	0.06	A SV‘18	0.80	F SV ‘18	1.31	F SV ‘21	1.29
SEVERE CASE									
G $ ‘17	78.38	G $ ‘18	65.39	G $ ‘19	58.39	G $ ‘20	50.21	G $ ‘21	42.51
A $ ‘17	8.87	G SV ‘18	11.47	G SV‘19	9.19	G SV ‘20	8.99	G SV ‘21	7.50
F $ ‘17	5.16	A $ ‘18	7.41	G SV‘18	7.36	G SV ‘18	6.90	G SV ‘18	7.27
C ‘17	3.56	F $ ‘18	4.42	A $ ‘19	6.53	G SV ‘19	6.77	G SV ‘19	6.79
P $ ‘17	2.98	C ‘18	2.54	F $ ‘19	3.58	A $ ‘20	5.97	G SV‘20	6.30
B ‘17	0.68	P $ ‘18	2.53	C ‘19	2.41	F $ ‘20	3.68	A $ ‘21	5.14
BD ‘17	0.22	F SV‘18	1.86	P $ ‘19	2.23	P $ ‘20	2.01	F $ ‘21	3.07
B ‘17	0.00	A SV‘18	1.06	F SV ‘18	1.62	F SV ‘20	1.61	C ‘21	1.82
B ‘17	0.00	M SV ‘18	0.81	F SV ‘19	1.60	C ‘20	1.59	P $ ‘21	1.79
B ‘17	0.00	B ‘18	0.42	A SV‘19	0.92	F SV‘19	1.50	F SV‘19	1.55

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.2: Return on Assets Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	82.16	G $ ‘18	68.64	G $ ‘19	61.56	G $ ‘20	52.40	G $ ‘21	45.65
A $ ‘17	9.19	G SV ‘18	11.15	G SV‘19	9.47	G SV‘20	9.22	G SV ‘21	8.20
F $ ‘17	5.30	A $ ‘18	7.68	G SV‘18	7.16	G SV‘18	7.12	G SV ‘18	7.42
P $ ‘17	3.18	F $ ‘18	4.53	A $ ‘19	6.62	G SV‘19	6.94	G SV ‘19	6.98
C ‘17	0.15	P $ ‘18	2.62	F $ ‘19	3.81	A $ ‘20	6.05	G SV‘20	6.80
B ‘17	0.03	F SV ‘18	1.84	P $ ‘19	2.31	F $ ‘20	3.72	A $ ‘21	5.29
B ‘17	0.00	A SV ‘18	0.97	F SV ‘18	1.58	P $ ‘20	1.97	F $ ‘21	3.12
B ‘17	0.00	M SV‘18	0.85	F SV ‘19	1.57	F SV‘20	1.61	P $ ‘21	1.72
BD ‘17	0.00	C ‘18	0.06	A SV‘19	0.89	F SV‘19	1.44	F SV ‘19	1.40
B ‘17	0.00	P SV‘18	0.02	M SV‘18	0.78	F SV‘18	1.38	F SV ‘18	1.34
SEVERE CASE									
G $ ‘17	78.69	G $ ‘18	66.59	G $ ‘19	59.82	G $ ‘20	51.68	G $ ‘21	44.43
A $ ‘17	8.75	G SV ‘18	10.45	G SV‘19	8.96	G SV‘20	8.82	G SV ‘21	7.94
F $ ‘17	5.12	A $ ‘18	7.41	G SV‘18	6.66	G SV‘18	6.71	G SV ‘18	7.25
C ‘17	3.57	F $ ‘18	4.43	A $ ‘19	6.53	G SV‘19	6.31	G SV ‘19	6.80
P $ ‘17	2.97	P $ ‘18	2.58	F $ ‘19	3.63	A $ ‘20	6.01	G SV ‘20	6.37
B ‘17	0.68	C ‘18	2.54	C ‘19	2.38	F $ ‘20	3.73	A $ ‘21	5.12
BD ‘17	0.22	F SV ‘18	1.76	P $ ‘19	2.23	P $ ‘20	1.99	F $ ‘21	3.09
B ‘17	0.00	A SV ‘18	0.98	F SV ‘18	1.59	F SV‘20	1.60	C ‘21	1.77
B ‘17	0.00	M SV ‘18	0.82	F SV ‘19	1.55	C ‘20	1.56	P $ ‘21	1.71
B ‘17	0.00	B ‘18	0.42	A SV‘19	0.87	F SV‘19	1.44	F SV ‘19	1.47

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.3: Debt to Equity Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	84.60	G SV‘18	45.17	G SV‘19	26.40	G SV ‘20	20.04	G SV ‘21	13.37
A $ ‘17	6.23	G $ ‘17	23.00	G $ ‘18	15.46	G $ ‘19	11.24	G $ ‘21	9.57
F $ ‘17	4.93	G $ ‘18	14.84	G SV‘18	13.78	G $ ‘18	10.56	G $ ‘20	9.54
P $ ‘17	3.21	G M‘18	4.41	G $ ‘17	13.52	G $ ‘17	9.83	G $ ‘18	8.68
C ‘17	0.24	A $ ‘17	2.64	G $ ‘19	9.81	G SV ‘19	9.74	G $ ‘19	8.64
B ‘17	0.05	F $ ‘17	1.37	G M‘18	2.99	G $ ‘20	8.48	G $ ‘17	7.63
B ‘17	0.00	A SV ‘18	1.35	G M‘19	2.63	G SV ‘18	3.17	G SV ‘20	5.20
B ‘17	0.00	A $ ‘18	1.18	A $ ‘18	1.73	G M ‘19	2.28	M SV‘18	2.23
BD ‘17	0.00	P $ ‘17	0.88	A $ ‘17	1.67	G M ‘20	2.15	G M ‘19	1.80
B ‘17	0.00	F $ ‘18	0.85	F $ ‘18	0.89	G M ‘18	2.10	G M ‘18	1.64
SEVERE CASE									
G $ ‘17	68.61	G SV ‘18	34.69	G $ ‘19	16.25	G $ ‘19	14.50	G $ ‘21	11.72
A $ ‘17	6.24	G $ ‘17	22.91	G $ ‘18	16.03	G $ ‘20	12.47	G $ ‘20	10.28
C ‘17	5.27	G $ ‘18	17.79	G SV‘19	15.41	G $ ‘18	11.14	G $ ‘19	9.46
F $ ‘17	4.62	G M‘18	3.67	G $ ‘17	12.93	G $ ‘17	9.07	G $ ‘18	7.27
P $ ‘17	2.79	A $ ‘17	2.61	G SV‘18	7.27	G SV ‘20	8.03	G $ ‘17	5.96
B ‘17	1.05	A $ ‘18	1.82	G M ‘18	2.38	G SV ‘19	3.48	G SV ‘21	3.14
BD ‘17	0.37	F $ ‘17	1.38	A $ ‘19	2.06	A $ ‘19	2.16	M SV‘18	2.54
B ‘17	0.01	F $ ‘18	1.33	G M‘19	1.98	M SV‘18	2.01	F SV ‘18	2.12
B ‘17	0.00	C ‘17	1.26	A $ ‘18	1.84	G M‘19	1.56	A $ ‘21	1.55
B ‘17	0.00	C ‘18	1.15	A $ ‘17	1.65	G M‘18	1.48	A $ ‘20	1.49

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.4: Total Asset Turnover Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	91.05	G SV‘18	90.84	G SV ‘18	45.80	G SV ‘20	30.97	G SV ‘21	23.44
F $ ‘17	3.90	G M‘18	4.98	G SV ‘19	45.14	G SV ‘18	29.94	G SV ‘20	22.91
P $ ‘17	3.05	F SV ‘18	1.59	G M‘19	2.63	G SV ‘19	29.84	G SV ‘18	22.38
A $ ‘17	2.00	G $ ‘18	1.33	G M‘18	2.53	G M‘19	1.81	G SV ‘19	21.98
B ‘17	0.00	A SV‘18	0.25	F SV ‘19	0.80	G M‘20	1.70	G M‘19	1.30
C ‘17	0.00	F M‘18	0.25	F SV ‘18	0.79	G M‘18	1.65	G M‘18	1.24
B ‘17	0.00	P SV ‘18	0.12	G $ ‘19	0.68	F SV ‘20	0.56	G M‘20	1.23
BD ‘17	0.00	M SV‘18	0.09	F M‘19	0.15	F SV ‘19	0.55	G M‘21	1.21
B ‘17	0.00	A M‘18	0.06	A SV ‘18	0.14	F SV ‘18	0.54	F SV ‘20	0.43
B ‘17	0.00	F $ ‘18	0.05	A SV ‘19	0.12	G $ ‘20	0.42	F SV ‘18	0.40
SEVERE CASE									
G $ ‘17	91.05	G SV‘18	90.82	G SV ‘18	45.81	G SV ‘20	30.99	G SV ‘21	23.45
F $ ‘17	3.90	G M‘18	4.97	G SV ‘19	45.14	G SV ‘18	29.96	G SV ‘20	22.93
P $ ‘17	3.05	F SV ‘18	1.59	G M‘19	2.63	G SV ‘19	29.84	G SV ‘18	22.41
A $ ‘17	2.00	G $ ‘18	1.32	G M‘18	2.53	G M‘19	1.81	G SV ‘19	21.99
B ‘17	0.00	A SV‘18	0.25	F SV ‘19	0.80	G M‘20	1.70	G M‘19	1.30
C ‘17	0.00	F M‘18	0.25	F SV ‘18	0.79	G M‘18	1.65	G M‘18	1.24
B ‘17	0.00	P SV ‘18	0.12	G $ ‘19	0.67	F SV ‘20	0.57	G M‘20	1.23
BD ‘17	0.00	M SV‘18	0.09	F M‘19	0.15	F SV ‘19	0.55	G M‘21	1.21
B ‘17	0.00	A M‘18	0.06	A SV ‘18	0.14	F SV ‘18	0.54	F SV ‘20	0.43
B ‘17	0.00	F $ ‘18	0.05	A SV ‘19	0.12	G $ ‘20	0.42	F SV ‘18	0.40

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.5: Debt Service Coverage Ratio Contributions to Variation

2017	%	2018	%	2019	%	2020	%	2021	%
BASE CASE									
G $ ‘17	80.62	G $ ‘18	65.62	G $ ‘19	58.13	G $ ‘20	48.29	G $ ‘21	41.90
A $ ‘17	9.02	G SV ‘18	12.80	G SV ‘19	10.52	G SV ‘20	9.79	G SV ‘18	8.62
F $ ‘17	5.23	A $ ‘18	7.36	G SV ‘18	8.87	G SV ‘18	8.58	G SV ‘21	8.31
P $ ‘17	3.13	F $ ‘18	4.37	A $ ‘19	6.18	G SV ‘19	8.10	G SV ‘19	7.84
C ‘17	1.77	P $ ‘18	2.45	F $ ‘19	3.53	A $ ‘20	5.44	G SV ‘20	7.42
B ‘17	0.12	F SV ‘18	1.95	P $ ‘19	2.11	F $ ‘20	3.37	A $ ‘21	4.70
B ‘17	0.00	A SV ‘18	1.09	F SV ‘18	1.67	P $ ‘20	1.78	F $ ‘21	2.74
B ‘17	0.00	C ‘18	0.90	F SV ‘19	1.60	F SV ‘20	1.55	P $ ‘21	1.47
BD ‘17	0.00	M SV‘18	0.81	A SV ‘19	0.94	F SV ‘19	1.48	F SV ‘19	1.44
B ‘17	0.00	G $ ‘17	0.30	A SV ‘18	0.76	F SV ‘18	1.44	F SV ‘18	1.34
SEVERE CASE									
G $ ‘17	65.80	G $ ‘18	56.95	G $ ‘19	55.54	G $ ‘20	48.12	G $ ‘21	42.53
C ‘17	17.07	C ‘18	11.87	G SV ‘19	9.03	G SV ‘20	8.77	G SV ‘21	7.84
A $ ‘17	7.28	G SV ‘18	10.31	G SV ‘18	6.64	G SV ‘18	6.75	G SV ‘18	7.11
F $ ‘17	4.28	A $ ‘18	6.41	C ‘19	5.95	G SV ‘19	6.09	G SV ‘19	6.55
P $ ‘17	2.50	F $ ‘18	3.82	A $ ‘19	5.89	A $ ‘20	5.52	G SV ‘20	5.99
B ‘17	1.29	P $ ‘18	2.13	F $ ‘19	3.39	C ‘20	4.29	A $ ‘21	4.75
BD ‘17	0.18	F SV ‘18	1.63	P $ ‘19	2.01	F $ ‘20	3.42	C ‘21	3.08
B ‘17	0.00	G $ ‘17	0.92	F SV ‘18	1.52	P $ ‘20	1.78	F $ ‘21	2.87
B ‘17	0.00	A SV ‘18	0.89	F SV ‘19	1.46	F SV ‘20	1.49	P $ ‘21	1.52
B ‘17	0.00	B ‘18	0.79	A SV ‘19	0.85	F SV ‘19	1.37	F SV ‘19	1.43

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.6: Current Ratio Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	82.41	G $ ‘17	40.99	G $ ‘18	25.18	G $ ‘20	15.26	G SV‘18	14.54
A $ ‘17	8.66	G $ ‘18	38.84	G $ ‘17	24.43	G $ ‘19	14.96	G $ ‘21	11.08
F $ ‘17	5.24	A $ ‘17	4.46	G $ ‘19	23.68	G $ ‘18	14.14	G $ ‘19	8.98
P $ ‘17	3.24	A $ ‘18	4.33	A $ ‘18	2.99	G $ ‘17	13.53	G $ ‘20	8.78
C ‘17	0.16	F $ ‘18	2.55	A $ ‘17	2.78	G SV‘18	11.18	G $ ‘18	8.24
B ‘17	0.09	F $ ‘17	2.53	A $ ‘19	2.50	G SV‘19	3.23	G $ ‘17	7.66
B ‘17	0.00	P $ ‘17	1.58	F $ ‘19	1.61	F SV ‘18	3.04	G SV‘19	7.15
B ‘17	0.00	P $ ‘18	1.55	F $ ‘17	1.58	M SV‘18	1.93	F SV ‘18	3.88
BD ‘17	0.00	MSV‘18	0.50	F $ ‘18	1.56	A $ ‘20	1.92	G SV‘20	2.33
B ‘17	0.00	F SV‘18	0.44	M SV‘18	1.38	A $ ‘19	1.75	M SV‘18	2.11
SEVERE CASE									
G $ ‘17	73.57	G $ ‘18	37.96	G $ ‘19	27.47	G $ ‘20	15.75	G SV‘18	14
A $ ‘17	8.48	G $ ‘17	33.28	G $ ‘18	19.73	G $ ‘19	13.69	G $ ‘21	11.39
F $ ‘17	5.07	A $ ‘18	4.69	G $ ‘17	17.79	G SV ‘18	11.05	G SV‘19	9.33
C ‘17	3.93	A $ ‘17	3.59	A $ ‘19	3.53	G $ ‘18	10.67	G $ ‘20	7.93
P $ ‘17	3.10	F $ ‘18	2.71	G SV‘18	2.68	G $ ‘17	9.37	G $ ‘19	7.43
B ‘17	0.99	F $ ‘17	2.18	A $ ‘18	2.29	G SV‘19	5.29	G $ ‘18	5.61
BD ‘17	0.26	P $ ‘18	1.78	A $ ‘17	2.12	F SV ‘18	3.16	G $ ‘17	5.04
B ‘17	0.00	C ‘18	1.74	F $ ‘19	1.96	A $ ‘20	2.16	G SV‘20	4.92
B ‘17	0.00	C ‘17	1.66	F SV ‘18	1.70	M SV‘18	1.98	F SV ‘18	3.57
B ‘17	0.00	P $ ‘17	1.40	M SV‘18	1.49	A $ ‘19	1.74	F SV ‘19	2.37

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.7: Local Return on Sales Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	82.00	G $ ‘18	74.61	G $ ‘19	67.72	G $ ‘20	58.36	G $ ‘21	49.22
A $ ‘17	9.28	A $ ‘18	8.74	A $ ‘19	7.59	A $ ‘20	7.24	A $ ‘21	6.70
F $ ‘17	5.32	F $ ‘18	4.98	G SV ‘19	4.67	G SV ‘20	5.52	G SV ‘18	5.94
P $ ‘17	3.18	G SV ‘18	4.09	F $ ‘19	4.41	G SV ‘18	4.80	G SV ‘21	5.78
C ‘17	0.15	P $ ‘18	2.97	G SV ‘18	4.26	G SV ‘19	4.64	G SV ‘19	5.53
B ‘17	0.03	F SV ‘18	1.55	P $ ‘19	2.70	F $ ‘20	4.40	G SV ‘20	5.50
B ‘17	0.00	M SV ‘18	0.94	F SV ‘18	1.57	P $ ‘20	2.32	F $ ‘21	3.72
B ‘17	0.00	A SV ‘18	0.85	F SV ‘19	1.48	F SV ‘19	1.58	P $ ‘21	2.05
BD ‘17	0.00	G M‘18	0.22	M SV ‘18	0.89	F SV ‘20	1.54	F SV ‘18	1.51
B ‘17	0.00	C ‘18	0.07	A SV ‘19	0.85	F SV ‘18	1.52	F SV ‘19	1.51
SEVERE CASE									
G $ ‘17	78.47	G $ ‘18	69.83	G $ ‘19	62.00	G $ ‘20	53.51	G $ ‘21	43.55
A $ ‘17	8.80	A $ ‘18	8.12	A $ ‘19	6.98	G SV ‘20	7.34	G SV ‘21	7.70
F $ ‘17	5.13	G SV ‘18	6.18	G SV ‘19	6.93	A $ ‘20	6.77	G SV ‘18	7.29
C ‘17	3.67	F $ ‘18	4.77	G SV ‘18	5.60	G SV ‘18	5.82	G SV ‘19	6.85
P $ ‘17	2.97	P $ ‘18	2.82	F $ ‘19	3.94	G SV ‘19	5.48	G SV ‘20	6.36
B ‘17	0.70	C ‘18	2.80	C ‘19	2.63	F $ ‘20	4.08	A $ ‘21	5.43
BD ‘17	0.23	F SV ‘18	1.63	P $ ‘19	2.45	P $ ‘20	2.16	F $ ‘21	3.34
B ‘17	0.00	A SV ‘18	0.94	F SV ‘18	1.63	C ‘20	1.66	P $ ‘21	1.84
B ‘17	0.00	M SV ‘18	0.88	F SV ‘19	1.57	F SV ‘20	1.62	C ‘21	1.84
B ‘17	0.00	B ‘18	0.44	M SV ‘18	0.91	F SV ‘19	1.56	F SV ‘19	1.54

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.8: Interest Coverage Ratio Contributions to Variation

BASE CASE									
2017	%	2018	%	2019	%	2020	%	2021	%
G $ ‘17	78.27	G $ ‘18	64.04	G $ ‘19	57.75	G $ ‘20	47.74	G $ ‘21	41.56
A $ ‘17	8.71	G SV ‘18	12.28	G SV ‘19	10.31	G SV ‘20	9.49	G SV ‘18	8.39
F $ ‘17	5.11	A $ ‘18	7.19	G SV ‘18	7.76	G SV ‘18	8.02	G SV ‘21	8.18
C ‘17	3.63	F $ ‘18	4.32	A $ ‘19	6.18	G SV ‘19	6.98	G SV ‘19	7.40
P $ ‘17	2.99	P $ ‘18	2.36	F $ ‘19	3.51	A $ ‘20	5.38	G SV ‘20	6.63
B ‘17	0.68	F SV ‘18	1.93	P $ ‘19	2.06	F $ ‘20	3.40	A $ ‘21	4.69
B ‘17	0.00	C ‘18	1.85	F SV ‘19	1.63	P $ ‘20	1.76	F $ ‘21	2.79
B ‘17	0.00	A SV ‘18	1.07	F SV ‘18	1.63	F SV ‘20	1.52	F SV ‘19	1.48
BD ‘17	0.00	M SV ‘18	0.80	C ‘19	0.98	F SV ‘18	1.47	P $ ‘21	1.44
B ‘17	0.00	G $ ‘17	0.66	A SV ‘19	0.94	F SV ‘19	1.47	F SV ‘18	1.37
SEVERE CASE									
G $ ‘17	61.87	G $ ‘18	55.22	G $ ‘19	53.35	G $ ‘20	46.31	G $ ‘21	41.43
C ‘17	16.53	C ‘18	10.68	G SV ‘19	8.67	G SV ‘20	8.50	G SV ‘21	7.70
A $ ‘17	6.80	G SV ‘18	10.03	G SV ‘18	6.57	G SV ‘18	6.77	G SV ‘18	7.07
F $ ‘17	4.09	A $ ‘18	6.21	C ‘19	6.10	G SV ‘19	6.06	G SV ‘19	6.53
B ‘17	3.19	F $ ‘18	3.76	A $ ‘19	5.67	A $ ‘20	5.35	G SV ‘20	6.02
P $ ‘17	2.47	P $ ‘18	2.01	F $ ‘19	3.29	C ‘20	4.33	A $ ‘21	4.68
BD ‘17	0.17	B ‘18	1.86	P $ ‘19	1.90	F $ ‘20	3.36	F $ ‘21	2.86
B ‘17	0.00	F SV ‘18	1.60	F SV ‘18	1.51	P $ ‘20	1.74	C ‘21	2.62
B ‘17	0.00	G $ ‘17	0.97	F SV ‘19	1.43	F SV ‘20	1.43	P $ ‘21	1.47
B ‘17	0.00	A SV ‘18	0.85	A SV ‘19	0.85	F SV ‘19	1.35	F SV ‘19	1.40

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.9: Working Capital to Total Sales Contributions to Variation

2017	%	2018	%	2019	%	2020	%	2021	%
BASE CASE									
G $ ‘17	81.43	G $ ‘17	41.21	G $ ‘18	24.24	G $ ‘20	15.06	G SV‘18	12.24
A $ ‘17	9.35	G $ ‘18	37.91	G $ ‘17	23.54	G $ ‘19	14.77	G $ ‘21	10.74
F $ ‘17	5.37	A $ ‘18	4.61	G $ ‘19	21.82	G $ ‘18	14.01	G $ ‘20	8.45
P $ ‘17	3.25	A $ ‘17	4.51	G SV‘19	4.35	G $ ‘17	13.58	G $ ‘19	8.27
C ‘17	0.17	F $ ‘18	2.61	A $ ‘18	2.91	G SV ‘18	8.58	G $ ‘18	7.74
B ‘17	0.09	F $ ‘17	2.58	A $ ‘17	2.81	F SV ‘18	3.16	G $ ‘17	7.27
B ‘17	0.00	P $ ‘17	1.59	A $ ‘19	2.77	A $ ‘20	2.16	G SV‘19	5.72
B ‘17	0.00	P $ ‘18	1.56	F $ ‘19	1.63	M SV‘18	1.97	F SV ‘18	4.01
BD ‘17	0.00	M SV‘18	0.47	F $ ‘17	1.55	G SV ‘19	1.95	M SV‘18	2.26
B ‘17	0.00	G M‘18	0.45	F $ ‘18	1.54	A $ ‘19	1.82	F SV ‘19	2.19
SEVERE CASE									
G $ ‘17	71.49	G $ ‘18	36.89	G $ ‘19	26.29	G $ ‘20	14.79	G SV‘18	13.09
A $ ‘17	8.87	G $ ‘17	32.44	G $ ‘18	18.98	G $ ‘19	12.79	G $ ‘21	10.03
F $ ‘17	5.11	A $ ‘18	4.83	G $ ‘17	16.86	G SV ‘18	10.10	G SV‘19	8.99
C ‘17	3.96	A $ ‘17	3.55	A $ ‘19	3.77	G $ ‘18	9.75	G $ ‘20	7.15
P $ ‘17	3.07	F $ ‘18	2.75	A $ ‘18	2.26	G $ ‘17	8.55	G $ ‘19	6.54
B ‘17	0.95	F $ ‘17	2.15	F $ ‘19	2.03	G SV ‘19	4.90	G SV‘20	4.91
BD ‘17	0.27	P $ ‘18	1.81	A $ ‘17	1.89	F SV ‘18	3.13	G $ ‘18	4.91
B ‘17	0.01	C ‘18	1.76	F SV ‘18	1.64	A $ ‘20	2.15	G $ ‘17	4.34
B ‘17	0.00	C ‘17	1.62	M SV‘18	1.51	M SV‘18	1.98	F SV ‘18	3.46
B ‘17	0.00	P $ ‘17	1.38	C ‘19	1.49	F SV ‘19	1.77	F SV ‘19	2.34

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.

Table B.10: Long Term Debt to Equity Contributions to Variation

2017	%	2018	%	2019	%	2020	%	2021	%
BASE CASE									
G $ ‘17	78.54	G $ ‘17	37.39	G $ ‘18	20.95	G SV ‘18	16.04	G SV ‘18	17.59
A $ ‘17	9.01	G $ ‘18	33.80	G $ ‘19	20.57	G $ ‘19	14.50	G SV ‘19	11.16
F $ ‘17	5.29	G SV ‘18	6.22	G $ ‘17	17.15	G $ ‘20	11.61	G $ ‘21	8.57
B ‘17	3.40	A $ ‘17	4.39	G SV ‘18	13.34	G $ ‘18	10.40	G $ ‘20	8.49
P $ ‘17	3.11	A $ ‘18	3.86	G SV ‘19	3.51	G $ ‘17	9.74	G $ ‘19	6.05
C ‘17	0.14	F $ ‘17	2.52	A $ ‘19	2.60	G SV ‘19	8.10	G SV ‘20	5.71
B ‘17	0.00	F $ ‘18	2.42	F SV ‘18	2.56	F SV ‘18	3.31	G $ ‘18	5.27
B ‘17	0.00	B ‘18	1.79	A $ ‘18	2.51	G SV ‘20	2.31	G $ ‘17	5.05
BD ‘17	0.00	P $ ‘17	1.44	A $ ‘17	2.13	F SV ‘19	1.77	F SV ‘18	3.56
B ‘17	0.00	P $ ‘18	1.39	A SV ‘18	1.39	A SV ‘18	1.77	F SV ‘19	2.31
SEVERE CASE									
G $ ‘17	47.38	G $ ‘17	27.10	G $ ‘19	20.55	G $ ‘19	13.23	G SV ‘18	11.48
B ‘17	33.41	G $ ‘18	24.87	G $ ‘18	17.50	G $ ‘20	12.04	G $ ‘21	8.91
A $ ‘17	5.89	B ‘18	17.09	G $ ‘17	11.86	G SV ‘18	10.47	G $ ‘20	8.07
F $ ‘17	3.43	G SV ‘18	3.71	G SV ‘18	8.39	G $ ‘18	8.77	G SV ‘19	7.94
C ‘17	2.36	B ‘17	3.65	B ‘19	3.55	G $ ‘17	7.31	G $ ‘19	6.37
P $ ‘17	1.98	A $ ‘18	3.15	A $ ‘19	3.05	G SV ‘19	5.63	G $ ‘18	4.48
BD ‘17	0.16	A $ ‘17	3.01	G SV ‘19	2.64	F SV ‘18	2.79	G SV ‘20	4.45
B ‘17	0.00	F $ ‘18	1.89	B ‘19	2.44	B ‘20	2.29	G $ ‘17	4.01
B ‘17	0.00	F $ ‘17	1.80	F SV ‘18	2.08	G SV ‘20	2.00	F SV ‘18	3.01
B ‘17	0.00	C ‘17	1.49	A $ ‘18	1.97	F SV ‘19	1.74	F SV ‘19	2.25

Notes: $ stands for price distribution, SV stands for sales volume distribution, M stands for the Margin distribution, A stands for Agronomy, F stands for Fertilizer, P stands for Petroleum, G stands for Grain, B stands for the Base Interest rate, C stands for the additional interest rate based on the credit rating score and BD stands for Bad Debt.