Diversions and the Role they play in Determining Order 7 Milk Price

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Abstract:

The Southeast Order has been milk deficit for over ten years and because of this milk has to be brought in from other orders to meet processor's demand. Transportation credits provide processors with help to cover transportation costs to bring outside milk into the order. To help keep Class I utilization and support milk prices, relative to orders in the North, Order 7 has low diversion limits. As milk produced within Order 7 has been on a downward trend, milk brought into the order has not increased as consistently. In 2000 milk pooled from farms within the order made up an average of 66% out of the total amount pooled compared to a 2012 average of 43%. The results showed that only Class II diverted pounds had a stastically significant impact on Order 7's uniform price.

Introduction

A dairy producer within the Southeast Order submitted a request to the Order 7 market administrator in 2014 for the diversion limits in the Southeast Order to be lowered to 0%. The dairy farmer wrote on behalf of himself and other dairy farmers within the order that they believed certain provisions were creating "inefficient handling of milk and results in disorderly marketing" (USDA-AMS, Robey Diversions Request, 2014). The request asked for diversion limits to be lowered to 0% for the months July, August, September, October, and November of 2014. The letter also mentioned that the dairy farmers of the Southeast Order "believe this is an emergency" (USDA-AMS, Robey Diversions Request, 2014). After an open period to receive comments on the request and holding several listening sessions, the market administrator, Patrick Clark, denied the request citing that the decision would be disruptive and could have unintended consequences (USDA-AMS, Diversion Limit Decision, 2014).

The Southeast Order currently allows diversions up to 25% during the months of January, February, and July through November and 35% for months December and March through June. The diversion limits are lower than a majority of the ten other FMMOs. The Appalachian Order has the same diversion limits as the Southeast Order, and the Florida Order has the lowest diversion limits of all the orders. These low diversion limits help the order cope with being "milk deficit" markets. Along with diversion limits, the Appalachian and Southeast Orders have transportation credits to help subsidize transportation costs for processors and handlers. Milk pooled on Order 7 that is from farms within the Southeast Order has been on a downward trend since 2000 but has remained relatively stable since 2012 as can be seen in Figure 15.

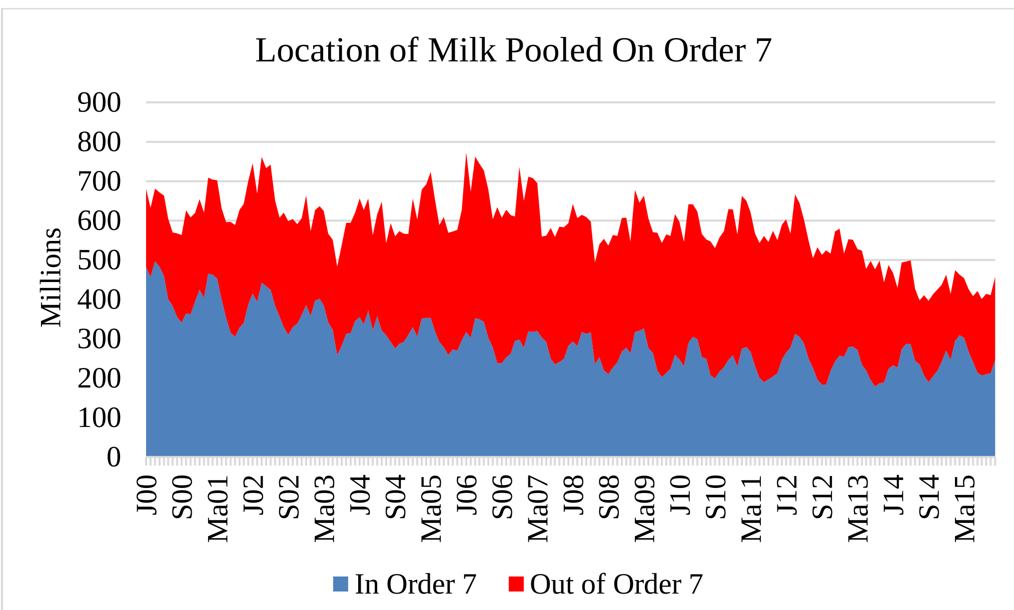

Figure 1. Milk Pooled On Order 7 (USDA-AMS, Florida and Southeast Marketing Areas, Market Administrator)

The amount of literature that focuses on analyzing federal milk marketing orders diversion limits is scarce, if not nonexistent. This could have many explanations, but part of the reasoning is due to the amount of data that is publically available via each federal order. While there is standard information provided by the market administrators, there is also a wide amount of information that varies per order making it not only difficult to compare, but also difficult to assemble. Order 7, for instance, publishes detailed information on diversions and transfers for each class going back to 2000. Order 5, however, has only published that information since 2014. The study provides an initial analysis of the procured data and a framework for investigating the implications of diversions and transportation credits.

Dairy farmers within the Southeast Order believe that the issue of diversions needs to be addressed and this is an emergency in their point of view. This study will help dairy farmers within the Southeast Order, and potentially other Southern orders, gauge the impact that both diversions and transportation credits are having on their milk price. The objective of this research is to quantify the effect of diverted pounds and the amount of dollars paid out for transportation credits on Order 7's uniform price.

Methodology

Panel data is used for a number of reasons. The ability to utilize the time series component of data along with studying cross-sectional variables allows research studies to maximize their analysis. In the case of this research study there is no research to use as background, and because of this there is a chance that variables could be omitted. Using panel data helps solve the potential omitted variable problem. Woolridge (2002) states that using panel data will help "to obtain consistent estimators in the presence of omitted variables." Using panel data analysis enables the potential omitted variables to be held constant, as its own variable, to obtain the partial effects of the observed explanatory variables. Woolridge follows Chamberlain's (1984) example of using *c* to demonstrate the unobserved variable, where written in error form we see:

$$Y_t = \beta_0 + x_t\beta + c + \; u_t$$

Where *y* is the dependent variable, β_0 is the intercept, $x_t\beta$ is the explanatory variables, c is the unobserved explanatory variables, and u_t is the error term. By assuming that *c* is time constant, using multiple years of data and differencing the equations allows the time-constant *c* to be eliminated. The differencing of equations can also be referred to as within-group estimation or fixed effects estimator.

Arellano discusses two primary assumptions for a static fixed effect model,

$$Y_{it} = x'_{it}\beta + \; \eta_i + \; v_{it}$$

Arellano uses η_i as the unobserved variable and v_{it} as the error term in this example. This first assumption is that the error term is not correlated to the observed and unobserved explanatory variables,

$$\mathrm{E}(v_i|x_i, \eta_i) = 0 \; (t = 1, \ldots, T)$$

Another way of looking at this assumption is that the error term "at any period is uncorrelated with the past, present, and future values of *x* (Arellano, 2003)."

The second assumption is that “the errors are conditionally homoskedastic and not serially correlated,

$$Var(v_i|x_i, \eta_i) = \sigma^2 I_t$$

Assumption 1, however, can be weakened to:

$$\mathrm{E}(v_i|x_i) = 0 \; (t = 1, \ldots, T)$$

And this assumption will be more often used for convenience, according to Arellano (2003), “since many results of interest can be obtained with it.”

While work in the dairy sector on the impact of diversions and transportation credits is scarce, there is, however, a large amount of research that uses panel data. Most panel data research that focuses on dairy involves consumer demand or technical efficiency. In 1996, Ahmad and Bravo-Ureta used panel data to examine “the impact of fixed effects production functions vis-a-vis stochastic production frontiers on technical efficiency measures.” The study looked at Vermont dairy farmers over a 14-year period and found the fixed effects technique to be superior, but overall their efficiency analysis was consistent with both models (Ahmad & Bravo-Ureta, 1996). Using Nielsen Homescan data, Copeland and Dharmasena (2016) were able to analyze the impact of rising demand for dairy alternative beverages on dairy farmers. Using a tobit econometric procedure it was found that white milk was a substitute for soymilk and almond milk, and people who buy white milk treat almond milk as a complement (Copeland & Dharmasena, 2016). Seo and McCarl (2014) look at how transportation costs, supply and demand, along with seasonality can affect Class I milk price differentials using a random effects approach. The research found that changes in transportation costs or supply/demand are significant and can cause an increase in Class I differentials. Seo and McCarl's (2014) research also found that transportation credits were having their intended effect of moving milk from low utilization areas to high utilization areas. Foltz (2004) uses panel data to develop a model analyzing the factors that lead to dairy farms exiting the industry under the New England Dairy Compact. This analysis specified a random effects probit model and an autocorrelated generalized least squares model and found that the price supports enacted by the Dairy Compact helped to reduce the number of dairy farms exiting in the area.

Fixed Effects Models

Dairy research has found that time is an important component. Due to time being such an important factor this model uses panel data to analyze both the time series factor and the cross-sectional standpoint.

The Southeast Order's uniform price was specified in two linear regression equations. The first model focuses on the effect of diversions:

$$\begin{aligned} Price_{it} = \; & \beta_o + \beta_1 lnClass2Diversions_{it} + \beta_2 lnClass3Diversions_{it} \\ & + \beta_3 lnClass4Diversions_{it} + \beta_4 lnClass3_{it} + \beta_5 lnKYCorn_{it} \\ & + \beta_6 lnMilkSales_{it} + a_i + u_{it} \end{aligned}$$

The i in this equation indexes the twelve months in a year for the years 2007 through 2015 and is the time series factor of this model. While the cross-sectional units for this model are: Class II, III, and IV are the pounds of milk diverted for Class II, III, and IV each month, respectively, Class3 is the announced Class III price for each month, KYCorn is the price paid for Kentucky corn, and Milk Sales is the estimated amount of fluid milk sold in the United States each month.

The second model focuses on the impact of transportation credits. Seo and McCarl (2014) determined that an increase in transportation costs can cause an increase in Class I differentials, and transportation credits helped to milk move from low to high utilization markets. This can be viewed as the effect of transportation on consumers by moving milk to milk deficit areas, and the following regression focuses on the effect of transportation credits on producers:

$$Price_{it} = \beta_0 + \beta_1 TC_{it} + \beta_2 lnClass3_{it} + \beta_3 lnKYCorn_{it} + \beta_4 lnMilkSales_{it}$$

As with the first equation, the t in this equation indexes the twelve months in year for 2007 to 2015 and is the time series unit. Within the second model the cross-sectional units are: TC is the amount of money that is paid out each month for transportation credits, and Class3, KYCorn, and Milk Sales are the same as with the first model.

<u>Data</u>

The original intent was for the data set to range from years 2000 to 2015. However, due to proprietary reasons the pounds of diverted milk could only be provided for years 2007 to 2015. The data is monthly from January 2007 to December 2015 for a total of 108 observations. All of the variables that are represented in the results have the natural log taken of them.

VARIABLE	DESCRIPTION	UNIT		MEAN	STD. DEV.	MIN	MAX	OBS.	SOURCE
LNUNIF7	The monthly blend price that is the lowest amount pooled producers can receive for milk per cwt.	$/cwt	overall	2.99	0.1796	2.523	3.327	N = 108	UW (2016)
			between		0.0498	2.920	3.053	n = 12	
			within		0.1731	2.545	3.350	T = 9	
LNC2DIV	The pounds of milk diverted into Class II that are pooled on Order 7	lbs	overall	16.58	0.6268	14.06	17.58	N = 108	Mkt. Admin
			between		0.2962	16.08	17.03	n = 12	
			within		0.5583	14.45	17.65	T = 9	
LNC3DIV	The pounds of milk diverted into Class III that are pooled on Order 7	lbs	overall	17.43	0.6042	16.20	18.73	N = 108	Mkt. Admin
			between		0.2995	16.97	17.84	n = 12	
			within		0.5311	16.28	18.61	T = 9	
LNC4DIV	The pounds of milk diverted into Class IV that are pooled on Order 7	lbs	overall	16.85	0.7031	14.66	17.96	N = 108	Mkt. Admin
			between		0.5453	15.86	17.50	n = 12	
			within		0.4683	15.60	18.14	T = 9	
LNC3	The advanced price which is calculated using the USDA's Current Price Formulas	$/cwt	overall	2.81	0.2061	2.231	3.202	N = 108	UW (2016)
			between		0.0480	2.746	2.877	n = 12	
			within		0.2008	2.282	3.234	T = 9	
LNKY	The amount per bushel received for corn in the state of Kentucky	$/bu	overall	1.56	0.2469	1.137	1.986	N = 108	UW (2016)
			between		0.0524	1.477	1.631	n = 12	
			within		0.2417	1.176	2.016	T = 9	
LNSALES	The estimated U.S. sales of fluid milk per month	Mil $/Cwt	overall	8.39	0.0620	8.190	8.497	N = 108	USDA-ERS
			between		0.0446	8.312	8.455	n = 12	
			within		0.0446	8.259	8.459	T = 9	
LNTCDO~S	The amount of dollars paid to processors/handlers each month that qualified for transportation credits	$$	overall	14.17	0.3492	13.55	15.01	N = 74	Mkt. Admin
			between		0.2909	13.86	14.79	n = 9	
			within		0.2041	13.50	14.62	T = 8.22	

Figure 2. Descriptive Statistics for Fixed Effects Models

The objective of the two models is to determine the effect of diverted pounds and transportation credits on the uniform price, therefore within this analysis, the dependent variable for both models is the uniform price for Order 7. The uniform price, which can also be referenced as the blend price, is the minimum price that producers can receive for their milk if they pool their milk on Order 7. It is the weighted average of the skim milk and butterfat pounds for each of the four classes. The mailbox price was another potential option to be the dependent variable. However, the mailbox price is determined by region rather than milk marketing order, and there are other factors within the mailbox price that would have been difficult to separate for this research.

Milk is a heavily regulated commodity, and because of this, there is a large amount of publically available data via USDA's Economic Research Service (ERS). Websites such as the University of Wisconsin's Understanding Dairy Markets allow a plethora of milk-related data to be located in one area, which allowed for easy gathering data. As mentioned earlier, the only difficult data to gather was the order specific data that needed to be specially requested from the Order 7 market administrator.

For the first model, the variables are: Class II, III, and IV diverted pounds of milk, Class III price, the price received for Kentucky corn, and the estimated U.S. sales of fluid milk. Milk that is diverted can be diverted into any class out of the four. Since Order 7 has a high Class I utilization rate then milk that is diverted to Class I is unlikely to cause a decrease in the uniform price or a change in Class I utilization. However, milk that is diverted into Class II, III, or IV can decrease the uniform price. This is why the number of pounds of milk diverted into these classes other than Class I are used in the first model. Additionally, a certain class could have more milk diverted into it on a regular basis. For this reason, each class was included to gauge its potential impact on the uniform price. The pounds of diverted milk were requested, and received, directly from the market administrator as they were not publically available via the Order 7 website.

The Class III price has a strong correlation with the U.S. milk price and fluid milk price (Bolotova & Novakovic, 2014; Bozic & Fortenberry, 2010). While the fluid milk price specifically refers to Class I milk, Order 7 has a high Class I utilization and because Class III price is correlated with the fluid milk price the advanced Class III milk price was included. Additionally, the advanced Class III skim milk price is directly calculated into the Class I price in months when it exceeds the advanced Class IV price. As mentioned earlier, the Understanding Dairy Markets website has a large collection of data located in one place, and the advanced Class III price was gathered from this website.

The Kentucky feed price was included in this analysis as a control for feed prices. Feed prices can have an impact on milk prices through milk production. As corn price rises, producers are forced to consider alternative feedstuffs, which in turn impacts milk production. Chavas, Kraus, and Jesse (1990) showed that feed prices could affect different regions differently. Their 1990 study found that the 'East South Central' region – Kentucky, Tennessee, Alabama, Mississippi – experienced higher milk production during high feed costs (Chavas et al., 1990). The variable was taken from the Understanding Milk Markets website as well who pulled it from USDA's National Agricultural Statistics Service Agricultural Prices.

The estimated U.S. sales of fluid milk was derived from the Understanding Milk Markets website. The Understanding Milk Markets website pulled the sales information from the Estimated Fluid Milk Products Sales Report that is published by USDA-AMS. It has been mentioned many times that Order 7 has a high Class I utilization, but sales of fluid milk have been decreasing since around 2010. The decreasing sales of fluid milk can be hypothesized to have an effect on Class I utilization and therefore could have an effect on Order 7's uniform price. For this reason and because this variable can be thought of like a milk supply measure, the estimated U.S. sales of fluid milk were included in this model.

The second model contains several of the same explanatory variables, but there are four total independent variables: the amount of transportation credits paid (the number of dollars that went out to handlers/processors), the Class III price, the price received for Kentucky corn, and the estimated amount of fluid milk sales. The only new variable within the second model is the transportation credits information. A processor/handler has to apply for and claim transportation credits, and then based on the qualifications of the milk the processor/handler is claiming, the processor/handler is paid accordingly. The amount that is paid to processor/handlers for transportation credits is the explanatory variable in the second model. This data was gathered from the Order 7's website. Within each annual statistical report, there is information related to how many dollars were claimed for transportation credits and how many dollars were paid for transportation credits.

Results

The first fixed effects model quantifies the effect of Class II, III, and IV diversions on Order 7's uniform price. The Breusch Pagan Lagrange Multiplier test was the first test run on the first model. This test failed to reject the null hypothesis, therefore, concluding that there were no significant differences between the months and that random effects is not an appropriate method for this model. The Hausman test showed that fixed effects were the appropriate method since the null hypothesis (random effects model is preferred) was rejected. To decrease the potential for heteroscedasticity since the variables used varied in units – the pounds of milk are in millions and prices of milk are dollars per hundredweight – the natural log of each variable was taken. However, there were still traces of heteroscedasticity in the model, so the "robust" option was used to control for heteroscedasticity by obtaining robust standard errors. From Table 5 below it can be seen that there were two significant variables out of a total of six explanatory variables. Both the Class II diversions and the Class III price are significant at the 1% level ($p<.01$).

R^2			*Obs.*		*108*
within	0.9133		Groups		12
between	0.7457				
overall	0.9006				
corr(u_i, xb)	-0.0590			f(6,11)	407.39
				prob > f	0.0000
variables	coefficient	robust st. error	p>|t|		
Intercept	4.3233**	1.750	0.031		
Class II div	-0.0236***	0.007	0.009		
Class III div	-0.0007	0.016	0.966		
Class IV div	-0.0130	0.016	0.426		
Class III	.7759***	0.035	0.000		
KY corn	.0123	0.025	0.636		
Fluid milk sales	-.3470	0.231	0.161		
Sigma_u	0.0257				
Sigma_e	0.0556				
Rho	0.1766				
*** *0.01% significance, ** 0 .05% significance, * 0.10% significance*					

Table 1. Diversions Fixed Effects Model Results

Out of the three classes of diversions, only Class II diversions had a statistical significance on Order 7's uniform price. This finding of a diversions having a negative impact on uniform price is what was expected. The model shows that, ceteris paribus, a 1% increase in Class II diversions will have a .0236% decrease on Order 7's uniform price. This effect is small and could amount to pennies on the uniform price, however, it is significant which is an important part to consider. If Class II diversions were to increase 1%, holding everything else constant – and the uniform price was set at $16.00 – the price would decrease by $0.0038. A 1% change in diversions wouldn't be expected to garner a large amount of change. However, if Class II diversions were to increase by 5% then the uniform price – once again, set at $16.00 – would decrease by $0.018. The uniform price would then be $15.98 per hundredweight. Another example is if Class II diversions were to increase by 10% then, ceteris paribus, the uniform price – set at $16.00 –

would decrease by $0.038. As can be seen below in Tables 6 and 7, the effect of increasing Class II diversions on a dairy farm are relatively small.

		Uniform Price - $16.00	
Pounds of Milk Produced	5%	Per cow	60 Cow Farm
	17,000	$0.31	$18.60
	20,000	$0.36	$21.60
	25,000	$0.45	$27.00
	30,000	$0.54	$32.40

Table 2. 5% Increase in Class II Diversions

		Uniform Price - $16.00	
Pounds of Milk Produced	10%	Per cow	60 Cow Farm
	17,000	$0.65	$39.00
	20,000	$0.76	$45.60
	25,000	$0.95	$57.00
	30,000	$1.14	$68.40

Table 3. 10% Increase in Class II Diversions

This finding supports the hypothesis that diversions have a negative effect on the uniform price. The statistical significance of Class II on the uniform price could be because as Class IV products consumption remains relatively stable and Class III steadily climbs higher Class II milk is where the excess milk goes making a more significant determinant of Class I price. The figure below (Figure 17) shows the rise in Class III consumption (American and Other cheese as listed in ERS) and the steady usage of Class IV (Butter, dry whole milk, nonfat dry milk, and dry buttermilk as listed in ERS).

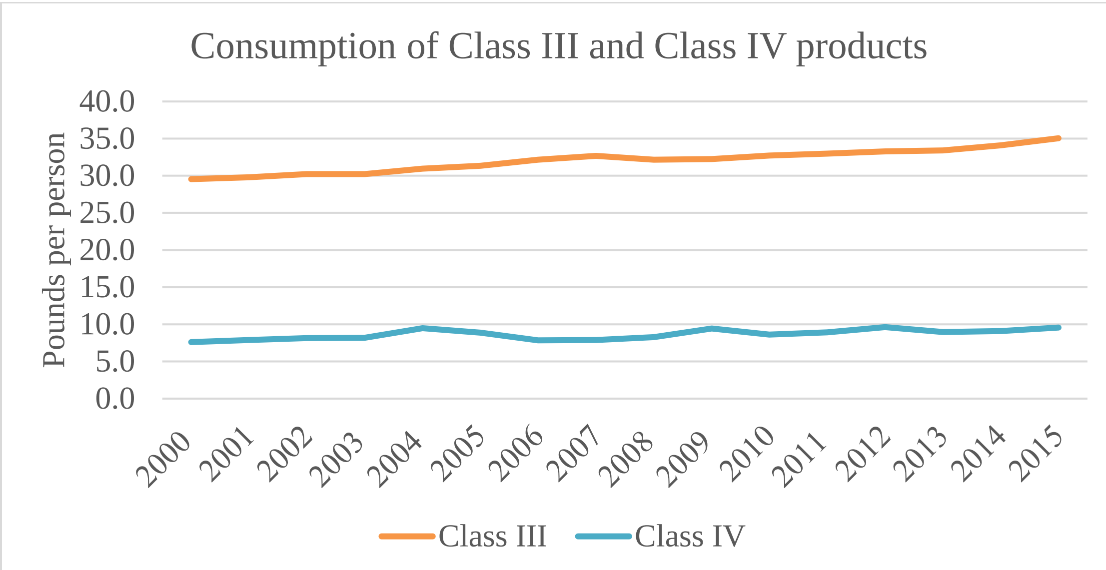

Figure 3. Class III and IV Consumption (USDA-ERS, Dairy Data 2016)

The Class III and IV diversions also show a negative impact on the uniform price. However, their impact is not statistically significant. This is not the result that was expected. Class III, out of the nine years of data, had the most pounds of milk diverted at over 4,798 million pounds, and Class IV had the second most pounds at over 2,792 million pounds. Since Class III and Class IV had more diverted pounds than Class II, over 1,979 million pounds, their significance was expected to be more statistically significant than Class II. Since this was not the case, it could be assumed that while Class III and IV have large quantities diverted, the amount is more consistent than Class II and has been for the nine years of data analyzed within this study.

The variable Class III had a positive impact on Order 7's uniform price, and this is a result that would be expected. The model shows that a 1% increase in the advanced Class III price, ceteris paribus, leads to a .7759% increase in Order 7's uniform price. For example, if the advanced Class III price increases by 1% then the uniform price – if set at $16.00 – would increase by $0.12. The advanced Class III price is a driver of the uniform price calculation, therefore, the higher the Class III price is then, theoretically, the higher the uniform price. The advanced Class III price also has a significant impact on Order 7's uniform price. This is a result we would expect because of the explanation that Class III is a driver of uniform price.

Kentucky corn shows a positive impact for Order 7's uniform price though the variable is not statistically significant. This is a result we would expect. The expectation of a positive impact of Kentucky corn on uniform price is because of the rationale that an increase in feed costs would decrease milk supply due to farmers changing their feed rations and substituting corn for a component that is not as nutritional. However, as Wolf (2010) points out "milk supply does not adjust immediately to changes in feed costs." The Kentucky corn price and Order 7's uniform price do not move consistently, as can be seen in Figure 18 below, and the uniform price experiences greater volatility than Kentucky corn.

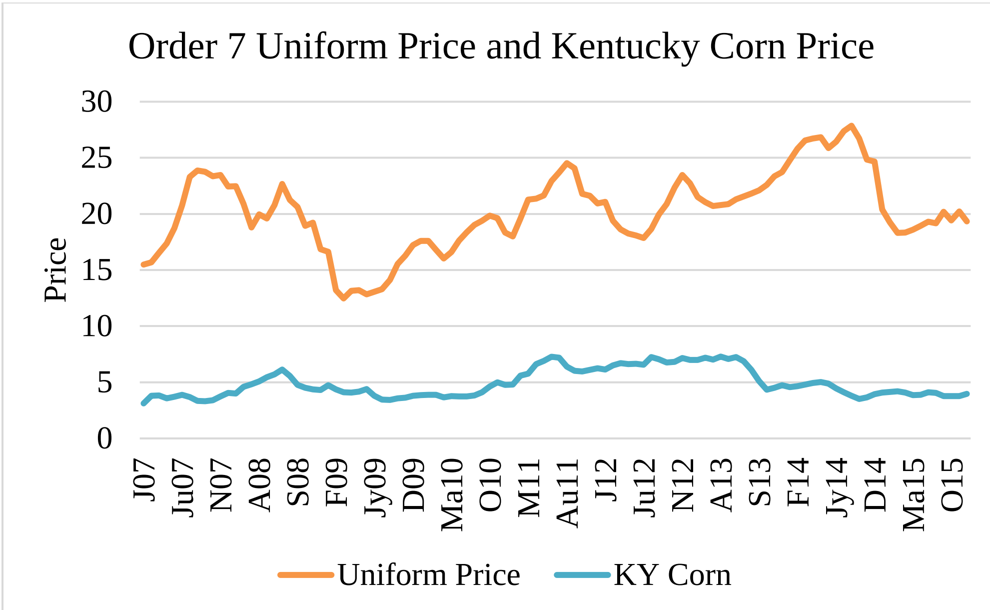

Figure 4. Uniform and KY Corn Price (University of Wisconsin Dairy Marketing and Risk Management Program, Understanding Milk Markets)

The last variable within the first model is the estimated U.S. fluid milk sales. The model shows that there is a negative effect of estimated U.S. fluid milk sales on the uniform price. This result is to be expected as well. While not a significant variable, the milk sales help to represent demand. As demand for fluid milk decreases and milk supply/production stays constant, then the uniform price will, hypothetically, fall. The rationale for the estimated U.S. fluid milk sales having a negative effect on Order 7's uniform price is because Order 7 primarily processes fluid milk. The decline of fluid milk sales could decrease Class I utilization and then have a negative effect on the uniform price.

R^2			*Obs.*		*74*
within	0.9064		Groups		9
between	0.5771				
overall	0.8792				
corr(u_i, xb)	-0.0957			f(4,8)	383.68
				prob > f	0.0000
variables	coefficient	robust st. error	p>|t|		
Intercept	3.7533	2.074	0.108		
TC	0.0333	0.022	0.166		
Class III	0.7766***	0.055	0.000		
KY corn	-0.0210	0.019	0.307		
Fluid milk sales	-0.4020	0.0231	0.120		
Sigma_u	0.0351				
Sigma_e	0.0557				
Rho	0.2845				
****0.01% significance, ** 0.05% significance, * 0.10% significance*					

Table 4. Transportation Credits Fixed Effects Model Results (w/sales)

The second fixed effects model analyzes the effect of money paid towards transportation credits on the uniform price for Order 7. The second model went through the same tests as the first model as well as the natural log being taken for each variable within the model. While the second model did not have an issue with heteroscedasticity, the “robust” option was still used. This second model, which can be viewed above in Table 8, showed that only one variable, the advanced Class III price, has a statistically significant impact on Order 7’s uniform price. This significant variable is consistent with the first model. The results of this model, though, could be skewed by a smaller set of observations. Transportation credits are only paid out during certain months of the year, meaning that during certain months $0 were requested and paid. Because of this, the number of observations went from 108 (the number of observations in the first model) to 74.

The first variable, the money paid for transportation credits, is shown to have a positive impact on uniform price. However, the transportation credits do not have a statistically significant impact on Order 7's uniform price. The expectation was for transportation credits to have a negative effect on Order 7's uniform price. However, as mentioned earlier, a small number of observations could have a biased effect on the model.

The Class III variable is consistent with the first model. The advanced Class III price has a positive effect on Order 7's uniform price and is statistically significant. Additionally, the Class III price impact in the second model (0.7766) is almost the same as the first model (0.7759). The advanced Class III price shows that a 1% increase in the Class III price will, ceteris paribus, have a 0.7766% increase in Order 7's uniform price.

The Kentucky corn price within this second model shows a negative effect on Order 7's uniform price and is not statistically significant. While the Kentucky corn price was not significant in the first model, it had a positive impact on the uniform price. This could be due to the decrease in a number of observations because of the months that transportation credits can be requested. The months that the transportation credits were paid out for Order 7 could coincide with certain months (seasons) that the Kentucky corn price increases while the uniform price decreases or, where the corn price decreases while the uniform price increases. The transportation credits are available during months that local supply is determined to not be able to meet demand. However, as can be seen below in Figure 19, the uniform price for Order 7 has been volatile and unpredictable seasonally. In 2012, the uniform price steadily rose from June to November, but in 2011 the price dropped from August to December.

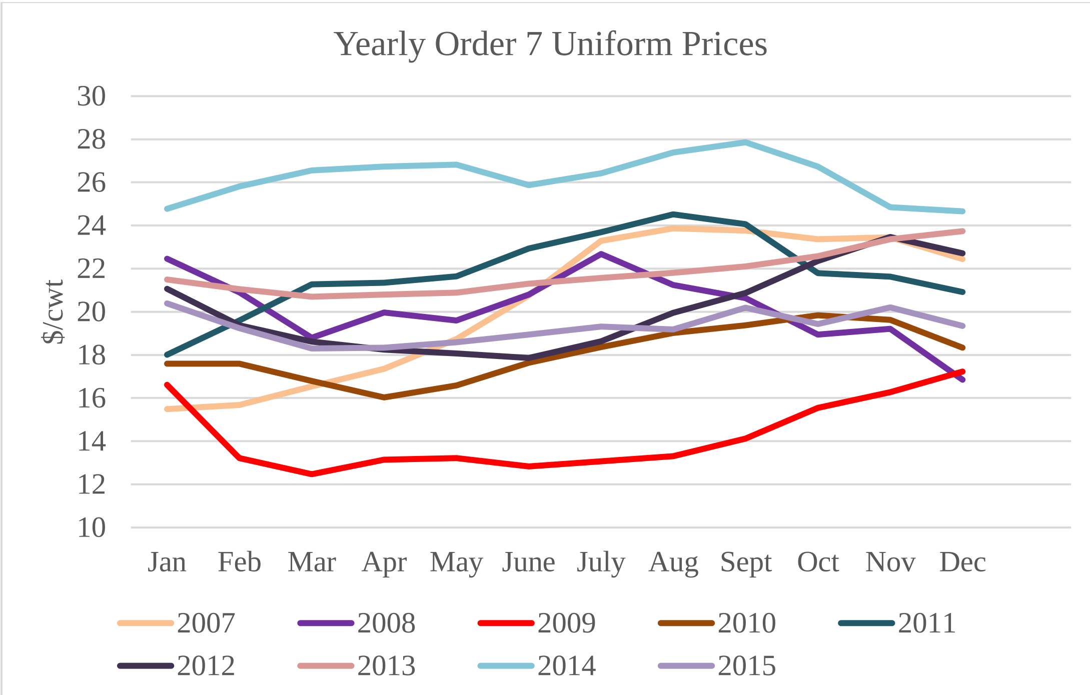

Figure 5. Yearly Prices By Month for Order 7 Uniform Price (USDA-AMS, Florida and Southeast Marketing Areas)

Within this second model, fluid milk sales are consistent with the first model. Both results are shown to have a negative effect on uniform price but are not statistically significant. This impact is what would be expected, though, because of high the Class I utilization is within Order 7 it would also be expected to be statistically significant. Interestingly, when estimated U.S. fluid milk sales are dropped from the transportation credits model (as can be seen in Table 7), the R^2 for between group rises from 0.5771 or almost 58% of the model explained to 0.8660, or almost 87%, of the model, explained between groups. Additionally, the overall R^2 rises from .8792, almost 88%, to .8941, roughly 89% of the overall model is explained.

R^2			Obs.		74
within	0.8975		Groups		9
between	0.8660				
overall	0.8941				
corr(u_i, xb)	-0.0669			f(3,8)	228.03
				prob > f	0.0000
variables	coefficient	Robust st. error	p>|t|		
Intercept	0.5066	0.349	0.186		
TC	0.0187	0.034	0.585		
Class III	0.8010***	0.037	0.000		
KY corn	-0.0291	0.030	0.341		
****0.01% significance, **0.05% significance, *0.10% significance*					

Table 5. Transportation Credits Fixed Effects Model Results (w/o sales)

Conclusion

This study addressed the effect of lower class diversions and transportation credits on the Southeast Order's uniform price. Using panel data, two fixed effects models were estimated to quantify the effects of diversions and transportation credits on Order 7's uniform price. The first model's analysis showed that out of the three lower class diversions all had a negative impact on the uniform price, but only Class II had a statistically significant impact. The second model that quantified transportation credits impact on uniform price showed there was no statistically significant impact of the money paid out for transportation credits on Order 7's uniform price.

The policy implications of this study are that diversions could be further looked into to ensure that both producers and processors/handlers are being fairly treated with the Southeast milk marketing order. This study showed the Class II diversions have a significant impact on Order 7's uniform price, and while that impact is small, it is still important to consider. However, the impact of transportation credits on the uniform price is statistically nonexistent meaning that transportation credits are having the intended effect of moving milk from low utilization areas to high utilization and are not having a negative impact on producers within the Southeast Order.

There were some limitations with this study. The main limitation was the lack of research investigating the effects of diversions and transportation credits on the federal milk marketing orders. The topic has come up within orders before such as requests to lower the diversion limit, but depending on the milk production level of pooled producers the responses have varied. Due to this limitation of limited research, the ability to draw from previous studies and build upon this area was not possible. However, this limitation did open up the door for this area to begin being looked at more in-depth.

With the lack of research, a second limitation is the lack of openly available data. The market administrators for both Order 5 and Order 7 were very helpful at putting together each data requests that was submitted. Unfortunately, due to concerns about releasing proprietary information, regarding diverted pounds of milk, the data set was limited to the years 2007 to 2015 instead of the desired 2000 to 2015. In the future, hopefully milk marketing order data will be more easily accessible online or through a different database.

This research helps lay the groundwork for more research into the effect of diversions on milk marketing orders. The effect of diversions could vary by milk marketing order depending on the milk supply within the order’s boundaries. Since the Appalachian and Southeast Orders are the only two orders with a transportation credit balancing fund more research to compare the effects of transportation credits on each order could be done to fully understand the effects of the credits on producers. While this study showed there was no effect on Southeast producers, there could potentially be an effect on Appalachian producers, since there is a difference in assessment rates between the two orders.

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Appendix

Appendix 1. Current Milk Pricing Formulas

Class I:

$$Class\ I\ Price = (Class\ I\ skim\ milk\ price\ x\ 0.965) + (Class\ I\ butterfat\ price\ x\ 3.5).$$

$$Class\ I\ Skim\ Milk\ Price = Higher\ of\ advanced\ Class\ III\ or\ IV\ skim\ milk\ pricing\ factors + applicable\ Class\ I\ differential.$$

$$Class\ I\ Butterfat\ Price = Advanced\ butterfat\ pricing\ factor + (applicable\ Class\ I\ differential\ divided\ by\ 100).$$

Class II:

$$Class\ II\ Price = (Class\ II\ skim\ milk\ price\ x\ 0.965) + (Class\ II\ butterfat\ price\ x\ 3.5).$$

$$Class\ II\ Skim\ Milk\ Price = Advanced\ Class\ IV\ skim\ milk\ pricing\ factor + \$0.70.$$

$$Class\ II\ Butterfat\ Price = Butterfat\ price + \$0.007.$$

$$Class\ II\ Nonfat\ Solids\ Price = \frac{Class\ II\ skim\ milk\ price}{9}.$$

Class III:

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

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

$$Protein\ Price = ((Cheese\ price - 0.2003)\ x\ 1.383) + ((((Cheese\ price - 0.2003)\ x\ 1.572) - Butterfat\ price\ x\ 0.9)\ x\ 1.17).$$

$$Other\ Solids\ Price = (Dry\ whey\ price - 0.1991)\ x\ 1.03.$$

$$Butterfat\ Price = (Butter\ price - 0.1715)\ x\ 1.211.$$

Class IV:

$$Class\ IV\ Price = (Class\ IV\ skim\ milk\ price\ x\ 0.965) + (Butterfat\ price\ x\ 3.5).$$

$$Class\ IV\ Skim\ Milk\ Price = Nonfat\ solids\ price\ x\ 9.$$

$$Nonfat\ Solids\ Price = (Nonfat\ dry\ milk\ price - 0.1678)\ x\ 0.99.$$

$$Butterfat\ Price = See\ Class\ III.$$

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