2017

THE MARGIN PROTECTION PROGRAM FOR DAIRY: A FORECAST & AD HOC REGIONAL ANALYSIS

Jessica A. G. Richard
University of Kentucky, jari245@g.uky.edu
Digital Object Identifier: https://doi.org/10.13023/ETD.2017.447

STUDENT AGREEMENT:

I represent that my thesis or dissertation and abstract are my original work. Proper attribution has been given to all outside sources. I understand that I am solely responsible for obtaining any needed copyright permissions. I have obtained needed written permission statement(s) from the owner(s) of each third-party copyrighted matter to be included in my work, allowing electronic distribution (if such use is not permitted by the fair use doctrine) which will be submitted to UKnowledge as Additional File.

I hereby grant to The University of Kentucky and its agents the irrevocable, non-exclusive, and royalty-free license to archive and make accessible my work in whole or in part in all forms of media, now or hereafter known. I agree that the document mentioned above may be made available immediately for worldwide access unless an embargo applies.

I retain all other ownership rights to the copyright of my work. I also retain the right to use in future works (such as articles or books) all or part of my work. I understand that I am free to register the copyright to my work.

REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student's advisor, on behalf of the advisory committee, and by the Director of Graduate Studies (DGS), on behalf of the program; we verify that this is the final, approved version of the student's thesis including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Jessica A. G. Richard, Student

Dr. Tyler Mark, Major Professor

Dr. Carl Dillon, Director of Graduate Studies

THE MARGIN PROTECTION PROGRAM FOR DAIRY: A FORECAST & AD HOC REGIONAL ANALYSIS

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture, Food and Environment at the
University of Kentucky

By

Jessica Ashley Georgia Richard

Lexington, Kentucky

Director: Dr. Tyler Mark, Assistant Professor of Agricultural Economics

Lexington, Kentucky

2017

ABSTRACT OF THESIS

THE MARGIN PROTECTION PROGRAM FOR DAIRY: A FORECAST & AD HOC REGIONAL ANALYSIS

This study examined The Margin Protection Program for Dairy's impact on the "effective margins" or margins realized by dairy producers in various regions. Each selected margin and percentage of production history offered by the national policy was analyzed in a forecasting, national and regional manner. Couplet margins were simulated for fifteen regions from 2017 through 2020. Five scenarios were analyzed for the change in MPP's effects under a 15%, 10%, and 5% drop in the price of milk as well as a 50% increase in the price of corn and a scenario where milk decreases 15% while corn prices simultaneously increases 25%. The results demonstrate that more than half of the regions have higher probabilities of triggering indemnities at every coverage level when compared to the US, MPP margin. Margins change in response to the policy effects, where lower coverage levels experience margin increase, and higher coverage levels experience margin decrease. In the US, MPP margin, risk reduction is observed at every coverage level. The program was found to decrease risk at most coverage levels, where higher shocks to the margin increased the protection offered by the program's effects.

Keywords: MPP-Dairy, ADPM, coverage level, indemnities, couplet, effective margin, Risk Reduction

Jessica Richard

November 11, 2017

THE MARGIN PROTECTION PROGRAM FOR DAIRY: A FORECAST & AD HOC REGIONAL ANALYSIS

By

Jessica Ashley Georgia Richard

Dr. Tyler Mark
Director of Thesis

Dr. Carl Dillon
Director of Graduate Studies

November 11, 2017

ACKNOWLEDGEMENTS

Is it not great when you are climbing a mountain, and you reward yourself with a break, to stop, turn around, and take in the great perspective of the landscape below? This moment, I have the unique opportunity to recognize people whom helped me find my way through this exciting time in my life.

Mom and dad, the values you taught me have guided and motivated my work and life in a way I am very fortunate to embrace. Sarah and Nick, the little time that we get when I am away from school means the world to me, I'm happy to see you both succeed in your education as well, and I love the laughs we share. Sonja and Gustav, though you may not know it, I am happy, healthy, and working hard to carry on the tradition of strength you established for my family. I can only hope that if you saw me now you would be very proud of your girl.

Kenny, I could not thank you enough for your time, patience, and looking out for me along this Master's journey. I see you as example of the type of professional and person I would like to become. "Forget about the mule, load the wagon!" I will remember all your advice for prioritizing my work and pacing myself.

Jeffrey, oh how much growth I have and still have yet to show you. I admire your passion for the dairy animal and how you employ that in your research. I hope to learn more from you in the future, and thank you for your hospitality in letting me spend time learning from you, your students, and the whole dairy team here at UK.

Tyler, where do I start? I could probably write a book on everything I have learned from you. Simple human language and any form of the utterance "thank you" does not seem to put a dent in the gratitude I owe. I hope that regardless of where my life takes me, how many more times I stumble and fall, you eventually realize your impact on me has made all the difference. I am lucky to have such a great example of what it means to lead a life of strong work ethic, honoring family and faith, and setting ever-higher standards for oneself. Thank you.

The following list of people represents those whom I would like to recognize at length. All the extended Richard and Kelly family, Jessica Meiller & family, David, Peter, and Timmy Coon, family, & the whole farm team, Christine Mac Neil, Dr. Leigh Maynard, Jerrod Penn, Rita Parsons, Dr. Kelly Bryant, and the ever-patient Joey Clark.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Dairy Policy

Established by the Agricultural Act of 2014, the Margin Protection Program (MPP) is administered by the Farm Service Agency branch of the United States Department of Agriculture. This motivates researchers to analyze how the program works as a risk-management tool, changes market efficiency, and potential unintended effects. This section reviews present articles of dairy policy, establishing the context for focusing on MPP analytics.

1.2 Livestock Gross Margin

Released as a pilot program to dairy producers in 2008 Livestock Gross Margin Insurance for Dairy (LGM-Dairy) was developed with the intention of providing support that was more related to margins, rather than milk price alone. Burdine et. al. (2014) focuses on LGM, demonstrating its ability to reduce risk. By first determining Gross Margin Guarantees and Actual Gross Margins, root mean squared downside deviations are then calculated to identify and measure risk. Across thirteen regions, a range of 26% to 41% risk reduction is determined to be the result of LGM's utilization. Mark et al. (2016) also compared LGM with MPP, finding MPP to reduce risk levels more than LGM, suggesting that supply expansion is potentially greater with MPP.

LGM can be referred to as a "bundled" insurance product because it works similar to a put option on milk futures and a call option on corn and soybean meal futures, respectively. Futures markets and LGM are both intended to act as insurance against market volatility but are underutilized due to either complexity or limited funding

(Wright 2012.) Mark et. al. (2016) explains LGM's limitations include a statutory livestock insurance limit from the Federal Crop Insurance Act. Once a $20 million limit on payments made to subsidize premium, administrative, and operating activities is met within a given fiscal year, insurance product sales must be discontinued.

Administered by the Risk Management Agency, LGM can be a useful tool to manage market risk, but a fiscal impediment limits producer utilization. This conclusion increases the importance of MPP to perform the role of a risk management tool for those not participating in LGM.

1.3 Dairy Product Donation Program

The Dairy Production Donation Program (DPDP) is jointly administered by the Farm Service Agency and Food and Nutrition Services (FNS.) Established by the Agricultural Act of 2014, this program does not require enrollment, it triggers the purchase of dairy products for redistribution to low-income households but provides no support directly to dairy producers (FSA, 2014.) DPDP acts as a milk supply control mechanism; purchases are triggered when the margin (as calculated in MPP) falls below $4/cwt for two consecutive months.

1.4 The Margin Protection Program

Previous to MPP, the Milk Income Loss Contract (MILC) administered by the Farm Service Agency from 2002 to 2012 provided dairy revenue risk protection through a direct payment method to dairy producers. Bozic and Gould (2009) provide discussion for how MILC set the stage for MPP, including how it was modified to link directly to feed costs in the 2008 version. Comparing MILC with MPP, MILC paid out only 45% of the target and actual milk price, where as MPP pays out 100%, but dairy producers actually pay premiums into MPP.

The Margin Protection Program is provided to dairy producers as a risk management tool for market risk. MPP effectively decoupled payments from production because payments are not made until after production decisions have already been made. For this reason, the movement towards margin-oriented policies such as MPP may reduce supply impacts caused by the program. Mark et al. (2016) provide discussion about dairy policy history that details the debate about direct vs. indirect payments. In times where margins are small, a producer's probability of receiving payments increases, and therefore production decisions could be influenced in the long run based on this perception (Westcott and Young, 2014.)

How does the Margin Protection Program work? MPP triggers indemnities for the farmer when the national average couplet margin falls below the selected coverage level. There are six couplets throughout the year, January/February to November/December. Additionally, there are nine margin levels to select from ranging from \$4.00 to \$8.00/cwt, in \$0.50 increments, and fourteen production coverage level percentages ranging from 25% to 90%, in 5% increments. The production level is determined by the highest level of milk produced by that operation for the past three years prior to enrollment.

Equation 1 outlines how the national margin is calculated:

$$ADPM_t = M_t - (C_t * 1.0728 + SBM_t * 0.00735 + Alf_t * 0.0137) \quad (1)$$

where t is the month, M is the reported all-milk price, C is the reported corn price per bushel, SBM is the reported soybean meal price per ton in Decatur, and Alf is the announced alfalfa hay price.

Indemnities are paid out when the national margin falls below the selected level for two consecutive couplet months. At the $4.00 coverage level, dairy producers can enter the program by only paying the $100 enrollment fee. The premium schedule changes above and below a 4 million pound production history. Smaller farms pay a lower premium relative to the rates charged to medium and larger farms facing a higher premium.

1.5 Objective

This paper establishes a stochastic method for developing the margins calculated by MPP. Analysts would be able to evaluate the magnitude and frequency of future payments for this program. This advance will allow the program to be tested for how various market scenarios might change the net indemnities paid by the program.

Another objective to extend the literature includes analyzing the regional impacts of the program. National farm policy, particularly insurance products like the current Farm Bill programs, will always be challenged in addressing regional differences. In the case of dairy, Maynard, Wolf, and Gearhardt, 2005 postulate that based on the Class III utilization rates and basis risk, incentive to hedge against risk changes across the various regions. In context of this analysis, basis risk exists between regional mailbox milk prices and national all-milk prices, and ability of the all-milk price to capture ADPM risk in each region is the focus.

New York and Pennsylvania have not been analyzed under MPP, and are included in addition to the thirteen evaluated in Mark et al. (2016.) The average margin, change in the margin, and risk reduction are evaluated across regions. The likelihood of each region to trigger payments is also compared with the likelihood of MPP margin to pay out.

The objective of this study includes analyzing how MPP's effects change across farm size. Large, medium and a small dairy are evaluated to analyze the program's effects by farm size. 2000, 1000, and 200 cow dairies are utilized to calculate premiums and replicate the analysis over each region. Each region and farm size combination is analyzed across six scenarios.

The baseline scenario follows FAPRI's price expectations and is analyzed in Chapter 2. Five additional scenarios are analyzed in Chapter 3, with the objective of comparing a market shock to the baseline scenario. A 15%, 10%, and 5% downward shock in the price of milk are analyzed for Scenarios 2 through 4. Scenario 5 and 6 represent a 50% increase in the price of corn, and a simultaneous 25% increase in the price of corn and 15% decrease in the price of milk respectively. These developments will contribute to the evidence needed upon re-evaluation of the program when it expires in December of 2018.

CHAPTER 2: THE MARGIN PROTECTION PROGRAM'S EFFECTS BY REGION AND FARM SIZE

2.1 Introduction

The Margin Protection Program for Dairy (MPP-Dairy) shifted the U.S. Dairy program towards a margin-oriented policy providing countercyclical support, relative to the Milk Income Loss Contract that it replaced. Novakovic and Wolf (2016) discuss how MPP was received well by Congress, partially due to how producers elect a coverage level for the entire year, and premiums do not fluctuate with the market. Novakovic and Wolf (2016) suggest this design is key, and also provide more recent literature discussing the policy.

Newton, Thraen, and Bozic (2015) identify MPP as a policy that could be taken advantage of to "maximize expected program returns" due to this fixed premium structure. Newton Thraen, and Bozic (2015) find that by selecting the optimal coverage level, dairy producer enrollment is partially explained by the ability to estimate future market conditions and therefore indemnities and premiums. This concept of policy utilization motivates the need to forecast MPP's margins.

Counter-cyclical programs mitigate supply impact problems because of the timing of support (Westcott and Young 2014.) MPP provides indemnities once production decisions have already been made for that period. By definition for "decoupled" in Westcott and Young (2014), MPP could be considered partially decoupled, because the program can increase net returns per unit, but payments are not directly coupled with milk price alone.

Burdine et al (2014) provide perspective on the Livestock Gross Margin (LGM) and analyzes its ability to reduce margin risk for dairy producers. They found risk reduction as a result of utilizing the program, validating the ability of this market-oriented policy framework to mitigate market threats to dairy profitability. However, the funding limit established by the Federal Crop Insurance act causes the program to utilize its resources early in the year, leaving its constituents without coverage for the rest of the year Burdine et al (2014).

For this reason, MPP serves to provide countercyclical support for the entire length of the program. Burdine et al (2014) motivate the analysis of the Margin Protection Program for its ability to reduce risk, also an objective of this analysis, where coefficient of variation is the identification tool for measuring risk.

Mark et al. (2016) conducted an ex-post analysis of MPP to evaluate the implications of MPP if it had been in place from 2002 through 2013. Specifically, average margins, risk reduction by farm size, and supply impacts were analyzed over the period for thirteen regions. While the ex-post analysis is useful to develop a historical depiction of how the program may have operated over the 2002-2013 period, it provides little information for producers and policy makers going forward. Future outcomes and their sensitivity to market shocks are also not analyzed.

Mark et al (2016) found average margins and risk reduction varied significantly by region. At the maximum coverage level ($8 and 90%), there was a 29% difference in the risk reduction derived from MPP between the North West and New England. The highest average net margins for medium and large farms was $6 and 90%, while the optimal coverage level for small farms was $8 and 90%. These findings place an increasing importance on understanding how MPP impacts various farm sizes and across regions due to the premium structure.

A major limitation of Mark et al (2016) due to the historical framework is its inability to study the remainder of the 2014 Farm Bill period and beyond. Mark et al (2014) however, developed a means for analyzing MPP's future expectations. Utilizing the Actual Dairy Production Margin (ADPM) defined in the 2014 legislation, national couplet margins were simulated for the period from January 2015 to December of 2018. Utilizing a multivariate empirical distribution, simulation price data is generated and examined for each coverage level offered by MPP. No regional analysis is conducted in this study.

The findings of the Mark et al (2014) analysis suggests that MPP is not likely to pay out any indemnities unless there is a catastrophic market event. Most of the years under each of the market scenarios tested did not trigger any payments, but small payments when they did. This finding echoes the concern producers have for how MPP is designed (Newton, Thraen, and Bozic, 2015.)

Combining the methodologies of Mark et al (2014) and Mark et al (2016) will extend the current understanding of the Margin Protection Program. The objective of this study is to evaluate MPP for the remaining life of the Farm Bill. Forecasting provides policy implications that become vital to managing budgetary constraints. Analyzing the regional impacts allows questioning of the fundamental policy design and leads to a better understanding of limited adoption and producer satisfaction. While the goal of federal support is not and should not be to design an insurance policy that pays out more than producers pay into it, this study aims to contribute novel evidence that considers future and regional market differences for the Margin Protection Program's expectations.

2.2 Data & Methodology

This study utilizes the regions constructed in Mark et al. (2016), in addition to two new regions, New York and Pennsylvania. While the simple inclusion of two additional regions is not a novel extension of the previous work, an important gain in the representation of the milk covered by the program is made by these two prominent dairy states. Utilizing Table 4 of the Farm Service Agency Margin Protection Program Fact Sheets, 76% of the milk covered by MPP is calculated to be represented in this analysis (a 9% gain from the previous 67% achieved by Mark et al 2016.)

Regional effects of the national policy are examined for Appalachia, California, Florida, Illinois, Michigan, Minnesota, New England, New Mexico, the North West, New York, Ohio, Pennsylvania, Southern Missouri, West Texas and Wisconsin. Regions that are not states are defined clearly in the glossary below. The USDA-ERS defines all regions. Table 2.1 describes how much milk is covered by MPP for each region in this study.

Table 2.1 Regional Milk Covered by The Margin Protection Program

Region	Lbs. Covered by MPP	% of Total
California	29,546,198,691	20.8%
Wisconsin	18,514,602,713	13.0%
Texas	8,280,615,352	5.8%
New York	7,724,222,490	5.4%
New Mexico	7,002,321,599	4.9%
Minnesota	6,655,423,187	4.7%
North West	6,375,748,019	4.5%
Michigan	5,929,765,867	4.2%
Pennsylvania	4,641,713,170	3.3%
Appalachia	3,301,788,146	2.3%
Ohio	3,082,766,972	2.2%
New England	2,717,180,289	1.9%
Florida	1,688,887,406	1.2%
Illinois	1,400,103,814	1.0%
Missouri	895,879,305	0.6%
Grand	142,063,114,450	100.0%
This Study	**107,757,217,020**	**75.9%**

Source: Calculations made on data from Farm Service Agency Margin Protection Program Fact Sheets, Table 4: Production History Eligible for Payment (Production History Multiplied by Coverage Level Selected: 25% to 90%) for 2015 Margin Protection Program Dairy (April 9, 2014)

Resulting figures represent the production history multiplied by the selected coverage levels. One hundred and forty-two billion pounds of milk are covered by MPP. The two largest dairy producing states, California and Wisconsin represent a combined 33.8% of the milk covered by MPP. The next closest state regarding insured milk is Texas, with New York close behind, and each successive region holding less weight in the insured milk pool.

The current MPP program is a national program, however, differences exist on a regional basis. To evaluate these differences, we collect representative proxies for some regional feed prices that are not available. Table 2.2 reveals which region’s data is utilized to replace missing commodity prices when necessary.

Table 2.2 Proxy Regions utilized in Regional Margin Construction

Region	Milk	Corn	Soybean Meal	All-Hay	Alfalfa
AP	Appalachian States	Kentucky	Memphis	Kentucky	Kentucky
CA	-	Colorado	Calif. points	-	-
FL	-	US	Memphis	US	US
IL	-	-	Decatur Rail	-	-
MI	-	-	Chicago Rail	-	-
MN	-	-	Chicago Rail	-	-
NW	-	US	Calif. Points	Washington	Washington
NM	-	Texas	Calif. Points	-	-
NE	-	Pennsylvania	Chicago Rail	New York	New York
NY	-	Pennsylvania	Decatur Rail	-	-
OH	-	-	Chicago Rail	-	-
PA	East Pennsylvania	-	Decatur Rail	-	-
SM	-	Missouri	Kansas City Truck	Missouri	Missouri
WT	-	Texas	Kansas City Truck	Texas	Texas
WI	-	-	Chicago Rail	-	-

Source: Unique to this study, proxy names appear exactly as "Understanding Dairy Markets" displays price data.

Florida corn, for example, was replaced with U.S. corn because neighboring states are not reported either. In general, replacements were made with data close in proximity to that region, otherwise, national commodity prices where used if a close relative area is not available. Except for soybean meal, close proxies (from neighboring states) were found to represent the regions. Soybean meal prices are limited to Chicago, Decatur, Kansas city, and Memphis.

Richardson, Klose, and Gray (2010) develop the foundation for utilizing this multivariate empirical simulation method, detailing the process for utilizing stochastic simulation for risk management analyses. First, the average price is determined within each year, and then the stochastic or random component is calculated by subtracting the observed price from the average price for that year. By dividing this residual by the observed price, a relative deviate is the result. These deviates are then sorted on values, and assigned a probability from zero to one, where each residual has an equal chance of being observed. An inter- and intra-temporal correlation matrix is calculated using the unsorted random components to complete the parameterization for the distribution. The stochastic component is then simulated (not the whole observed price) utilizing the average, sorted deviates, the probability minimum, maximum and distribution, inter- and intra-correlation matrices.

Mark et al (2014) demonstrate that this method can be utilized to forecast margins and therefore analyze the MPP effects. The combined methodology of (Mark, 2014 and Mark et al., 2016), along with new techniques developed in this analysis will demonstrate that margins can be modeled and evaluated for both future and regional effects. Forecasted margins were simulated as demonstrated by (Mark et al., 2014) for the period from January 2017 to December 2020 following the procedures below.

US all-milk, corn, and alfalfa hay prices are reported by the National Agricultural Statistics Service's Agricultural Prices Report (USDA/NASS, 2016.) The Agricultural Marketing Service's Mailbox Milk Price Report and the NASS's Livestock, Poultry, and Grain Reports report regional mailbox-milk and soybean meal prices respectively (USDA/AMS, 2016, USDA/NASS, 2016.) All annual average forecasted prices were accessed using the Food and Agricultural Policy Research Institute's Annual Briefing Book (FAPRI, 2016.)

The Margin Protection Program has only triggered payments on two occasions. The first payment made was the Jan/Feb couplet of 2015 at a rate less than a penny/cwt, and only to the few producers covered at the $8.00 level. The national average margin for the May-June 2016 two-month consecutive period was $5.76/cwt, resulting the second time MPP paid out. As an example, producers who elected to secure a $6.00 margin, were paid $0.24 per cwt insured (USDA press release, 2016.) This May/June 2016 couplet margin triggered payments for each producer insured at the top five coverage levels.

To calculate the expected regional prices, monthly price data for 2006 to 2016 was arranged first by region, then commodity. Equation 2.1 outlines how the monthly price index was determined for each commodity:

$$x^1_{cij} = \frac{P_{cij}}{\bar{P}_{cj}} \tag{2.1}$$

where x^1 is the monthly commodity index, P is the historical price, $\bar{P}$ is the average price in that year, c = (milk, corn, SBM, and all-hay), i = (January, …, December), and j = (2006,…,2016). Alfalfa hay was not indexed by month because FAPRI does not report alfalfa hay forecasted prices. All-hay was used as a substitute, and the relationship between national all-hay and regional alfalfa hay was accounted for when calculating the monthly indices. Bozic et al. (2012) offers another approach for forecasting alfalfa prices based on a regression of alfalfa hay on corn and soybean futures prices. The time-period from 2006 to 2016 was selected because it has a greater influence on the future prices relative to data pre-dating 2006.

The FAPRI baseline was first adjusted for seasonality, then regional differences. The method for calculating relationships between the national and regional commodity prices is unique to this study. Equation 2.2 outlines how the national prices were compared to the regional prices:

$$x_{cij}^{2} = \frac{P_{cij}^{n} - P_{cij}^{r}}{P_{cij}^{n}} \qquad (2.2)$$

where x^2 are the monthly regional indices, P_{cij}^{n} are the national prices and P_{cij}^{r} are the regional prices where c, i, and j are defined as above.

The only exception to this methodology is the case of alfalfa and all-hay as mentioned above. Regional alfalfa hay prices were subtracted from national all-hay prices, then taken as a percent of national all-hay, all within that period, simultaneously accounting for this historic and spatial relationship. This was utilized to create a national and regional monthly alfalfa hay forecast.

The results of Equations 2.1 and 2.2 were indices accounting for both seasonal and regional effects. These indices were then utilized in combination with FAPRI baseline projections to develop the expected prices for each region and month in the study period.

Table 2.4: FAPRI Baseline Prices for 2017 to 2020

Commodity	**2017**	**2018**	**2019**	**2020**	**Units**
Milk	17.14	17.80	18.17	18.32	$/Cwt
Marketing Year	**16/17**	**17/18**	**18/19**	**19/20**	
Corn	3.75	3.87	3.94	4.00	$/Bushel
Soybean Meal	311.31	331.26	330.50	338.47	$/ton
All-Hay	149.85	157.47	162.06	166.91	$/ton

Source: FAPRI, August 2016

This method for developing indices accounts for the price difference over time within each region, as well as the difference between the national and regional commodity prices. Provided on an annual basis, the FAPRI expected price was rearranged to handle marketing versus the calendar year reporting. The marketing year is defined from September to August for corn, October to September for soybean meal, and May to April for all-hay. Milk prices are reported on a January to the December calendar year.

The expected monthly prices are to be used in the simulation from January 2017 to December 2020 and are considered to maintain historic relationships. Simulating the monthly prices for the study period follows the demonstration by (Richardson et al. 2000 and Mark, 2014). Paulson and Schnitkey (2012), Barnett and Coble (2012), Paulson et al. (2013) have all utilized simulation models to evaluate Farm Bill policy effects, validating the approach for analyzing MPP.

All region's couplet margins are simulated in addition to the national margin for the four-year period. Ten years (2006-2016) of historical prices are utilized in the parameterization of a multivariate empirical distribution described by Equation 2.3.

$$MVEMP\ \{\ P_{cij}, x_{cij}^{3}\} \tag{2.3}$$

where P_{cij} and x_{cij}^{3} describe the historical commodity data and FAPRI-derived expectations which have been adjusted for seasonal and regional trends.

This framework provides the advantage of accounting for inter- and intra-correlations of the historical data. This distribution type is desirable for its ability to deal with correlation and heteroscedasticity issues Richardson (2010.) Five hundred iterations of each set of historic prices expected prices, and thus margins and couplet margins, are simulated using the MVEMP function in Simetar©.

This process is repeated for three farm sizes in addition to each region. The resulting couplet margins were used to determine when MPP payments would be triggered over the study period. "Net indemnities" were calculated by subtracting the premiums from the indemnities, assuming enrollment at each specific coverage level. Following Equation 2.4, national net indemnities are applied to each region.

$$\text{Effective Margins} = x_{ij}^{4} + (\text{I} - \text{P}) \tag{2.4}$$

where x_{ij}^{4} represents the regional couplet margins and I and P are the indemnities and premiums calculated from the national program. Effective margins are the margins actually realized in a given region, as a function of the national net indemnity having been added to their respective milk and feed prices at each respective coverage level. These margins reflect policy effects for each period, farm size, and region in the study.

2.3 Results

The utilization of this methodology provided the framework to study MPP for the remainder of the current dairy program. A guide to the couplet margins is provided in Table 2.5. Each couplet margin is a function of the two consecutive month's margins. January and February margins, for example, are calculated and then averaged together to derive the first couplet margin for the year.

Table 2.5 Couplet Margin Months by Number

Couplet Number	Months
1	January/February
2	March/April
3	May/June
4	July/August
5	September/October
6	November/December

Figure 2.1 describes the average simulated margin utilized by MPP, for the entire period from 2017 to 2020. With time as the horizontal axis, each couplet margin is

labeled with the average margin for that period (measured in $/cwt), derived by averaging every iteration within that period.

Figure 2.1 The Margin Protection Program Margin simulated from 2017 to 2020

1-17 (Jan/Feb couplet) 2-17 (Mar/Apr couplet)…6-20 (Nov/Dec couplet)

This figure demonstrates the seasonal pattern preserved from historic prices. The expected value of the national margin is $9.01 throughout the life of this Farm Bill and into the next. Ranging from $7.73 to $10.44, the event of the Margin Protection Program to pay out under the current design is unlikely. These figures represent expectations, should FAPRI's market predictions be fulfilled.

Evaluating the future expectations by region fills a knowledge gap that has not been explored. Table 2.6 provides a compilation of regional margin statistics averaged across the whole study period.

Table 2.6: Regional Expected Margin Statistics (2017 to 2020)

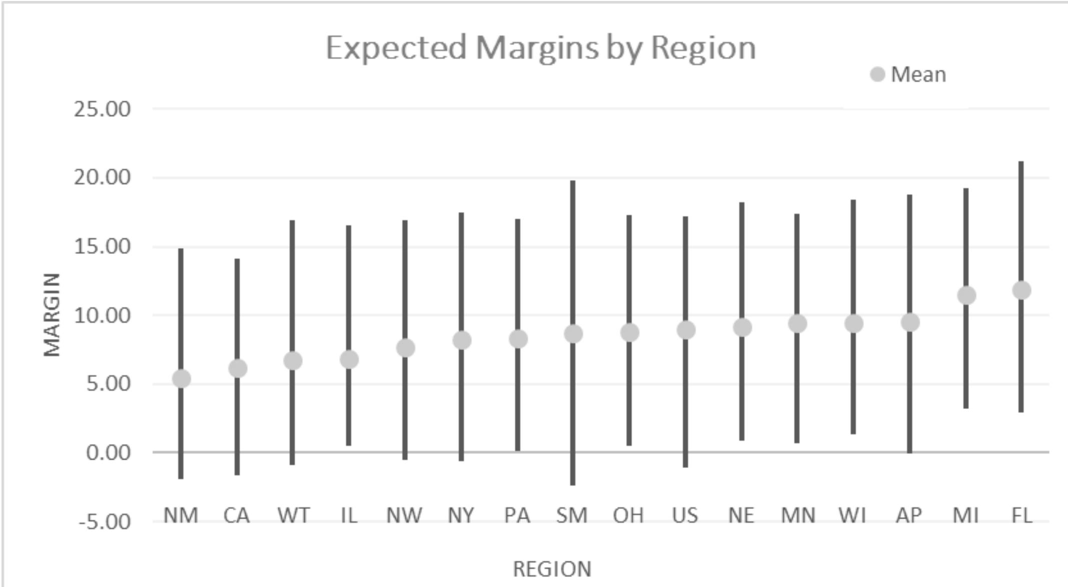
Region	CA	NM	US	WT	MN	WI	NW	IL	OH	PA	NY	NE	MI	AP	FL	SM
Mean	6.18	5.49	9.01	6.72	9.45	9.49	7.66	6.88	8.76	8.31	8.27	9.19	11.48	9.51	11.86	8.74
St. Dev.	2.10	2.13	2.14	2.15	2.16	2.20	2.22	2.24	2.24	2.27	2.29	2.37	2.41	2.51	2.73	2.79
CV	33.96	38.77	23.76	32.00	22.83	23.20	28.99	32.60	25.62	27.30	27.70	25.74	21.00	26.37	23.03	31.89
Min	-1.48	-1.71	-0.85	-0.68	0.92	1.54	-0.38	0.66	0.65	0.32	-0.45	1.08	3.40	0.14	3.09	-2.24
Max	13.94	14.69	16.99	16.72	17.21	18.20	16.75	16.40	17.12	16.80	17.32	18.04	19.07	18.63	21.00	19.61

Key: CA-California, NM-New Mexico, US-MPP, WT-West Texas, MN-Minnesota, WI-Wisconsin, NW-North West, IL-Illinois, OH-Ohio, PA-Pennsylvania, NY-New York, NE-New England, MI-Missouri, AP-Appalachia, FL-Florida, SM-Southern Missouri

Many regions have a negative margin as a minimum, but this may occur for only a few of the 500 iterations. This demonstrates that the MVEMP distribution allows for the possibility of dairy margins to be negative. The margins can be as high as $11.86 as observed for Florida on average of the whole study period. With New Mexico being as low as $5.49, the diversity of the regions is apparent noting this $6.37 range in the revenue over feed cost margin.

Comparing the national “US” margin to each respective region, Figure 2.2 demonstrates the range of margin expectations. This figure is the minimum and maximum, where the center is marked to represent the average. This figure is irrespective of farm size because policy effects are not yet included.

Figure 2.2: Expected Margins by Region (Average from 2017 to 2020)



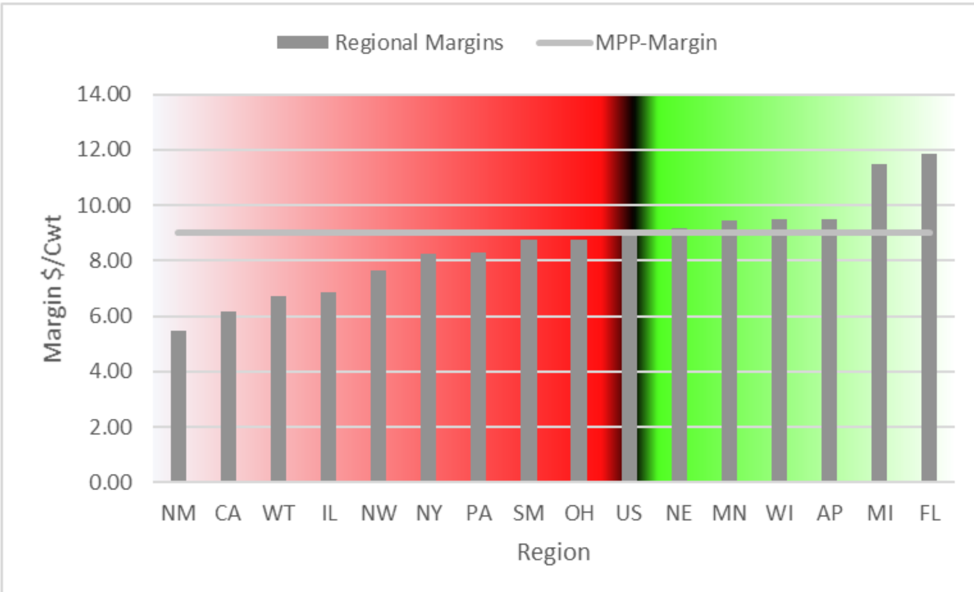
Note that the US ranges from -$0.85 to $16.99.

This range includes the occurrence of every iteration, and some margins with higher feed costs than milk price will produce a negative margin. Seven regions experience a negative margin at least once, but this by no means represents the average expectations. The US or MPP, California, New Mexico, North West, New York, Southern Missouri, and West Texas could experience negative margins during this period. If this occurs, dairy profitability is impossible for those months affected and could drive a farm to go out of business.

This figure is ordered from lowest to highest average margin across the horizontal axis, with New Mexico having the least favorable expected margin, and Florida the most favorable. While most regions are quite similar in the range of margins, Southern Missouri has the broadest range. This ordering begins to reveal which dairy regions have an advantage regarding revenue over feed cost, but analyzing profitability in its entirety would need to include fuel, labor, and other variable costs.

Federal policy needs to address how each region is represented in the legislation considering unique input and output markets. Understanding how dairy regions differ becomes evident in this analysis. Figure 2.3 describes which regional margins are expected to perform above and below the US, Margin Protection Program margin.

Figure 2.3 Comparing Regional Margins with the MPP Margin



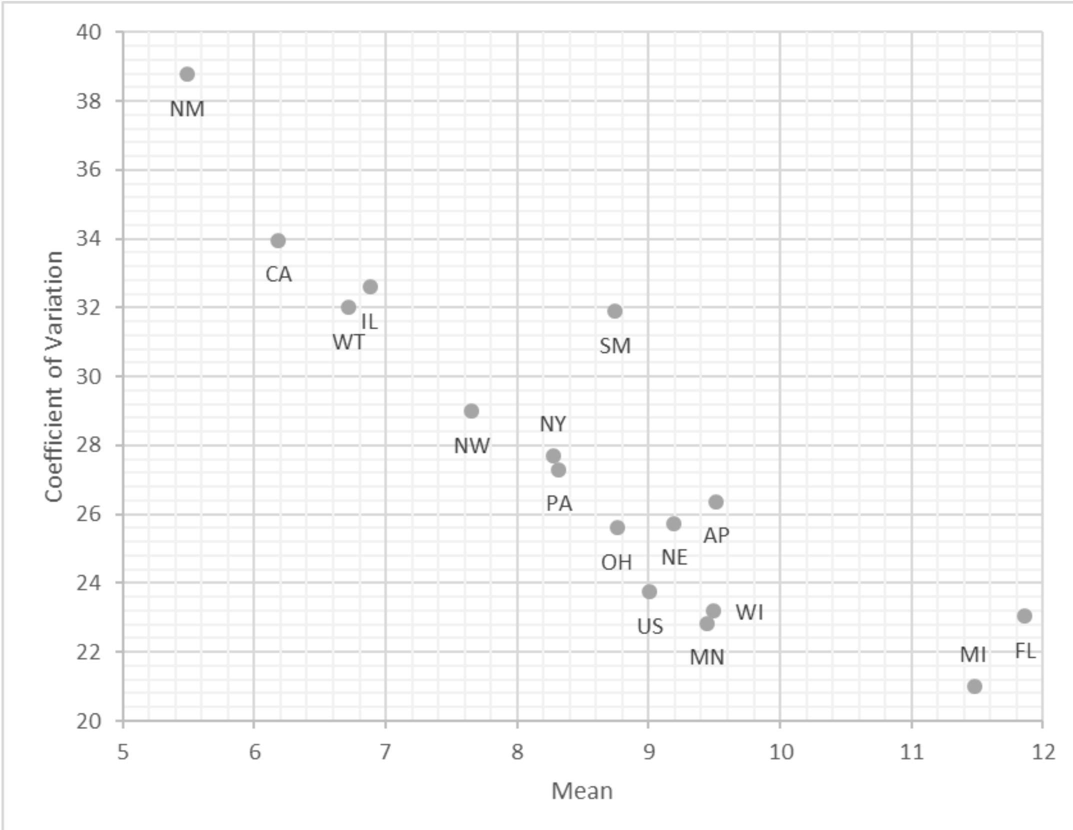
New England, Minnesota, Wisconsin, Appalachia, Minnesota, and Florida are all expected to have higher margins on average than what MPP calculates. These regions may receive indemnities when a payment would not have been triggered if the policy were regionally designed. Under-represented by MPP, the other regions would be more likely to trigger a payment than the "nationally representative" margin calculated in the current national policy. New Mexico, California, West Texas, Illinois, the North West, New York, Pennsylvania, Southern Missouri, and Ohio are all expected to have lower margins, on average.

New Mexico's $5.49 margin average is $3.52 below, while Florida's $11.86 margin average is $2.85 above the nationally expected margin. This disparity makes a significant difference, especially considering this margin excludes fuel, veterinary services, barn maintenance, and return to labor and management, among other expenses, which still need to be covered.

NM and CA are far lower in margins that the US, compared to MI and FL with significantly higher expected margins. In the middle ground, twelve other regions are similar in terms of average margin to the MPP margin on average and could be considered well represented.

It is useful to think of not only average margins in their magnitude but also their associated variances. Regions with moderate to high margins and high volatility may benefit more from the MPP than regions with lower margins, but also very low volatility. This becomes the center for discussion when a policy where payments are triggered based on regional margins, as opposed to the national margin. Figure 2.4 displays each region's mean-variance metric, as calculated from the entire simulation period from 2017 to 2020.

Figure 2.4: Mean-Variance of Margins by Region for 2017 to 2020



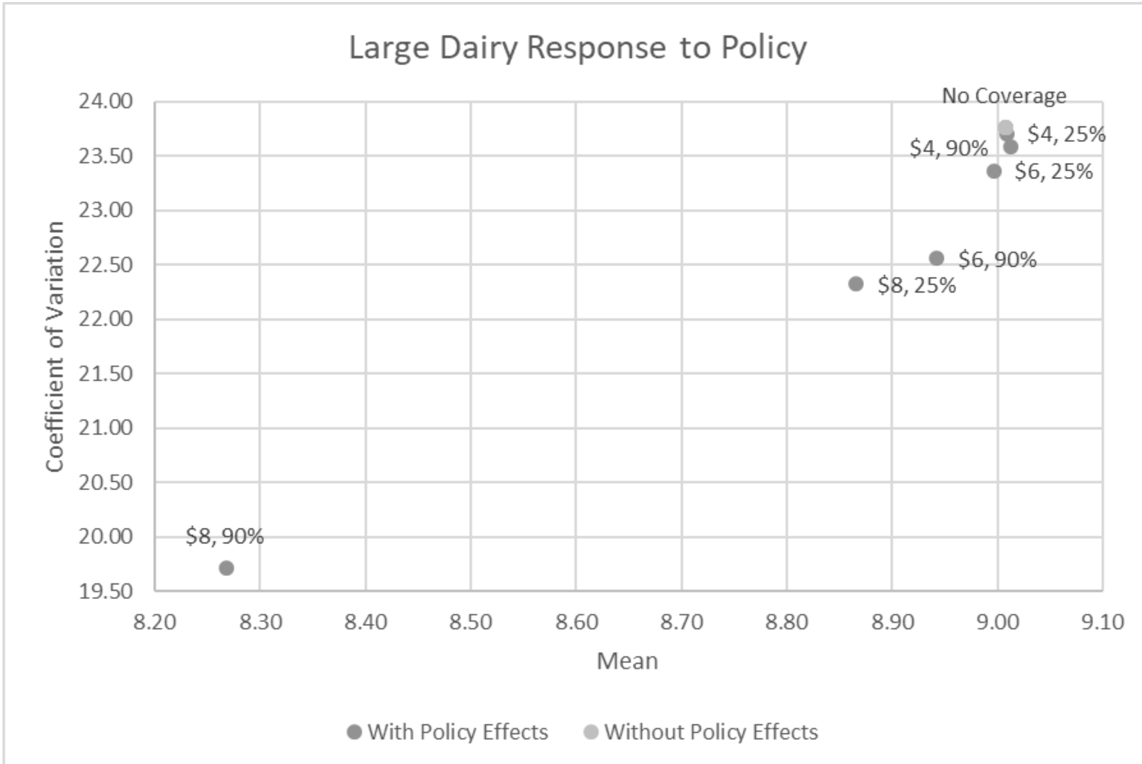
New Mexico stands out again as having the lowest expected margins, paired with the highest volatility. This disposition could drive NM to be less profitable, but more information about the other variable costs before concluding its suitability for dairy profitability altogether. It should not be overlooked that similar regions such as CA, WT, and IL also have lower average and higher variance for dairy margins.

On the other end of the mean-variance graph, Florida and Michigan have more favorable margins. Dairy farming in Florida could benefit from higher margins, with a mean $11.86 and CV 23.03, where only Minnesota and Michigan have lower CVs of 22.83 and 21.00 respectively.

Two sets of regions pair together neatly, New York and Pennsylvania, as well as Minnesota and Wisconsin. This is evidenced by the close clustering between these regions in Figure 2.4. NY and PA could have an advantage of being closer to more higher population cities. MN and WI could be benefiting from being closer in proximity to the corn and soybean belt. These potential market differences could begin to explain the differences evident in the mean-variance of each dairy region's margins.

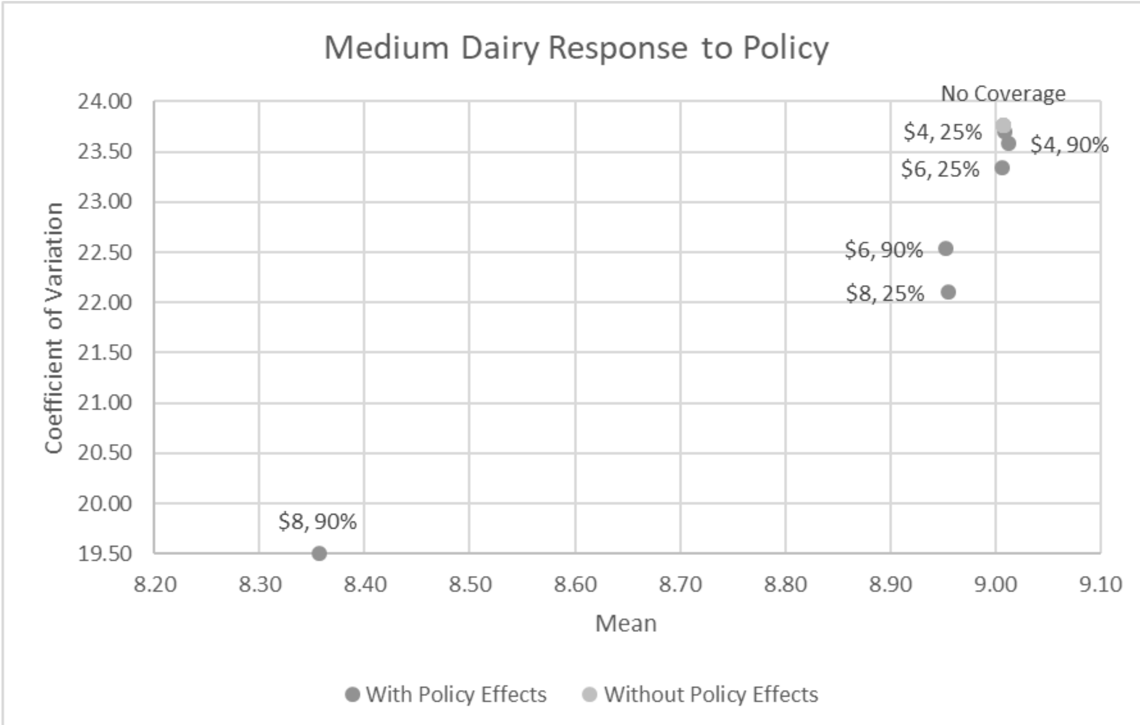
Regional differences exposed by this new methodology for analyzing the MPP will provide points of interest for policy reform. Also advantageous to this development is the ability to decompose the policy's effects by farm size. Figures 2.5, 2.6, and 2.7 demonstrate the policy impact on mean-variance expectations for large, medium, and small dairies, respectively. These farm sizes correspond with 2000, 1000, and 200 cow dairies utilized to model the policy effects by farm size. Six available coverage levels were analyzed in this fashion. The $4, $6, and $8 margin levels were analyzed at the 25% and 90% production level to capture the range of coverage levels that dairy farmers can select.

Figure 2.5: Large Dairy Herd Change in Mean-Variance for 2017 to 2020



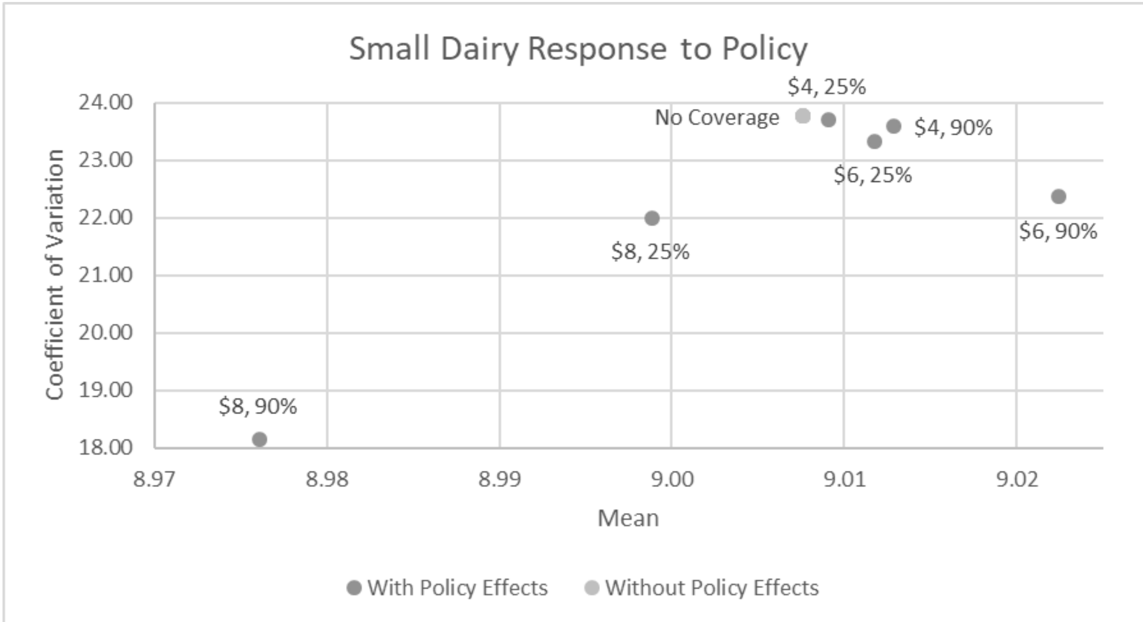
Due to premiums paid into the program, expected margins were lowered for each coverage level on the large farms. No coverage has the highest mean and CV, with the lowest coverage level nearby due to a slightly lower CV. This trend continues with each higher respective coverage level, where MPP is responsible for lowering the variation, but also the average margin. At the highest coverage level $8.00 for 90% of the large farm's production history, the expected margin is $0.74 lower than the margin with no coverage, but the CV is also significantly lower. A similar trend was observed for medium dairy farms, as demonstrated by Figure 2.6.

Figure 2.6: Medium Dairy Herd Change in Mean-Variance



Only showing a $0.65 reduction in the expected margin, the highest coverage level ($8.00/90%) experienced variation reduction, with a lower CV. MPP lowered expected margins for each successive coverage level on the medium farms. The tradeoff finds that CV was also lowered, and therefore insuring against margin risk, as intended. The medium farms mean-variance trend across the plot is very similar to the large farms. However, the $6.00/25%, $6.00/90%, and $8.00/25% coverage levels have higher expected margins when compared with the large dairy farm response to policy effects. One difference that could explain this is the higher premium rate paid by producers securing margins on over 4 million pounds of milk. These results follow policy expectations, and interesting deviations appear for how MPP is expected to impact small dairy farms as demonstrated by Figure 2.7.

Figure 2.7: Small Dairy Herd Change in Mean-Variance



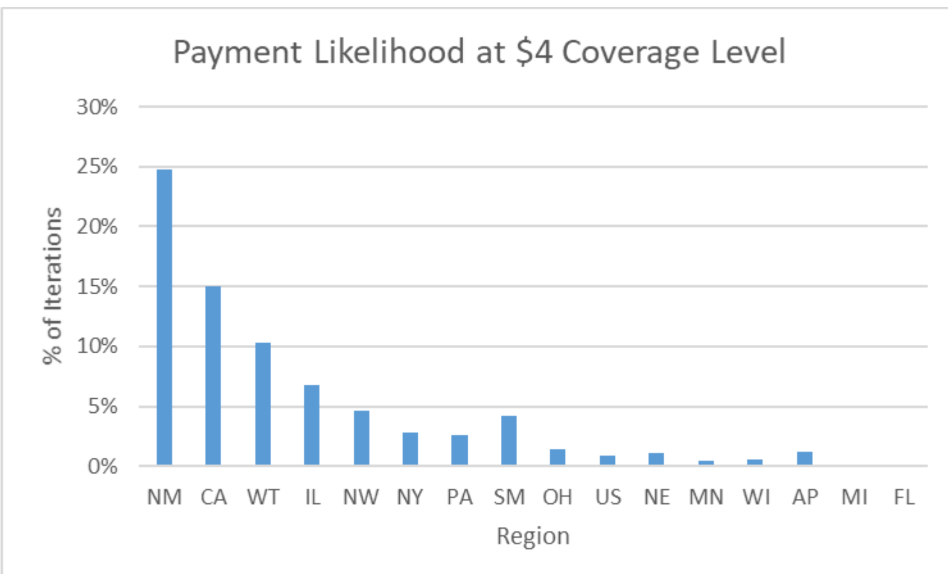
Note the scale of the plot area has changed.

Except for the highest coverage level, expected margins for small dairy farms are all within $0.01 from the margin representing farms not utilizing MPP. Both sets of $4.00 and $6.00 observations appear to have higher margins, but these are by fractions of a penny. This higher expected margin could be a result of lower premium rates with equal likelihood of indemnities when compared to the medium and large farms. The highest coverage level ($8.00/90%) yielded a $0.03 reduction in the expected margin and $5.60 (24% relative to before policy effects) reduction in CV.

These findings suggest MPP has more favorable impacts on small farms as compared with medium and large operations. Large farms are encouraged to consider the 4 million pound rule where higher premiums are charged above this production level. Lower margin levels and lower production percentages are associated with increased margins in response to MPP. Changes in the mean-variance disposition after considering policy effects should help producers determine which coverage level to select based on their risk preferences.

This study also allowed the likelihood of MPP to trigger payments to be analyzed. By considering each of the 500 iterations within each couplet margin across the 2017 to 2020 period, an estimate of how often payments should be expected is determined. The likelihood is expressed as a percent of all observations and is summarized in Figures 2.8, 2.9, and 2.10. Each figure is ordered from highest to lowest likelihood, revealing which regions vary the most in the difference of market expectations.

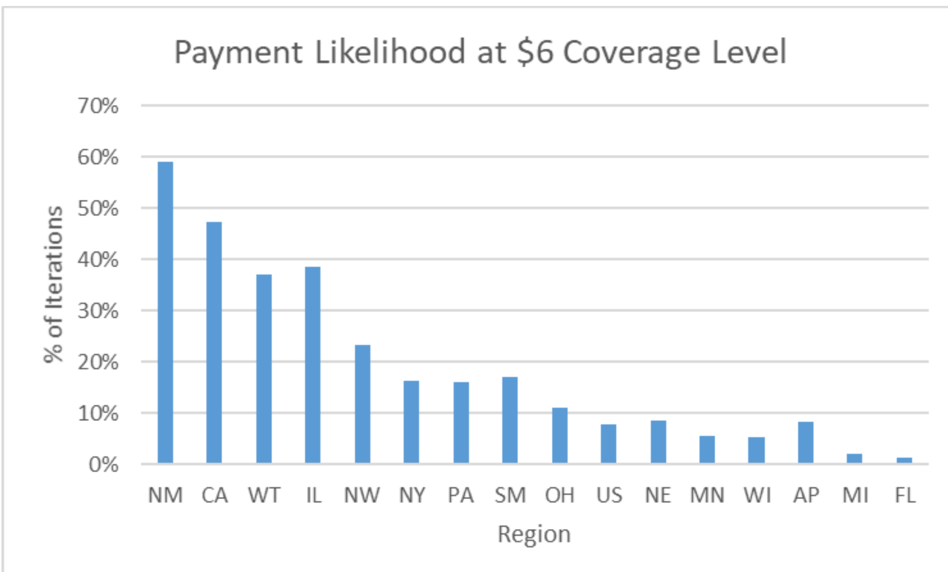
Figure 2.8: Frequency of MPP-Dairy Payments at the $4.00 Coverage Level



The US margin and respective likelihood is the most important observation that is significant to the remaining life of the current policy. The regional likelihoods are hypothetical, in that payments will not be triggered for New Mexico when their margin falls below $4.00. These regional likelihoods are useful for discussing how regions relate to the nationally representative margin calculated in the Margin Protection Program.

At the $4.00 level, the US margin has a negligible 1% chance of triggering payments. While producers certainly would not hope for those small margins, it should put in perspective the current utilization of MPP. Three regions have likelihoods relatively higher than the US expectation. New Mexico, California, and West Texas are 25%, 15%, and 10% respectively, likely to trigger payments at this level. If a regional policy of similar core construction were in place, regions such as these would trigger indemnities to be paid to producers more often than the current national margin.

Figure 2.9: Frequency of MPP-Dairy Payments at the $6.00 Coverage Level

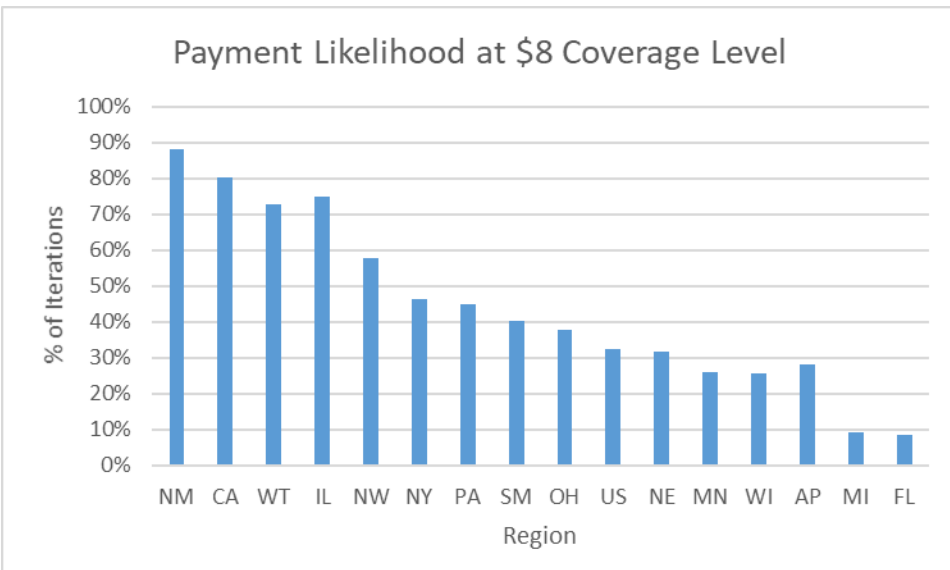


Note each of regions is ordered by the expected margin

NM, CA, and WT are now 59%, 47%, and 37% respectively likely to trigger indemnities. Michigan and Florida perform consistently when considering different coverage levels. A negligible 0% likelihood is determined, meaning no iterations fell below $4.00 at any time during the forecast period. This likelihoods rise to 2% and 1% respectively when considering the $6.00 coverage level. These expectations for payments to be made to producers are also quite negligible.

Regarding opportunity to trigger payments, New York, Pennsylvania, Southern Missouri, Ohio, New England, Minnesota, Wisconsin, Appalachia, Michigan, and Florida could be considered well represented by MPP. This is determined by the expectation of frequency of payments triggered in the forecast at the $6.00 coverage level. This suggests that representativeness is measured by the difference in the average margin and the likelihood of payments for each region as compared to the MPP margin. However, there is still considerable variability that the national program is not able to account for. Each of these regions is within 10% of the US expected margin. As higher coverage levels are considered, greater differences in the magnitude of payment likelihood are revealed and thus more political discrepancy.

Figure 2.10: Frequency of MPP-Dairy Payments at the $8.00 Coverage Level



Note again the change in vertical axis units

Lastly, Figure 2.10 demonstrates what can be expected at the highest, $8.00 coverage level. Noting that payments are triggered when the US calculated margin falls below the producer-selected level, and they are paid out the difference between the two, the highest coverage level is the most likely to trigger payments.

At the highest coverage level offering, likelihoods raise in magnitude. New Mexico and California are now 88% and 80% likely to trigger payments, respectively. Considering the MPP margin is now 33% likely to trigger payments at the $8.00 coverage level, NM and CA are more likely to receive indemnities when considering their actual margins in that region. This puts these regions at a disadvantage due to their difference in the MPP margin. The nine regions to the left of the US margin are all more likely to receive payments than the US, representing the inability of the current policy to account for regional margin trends At this level, even Michigan and Florida have a small chance of triggering payments, with 9% and 8% respectively.

In general, each likelihood figure shows the trend that more regions are under-represented by the MPP margin, having higher likelihoods to trigger payments if the ADPM utilized their feed prices in MPP. Fewer regions have effective margins above the MPP margin. This could indicate that payments made by MPP are representing those regions well. While comparing the likelihood of payments across regions is hypothetical under the current construction of the policy, it is clear to differentiate which regions are well served by MPP and which are significantly different.

2.4 Conclusions

The Margin Protection Program for dairy producers affects each region differently. Various milk and feed price trends significantly influence the likelihood and magnitude of MPP’s payments. Small farms are advantaged in mean-variance disposition under MPP as compared to the large and medium farm sizes. This result is due to the premium schedule being designed to have lower rates under 4 million pounds of production. All farm sizes recognize a reduction in margin risk as measured by the coefficient of variation.

As a trend across the various metrics analyzed, Michigan and Florida are at an advantage above regions such as New Mexico and California, where both sets widely deviate from the US (MPP) expected margins. The evidence is provided that motivates the discussion for reforming the Margin Protection Program to allow for regional differences.

If a regional policy of similar construction were available to producers, it might pay out more frequently in regions with smaller margins. One approach may be to re-evaluate the premium schedule based on the likelihood of payment for a given region. New Mexico, for example, is more likely to trigger payments and therefore should pay in higher premiums relative to the US margin.

Another approach may be to utilize regional prices in the same ADPM calculation as in the current policy, which could trigger payments separately in each region. Two important hurdles to this is a potential increase in the cost of the program as well as a lack of regional data, as faced in this analysis. Careful consideration should be taken to ensure that particular farm sizes or potentially regions would not be poorly represented by the national policy.

Concerning the political nature of a diverse set of dairy producing regions, this analysis serves to communicate regional differences while cautioning the breadth of reform. As regional differences are adjusted for, a new layer of more localized differences emerges, and the same representation problem occurs.

Supposing that MPP could be negotiated as a regional policy with similar construction, the use of proxies as in this analysis would limit the feasibility of implementing a regional feed cost calculation. Evaluating the potential utilization of regional prices for a policy of similar construction could include how this changes the cost of the program.

In conclusion, the new approach to analyzing the Margin Protection Program successfully combined two of the existing methodologies (Mark et al 2014 and Mark et al 2016.) This approach allowed for regional and farm size differences to weigh in on future expectations of the MPP calculated margins. Testing the sensitivity of the MPP margin to deviations from this baseline scenario would provide a useful extension to this work.

CHAPTER 3: A SENSITIVITY OF THE MARGIN PROTECTION PROGRAM TO VARIOUS MARKET SCENARIOS

3.1 Objective

Chapter 2 developed a new methodology for analyzing the Margin Protection Program, combining the framework of Mark et al (2016) and Mark et al (2014.) A baseline market scenario was analyzed where prices follow the FAPRI projections. The scenario developed in Chapter 2 will hereby be referred to as the “baseline scenario.” The effects of the Margin Protection Program provided valuable insight into how well each dairy region was represented by the policy. The objective of this analysis is to test various market scenarios and develop an understanding of how well MPP manages risk for regional basis risk. Basis risk here is a measure of a nominal difference between the national price of a commodity and the regional price of the same commodity.

3.2 Data & Methodology

US all-milk, corn, and alfalfa hay prices are reported by the National Agricultural Statistics Service’s Agricultural Prices Report (USDA/NASS, 2016.) The Agricultural Marketing Service’s Mailbox Milk Price Report and the NASS’s Livestock, Poultry, and Grain Reports report regional mailbox-milk and soybean meal prices respectively (USDA/AMS, 2016, USDA/NASS, 2016.) All annual average forecasted prices were accessed using the Food and Agricultural Policy Research Institute’s Annual Briefing Book (FAPRI, 2016.)

This data is utilized to construct regional margins under the MPP specification. Historical price data from 2005 to 2016 is utilized to calculate future expected values by the process of Equations 2.1 and 2.2

$$x_{cij}^{1} = \frac{P_{cij}}{\bar{P}_{cj}} \quad (2.1)$$

$$x_{cij}^{2} = \frac{P_{cij}^{n} - P_{cij}^{r}}{P_{cij}^{n}} \quad (2.2)$$

where c, i, and j represent each commodity, month and year of the 2006 to 2016 historic data. Each region is indexed, where x_{cij}^{1} and x_{cij}^{2} represent the seasonal and regional indices respectively. In Equation 2.2, n and r denote national and regional. Each of these indices are multiplied by the FAPRI baseline projections for 2017 to 2020 to generate the expected values to be used in the simulation.

At this point, a modification is made to the methodology established by Chapter 2 in order to impose price shocks. Price shock methodology is developed after the price simulation, but before couplet margins are calculated. Equation 3.1 calculates prices in the first month of the shock period:

$$P_{c}^{Dec\ 17} = P_{c}^{Nov\ 17} * (1 - Shock\%) \quad (3.1)$$

where $P_{c}^{Dec\ 17}$is the initial price shock occurring in December of 2017 $P_{c}^{Nov\ 17}$ is the November 2017 price preceding the shock, c denotes the commodity affected by the shock, and Shock % is unique to each scenario. This mechanism is utilized solely to determine each price in the first period affected by the price shock. The remaining periods' affected by the shock are determined by the combined use of Equations 3.2 and 3.3.

$$\text{“}Set\text{”} \left(Baseline_{Aug\ 18} - Scenario_{Aug\ 18}\right)$$

$$\text{"}Equal\ to\text{"}\ (0)$$

$$"By\ changing"\ (Exp\ Rate) \quad (3.2)$$

Microsoft Excel's "Goal Seek" function determined the exponential rates .0046, .0030, .0015, -.0117, and .0046/-.0066 (milk/corn) for each Scenario 2, 3, 4, 5, and 6 respectively. Each rate is then utilized in Equation 3.3, determining the price for each period affected by the shock.

$$x_{cij}^{3} = P_{cij}^{t-1} * (t * Exp\ Rate) \quad (3.3)$$

where x_{cij}^{3} is the prices in each successive month affected by the price shock, t is the number of periods since the initial shock, and P_{cij}^{t-1} is the price in the previous month. Ending shock period prices were almost exactly equal to baseline prices because this was minimized in the goal seek function for determining the exponential rate.

Pre- and post-shock period prices are set equal to the baseline, such that with every iteration, scenario prices are exactly equal to baseline commodity prices, making the only difference between the two scenario's data the prices during the shock period. This extension of the methodology allows sensitivity analysis to be tested on the Margin Protection Program. After prices are modified for shocks, couplet margins are calculated and then simulated, assuming a multi-variate empirical distribution for 500 iterations of the forecasting simulation, as described by Equation 2.3.

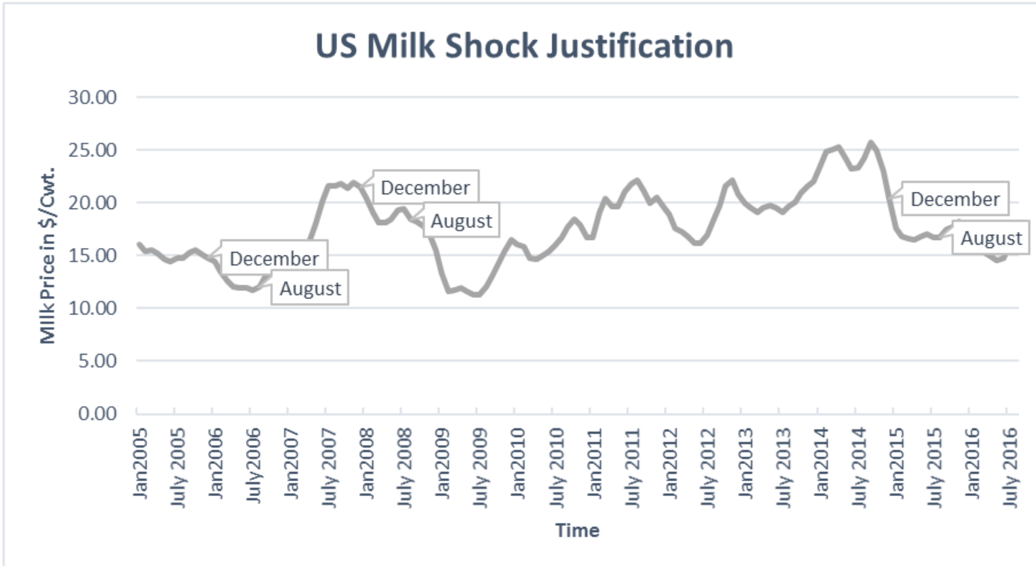
$$MVEMP\ \{ P_{cij}, x_{cij}^{3} \} \quad (2.3)$$

where P_{cij} and x_{cij}^{3} describe the historical commodity data and FAPRI-derived expectations which have been adjusted for seasonal and regional trends.

The simulated couplet margins in Chapter 2 follow FAPRI's expectations, but Scenarios 2 through 6 impose unfavorable market conditions to analyze how the Margin Protection Program's effects change. Scenarios 2, 3, and 4 are downward milk price shocks, while scenario 5 is an upward corn price shock. Scenario 6 will test how the margin, and therefore payout expectations, will change when both milk and corn price shock coincide. Each scenario utilizes the methodology described above to model price shocks and detailed justification for the period and magnitude choice of the shock is provided below.

Scenarios 2, 3, and 4 represent the occurrence of a 15%, 10%, and 5% downward milk price shock in December of 2017, which exponentially recovers by the ending period of August 2018. This investigation is justified by historic shocks to US milk prices. Figure 3.1 demonstrates three times where milk price threatened dairy margins and therefore profitability. Mark et al (2014) concluded milk as being more important to the MPP margin due to having more weight than soybean meal and alfalfa. Although corn price has a higher coefficient in the margin calculation, a one unit change in corn price is less likely than a one unit change in milk price.

Figure 3.1: Historic Shocks in the US milk price



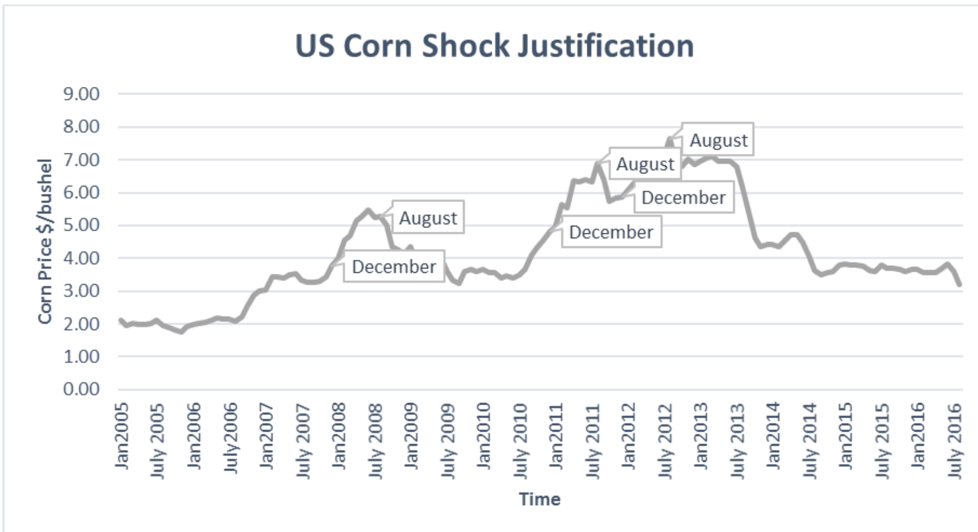
The ’06 ’08 and ’15 milk shocks resulted in a 2%, 2%, and 11% initial drop in the price of milk. Shifting this upward to a range for this analysis from 5% to 15% provides a means for testing reasonable market threats. Prices continued to decline, resulting in a 21%, 16%, and 27% shock over the whole shock period. The choice to restrict the shock to one period, and allow prices to grow exponentially back up to baseline expectations was a conscious decision to provide proof of concept before extending the methodology to include compounding price declines.

The period from December to August could have easily been replaced with a period from July to January when considering historical price shocks. This period would also provide a reasonable market scenario framework in the case of milk.

Scenario 5 follows this methodology as well, imposing a 50% upward shock on the price of corn. In order of weight, corn, alfalfa, and soybean meal have 1.0728, 0.0137, and 0.00735 as coefficients for the feed cost component of the ADPM calculation. This dictates corn as being the most important feed price in the national feed cost estimation.

For this reason, a shock to corn price is considered. Historical prices were evaluated for their trends and shock periods, as documented by Figure 3.2.

Figure 3.2: Historical Shocks in the US Corn Price



A shock starting in December 2017, lasting until August 2018 is determined by anecdotal shocks in the historic corn prices. Even though corn holds less weight in the MPP margin, it is important to consider both contributors to the margin when facing market uncertainty.

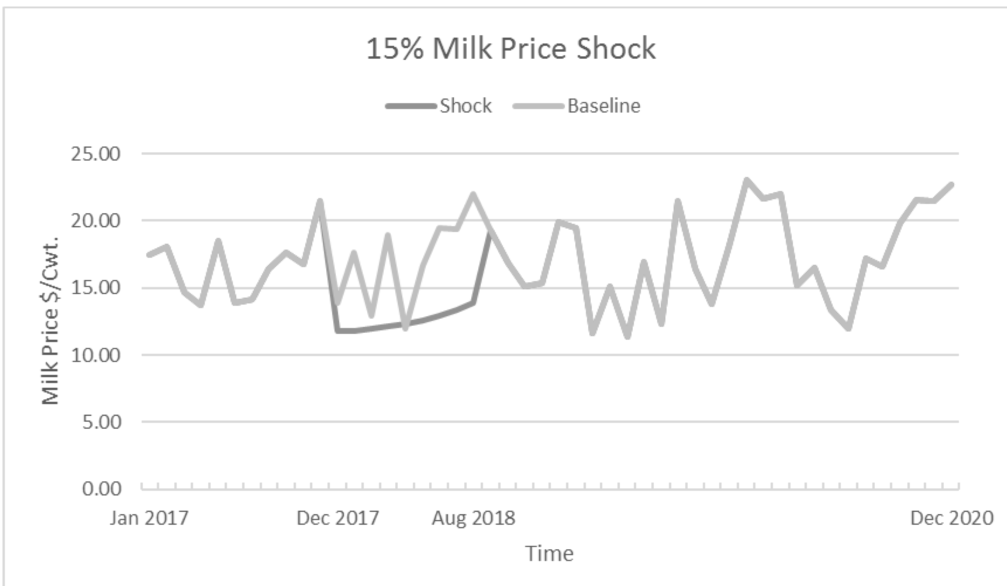
Upward shocks of this magnitude have transpired in the past, the ’08 ’11 and ’12 shocks resulted in a 10%, 6%, and 1% initial increase in the price of corn respectively. More interestingly, each shock turned out to be 53%, 51% and 31% of magnitude over the entire December-August period. These historical figures justify not only the 50% shock in Scenario 5 but also the 25% corn price shock presented in Scenario 6.

Scenario 6 would be the least favorable for dairy producers, with a 15% downward milk and 25% upward corn price shock. The same time-period is maintained as in Scenarios 2 through 5. While corn and milk price shocks may happen independently, it is also possible that they occur simultaneously. This scenario investigates the effects of that market possibility, and this situation would be the most threatening to dairy profitability.

3.3 Results

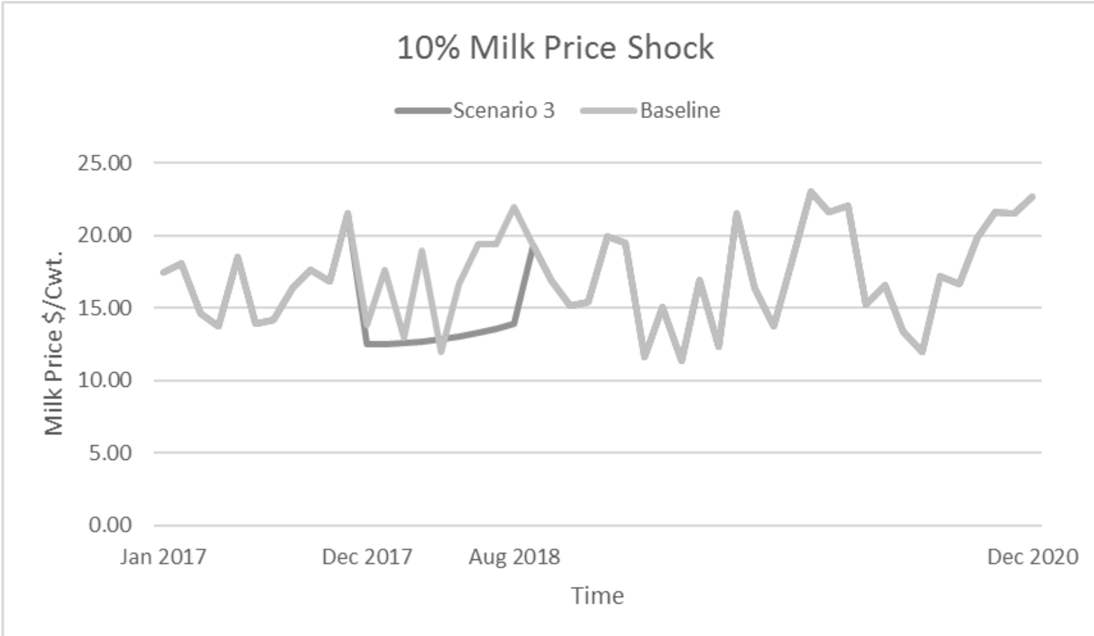
To visualize the difference between the baseline and various market situations, a sample of price data is provided. Figures 3.3 through 3.7 demonstrate how the shock period deviates from the baseline, ordered from Scenario 2 through 6.

Figure 3.3: Scenario 2, US Prices from 2017 to 2020



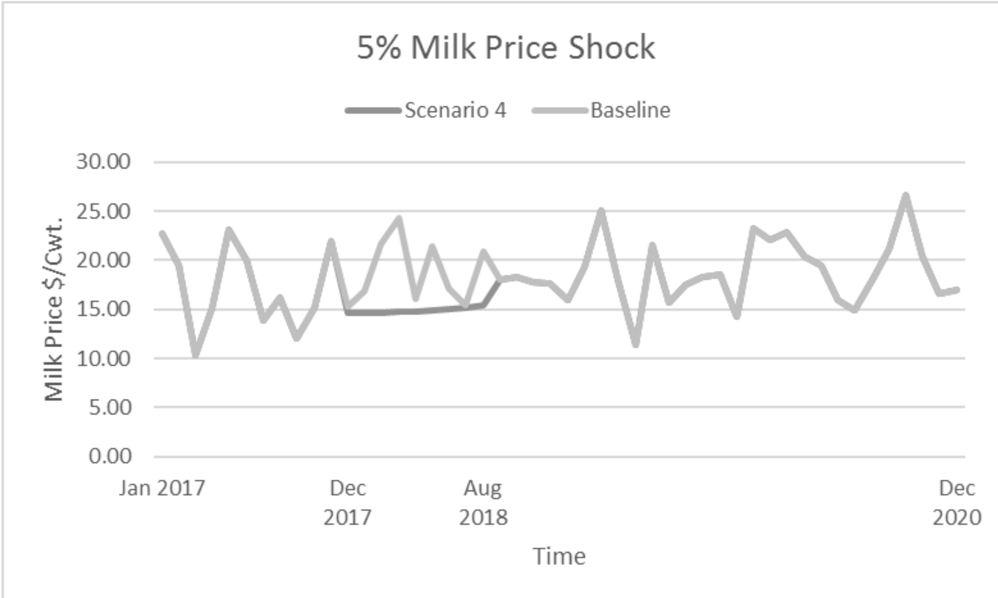
The ‘06 ‘08 and ’15 downward shocks in the price of milk occurred in December. A 15% drop in the price of milk would shift dairy profitability by putting downward pressure on the margins. This figure represents just one iteration, where observed deviation from the baseline milk price is noticed and eventually recovers through a price increase to meet the baseline expectation. This visualization is valuable for considering how milk price impacts the ADPM especially noting this deviation from the baseline occurs for each iteration of the simulation.

Figure 3.4: Scenario 3, US Milk Prices from 2017 to 2020



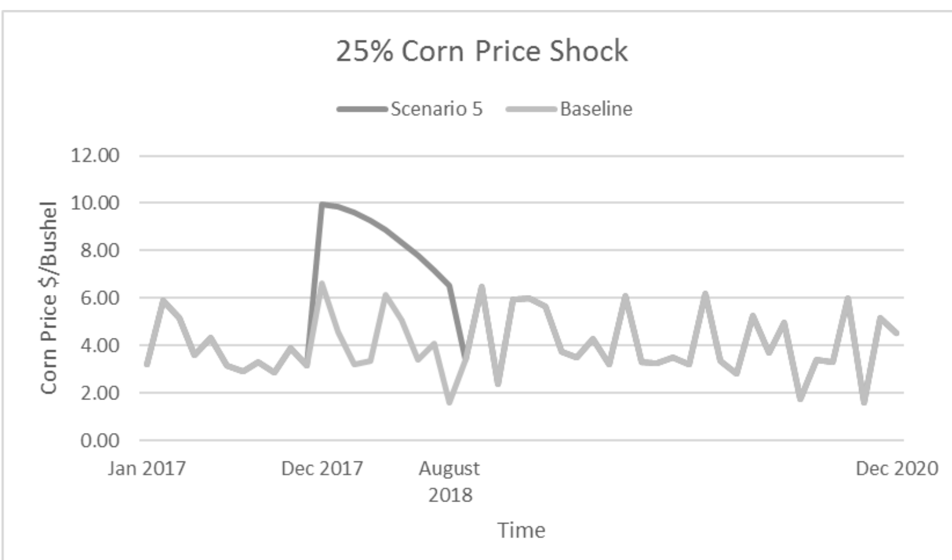
A 10% drop in the price of milk would be less dramatic to dairy margins. When observing the trend across the period, this less dramatic price shock starts to resemble historic, expected volatility. A similar deviation and growth upward to meet the baseline pattern is noticed by this example iteration. Observing this figure, this scenario's price shock shows a smaller impact on the milk price and therefore margin.

Figure 3.5: Scenario 4, US Milk Prices from 2017 to 2020



A 5% drop in the price of milk has the least dramatic deviation from the baseline scenario prices. After analyzing this type of shock in MPP's framework, it is concluded shocks this small are less valuable to a market sensitivity analysis. This magnitude of shock should be considered expected price volatility.

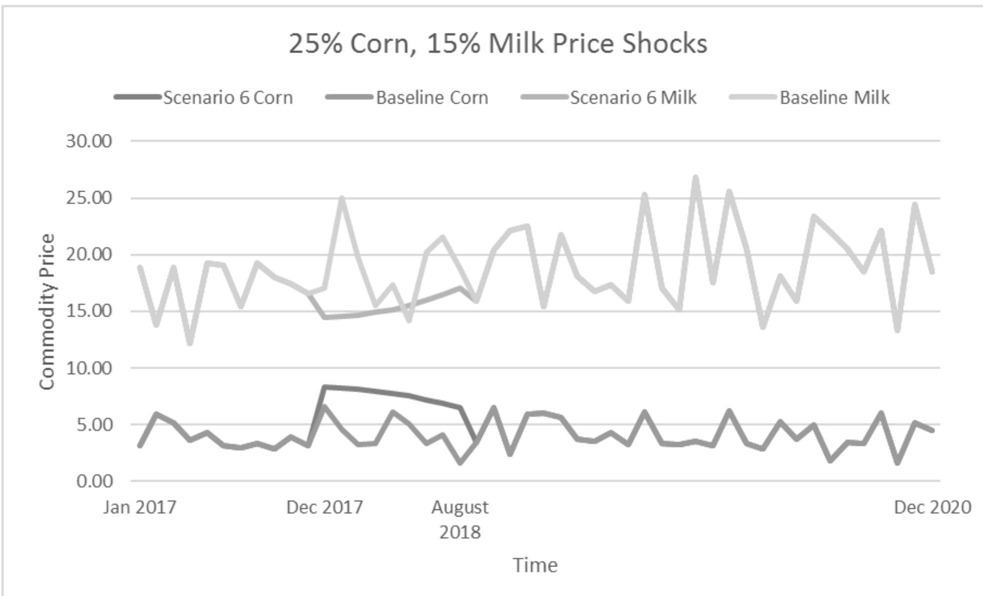
Figure 3.6: Scenario 5, US Corn Prices from 2017 to 2020



The 50% upward shock in the price of corn deviates considerably from the baseline price and is modeled after the historic, 53% and 51% shock occurring in

December of ’08 and ‘11. This shock is visually different from the trend observed in the baseline scenario. This pattern reinforces the value of analyzing such a shock because this shock is considerably different from historic volatility. Scenario 6 introduces a less dramatic corn price shock, but paired with a significant milk price shock, margins tighten. Figure 3.7 visualizes Scenario 6 impacts to the margin, the most unattractive situation for dairy producers.

Figure 3.7: Scenario 6 Prices 2017 to 2020

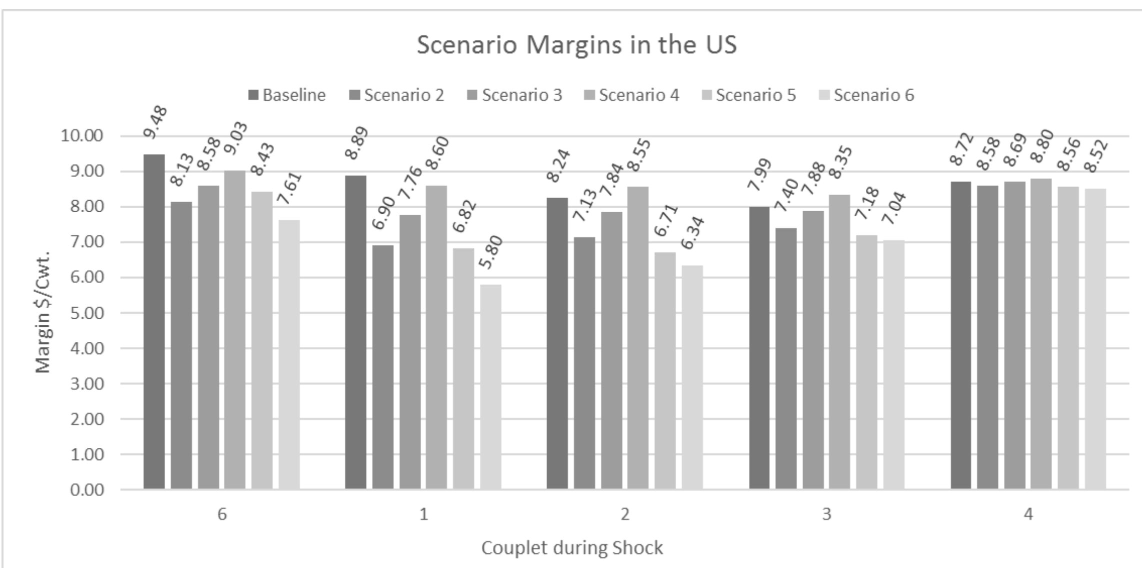


Scenario 6 is the least favorable market event for dairy producers. The figure demonstrates each shock is deviating towards the center, limiting the difference between these prices, thus limiting the margins. It is important to note these figures as being a sample of one cross-section or one iteration of each margin. Each of these figures could be constructed for 8000 (500 iterations, 16 regions) couplet margins, but this sample serves as a visual representation of how the price deviates away from the baseline, then grows back up to meet the baseline by the period of August of 2018.

It is observed for Scenario's 2, 3, and 4, the shock price deviation from the baseline descends in magnitude as expected. Corn price impacts will be rendered smaller after the margin is calculated because soybean meal and alfalfa hay prices hold weight in the feed cost as well. It is when both milk price and a feed component are shocked that the most dramatic pressure is placed on the margin.

Each scenario has various effects on the expected margins. While directly affecting the shock period from December to August, each shock will also indirectly reduce the average margin for the whole period from 2017 to 2020. First, relationships between shock periods and the average margin within each couplet margin is presented in Figure 3.8. Note that while couplet 6 takes the average of both November and December, only December is affected by the initial shock, limiting the impact of the initial shock when considering the couplet as opposed to the margin in December. The figure above each bar is the margin for each couplet, where "1" is the January/February couplet margin, "2" is the March/April couplet, etc.

Figure 3.8: Expected US Margins during Couplets affected by the Shock

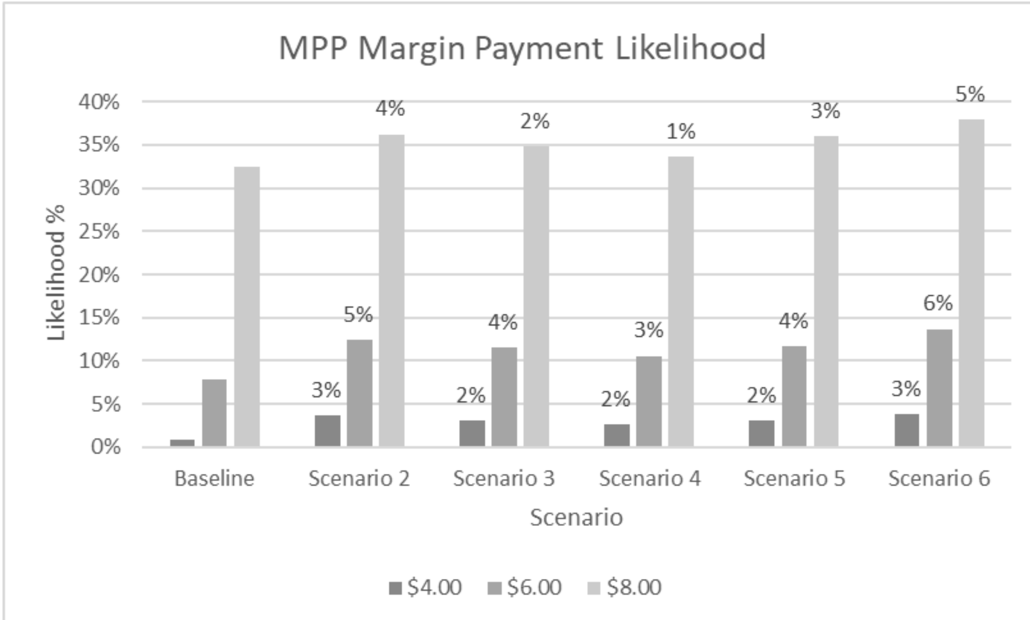


The trend across the couplet margins shows recovery of average margins as expected. The baseline couplet margin in December of 2017 is $9.48. In the milk price shock Scenario 2, the average margin drops $1.35 down from the baseline to $8.13. It takes until couplet 1, $6.90 to realize the full effects on the couplet margin, where both months are now lower margins. This margin then rises to $7.13, $7.40 and $8.58 by couplet margin number 5, where there is only a $0.04 difference between Scenario 2 and the baseline. Each scenario ends within $0.20 of the baseline average margin. This trend of reducing slightly in the initial couplet margin, more so by the second couplet margin, and then beginning to rise slowly with each successive couplet, back up to the baseline is similar to each scenario.

When considering the trend across scenarios within each couplet margin, the average margin is effected the most by Scenario 6. Scenario 5 then Scenario 2 rank second and third in the most harmful to the average margin. This is evident by lower bars for Scenario 5 relative to Scenario 2 in all but couplet margin number “6,” where Scenario 2’s average margin is only $0.30 lower than that of Scenario 5.

After considering the impacts to the average margin, it was constructive to evaluate the likelihood of the program to trigger indemnities to dairy producers. The likelihood of receiving payments was found to be irrespective of farm size. Farm size only impacts the premium rate determined, not the expected indemnities, and was considered a check that the analysis is conforming to expectations. Figure 3.9 demonstrates the likelihood that payments could be triggered in each scenario relative to the baseline.

Figure 3.9: Comparing Baseline Likelihood of MPP to Pay with Market Scenarios



Each column is labeled with the percent change in likelihood to trigger payments relative to the baseline scenario. Scenario 6 increases the likelihood of payments more than any other scenario, and it does this at every coverage level as expected. Every scenario will make MPP more likely to pay indemnities. Every scenario and coverage level only experience a 1% to 6% change, indicating historical shocks even would not be expected to dramatically change the Margin Protection Program's performance. Table 3.1 provides the average margin for three regions, representing the highest and lowest expected margins, a starting point for analyzing effects on regional margins.

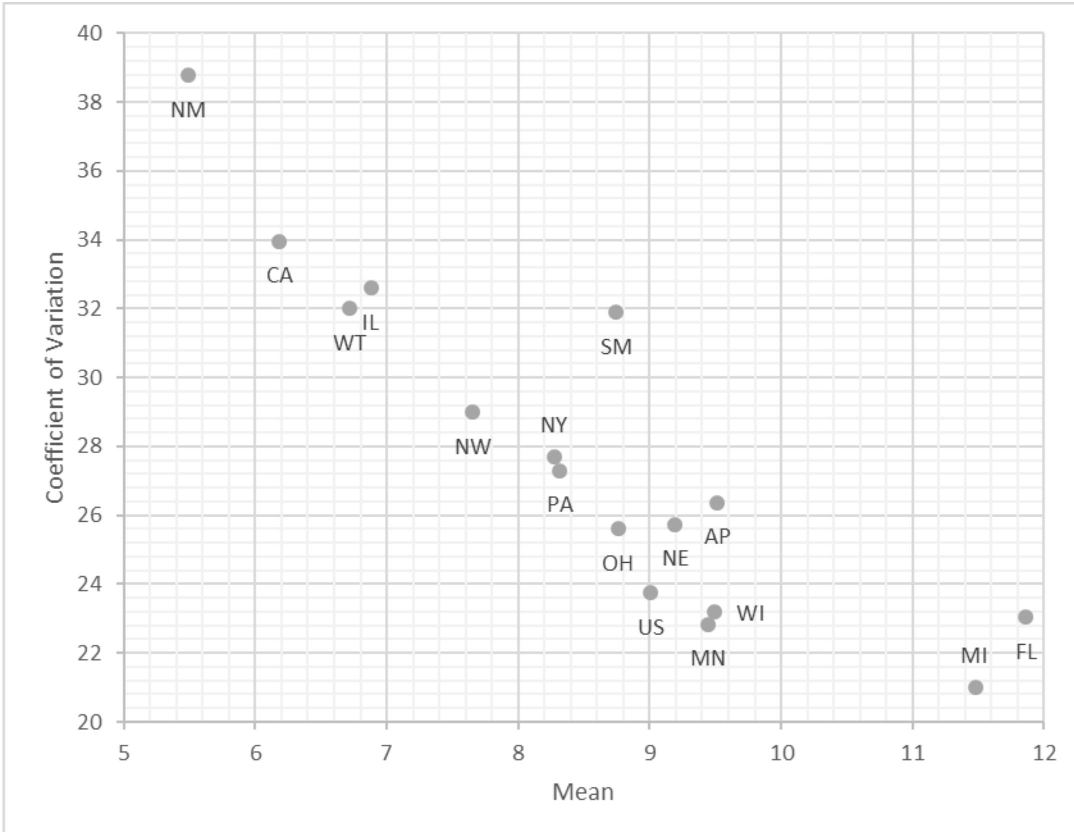
Table 3.1 Average Margin Before Policy Effects

	Average Margin Before Policy Effects					
	Baseline	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
US	$ 9.01	$ 8.79	$ 8.90	$ 9.01	$ 8.77	$ 8.67
NM	$ 5.49	$ 5.36	$ 5.46	$ 5.55	$ 5.24	$ 5.23
FL	$ 11.86	$ 11.56	$ 11.69	$ 11.81	$ 11.62	$ 11.44

Each market shock scenario has lower average margins than baseline margins within that region. New Mexico, Scenario 4, is the only exception to this trend. Because it is the smallest milk price shock, more couplet margins are unaffected by the shock as compared with those that are affected, and therefore the exponential recovery mechanism surpassed baseline margins. Scenario 6 has the smallest margins, reinforcing the suggestion that the biggest market threat to dairy producers is a price shock to both the milk price and cost of the dairy ration.

New Mexico, Florida and the United States (MPP) margins have been chosen as regions of interest for two reasons. Figure 3.10 finds these two regions were designated as the best and the worst regarding MPP's ability to represent their average margins. They also represent the ends of the spectrum for risk of regional misrepresentation due to a difference between the national average and the local or regional input and output markets.

Figure 3.10 Mean-Variance by Region for 2017 to 2020 period



The remainder of this section will present each scenario's change in average margin after MPP's effects. Each of these tables is formatted to show favorable or unfavorable, increases (green) or reductions (red) in the average margin. Risk measurement results, as measured by the change in coefficient of variation are presented by each farm size after that scenario's change in average margin. Tables 3.2 through 3.25 compile the change in average margin as well as risk reduction for each scenario of interest.

Table 3.2: Baseline Change in Margin after Policy Effects by Coverage Level

	Baseline								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	0.02%	0.02%	0.02%	0.03%	0.03%	0.03%	0.01%	0.01%	0.01%
$4.00, 60%	0.04%	0.04%	0.04%	0.06%	0.06%	0.06%	0.03%	0.03%	0.03%
$4.00, 90%	0.06%	0.06%	0.06%	0.10%	0.10%	0.10%	0.04%	0.04%	0.04%
$6.00, 25%	-0.12%	-0.01%	0.05%	-0.20%	-0.02%	0.08%	-0.09%	-0.01%	0.03%
$6.00, 60%	-0.45%	-0.33%	0.11%	-0.73%	-0.55%	0.18%	-0.34%	-0.25%	0.08%
$6.00, 90%	-0.72%	-0.61%	0.16%	-1.19%	-1.00%	0.27%	-0.55%	-0.47%	0.13%
$8.00, 25%	-1.57%	-0.59%	-0.10%	-2.58%	-0.97%	-0.16%	-1.19%	-0.45%	-0.07%
$8.00, 60%	-5.15%	-4.16%	-0.23%	-8.44%	-6.83%	-0.38%	-3.91%	-3.16%	-0.18%
$8.00, 90%	-8.21%	-7.23%	-0.35%	-13.47%	-11.86%	-0.57%	-6.24%	-5.49%	-0.27%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

Each region presented and farm size can expect a small increase in the average margin at the $4 coverage level. At the $8 coverage level, however, each region should expect lower margins on average due to higher premium rates paid into the program and low frequency of payouts. New Mexico and Florida are considered book-end representatives with the US (MPP) margin positioned approximately in the middle. Considering the excluded regions would mean interpolating the findings.

The MPP-Dairy program could be expected to have some tradeoff between expected margin and risk reduction. To receive some risk reduction, some expected margin should be forgone. This principle is evident in some regions and coverage levels with the program, but some situations show no risk reduction and also lower expected margins. Evaluating the baseline risk reduction, Table's 3.3-3.5 described the change in CV with respect to the model farm sizes large, medium, and small after policy effects. Desirable changes, (negative numbers), are denoted by bold text for every table analyzing risk reduction.

Table 3.3: Baseline Risk Reduction by Region and Coverage Level, Large Farms

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.01**	**-0.02**	**-0.03**	**-0.03**	0.02	0.11	0.17	1.15	2.39
CA	**-0.01**	**-0.03**	**-0.03**	0.01	0.19	0.44	0.62	2.99	5.89
FL	**-0.01**	**-0.02**	**-0.02**	**-0.03**	0.00	0.06	0.09	0.74	1.57
IL	**-0.01**	**-0.02**	**-0.02**	0.03	0.22	0.45	0.61	2.74	5.28
MI	**0.00**	**-0.01**	**-0.01**	0.04	0.16	0.30	0.40	1.53	2.83
MN	**0.00**	**-0.01**	**0.00**	**-0.01**	0.07	0.20	0.23	1.31	2.69
NE	**-0.01**	**-0.02**	**-0.03**	**-0.01**	0.07	0.19	0.27	1.44	2.89
NM	**-0.02**	**-0.04**	**-0.05**	0.01	0.22	0.50	0.78	3.72	7.29
NW	**-0.01**	**-0.03**	**-0.03**	0.01	0.14	0.33	0.44	2.13	4.18
NY	**-0.01**	**-0.02**	**-0.02**	**0.00**	0.11	0.26	0.33	1.72	3.44
OH	**-0.01**	**-0.01**	**-0.01**	**0.00**	0.10	0.24	0.29	1.56	3.14
PA	**-0.01**	**-0.02**	**-0.02**	**-0.01**	0.08	0.22	0.31	1.66	3.36
SM	**-0.01**	**-0.03**	**-0.04**	**-0.04**	0.02	0.11	0.24	1.43	2.88
US	**-0.05**	**-0.12**	**-0.17**	**-0.39**	**-0.85**	**-1.20**	**-1.43**	**-2.97**	**-4.05**
WI	**-0.01**	**-0.01**	**-0.01**	**0.00**	0.09	0.22	0.22	1.29	2.65
WT	**-0.02**	**-0.03**	**-0.04**	**-0.02**	0.11	0.30	0.46	2.41	4.83

Large Farm: 2000 cows

Table 3.4: Baseline Risk Reduction by Region and Coverage Level, Medium Farms

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.01**	**-0.02**	**-0.03**	**-0.06**	**0.00**	0.09	**-0.08**	0.88	2.10
CA	**-0.01**	**-0.03**	**-0.03**	**-0.05**	0.14	0.38	0.12	2.42	5.25
FL	**-0.01**	**-0.02**	**-0.02**	**-0.04**	**-0.02**	0.04	**-0.08**	0.55	1.38
IL	**-0.01**	**-0.02**	**-0.02**	**-0.02**	0.17	0.40	0.18	2.26	4.75
MI	**0.00**	**-0.01**	**-0.01**	0.02	0.14	0.28	0.24	1.35	2.63
MN	**0.00**	**-0.01**	**0.00**	**-0.03**	0.05	0.18	0.01	1.07	2.44
NE	**-0.01**	**-0.02**	**-0.03**	**-0.04**	0.04	0.17	0.02	1.17	2.60
NM	**-0.02**	**-0.04**	**-0.05**	**-0.06**	0.15	0.43	0.14	2.98	6.45
NW	**-0.01**	**-0.03**	**-0.03**	**-0.03**	0.11	0.29	0.10	1.75	3.76
NY	**-0.01**	**-0.02**	**-0.02**	**-0.03**	0.08	0.23	0.02	1.39	3.08
OH	**-0.01**	**-0.01**	**-0.01**	**-0.03**	0.07	0.21	0.03	1.27	2.82
PA	**-0.01**	**-0.02**	**-0.02**	**-0.04**	0.05	0.19	0.01	1.34	3.00
SM	**-0.01**	**-0.03**	**-0.04**	**-0.07**	**-0.02**	0.07	**-0.09**	1.08	2.50
US	**-0.05**	**-0.12**	**-0.17**	**-0.42**	**-0.88**	**-1.22**	**-1.65**	**-3.18**	**-4.26**
WI	**-0.01**	**-0.01**	**-0.01**	**-0.03**	0.06	0.19	0.00	1.05	2.39
WT	**-0.02**	**-0.03**	**-0.04**	**-0.06**	0.07	0.26	0.03	1.93	4.29

Medium farms: 1000 cows

Table 3.5: Baseline Risk Reduction by Region and Coverage Level, Small Farm

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.01**	**-0.02**	**-0.03**	**-0.07**	**-0.12**	**-0.11**	**-0.20**	**-0.14**	0.24
CA	**-0.01**	**-0.03**	**-0.03**	**-0.07**	**-0.08**	**0.00**	**-0.13**	0.33	1.31
FL	**-0.01**	**-0.02**	**-0.02**	**-0.05**	**-0.09**	**-0.09**	**-0.17**	**-0.15**	0.10
IL	**-0.01**	**-0.02**	**-0.02**	**-0.04**	**-0.02**	0.07	**-0.03**	0.46	1.37
MI	**0.00**	**-0.01**	**-0.01**	0.01	0.06	0.15	0.15	0.66	1.35
MN	**0.00**	**-0.01**	**0.00**	**-0.04**	**-0.05**	0.01	**-0.10**	0.17	0.77
NE	**-0.01**	**-0.02**	**-0.03**	**-0.05**	**-0.07**	**-0.03**	**-0.10**	0.13	0.68
NM	**-0.02**	**-0.04**	**-0.05**	**-0.10**	**-0.14**	**-0.07**	**-0.18**	0.28	1.32
NW	**-0.01**	**-0.03**	**-0.03**	**-0.05**	**-0.05**	0.02	**-0.07**	0.32	1.10
NY	**-0.01**	**-0.02**	**-0.02**	**-0.05**	**-0.06**	**-0.01**	**-0.12**	0.14	0.76
OH	**-0.01**	**-0.01**	**-0.01**	**-0.05**	**-0.05**	0.01	**-0.10**	0.18	0.80
PA	**-0.01**	**-0.02**	**-0.02**	**-0.06**	**-0.08**	**-0.04**	**-0.13**	0.12	0.73
SM	**-0.01**	**-0.03**	**-0.04**	**-0.09**	**-0.17**	**-0.19**	**-0.25**	**-0.26**	0.05
US	**-0.05**	**-0.12**	**-0.17**	**-0.43**	**-0.98**	**-1.40**	**-1.76**	**-3.99**	**-5.60**
WI	**-0.01**	**-0.01**	**-0.01**	**-0.04**	**-0.04**	0.02	**-0.11**	0.14	0.71
WT	**-0.02**	**-0.03**	**-0.04**	**-0.09**	**-0.12**	**-0.08**	**-0.18**	0.13	0.93

Small farms: 200 cows

MPP is found to provide risk reduction at the lower coverage levels for most regions and each farm size. As a trend across large to small farm sizes, more risk reduction is apparent for successively smaller farms at higher coverage levels. For large farms, risk reduction is provided at every production history at the $4.00 coverage level. As the coverage level is raised, fewer and fewer coverage combinations provide any risk reduction. In fact, in measurement of CV, risk is increased by MPP at higher coverage levels in the baseline scenario. Medium farms are expected to have a similar outcome, where only a few more coverage combinations provide some risk reduction. Small farms however, are still expected to have many combinations that provide risk reduction even up to the $8.00 level.

The US margin experiences risk reduction at every coverage level in the baseline scenario. This trend also appears for each of the five market scenarios. This is a positive outcome for producers in regions that are fairly well represented by the MPP margin, but for other regions, this disparity suggests that the regional differences left unaccounted for in the current policy are critical to the determination of the effectiveness of this policy as a risk management tool.

Considering the baseline scenario, small farms have some advantage at the $6 coverage level, where the US margin increased, and risk was reduced. A 0.05%, 0.11% and 0.17% margin increase is met with a .43, .98, and 1.4 reduction in CV. This is the largest risk reduction considering medium farms experienced a 0.12%, 0.45% and 0.72% margin decrease and a .42, .88, and 1.22 risk reduction. This is an example where the trade-off between margin and risk reduction is evident. Large farms also experienced 0.01%, 0.33% and 0.61% margin decrease, paired with a .39, .85, and 1.20 reduction in risk at the 25%, 60%, and 90% production history levels respectively. CV being a unit-less measure, this summary is meant to identify that farm size may change the tradeoff between margin changes and changes in the CV in terms of MPP.

Considering higher premium rates are paid at higher coverage levels, this negative outcome is expected more at the $6 and $8 levels. Expected change in margin and risk reduction effects of MPP are considered to vary based on the market conditions in the future. Tables 3.6-3.9 evaluate the 15% milk price shock and its effects on the regions' margin and risk reduction.

Table 3.6: Scenario 2 Change in Margin after Policy Effects by Coverage Level
15% downward price shock in milk

	Scenario 2								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	0.15%	0.15%	2.46%	0.25%	0.25%	4.04%	0.12%	0.12%	1.87%
$4.00, 60%	0.37%	0.37%	2.48%	0.61%	0.61%	4.08%	0.28%	0.28%	1.89%
$4.00, 90%	0.56%	0.56%	2.50%	0.91%	0.91%	4.11%	0.42%	0.42%	1.90%
$6.00, 25%	0.23%	0.34%	2.49%	0.37%	0.56%	4.09%	0.17%	0.26%	1.89%
$6.00, 60%	0.39%	0.50%	2.56%	0.64%	0.82%	4.20%	0.30%	0.38%	1.94%
$6.00, 90%	0.53%	0.64%	2.61%	0.86%	1.05%	4.29%	0.40%	0.49%	1.99%
$8.00, 25%	-1.00%	0.00%	2.34%	-1.64%	0.01%	3.85%	-0.76%	0.00%	1.78%
$8.00, 60%	-3.81%	-2.81%	2.21%	-6.26%	-4.61%	3.62%	-2.90%	-2.14%	1.68%
$8.00, 90%	-6.22%	-5.22%	2.09%	-10.22%	-8.57%	3.42%	-4.73%	-3.97%	1.59%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

In the case of a milk price shock, margins are expected to increase due to use of the program at most of the lower coverage levels. Only large and medium farms experience reduced margins when high coverage is selected due to high premium rates relative to the increase in the frequency of indemnities expected. At these higher coverage levels, the margin reduction is traded off for a risk reduction, as noticed by Tables 3.7-3.9.

Table 3.7 Scenario 2 Risk Reduction by Region and Coverage Level, Large Farms

15% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.12**	**-0.23**	**-0.28**	**-0.27**	**-0.39**	**-0.28**	**-0.15**	0.76	2.24
CA	**-0.22**	**-0.42**	**-0.50**	**-0.42**	**-0.52**	**-0.24**	0.12	2.48	5.87
FL	**-0.12**	**-0.25**	**-0.32**	**-0.26**	**-0.44**	**-0.43**	**-0.23**	0.26	1.18
IL	**-0.07**	**-0.11**	**-0.09**	**-0.16**	**-0.09**	0.19	0.06	1.34	3.22
MI	**-0.11**	**-0.18**	**-0.19**	**-0.24**	**-0.25**	**-0.01**	0.01	1.36	3.38
MN	**-0.08**	**-0.12**	**-0.11**	**-0.17**	**-0.13**	0.13	0.03	1.25	3.05
NE	**-0.10**	**-0.17**	**-0.18**	**-0.21**	**-0.22**	**-0.01**	0.00	1.20	2.97
NM	**-0.17**	**-0.29**	**-0.30**	**-0.32**	**-0.20**	0.29	0.48	3.77	8.19
NW	**-0.08**	**-0.11**	**-0.07**	**-0.16**	**-0.03**	0.36	0.30	2.30	4.99
NY	**-0.12**	**-0.22**	**-0.24**	**-0.25**	**-0.27**	**-0.04**	0.04	1.51	3.65
OH	**-0.09**	**-0.15**	**-0.14**	**-0.18**	**-0.11**	0.17	0.10	1.54	3.60
PA	**-0.13**	**-0.25**	**-0.28**	**-0.30**	**-0.38**	**-0.20**	**-0.07**	1.22	3.22
SM	**-0.09**	**-0.17**	**-0.18**	**-0.21**	**-0.22**	**-0.04**	0.04	1.33	3.16
US	**-0.48**	**-1.09**	**-1.56**	**-1.28**	**-2.83**	**-3.94**	**-2.59**	**-5.55**	**-7.61**
WI	**-0.09**	**-0.16**	**-0.16**	**-0.19**	**-0.17**	0.07	0.00	1.16	2.90
WT	**-0.15**	**-0.27**	**-0.29**	**-0.33**	**-0.37**	**-0.07**	0.07	2.10	5.05

Large Farm: 2000 cows

Table 3.8 Scenario 2 Risk Reduction by Region and Coverage Level, Medium Farms

15% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.12**	**-0.23**	**-0.28**	**-0.30**	**-0.42**	**-0.31**	**-0.44**	0.45	1.91
CA	**-0.22**	**-0.42**	**-0.50**	**-0.49**	**-0.58**	**-0.31**	**-0.49**	1.81	5.11
FL	**-0.12**	**-0.25**	**-0.32**	**-0.29**	**-0.46**	**-0.46**	**-0.43**	0.04	0.96
IL	**-0.07**	**-0.11**	**-0.09**	**-0.19**	**-0.12**	0.16	**-0.23**	1.04	2.89
MI	**-0.11**	**-0.18**	**-0.19**	**-0.27**	**-0.28**	**-0.04**	**-0.31**	1.02	3.01
MN	**-0.08**	**-0.12**	**-0.11**	**-0.20**	**-0.16**	0.10	**-0.23**	0.97	2.75
NE	**-0.10**	**-0.17**	**-0.18**	**-0.24**	**-0.25**	**-0.04**	**-0.30**	0.87	2.62
NM	**-0.17**	**-0.29**	**-0.30**	**-0.40**	**-0.29**	0.20	**-0.29**	2.91	7.20
NW	**-0.08**	**-0.11**	**-0.07**	**-0.21**	**-0.07**	0.31	**-0.13**	1.84	4.48
NY	**-0.12**	**-0.22**	**-0.24**	**-0.29**	**-0.31**	**-0.08**	**-0.32**	1.12	3.23
OH	**-0.09**	**-0.15**	**-0.14**	**-0.21**	**-0.15**	0.14	**-0.21**	1.21	3.23
PA	**-0.13**	**-0.25**	**-0.28**	**-0.34**	**-0.42**	**-0.24**	**-0.42**	0.84	2.81
SM	**-0.09**	**-0.17**	**-0.18**	**-0.25**	**-0.26**	**-0.08**	**-0.32**	0.95	2.74
US	**-0.48**	**-1.09**	**-1.56**	**-1.31**	**-2.85**	**-3.97**	**-2.86**	**-5.79**	**-7.84**
WI	**-0.09**	**-0.16**	**-0.16**	**-0.21**	**-0.19**	0.04	**-0.25**	0.88	2.60
WT	**-0.15**	**-0.27**	**-0.29**	**-0.39**	**-0.42**	**-0.13**	**-0.44**	1.54	4.42

Medium Farm: 1000 cows

Table 3.9 Scenario 2 Risk Reduction by Region and Coverage Level, Small Farms

15% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.12**	**-0.23**	**-0.28**	**-0.32**	**-0.55**	**-0.54**	**-0.58**	**-0.71**	**-0.21**
CA	**-0.22**	**-0.42**	**-0.50**	**-0.52**	**-0.85**	**-0.78**	**-0.79**	**-0.69**	0.45
FL	**-0.12**	**-0.25**	**-0.32**	**-0.30**	**-0.55**	**-0.61**	**-0.53**	**-0.77**	**-0.51**
IL	**-0.07**	**-0.11**	**-0.09**	**-0.21**	**-0.25**	**-0.06**	**-0.37**	**-0.12**	0.75
MI	**-0.11**	**-0.18**	**-0.19**	**-0.29**	**-0.42**	**-0.29**	**-0.46**	**-0.27**	0.62
MN	**-0.08**	**-0.12**	**-0.11**	**-0.22**	**-0.27**	**-0.10**	**-0.36**	**-0.10**	0.77
NE	**-0.10**	**-0.17**	**-0.18**	**-0.26**	**-0.38**	**-0.28**	**-0.45**	**-0.35**	0.38
NM	**-0.17**	**-0.29**	**-0.30**	**-0.44**	**-0.62**	**-0.39**	**-0.67**	**-0.27**	1.22
NW	**-0.08**	**-0.11**	**-0.07**	**-0.23**	**-0.26**	**-0.02**	**-0.33**	0.10	1.25
NY	**-0.12**	**-0.22**	**-0.24**	**-0.31**	**-0.47**	**-0.36**	**-0.50**	**-0.35**	0.51
OH	**-0.09**	**-0.15**	**-0.14**	**-0.23**	**-0.29**	**-0.10**	**-0.36**	**-0.07**	0.86
PA	**-0.13**	**-0.25**	**-0.28**	**-0.36**	**-0.58**	**-0.51**	**-0.60**	**-0.58**	0.19
SM	**-0.09**	**-0.17**	**-0.18**	**-0.27**	**-0.43**	**-0.36**	**-0.50**	**-0.52**	0.07
US	**-0.48**	**-1.09**	**-1.56**	**-1.32**	**-2.97**	**-4.17**	**-2.99**	**-6.71**	**-9.30**
WI	**-0.09**	**-0.16**	**-0.16**	**-0.23**	**-0.31**	**-0.16**	**-0.38**	**-0.17**	0.66
WT	**-0.15**	**-0.27**	**-0.29**	**-0.42**	**-0.65**	**-0.53**	**-0.70**	**-0.58**	0.48

Small Farm: 200 cows

Drawing comparisons between the regions, this scenario demonstrates the challenges associated with designing a policy that has fair outcomes regardless of farm size and region. New Mexico's small farms are expected to have margin increases at the $8.00 coverage level, but large farms have margin decreases at every production history coverage level. Florida's large and small farms exhibit a similar margin response but have more coverage levels with a risk reduction effect relative to New Mexico. At the $6.00 and 90% coverage level, one would rather be a small producer in New Mexico than a larger producer in Florida, considering the -4.73%/1.18 and 3.42%/1.22 margin and risk change in Florida and New Mexico respectively. In this same comparison at the $8.00 and 90% coverage level, Florida large farms are expected to have a .4%/-.43 margin and risk change while New Mexico small farms are expected to have a 4.29%/-.39 change. This demonstrates how even in the lower average margin region, small producers are still have better policy outcomes than large producers in higher margin regions. Tables 3.10-3.13 demonstrate the policy effects in the event of a smaller, 10% downward shock in the price of milk.

Table 3.10: Scenario 3 Change in Margin after Policy Effects by Coverage Level
10% downward price shock in milk

	Scenario 3								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	2.32%	0.12%	0.12%	3.79%	0.20%	0.20%	1.77%	0.09%	0.09%
$4.00, 60%	0.29%	0.29%	0.29%	0.47%	0.47%	0.47%	0.22%	0.22%	0.22%
$4.00, 90%	0.43%	0.43%	0.43%	0.71%	0.71%	0.71%	0.33%	0.33%	0.33%
$6.00, 25%	0.15%	0.26%	0.31%	0.24%	0.42%	0.51%	0.11%	0.20%	0.24%
$6.00, 60%	0.19%	0.31%	0.75%	0.32%	0.50%	1.23%	0.15%	0.23%	0.57%
$6.00, 90%	0.23%	0.35%	1.13%	0.38%	0.56%	1.85%	0.18%	0.26%	0.86%
$8.00, 25%	-1.14%	-0.14%	0.35%	-1.86%	-0.23%	0.58%	-0.87%	-0.11%	0.27%
$8.00, 60%	-4.12%	-3.13%	0.85%	-6.73%	-5.10%	1.38%	-3.14%	-2.38%	0.65%
$8.00, 90%	-6.68%	-5.69%	1.27%	-10.90%	-9.28%	2.08%	-5.09%	-4.33%	0.97%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

A negative change in the margin only occurs in the $8 margin level for large and medium farms. Small farms, however, are expected to draw the benefit at every coverage level due to increased margins from the policy effects. The greatest increase in the expected margin is noticed at the lowest coverage level where only 1.77%, 2.32%, and 3.79% margin increase is expected in Florida, the US, and New Mexico respectively. This shows that given a modest shock to the price of milk, there is very little value in participating in MPP.

Table 3.11: Scenario 3 Risk Reduction by Region and Coverage Level, Large Farms
10% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.08**	**-0.14**	**-0.15**	**-0.16**	**-0.17**	**-0.01**	0.03	1.11	2.67
CA	**-0.14**	**-0.27**	**-0.30**	**-0.25**	**-0.20**	0.13	0.39	2.96	6.39
FL	**-0.08**	**-0.17**	**-0.21**	**-0.17**	**-0.25**	**-0.20**	**-0.08**	0.55	1.54
IL	**-0.04**	**-0.04**	**0.00**	**-0.06**	0.10	0.42	0.23	1.66	3.58
MI	**-0.06**	**-0.09**	**-0.07**	**-0.12**	**-0.01**	0.28	0.20	1.71	3.78
MN	**-0.04**	**-0.04**	**-0.01**	**-0.07**	0.06	0.36	0.21	1.56	3.41
NE	**-0.05**	**-0.09**	**-0.07**	**-0.10**	**0.00**	0.25	0.19	1.55	3.38
NM	**-0.10**	**-0.15**	**-0.11**	**-0.14**	0.13	0.68	0.77	4.29	8.74
NW	**-0.03**	**-0.03**	0.03	**-0.04**	0.19	0.61	0.49	2.65	5.38
NY	**-0.07**	**-0.12**	**-0.11**	**-0.13**	**-0.04**	0.24	0.24	1.86	4.05
OH	**-0.05**	**-0.06**	**-0.03**	**-0.07**	0.09	0.41	0.29	1.87	3.96
PA	**-0.08**	**-0.14**	**-0.14**	**-0.17**	**-0.13**	0.10	0.14	1.62	3.68
SM	**-0.06**	**-0.09**	**-0.09**	**-0.11**	**-0.03**	0.20	0.21	1.64	3.51
US	**-0.38**	**-0.86**	**-1.23**	**-1.07**	**-2.35**	**-3.29**	**-2.29**	**-4.84**	**-6.63**
WI	**-0.05**	**-0.07**	**-0.05**	**-0.09**	0.02	0.29	0.17	1.45	3.23
WT	**-0.09**	**-0.14**	**-0.13**	**-0.18**	**-0.06**	0.30	0.33	2.58	5.59

Large Farm: 2000 cows

Table 3.12: Scenario 3 Risk Reduction by Region and Coverage Level, Medium Farms

10% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.08**	**-0.14**	**-0.15**	**-0.19**	**-0.20**	**-0.04**	**-0.25**	0.81	2.34
CA	**-0.14**	**-0.27**	**-0.30**	**-0.32**	**-0.27**	0.07	**-0.20**	2.30	5.65
FL	**-0.08**	**-0.17**	**-0.21**	**-0.19**	**-0.27**	**-0.22**	**-0.28**	0.34	1.32
IL	**-0.04**	**-0.04**	**0.00**	**-0.09**	0.07	0.39	**-0.04**	1.36	3.26
MI	**-0.06**	**-0.09**	**-0.07**	**-0.15**	**-0.05**	0.24	**-0.10**	1.38	3.41
MN	**-0.04**	**-0.04**	**-0.01**	**-0.10**	0.03	0.33	**-0.05**	1.29	3.11
NE	**-0.05**	**-0.09**	**-0.07**	**-0.13**	**-0.04**	0.22	**-0.10**	1.23	3.04
NM	**-0.10**	**-0.15**	**-0.11**	**-0.22**	0.05	0.59	0.03	3.44	7.78
NW	**-0.03**	**-0.03**	0.03	**-0.09**	0.15	0.57	0.08	2.20	4.88
NY	**-0.07**	**-0.12**	**-0.11**	**-0.17**	**-0.08**	0.20	**-0.11**	1.48	3.63
OH	**-0.05**	**-0.06**	**-0.03**	**-0.10**	0.05	0.38	**-0.02**	1.54	3.60
PA	**-0.08**	**-0.14**	**-0.14**	**-0.21**	**-0.17**	0.07	**-0.20**	1.25	3.28
SM	**-0.06**	**-0.09**	**-0.09**	**-0.15**	**-0.07**	0.16	**-0.14**	1.26	3.10
US	**-0.38**	**-0.86**	**-1.23**	**-1.10**	**-2.38**	**-3.31**	**-2.54**	**-5.08**	**-6.86**
WI	**-0.05**	**-0.07**	**-0.05**	**-0.12**	**-0.01**	0.26	**-0.08**	1.18	2.93
WT	**-0.09**	**-0.14**	**-0.13**	**-0.23**	**-0.11**	0.25	**-0.17**	2.03	4.97

Medium Farm: 1000 cows

Table 3.13: Scenario 3 Risk Reduction by Region and Coverage Level, Small Farms

10% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.08**	**-0.14**	**-0.15**	**-0.21**	**-0.32**	**-0.26**	**-0.38**	**-0.33**	0.26
CA	**-0.14**	**-0.27**	**-0.30**	**-0.35**	**-0.52**	**-0.39**	**-0.49**	**-0.14**	1.07
FL	**-0.08**	**-0.17**	**-0.21**	**-0.21**	**-0.36**	**-0.37**	**-0.37**	**-0.45**	**-0.11**
IL	**-0.04**	**-0.04**	**0.00**	**-0.10**	**-0.05**	0.17	**-0.18**	0.23	1.15
MI	**-0.06**	**-0.09**	**-0.07**	**-0.17**	**-0.18**	0.00	**-0.26**	0.11	1.06
MN	**-0.04**	**-0.04**	**-0.01**	**-0.12**	**-0.08**	0.13	**-0.17**	0.24	1.16
NE	**-0.05**	**-0.09**	**-0.07**	**-0.15**	**-0.17**	**-0.01**	**-0.25**	0.03	0.83
NM	**-0.10**	**-0.15**	**-0.11**	**-0.26**	**-0.28**	0.02	**-0.34**	0.34	1.91
NW	**-0.03**	**-0.03**	0.03	**-0.11**	**-0.03**	0.25	**-0.12**	0.50	1.70
NY	**-0.07**	**-0.12**	**-0.11**	**-0.19**	**-0.23**	**-0.07**	**-0.29**	0.04	0.96
OH	**-0.05**	**-0.06**	**-0.03**	**-0.12**	**-0.08**	0.14	**-0.17**	0.28	1.27
PA	**-0.08**	**-0.14**	**-0.14**	**-0.23**	**-0.32**	**-0.20**	**-0.37**	**-0.14**	0.70
SM	**-0.06**	**-0.09**	**-0.09**	**-0.17**	**-0.23**	**-0.12**	**-0.32**	**-0.18**	0.47
US	**-0.38**	**-0.86**	**-1.23**	**-1.11**	**-2.50**	**-3.51**	**-2.67**	**-6.00**	**-8.33**
WI	**-0.05**	**-0.07**	**-0.05**	**-0.13**	**-0.12**	0.06	**-0.21**	0.15	1.02
WT	**-0.09**	**-0.14**	**-0.13**	**-0.26**	**-0.34**	**-0.14**	**-0.41**	**-0.04**	1.10

Small Farm: 200 cows

Comparing Scenario 3 with Scenario 2 in the North West region, the highest production history at the lowest ($4.00) margin level is now demonstrating a risk increase due to the premiums charged by the policy. While other regions also show risk increase at successively lower coverage combinations when comparing these two milk shock scenarios, this region has some risk increase at this low coverage level because of the ratio between its average margin and CV before the policy effects. Relative to a region like California for example, the North West region has a greater disparity between margin and CV, where its margins are lower on average, and CV is higher on average. Regions with this less favorable disposition are drawing less benefit from MPP at lower shock rates, therefore regional effects are altering the magnitude of benefits provided by the insurance tool designed to serve a national average dairy margin. Table 3.14 gathers evidence for how MPP will affect each region in the occurrence of the lowest impact scenario, a 5% decrease in the price of milk.

Table 3.14: Scenario 4 Change in Margin after Policy Effects by Coverage Level
5% downward price shock in milk

	Scenario 4								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	0.10%	0.10%	0.10%	0.16%	0.16%	0.16%	0.07%	0.07%	0.07%
$4.00, 60%	0.23%	0.23%	0.23%	0.37%	0.37%	0.37%	0.18%	0.18%	0.18%
$4.00, 90%	0.34%	0.34%	0.34%	0.56%	0.56%	0.56%	0.26%	0.26%	0.26%
$6.00, 25%	0.08%	0.19%	0.25%	0.13%	0.31%	0.40%	0.06%	0.15%	0.19%
$6.00, 60%	0.04%	0.15%	0.60%	0.07%	0.25%	0.97%	0.03%	0.12%	0.46%
$6.00, 90%	0.01%	0.12%	0.90%	0.02%	0.20%	1.46%	0.01%	0.09%	0.68%
$8.00, 25%	-1.25%	-0.26%	0.23%	-2.02%	-0.43%	0.37%	-0.95%	-0.20%	0.17%
$8.00, 60%	-4.37%	-3.38%	0.55%	-7.08%	-5.49%	0.88%	-3.33%	-2.58%	0.42%
$8.00, 90%	-7.04%	-6.06%	0.82%	-11.42%	-9.83%	1.33%	-5.37%	-4.62%	0.62%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

As a trend, each of the coverage combinations for all farm sizes in these example regions have smaller, positive margin increases except at the $8.00 margin level for large and medium farms. MPP provides smaller margin increases as the magnitude of the milk price shock decreases. In those margin decreasing coverage levels, at this 5% shock level, the margin decreases are more severe relative to both the 10% and 15% shock in Scenarios 3 and 2. Tables 3.15-3.17 describe the risk reduction associated with these smaller increases to the expected margins in Scenario 4.

Table 3.15: Scenario 4 Risk Reduction by Region and Coverage Level, Large Farms
5% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.05**	**-0.08**	**-0.08**	**-0.09**	**-0.03**	0.16	0.15	1.32	2.89
CA	**-0.09**	**-0.17**	**-0.18**	**-0.15**	**-0.01**	0.34	0.56	3.23	6.64
FL	**-0.06**	**-0.12**	**-0.14**	**-0.11**	**-0.14**	**-0.05**	0.02	0.73	1.74
IL	**-0.02**	**-0.01**	0.04	**0.00**	0.20	0.52	0.34	1.84	3.74
MI	**-0.03**	**-0.04**	**-0.01**	**-0.04**	0.12	0.42	0.33	1.91	3.97
MN	**-0.01**	**0.00**	0.04	**-0.01**	0.17	0.47	0.31	1.73	3.55
NE	**-0.03**	**-0.04**	**-0.02**	**-0.03**	0.12	0.39	0.31	1.75	3.59
NM	**-0.05**	**-0.07**	**-0.03**	**-0.03**	0.32	0.88	0.94	4.54	8.94
NW	**-0.01**	0.01	0.07	0.02	0.31	0.73	0.61	2.83	5.52
NY	**-0.04**	**-0.06**	**-0.04**	**-0.06**	0.09	0.39	0.36	2.05	4.22
OH	**-0.02**	**-0.02**	0.02	**-0.01**	0.19	0.52	0.39	2.03	4.10
PA	**-0.05**	**-0.08**	**-0.07**	**-0.09**	0.02	0.28	0.28	1.85	3.92
SM	**-0.03**	**-0.05**	**-0.04**	**-0.05**	0.08	0.32	0.31	1.82	3.69
US	**-0.30**	**-0.68**	**-0.97**	**-0.90**	**-1.98**	**-2.76**	**-2.02**	**-4.24**	**-5.78**
WI	**-0.02**	**-0.03**	0.01	**-0.03**	0.12	0.40	0.27	1.61	3.36
WT	**-0.05**	**-0.07**	**-0.04**	**-0.08**	0.12	0.51	0.50	2.85	5.85

Large Farm: 2000 cows

Table 3.16: Scenario 4 Risk Reduction by Region and Coverage Level, Medium Farms

5% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.05**	**-0.08**	**-0.08**	**-0.12**	**-0.06**	0.13	**-0.12**	1.03	2.57
CA	**-0.09**	**-0.17**	**-0.18**	**-0.21**	**-0.07**	0.28	**-0.02**	2.58	5.91
FL	**-0.06**	**-0.12**	**-0.14**	**-0.14**	**-0.16**	**-0.07**	**-0.17**	0.52	1.53
IL	**-0.02**	**-0.01**	0.04	**-0.03**	0.17	0.49	0.07	1.54	3.42
MI	**-0.03**	**-0.04**	**-0.01**	**-0.08**	0.09	0.39	0.02	1.59	3.61
MN	**-0.01**	**0.00**	0.04	**-0.04**	0.14	0.44	0.06	1.46	3.26
NE	**-0.03**	**-0.04**	**-0.02**	**-0.07**	0.09	0.36	0.02	1.44	3.25
NM	**-0.05**	**-0.07**	**-0.03**	**-0.11**	0.24	0.80	0.22	3.71	8.00
NW	**-0.01**	0.01	0.07	**-0.02**	0.26	0.69	0.21	2.38	5.03
NY	**-0.04**	**-0.06**	**-0.04**	**-0.10**	0.06	0.35	0.01	1.68	3.82
OH	**-0.02**	**-0.02**	0.02	**-0.04**	0.16	0.49	0.09	1.71	3.75
PA	**-0.05**	**-0.08**	**-0.07**	**-0.12**	**-0.01**	0.25	**-0.06**	1.49	3.52
SM	**-0.03**	**-0.05**	**-0.04**	**-0.09**	0.04	0.28	**-0.03**	1.44	3.28
US	**-0.30**	**-0.68**	**-0.97**	**-0.93**	**-2.01**	**-2.79**	**-2.28**	**-4.48**	**-6.01**
WI	**-0.02**	**-0.03**	0.01	**-0.06**	0.09	0.37	0.02	1.34	3.07
WT	**-0.05**	**-0.07**	**-0.04**	**-0.13**	0.07	0.45	0.01	2.31	5.24

Medium Farm: 1000 cows

Table 3.17: Scenario 4 Risk Reduction by Region and Coverage Level, Small Farms

5% downward price shock in milk

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.05**	**-0.08**	**-0.08**	**-0.14**	**-0.18**	**-0.09**	**-0.26**	**-0.09**	0.52
CA	**-0.09**	**-0.17**	**-0.18**	**-0.24**	**-0.33**	**-0.17**	**-0.30**	0.19	1.41
FL	**-0.06**	**-0.12**	**-0.14**	**-0.15**	**-0.24**	**-0.22**	**-0.27**	**-0.25**	0.12
IL	**-0.02**	**-0.01**	0.04	**-0.05**	0.05	0.28	**-0.06**	0.42	1.34
MI	**-0.03**	**-0.04**	**-0.01**	**-0.09**	**-0.05**	0.15	**-0.12**	0.34	1.29
MN	**-0.01**	**0.00**	0.04	**-0.06**	0.03	0.24	**-0.06**	0.42	1.34
NE	**-0.03**	**-0.04**	**-0.02**	**-0.08**	**-0.04**	0.13	**-0.12**	0.26	1.06
NM	**-0.05**	**-0.07**	**-0.03**	**-0.15**	**-0.07**	0.24	**-0.13**	0.68	2.24
NW	**-0.01**	0.01	0.07	**-0.04**	0.09	0.37	0.01	0.71	1.91
NY	**-0.04**	**-0.06**	**-0.04**	**-0.11**	**-0.10**	0.08	**-0.16**	0.27	1.19
OH	**-0.02**	**-0.02**	0.02	**-0.06**	0.03	0.25	**-0.05**	0.47	1.45
PA	**-0.05**	**-0.08**	**-0.07**	**-0.14**	**-0.16**	**-0.01**	**-0.22**	0.12	0.99
SM	**-0.03**	**-0.05**	**-0.04**	**-0.11**	**-0.11**	0.01	**-0.20**	0.02	0.68
US	**-0.30**	**-0.68**	**-0.97**	**-0.94**	**-2.12**	**-2.98**	**-2.40**	**-5.40**	**-7.50**
WI	**-0.02**	**-0.03**	0.01	**-0.07**	**-0.02**	0.18	**-0.10**	0.32	1.18
WT	**-0.05**	**-0.07**	**-0.04**	**-0.16**	**-0.15**	0.07	**-0.23**	0.28	1.44

Small Farm: 200 cows

Considering the trend across milk price scenarios, the changes in CV with bold font become more prevalent from left to right as the magnitude of the shock increases. That is, from the Baseline scenario to Scenario 4, the likelihood of a risk reduction as opposed to a risk increase is greater at higher coverage levels. This means in general, higher coverage level become more likely to provide some risk reduction as the shock becomes smaller. Though counterintuitive, this change in CV is relative to the shocked margins (as opposed to the baseline) before the policy effects. MPP is more beneficial in smaller shock periods than higher shock periods when considering the higher coverage levels for only a milk price shock to the margins. Table 3.18 provides evidence for margin impacts under Scenario 5, a shock to only the feed cost component of the margin.

Table 3.18: Scenario 5 Change in Margin after Policy Effects by Coverage Level

50% upward price shock in corn

	Scenario 5								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	0.12%	0.12%	0.12%	0.20%	0.20%	0.20%	0.09%	0.09%	0.09%
$4.00, 60%	0.29%	0.29%	0.29%	0.49%	0.49%	0.49%	0.22%	0.22%	0.22%
$4.00, 90%	0.44%	0.44%	0.44%	0.73%	0.73%	0.73%	0.33%	0.33%	0.33%
$6.00, 25%	0.15%	0.26%	0.32%	0.25%	0.44%	0.54%	0.11%	0.20%	0.24%
$6.00, 60%	0.20%	0.31%	0.77%	0.34%	0.53%	1.29%	0.15%	0.24%	0.58%
$6.00, 90%	0.24%	0.36%	1.16%	0.41%	0.60%	1.94%	0.18%	0.27%	0.87%
$8.00, 25%	-1.11%	-0.11%	0.40%	-1.87%	-0.18%	0.67%	-0.84%	-0.08%	0.30%
$8.00, 60%	-4.09%	-3.08%	0.96%	-6.85%	-5.16%	1.61%	-3.08%	-2.32%	0.72%
$8.00, 90%	-6.63%	-5.62%	1.44%	-11.11%	-9.42%	2.41%	-5.01%	-4.24%	1.08%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

Scenario 5 changes expected margins positively for all farm sizes up to, but not including, the $8 margin level. Only small farms then experience an increase in the expected margin due to MPP. Comparing Scenario 5 with Scenario 2, the largest shocks to an independent commodity, there is only a 0.65% (Scenario 2- 2.09%, Scenario 5- 1.44% margin increases) difference between the US margin increase at the $8/90% coverage level for small farms. This shows that a large feed cost shock is comparable with a moderate milk price shock.

Table 3.19 Scenario 5 Risk Reduction by Region and Coverage Level, Large Farms

50% upward price shock in corn

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.10**	**-0.19**	**-0.23**	**-0.24**	**-0.35**	**-0.27**	**-0.15**	0.69	2.06
CA	**-0.22**	**-0.46**	**-0.58**	**-0.46**	**-0.68**	**-0.56**	**-0.06**	1.93	4.94
FL	**-0.09**	**-0.19**	**-0.24**	**-0.21**	**-0.33**	**-0.31**	**-0.19**	0.30	1.18
IL	**-0.09**	**-0.18**	**-0.20**	**-0.22**	**-0.28**	**-0.13**	**-0.11**	0.87	2.45
MI	**-0.09**	**-0.16**	**-0.17**	**-0.20**	**-0.21**	**0.00**	**-0.02**	1.21	3.08
MN	**-0.10**	**-0.18**	**-0.20**	**-0.23**	**-0.29**	**-0.15**	**-0.11**	0.85	2.40
NE	**-0.08**	**-0.15**	**-0.16**	**-0.19**	**-0.21**	**-0.05**	**-0.01**	1.10	2.76
NM	**-0.20**	**-0.39**	**-0.47**	**-0.44**	**-0.56**	**-0.32**	0.18	2.97	6.92
NW	**-0.12**	**-0.23**	**-0.26**	**-0.27**	**-0.33**	**-0.15**	0.04	1.59	3.87
NY	**-0.12**	**-0.22**	**-0.27**	**-0.24**	**-0.30**	**-0.14**	**-0.03**	1.25	3.18
OH	**-0.10**	**-0.18**	**-0.20**	**-0.20**	**-0.22**	**-0.03**	**0.00**	1.21	3.04
PA	**-0.10**	**-0.19**	**-0.21**	**-0.22**	**-0.25**	**-0.06**	0.01	1.32	3.28
SM	**-0.13**	**-0.26**	**-0.34**	**-0.30**	**-0.48**	**-0.46**	**-0.14**	0.84	2.34
US	**-0.39**	**-0.89**	**-1.26**	**-1.11**	**-2.45**	**-3.43**	**-2.43**	**-5.21**	**-7.17**
WI	**-0.10**	**-0.19**	**-0.22**	**-0.22**	**-0.28**	**-0.14**	**-0.09**	0.86	2.41
WT	**-0.13**	**-0.25**	**-0.28**	**-0.31**	**-0.35**	**-0.11**	0.05	1.95	4.73

Large Farm: 2000 cows

Table 3.20 Scenario 5 Risk Reduction by Region and Coverage Level, Medium Farms

50% upward price shock in corn

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.10**	**-0.19**	**-0.23**	**-0.27**	**-0.38**	**-0.30**	**-0.43**	0.39	1.74
CA	**-0.22**	**-0.46**	**-0.58**	**-0.53**	**-0.75**	**-0.63**	**-0.65**	1.28	4.21
FL	**-0.09**	**-0.19**	**-0.24**	**-0.23**	**-0.35**	**-0.33**	**-0.38**	0.10	0.97
IL	**-0.09**	**-0.18**	**-0.20**	**-0.25**	**-0.31**	**-0.16**	**-0.39**	0.57	2.13
MI	**-0.09**	**-0.16**	**-0.17**	**-0.24**	**-0.25**	**-0.04**	**-0.33**	0.88	2.72
MN	**-0.10**	**-0.18**	**-0.20**	**-0.25**	**-0.32**	**-0.18**	**-0.36**	0.58	2.11
NE	**-0.08**	**-0.15**	**-0.16**	**-0.22**	**-0.25**	**-0.08**	**-0.29**	0.80	2.43
NM	**-0.20**	**-0.39**	**-0.47**	**-0.53**	**-0.65**	**-0.40**	**-0.59**	2.11	5.94
NW	**-0.12**	**-0.23**	**-0.26**	**-0.32**	**-0.38**	**-0.19**	**-0.36**	1.16	3.39
NY	**-0.12**	**-0.22**	**-0.27**	**-0.28**	**-0.34**	**-0.18**	**-0.37**	0.88	2.78
OH	**-0.10**	**-0.18**	**-0.20**	**-0.24**	**-0.26**	**-0.07**	**-0.31**	0.88	2.69
PA	**-0.10**	**-0.19**	**-0.21**	**-0.26**	**-0.29**	**-0.10**	**-0.33**	0.96	2.88
SM	**-0.13**	**-0.26**	**-0.34**	**-0.34**	**-0.52**	**-0.50**	**-0.51**	0.45	1.93
US	**-0.39**	**-0.89**	**-1.26**	**-1.14**	**-2.48**	**-3.45**	**-2.68**	**-5.44**	**-7.38**
WI	**-0.10**	**-0.19**	**-0.22**	**-0.25**	**-0.31**	**-0.17**	**-0.34**	0.60	2.12
WT	**-0.13**	**-0.25**	**-0.28**	**-0.36**	**-0.41**	**-0.17**	**-0.46**	1.39	4.11

Medium Farm: 1000 cows

Table 3.21 Scenario 5 Risk Reduction by Region and Coverage Level, Small Farms

50% upward price shock in corn

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.10**	**-0.19**	**-0.23**	**-0.29**	**-0.51**	**-0.52**	**-0.57**	**-0.74**	**-0.32**
CA	**-0.22**	**-0.46**	**-0.58**	**-0.56**	**-1.01**	**-1.08**	**-0.94**	**-1.12**	**-0.26**
FL	**-0.09**	**-0.19**	**-0.24**	**-0.24**	**-0.44**	**-0.48**	**-0.47**	**-0.68**	**-0.43**
IL	**-0.09**	**-0.18**	**-0.20**	**-0.27**	**-0.43**	**-0.38**	**-0.53**	**-0.55**	0.06
MI	**-0.09**	**-0.16**	**-0.17**	**-0.26**	**-0.38**	**-0.28**	**-0.48**	**-0.37**	0.42
MN	**-0.10**	**-0.18**	**-0.20**	**-0.27**	**-0.43**	**-0.37**	**-0.48**	**-0.45**	0.22
NE	**-0.08**	**-0.15**	**-0.16**	**-0.24**	**-0.37**	**-0.30**	**-0.44**	**-0.37**	0.28
NM	**-0.20**	**-0.39**	**-0.47**	**-0.57**	**-0.99**	**-0.99**	**-0.97**	**-1.05**	0.00
NW	**-0.12**	**-0.23**	**-0.26**	**-0.34**	**-0.55**	**-0.50**	**-0.55**	**-0.46**	0.38
NY	**-0.12**	**-0.22**	**-0.27**	**-0.30**	**-0.49**	**-0.44**	**-0.54**	**-0.51**	0.20
OH	**-0.10**	**-0.18**	**-0.20**	**-0.26**	**-0.39**	**-0.31**	**-0.46**	**-0.36**	0.38
PA	**-0.10**	**-0.19**	**-0.21**	**-0.28**	**-0.44**	**-0.36**	**-0.50**	**-0.43**	0.32
SM	**-0.13**	**-0.26**	**-0.34**	**-0.36**	**-0.68**	**-0.79**	**-0.69**	**-1.04**	**-0.77**
US	**-0.39**	**-0.89**	**-1.26**	**-1.16**	**-2.59**	**-3.64**	**-2.81**	**-6.31**	**-8.77**
WI	**-0.10**	**-0.19**	**-0.22**	**-0.26**	**-0.42**	**-0.37**	**-0.47**	**-0.42**	0.25
WT	**-0.13**	**-0.25**	**-0.28**	**-0.39**	**-0.63**	**-0.56**	**-0.71**	**-0.68**	0.25

Small Farm: 200 cows

Scenario 5 finds high degrees of risk reduction at most coverage levels in all regions. Comparing this to other scenarios, there is an overall trend where higher shocks to the margin increase the risk reduction capability of the program. Note, the risk reduction is calculated as reduction relative to the shocked margins before the program effects. Table 3.22 evaluates the expected change in margins for this scenario where both milk price and feed cost are shocked.

Table 3.22: Scenario 6 Change in Margin after Policy Effects by Coverage Level

15% & 25% downward & upward price shock in milk & corn respectively

	Scenario 6								
	MPP-US			New Mexico			Florida		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
$4.00, 25%	0.18%	0.18%	0.18%	0.30%	0.30%	0.30%	0.14%	0.14%	0.14%
$4.00, 60%	0.36%	0.36%	0.36%	0.60%	0.60%	0.60%	0.27%	0.27%	0.27%
$4.00, 90%	0.52%	0.52%	0.52%	0.85%	0.85%	0.85%	0.39%	0.39%	0.39%
$6.00, 25%	0.29%	0.41%	0.47%	0.48%	0.68%	0.77%	0.22%	0.31%	0.35%
$6.00, 60%	0.46%	0.58%	1.04%	0.77%	0.96%	1.72%	0.35%	0.44%	0.79%
$6.00, 90%	0.61%	0.73%	1.53%	1.01%	1.20%	2.54%	0.46%	0.55%	1.16%
$8.00, 25%	-0.87%	0.15%	0.66%	-1.44%	0.25%	1.10%	-0.66%	0.12%	0.50%
$8.00, 60%	-3.59%	-2.57%	1.51%	-5.95%	-4.26%	2.51%	-2.72%	-1.95%	1.15%
$8.00, 90%	-5.92%	-4.90%	2.24%	-9.82%	-8.13%	3.72%	-4.49%	-3.71%	1.70%

Large, Medium and Small farms are 2000, 1000, and 200 cows respectively

One difference in the trend of risk reduction is the case of a market situation like Scenario 6, where medium farms finally see a positive impact on margin expectations at the $8.00 coverage level due to the effects of the program. Expected margins increase by .15%, .25%, and .12% in the US, New Mexico, and Florida at the $8 and 25% coverage level as noted by Table 3.22. This, and the overall presence of increased margins, show how MPP will provide margin protection in the occurrence of unfavorable price shocks in both the milk price and feed cost. By stressing the margin from both directions, Scenario 6 would be the least favorable scenario for dairy farmers. Table 3.23 evaluates risk reduction in this event of a 25% increase in the price of corn and a 15% decrease in the price of milk.

Table 3.23 Scenario 6 Risk Reduction by Region and Coverage Level, Large Farms

15% & 25% downward & upward price shock in milk & corn respectively

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.14**	**-0.29**	**-0.38**	**-0.38**	**-0.67**	**-0.74**	**-0.41**	0.11	1.27
CA	**-0.22**	**-0.45**	**-0.58**	**-0.55**	**-0.86**	**-0.80**	**-0.25**	1.59	4.52
FL	**-0.11**	**-0.25**	**-0.33**	**-0.34**	**-0.63**	**-0.75**	**-0.43**	**-0.25**	0.41
IL	**-0.12**	**-0.24**	**-0.31**	**-0.34**	**-0.55**	**-0.52**	**-0.31**	0.46	1.91
MI	**-0.14**	**-0.28**	**-0.36**	**-0.38**	**-0.62**	**-0.60**	**-0.32**	0.54	2.16
MN	**-0.11**	**-0.22**	**-0.27**	**-0.31**	**-0.47**	**-0.41**	**-0.27**	0.50	1.95
NE	**-0.10**	**-0.20**	**-0.24**	**-0.31**	**-0.48**	**-0.42**	**-0.24**	0.60	2.08
NM	**-0.21**	**-0.41**	**-0.52**	**-0.57**	**-0.84**	**-0.69**	**-0.12**	2.34	6.07
NW	**-0.12**	**-0.24**	**-0.29**	**-0.33**	**-0.45**	**-0.30**	**-0.08**	1.41	3.67
NY	**-0.11**	**-0.20**	**-0.24**	**-0.30**	**-0.42**	**-0.29**	**-0.16**	1.01	2.90
OH	**-0.12**	**-0.25**	**-0.32**	**-0.33**	**-0.50**	**-0.43**	**-0.24**	0.71	2.37
PA	**-0.15**	**-0.30**	**-0.39**	**-0.39**	**-0.65**	**-0.64**	**-0.32**	0.60	2.28
SM	**-0.13**	**-0.26**	**-0.35**	**-0.36**	**-0.60**	**-0.63**	**-0.28**	0.54	1.96
US	**-0.38**	**-0.87**	**-1.25**	**-1.24**	**-2.75**	**-3.86**	**-2.67**	**-5.76**	**-7.95**
WI	**-0.11**	**-0.22**	**-0.28**	**-0.32**	**-0.51**	**-0.47**	**-0.30**	0.41	1.81
WT	**-0.19**	**-0.40**	**-0.51**	**-0.54**	**-0.88**	**-0.87**	**-0.40**	0.96	3.35

Large Farm: 2000 cows

Table 3.24 Scenario 6 Risk Reduction by Region and Coverage Level, Medium Farms

15% & 25% downward & upward price shock in milk & corn respectively

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.14**	**-0.29**	**-0.38**	**-0.41**	**-0.71**	**-0.77**	**-0.70**	**-0.19**	0.95
CA	**-0.22**	**-0.45**	**-0.58**	**-0.61**	**-0.93**	**-0.86**	**-0.86**	0.92	3.78
FL	**-0.11**	**-0.25**	**-0.33**	**-0.36**	**-0.65**	**-0.77**	**-0.63**	**-0.46**	0.20
IL	**-0.12**	**-0.24**	**-0.31**	**-0.37**	**-0.58**	**-0.55**	**-0.59**	0.16	1.59
MI	**-0.14**	**-0.28**	**-0.36**	**-0.42**	**-0.66**	**-0.64**	**-0.64**	0.21	1.80
MN	**-0.11**	**-0.22**	**-0.27**	**-0.34**	**-0.50**	**-0.44**	**-0.53**	0.23	1.66
NE	**-0.10**	**-0.20**	**-0.24**	**-0.34**	**-0.51**	**-0.46**	**-0.54**	0.29	1.74
NM	**-0.21**	**-0.41**	**-0.52**	**-0.65**	**-0.92**	**-0.78**	**-0.89**	1.49	5.11
NW	**-0.12**	**-0.24**	**-0.29**	**-0.37**	**-0.50**	**-0.35**	**-0.49**	0.96	3.18
NY	**-0.11**	**-0.20**	**-0.24**	**-0.34**	**-0.46**	**-0.33**	**-0.52**	0.63	2.48
OH	**-0.12**	**-0.25**	**-0.32**	**-0.36**	**-0.53**	**-0.46**	**-0.55**	0.38	2.01
PA	**-0.15**	**-0.30**	**-0.39**	**-0.43**	**-0.69**	**-0.67**	**-0.67**	0.23	1.88
SM	**-0.13**	**-0.26**	**-0.35**	**-0.40**	**-0.64**	**-0.67**	**-0.64**	0.16	1.56
US	**-0.38**	**-0.87**	**-1.25**	**-1.27**	**-2.78**	**-3.88**	**-2.94**	**-6.00**	**-8.17**
WI	**-0.11**	**-0.22**	**-0.28**	**-0.35**	**-0.54**	**-0.50**	**-0.55**	0.15	1.52
WT	**-0.19**	**-0.40**	**-0.51**	**-0.59**	**-0.94**	**-0.93**	**-0.91**	0.41	2.74

Medium Farm: 1000 cows

Table 3.25 Scenario 6 Risk Reduction by Region and Coverage Level, Small Farms

15% & 25% downward & upward price shock in milk & corn respectively

	25%	60%	90%	25%	60%	90%	25%	60%	90%
	$4.00	$4.00	$4.00	$6.00	$6.00	$6.00	$8.00	$8.00	$8.00
AP	**-0.14**	**-0.29**	**-0.38**	**-0.43**	**-0.83**	**-0.99**	**-0.84**	**-1.33**	**-1.11**
CA	**-0.22**	**-0.45**	**-0.58**	**-0.65**	**-1.20**	**-1.33**	**-1.16**	**-1.56**	**-0.80**
FL	**-0.11**	**-0.25**	**-0.33**	**-0.37**	**-0.74**	**-0.93**	**-0.73**	**-1.26**	**-1.23**
IL	**-0.12**	**-0.24**	**-0.31**	**-0.39**	**-0.70**	**-0.76**	**-0.72**	**-0.95**	**-0.44**
MI	**-0.14**	**-0.28**	**-0.36**	**-0.43**	**-0.80**	**-0.88**	**-0.79**	**-1.05**	**-0.51**
MN	**-0.11**	**-0.22**	**-0.27**	**-0.35**	**-0.62**	**-0.64**	**-0.66**	**-0.81**	**-0.24**
NE	**-0.10**	**-0.20**	**-0.24**	**-0.36**	**-0.64**	**-0.69**	**-0.68**	**-0.90**	**-0.42**
NM	**-0.21**	**-0.41**	**-0.52**	**-0.70**	**-1.26**	**-1.36**	**-1.26**	**-1.61**	**-0.67**
NW	**-0.12**	**-0.24**	**-0.29**	**-0.40**	**-0.68**	**-0.67**	**-0.70**	**-0.74**	0.06
NY	**-0.11**	**-0.20**	**-0.24**	**-0.36**	**-0.62**	**-0.61**	**-0.69**	**-0.82**	**-0.18**
OH	**-0.12**	**-0.25**	**-0.32**	**-0.38**	**-0.67**	**-0.70**	**-0.70**	**-0.87**	**-0.28**
PA	**-0.15**	**-0.30**	**-0.39**	**-0.45**	**-0.84**	**-0.95**	**-0.84**	**-1.18**	**-0.69**
SM	**-0.13**	**-0.26**	**-0.35**	**-0.42**	**-0.80**	**-0.94**	**-0.82**	**-1.28**	**-1.04**
US	**-0.38**	**-0.87**	**-1.25**	**-1.28**	**-2.89**	**-4.08**	**-3.07**	**-6.90**	**-9.60**
WI	**-0.11**	**-0.22**	**-0.28**	**-0.36**	**-0.65**	**-0.69**	**-0.68**	**-0.86**	**-0.32**
WT	**-0.19**	**-0.40**	**-0.51**	**-0.62**	**-1.16**	**-1.33**	**-1.17**	**-1.67**	**-1.07**

Small Farm: 200 cows

Interestingly, the conclusion drawn from the results of Scenario 5 are extended to this more severe threat to dairy margins. Protection in the form of risk reduction is more prevalent at higher coverage levels after this shock, relative to the milk price or feed costs shocks, and especially relative to the baseline scenario. This most narrow margin scenario shows small farms in all regions with the exception of the North West draw some degree of risk reduction benefits at the highest coverage level, $8.00 and 90%, from enrollment in MPP. Large and medium farms also demonstrate more risk reduction in the $8.00 level than any other scenario. In terms of magnitude, the US margin demonstrates a 4.05, 7.61, 6.63, 5.78, 7.17, and 7.95 risk reduction in terms of CV at the $8.00, 90% level, for large farms under the baseline through Scenario 6 respectively. Medium and Small farms expect 4.26, 7.84, 6.86, 6.01, 7.38, 8.17 and 5.60, 9.30, 8.33, 7.50, 8.77, 9.6 risk reductions in the US margin. Considering that in order of severity of the shock, Scenario 6, 5, then 2, 3, and lastly, Scenario 4, MPP provides greater risk reduction at greater threats to the margin.

The inclusion of a regional analysis is each market scenario analyzed finds favorable risk reduction in the MPP margin, but less favorable change in margin risk in the regions. In terms of magnitude, there is a 9.94 and 6.95 difference in magnitude between the greatest and least change in risk, for large and small farms respectively. This is comparing across the regions at the $8.00 and 90% coverage level in the baseline scenario. In Scenario 6, this spread increases to 14.02 and 9.66 at the same coverage level. Considering that the $4.00 and 25% coverage level ranges from a .05 and .28 difference in risk change in the baseline and Scenario 6 respectively, this range at the higher coverage levels is very different. Comparing the range of change in risk across the regions and scenarios finds the level of coverage to change the variability of program benefits. This type of difference is especially critical to dairy producers in regions where the trade-off between decreased margins and decreased risk reduction is not evident.

3.4 Conclusions

The objective of testing various market scenarios provided some inference upon how various regions would be affected if prices deviate significantly from the baseline expectations. Valuable insight was gained into the relationship between risk reduction and effective margins by region, farm size, and market scenario considering the expectations of MPP net indemnities.

When considering the effects of each successive scenario, it is concluded that a both a feed cost and milk price shock occurring simultaneously would have the greatest impact on the average margin. Depending on the relative magnitude of the shock, a very large feed cost shock would be necessary to have equivalent impacts as compared with a moderate milk price shock, due to the coefficients of the feed cost calculation of MPP's margin. In the case of all feed prices experiencing a smaller upward shock, this could also have similar impacts as a milk price decline.

This study provided insight into how future policy analyses should consider price shocks to test. Because feed prices in the ADPM are weighted by coefficients, each has a different influence on the overall margin. Corn has the greatest influence, weighted by a coefficient of 1.0728, and milk following, with a coefficient of 1. Soybean meal and alfalfa follow, where these two prices have the least influence on the overall margin. This conclusion guides the analyst to consider corn and milk more important to test the sensitivities of the policy. Additional shocks to soybean and alfalfa prices could extend this analysis to decompose the effects of price shocks in those inputs.

Another way to extend the findings of this work would be to analyze how likely each market scenario is. Each scenario here was justified by historical shocks, but the imposition of probability theory could provide more insight into the program's ability to serve as a risk management tool.

The Margin Protection Program could be debated amongst dairy producers and political figures for its effects on margin and CV expectations across farm size and region. In fact, this analysis presents results that various market scenarios could expose more regional differences in the policy effects as compared to what is expected from the baseline scenario. This indicates the need for scrutiny in the reform process to include whether the policy is meant for reasonably moderate margin fluctuation, or is reserved for catastrophic loss in terms of the shocks to these commodity prices.

CHAPTER 4: CONCLUSIONS

Careful consideration of farm policy issues increases in demand as the new legislation window comes closer. This section will summarize what this paper accomplished in contribution to the dairy policy literature. Chapter 2 established a framework for analyzing the Margin Protection Program in a forecasting, regional manner, a method not currently utilized in the literature. Analyzing the policy for its remaining life in addition to extending this work by testing the framework's ability to model various market scenarios was accomplished through the work Chapter 3 initiated.

This is important for future work to have a method for reporting net indemnity expectations when market shocks occur. This method could be extended in the future to involve a market equilibrium shift, where the end of the shock period results in a new average margin, where as this work allowed the margins to return to the previous equilibrium. This is especially important considering the partial equilibrium may change with respect to supply impacts directly caused by dairy policy.

Chapter 2 found expectations for MPP to pay out indemnities to be unlikely. At the \$8.00 coverage level, there is a 33% chance for indemnities to be paid to producers. At the \$6.00 and \$4.00 coverage levels, the likelihood drops dramatically down to 8% and 1%. For the remainder of the 2014 Farm Bill, dairy producers enrolled in the Margin Protection Program should not expect to see many payments.

Should prices deviate from the FAPRI baseline projections, producers are more likely to see payments before the expiration of the Farm Bill in December of 2018. For those enrolled in the program, the risk was reduced in many regions at most lower and middle coverage levels. At higher coverage levels, the risk was sometimes increased due to the premiums paid into the program out-weighing the expected indemnities. This analysis revealed positive outcomes for the US MPP margin at every coverage level in terms of risk reduction.

Compiling the evidence found in both analyses, regional differences in the performance of the Margin Protection Program is a trend. Average margins and coefficient of variation were found to have a wide range depending on the region analyzed. In all scenarios, some margin increase is provided by the policy effects in addition to some risk reduction.

Farm size is also a critical factor in the implications of MPP. Large and medium farms tend to expect margins that are reduced due to the higher premium rates paid, where small farms still expect increased margins, even at the $8.00 coverage level. This program as currently designed does act as a safety net for dairy producers, but provides the most value when catastrophic market scenarios occur. However, design needs to be adjusted for a better representation of regional margins.

While accounting for regional differences can be difficult in a national program, adjustments could be made to the margins utilized to trigger payments. One concept for doing this may include shifting the margin based on the nominal historic difference between the US and regional margin. This would utilize the data reported in the current policy, keeping administrative costs similar, but allow for some regional variation to be accounted for.

Should margins become very low, MPP could be the only thing to prevent farmers from going out of business. As the 2018 Farm Bill approaches, this work will contribute reasonable evidence to investigate the possibility of a regionally structured MPP. Future work can extend this analysis to include; determining optimal coverage levels given individual farm specifications (region and milk production), potential supply impacts (as demonstrated by Mark et al (2016)), and various feed coefficients to better represent a typical hundredweight ration in each region.

Developing tools to help producers assess the appropriate coverage level, given their farm size, region, and risk preferences to make the best use of the national policy could extend the work presented in this analysis. However, previous literature suggests that dairy policy is chronically challenged by supply impact issues, potentially outweighing the benefit of implementing any policy at all. Specifically, Luh and Stefanou (1989) find risk neutrality and conclude potential social benefit from risk reduction, if any at all may be outweighed by excess supply impacts. This may suggest limited satisfaction with this insurance product is likely to persist if most of the regions experience little risk reduction coupled with potential persistence of excess supply.

In conclusion, this analysis provided key insight into the Margin Protection Program's design and expected performance. This work provides a method for future analyses of this or similar policies and key insights for dairy producers in the various dairy production regions across the United States.

REFERENCES

Agricultural Act of 2014 (PL 113-79, February 7, 2014). 113th U.S. Congress.

Bozic, M., and B. Gould. ''The Dynamics of US Milk Supply: Implications for Changes in US Dairy Policy.'' Staff Paper 540, Department of Agricultural and Applied Economics. Madison, WI: University of Wisconsin, 2009.

Bozic, M., J. Newton, C.S. Thraen, and B.W. Gould. ''Mean-Reversion in Income Over Feed Cost Margins: Evidence and Implications for Managing Margin Risk by U.S. Dairy Producers.'' *Journal of Dairy Science* 95(2012):7417–28.

Burdine, Kenneth H., Kusunose, Yoko, Maynard, Leigh J., Blayney, Don P., and Mosheim, Roberto. "Livestock Gross Margin–Dairy: An Assessment of Its Effectiveness as a Risk Management Tool and Its Potential to Induce Supply Expansion." *Journal of Agricultural and Applied Economics*, May 2014.

Dairy Product Donation Program Fact Sheet, United States Department of Agriculture, Farm Service Agency, August 2014

FAPRI. (2016, March) "March 2016 baseline update for U.S. agricultural markets". FAPRI-MU Report #02-16, Food and Agricultural Policy Research Institute, Division of Applied Social Sciences, University of Missouri, Columbia.

Luh, Y.-H., and S.E. Stefanou. "Dairy Supply and Factor Demand Response to Output Price Risk: An Econometric Assessment." *Northeastern Journal of Agricultural and Resource Economics* 18(1989):103–108.

Mark, T. Burdine, K., Halich, G. 2014. "How Sensitive are the Frequencies and Magnitudes of MPP-Dairy Indemnities?" *Journal of Agribusiness* 32, 2 Fall 2014

Mark, Tyler B., Burdine, Kenneth H., Cessna, Jerry, and Dohlman, Erik. "The Effects of the Margin Protection Program for Dairy Producers" ERR-214, U.S. Department of Agriculture, Economic Research Service, September 2016.

Maynard, L.J., C. Wolf, and M. Gearhardt. ''Can Futures and Options Markets Hold the Milk Price Safety Net? Policy Conflicts and Market Failures in Dairy Hedging.'' *Review of Agricultural Economics* 27(2005):273–86.

Novakovic, A.M. and C. Wolf. 2016. "Federal Interventions in Milk Markets." Choices. Quarter 4. Available online: http://www.choicesmagazine.org/choices-magazine/theme-articles/looking-ahead-to-the-next-farm-bill/federal-interventions-in-milk-markets

Richardson, J.W. (2008). *Simulation for Applied Risk Management.* Department of Agricultural Economics, Agricultural and Food Policy Center, Texas A&M University, College Station, Texas

Richardson, J. W., S.L. Klose, and A.W. Gray, (2000, August). "An Applied Procedure for Estimating and Simulating Multivariate Empirical (MVE) Probability Distributions In Farm-Level Risk Assessment and Policy Analysis." *Journal of Agricultural and Applied Economics* 32, 299-315.

Richardson, J.W., K. Schumann, and P. Feldman (2008). Simetar: simulation for Excel to Analyze Risk. Department of Agricultural Economics, Agricultural and Food Policy Center, Texas A&M University, College Station, Texas.

U.S. Department of Agriculture, Agricultural Marketing Service. 2016. Livestock, Poultry & Grain portal, https://www.ams.usda.gov/market-news/livestock-poultry-grain.

U.S. Department of Agriculture, National Agricultural Statistics Service. 2005-2016 *Agricultural Prices*.

USDA Press Release, August 4, 2016, https://www.usda.gov/media/press-releases/2016/08/04/usda-announces-safety-net-assistance-milk-producers-due-tightening

Wright, P.J. April 26, 2012. *Testimony of Patrick Joseph 'Joe' Wright, Southeast Milk, Inc. Before the House of Representatives, Committee on Agriculture, Subcommittee on Livestock, Dairy, and Poultry*, House Committee on Agriculture, Washington, D.C.

Westcott, P.C., and E. Young. 2004. "Farm Program Effects on Agricultural Production: Coupled and Decoupled Programs" AER-838, U.S. Department of Agriculture, Economic Research Service. http://www.ers.usda.gov/media/874678/aer838b_002.pdf.

Vita

Jessica Ashley Georgia Richard

EDUCATION

University of Kentucky — Expected Dec 2017

College of Agriculture

Lexington, KY

Master of Science in Agricultural Economics

Morehead State University — Aug 2011 – Dec 2013

College of Science and Technology

Morehead, KY

Bachelor of Agricultural Science,

Concentration in Agribusiness

LEADERSHIP AND INVOLVEMENT

Graduate Student Organization, President

Advocate for the Student Experience and create an opportunity for faculty/student interaction and collaboration.

Professional-Societies, Member

Kentucky Economic Association

Southern Agricultural Economics Association

Agriculture and Applied Economics Association

American Dairy Science Association – Graduate Student Division

International Farm Management Association

Made presentations of current research contributed through professional conference engagement.

Dairy Farming Institute, Heilongjiang Province of China, Ambassador

Research and teaching outreach, developing opportunities for further cooperation and study abroad/internship programs.

WORK HISTORY

Research Assistant

University of Kentucky, Agricultural Economics

Lexington, KY

January 2017 – August 2017

Consultant

University of Arkansas-Monticello

Monticello, AR

November 2016 – Present

Teaching Assistant

University of Kentucky, Agricultural Economics

Lexington, KY

Fall 2016

Research Assistant

DeLaval Inc., Dairy Technology Firm

Lexington, KY

August 2015-February 2016

Dairy Farm Worker

UK~Coldstream Research Farm

Lexington, KY

Summer 2016

Assistant Manager

Dollar General

Morehead, Ky, Amenia, Ny

2013-2014

Assistant Manager

Jimmy John's

Morehead, KY

2012-2013

Equine Handler and Property Maitenance

Bloodstock Farm and Stables

Stanfordville, Ny

2011-2012

Athletic Instructor

Cheer Jamz Allstars, Mazetti Enterprises

LaGrange, New York

August 2009 – July 2012

VOLUNTEER EXPERIENCE

Adopt-A-Spot 2016 to 2017

Cleaning up garbage around UK Agriculture Campus

HONORS and AWARDS

Gillis Scholarship Fall 2015

Three-Minute Thesis, 3rd Place Fall 2016

INTERESTS

All of my interests revolve around agriculture. I like to read about commodities I am less familiar with, peruse machinery videos, and read agricultural news. Progressive Dairymen is my favorite magazine, and a great way to relax.

I'm always humbled to learn from the perspective of our country's farmers. From the Ag Economics annual Ag Tour, to my own adventures, I take any opportunity to spend time talking to and hearing the stories of farmers.

I aspire to travel and see agriculture in new places. I strive to create opportunity for collaboration without borders. Driving on a country road does my heart good and gives me back creativity and the stamina it takes to research as a career.