

The feasibility of a DRP margin private product

by

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ABSTRACT

The Dairy Revenue Protection (DRP) of the Federal Crop Insurance Program offered by Risk Management Agency had grown from \$95 million in premium in 2019 reinsurance year to \$221 million in premium for the 2020 reinsurance and \$399 million for the 2021 reinsurance year. With Dairy Revenue Protection being a federally subsidized program and rated by the Risk Management Agency, there is little that an Approved Insurance Provider (AIP) can do to differentiate itself in the market other than to compete with other AIP's in offering the best service and/or creating differentiation by the means of non-subsidized private insurance products. The tactic of creating private products to differentiate an AIP from the market of competitors has worked before for AIPs, but also can have costly consequences if not rated and marketed appropriately.

The purpose of this thesis is to study the feasibility of the DRP private product, DRP Margin Plus, in terms of whether a 65% loss ratio could be achieved and comparatively priced to other risk management tools. The past performance history of Livestock Gross Margin - Dairy, Dairy Revenue Protection, and Dairy Margin Coverage will be evaluated and DRP Margin Plus performance will also be evaluated using the 2019-2021 reinsurance years of livestock gross margin-based feed prices with the volumes of DRP sold to assess how Dairy Margin Plus would have performed. The feasibility of the private product is evaluated based on its loss ratio and its payouts by comparing with those of the alternative products.

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CHAPTER I: INTRODUCTION

The Dairy Revenue Protection (DRP) program is one of the insurance products in the Federal Crop Insurance Program offered by the Risk Management Agency (RMA). The DRP program had grown from \$95 million in premium in 2019 reinsurance year to \$399 million in premium for the 2021 reinsurance year. The DRP program is a federally subsidized program and the RMA administers the program by setting up the rule and the premium rates.

As an Approved Insurance Provider (AIP), there are not many management and marketing strategies it can do to differentiate itself in the market other than to compete with other AIP's in offering the best service and/or creating differentiation by the means of non-subsidized private insurance products. The tactic of creating private products to differentiate an AIP from the market of competitors has worked before for approved insurance providers, but also can have costly consequences if not rated and marketed appropriately.

Furthermore, Dairy farmers who have purchased DRP and cannot purchase another federal insurance product such as Livestock Gross Margin (LGM) – Dairy. That is, with DRP, the need for the ability to lock in their income over feed cost margin can exist. A private product, Dairy Revenue Protection – Margin Plus, which is the product that this thesis investigates, can provide such need.

The purpose of this thesis is to study the feasibility of the DRP private product, DRP Margin plus. The main gauge of the feasibility is whether the hypothetical performances based on historical data would indicate a competitively priced premium rate to maintain a 65-80% loss ratio. DRP Margin Plus performance is also evaluated using the

past 3 years of Class III and Class IV milk prices and feed prices to assess how this private product would have performed. The feasibility of the Dairy Margin plus as a private product can be determined based on examining the main risk management tools that are already in the market now for Dairy producers such as DMC, DRP, and LGM-Dairy. DRP is the base product that DRP Margin Plus will be based on and will require a DRP base policy.

CHAPTER II: LITERATURE REVIEW

Recent studies such as Fiechter and Ifft (forthcoming) document empirical evidence on the need of risk management tools for the dairy producers. Fiechter and Ifft (forthcoming) show that there is a negative relationship between the trade credit use of dairy producers and the milk price. While the recent policy changes encourage the development of the risk management tools for the dairy producers, there has been relatively thin literature on the risk management tools for the US dairy producers.

Wolf (2012) discusses the growing volatility in milk prices and feed prices and the greater need for dairy producers to engage in risk management. Engagement in the use of risk management tools by dairy producers was inversely affected by the dairy producers age, entity status of a sole proprietorships, basis, and smaller herd size. Dairies that were part of coops that engaged in risk management practices could take advantage of economies of scale and have the coops manage futures contracts as well as managing margin calls. Wolf (2012) did mention that the need for affordable subsidized risk management tools such as LGM – Dairy being a useful tool for dairies to utilize for risk management pending the available funding in the future farm bills.

Burdine (2020) presents the differences between the dairy risk management tools available, and argues that LGM - Dairy is a better risk management tool when the margins between feed and milk prices are bigger, while the Dairy Margin Coverage Program is more beneficial when the gap between the “all milk price” and feed prices is smaller than the futures market gap.

Bozic (2020) describes a particular risk management strategy to use with Dairy Revenue Protection which was described as “minimize regret”, which was described as a

five-step process which starts with looking at prices every two weeks, if the prices are desirable then to hedge five percent of the projected marketing's or more. If the prices are not as desirable, then hedge two percent of the marketings. Target having sixty-five percent of the milk declared covered three to four months before the start of a quarter with the protection factor at one hundred and fifty percent. The goal was to leave thirty five percent of milk marketings available in the last three to four months for 'opportunistic hedging'. Bozic (2020) described using the protection factor with dairy revenue protection at a hundred fifty percent so that a dairy farmer could cover all their marketing by only using sixty five percent of the milk marketing, and as said leave the other thirty five percent available to use for more opportunities for higher milk prices.

Prager et al. (2020) focuses on the use of futures, options, and marketing contracts by farmers. The study found that less than half of 1 percent of cattle and milk producers used corn and soybean contracts, which could indicate a use and need for DRP margin plus for use as a risk management tool for dairies. Some other interesting finds of the study was that small farms which were operations under \$350 thousand, that .7% used futures contracts, while that number jumped up in used for medium size farms that 11.8% used for farms that were from \$350,000 to \$1,000,000, and that 27% farms that were considered large or over \$1,000,000 used futures contracts. The farms that did utilize futures contracts also tended to have on-site storage for their grain and were more likely to use marketing contracts as well. The paper went over some of the pros and cons of using futures with the money needed for margin calls being a one of the downsides and that the contract sizes of futures sometimes are too large for smaller farmers. Options prices also has the downside of being too big for smaller some farms, but the upfront premium cost was a barrier to

entry, which would DRP Margin plus an advantage for dairies in the way that premium for insurance could be due at more flexible times for dairy farmers.

MacDonald et al. (2020) discuss the structural and geographics changes that are happening in the US dairy industry and the factors that have driven some of those structural and financial shifts. They discuss Dairy Margin Coverage as a policy result of the number of dairy operations closing. Sumner, Balagtas, and Yu (2013) describes the origin of the DMPP, which is the previous version of the DMC.

CHAPTER III: DISCUSSION OF EXISTING DAIRY RISK MANAGEMENT TOOLS

3.1. Dairy Risk Management Tools

Currently, there are three federally-supported risk management tools for dairy producers, Dairy Revenue Protection (DRP), Livestock Gross Margin (LGM) – Dairy, and Dairy Margin Coverage (DMC) (NMPF, n.d.). The DRP and LGM – Dairy programs are part of the Federal Crop Insurance Program (FCIP) and the DMC is a Farm Service Agency program, which is part of the Dairy Title in the Farm Bill. This chapter provides the overview of these three tools.

3.2. Dairy Revenue Protection (DRP)

Dairy Revenue Protection (DRP) is an area-based revenue production insurance product that protects the revenue of milk production for a dairy operation. Protection is based on quarterly revenue from milk sales in relation to the guaranteed coverage level. Expected revenue is tied to the futures prices for milk and dairy commodities, and the amount of covered milk production elected by the dairy producer. The milk production is indexed based on the region where the dairy production takes place. The pricing is based on the class pricing that can be done on a combination of class III and IV milk prices to base indemnities and coverage. Component based milk pricing is also available which is the milk prices for butterfat, protein, and the other solids as a basis for determining coverage and indemnities (RMA). The price on the component option is based on the butterfat test percentage and protein test percentage to establish the insured milk price.

Dairy farmers can purchase coverage on business days that the RMA posts prices and sales will be available from 4:30 pm CDT to 9 am CDT the following day to purchase

coverage based off those prices for up to five quarterly coverage endorsements in the future. Each crop year ranges from July 1st to June 30th of the following year in which insureds can have the opportunity to purchase coverage based on the class III, IV, and component milk prices with eight quarters available to purchase in that time frame, but only up to five available to purchase in the future. Milk production is covered under DRP based on an index by regions or state where the dairy farm is located.

DRP acts like a put option in the way that it sets up a price floor for the milk based on the daily CME prices the respective coverage level, and the protection factor that the insured selects. DRP is subsidized based on coverage level. Coverage levels at 80%, 85%, 90%, and 95% are subsidized at the 55%, 49%, 44%, and 44% levels, respectively.

DRP payout is determined as follows:

$$\begin{aligned} \text{Payout} &= (\text{Expected Prices} - \text{Realized Price}) * \text{Production Base} * \\ &\text{Coverage level} * \text{Protection Factor if } \text{Expected Price} > \text{Realized Price}, \\ &= 0 \text{ if } \text{Expected Price} \leq \text{Realized Price}. \end{aligned}$$

DRP has only been around since the 2019 crop year but has had an increasing participation rate since inception with 3,895 policies in 2019, 4,918 policies in 2020, 5,587 policies in 2021, and 5,386 policies in 2022 thus far. The amount of premium has increased since inception with \$95.1 million in premium in 2019, \$293 million in 2020, \$398.5 million in 2021, and \$322.9 million as of 4/4/2022 in 2022. The indemnity payments have also increased since the inception with \$69.3 million in 2019, \$464.9 million in 2020, and \$108.5 million in 2021 as of April 9, 2022.

3.3. Livestock Gross Margin (LGM) – Dairy

Livestock Gross Margin (LGM) is a margin-based dairy insurance plan that guarantees a minimum gross margin. The LGM program is administered by the RMA as it is part of the FCIP. The way that it works is that a claim is triggered if the gross margin guarantee at the beginning of the contract period is higher than the actual gross margin at the end of the contract period.

LGM insurance can be purchased on Thursday when the RMA posts the rates and prices to 9 am on Friday. Dairy producers can purchase coverage for their milk to be sold from two to eleven months in the future. To qualify for a subsidy a dairy producer must purchase at least two months of coverage. Multiple policies are allowed for coverage to be purchased at different sales closing dates throughout the year. Since dairy producers can only purchase coverage at a minimum of two months in the future, coverage will not attach until one month after purchase.

Premium is due at the end of the insurance period, and insureds are required to document and submit their milk marketing reports by the sales closing of each month to document the actual marketing's over the course of the period of insurance. The indemnities are triggered based on the expected gross margin, actual gross margin, and the deductibles, and after the last month of the LGM policy. The deductibles range from zero to two dollars per hundredweights in ten cent increments and the subsidy ranges from eighteen to fifty percent based on the deductible. The higher the deductible, the more subsidy will be applied to premium. There is no minimum for the hundredweight of milk insured per month. The gross margin is based on the difference of the class III milk price

and the corn and soybean meal futures contracts. LGM-Dairy cannot have coverage on the same months that are covered in quarters of DRP.

LGM payout is determined by this formula:

$Payout = Production\ Base * (Margin\ Guarantee - Margin - Deductible)$ if
 $Margin < Margin\ Guarantee - Deductible,$
 $= 0$ if $Margin \geq Margin\ Guarantee - Deductible.$

Though both LGM and DMC are margin-based products, there are some key differences between the two products in how they work and what they cover. LGM is market-based margin based off futures prices while DMC is a fixed margin. DMC is all milk price while LGM is just the class III price. The feed that the margins are covering are also different with LGM-Dairy the default feed is 28 pounds of corn and 4 pounds of soybean meal which can be changed, while DMC uses 60.1 pounds of corn, 14.7 pounds of soybean meal, and it also includes 27.4 pounds of alfalfa hay.

There have only been on average about 1480 policies sold each since 2015 with 2,089, 1,637, 1,622, 1,070, 1,232, 1,230, 1181, and 1308 policies sold during the commodity years 2015 through 2022, respectively. The total premium amount for Livestock Gross Margin was \$22.3 million, \$7.1 million, \$6.5 million, \$6.1 million, \$2.1 million, \$4.9 million, \$15.8 million, and \$12.9 million in the 2015-2022 crop years respectively. The indemnity payments for Livestock Gross Margin from 2015 through 2022 so far have been \$16.7 million, \$8.7 million, \$4.9 million, \$5.4 million, \$2.4 million, \$3.7 million, \$5.5 million, and \$201,621 respectively. The loss ratio from 2015 through 2022 respectively was .74, 1.21, .75, .90, 1.32, .76, .348, and .0155. These numbers for LGM were just for LGM Dairy Cattle, not the other LGM products.

3.4. Dairy Margin Coverage (DMC)

Dairy Margin Coverage (DMC) is a margin-based Farm Service Agency product that guarantees the margin selected by the producer between the average feed cost and the all-milk price. DMC is originated from the Dairy Margin Protection Program (DMPP) in the 2014 Farm Bill, which replaced the Milk Income Loss Contract program (Sumner, Balagtas, and Yu, 2016).

Insureds can purchase it between Catastrophic (CAT) coverage at sixty five percent all the way to ninety five percent level. Dairy farmers can lock in coverage levels until 2023 at a 25 percent premium discount. Payments can happen monthly pending if the difference between the “all milk price” and the average feed price for a month falls below the margin level selected by the producer. Coverage level is dependent on production history which needs to be determined by the Farm Service Agency, and most operations production history is determined by the highest milk production in 2011, 2012, and 2013, while newer dairy operations have other options for determining production history.

Catastrophic coverage at the \$4 margin coverage level for Dairy Margin Coverage is at no cost other than a \$100 administrative fee, with a schedule table of premiums for various levels of coverage at two tiers of coverage level, Tier 1 for 5 million pounds or less and Tier 2 for 5 million pounds or more if the \$8.50 margin level is selected at the Tier 1 level. Both tiers of Dairy Margin Coverage level premium are considered when making premium amounts for DRP-Margin coverage. The election of coverage level and coverage percentage is elected once, which is applied to each calendar year from 2019-2023 will receive a 25 percent off premium if elected through 2023.

In the first year of the DMPP, which is 2015, about 81% of the total US milk production and 55% of the total operation has been covered by the DMPP (Sumner, Balagtas, and Yu 2016). Among the enrolled, 42% of the production and 57% of the operation chose the Buy-up margin coverages, which have positive farm-paid premiums. Sumner, Balagtas, and Yu (2016) also finds that the shares of enrolled in the Buy-up coverages are higher among the states with smaller dairy farms.

DMC is part of the 2018 Farm Bill and replaced the DMPP. DMC has lower premium costs and wider margin coverage range from \$4-\$9.50 in \$.50 increments. The amount of production coverage was expanded in the 2018 Farm Bill. DMPP only had coverage available from 25-90 percent in 5 percent increments, while DMC now offers from 5-95 percent in 5 percent increments.

One of the big differences that came with the 2018 Farm Bill from DMC to DMPP was the removal of the restrictions for dairy farmers to be able to also use the DRP and LGM - Dairy with DMC. The removal of the restrictions for policy holders of DMC to also be able to get DRP is factor that will be a competing factor for a DRP-Margin private product which would have to compete against the ability of dairy farmers to get DMC and DRP.

Dairy Margin Coverage Formula payout is determined by the following formula

*Payout = Production Base * (Margin Guarantee – Margin) if*

Margin Guarantee > Margin

= 0 if Margin Guarantee ≤ Margin.

For example, if Margin Coverage Guarantee is \$9.50, and Margin is \$8 then payout is \$1.50 * Production Base.

The DRP, LGM – Dairy, and DMC programs have seen varying degrees of participation of US dairies in 2019 and 2020 crop years. DMC had a high participation rate with 83.6% of dairy operations in the United States participating. The 2019 program year for DMC expecting \$313,893,681 in payments that a total of 23,410 operations receiving with an average payment of \$13,409. For the 2020 year there was a 48% enrollment rate of U.S. dairy operations with 13,484 operations receiving \$234,006,404 in total payments with an average payment of \$17,354. In 2021 there was 73.7% enrollment rate with 19,053 operations receiving \$1,191,116,085 in total payments with operations being paid on average \$62,516. In 2019, DMC has triggered payments in January, February, March, April, May, June, and July.

CHAPTER IV: DAIRY REVENUE PROTECTION MARGIN PLUS

4.1. Dairy Revenue Protection (DRP) Margin Plus Description

DRP Margin Plus works like LGM but the margin that is based on Class III and Class IV milk prices and the corn and soybean meal prices can be locked in. The product is intended to work as a supplemental private product with a DRP policy. The DRP Margin Plus acts as a put option protecting against milk price decreases. The DRP Margin Plus protects DRP policy holders who have protection from Class III and Class IV milk prices from going down, but who do not have margin protection from feed costs going up. To protect from double insurance payment, indemnity will be due only when feed costs rise and cut into the specified coverage level of margin, making the expected gross margin larger than the actual gross margin and thus causing an indemnity payment for a quarter.

The DRP-Margin Plus differs from LGM in the way that the margin between the class III and IV milk prices and corn and soybean meals prices is linked with the corresponding DRP quarters instead of based on LGM coverage by the month. There are deductibles on par with LGM in terms of deductibles being between zero and two dollars per hundredweights in ten cent increments.

Margin Plus allow smaller dairies to lock in a margin that otherwise did not have the liquidity and the economies of scale to purchase a futures contract, and it allows insured's who do purchase DRP to be able to lock in a market-based margin on their Class III and IV milk. Class III milk can be insured under LGM, but class IV milk cannot be insured under LGM and is not separated from DMC of which typically class III milk makes up 41.7 % of the fluid milk and Class IV is about 14%. DRP Margin plus also allows dairy farmers to lock in a margin on their quarters that they had purchased DRP and are not

allowed to purchase LGM coverage for. DRP Margin plus also allows for Dairy Farmers to lock in market-based input prices that DMC only covers a non-market based fixed range.

The DRP Margin Plus payout is determined as follows:

$$\text{Payout} = \text{Production Base} *$$

(Realized Feed Price - Expected Feed Price - Deductible) if

Realized Feed Price > Expected Feed Price - Deductible,

= 0 if Realized Feed Price < Expected Feed Price - Deductible.

In the remaining parts of the thesis, I provide the results from the feasibility study, which is a preliminary investigation that is based on historical data and estimates the premium rates that can possibly reach the .65 loss ratio. The premium rates and payouts are reported in sections 4.2. and 4.3. Then the rates are compared with those of the alternative dairy risk management tools in Chapter V.

4.2 Premium Rates

Table 4.1 shows the rates from the feasibility study. In column (1), the base premium rates, which is the premium rate that achieves the .65 loss ratio, are reported for each of the corresponding deductibles on the left hand side, and to get the rate for the 65% loss ratio the actuarially fair premium rate (Expected losses = premium) is divided by 65%. Since DRP Margin plus would be a lower cost product without the need loss adjusters, other rates were explored for what the rates would be at higher loss ratios. The rates for the higher loss ratios were found by multiplying the base rate column by 65% to get back to the pure premium rate and then divided by the 70%-90% columns in 5% increments to reflect what the rates would be if higher loss ratios were tolerated.

The rates are derived by the following formula:

$$\text{Historical Losses Per CWT} = \sum(\text{Expected Feed Price} - \text{Realized Feed Price} - \text{Deductible Amount}) * I(\text{Expected Feed Price} - \text{Realized Feed Price} - \text{Deductible Amount} > 0),$$

$$\text{Premium Rate} = \frac{\text{Historical Losses Per CWT}}{\text{Desired Loss Ratio}}$$

Table 4.1 Rates by Deductible level and Loss Ratio

| Deductible CWT Milk for Feed Portion | Base Rate (Premium CWT for .65 Loss Ratio) (1) | Premium CWT for 70% Loss Ratio (Base Rate Column* .65/.7) (2) | Premium CWT for 75% Loss Ratio (Base Rate Column* .65/.75) (3) | Premium CWT for 80% Loss Ratio (Base Rate Column* .65/.8) (4) | Premium CWT for 85% Loss Ratio (Base Rate Column* .65/.85) (5) | Premium CWT for 90% Loss Ratio (Base Rate Column* .65/.90) (6) |
|--------------------------------------|---|--|---|--|---|---|
| \$ - | \$ 0.6044 | \$ 0.5612 | \$ 0.5238 | \$ 0.4911 | \$ 0.4622 | \$ 0.4365 |
| \$ 0.05 | \$ 0.5557 | \$ 0.5160 | \$ 0.4816 | \$ 0.4515 | \$ 0.4249 | \$ 0.4013 |
| \$ 0.15 | \$ 0.4780 | \$ 0.4439 | \$ 0.4143 | \$ 0.3884 | \$ 0.3656 | \$ 0.3453 |
| \$ 0.25 | \$ 0.4134 | \$ 0.3839 | \$ 0.3583 | \$ 0.3359 | \$ 0.3161 | \$ 0.2986 |
| \$ 0.35 | \$ 0.3542 | \$ 0.3289 | \$ 0.3069 | \$ 0.2877 | \$ 0.2708 | \$ 0.2558 |
| \$ 0.50 | \$ 0.2765 | \$ 0.2567 | \$ 0.2396 | \$ 0.2246 | \$ 0.2114 | \$ 0.1997 |
| \$ 0.75 | \$ 0.1829 | \$ 0.1698 | \$ 0.1585 | \$ 0.1486 | \$ 0.1398 | \$ 0.1321 |
| \$ 1.00 | \$ 0.1111 | \$ 0.1032 | \$ 0.0963 | \$ 0.0903 | \$ 0.0850 | \$ 0.0803 |
| \$ 1.25 | \$ 0.0572 | \$ 0.0532 | \$ 0.0496 | \$ 0.0465 | \$ 0.0438 | \$ 0.0413 |
| \$ 1.50 | \$ 0.0265 | \$ 0.0246 | \$ 0.0229 | \$ 0.0215 | \$ 0.0202 | \$ 0.0191 |

4.3. Payout Comparison

Table 4.2 illustrates the average net return from each risk management tool per hundred weight of milk (premium – indemnity per CWT of milk) for the first two quarters of the crop years 2019, 2020, and 2021 with the corresponding Sales closing dates of 10/29/2018, 7/1/2019, and 7/2/2020 which were some of the first available sales closing dates for the 2019 through 2021 crop years for Dairy Revenue Protection. Net payout was determined by per hundred weight indemnity payment or payout for DRP, DRP-Margin Plus, LGM, and DMC minus the premium cost per hundred weights of Milk. The livestock

gross margin sales closing dates were on the last business Friday of the month for the 2019 through 2021 crop years, so the months of the sales closing dates were used as the reference sales month that the LGM coverage was purchased. The LGM payouts and premiums were averaged out over quarters for comparison to DRP and DRP-Margin Plus because LGM margins are based on months. The products in the payout chart all have key differences in the milk prices, feed prices, and mechanisms for triggering payouts.

The milk amounts in the payout chart are all the at the per CWT amount, but the milk prices used in the payout chart are all different based on the respective products. DMC uses the fluid milk price, while LGM only uses the class III milk price. In table 4.2, DRP uses Class III (41% of fluid milk) and Class IV (about 15% of fluid milk) milk at a per CWT ratio of 75% Class III and 25% Class IV milk. DRP Margin Plus is in pace with DRP with the CWT of milk amount as it is the feed input required to produce CWT of milk. The feed that the margin-based products are covering are also different with LGM - Dairy the default feed ration cwt of milk is 28 pounds of corn and 4 pounds of soybean meal which can be changed, while DMC uses 60.1 pounds of corn, 14.7 pounds of soybean meal, and it also includes 27.4 pounds of alfalfa hay as the feed ration to product CWT of fluid milk. DRP Margin plus uses the default LGM feed ration per CWT as well which is the 28 pounds of corn and 4 pounds of soybean meal.

Table 4.2 Quarter average per CWT of milk net payouts 2019-2021

| Net Payout Only | | | | | | | |
|--|---------------------------------|---|----------------------------------|----------------------|-----------------------------------|-----------------------------------|-------------------------|
| All Payouts measured by: (Indemnity – premium(producer))/CWT = Payout per CWT. | | | | | | | |
| Sales Closing Date (DRP Reference) | Quarter or DRP Endorsement | Quarterly Coverage Protection Level) (1.0 Factor) | DRP Margin Plus (.50 Deductible) | LGM (.50 Deductible) | DMC Tier 1(\$7.5 Margin Coverage) | DMC Tier 2(\$7.5 Margin Coverage) | DRP and DRP Margin Plus |
| 10/29/2018 | 2019 Apr - Jun/Yr2 - Qtr2 | -\$0.2000 | -\$0.2800 | -\$0.2900 | -\$0.0900 | -\$1.4130 | -\$0.4800 |
| 10/29/2018 | 2019 Jan - Mar/Yr2 - Qtr1 | -\$0.1000 | -\$0.2800 | -\$0.2200 | -\$0.0900 | -\$1.4130 | -\$0.3800 |
| | 2019 Q1 and Q2 Crop Year | -\$0.3000 | -\$0.5600 | -\$0.5100 | -\$0.1800 | -\$2.8260 | -\$0.8600 |
| 7/1/2019 | 2020 Apr - Jun/Yr2 - Qtr2 | \$1.4900 | -\$0.2800 | -\$0.3600 | \$1.2433 | -\$0.0797 | \$1.2100 |
| 7/1/2019 | 2020 Jan - Mar/Yr2 - Qtr1 | -\$0.2000 | -\$0.2800 | -\$0.2800 | -\$0.0900 | -\$1.4130 | -\$0.4800 |
| | 2020 Q1 and Q2 Crop Year | \$1.2900 | -\$0.5600 | -\$0.6400 | \$1.1533 | -\$1.4927 | \$0.7300 |
| 7/2/2020 | 2021 Apr - Jun/Yr2 - Qtr2 | -\$0.5000 | \$0.3470 | -\$0.2200 | \$0.9200 | -\$0.4030 | -\$0.1530 |
| 7/2/2020 | 2021 Jan - Mar/Yr2 - Qtr1 | -\$0.4000 | \$0.0190 | -\$0.1800 | \$3.2800 | \$1.9570 | -\$0.3810 |
| | 2021 Q1 and Q2 Crop Year | -\$0.9000 | \$0.3660 | -\$0.4000 | \$4.2000 | \$1.5540 | -\$0.5340 |
| | Overall Payout to date: | \$0.0900 | -\$0.7540 | -\$1.5500 | \$5.1733 | -\$2.7647 | -\$0.6640 |

The coverage structures mechanisms for indemnity varied differently between each of the products in table 4.2. DRP Margin Plus in the payout chart used the premium costs and indemnity payments based on the feed input costs to produce 100 pounds of Class III Milk with a \$.50 deductible. DRP Margin plus only paid when the realized feed price minus the deductible. DRP in the payout chart used the 95% coverage level for payout with a 1.0 payment factor with using a ratio of 75% Class III and 25% Class IV milk prices combined via a weighted average to establish the guaranteed combined class IV and III price per cwt of milk. With DRP using 95% coverage for price protection and DRP Margin Plus protecting feed costs with a \$.50 deductible it compared easiest with LGM coverage at the \$.50 deductible level which protects the same feed input as DRP Margin Plus, but only protects the class III milk for milk price protection. The Dairy Margin Coverage for the 4.2 Net Payout Chart used the fluid milk price cwt with a \$7.5 margin cwt which covered a feed ration which included 27.4 pounds of alfalfa hay, 60.1 pounds of corn, and 14.7 pounds soybean meal for the feed price to establish margin.

When looking at the performance of Dairy Margin plus for Quarters 1 and 2 of 2019 it had a negative per cwt of milk payout of -\$0.28 for each of those quarters. When DRP Margin Plus was combined with the same quarters of DRP the negative net payout was even bigger as DRP had a net payout of -\$0.10 cwt for quarter 1 and -\$0.20 for quarter 2, which would give DRP with Margin Plus a combined negative payout of -\$0.38 and -\$0.48 for quarters 1 and 2 respectively. LGM – Dairy payout for quarters 1 and 2 of 2019 were -\$0.22 and -\$0.29 respectively which was only \$0.05 more of a payout when compared to DRP Margin Plus, but a combined \$0.30 more of a payout/cheaper CWT of milk then DRP and Margin Plus combined, though again LGM – Dairy only uses Class III milk per CWT

while the DRP coverage was Class III and IV milk at the per CWT. Dairy Margin plus when compared against Dairy Margin coverage for Q1 and Q2 of 2019 was less of a payout as DMC tier 1 had net payouts $-\$.09$ each, which was the premium cost for DMC tier 1, though DMC tier 2 was the costliest net payout performance with a negative payout (just premium) of $-\$1.41$ cwt of fluid milk for Q1 and Q2 of 2019, which was more costly than DRP with Margin Plus at the same time which was as stated earlier $-\$.38$ and $-\$.48$ for quarters 1 and 2 respectively.

When looking at the performance of Dairy Margin plus for Quarters 1 and 2 of 2020 it had a negative per cwt of milk payout of $-\$.28$ for each of those quarters. When DRP Margin Plus was combined with the same quarters of DRP the net payout was positive as DRP had a net payout of $-\$.20$ cwt for quarter 1 and $\$1.49$ for quarter 2, which would give DRP with Margin Plus a combined positive net payout of $\$1.21$ and $-\$.48$ for quarters 1 and 2 respectively at the per cwt of milk. LGM – Dairy payout for quarters 1 and 2 of 2020 were $-\$.28$ and $-\$.36$ respectively which was only $\$.08$ less of a payout when compared to DRP Margin Plus, but a combined $\$1.37$ less of a payout/cheaper CWT of milk than DRP and Margin Plus combined, though again LGM – Dairy only uses Class III milk per CWT while the DRP coverage was Class III and IV milk at the per CWT. Dairy Margin plus when compared against Dairy Margin coverage for Q1 and Q2 of 2020 was less of a payout as DMC tier 1 had net payouts $-\$.09$ for Q1 and $\$1.24$ for Q2 which outperformed DRP with Margin Plus by $\$.42$ for both quarters, though DMC tier 2 was the costliest net payout performance with a negative payout (just premium) of $-\$1.41$ cwt of fluid milk for Q1 and $-\$.0797$ for Q2 of 2020, which was more costly than DRP with Margin Plus at the same time which was as stated earlier $-\$.48$ and $\$1.21$ for quarters 1 and 2

respectively.

When looking at the performance of Dairy Margin plus for Quarters 1 and 2 of 2021 it had a positive per cwt of milk payout of \$.019 for Q1 and \$.347 for Q2. When DRP Margin Plus was combined with the same quarters of DRP the net payout was negative as DRP had a net payout of $-\$.40$ cwt for quarter 1 and $-\$.50$ for quarter 2, which would give DRP with Margin Plus a combined negative net payout of $-\$.38$ and $-\$.153$ for quarters 1 and 2 respectively at the per cwt of milk. LGM – Dairy payout for quarters 1 and 2 of 2021 were $-\$.18$ and $-\$.22$ respectively which was a $\$.76$ less of a payout when compared to DRP Margin Plus and a combined $\$.09$ less of a payout/cheaper CWT of milk then DRP and Margin Plus combined, though again LGM – Dairy only uses Class III milk per CWT while the DRP coverage was Class III and IV milk at the per CWT. Dairy Margin plus when compared against Dairy Margin coverage for Q1 and Q2 of 2021 was less of a payout as DMC tier 1 had net payouts $\$3.28$ for Q1 and $\$.92$ for Q2 which outperformed DRP with Margin Plus by $\$3.84$ for both quarters, though DMC tier 2 the net payout performance of $\$1.95$ cwt of fluid milk for Q1 and $-\$.403$ for Q2 of 2021, which was less costly than DRP with Margin Plus at the same time which was as stated earlier $-\$.381$ and $-\$.153$ for quarters 1 and 2 respectively.

Some of the variance in the payout chart is the variation in the rates of the products and what they cover. DRP rates are the most variable in cost ranging from $\$.10$ to $\$.50$, but they lock in the Class III and IV milk market prices, while Margin plus locks in the feed costs like LGM. LGM only locks in the margin between class III only and feed prices. Similar DMC is a fixed margin program only it covers the fluid milk price and is the cheapest of all the programs at the tier 1 level. DRP with DRP margin plus do not insure

the margin as much in the way that margin plus can pay a claim for feed prices and while
DRP may not pay at all and milk prices soar. Both DRP and margin plus can pay
independently and adjust the coverage thresholds for feed and milk independently.

CHAPTER V: DISCUSSION

The main measure of feasibility for the dairy margin plus insurance product is whether the insurance premium charged to maintain a 65-90% loss ratio is equal to the option premium that would be charged on livestock gross margin premium costs, Dairy Margin Costs, and soybean meal and corn option contracts.

The main formula for determining the insurance premium to charge is premium equals losses plus loss adjustment expenses plus underwriting expenses plus underwriting profit Werner (2020). Since the exact expenses to run DRP Margin Plus are not known, the loss ratio range to determine feasibility was measured at 65% to 80% to cover assumed expenses. The loss ratio was determined by calculating the would-be losses if DRP Margin Plus was in place in the 2019 to 2021 reinsurance years.

The DRP volume of cwt of class III and IV milk sales by effective date was used as a reference against the daily price offerings of the LGM feed prices offered. The volume of DRP Margin plus was based on the cwt sales of DRP for class III and IV from October of 2019 to July of 2021. The feed prices are based on soybean meal and corn daily price offerings. A loss is triggered for DRP Margin Plus by the LGM feed prices going higher than the covered feed price and the applicable deductible. The feed prices for livestock gross margin were looked at from the beginning of DRP sales in October of 2018 until July 1st of 2021. LGM feed prices are based on the feed required to make a hundred pounds of milk, which the default is set at .014 tons of corn and .002 tons of soybeans meal, which are added together to get the feed price.

Since DRP Margin Plus is a supplemental private product that is sold in step with DRP, the DRP effective dates were used as feed price reference dates for corn and soybean

meal. The DRP quarterly coverage endorsements that represent the quarters available to insure under DRP served as the feed price reference period in which the average feed price was determined and would be the quarter realized price. If the quarter realized price was found to be higher than the locked in feed price based on the day of sale prices of corn and soybean meal, then an indemnity would be due if the average price for the quarter is also above the deductible. The DRP Margin Plus sales volumes were based on the class III and IV sales volumes of DRP from October of 2018 to March 15th of 2021.

Indemnity was determined by setting deductible levels at \$0, \$.05, \$.15, \$.25, \$.35, \$.50, \$.75, \$1.00, \$1.25, and then \$1.50. The deductible levels for DRP Margin plus are like the livestock gross margin deductibles that range from a \$0 - \$2 deductible for the feed to produce a 100 pounds of milk. A loss is triggered based on if the feed reference price (feed price locked in) was lower than the deductible plus the average realized feed price for the quarter being locked. Liability for Margin Plus was determined based on the locked in reference price multiplied by the declared covered milk production for the referenced effective date and quarterly coverage endorsement. Various levels of loss ratios were also analyzed from a 65%-90% levels at 5% increments to see what the impact on the insurance premiums would be at the difference loss ratio tolerances based on the insurance premium equation of premium equals losses plus underwriting expenses and profits.

Based on the results of the analysis in table 4.1., the calculated DRP Margin Plus insurance premiums were found to be \$.60, \$.56, \$.48, \$.41, \$.35, \$.28, \$.18, \$.11, \$.06, and \$.03 at the \$0, \$.05, \$.15, \$.25, \$.35, \$.50, \$.75, \$1.00, \$1.25, and \$1.50 deductibles respectively. The loss frequency at 40.086% occurrence at the \$0 deductible, but was

30.558%, 27.011%, 16.544%, 9.536%, and 6.472% at the \$.15, \$.35, \$.75, \$1.25, and \$1.50 deductibles.

Comparing rates to that of LGM, DMC, and DRP with average option premium, DRP average premium for the 95% coverage level was \$.26. for 2022 QRT 1, \$.33 for 2022 QRT 2, \$.37 for 2022 Quarter 3, and \$.38 for Quarter 4 as shown in Table 5.1. The average option premium for options based on the livestock gross margin feed price was \$.235 based on the available options on 9/10/2021 of soybean meal and corn. The Dairy Margin Coverage program put out by the Farm Service Agency is different as in the coverage levels are pre-determined and fixed costs and the margin coverage is fixed at nonmarket based margins with feed prices of corn, soybean meal, and alfalfa hay, only the default feed quantities are different for DMC with 60.1 lbs of corn, 14.7 lbs of soybean meal, and 27.4 lbs of alfalfa hay. DMC premium levels range from \$0 with \$4 margin to \$.15 for \$9.50 margin coverage up to 5 million pounds. Based on a presentation done by McConnell (2020) the average livestock gross margin dairy premium ranged from fifteen cents to thirty cents per hundred weights depending on the length and deductible. Based off the premium comparisons Dairy Margin Plus is comparable in costs to the other available insurance products and is comparable in costs to option premiums, only it has the advantage of not requiring a full options contract lock in feed protection.

Table 5.1 Premium Rate Comparison (per CWT of milk)

| Average Premium CWT | Dairy Revenue Protection | DRP Margin Plus | LGM | DMC Tier 1 | DMC Tier 2 | |
|------------------------------------|---|--------------------------------|------------|-------------------|-------------------|------|
| 2019 | \$ 0.21 | \$ 0.28 | \$ 0.32 | \$ 0.09 | \$ | 1.41 |
| 2020 | \$ 0.28 | \$ 0.28 | \$ 0.30 | \$ 0.09 | \$ | 1.41 |
| 2021 | \$ 0.41 | \$ 0.28 | \$ 0.33 | \$ 0.09 | \$ | 1.41 |

CHAPTER VI: CONCLUSION

There is a need in the dairy insurance industry for a product that can provide feed input risk protection for dairy producers that have purchased dairy revenue protection. Most dairy producers do not engage with hedging in the market with call options, yet about thirty to forty percent of dairies were considered high risk with debt. Market based insurance protection with DRP to cover price of class III and IV milk combined with DRP Margin plus to lock in price protection for feed inputs can give dairy farmers greater flexibility in input risk protection.

Based on the results of the feasibility investigation, the question as to whether DRP Margin plus is feasible when comparing costs to other risk management options and insurance products. DRP Margin Plus fills gaps that are in the market for dairy farmers that are trying to hedge their feed price further into the future than LGM allows and do not have the economies of scale to purchase futures contracts, and class IV milk feed protection.

The thesis answered the question that DRP Margin Plus is feasible based on the 65% loss ratio rate with 80% (about a \$.50 deductible) is a reasonable price when compared to the alternatives, but to implement the product there would need to be further development in properly rating via Monte Carlo simulations of price outcomes based on the respective futures contract prices for feed that the dairy farmers are trying to lock in which would be a future market condition. The DRP Margin rating method in the thesis was purely investigative in respects that it purely looked at the historical costs if DRP Margin was in place and not based on a future market condition.

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