

## **Analysis of the Impacts of a Market Cow Bonus Program in the United States**

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May 2011

### ***Proposed Program***

This document analyzes a proposed program, the Market Cow Bonus Program (MCBP) that would charge an assessment on all milk marketed in the US. Funds collected under the MCBP would be used to pay a price premium for cows culled above a base culling rate when the Class I mover declines for two consecutive months. The cull cow price premium is designed to encourage additional culling when margins are low, thus reducing milk supplies more quickly than would otherwise occur. The Dairy Product Price Support Program (DPPSP) would be eliminated at the inception of the MCBP, but MILC and the current structure of Federal Milk Marketing Orders (FMMOs) would be retained.

### ***Model Structure and Assumptions***

The analysis uses a version of the model previously used to analyze the market impacts of other recently-proposed dairy policy alternatives. This model is described in greater detail in Nicholson and Stephenson (2010). The program modeled assumes that:

- An *assessment* per cwt is collected on all marketed US milk beginning in January 2012. (This date was chosen for consistency with other programs analyzed, as in Nicholson and Stephenson, 2010);
- Assessment funds are collected without a *maximum accumulated amount*;
- The accumulated funds are used to pay a *premium for each eligible culled cow*;
- The *trigger* for premium payments under the program would be a decline in the Class I mover for two consecutive months. No payments are made when the Class I mover has not declined for two consecutive months;
- Cows eligible to receive the premium are those cows culled in excess of a farm's *base culling rate*. This base culling rate is determined as milk marketed by the farm in the month prior to the trigger condition being met divided by 100,000. (For example, a farm producing 1 million lbs of milk in the month prior to the trigger condition being met would be eligible to receive payment for cows culled above 10 cows during the subsequent month.) Payments would be made only for eligible culled cows, not all cows culled.
- Upon initiation of the program, no cull cow premium payments are made until the assessment fund reaches a value of \$100 million. To maintain an adequate amount of funding for the program, if the accumulated amount in the fund drops below \$50

million, the payments under the MCBP will not be made even if the trigger condition is met.

- The Dairy Product Price Support Program (DPPSP) is eliminated in January 2012 (when the MCBP begins), but the MILC program and the current structure of FMMOs is retained.

The value of any of these program parameters show in italics above can be modified to assess their impacts on outcomes, to identify preferred program parameters and to highlight potential issues in program implementation.

Consistent with the program description document provided, this analysis assumes that the assessment will be collected on all milk marketed in the US. The scenarios analyzed assume that there is no maximum accumulated amount of funds, so a constant value for the assessment is collected continuously beginning January 2012. Once the Class I mover declines for two consecutive months, payments of the premium for culled cows are assumed to begin immediately and payments are made for the subsequent 30 days<sup>1</sup>.

One of the key assumptions that must be made for this analysis is the responsiveness of dairy farmer culling decisions to price incentives such as those offered under the MCBP. The analysis (and previous modeling work) assumes that the primary driver of culling decisions is past and expected future profitability, which determines how many cows farmers in four farm-size categories want to milk. When net farm operating income (NFOI) (the measure of profitability used in the model) increases for the four farm-size categories in the model, this implies that farmers will want to increase herd sizes (decrease culling rates), and when NFOI decreases, farmers will want to increase culling rates. Culling decisions also are determined by cull cow prices, but the effect of cull cow prices on culling decisions is smaller than that of profitability. This is consistent with previous analyses in which a larger response of culling rates to cull cow prices would imply that the current price volatility in the industry would be dampened substantially.

The MCBP modifies incentives to cull by providing a premium per cow for cows over the base culling rate specified by the program. Thus, the MCBP increases incentives to cull cows in addition to those that would have been culled otherwise. The decision is based on the marginal (additional) return to additional culling, rather than the average revenue received for each culled cow. In general, this decision “at the margin” will be more sensitive to the premium than a decision about overall average culling rates. To model this effect, the model assumes that dairy farmers increase the marginal culling rate in response to the ratio of the market cull cow price plus the premium divided by the market cull cow price<sup>2</sup>. The strength of this response is measured with a parameter that describes the

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<sup>1</sup> If at the end of 30 days the Class I mover has declined for the previous two months, the program continues to make premium payments until a 30-day period of payments expires and the Class I mover has not declined for the previous two months. This implies that payments may be made for more than 30 days.

<sup>2</sup> For example, if the market cull cow price was \$1000 and the premium was \$500, the ratio of the two would be \$1500/\$1000, or 1.5. A larger premium would result in a larger ratio for a given market cull cow price, and therefore a greater incentive to cull additional cows. In reality, the marginal culling decision would be much more complex for an individual farm, and would take into account the future reduction in costs (such as

“sensitivity” of culling to this ratio. There is limited empirical evidence available to specify a value for this “sensitivity,” so a range of values is examined in the scenarios below.

### ***Scenarios Analyzed and Outcomes Reported***

The scenarios analyzed include:

- A *Baseline*, which indicates future outcomes in the absence of any changes to current programs, which is compared to:
- *Scenario 1*: MCBP with an *assessment* of \$0.10/cwt and a *premium for each eligible culled cow* of \$500 under the assumption of average responsiveness of farmers to a premium for eligible cows culled<sup>3</sup>;
- *Scenario 2*: MCBP with an *assessment* of \$0.10/cwt and a *premium for each eligible culled cow* of \$500 under the assumption of larger responsiveness of farmers to a premium for eligible cows culled;
- *Foundation for the Future (FFTF)*: This scenario represents the impacts of the Dairy Market Stabilization Program (DMSP) and Dairy Producer Margin Protection Program (DPMPP), based on the FFTF formulation as of September 2010<sup>4</sup>. The DPMPP analysis assumes a \$4/cwt Base Margin protected at no cost to producers, a \$6/cwt supplemental margin protection program for which producers would pay \$0.14/cwt, and 60% of producers covering 45% of the milk not covered by the Base Margin protection.
- A *Baseline with Shocks* to feed costs (a permanent increase of 20% is assumed in 2015) and export demand (an increase in demand in 2016 followed by a decrease in demand in 2017). This scenario is intended to assess the effectiveness of the MCBP in response to conditions similar to those observed during 2007-2010;
- *Scenario 3*: MCBP with an *assessment* of \$0.10/cwt and a *premium for each eligible culled cow* of \$500 under the assumption of average responsiveness of farmers to a premium for eligible cows culled, but with feed cost and export demand shocks;
- *Scenario 4*: MCBP with an *assessment* of \$0.10/cwt and a *premium for each eligible culled cow* of \$500 under the assumption of larger responsiveness of farmers to a premium for

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feed) and returns from culling (including receiving the premium) compared to the net profits from retaining individual animals in the herd and selling the milk produced (but incurring additional costs). This analysis represents the incentives in a simplified manner to capture the kinds of changes that would be expected, but a more detailed analysis of this issue would improve understanding of the MCBP's impacts.

<sup>3</sup> Average responsiveness in this case means that a ratio of 1.5 in would increase the overall culling rate by 11% (a sensitivity value of 0.25). Other values for the sensitivity simulated were 0 (in which case the program has no effect) and a larger sensitivity of 0.5 (which would imply that a ratio of 1.5 would increase the culling rate by 22%).

<sup>4</sup> A number of the elements of DMSP and DPMPP have been modified since this time, particularly the schedule for the supplemental margin insurance programs and the addition of federal order reform components. Given time and budget constraints, these modifications have not been incorporated into this analysis.

eligible cows culled to a premium for eligible cows culled, but with feed cost and export demand shocks;

- *Foundation for the Future (FFTF) with Shocks*: This scenario is as described above for the FFTF, but with feed cost and export demand shocks.

For each of these scenarios, the outcomes of interest are the:

- Average US all-milk price after the program from 2013 to 2018;
- Variation the US all-milk price (measured as the average absolute deviation from the average, an indication of by how much, on average, the all-milk price in a given month deviates from the average) during 2013 to 2018;
- Average annual net farm operating income (NFOI, a measure of profitability) for each of four farm-size categories during 2012 to 2018;
- Cumulative NFOI for all farms during the period 2012 to 2018;
- Cumulative government expenditures during 2012 to 2018 (relevant for assessment of the potential political feasibility);
- Cumulative net exports (US exports minus US imports) for cheese and dry whey during 2012 to 2018 (an assessment of the trade impacts of the program);

Most of these results are reported in Table 1, but selected figures are used to illustrate some of the outcomes.

### ***Principal Results***

The key findings of this analysis are as follows:

- Scenarios with \$0.10/cwt assessment under two assumed values of the responsiveness of culling to the incentives under the program would generate sufficient funds to pay the cull cow premium, given that payments will not be made when the value of the fund is less than \$50 million (Table 1 and Figure 3a). For the two MCBP scenarios with feed cost and export demand shocks, a \$0.10/cwt would generate sufficient funds to pay the cull cow premium (Table 2 and Figure 3b).
- The simulated impacts of the program on the All-milk price range from \$0.13/cwt to \$0.19/cwt for 2013 to 2018 (Table 1 and Figure 1a). For the two MCBP scenarios with shocks, the impact on the average All-milk price would be slightly negative, at -\$0.02/cwt (Table 2 and Figure 1b);
- The period of time for which the Class I mover declines for two consecutive months is longer than the 30-day period envisioned under all three MCBP scenarios examined. Graphs of total assessments collected and payments made for the scenarios with a \$0.10/cwt assessment show that payments would be made for periods longer than 30 days (Figures 4a and 4b);

- The MCBP scenarios would decrease variation in the US All-milk price by a small amount, with a decrease in the average deviation from the mean up to \$0.06/cwt (Table 1). For the scenario with shocks, the reduction in average deviation from the mean value of the All-milk price would be larger, \$0.28/cwt to \$0.39/cwt (Table 2);
- The MCBP scenarios without a shock would have a positive impact on simulated average annual net farm operating income (NFOI) for all of the farm size categories analyzed (Table 1; Figure 2a shows the NFOI over time for a medium-size farm). Impacts on NFOI are smaller for the scenarios with shocks, and would be negative for the largest three farm size categories (Table 2 and Figure 2b);
- Cumulative NFOI for all farms from 2013 to 2018 would increase by \$885 to \$894 million (4.9 to 5.6%) under the MCBP scenarios (Table 1). For the scenarios with shocks, the impact on cumulative NFOI for all farms would be negative, -\$558 million to -\$686 million (-2.8% to -3.6%, Table 2);
- Cumulative government expenditures under the MILC would decrease somewhat (\$63 to \$363 million) during 2013 to 2018 (2.0 to 11.5%; Table 1). Government expenditures would be reduced by \$268 to \$355 million (8.3% to 11.1%, Table 2) under the scenarios with shocks;
- Cumulative US net exports of cheese and dry whey would decrease somewhat under the MCBP scenarios, with a reduction of 55 to 100 million lbs (1.4 to 2.6%) for cheese and a reduction of 23 to 41 million lbs (0.6 to 1.1%) for dry whey (Table 1). For the scenarios with shocks, cumulative cheese exports would be reduced by \$40 to \$46 million (1.2 to 1.4%; Table 2) and dry whey exports are reduced by \$17 to \$18 million (0.5%).
- Compared to the Foundation for the Future (FFTF) scenario, the MCBP results in a somewhat lower average all-milk price, somewhat larger price variation, lower Class III prices, higher Class IV prices, larger NFOI for all farm sizes, higher government expenditures, and larger exports of cheese and dry whey (Table 1).
- Compare to the FFTF for the scenarios with shocks, the MCBP would result in a lower average all-milk price, less price variation, a lower Class III price, a higher Class IV price, lower NFOI, larger government expenditures, and larger exports of cheese and whey products (Table 2). The effects on income are due in part to the time horizon selected, because the simulation model projects higher prices and NFOI during the last couple of years of the simulation for the FFTF program with shocks (Figures 1b and 2b).

## ***Conclusions***

In the absence of significant shocks, a financially-feasible Market Cow Bonus Program (MCBP) would have increase the US All-milk price, average net farm operating income for four farm size categories and on the cumulative net farm operating income earned by all farms during 2012 to 2018. Impacts of the program on one measure of price variation are small. The MCBP would reduce cumulative government expenditures during 2012-2018. US net exports of cheese and dry whey would be reduced under the MCBP, but the effects appear relatively modest under the scenarios examined. A number of the simulated

outcomes of the MCBP differ from those of the FFTF program. The outcomes discussed above are not, in general, very sensitive to the assumption regarding the sensitivity of culling rates to the incentives provided under the MCBP.

With significant feed cost and export demand shocks, the program would be more effective at mitigating price variability, but the average all milk price and cumulative NFOI for all farms would be lower than in the Baseline scenario with shocks. With shocks, the outcomes are not changed a great deal by different assumed values of the sensitivity of voluntary culling rates to the incentives provided by the MCBP.

### ***References***

Nicholson, C. F. and M. W. Stephenson. 2010. Analysis of Proposed Programs to Mitigate Price Volatility in the U.S. Dairy Industry. Project report for consortium of dairy industry organizations administered by the Milk Producers Council. September.  
(<http://dairy.wisc.com>)

**Table 1. Simulated Outcomes of a Baseline and MCBP Scenarios with a \$500 Premium Payment, No Shocks**

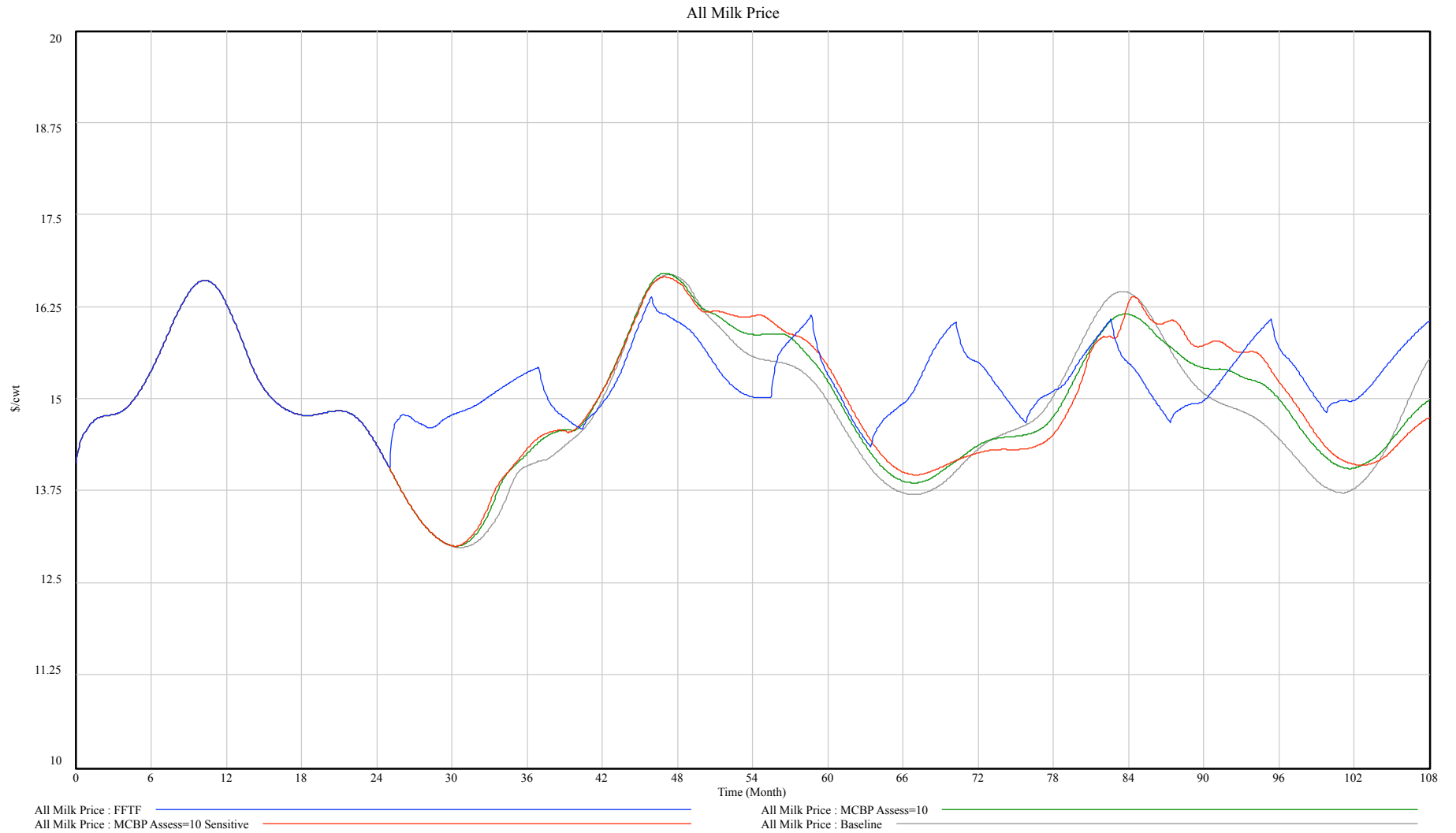
| <b>Program Parameters, Outcome</b>                        | <b>Baseline</b> | <b>1</b>   | <b>2</b>   | <b>FFTF No Shocks</b> |
|---|-----------------|------------|------------|-----------------------|
| <i>Program Parameters</i>                                 |                 |            |            |                       |
| Assessment  | --              | 0.10       | 0.10       | <sup>a</sup>          |
| Cow Cull Price  | --              | <b>500</b> | <b>500</b> | <sup>a</sup>          |
| Responsiveness of Culling to Program                      |                 | 0.25       | 0.40       | <sup>a</sup>          |
| <i>Outcomes</i>   |                 |            |            |                       |
| Average All-Milk Price, 2013-18, \$/cwt                   | 14.97           | 15.09      | 15.16      | 15.32                 |
| Average Deviation in All-Milk Price, 2013-18, \$/cwt      | 0.72            | 0.65       | 0.71       | 0.37                  |
| Average Class III Price, 2013-18, \$/cwt                  | 13.31           | 13.37      | 13.42      | 14.16                 |
| Average Class IV Price, 2013-18, \$/cwt                   | 13.18           | 13.30      | 13.34      | 12.72                 |
| Average Net Farm Operating Income, \$/year                |                 |            |            |                       |
| Small Farm  | 19,732          | 21,500     | 22,144     | 18,395                |
| Medium Farm   | 35,198          | 40,126     | 41,550     | 33,885                |
| Large Farm  | 238,451         | 254,407    | 259,796    | 229,069               |
| Extra Large Farm  | 1,278,978       | 1,304,445  | 1,325,978  | 1,183,714             |
| Cumulative NFOI, All Farms, 2012-18, \$bil                | 16.0            | 16.9       | 16.9       | 15.2                  |
| Cumulative Government Expenditures 2012-18, \$bil         | 3.1             | 2.8        | 3.1        | 0.2                   |
| Cumulative Net Exports, American Cheese, 2012-18, mil lbs | 3,806           | 3,752      | 3,706      | 2,921                 |
| Cumulative Net Exports, Dry Whey, 2012-18, mil lbs        | 3,548           | 3,525      | 3,507      | 3,313                 |
| Ending Balance of Funds for Program, \$mil                | --              | 153.0      | 142.2      | --                    |
| <i>Outcomes, Change from Baseline</i>                     |                 |            |            |                       |
| Average All-Milk Price, \$/cwt                            | --              | 0.13       | 0.19       | 0.35                  |
| Average Deviation in All-Milk Price, \$/cwt               | --              | -0.06      | 0.00       | -0.34                 |
| Average Class III Price, 2013-18, \$/cwt                  | --              | 0.06       | 0.11       | 0.85                  |
| Average Class IV Price, 2013-18, \$/cwt                   | --              | 0.12       | 0.15       | -0.46                 |
| Average Net Farm Operating Income, \$/year                |                 |            |            |                       |
| Small Farm  | --              | 1,768      | 2,412      | -1,337                |
| Medium Farm   | --              | 4,929      | 6,353      | -1,313                |
| Large Farm  | --              | 15,956     | 21,345     | -9,382                |
| Extra Large Farm (\$ 000)                                 | --              | 25,467     | 47,000     | -95,264               |
| Cumulative NFOI, All Farms, 2012-18, \$bil                | --              | 0.9        | 0.9        | -0.8                  |
| Cumulative NFOI, All Farms, 2012-18 % change              |                 | 5.6%       | 5.5%       | -4.6%                 |
| Cumulative Government Expenditures 2012-18, \$bil         | --              | -0.4       | -0.1       | -2.6                  |
| Cumulative Net Exports, American Cheese, 2012-18, mil lbs | --              | -55        | -100       | -831                  |
| Cumulative Net Exports, Dry Whey, 2012-18, mil lbs        | --              | -23        | -41        | -211                  |

<sup>a</sup> FFTF scenario does not include these elements, but includes previously-specified program parameters for the Dairy Market Stabilization Program (DMSP) and Dairy Producer Margin Protection Program (DPMPP).

**Table 2. Simulated Outcomes of a Baseline and MCBP Scenarios with a \$500 Premium Payment, With Feed Cost and Export Shocks**

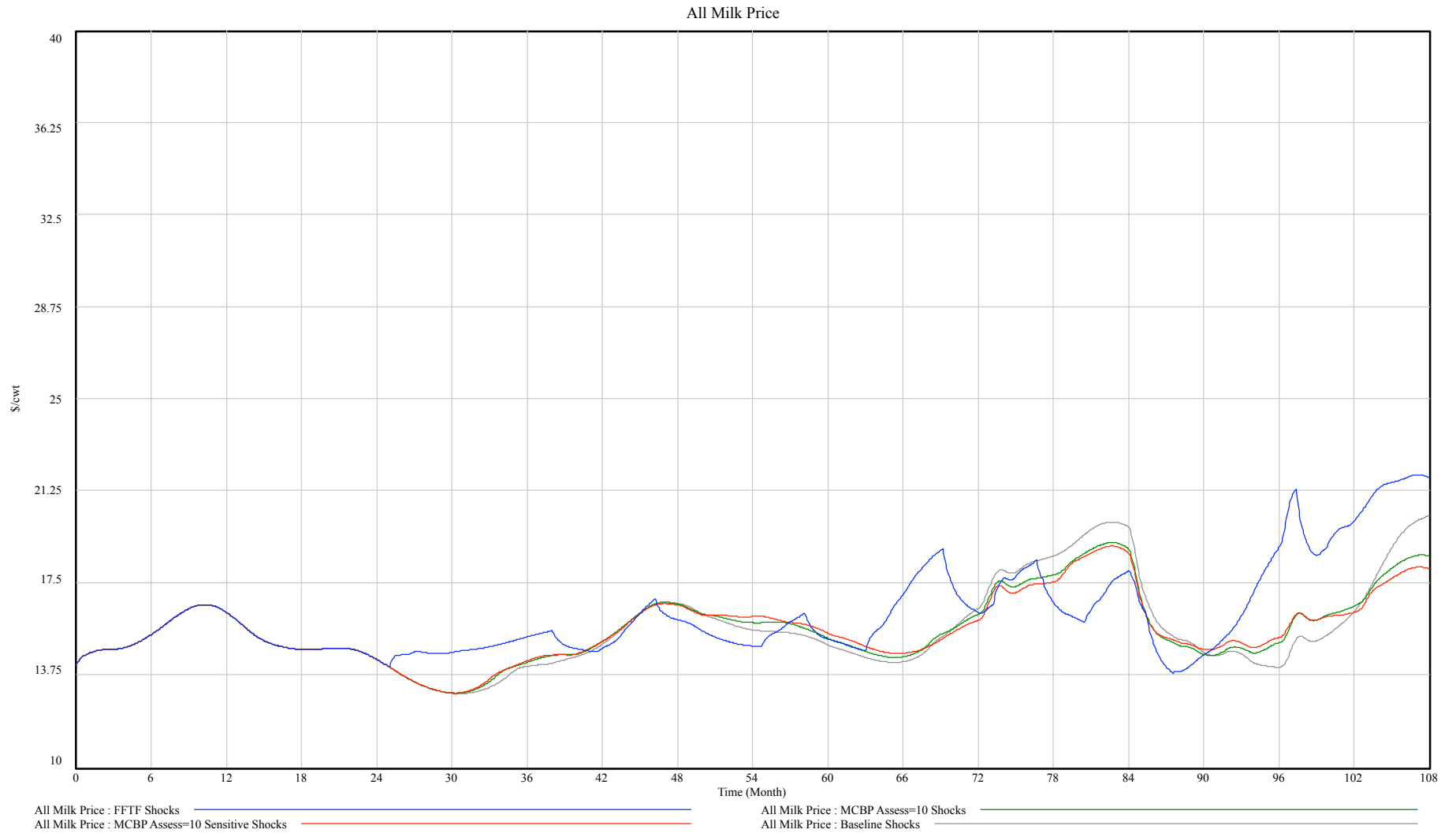
| <b>Program Parameters, Outcome</b>                        | <b>Baseline with Shocks</b> | <b>3</b>   | <b>4</b>   | <b>FFTF Shocks</b> |
|---|-----------------------------|------------|------------|--------------------|
| <i>Program Parameters</i>                                 |                             |            |            |                    |
| Assessment  | --                          | 0.10       | 0.10       | a                  |
| Cow Cull Price  | --                          | <b>500</b> | <b>500</b> | a                  |
| Responsiveness of Culling to Program                      | --                          | 0.25       | 0.40       | a                  |
| <i>Outcomes</i>   |                             |            |            |                    |
| Average All-Milk Price, 2013-18, \$/cwt                   | 16.07                       | 16.05      | 16.04      | 16.71              |
| Average Deviation in All-Milk Price, 2013-18, \$/cwt      | 1.32                        | 1.05       | 0.94       | 1.43               |
| Average Class III Price, 2013-18, \$/cwt                  | 13.97                       | 13.98      | 13.97      | 14.84              |
| Average Class IV Price, 2013-18, \$/cwt                   | 14.03                       | 14.04      | 14.03      | 13.87              |
| Average Net Farm Operating Income, \$/year                |                             |            |            |                    |
| Small Farm  | 22,432                      | 22,642     | 22,837     | 22,843             |
| Medium Farm   | 44,808                      | 44,007     | 43,846     | 35,198             |
| Large Farm  | 290,432                     | 279,494    | 275,782    | 296,057            |
| Extra Large Farm  | 1,675,215                   | 1,578,660  | 1,548,911  | 1,993,846          |
| Cumulative NFOI, All Farms, 2012-18, \$bil                | 19.9                        | 19.3       | 19.2       | 22.8               |
| Cumulative Government Expenditures 2012-18, \$bil         | 3.2                         | 2.9        | 2.8        | 1.0                |
| Cumulative Net Exports, American Cheese, 2012-18, mil lbs | 3,259                       | 3,219      | 3,213      | 2,417              |
| Cumulative Net Exports, Dry Whey, 2012-18, mil lbs        | 3,331                       | 3,313      | 3,313      | 3,126              |
| Ending Balance of Funds for Program, \$mil                | --                          | 275.0      | 179.5      | --                 |
| <i>Outcomes, Change from Baseline</i>                     |                             |            |            |                    |
| Average All-Milk Price, \$/cwt                            | --                          | -0.02      | -0.02      | 0.64               |
| Average Deviation in All-Milk Price, \$/cwt               | --                          | -0.28      | -0.39      | 0.11               |
| Average Class III Price, 2013-18, \$/cwt                  | --                          | 0.01       | 0.00       | 0.87               |
| Average Class IV Price, 2013-18, \$/cwt                   | --                          | 0.01       | 0.00       | -0.15              |
| Average Net Farm Operating Income, \$/year                |                             |            |            |                    |
| Small Farm  | --                          | 210        | 405        | 411                |
| Medium Farm   | --                          | -801       | -962       | -9,610             |
| Large Farm  | --                          | -10,938    | -14,650    | 5,624              |
| Extra Large Farm (\$ 000)                                 | --                          | -96,555    | -126,304   | 318,631            |
| Cumulative NFOI, All Farms, 2012-18, \$bil                | --                          | -0.6       | -0.7       | 2.9                |
| Cumulative NFOI, All Farms, 2012-18 % change              |                             | -2.8%      | -3.6%      | 15.2%              |
| Cumulative Government Expenditures 2012-18, \$bil         | --                          | -0.3       | -0.4       | -2.2               |
| Cumulative Net Exports, American Cheese, 2012-18, mil lbs | --                          | -40        | -46        | -842               |
| Cumulative Net Exports, Dry Whey, 2012-18, mil lbs        | --                          | -17        | -18        | -205               |

<sup>a</sup> FFTF scenario does not include these elements, but includes previously-specified program parameters for the Dairy Market Stabilization Program (DMSP) and Dairy Producer Margin Protection Program (DPMPP).



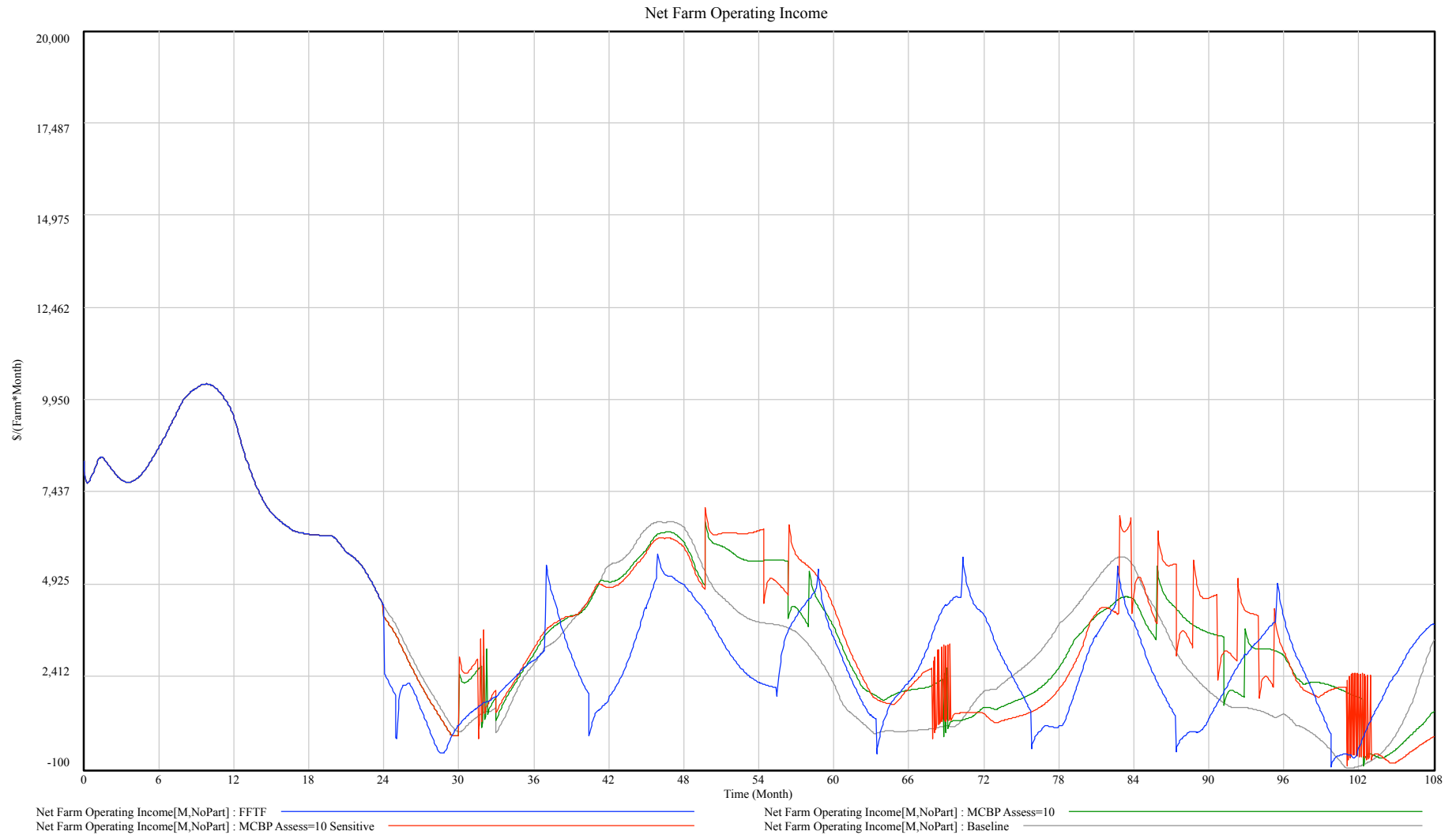
**Figure 1a. Simulated US All-Milk Price, January 2010 to December 2018, Baseline, 2 MCBP Scenarios and FFTF Without Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



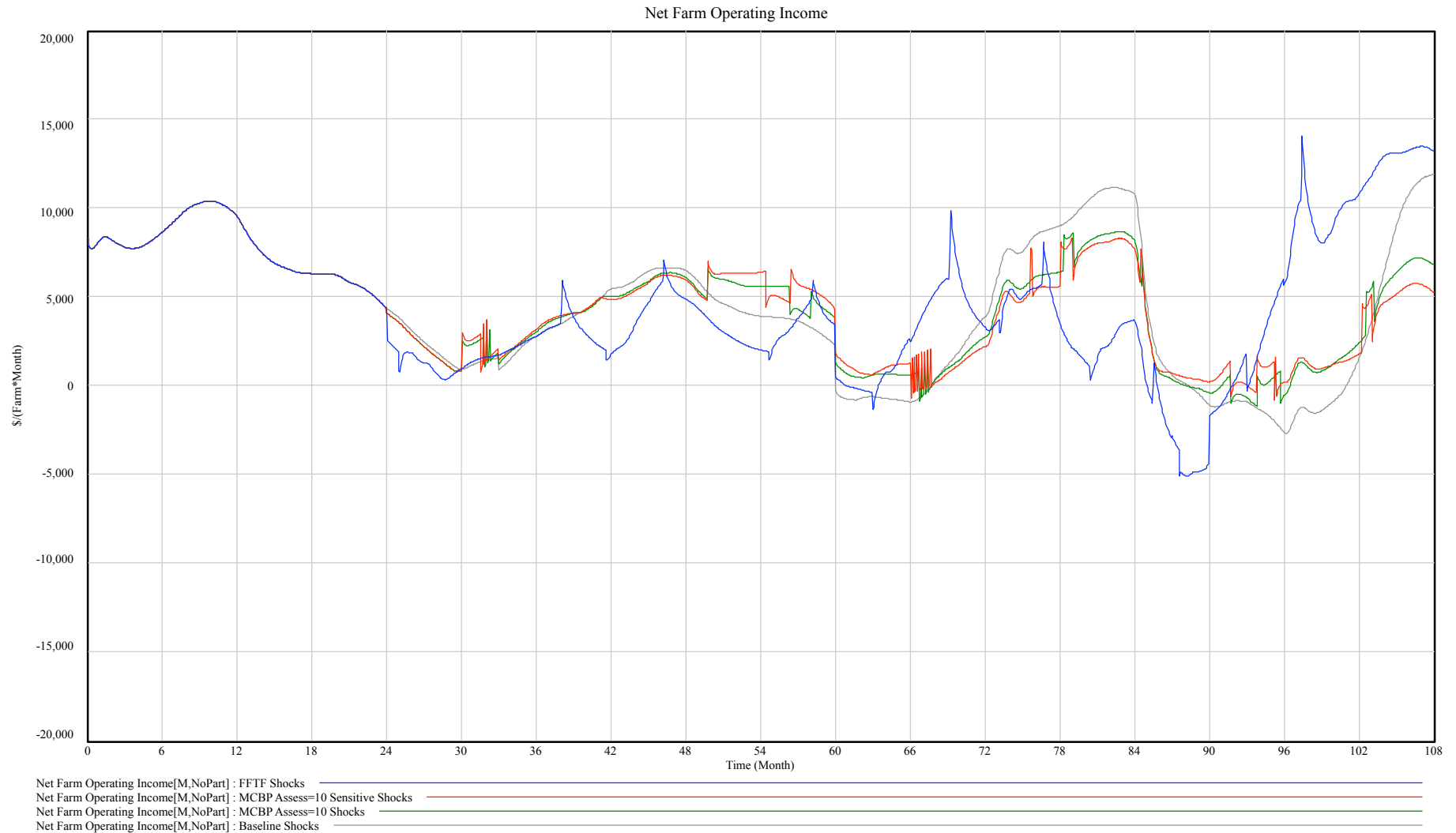
**Figure 1b. Simulated US All-Milk Price, January 2010 to December 2018, Baseline, 2 MCBP Scenarios and FFTF with Feed Cost and Export Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



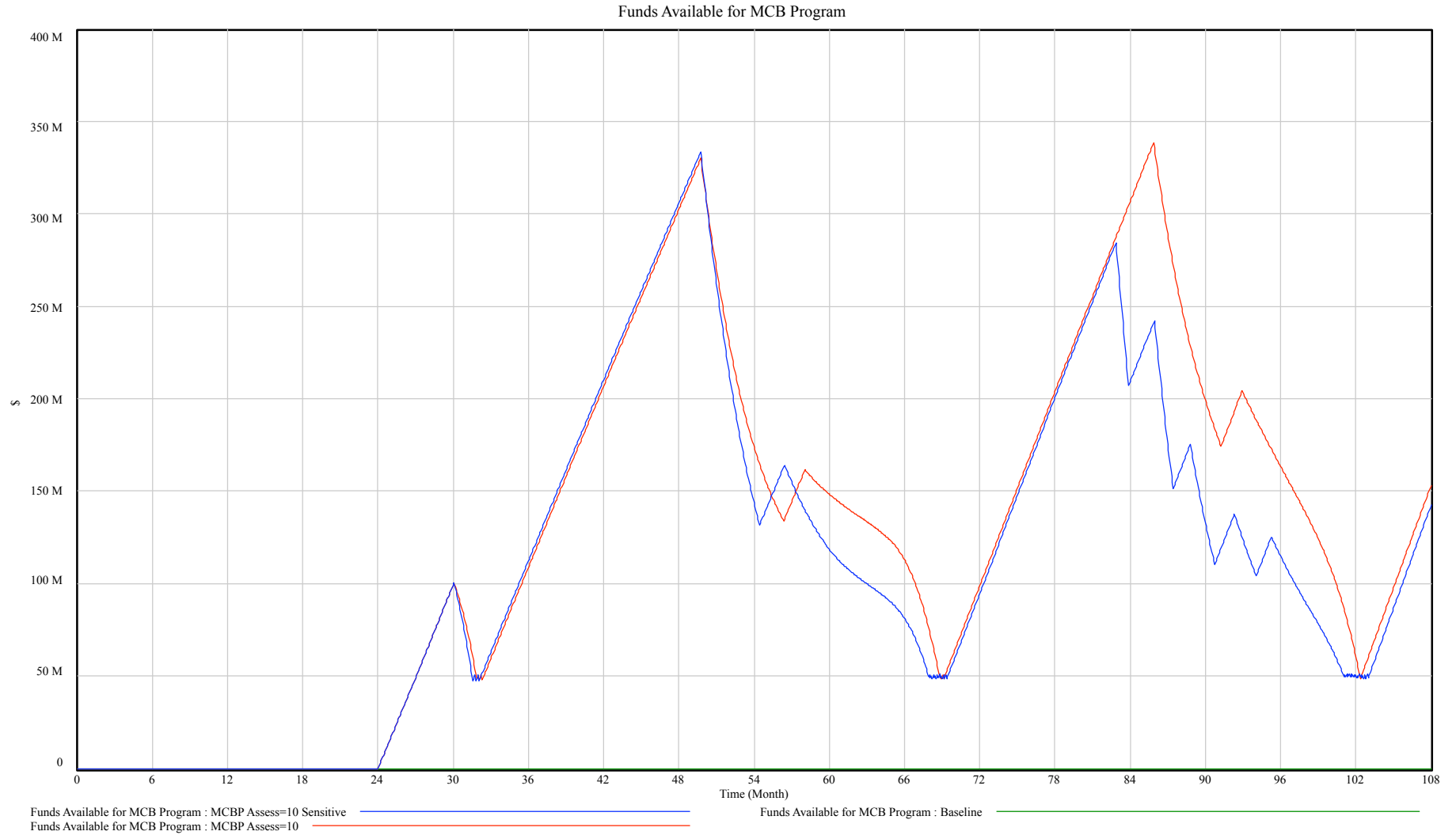
**Figure 2a. Simulated Net Farm Operating Income, Medium-size Farm (200-499 Cows), January 2010 to December 2018, Baseline, 2 MCBP Scenarios and FTFF Without Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



**Figure 2b. Simulated Net Farm Operating Income, Medium-size Farm (200-499 Cows), January 2010 to December 2018, Baseline, 2 MCBP Scenarios and FTF with Feed Cost and Export Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



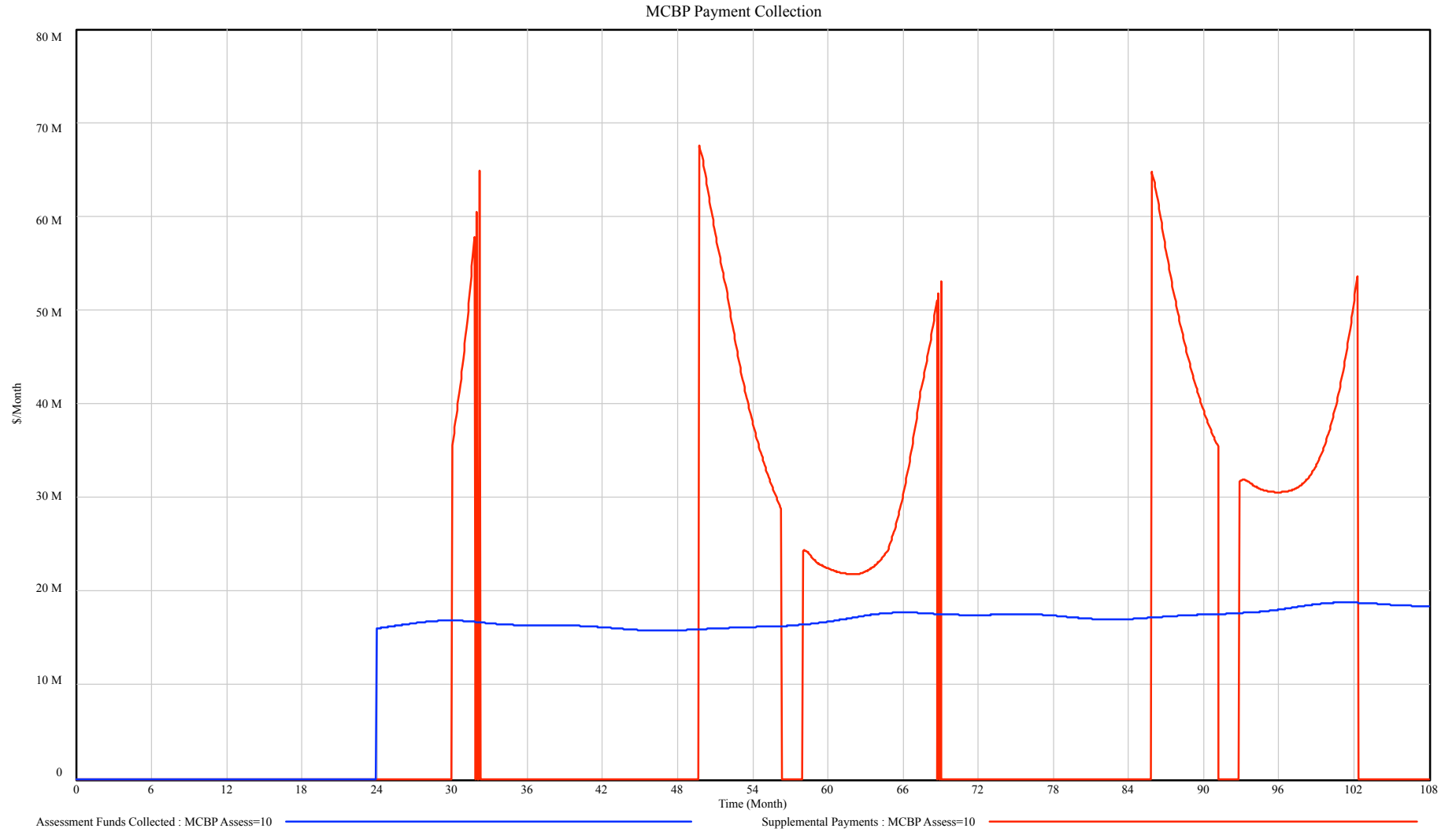
**Figure 3a. Simulated Value of Assessment Fund, January 2010 to December 2018, Baseline and 2 MCBP Scenarios Without Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



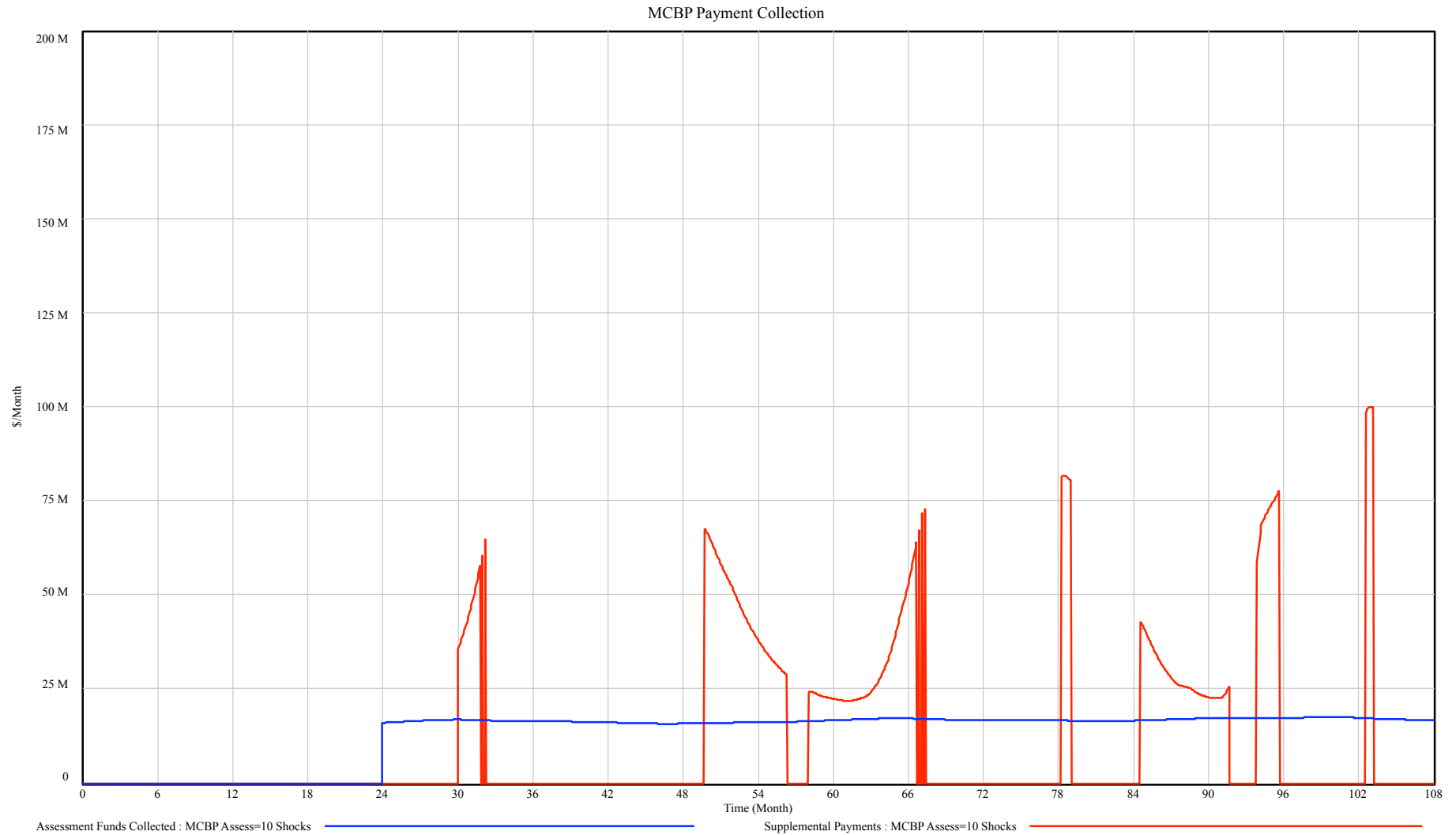
**Figure 3b. Simulated Value of Assessment Fund, January 2010 to December 2018, Baseline and 2 MCBP Scenarios with Feed Cost and Export Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



**Figure 4a. Simulated Value of Total Assessments Collected and Cull Cow Payments, January 2010 to December 2018, Baseline and MCBP Scenario with \$0.10/cwt Assessment Without Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018



**Figure 4b. Simulated Value of Total Assessments Collected and Cull Cow Payments, January 2010 to December 2018, Baseline and MCBP Scenario with \$0.10/cwt Assessment with Feed Cost and Export Shocks**

NOTE: Time Scale for all graphs is 12 = 2011, 24=2012, 36=2013, 48=2014, 60=2015, 72=2016, 84=2017, 96=2018