Sources of Differences in California Class 4b and Federal Milk Marketing Order Class III Prices During 2007 to 2012

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April 2012

Introduction

More than 80% of the farm milk produced in the U.S. is regulated under state or federal milk marketing orders, which determine a minimum regulated price[2] for milk by its use. In recent years, there has been a growing unease with the current system of price discovery and price setting[3] on the part of many dairy industry stakeholders. Two characteristics of the current milk pricing system that are commonly discussed at present include transparency and adequacy. Transparency means that the minimum farm milk prices arrived at under price regulation are determined in a clear, transparent way—and in the absence of any manipulation of the relevant markets. Adequacy typically means that the minimum regulated farm milk prices are sufficient to provide an adequate profit margin to many, if not all, dairy farmers.

Another (related) issue is the alignment of prices between different regulated regions. Price alignment has been an issue within, and between, federal milk marketing orders, but it is also an issue between federal and state regulated regions. California, with more than one-fifth of U.S. milk production, has long maintained a system of pricing milk different from the rest of the country. Prices for farm milk in California for use in specific product classes have tended to be lower than those in the Federal Milk Marketing Order (FMMO) system. This pattern of pricing is consistent with the fact that much of the milk in California is processed into products (especially butter, nonfat dry milk and cheese) that is consumed outside of the state. California has higher transportation costs to urban locations in the eastern U.S. that are among the main markets for California dairy products. Lower milk costs help to offset this higher transportation costs and allow California products to be cost-competitive.

In recent years, however, the California Class 4b and the FMMO Class III prices (the minimum regulated prices for milk used in cheese) have been observed to diverge a good deal more than they used to. The Class 4b price has been consistently lower, with differences larger than $3.50/cwt (nearly 25%) in some recent months. The California Department of Food and Agriculture announced changes to the price formula used to set

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Mark Stephenson at the University of Wisconsin and Rob Vandenheuvel of the Milk Producers Council provided helpful comments on a previous version of this document. No external sources provided funding for the work described in this document.

[2] Note that prices can be, and frequently are in many parts of the country, larger than the regulated minimum price.

[3] "Price discovery" is the process by which buyers and sellers determine a price, which in the U.S. dairy industry is more applicable to the determination of dairy product prices. "Price setting" is used to describe the process of determining minimum regulated farm milk prices, usually based on dairy the "discovered" dairy product prices.

the Class 4b price in September 2011. These changes were designed to better account for the value of whey products in pricing milk[4], but the ongoing large differences between Class 4b and Class III have become a point of significant consternation for California dairymen, who believe that they are being underpaid for milk used in cheese based on comparisons with Class III prices.

Given the foregoing, this document provides an overview of the patterns of prices for Class 4b and Class III in recent years, discusses the reasons for the differences and identifies the implications of large differences in minimum regulated prices for milk used in cheese between California and the FMMO system. More specifically, the objectives of this document are to:

1) Describe the pattern of differences between the Class 4b and Class III prices during 2000 to 2012;
2) Assess the reasons for the differences between the Class 4b and Class III prices;
3) Discuss the implications of these differences;
4) Describe a pattern of differences in minimum regulated prices paid for milk used in cheese consistent with cost minimization in the US dairy industry;

This information is intended to provide additional context for further discussions of the system of minimum regulated prices for milk in California. It is not intended to advocate for any specific policy proposal to modify milk pricing in California or under FMMOs.

Comparison of Class 4b and Class III Prices

The Class 4b and Class III prices tend to move together, but with the Class 4b price usually below the Class III price (Figure 1). From January 2000 to December 2009, the average difference between the California Class 4b price and the Class III price was -$0.41/cwt. That is, the Class 4b price averaged about 41 cents lower than the Class III price. Since January 2010, however, the average difference has been more than four times the difference during 2000 to 2009, more than -$1.70/cwt. Since January 2011, the difference has averaged more than $2.00/cwt. Although there is considerable variation in the difference between the two prices, the average difference has increased during the last two years, and values for individual months are much larger than any observed previously.

Sources of Differences Between Class 4b and Class III Prices

To understand the sources of the differences between the prices, it is useful to consider the formulas used to calculate them. The Class III price is calculated as:

[4] As for many dairy policy issues, there is a long history of discussion and debate about how whey products should be valued in pricing milk, particularly in California. Changes related to whey were made to CA milk pricing formulas in 2003, 2005, 2006, 2007 and 2011. This document does not provide a detailed history of these changes, focusing more on the implications of the current formulas compared to those used previously. It also does not discuss recent proposals made by various dairy organizations to modify the current formula .

$$\text{Class III} = (3.5)(\text{Butterfat value}) + (0.965)(\text{Class III Skim Value}),$$

where the butterfat value is calculated as:

$$\text{Butterfat} = (\text{NASS butter price} - 0.1715)(1.211),$$

and the Class III skim value is calculated as:

$$\text{Class III Skim Milk Price} = (\text{Protein price} \times 3.1) + (\text{Other solids price} \times 5.9).$$

The protein price used in this formula is derived from the NASS cheese price and the Other solids price from the NASS dry whey price.

The Class 4b price calculation is a bit more complicated. It is calculated as:

$$\text{Class 4b price} = (3.5)(\text{Butterfat value}) + (8.7)(\text{SNF value}),$$

where

$$\text{Butterfat value} = (\text{CME Butter Price} - 0.0485 - 0.1635)(1.2),$$

the SNF value is calculated as:

$$\text{SNF value} = \frac{\text{Product value - (3.72)(Butterfat value)}}{8.80},$$

and Product value is calculated as:

$$\begin{aligned}\text{Product value} = {} & (\text{CME cheddar price} - 0.0252 - 0.1988)(10.2) \\ & + (\text{CME butter price} - 0.10 - 0.1635)(0.27) \\ & + \text{Whey factor.}\end{aligned}$$

The whey factor is calculated based on a schedule of values using the average price for dry whey reported by *Dairy Market News* (www.ams.usda.gov/mnreports) for "Western (Mostly)" for weeks between the 26th of the preceding month and the 25th of the month for which the price will be calculated. This was changed beginning in September 2011 from the previous formula, which included a fixed value of the whey factor equal to 0.25. Prior to December 2007, the whey factor was based on a formula that included a whey price, a whey make-allowance and a yield factor, somewhat similar to the manner in which the other solids value is calculated for Class III. From August 2006 to December 2007, this formula was given by:

$$\text{Whey contribution to product value} = (\text{Whey Price} - 0.267)(5.8).$$

There are a number of differences in the formulas that will contribute to differences between the Class 4b and Class III prices. First, they use different product prices for butter, cheese and whey. The Class 4b price uses CME prices for butter and cheddar cheese, then adjusts them to reflect California market values, and uses the whey price reported by *Dairy Market News*. The Class III price uses NASS survey values. The use of different prices will result in somewhat different values, but larger differences arise from other elements of the formulas. Another difference is the "make allowance" values[5] assumed for different products (Table 1). These "make allowances" are lower in California, and their impact is to contribute to a higher value of farm milk than would be the case if the make allowances were equal to those used in FMMO formulas. However, the make allowance for dry whey in the Class 4b formula used from August 2006 to November 2007 was substantially larger than that used in the FMMO formula. Other factors include the adjustments for market value in California, assumed yields, and the use of a price schedule to determine the value of the "whey factor" in the Product value calculation.

Table 1. Make Allowance Values for California 4b and Class III Formulas

Product	California	FMMO
Cheddar cheese	0.1988	0.2003
Butter	0.1635	0.1715
Dry whey	NA*	0.1991

* Not currently used given the tabular values that relate the whey price and the value of the whey factor. The CA formula from August 2006 to December 2007 used a make allowance for whey of 0.267.

These differences make assessment of the reasons for the growing disparity between Class 4b and Class III somewhat difficult to determine. However, it is possible to undertake a relatively simple analysis that divides the changes into those due to differences in the value of butterfat and the value due to solids not fat. This at least identifies which of the basic components of the price contributes to the observed differences.

To compare the butterfat values, the components of the Class 4b and Class III prices are compared as follows:

Difference due to butterfat = (3.5)(CA butterfat value – FMMO butterfat value).

Essentially, this difference arises from difference in the butter prices, make allowances and yield factors assumed under the two pricing systems. For the solids not fat, a similar calculation can be undertaken, which is:

Difference due to SNF = (8.7)(CA SNF Value) – (0.965)(Class III Skim Milk Value),

where again this represents differences in a prices, make allowances, yield factors and the basic structure of the equation. The SNF value can also be calculated as the difference between the overall difference and the value of the difference due to butterfat, and this is the approach used for the calculations reported here.

[5] A "make allowance" is a cost of transforming an input into a product. For instance, in the FMMO Butterfat formula, the 0.1715 value is the make allowance which implies that it costs a little more than 17 cents to produce a pound of butter (not including the cost of the milk or cream). In that same Butterfat formula, the 1.211 value is referred to as the "yield factor". This represents the number of pounds of butter that could be made from one pound of butterfat.

These calculations suggest that the largest source of the differences between Class 4b and Class III in most months is the difference in the value of the SNF contribution (Figure 2). Over the period from January 2000 to February 2012, the average difference in the butterfat contribution was $0.12/cwt and the contribution of the SNF difference was $0.52/cwt. Thus, about 80% of the difference is attributable to differences in the SNF value. Since January 2011, the proportion of the difference due to SNF value is higher, about 95%, with the contribution of the difference in butterfat values equal to $0.09/cwt and the difference due to SNF values equal to $1.61/cwt.

Although the foregoing calculation is useful, much of the discussion has focused on the contribution of whey to the Class 4b price, in part because this was the focus of changes made to the pricing formulas made in September 2011. Based on the previous formulas, the contribution of whey to the Class 4b price can be calculated as:

Contribution of Whey to Class 4b = (Whey Factor)(8.7)/(8.8),

And the contribution of the whey value to the Class III price can be calculated as:

Contribution of whey to Class III = (NASS Dry whey price – 0.1991)(1.03)(5.9)(0.965).

Once this contribution of whey is calculated, it is possible to calculate the contribution of SNF other than in whey to the Class 4b and Class III prices, and to determine the differences due to butterfat, whey and other nonfat solids.

These calculations indicate that the difference in whey value has almost always been the largest component of differences between Class 4b and Class III since mid-2009. The average contribution to the difference due to whey value during July 2009 to February 2012 was $1.14/cwt, compared to differences due to butterfat and other nonfat solids that averaged $0.07/cwt and $0.22/cwt, respectively. The large difference due to whey contribution is due to basic structural differences in the manner in which whey value is calculated in California and FMMO pricing formulas, and due to increases in whey prices from about $0.25/lb to nearly $0.70/lb (Figure 4). A key difference in the current CA formula is that it is much less responsive to whey price changes than the formula for FMMOs. If the same whey price were used in the current formulas (although technically this is not the case, the differences are often small), as the whey price rises the contribution in FMMOs increases much more rapidly (Figure 5). For example, at a whey price of $0.25/lb, the contribution to the Class 4b and Class III prices from whey are nearly equal, about $0.30/cwt. If the whey price increases to $0.60/lb, the contribution to Class 4b is about $0.64/cwt, whereas the contribution to Class III is $2.43/cwt. At a whey price of about $0.26/lb, the formulas provide an equal contribution to the Class 4b and Class III values, but whey prices during much of the past six years have been well above that value. The formula for the whey contribution used in California from August 2006 to December 2007 (the purple column) was more responsive to increases in whey prices than the two formulas used since that time.

It is worth noting, however, that the changes to the pricing formulas in September 2011 resulted in a higher contribution of whey to the Class 4b price than would have been the case under the previous formulas. In Figure 3, the purple line shows the contribution of whey to Class 4b under the previous fixed whey factor pricing formulas. Note also that the current California whey factor schedule currently will never result in a negative contribution of whey to Class 4b (as is possible for Class III, and was under the whey factor formula used prior from August 2006 to December 2007).

Discussion and Implications

The previous analysis indicates that much of the difference between Class 4b and Class III prices is due to differences in the contribution of SNF to the calculation of the minimum regulated milk price, and the differences in whey value are the largest component. What are the implications of large differences in Class 4b and Class III prices for farmers and milk buyers?

For California dairy farmers, the large spread between Class 4b and Class III often is viewed as resulting in an unfair lower price for a large component of their milk check. In 2011, SNF use in Class 4b amounted to nearly 50% of the SNF usage in the California, so it is certainly the case that the value of Class 4b has a significant impact on the value of milk. However, there are two factors that should also be considered. The first is over-order premiums. In many regions of the country, cheese plants pay significant premiums (at times, up to $1.00/cwt) above the minimum regulated price. FMMO administrators appear to have set formulas for the values of milk that allow for premiums to be a component of farm milk pricing in many instances. That is, they do not want the minimum regulated price to be above the market-clearing value for farm milk in a particular use. If minimum regulated prices are set below "market-clearing levels" in a particular use, there will be pressure to pay premiums in order to obtain the necessary milk for processing. In California, there is much less a tradition of paying over-order premiums than in other parts of the country, so it is unclear that the growing divergence between the minimum regulated prices under Class 4b and Class III has been offset by any premium payments.

A second consideration is what is an appropriate difference between Class 4b and Class III prices should be. As noted earlier, a Class 4b price somewhat lower than Class III is consistent with the "export" of large quantities of products (and therefore milk components) from California. An economically appropriate value of this difference between the two prices can be assessed with spatial economic modeling. A large-scale disaggregated spatial model of the U.S. dairy industry (described in greater detail in Nicholson et al., 2011) was used to generate values of milk used in the manufacture of cheese and whey at different locations throughout the U.S. Differences between the values of milk for cheese and whey in California and those elsewhere then suggest what an appropriate range for the differences between Class 4b and Class III might be (assuming no differences in over-order premiums, which is likely to be not quite correct). This analysis suggests that the marginal value of milk in cheese is lowest in the western US[6] and increases steadily as one moves east. This suggests that prices in California (but also Oregon and Washington) for milk used in cheese should be lower than elsewhere in the U.S.

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[6] In this case, the values indicate differences due to transportation and processing costs only, and therefore do not include the value of the farm milk itself. Thus, the differences between locations are what matters for assessing appropriate values for the differences in Class 4b and Class III values.

(Note that the administered FMMO Class III price at a standard composition does not vary spatially, although this analysis suggests that it should.) The maximum difference in the value of milk used in cheese is about $1.20/cwt, between central California and upstate New York, and the difference between central California and Wisconsin is about $0.60/cwt. Although these differences are calculated for May 2006 with an assumed diesel fuel cost of $3.50/gallon and many costs have increased since then, they suggest that price differences of $1.50/cwt or more between Class 4b and Class III are probably not justified on economic grounds.

Class 4b prices significantly lower than Class III provide California cheese manufacturers with a cost advantage for their major input compared to manufacturers regulated under FMMOs. The argument has been made that the lower Class 4b price is of particular importance to smaller-scale cheese manufacturers in California who do not have whey-processing capacity. A lower cost for the major input should provide incentives for increases in cheese production and sales. If this additional cheese production uses milk from California, this increased demand would offset to a certain extent the impact of lower Class 4b prices on producer revenues[7]. Cooperatives often make annual payments to producers based on profits earned in processing, which increases the effective price paid for producer milk. Because cheese production by cooperatives is not a major use of milk in California, the impact of these annual payments on the effective milk price to California producers is likely to be small. For cheese and whey manufacturers located elsewhere (especially in the west) and regulated under FMMOs, the lower Class 4b price places them at a competitive disadvantage, and to the extent that it provides California cheese manufacturers incentives to increase production of cheese and whey products, can have an effect on prices of these products in national markets.

Summary

Large differences in the values of the California Class 4b and FMMO Class III prices in recent years appear primarily driven by differences in contribution of whey, although other factors also contribute. The difference in whey values occurs due to different responsiveness of price formulas to changes in the price of dry whey, which is much smaller for California than in FMMOs. The differences in value appear larger than would be justified by differences in the spatial value of milk used in cheese, as indicated by spatial economic modeling. The lower Class 4b prices provide a competitive advantage to California cheese and whey product manufacturers, but the degree to which they reduce prices paid to California dairy farmers below appropriate values and have impacts on national markets have not been fully assessed.

[7] If the cost advantage is used to increase cheese manufacturing elsewhere for manufacturers that have production capacity in both California and other states, this increased demand for California milk would not occur.

References

Nicholson, C. F., M. I. Gómez and Oliver H. Gao. 2011. The Costs of Increased Localization for a Multiple-Product Food Supply Chain: Dairy in the United States. *Food Policy*, 36:300-310.

Appendix: Class III and Class 4b Pricing Formulas

Class III Price Formula (2012)

Class III Price = (Class III skim milk price x 0.965) + (Butterfat price x 3.5)

Class III Skim Milk Price = (Protein price x 3.1) + (Other solids price x 5.9)

Protein Price = ((NASS Cheese price – 0.2003) x 1.383) + ((((NASS Cheese price – 0.2003) x 1.572) – Butterfat price x 0.9) x 1.17)

Other Solids Price = (NASS Dry whey price – 0.1991) times 1.03.

Butterfat Price = (NASS Butter price – 0.1715) times 1.211.

Class 4b Price Formula (as of September 2011)

Class 4b price = (3.5)(Butterfat value) + (8.7)(SNF value),

Butterfat value = (CME Butter Price – 0.0485-0.1635)(1.2),

$$SNF \text{ value} = \frac{\text{Product value - (3.72)(Butterfat value)}}{8.80},$$

Product value = (CME cheddar price – 0.0252 – 0.1988)(10.2)
+ (CME butter price - 0.10 – 0.1635)(0.27)
+ Whey factor

The whey factor value is given as:

DMN Monthly Average Dry Whey Price ($/lb)	Whey Factor in 4b Formula ($/cwt.)
< 0.25	0.25
≥ 0.25 and < 0.30	0.30
≥ 0.30 and < 0.35	0.35
≥ 0.35 and < 0.40	0.40
≥ 0.40 and < 0.45	0.45
≥ 0.45 and < 0.50	0.50
≥ 0.50 and < 0.55	0.55
≥ 0.55 and < 0.60	0.60
≥ 0.60	0.65

Source: CDFA publication "Detailed Instructions Used to Calculate Class Prices (as of September 2011) Last Updated: August 23, 2011. (http://www.cdfa.ca.gov/dairy/pdf/DetailedInstructions.pdf), Accessed 3/31/12.

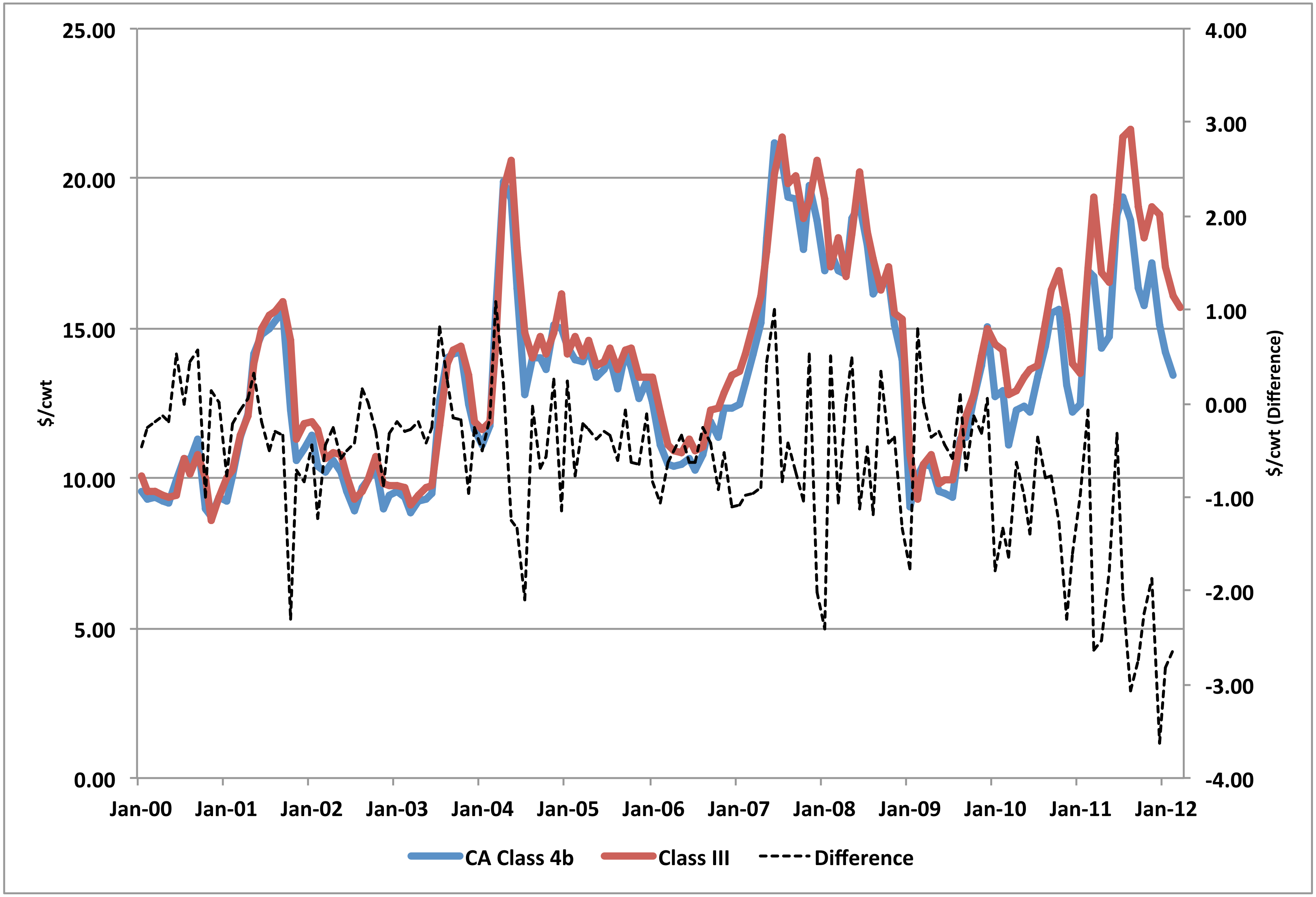

Figure 1. Difference Between California Class 4b and Class III Price, 2000-2012

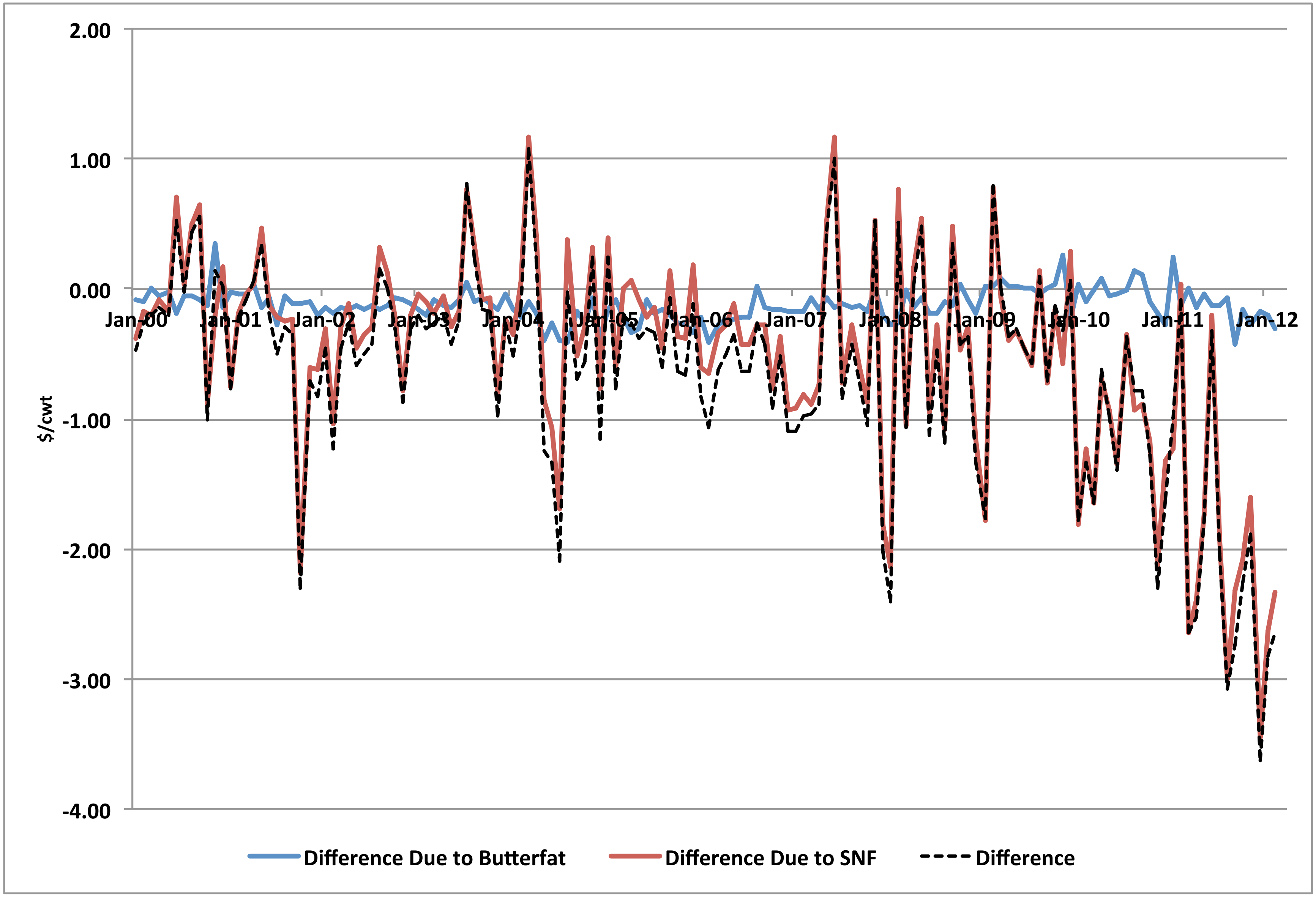

Figure 2. Difference Between Class 4b and Class III by Fat and SNF Value, 2000-2012

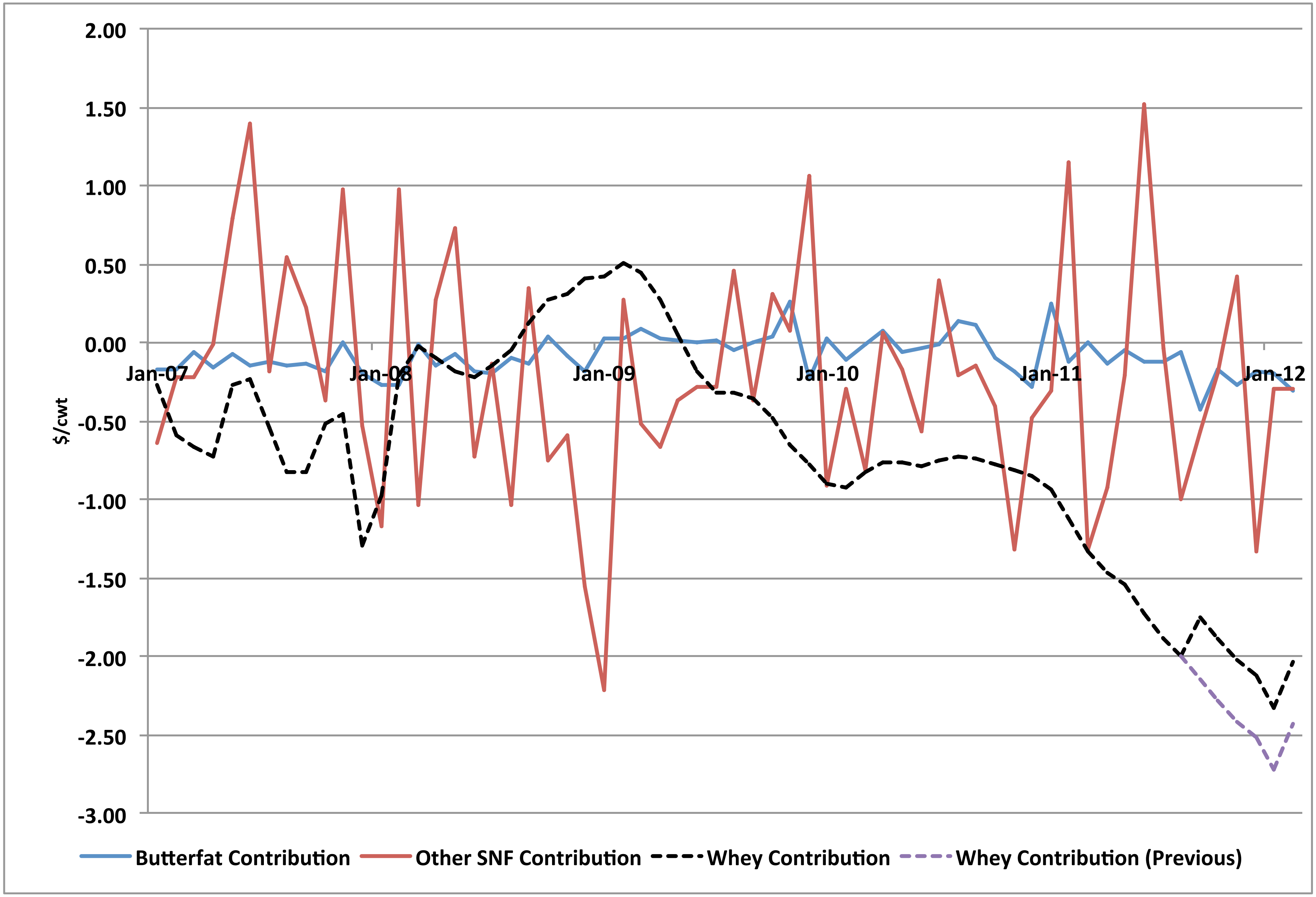

Figure 3. Difference Between Class 4b and Class III by Fat, Whey, and Non-Whey SNF Value, 2007-2012

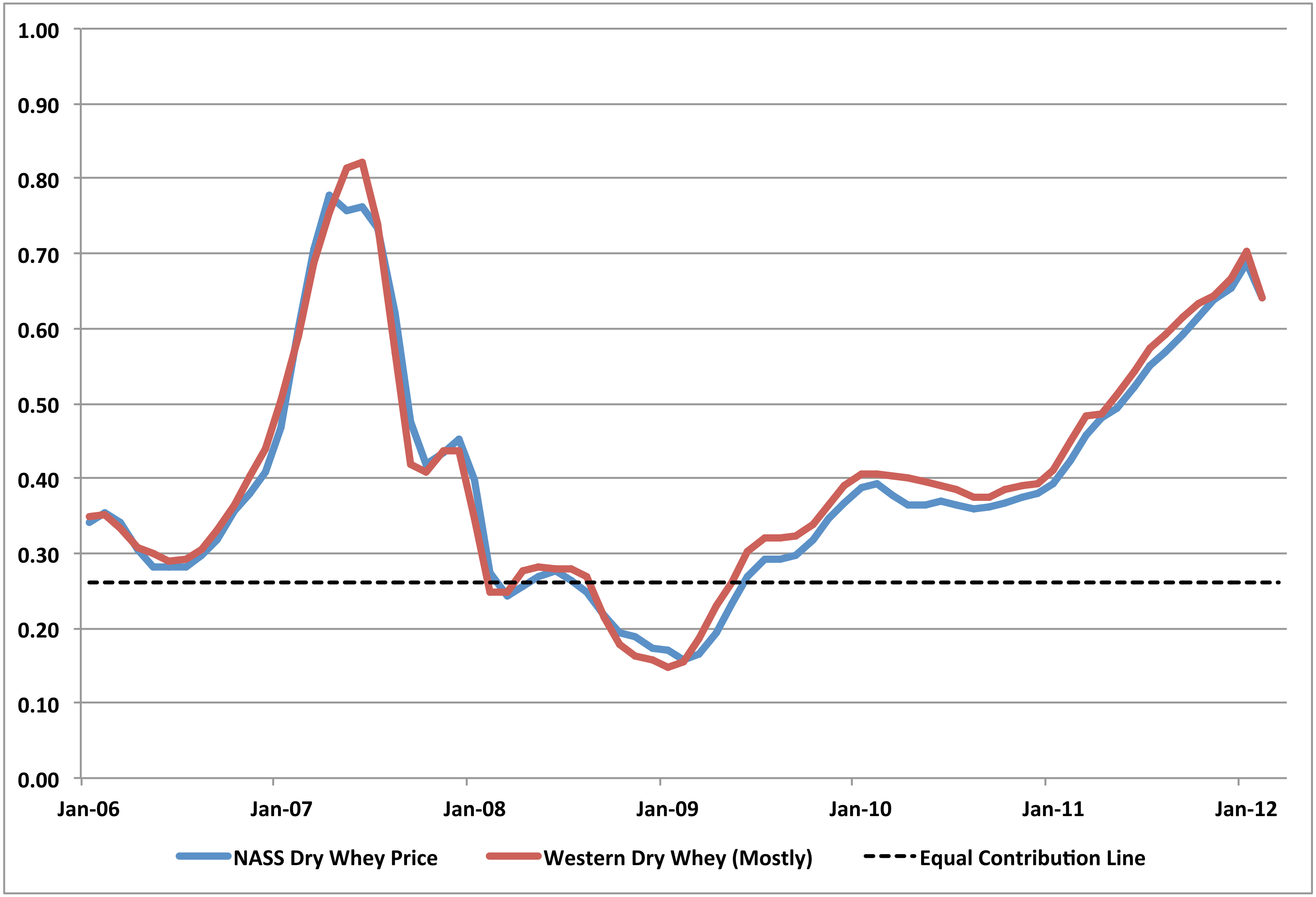

Figure 4. NASS Dry Whey and Western Dry Whey (Mostly) Prices, 2006-2012

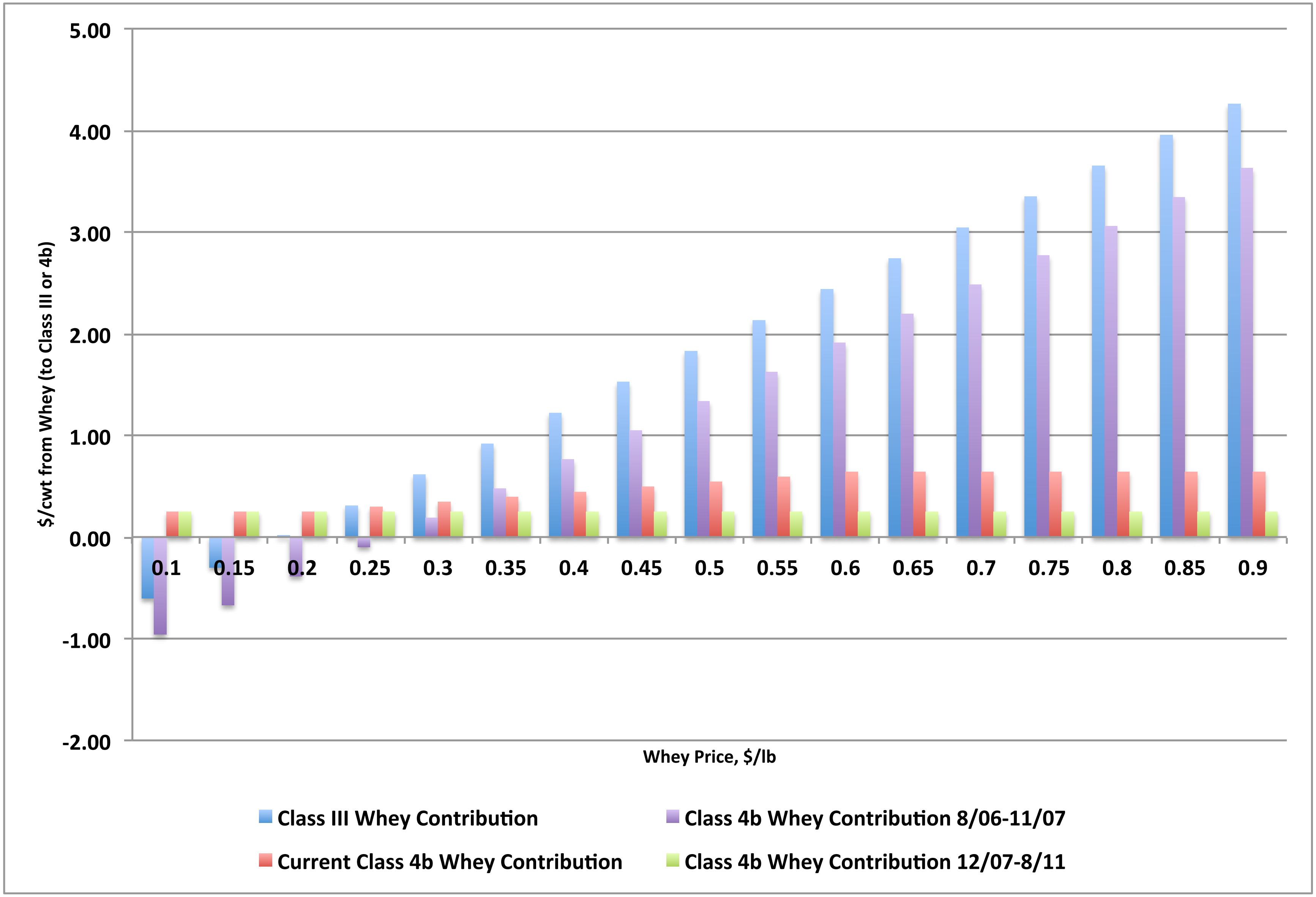

Figure 5. Contribution of Whey to Class 4b (Current and Two Previous) and Class III Prices at Various Whey Prices

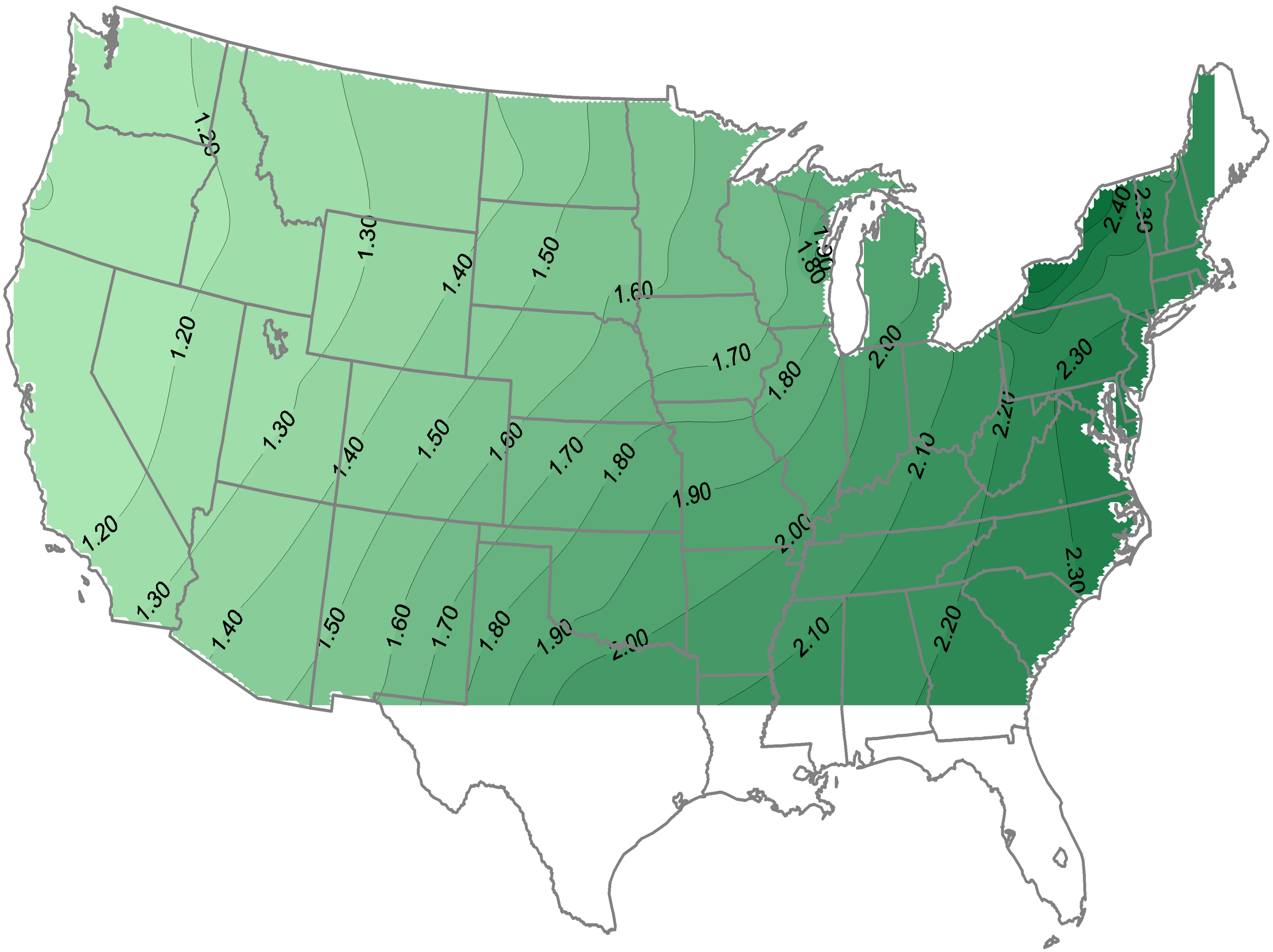

Figure 6. Model-Generated Cost-Minimizing Class III/4b Price Surface for May 2006 with $3.50/Gallon Diesel Fuel