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Do Large Farms Make Better Choices: Evidence from Dairy Margin

Coverage Program Participation Patterns

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Abstract

Risk management has been a centerpiece of the US farm policy since the Agricultural Act of 2014. We study the Dairy Margin Coverage (DMC) program utilizing a unique operation-level participation data. By investigating the participation and the choice decisions of the dairy operations in US, we find that larger operations are more likely to participate in DMC and also to make margin coverage choices that maximize the net returns.

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1. Introduction

Risk management programs have been the dominant form of farm payment programs since the Agricultural Act of 2014. The 2018 Farm Bill authorizes the new Dairy Margin Coverage (DMC) program, which replaces the Margin Protection Program for Dairy. The DMC program is a voluntary program that provides a payment to participating dairy producers based on the realization of the milk price over feed cost margin index contingent on the program choices of dairy producers. As the DMC program is the core of the federal dairy policy, it is important to understand how dairy producers are making the program choices and how the choices are related to the farm sizes as it provides insights on the budgetary implications of the program.

In this paper, we investigate the participation patterns of the DMC program among the US producers by utilizing a unique and novel farm-level dataset that combines the DMC program participation data and the population of dairy producers. With the unique dataset, we document the participation patterns and examine whether the larger farms make the program choices that result in greater returns from the program. By doing so, we draw the distributional and budgetary implications of the DMC program.

As the program is relatively new, the literature is thin. Newton et al. (2016) provide *ex-ante* simulation analyses of the MPP to assess the potential cost of the program. Similarly, Mark et al. (2016) show how the MPP can change the margins and downside risk. Recently, with the changes from MPP to DMC, Zulauf and Wolf (2018) indicate that the program change would lead to more payments in general and provide greater payments to small operations measured as dollar per hundredweight. To our knowledge, individual program choices have not been empirically examined. We contribute to the literature by providing the first set of empirical estimates on how the operation size and the program choices are related.

2. Background: Dairy Margin Coverage (DMC)

The DMC program is a voluntary risk management program. It provides a payment to dairy producers based on the realization of a dairy margin, which is computed as an index of the milk price over feed cost and the payment is contingent on the program choices of dairy producers. All dairy operations in the United States are eligible for the DMC program.¹ An eligible dairy operation must have a production history determined by the USDA Farm Service Agency (FSA) and register to participate during the signup announced by FSA.² The administrative fee for DMC participation is \$100 per year.³

DMC coverage levels range from \$4.00 to \$9.50 per hundredweight in \$0.50 increments. A dairy farmer can choose to enroll a certain percentage of the dairy operation's production history ranging from 5 percent to 95 percent, in 5 percent increments (USDA FSA 2019). When enrolling in the DMC program, a dairy producer chooses the coverage level, the share of their production history that they would like to enroll in the program, and the margin level-the margin below which the program payments are triggered. Dairy producers can choose one margin level for the first 5 million pounds of the production history (Tier 1) and another for the production history exceeding 5 million pounds (Tier 2). DMC provides catastrophic coverage at \$4.00 per cwt for both Tiers at zero premium. Farm-paid and subsidized premiums are different across margins and tiers.⁴ The schedule of premiums is provided in table 1.

¹ An operation can be run either by a single producer or multiple producers who commercially produce and market cows' milk.

² For most operations, production history is based on the highest milk production in 2011, 2012, and 2013.

³ The limited resource, beginning, socially disadvantaged, or veteran farmers and ranchers qualify for an administration fee waiver.

⁴ A dairy operation that makes a one-time election of coverage level and coverage percentage that are applicable to each of calendar years 2019 through 2023 will receive a 25 percent discount on premium rates.

Table 1 DMC Premium Rates by Coverage (Source: USDA FSA 2019)

| Margin Coverage Level | Tier 1 Premium per cwt for covered production history of 5 mil lbs. or less | Tier 2 Premium per cwt, all years for covered production history over 5 mil lbs. |
|-----------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| \$4.00 | None | None |
| \$4.50 | \$0.0025 | \$0.0025 |
| \$5.00 | \$0.005 | \$0.005 |
| \$5.50 | \$0.030 | \$0.100 |
| \$6.00 | \$0.050 | \$0.310 |
| \$6.50 | \$0.070 | \$0.650 |
| \$7.00 | \$0.080 | \$1.107 |
| \$7.50 | \$0.090 | \$1.413 |
| \$8.00 | \$0.100 | \$1.813 |
| \$8.50 | \$0.105 | N/A |
| \$9.00 | \$0.110 | N/A |
| \$9.50 | \$0.150 | N/A |

The DMC margin is computed monthly by a formula based on national milk and feed prices (USDA FSA 2019). That is, the expected return from the program depends on the distribution of the margin index, which is the linear combination of the national milk and feed prices. The margin is defined as “All Milk Price – Composite Feed Cost” where “Composite Feed Cost = $1.0728 \times \text{Corn Price} + 0.00735 \times \text{Soybean Meal Price} + 0.0137 \times \text{Alfalfa Hay Price}$ ”.

Starting November 2021, the margin formula uses 100 percent premium alfalfa price instead of the average of premium and regular alfalfa prices (USDA FSA 2021). The change in the formula increases the expected return from the program for every margin level. Understanding the participation pattern of the dairy producers would shed light on the budgetary implications of the change in the DMC program.

DMC preceded the Dairy Margin Protection Program (MPP), which was authorized by the 2014 Farm Bill through December 2018 (Schnepf, 2014). The initial MPP program only had

six pay periods.⁵ While the milk margin above feed cost was calculated each month, every even month a simple average of the margin for the current and previous month was taken to establish MPP payment eligibility. For example, for payment period one (Jan – Feb), the MPP milk margin for January and February were calculated. The simple average of these MPP milk margins then was taken to represent the MPP margin for Jan-Feb.

Based on feedback from dairy producers, US Congress made several changes to MPP in the Bipartisan Budget Act of 2018 (US Congress 2018a) and the Agricultural Improvement Act of 2018 (US Congress 2018b). The changes are i) calculations of the margin period became monthly rather than bi-monthly; ii) for Tier 1, the covered production was increased to 5 million pounds from 3 million pounds; iii) the premium rates for Tier 1 were substantially lowered; and iv) an exemption from paying an administrative fee were provided for limited resource, beginning, veteran, and disadvantaged producers. In addition, the dairy operators enrolled in the previous 2018 enrollment period that qualified for this exemption under the new provisions were able to request a refund.

The registration and re-enrollment period for the coverage year 2018 that started January 1, 2018 began on April 9, 2018, and continued through June 1, 2018. The re-enrollment period allowed dairy producers, including those that previously signed up and those that did not, an opportunity to make new elections for 2018.

The Bipartisan Budget Act of 2018 was economically significant for three main reasons. First, it effectively guaranteed retroactive payments for farmers enrolled at Tier 1 \$8.00 coverage level. The choice of \$8.00 coverage for up to 5 million pounds (Tier 1) ensured MPP enrollment had net positive returns for each hundredweight of milk enrolled prior to the enrollment deadline.

⁵ The paired months are specified in the 2014 Farm Bill and were Jan – Feb, Mar – Apr, May – Jun, Jul – Aug, Sep – Aug, Sep – Oct, and Nov – Dec.

By June 1, 2018, the deadline for 2018 enrollment, dairy farmers knew that MPP had triggered for February (\$6.88349), March (\$6.76837), and April (\$6.61635) of 2018. Second, the expansion of the Tier 1 limit from 3 million to 5 million pounds made significantly more milk eligible for net positive returns. Third, significant reductions in Tier 1 premiums made enrollment cheaper and further lucrative. In summary, the 2018 policy change guaranteed net positive returns for Tier 1 enrollment at an \$8.00 coverage level, made those returns available to additional quantities of milk, and it made securing those net positive returns cheaper by reducing Tier 1 premiums.

3. Data

Our main dataset consists of the farm-level DMC participation data and the milk and feed price data. We use a novel and unique panel dataset of the DMC program participants on their production history and the coverage and margin selection from 2019 to 2021 provided by USDA FSA. We combine the DMC participation data with the farm-level production data of 2021 constructed for the Coronavirus Farm Assistance Program (CFAP) payment to have information on dairy producers who did not participate in the DMC program. We also gather a series of milk and feed prices from USDA NASS and AMS that go into the margin formula to construct the expected and realized margins for a given year.

The DMC program dataset has two components. The first is the production history for the DMC contract that are based on individual operation's highest milk production in 2011, 2012, and 2013. DMC uses the production history to establish DMC contracts for the 2019-2022 period at the producer level. The second is producer-level information on coverage percentage, and coverage level for Tier 1 and Tier 2.

The CFAP payment dataset contains operation-level data on quantities of milk that dairy producers used to request CFAP payments. The initial payment program, CFAP 1, provided direct relief to producers who faced price declines and additional marketing costs due to COVID-19. The application period for CFAP 1 ended on September 11, 2020. USDA implemented updates to the Coronavirus Food Assistance Program for producers of agricultural commodities marketed in 2020 who faced market disruptions due to COVID-19. This was part of a larger initiative to improve USDA pandemic assistance to producers. USDA's Farm Service Agency began accepting new and modified CFAP 2 applications on April 5, 2021. The CFAP 2 signup deadline was October 12, 2021. While acknowledging that not all producers participate in government programs, one can think of the dairy quantities used for CFAP payment request as the total quantity of milk that participates in government programs.

Table 2 reports the summary statistics of the dataset. The number of operations in the dataset is 28,282 in 2019, 28,375 in 2020, and 26,271 in 2021. Among those operations in DMC contract data with the production history reported to FSA, 83% in 2019, 48% in 2020, and 73% in 2021 have participated in the DMC program. Average coverage level, that is the share of milk insured over the total production history, ranges from 91 to 95%. The average tier 1 margins, which is the margin coverage for the production less than five million pounds, are on average around 8.4 – 9.5 whereas the tier 2 margins are close to zero. With 2021 DMC contract data, we can match them with the CFAP payment data. Among the matched operations, we observe that 72% of them participate in the DMC program which is slightly lower than the share computed based on the DMC contract data.

Table 2 Mean and Standard Deviations of the Key Variables

| VARIABLES | 2019 | | 2020 | | 2021 | |
|-----------------------------------------------------------|--------|--------|--------|--------|--------|--------|
| | Mean | SD | Mean | SD | Mean | SD |
| DMC Contract Data | | | | | | |
| DMC Participation | 0.827 | 0.378 | 0.484 | 0.500 | 0.730 | 0.444 |
| DMC Production History (in thousand CWT) | 7,682 | 22,765 | 7,687 | 22,763 | 7,956 | 23,446 |
| N | 28,282 | | 28,375 | | 26,271 | |
| Coverage | 0.945 | 0.0610 | 0.906 | 0.195 | 0.938 | 0.100 |
| Tier 1 Margin Coverage | 9.470 | 0.506 | 8.351 | 2.551 | 9.234 | 1.300 |
| Tier 2 Margin Coverage | 0.944 | 1.721 | 1.042 | 1.789 | 1.051 | 1.797 |
| N | 23,446 | | 14,339 | | 19,367 | |
| DMC Contract Data Matched with CFAP | | | | | | |
| CFAP Production Base (in thousand CWT, Jan - Aug 2020) | | | | | 6,454 | 20,644 |
| DMC Participation | | | | | 0.717 | 0.450 |
| N | | | | | 23,345 | |
| Coverage | | | | | 0.940 | 0.0911 |
| Tier 1 Margin Coverage | | | | | 9.255 | 1.228 |
| Tier 2 Margin Coverage | | | | | 1.097 | 1.822 |
| N | | | | | 16,862 | |

Four price series are used to calculate the margin for the DMC payments. The price data contains January 2019 to March 2022 monthly observations of i) the national all-milk price determined from the average price received, per cwt. of milk, by dairy operations for all milk sold to plants and dealers in the United States; ii) the national price of corn per bushel for a month as reported in the USDA Agricultural Prices Report; iii) the central Illinois price of soybean meal per ton for a month as reported in the USDA Market News-Monthly Soybean Meal Price Report; and iv) the national price of alfalfa hay per ton for a month as reported in the USDA Agricultural Prices Report.

4. DMC Participation Pattern

We leverage the 2021 CFAP data to document the DMC participation patterns and the relationship between the likelihood of the DMC participation and the farm size. As the 2021 CFAP payment encompasses all dairy producers in the U.S., merging the 2021 CFAP payment data with the 2021 DMC participation data provides the full information on both participants and non-participants.

Figures 1 and 2 present the numbers of dairy operations and the average farm size (based on the CFAP production base) by margin coverage for Tier 1 and Tier 2. We observe that \$9.5 margin is the most common choice followed by not participating and then \$4.0 margin. The average farm size is largest for \$4.0 margin. The average farm size of non-participating operations is smaller than that of \$4.0 margin and that of \$9.0 margin.

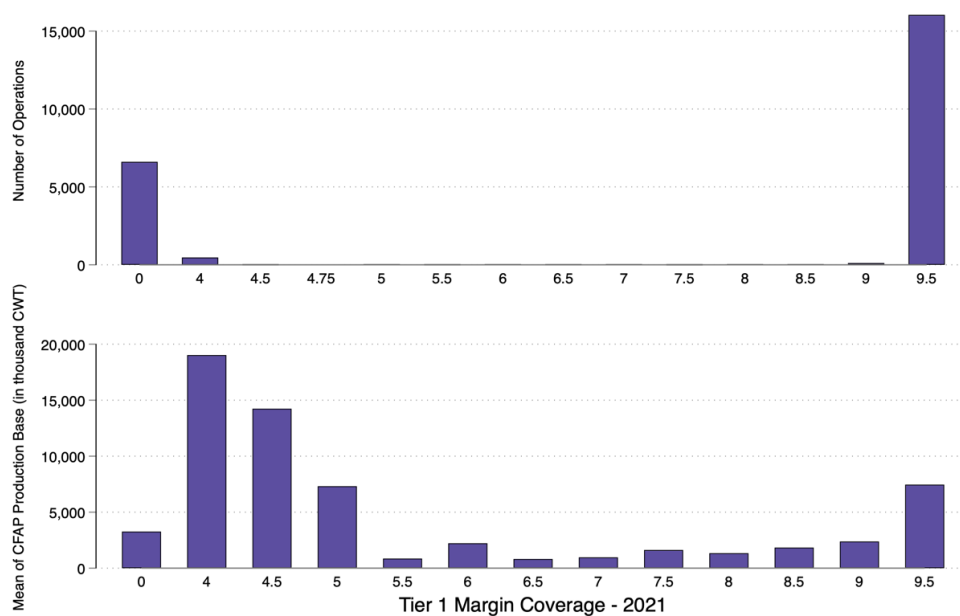


Figure 1 Number of Operations and Average Base Production by Tier 1 Margin Coverage (2021)

Note: Base production is the production base for the CFAP payments. Base production is calculated based on the production quantity for January – August 2020.

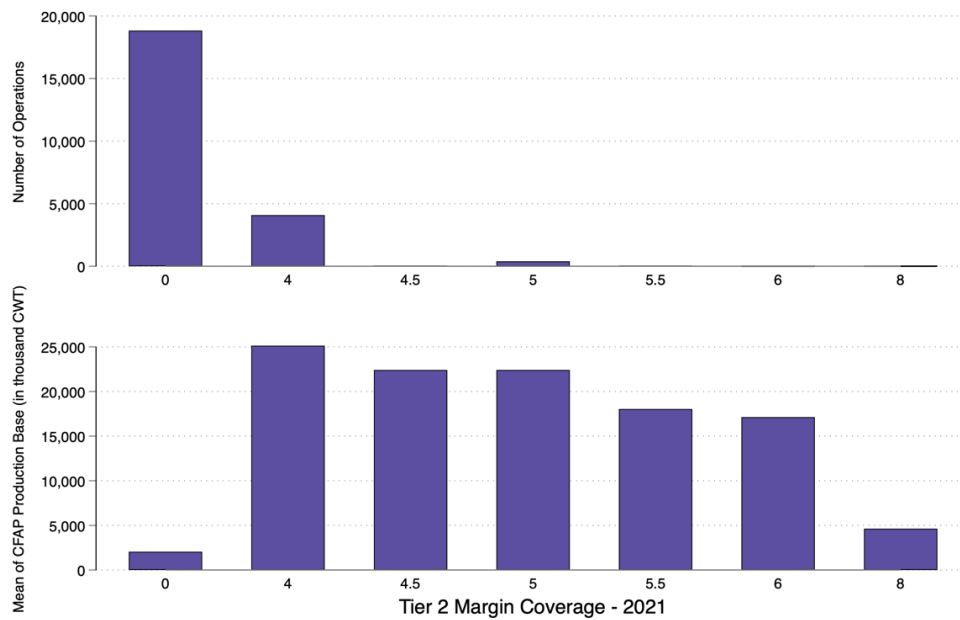


Figure 2 Number of Operations and Average Base Production by Tier 1 Margin Coverage (2021)

Note: Base production is the production base for the CFAP payments. Base production is calculated based on the production quantity for January – August 2020.

Figure 3 presents how much of US total milk productions are covered by DMC separated by each margin level. Almost 80% of the production history for the CFAP payment calculation is insured by tier 1 \$9.5 margin. About 70% of the production history is covered by the operations opt into tier 2 and the majority of them signed up for \$4.0.

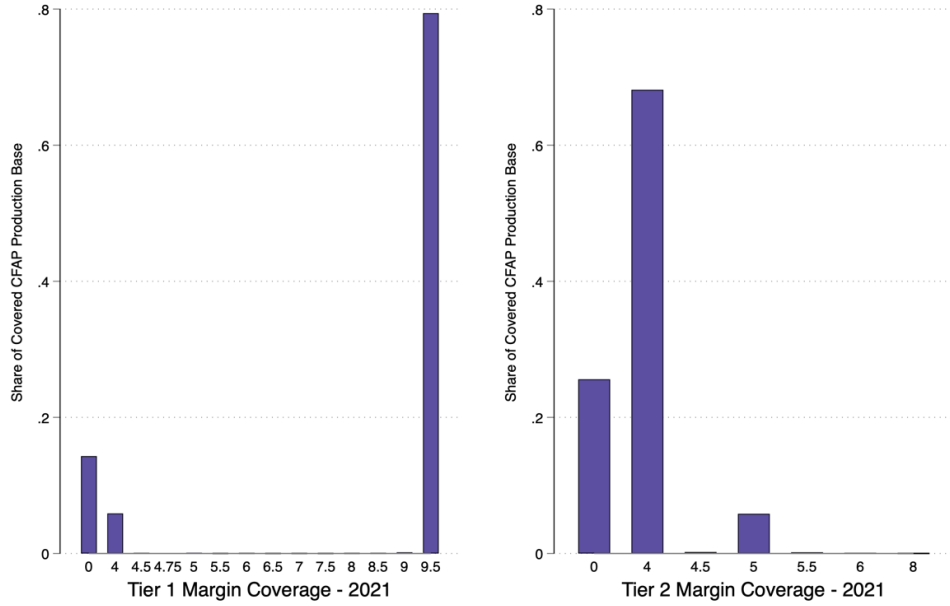


Figure 3 Shares of Production Covered by Margin Coverage over the Total US Production (2021)

Note: Base production is the production base for the CFAP payments. Base production is calculated based on the production quantity for January – August 2020.

Using the merged 2021 data, we estimate the following linear probability model (LPM):

$$P(DMC \text{ Participation} = 1)_i = \beta_0 + \beta_1 \ln(CFAP \text{ Production Base}_i) + u_i \quad (1)$$

where the outcome variable is the indicator of whether farm i participated in DMC in year 2021, and the regressor is a measure of farm size using the quantity of base production that is used for the 2021 CFAP payment. The base production is the quantity produced in January to August 2020. While our main specification is LPM, we also consider the following Logit regression:

$$P(DMC \text{ Participation}_i = 1) = \frac{\exp(\beta_0 + \beta_1 \ln(CFAP \text{ Production Base}_i))}{1 + \exp(\beta_0 + \beta_1 \ln(CFAP \text{ Production Base}_i))} \quad (2).$$

Table 3 reports the estimation results of equations (1) and (2). As expected, we find that the size and the likelihood of the DMC participation is positively correlated. The marginal effects estimated by LPM and the Logit are consistent and similar across each other.

Table 3 The Relationship between Farm Size and the Probability of DMC Participation (2021)

| | (1) | (2) | (3) | (4) |
|-------------------------------|---------------------------|---------------------|----------------------|---------------------|
| | LPM | | Logit | |
| VARIABLES | DMC Participation (1=Yes) | | | |
| | Marginal Effects | | | |
| ln(CFAP Production Base 2020) | 0.087*** (0.0017) | 0.10*** (0.0019) | 0.097*** (0.0021) | 0.11*** (0.0022) |
| Observations | 18,906 | 18,906 | 18,906 | 18,870 |
| State FE | No | Yes | No | Yes |

Note: Robust standard errors are in parentheses (***) denotes 1% significance)

5. Do Large Producers Make Better Choices?

We assess whether larger farms made the coverage and margin choices that maximize the return from the DMC program. To do so, we use the expected and actual margin data of years 2019 – 2021 to find the coverage and margin levels that maximize the return from the DMC program. We then estimate the relationship between the likelihood of choosing each margin and assess whether the size is correlated with the likelihood of choosing the net-return-maximizing margin coverage.

Table 4 presents the realized annual net return, which is the total indemnity received minus the total premium paid, per CWT by each margin for both Tier 1 and Tier 2. [Explain more] In all three years, the \$9.5 margin coverage level leads to the highest net return for Tier 1. For Tier 2, either the \$4 margin or not enrolling the excess quantity leads to zero returns whereas other margin levels yield negative returns.

Table 4 Realized Annual Net Return per hundredweight by Margin (2019 - 2021)

| | | | 2019 | 2020 | 2021 |
|-----------------------|--------------------|-------------------------------------|--------|--------|--------|
| Margin Coverage Level | Tier 1 Premium/cwt | Annual Net Return (Tier 1, per CWT) | | | |
| | \$9.50 | \$0.1500 | \$0.39 | \$0.66 | \$2.44 |
| | \$9.00 | \$0.1100 | \$0.16 | \$0.52 | \$2.03 |
| | \$8.50 | \$0.1050 | \$0.01 | \$0.40 | \$1.62 |

| | | | | |
|--------|----------|---------|---------|---------|
| \$8.00 | \$0.1000 | -\$0.07 | \$0.32 | \$1.25 |
| \$7.50 | \$0.0900 | -\$0.09 | \$0.24 | \$0.89 |
| \$7.00 | \$0.0800 | -\$0.08 | \$0.17 | \$0.52 |
| \$6.50 | \$0.0700 | -\$0.07 | \$0.10 | \$0.24 |
| \$6.00 | \$0.0500 | -\$0.05 | \$0.03 | \$0.08 |
| \$5.50 | \$0.0300 | -\$0.03 | \$0.00 | \$0.01 |
| \$5.00 | \$0.0050 | -\$0.01 | -\$0.01 | -\$0.01 |
| \$4.50 | \$0.0025 | \$0.00 | \$0.00 | \$0.00 |
| \$4.00 | \$0.0000 | \$0.00 | \$0.00 | \$0.00 |

| Margin Coverage Level | Tier 2 Premium/cwt | Annual Net Return (Tier 2, per CWT) | | |
|-----------------------------|-----------------------|-------------------------------------|---------|---------|
| \$8.00 | \$1.8130 | -\$1.78 | -\$1.81 | -\$1.81 |
| \$7.50 | \$1.4130 | -\$1.41 | -\$1.41 | -\$1.41 |
| \$7.00 | \$1.1070 | -\$1.11 | -\$1.11 | -\$1.11 |
| \$6.50 | \$0.6500 | -\$0.65 | -\$0.65 | -\$0.65 |
| \$6.00 | \$0.3100 | -\$0.31 | -\$0.31 | -\$0.31 |
| \$5.50 | \$0.1000 | -\$0.10 | -\$0.10 | -\$0.10 |
| \$5.00 | \$0.0050 | -\$0.01 | -\$0.01 | -\$0.01 |
| \$4.50 | \$0.0025 | \$0.00 | \$0.00 | \$0.00 |
| \$4.00 | \$0.0000 | \$0.00 | \$0.00 | \$0.00 |

Using the DMC contract data from 2019 to 2021, we estimate how the farm size is associated with the probability of choosing each margin. The farm size is measured by the production history in the DMC contract data. We restrict the farms who have been registered in the DMC contract data.

We estimate the following multinomial logit regression:

$$P(DMC \text{ Tier 1 Margin}_i = k) = \frac{\exp(\beta_0^k + \beta_1^k \ln(DMC \text{ Production History}_i))}{\sum_j \exp(\beta_0^j + \beta_1^j \ln(DMC \text{ Production History}_i))} \quad (3).$$

where $k = \{0, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5\}$ and the regressor is a measure of farm size using the quantity of the production history that farms report for contracting DMC.

Figure 4 reports the average of the marginal effects across the farm sizes for each margin coverage level. The farm size and the probability of choosing \$9.5 margin are positively

correlated indicating that larger farms are more likely to select the margin coverage level that maximizes the net return.

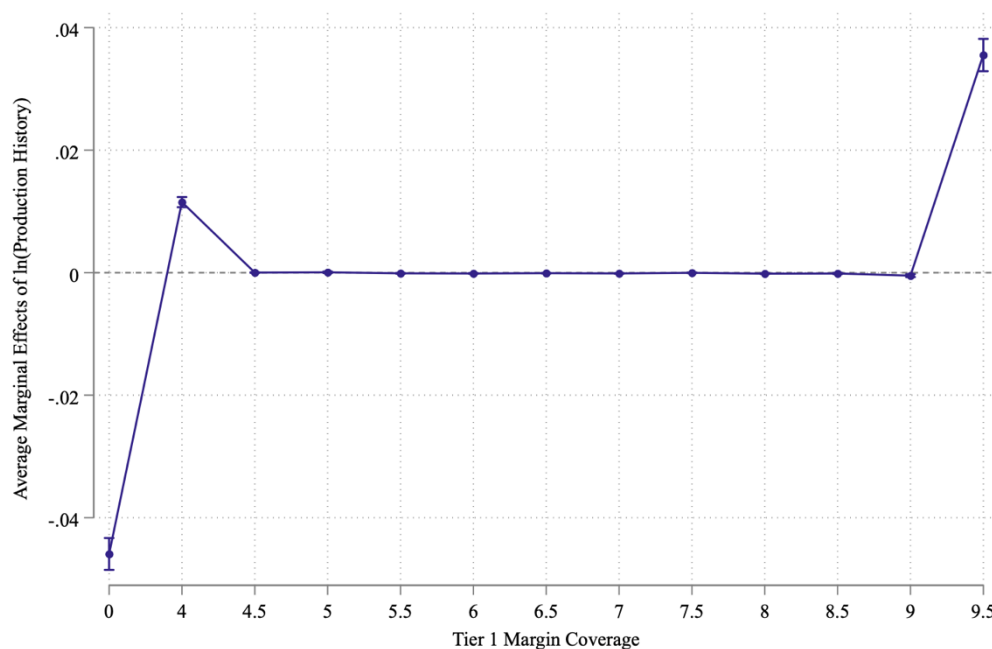


Figure 4 Average Marginal Effects of Farm Size on the Probability of Choosing Each Margin (Tier 1, 2019 - 2021)

Note: The 95% confidence intervals are reported and constructed based on the robust standard errors.

6. Margin Formula Change and Net Returns

USDA changed the DMC formula to accurately reflect dairy operation feed costs, the rule will amend the calculation of average feed cost and actual dairy production margins by determining the price for alfalfa by using the price for high quality hay. The previous rule used an average of high quality (premium and supreme) alfalfa hay and average quality hay to calculate the hay price according to 7 CFR 1430.411(c)(3). USDA is made this change retroactive to the beginning of the 2020 program year, as a discretionary change.⁶

⁶ The use of 100-percent “premium and supreme” hay in the DMC calculation is an administrative change made by FSA.

For Tier 1, with both the new formula and the old one the coverage level with the highest net return is \$9.50. For Tier 2, the highest net returns occur for the catastrophic coverage level of \$4.00. Figure 5 shows the monthly per cwt net returns for choosing \$9.50 coverage level. Figure 5 shows that new formula would have led to slightly higher net return in the early period when the retroactive payments were not applicable.

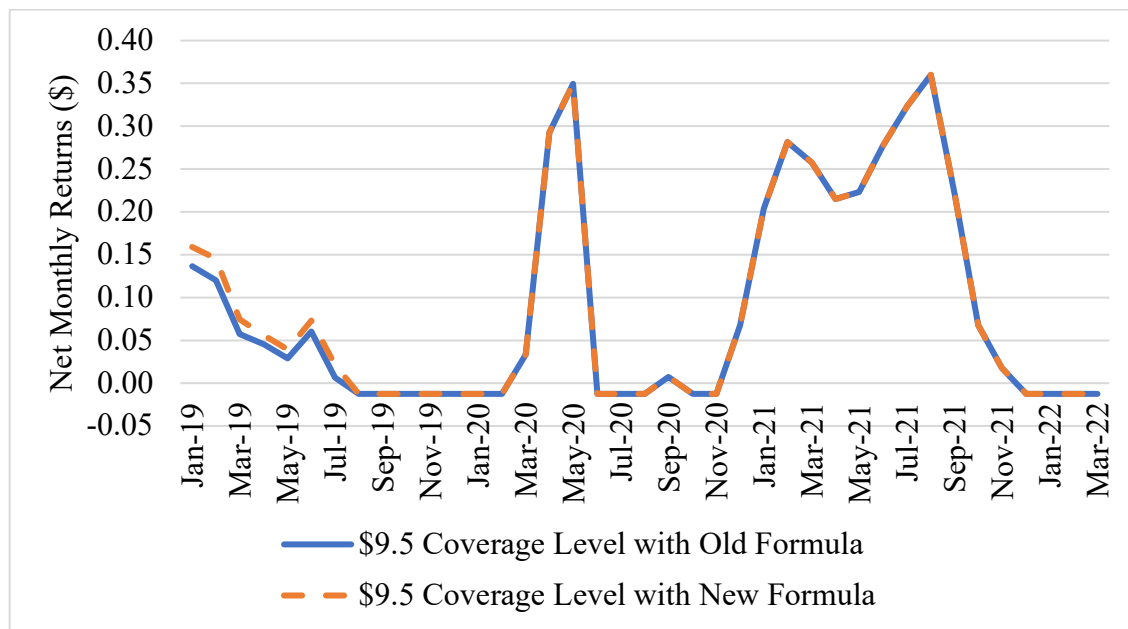


Figure 5 Per CWT Net Return from Choosing \$9.50 Margin for Tier 1

7. Concluding Remarks

Since the Agricultural Act of 2014, the US farm policy has been moving toward providing risk management tools. US dairy policy is not an exception with the introduction of the Margin Protection Program, which is the predecessor program of the Dairy Margin Coverage (DMC) program.

We study the DMC program exploring a unique operation-level participation data. By investigating the participation and the choice decisions of the dairy operations in US, we find

that larger operations are more likely to participate in DMC and also to make margin coverage choices that maximize the net returns. The finding indicates that the larger operations are more likely to capture the benefit from the program.

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