Indicators of Dairy Farm Financial Condition as Policy Triggers

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The 2014 Farm Bill repealed long-standing dairy farm safety net programs and introduced the Margin Protection Program for Dairy Producers (MPP). This program uses a national measure of milk income over feed cost (IOFC) as the trigger for farm payments. This paper considers the MPP IOFC and other potential triggers compared to actual dairy farm financial performance. We find that the MPP IOFC has been highly correlated with profitability on dairy farms in recent years while the milk-to-feed price ratio has not. Issues that remain in using IOFC as a dairy policy trigger include regional differences, herd size, and technological change.

Key words: dairy policy, income over feed cost, milk to feed price ratio, policy trigger

The 2014 Agricultural Act mandated several significant changes to U.S. dairy programs including the repeal of the Dairy Product Price Support Program and Milk Income Loss Contract (MILC) program. These programs were the foundation of the dairy farm safety net. Replacing these product and income support programs are the Margin Protection Program for Dairy Producers (MPP) and the Dairy Product Donation Program. Both new programs use a national benchmark milk income over feed cost (IOFC) margin as an action trigger.

Using the IOFC as a trigger is a tacit recognition that dairy farm financial conditions are determined by the volatile price of feed in addition to the volatile farm milk price. Following a couple of decades of relative stability, feed prices have been both higher and more volatile since 2007. The MILC program added a feed cost adjuster in 2008 but that program primarily benefited small dairy herds.

One traditional benchmark indicator of dairy farm financial well-being has been the milk-to-feed price (MF) ratio. While milk and feed prices are also used in the margin calculations, the ratio form means that should the relationship change, then the benchmarks values will also necessarily change. Further, if the relationship is not stable,

the ratio may not be consistent with farm financial conditions over time (Wolf, 2010). Using a margin measure instead may alleviate some of these issues. However, the use of the IOFC margin as an action trigger highlights the fact that we do not really know much about the utility of the indicators of dairy farm financial condition vis-à-vis policy triggers.

The primary objective of this paper is to assess potential indicators of dairy farm financial status as a trigger for dairy policy action. In order to achieve this objective we begin by defining and examining measures of actual dairy farm financial performance. Candidate farm financial condition indicators are then considered. Potential policy triggers are related to actual farm financial performance over time, across states and herd sizes. We conclude by drawing policy and farm management implications.

Measures of Farm Financial Performance

Farm financial performance has three dimensions: profitability, solvency, and liquidity. Economists have a tendency to focus exclusively on profit but all three are important for financial sustainability.

Profit is a dollar value defined as revenues minus the cost of production. Profit is a flow concept, meaning that it measures what is occurring in the business over a period of time, usually a year. For farms, dollars of profit is often measured using net farm income (NFI). NFI is farm profit which is the return to operator(s) labor and management, return to equity capital and the return to unpaid family labor. Here we examine NFI per hundredweight of milk sold.

In order to facilitate comparisons across farms and over time, financial ratios that account for farm size are used. For example, the dollar value of profit that is sufficient for a smaller farm might be insufficient for a larger farm. Profitability is the extent to which income is generated to adequately cover costs including a fair return to management and capital invested. To measure profitability we use rate of return on assets (ROA), defined as operating profit divided by total farm asset value, which controls for farm asset size. ROA measures before tax profitable earnings per dollar of investment in assets which reflects how efficiently the farm business uses all assets to generate profit.

Solvency is defined as possessing adequate assets to cover liabilities as reflected by positive equity. Solvency indicates the long-term accumulation of equity. The debt-to-asset ratio (D/A) measures the financial position of the business as the creditor's claims against the operation. A smaller D/A value indicates greater farm equity and less risk of insolvency. Lenders use D/A to assess insolvency risk and will charge higher interest rates to farms above risk thresholds. One common benchmark value is a D/A value of 0.6 with higher values indicating more risk but, of course, farm operators might set their own target below that benchmark.

Liquidity reflects the ability of farms to meet financial obligations as they come due. Current ratio (CR) indicates the extent to which current assets cover current liabilities. Liquidity varies widely from business to business. The variability can be due to age of the business, whether a large expansion and increased debt capital has been used with associated repayment required, structure of the debt and many other factors. A healthy CR farm benchmark is a value greater than 2.0—meaning twice as much current asset as current liability value—and higher CR indicates a better liquidity position.[1]

We would expect these measures to be correlated over time. For example, increased profitability can lead to paying down debt (increased solvency) or maintaining cash reserves (increased liquidity). However, equity can also change for other reasons including: a change in the price of assets, infusion of cash from a non-farm source, family withdrawals, forgiveness of a liability, and gifts and inheritances.

Data and Summary Statistics

Dairy farm data were collected from three programs that annually track farm business status and produce benchmark reports for analysis and decision-making (e.g., Bolton and Vanderlin, 2011; Knoblauch and Putnam, 2013; Wittenberg and Wolf, 2013). Cornell University, Michigan State University, and the University of Wisconsin provided records for their respective states from 2000 through 2012. These university programs collect annual balance sheet and income statements from dairy farms. The collection procedures are similar and definitions were confirmed consistent for the measures analyzed here. There were a total of 12,411 total farm records over that 13 year period. There were an annual average of 244 farms from New York, 130 farms from Michigan, and 582 farms from Wisconsin represented.

These farms were not randomly selected and should be considered better than average in terms of financial management. These states are also all located in the Upper Midwest and Northeast regions which are traditional dairy producing regions. None-the-less these farms represent a wide range of herd sizes from major dairy producing states and are illustrative of the utility of dairy policy triggers in relation to farm financial measures.

Definitions of the financial measures and summary statistics over the period by state are displayed in Table 1. From 2000 through 2012 these dairy farms generated an average NFI of $2.83 (Wisconsin) to $4.27 (Michigan) per hundredweight of milk sold. While

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[1] Because some farms have little or no current farm liabilities the CR can tend towards very large values which have disproportionate effects on the average across farms. The distribution of CR was much more skewed than the relatively symmetric distributions of ROA and D/A. Therefore, in the analysis that follows we use the median CR rather than the mean value to examine liquidity.

Michigan farms generated the highest average ROA that value was not significantly different from the New York and Wisconsin average as there was a great deal of variation both across farms and over time. All three states had D/A average around 30% while the Wisconsin farms possessed significantly more liquidity on average than the Michigan and New York farms.

Table 1. Farm Financial Measure Definitions and State Summary Statistics, 2000-2012

Measure	Definition	Michigan	New York	Wisconsin
		Mean[*] (St Dev)	Mean[*] (St Dev)	Mean[*] (St Dev)
		(%)		
NFI/cwt milk sold	NFI/total cwt of milk sold ($/cwt)	4.27 (2.17)	3.32 (1.96)	2.83 (1.04)
Rate of return on assets	(NFI[**] + interest expense –unpaid labor and mgt.)/(total asset value[***]) (%)	5.85 (3.07)	4.82 (4.90)	4.32 (2.47)
Debt to asset ratio	(total liabilities/total assets) (%)	29.5 (2.2)	33.9 (3.4)	30.3 (1.7)
Current ratio	current assets/current liabilities (ratio)	2.25[*]	1.84[*]	3.7[*]

[*] Current ratio is evaluated using the median rather than the mean value.
[**] Net farm income (NFI) = Cash farm revenues – cash farm expenses +/- change in inventory of (crops and feed, market livestock, accounts receivable, accounts payable)+/- capital adjustments (depreciation).
[***] Assets valued at current market value.

Figures 1 through 4 display average farm financial performance by state. Figure 1 reveals that, for example, 2002 and 2003 were quite difficult financially while 2011 generated extremely high profit. Figure 2 demonstrates that adjusting for farm asset value made the farm profitability even more similar across states and over time. Both figures reveal that 2009 was an abominable year in terms of dairy farm profits and profitability. Figure 3 demonstrates that the trend in all three states has been towards an increased solvency position but the trials and tribulations of 2009 produced a significant jump in D/A from which the average farm has not yet recovered. Similarly, the liquidity position captured by CR has generally improved over time except in the poor profit years in 2002, 2003, and 2009 certainly resulted in large declines in the average farm liquidity position (Figure 4).
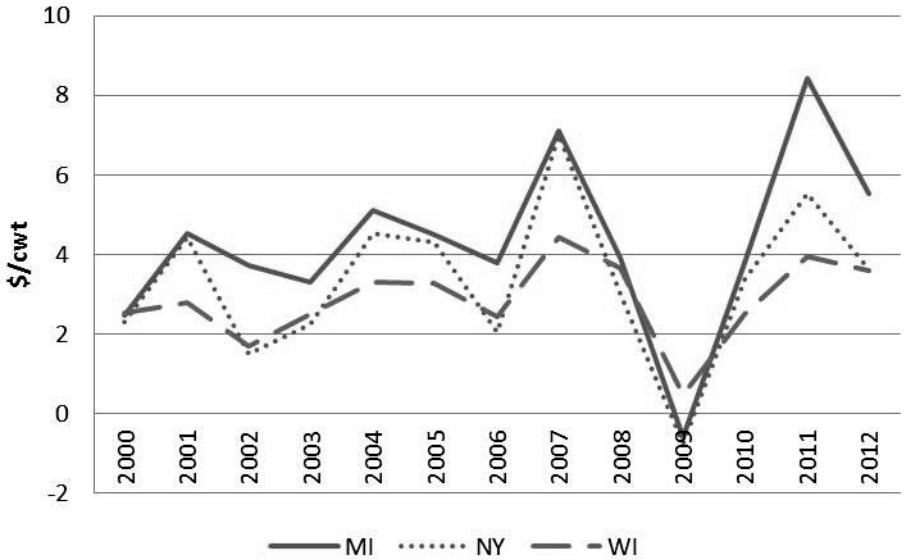
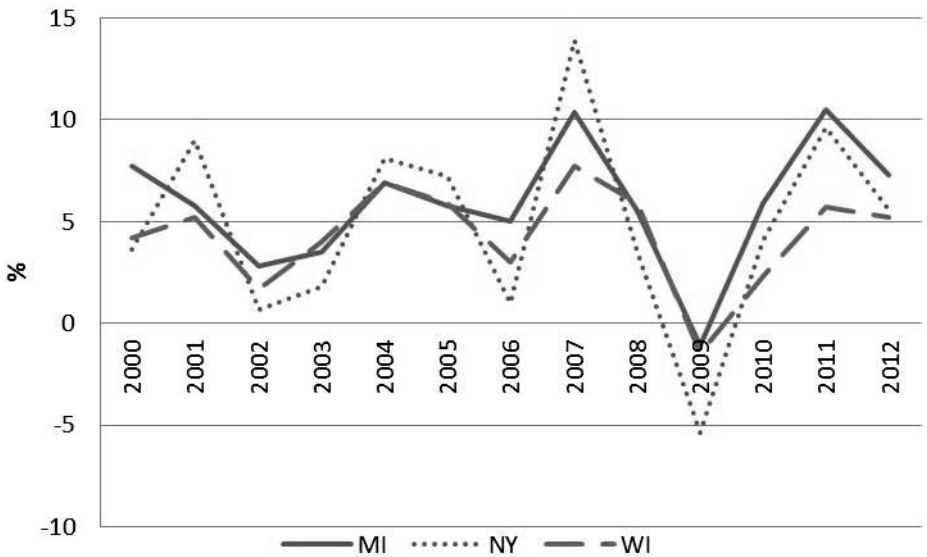**Figure 1. Net Farm Income per Hundredweight, 2000-2012**

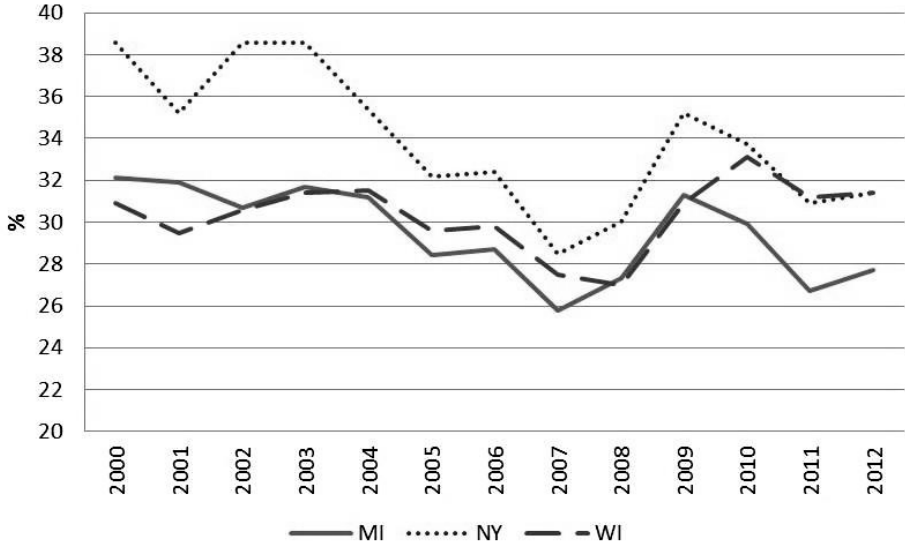**Figure 2. Average annual Rate of Return on Assets, 2000-2012**

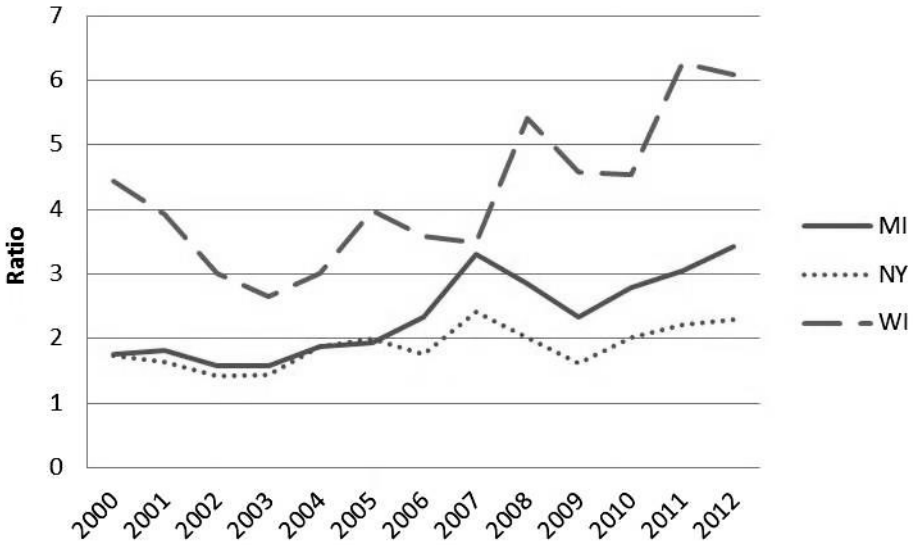**Figure 3. Average Annual Debt to Asset Ratio, 2000-2012**

Figure 4. Median Annual Current Ratio, 2000-2012

Average NFI and ROA by year across states were 80 to 90% correlated. Average D/A and CR by year across states were also positively correlated but at lower levels 30 to 9%. Across measures, NFI and ROA were highly correlated. Those measures of profit and profitability were negatively correlated with D/A and positively correlated with median CR as expected. Thus, improving (declining) profitability was correlated with improving (declining) solvency and liquidity positions.

Herd size is an important dimension of the dairy farm industry. One question that these data shed light on is the performance of dairy farm financial measures across herd size. Figures 5 through 7 display average farm financial performance measures over time by herd size. The milking herd size categories were < 200 cows, 200-499 cows, and 500 or more cows.
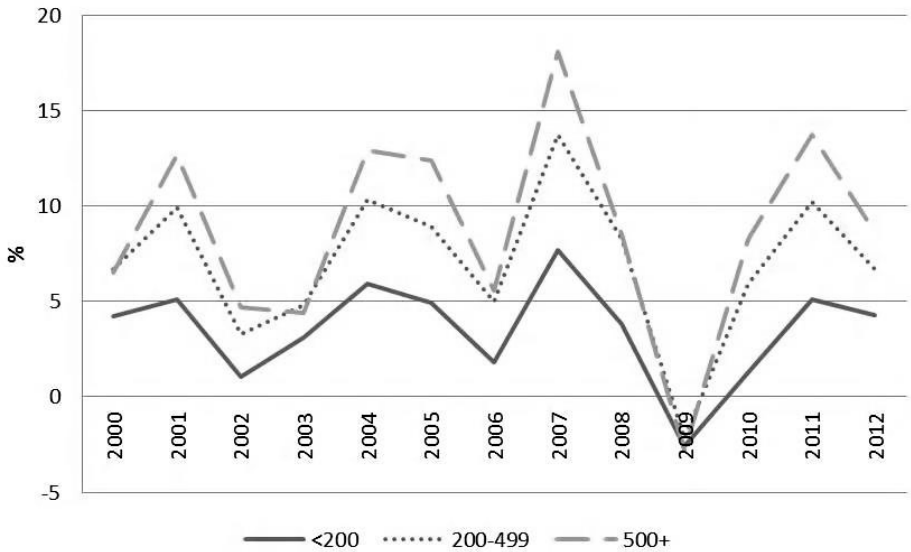

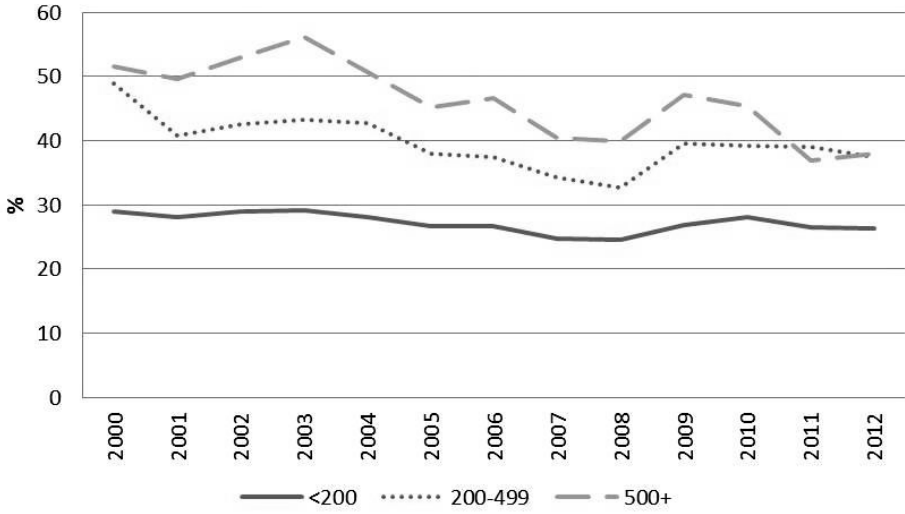**Figure 5. Average Rate of Return on Assets by Herd Size**

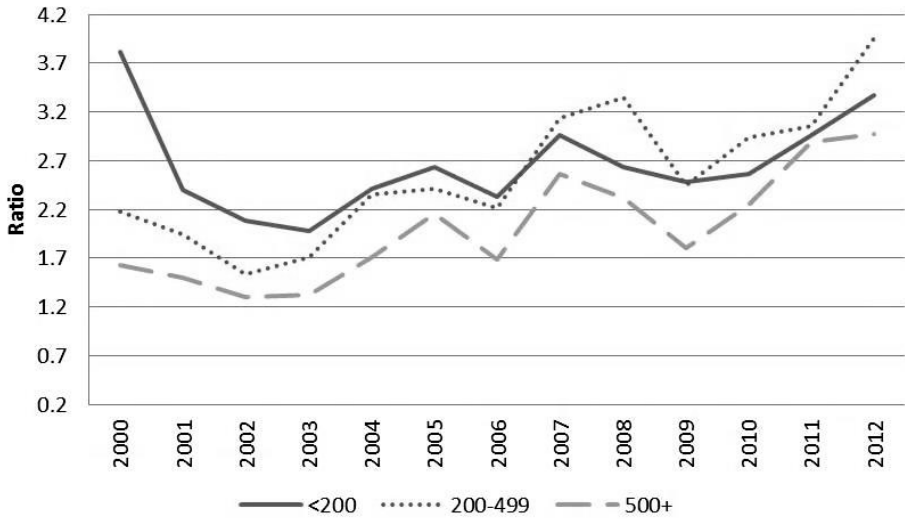**Figure 6. Average Debt to Asset Ratio by Herd Size**

Figure 7. Median Current Ratio by Herd Size

One can see that the ROA performance of the largest herd size group was consistently higher than the smaller sizes. In fact, Figure 5 reveals that while the ROA converged somewhat across herd sizes in poor years, the larger herds had, on average, much higher returns in good years than the smaller herds (e.g., 2007). The larger herd sizes consistently had higher D/A ratios likely reflecting investment in farm size expansions (Figure 6). While all three size group D/A ratios trended down over the period examined, the mid and large herds realized a much larger increase in debt in 2009. With respect to liquidity, the poor milk price years in 2002, 2003 and 2009 resulted in large liquidity losses for all three herd size groups (Figure 7). Mid-size herds consistently had the most favorable average liquidity situation since 2007 while the smallest herds had the most liquidity in the years prior to 2007. The largest herd size farms had the largest loss in liquidity in 2009 which may reflect the increased amount of purchased feed that is generally associated with larger herds. Note that following losses in liquidity, the largest herds recovered quickly.

Calculating these financial measures requires current, accrual adjusted balance sheets and income statements that account for changing inventories, prices and other factors. Further, the performance will vary across farms, regions and production models. As these measures cannot be tracked in any representative way in a timely manner and be available for policy action, proxies or indicators of dairy farm financial situation are necessary.

Past Dairy Policy Triggers

Policy triggers are intended to initiate policy actions in response to farm or market conditions. U.S. agricultural policy has used triggers for policy actions for decades. Many of these policies had their introduction in and around the time of the Great Depression. U.S. agricultural policy action triggers have often been reference prices, which could be farm, wholesale, or retail level. For example, counter-cyclical deficiency payments have been calculated based on historical prices. Considering input prices leads to policy triggers related to margins, ratios, or cost of production.

The Dairy Price Support Program began in 1949 and used a reference support price to trigger purchases of storable, wholesale dairy products in an attempt to temporarily increase demand in periods of low prices. For many years, the trigger support price was set in relation to the parity milk price where parity referred to the period of 1910-1914. The use of this historical period adjusted for inflation led to a support price that was too high relative to market conditions by the late 1970's as production technology and thus productivity increased. The support price reached $13.10 in 1983 per hundredweight (which translates to about $40/cwt in current dollars) which was above market clearing

price and resulted in the government purchasing significant amounts of dairy products. The resulting costs in a time of budgetary shortfalls led to the trigger price being ratcheted down $0.50/cwt every six months depending on market conditions. Landing at $9.80/cwt by the early 1990's the support price has since been at a level where it only affected farm milk prices in extreme circumstances. When the cost of producing milk jumped dramatically in 2007, the price support became irrelevant for all practical purposes. The program was repealed in the 2014 Agricultural Act but remains part of the permanent legislation.

Another example of a dairy program with a trigger was the Milk Income Loss Contract (MILC) program created in the 2002 Farm Bill as a deficiency payment scheme. The trigger price was the Boston class I minimum milk price with a feed cost adjuster based on feed prices added in 2008. The MILC payment trigger was the first dairy policy to acknowledge the effect of feed prices but the adjustment was *ad hoc* and the program had other issues, such as a production payment limit, making it less desirable to larger dairy herds.

A final example of a dairy related policy that uses a milk to feed price margin for a trigger is Livestock Gross Margin Insurance for Dairy Producers (LGM-Dairy) (Bozic et al., 2014). LGM-Dairy allows dairy farm operators to purchase insurance to protect against milk margins defined as the difference between estimated milk revenue and feed costs. The milk revenues and feed costs protected are based on current futures contract settle prices that exist at insurance sign-up. CME Class III milk, corn, and soybean meal futures and options markets are used to set premiums and determine insurance indemnities at the end of the contract. The actual margin protected can be customized within bounds by varying the weight put on feed cost. LGM-Dairy has existed since 2008 but has not been widely used because of factors such as limited funding and lack of producer understanding. The Agricultural Act of 2014 mandated that dairy farmers could participate in either MPP or LGM-Dairy but not both.

Potential Dairy Policy Triggers

A policy trigger used in a farm safety net program should possess several desirable characteristics. Some of these would include being: timely so that response occurs when needed; accurate with respect to farm financial conditions; representative across regions, herd sizes, and production models; understandable by farmers and industry alike; available publically; and beyond manipulation.

The U.S. Department of Agriculture through the National Agricultural Statistics Service and Economic Research Service and other government agencies including the Bureau of Labor Statistics collects and reports many prices and quantities of milk and dairy products as well as inputs including feed, labor, and cattle. These market statistics

are reported weekly, monthly, or annually. USDA also collects and publishes periodic information on cost of production. Candidate policy triggers include the milk-to-feed price ratio (MF), Income over feed cost (IOFC) margin, and the cost of producing milk (COP).

The MF ratio is defined as the all-milk price divided by a feed cost index. The milk-to-feed price ratio is the price of one pound of milk divided by the cost of one pound of feed. Thus, one interpretation is that the MF is the number of pounds of feed that can be purchased with the revenue generated by one pound of milk. The milk price used in the ratio is the "all-milk" price, which is a weighted average of prices paid at the processing plants for milk from farmers (Novakovic, 2009). The all-milk price is used because the information is available and broadly applicable across the United States. It includes both Grades A (fluid quality) and B (manufacturing quality) milk. Today, though, the vast majority of milk is Grade A and is used for beverage milk as well as manufactured dairy products. Because the price is at the plant, the all-milk price does not consider hauling costs, producer assessments, cooperative dues, or any other marketing cost that the farmer bears. Thus, the all-milk price is generally higher than the mailbox price that farmers receive.

The MF denominator uses a USDA calculated representative feed price using corn, soybean, and hay prices received by sellers at the farm level, not including transportation to the farm where it will be fed. The cost of 100 pounds of 16% protein dairy cow feed is calculated as 51% corn price per pound, 41% alfalfa price per pound, and 8% soybean price per pound. While this is not likely any actual farm ration, corn, soybeans, and alfalfa hay are common energy, protein, and forage components of a typical dairy ration and their prices are correlated with available substitute products. The MF is calculated as:

MF = [all-milk price ($/cwt)]/ [(price of corn, $/bu)/56 × 51] + [(price of soybeans, $/bu)/60 × 8] + [(price of alfalfa hay, $/ton)/2,000 × 41].

The IOFC is a dollar measure rather than a ratio. Unlike the MF where the quantity of feed is always 100 pounds, the quantity of feed in the IOFC is adjusted to be the quantity of feed to produce 100 pounds of milk and, in some cases, to account for accompanying young-stock. Thus, although the information content is similar between MF and IOFC, the measures are not identical. The National Milk Producers Federation worked with dairy nutritionists to calculate an appropriate dairy cow diet to use as the feed cost (National Milk Producers Federation, 2010). The MPP-Dairy margin is defined as:

MPP IOFC = All-milk Price - (1.0728 × Corn Price + 0.00735 × Soybean Meal Price + 0.0137 × Alfalfa Hay Price),

where the U.S. All-Milk price is the average price received by dairy producers for all milk sold to plants and dealers in the United States.; corn and alfalfa hay prices are taken from monthly U.S. Department of Agriculture *Agricultural Prices* reports (from USDA-National Agricultural Statistics Service); and the price of soybean meal is the central Illinois price for soybean meal as reported in the United States Department of Agriculture, Agricultural Marketing Service (AMS)-*Monthly Soybean Meal Price Report* (rail price). In the 2014 Farm Bill, the MPP IOFC is referred to as the "Actual Dairy Production Margin."

A third potential policy trigger for dairy policies is the cost of producing milk or some margin of milk revenues over the cost of production. USDA uses the Agricultural Resource Management Survey (ARMS) to assess the cost of producing milk as well as farm revenue sources and amounts. The full survey is completed about every five years. Annual milk cost-of-production estimates for the United States and major dairy states are developed from the most recent ARMS. From the most recent annual estimate, monthly estimates are developed using indexes that reflect differences between the month and the baseline (USDA-ERS, 2014). The annual COP estimates from the most recent milk producer survey, currently 2010, are used as the baseline until new survey information is available. Annual estimates from the next survey become the baseline for subsequent monthly estimates. Monthly estimates of COP are calculated by updating the annual estimates with current prices and milk production levels. The monthly estimates are an attempt to reflect how price and production variations in each month impact costs. Because the survey quantity information becomes dated, the monthly cost estimates become less reliable the longer the time interval between the update month and the year in which the last ARMS was conducted (USDA-ERS, 2014).

ARMS milk cost of production estimates are broken down into operating and ownership costs. Feed is the largest part of the operating costs and are further broken down into purchased and homegrown feed costs. We examine the utility of the milk price less total feed cost in dollars per hundredweight defined as:

$$ARMS\ IOFC = US\ Milk\ Price\ Received - US\ Total\ Feed\ Cost.$$

Figure 8 displays the annual values of the three indicators from 2000 through 2012. The average MF ratio over this period was 2.52 but, as the Figure shows, the ratio trended downward over the 13 year period examined. The MPP IOFC averaged $8.35/cwt with a peak near $12/cwt in 2007. Meanwhile the ARMS IOFC averaged $6.04/cwt. Both IOFC measures agreed that the best year was 2007 while the worst year was 2009. In contrast, the MF indicated that the worst year was 2012 while the best year was 2001.
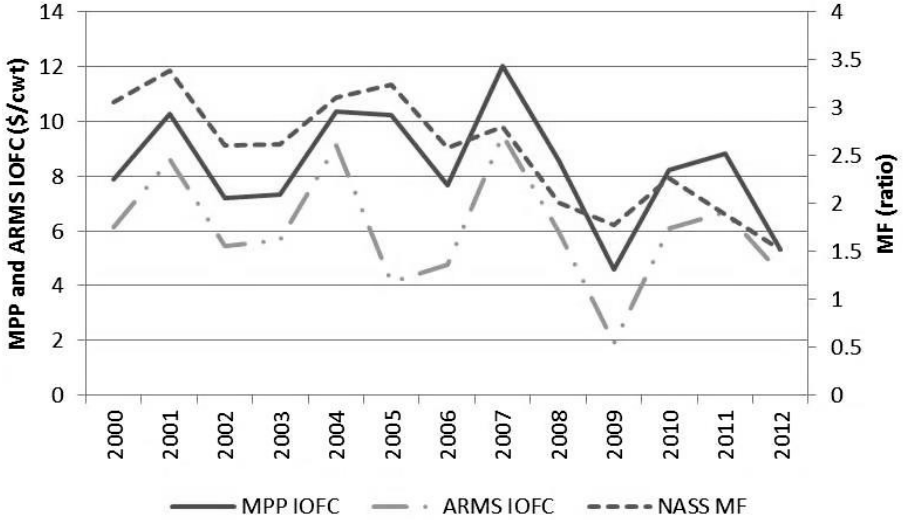
Figure 8. Indicators of Dairy Farm Status, 2000-2012

　　To examine the performance of the three candidate indicators in capturing the variation in farm financial status we estimated correlations between them and the four measures of farm financial performance (of all three states together). Table 2 shows the correlations using annual measures. The top two rows of the table display correlations across the indicators. While all the correlations are positive, perhaps not surprisingly the IOFC measures had a higher correlation than either did with MF. The bottom rows display correlations with the four measures of farm performance. The MPP IOFC outperforms the other indicators in terms of correlation with all four farm financial measures. For the profit related measures (NFI/cwt and ROA), the MPP IOFC and ARMS IOFC are quite close. The MPP IOFC performed better in correlating with the solvency (D/A) and liquidity values (CR). Recall that we expect a negative correlation between profitability and solvency values when performance improves (i.e., higher ROA leads to smaller D/A).

Table 2. Correlations of Farm Performance Measures and Indicators

	NASS MF	MPP IOFC	ARMS IOFC	ROA	NFI/cwt	DA
MPP IOFC	0.69	1.00				
ARMS IOFC	0.51	0.81	1.00			
ROA	0.31	0.79	0.78	1.00		
NFI/cwt	0.14	0.72	0.71	0.96	1.00	
DA	0.26	-0.38	-0.17	-0.53	-0.61	1.00
CR	-0.68	-0.13	-0.10	0.33	0.41	-0.65

The MF performed significantly worse than the IOFC margins and it is worth considering why this occurred. From the figures, one can see that the MF trended downward consistently since 2008 while the profitability, solvency and liquidity measures move up and down over that period. The MF while not an official policy trigger has long been used as a benchmark for conditions in the U.S. dairy industry (Wolf, 2010). Economic theory suggests that the relative ratio of input and output prices determines the amount of milk production and feed used in the short-run assuming average variable costs are covered. In the long-run dairy farmers should produce only if average total costs, all being variable in the long-run are covered. Thus, relative prices are used to determine the appropriate level of feed and therefore milk produced but if the milk price does not cover feed cost, theory suggests stop production. However, because of capital adjustment costs farmers might rationally produce for short periods even below average cost of production. The policy triggers considered here, rather than examining supply response directly, are interested in revealing farm financial condition. Thus, the issues with MF include changing relative relationships between milk and feed price levels.

The benchmark MF has traditionally been 3.0 where ratios in excess of that value encouraged milk production and values below discouraged production (Wolf, 2010). The average U.S. MF over the period from 1985 to 2007 was 2.90. In recent years the MF has consistently been much lower with substantially higher feed cost, for example, from 2008 through 2012, the average U.S. MF was 1.89. This has happened even though there have been some profitable years as previously discussed. Thus, the traditional 3.0 benchmark has not been relevant at indicating the financial performance of dairy farms. The reason is that the higher feed and milk prices fundamentally changed the ratio relationship (Wolf, 2010). To see this, consider an example of a MF of 3.0 where the milk price was $12/cwt and feed cost was $4/cwt. This indicates an IOFC of $8/cwt. If both milk and feed prices increase by 50%, then the milk price is $18/cwt and feed cost is $6/cwt. The MF remains unchanged at 3.0 but the IOFC grows to $12/cwt indicating, *ceteris paribus*, an increase in funds to improve profitability, solvency, and liquidity.

The average annual MPP IOFC is compared to the average ROA by state in Figure 9. The MPP IOFC was highly correlated with the average ROA in all three states (MI 63%, NY 83%, and WI 77%). MPP IOFC appears to diverge in 2012 where the low margins were driven by high feed prices caused by drought. Recall that the MPP IOFC uses the U.S. average feed prices. In 2012, feed prices were higher in the West and Southwest regions than in the three states considered here which highlights the potential issue of basis across states and regions with the MPP IOFC. The MPP IOFC is also based on monthly cash prices so it relates to operations which are purchasing feed in a given month. Operations that grow more of their feed needs or have contracted at lower prices, may have less correlated margins as they are not in the cash feed markets. Farms in Michigan, New York and Wisconsin would typically grow more of their feed requirements than herds in the Southwest and Pacific regions.
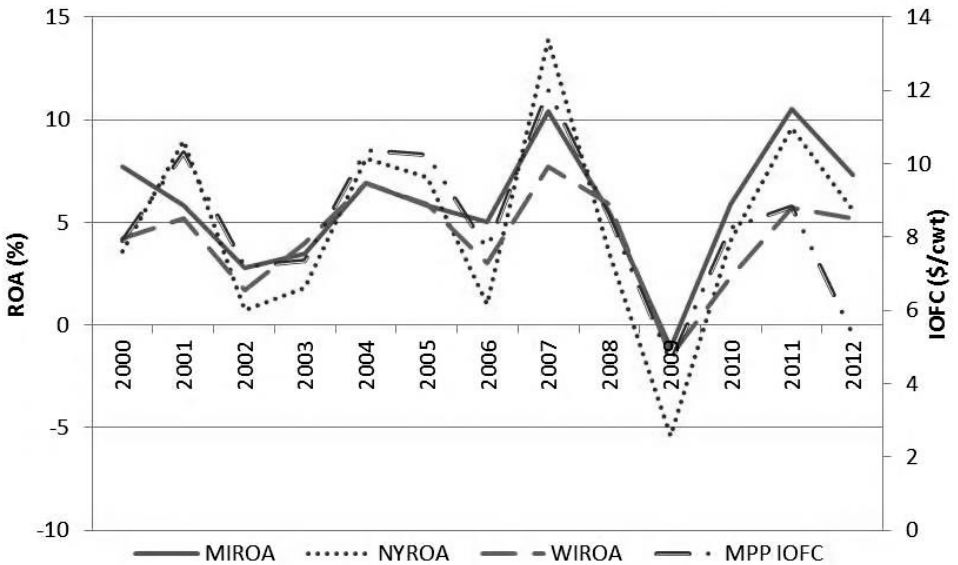

Figure 9. MPP IOFC and ROA by State

Note that all of these focus on prices with little reflection of change in quantities, technology, or production methods. The ARMS IOFC performs comparably to the MPP IOFC but likely suffers from the continued use of the parameters from, for example, the 2010 ARMS results in the 2012 cost estimates. The MPP IOFC also uses fixed feed quantities which, as the technology and production methods change in future years, might become less relevant to actual farm costs and performance. This suggests that the IOFC

margin calculations—in particular the ration for the feed cost—should likely be updated periodically.

Besides correlation with up and down movements, it is important that the trigger level be set such that payments occur when farms actually need them. The Margin Protection Program has margin coverage levels that start at $4/cwt and allows farmers to purchase levels in $0.50/cwt increments up to $8/cwt. Figure 9 reveals that there were two years when the MPP IOFC was at or near $4/cwt base trigger level. In 2009, the average profitability was negative in all three states. In 2012, when low margins were primarily driven by high feed prices, the average profitability for farms in these three states was not nearly as low. Here again, we call attention to the fact that these states grow a large portion of feed needs and, in particular, are consistent forage producing areas. Farms that purchase more feed—such as those in the Pacific and Southeast regions of the United States—likely suffered greater losses on average in 2012.

The farm-level financial implications of low margins are very operation specific. When margins are low, liquidity is used first with additional debt taken on—or longer-term assets sold—if liquidity is not sufficient to cover expenses. Operations that have recently taken on debt will, *ceteris paribus*, have less equity to use in times of financial distress.

Farm Management and Policy Implications

The volatility present in the milk and feed prices in recent years has resulted in large amounts of financial risk for U.S dairy farms. The recognition that current dairy policy was not responsive to existing dairy farm financial risk was the primary motivation for introducing the Margin Protection Program for Dairy Producers. MPP-Dairy uses an IOFC measure to trigger payments to participating farmers.

The increased margin risk in recent years means that farm operations closer to insolvency (D/A>0.6) likely have more financial risk than in previous periods. These herds are prime candidates to participate in MPP to manage risks.

This study revealed that the MPP IOFC did a respectable job of tracking farm financial condition. In particular, the MPP IOFC correlated highly with farm profitability. The correlation between financial measures means that the increased margin risk also correlates with liquidity risk. Holding more cash to alleviate liquidity risk comes at the opportunity cost of using that cash invested in productive assets (i.e., cows).

While the MPP IOFC margin was shown to be correlated across all three dimensions of farm financial performance, this tells us nothing about the appropriate level at which policy action—such as payments to farmers—should be triggered. Future research should examine this question, preferably using data at the monthly time period.

Dairy farmers respond to profit by expanding production by investing in new facilities and cows. Increased profits were shown to be correlated with improved solvency and liquidity. One question is how low profits need to be to result in production declines. Further research is needed to determine whether the profitability indicated by the MPP IOFC can be used to predict production response.

Finally, the data used for this analysis were from the "traditional" dairy states of Wisconsin, New York, and Michigan. These states all had programs from which consistent and accurate dairy farm financial records could be examined. As these states traditionally grow most of their feed needs and have smaller average herd sizes than operations in the Southwest and Pacific regions, it would be useful to perform the same analysis using farm-level financial records from those regions as well.

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