Appendix to Review of Agricultural Economics 2009 Article

U.S. Dairy Industry Supply Control:

Managing the Cooperatives Working Together Program

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This teaching note is intended as a guide for classroom use of the case, "U.S. Dairy Industry Supply Control: Managing the Cooperatives Working Together Program." Some of the teaching objectives of this case are to: (1) evaluate the benefits from an industry supply control effort; (2) understand the problems and causes of oversupply in a commodity industry; and (3) learn about price equilibrium. Teachers using this note can present a dynamic analysis using the cobweb theorem. Also, teachers can compare and contrast the welfare impact of funding supply control versus the welfare impact of funding commodity promotion.

Key words: CWT, Dairy, Elasticity, Milk, Supply Control

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Teaching Note

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Case Summary

In recent years the US dairy industry has organized and financed a milk supply control effort. The case provides an understanding of the historical motivations for such supply control. By using elasticities and other information, students analyze the cost and benefit of this approach to enhancing industry profitability. Given that supply control has been advocated in many agricultural industries, understanding supply control and its implications is an important skill.

Teaching Objectives and Possible Uses of the Case

Our case enables students to explore two very different, but still intertwined subjects. One subject pertains to understanding the *motivations* for an industry to constrain its production in order to enhance prices. The second focuses on the practical *estimation* of the price impact caused by placing such a supply constraint on an agricultural commodity, given known elasticities. In order to provide a storyline, case characters Courtney Phillips, Jon Bouma and Cindy Bouma are fictional teaching devices employed by the authors. Otherwise, all facts and quotes are based upon authors' actual interviews and/or research.

This case provides a good opportunity for students to apply their knowledge of elasticities to practical decision making. While supply management efforts are of common interest in agricultural commodity sectors, achieving long term success is much more difficult than simply achieving shorter term success.

In this case, students are challenged to analyze the CWT's current situation and consider potential improvements. Key case objectives are to:

1. Evaluate the benefits from an industry supply control effort;
2. Understand the problems and causes of oversupply in a commodity industry;
3. Learn about price equilibrium in the dairy industry;
4. Be able to understand competitive conditions and causes of low profitability in an agricultural commodity industry.

Student background needed for studying the case would be knowledge of price theory including supply and demand elasticities. The original purpose of the case was for use in a class on price theory or for use in a senior level capstone class on business management/strategy. However, the case does not require the application of other advanced tools. Following students' reading of the case, case discussion in class should take sixty to ninety minutes and require no preparation beyond knowledge of price theory.

Answers to Questions at the End of the Case

I. What have been the historic causes of low raw milk (i.e., farm milk) prices?

This is easily answered by the fact that, unless there is some constraining factor that limits new firm entry, there will be new entry into (or expansion within) a profitable industry until only normal profits can be earned by entrepreneurs. This force of new entry is further complicated by the fact that in most types of modern agriculture, yield (defined as output per unit of input) shows a steady increase over time due to technical improvements. For example, in the dairy industry, cows used to be milked by hand, randomly bred by bulls, fed inconsistent rations, and so on. This is a far cry from the scientific dairy farming of today. Because milk yields are

always increasing, if an existing dairy farmer fails to keep up for any reason, that farmer will face difficulty coping with on-going downward price pressure. Downward price pressure is caused by both more modern dairy farmers entering the business as well as the expansion of existing dairy farms. Stated differently, column 4 of table 4 shows an almost constant trend of large year-to-year increases in milk production per cow. When demand is not expanding at a similar pace, these increases bring on-going downward pressure upon farm milk prices. Overtime fewer cows (table 4, column 3) and also fewer farms (table 6, column 6) are needed to create a growing milk supply. Under such pressure, on an on-going basis, a large number of dairy farmers will necessarily be concerned about low milk prices and the future continuation of their own businesses.

Climate is a factor complicating the above since it is not equally favourable in all areas of the country. What would be considered a normal profit *price level* by a dairy farmer in Vermont may induce rapid production expansion amongst dairy farmers in the temperate climates of the West. Farm size (table 6) is also a complicating factor. *Ceteris paribus*, larger farmers may be able to earn a greater profit per dollar invested than smaller farmers. For reasons such as these, when comparing different farms, locations, and/or sizes, there will likely be many different dairy farmers experiencing very different economic conditions, simultaneously. Last but certainly not least, perishability complicates milk marketing. Particularly during the founding of milk marketing orders, dairy farmers faced an asymmetric bargaining power weakness in selling to milk processors. The saying goes that when producing milk, "the dairy farmer must either sell it or smell it." Milk is produced several times a day and cannot be stored by individual farmers. No dairy farmer, no matter how wealthy, can afford to produce milk without selling it. During milk surplus conditions, such perishability exacerbates price instability. When taken together

such factors led to the formation of milk marketing orders which set minimum prices. Also, for many of the same reasons as mentioned above, most of the raw milk in the US is marketed by farmer-owned cooperatives.

II. What government programs have been designed to respond to the low raw milk price problem?

This question is simply designed to insure students are reading the case. In the classroom environment this question naturally leads to many deeper issues. The straightforward answer to this question is that, beginning with the Agricultural Marketing Agreement Act of 1937, there have been an on-going variety of U.S. government programs mainly aimed at boosting farmers' milk prices. These have included marketing orders setting minimum prices, the Commodity Credit Corporation's purchasing of surplus dairy products so as to create a functional support (minimum) milk price, and also ad hoc programs such as the Milk Diversion Program, the Dairy Termination Program, and the Milk Income Loss Program.

III. Why does the NMPF feel these US government programs are not sufficient? How effective has the CWT been in addressing these problems?

It is interesting to ask why the NMPF felt the need to create CWT. The answer is that the existing government programs were not working effectively and this is reflected in President Jerry Kozak's recognition in 2002 that "no government program would be forthcoming to curb excess milk production" (p.17) and that they were "getting tired of always expecting the government to solve our problems" (p.19). The underlying causes for the lack of *effective* government programs might include such reasons as: (1) the adverse lobbying impact of having

a declining U.S. dairy farmer population due to the industry's structural change, (2) the increasing number of beverages that now compete with fluid milk, and (3) the historic negative government budgetary experience resulting from past significant expenditures on dairy price supports during the mid-1980s.

The second part of question III requires analysis to estimate how effective CWT has been in addressing dairy farmers' milk price problem. First we examine the dairy farmers' cost of CWT. The program assessment during 2007 was $0.10/cwt. Overall, this means the dairy industry paid approximately the following amount to operate CWT during 2007: $0.10/cwt. assessment x 70% participation x 1,856.02 million cwts. of US milk production or $129.9 million.

Next, let us estimate the 2007 increase in dairy farmers' price. This might be roughly calculated through the following five steps.

#1. Estimate the reduction in 2007's milk production due to CWT.

#2. Calculate a weighted average own price elasticity of demand for dairy products.

#3. Combine the results of the above two steps in order to estimate the anticipated milk price increase due to CWT.

#4. Estimate the *offsetting increase* in 2007 milk production due to CWT itself. When subtracted from the result in 1, this allows us to estimate the net effective milk production drop due to CWT.

#5. Last, combine the results from #2 and #4 so as to *re-compute* the estimated price increase due to CWT.

Step #1 pertains to estimating the amount of 2007 milk production reduction due to CWT. This amount can roughly be estimated as *-2.3 billion lbs. of milk*. This would be the sum of three different parts. First, we include all of the milk removed in round 4 (1.0 bil. lbs.). Second, we add all of the CWT export assistance in 2007 (0.9 bil. lbs.). Third, we include 1/3 of the milk removed in round 3. This round is now three years old and a dairy cow only remains in the milking herd an average of three years (i.e., 1.2 bil. lbs. x 1/3 = 0.4 bil. lbs. of milk).

For step #2 the price *elasticity of demand for dairy products is estimated as being equal to -0.31 (table 3).* This elasticity estimate is calculated, in table 3, as the sum of the following six pairs: the own price elasticity estimate for each different dairy product as multiplied by each product's share of milkfat consumed.

Step #3 pertains to combining the above two steps to compute the anticipated price increase due to CWT. This increase is estimated at $0.77/cwt. price. We compute as follows:

$$(dQ/Q) / (dP/P) = -0.31 \text{ (from step \#2 above)} \qquad (1)$$

$$\Leftrightarrow \quad (dP/P) = (dQ/Q) / -0.31 \qquad (2)$$

Since dQ is given at -2.3 billion pounds (from step #1) and Q = 186 billion (see table 4), then from equation (2) it follows that,

$$(dP/P) = (-2.3/186)/-0.31 \qquad (3)$$

$$\Leftrightarrow \quad (dP/P) = 0.04, \qquad (4)$$

or a price increase of 4.0%.[1] As shown in table 4, the average milk price was $19.13/cwt. in 2007. Therefore this 4.0% price increase would be equivalent to $0.77/cwt. (i.e., 0.04 x $19.13).

Step #4 uses the result in (4) above to estimate the offsetting milk production increase due to CWT. Since the short run elasticity of supply for milk is approximately 0.11 (p.20), this means that for those producers remaining in business,

$$(dQ/Q) / (dP/P) = 0.11 \quad (5)$$

or $$\Leftrightarrow \ (dQ/Q) = 0.11 * 0.04 = \ 0.0044 \quad (6)$$

This is approximately a 1/2 percent increase in production or *+0.8 billion pounds of new milk production* among those not bidding into CWT (0.0044 x 186 bil. lbs. of milk). Because CWT initially reduced milk production by 2.3 billion pounds this offsetting increase in supply among non-participants of 0.8 billion pounds shrinks the CWT milk supply reduction down to 1.5 billion pounds (i.e., 2.3 bil. lbs. – 0.8 bil. lbs.)

Step #5 substitutes the 1.5 billion lb. result from step #4 into equation (3) *to re-compute*, the net 2007 price increase as,

$$(dP/P) = (-1.5/186)/-0.31 \quad (7)$$

$$\Leftrightarrow \quad (dP/P) = 0.026, \quad (8)$$

or a price increase of 2.6%. As shown in table 4, the average milk price was $19.13 in 2007. Therefore this 2.6% price increase would be equivalent to $0.50/cwt. (i.e., 0.026 x $19.13).

One can picture the five step process described above as a part of a cobweb theorem progression toward reaching an equilibrium price. In figure tn-1, point **a** represents original equilibrium before the implementation of CWT. Point **c** represents the $0.77/cwt. price increase calculated in step 3. Point **e** represents the resulting lower $0.50/cwt. price increase after the impact of non-participants' production responses has been taken into account. Further iterations could be expected until reaching equilibrium at the intersection of D and S_2.

Note: In his *Hoard's Dairyman* article, Professor Scott Brown estimates the 2007 price impact of CWT at $0.75/cwt. The FAPRI Modeling System used by Brown covers interactions throughout the entire agricultural economy on a commodity-by-commodity and state-by-state basis, thus it is much a much more in-depth approach than our simple classroom example above.

For more details on the FAPRI model, interested students might want to visit the Food and Agricultural Policy Research Center website at the University of Missouri: http://www.fapri.missouri.edu/outreach/publications/2004/FAPRI_UMC_Report_12_04.pdf. The documentation for the model runs 238 pages and a large number of economists participate in the frequent calibration of the model.

IV. Looking to the future, would you recommend to National Milk that the CWT program be: (a) continued as is, (b) use different efforts to control supply, (c) be reduced or (d) be eliminated? Justify your answer.

There is merit for advocating any of the above options. Advocating (a), continuing as is, would be justified in that the CWT program appears to have a positive impact upon the milk price. Receiving $0.75/cwt. (or only $0.50/cwt. as shown in our simple calculation) constitutes a tremendous return on investment relative to a $0.10/cwt. cost.

(b) Reasons to advocate *different supply control methods* might include one or more of the following. First, if dairy farmers become accustomed to being paid to go out of business, then, in the advent of lower milk prices, some dairy farmers may hesitate to quit until they are paid to do so. The $0.10/cwt. assessment thus becomes a new (and permanent) cost of doing business. Second, the free-rider problem is an on-going concern in that 30% of the industry is getting the benefit of higher milk prices for free. Furthermore, and even more worrisome, this free-rider percentage might grow if more farmers take it for granted that "others" will pay for the CWT program. An exciting program thus has virtue in that it may boost dairy farmers' financial support. If they have not done so already, NMPF should survey other U.S. agricultural

industries, and other international dairy associations, to see if any of these groups have self-help ideas with significant potential for use as a new dimension of CWT.

(c) Reducing CWT might be a wise thing to do, at least on a temporary basis. This argument has to do with milk's long run elasticity supply elasticity of 1.0 (p.19). Such an elasticity level means that a one percent increase in price eventually results in a one percent increase in supply. For this reason, dairy farmers would be wise to discontinue the frequent operation of the CWT program. Relatively continuous operation may result in a supply of milk vastly in excess of demand. This in turn would result in an ever-greater need to expand CWT (i.e., higher assessments and more frequent retirement programs). For this reason, some dairy farmers refer to CWT funds as a "warchest" to be used only when absolutely necessary. Such a patient view has the potential to extend the program's life. However, it still impacts expectations among expansion-minded dairy farmers that they could be bailed out if economic conditions become severe.

(d) Eliminating the program holds appeal if the free-rider percentage increases. This also holds appeal if International milk production drops (and/or International milk demand increases) to the point that U.S. milk prices seem favourable relative to feed costs. Another long term concern about the program pertains to the on-going expansion of many dairy farmers as mentioned in point (c) above and as illustrated in table 6.

V. Contrast the use of dairy farmers' dollars for the promotion of dairy products versus the use of dairy farmers' dollars to reduce the supply of milk. What are the implications for consumer surplus? What are the implications for producer surplus?

Promotion of Dairy Products: In the case it states that, "for every one dollar dairy farmers spent on milk promotion, Kaiser and Dong estimated that farmers sales increased by $4.33 dollars" (p.15). This is a demand-expanding use of dairy farmers' funds. Looking at figure tn-2, one can envision this promotion as shifting dairy demand from curve D to the new demand curve, D′. D′ must be to the right of D (more sales). Therefore one can see that while consumer surplus may not grow in such a case, it is certain that producer surplus will grow. This is because equilibrium is shifting up and outward along the existing dairy supply curve S. In figure tn-2, we see equilibrium in the case of milk promotion denoted as point *mp*. *To summarize, in this demand-expanding example we are certain that dairy farmers are better off. However, we are not certain whether consumers are better or worse off. We can say the more elastic the supply curve, the more likely it is that consumers will be better off with such promotion.*

Milk Supply Reduction: In the case of CWT, Brown's analysis is that "CWT's mid-2007 impact was a positive $0.75/cwt. to dairymen" (p.19). Because dairy farmers' cost for CWT was a $0.10/cwt. assessment, this gain would be almost twice that of the milk promotion investment represented above (i.e., a $0.75/cwt. gain with an associated cost of $0.10/cwt. would be, a $7.50 gain for every $1.00 spent). Thus one can see from simply a pecuniary point of view, CWT holds great appeal to dairy farmers. However, looking again at figure tn-2, since the new supply curve S' must be to the left of S, it must be the case that consumer surplus is shrinking. This is because equilibrium is shifting up and backward along the existing demand curve D. In figure tn-2, we see equilibrium in the case of CWT, denoted as point *cwt*. *To summarize, in the supply-reducing case we are certain that consumers are worse off. Whether or not dairy farmers are better off will depend upon the elasticity of the demand for milk. Table 3 shows demand to be inelastic, exactly what is needed for a supply reduction to work in dairy farmers' favor.*

Conclusion

It is very difficult to get any group of agricultural producers, dairy or otherwise, to agree on what constitutes a reasonable or good price level. This is because individual producers can and do receive prices and/or incur costs which differ from the national average. When viewed in this light, the consensus achieved by CWT represents an amazing political feat for the milk industry. However, there is no guarantee of continued success and this is why Jerry Kozak recognizes an important need to "stay ahead of the curve" through continuing to evaluate the program and its effectiveness. The CWT program is currently ongoing in 2008 and continues to enjoy strong dairy farmer support.

Acknowledgements

The authors wish to thank Victoria Salin and Richard Woodward for comments on an earlier draft. The authors also wish to thank two anonymous referees for constructive comments and to thank Editor John Beghin. This research has been funded in part through USDA Hatch Project TEX08941.

Figure tn-1. Effects of a Supply Reduction upon Farm Price: the Cobweb Theorem

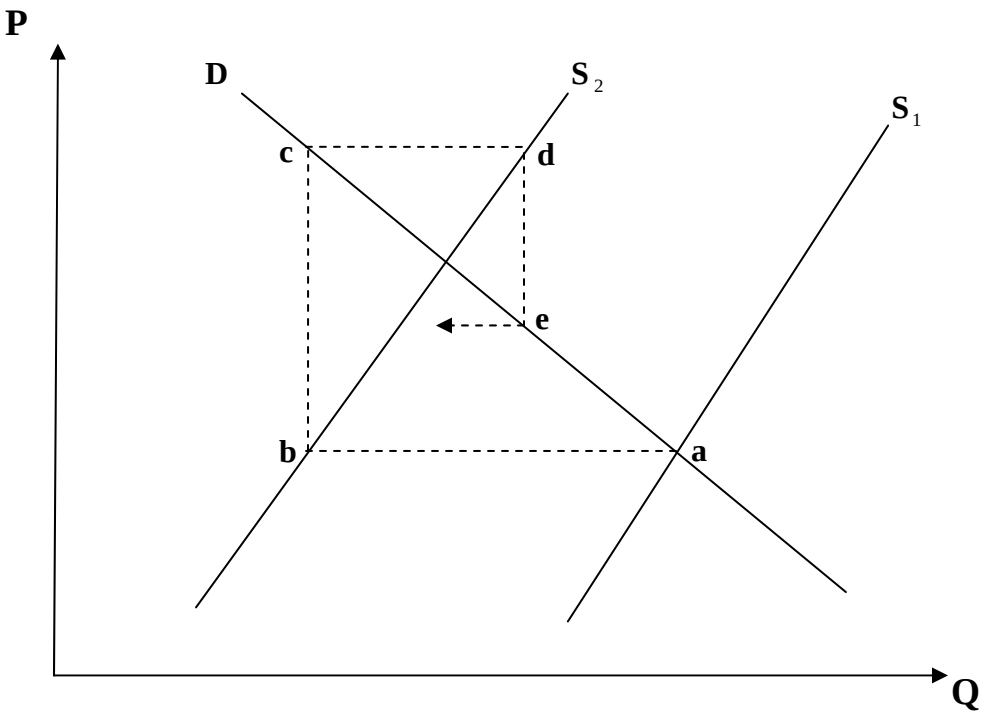
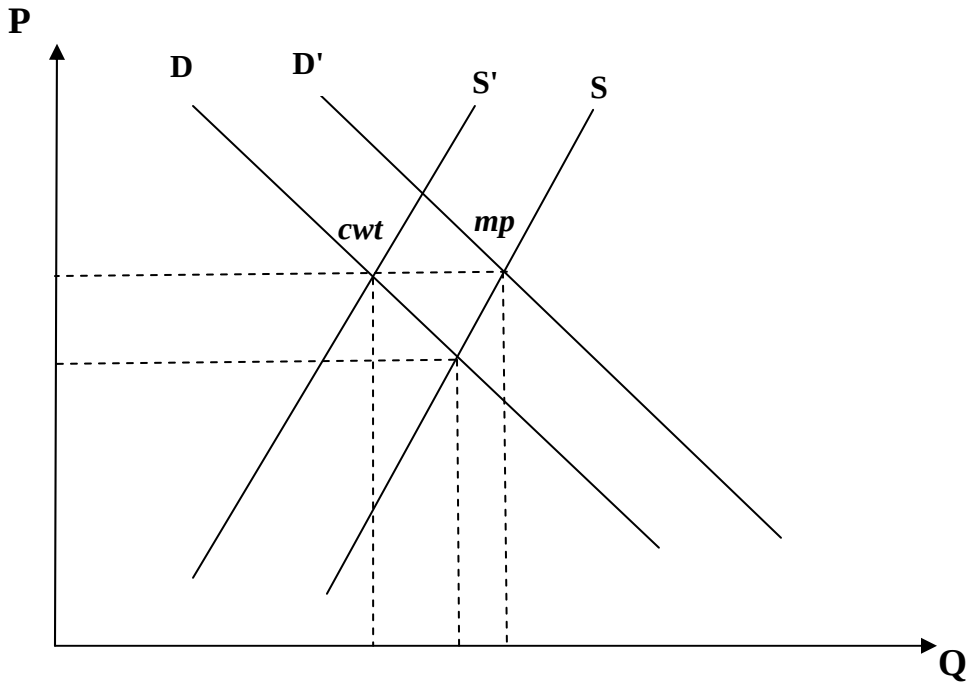


Figure tn-2. Milk Supply and Demand: Equilibrium in the Case of Dairy Promotion Denoted as *mp* and Equilibrium in the Case of CWT Denoted as *cwt*.



Endnote

[1] If the price elasticity of demand for milk were to be more elastic (inelastic), then the price impact of CWT's milk production cutback would less (greater). For example, equation (1) shows price elasticity of demand to be equal to -0.31. Were this price elasticity of demand to be -0.62 (twice as elastic), then the initial price changing impact of any reduction in milk production would only be half as great. In such a case CWT's 2.3 billion lb. milk production cutback would only have initially increased price by 2% instead of 4%. Using equation (1) as a starting point, students can be asked to work out other examples of this type.