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THE HISTORY OF THE FEDERAL MILK MARKETING SYSTEM AND AN ANALYTICAL VIEW OF UNIQUE QUALITIES EFFECTS ON MILK PRICES IN THE SOUTHEAST

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THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in
Agricultural Economics in the College of Agriculture
at the University of Kentucky

By

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Lexington, Kentucky

2017

ABSTRACT OF THESIS

THE HISTORY OF THE FEDERAL MILK MARKETING SYSTEM AND AN ANALYTICAL VIEW OF UNIQUE QUALITIES EFFECTS ON MILK PRICES IN THE SOUTHEAST

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 objectives of this paper are to review the history of the federal milk marketing system, describe the structure of milk pricing, examine the unique features of the southern orders, and estimate the impact of the amount of milk diverted and the amount paid in transportation credits on Order 7's uniform price. The results showed that only Class II diverted pounds had a statistically significant impact on the uniform price.

Keywords: Diversion limits, transportation credits, federal milk marketing orders, panel data, Southeast Order

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January 10, 2017

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Chapter 1: Introduction

Diversions have recently become a point of contention for the Appalachian and Southeast Orders, also known as Order 5 and Order 7, respectively. Diversions are a limit placed on the amount of pooled milk that a pool plant may divert to a non-pool plant and still be pooled on an order. In 2014 there was a request for the diversion limits in the Southeast Order to be lowered to 0%, but that request was denied (USDA-AMS, Florida and Southeast Marketing Areas, Combined Comments, 2014). Since the Southeast Order has a “milk deficit” status, milk producers who pool their milk on the order perceive diversions as putting downward pressure on the milk price they receive. Both the Appalachian and Southeast Orders have diversion limits of 25% during the months of July through November and January through February. The months December and March through June have a limit of 35%. The diversion limits for the Appalachian and Southeast Orders can be viewed in their federal order language (USDA-AMS, Historical Documents) There is a need and purpose for diversions, but what is the appropriate percentage of diversions to be beneficial to both producers and processors?

Transportation credits are another point of contention for dairy farmers who pool their milk on Order 7. Transportation credits date back to 1996 and are an assessment rate on each hundredweight of milk classified for fluid use that is received or handled by a regulated plant. The assessment rate then goes into a fund, and processors/handlers can apply for the credits to help cover transportation costs associated with bringing in supplemental milk from outside of the order’s regional boundaries. These credits are currently only active in the Appalachian and Southeast Orders. Anecdotal evidence suggests that farmers believe they are paying for the transportation credits out of their milk check since the processors/handlers have to pay into the transportation credit balancing fund. Since the Southeast Order is a milk deficit region, transportation credits were established to help processors and handlers with the transportation costs of bringing in milk from outside the order's regional boundaries. The transportation credits have not been formally asked to be removed, but their effect on Order 7's uniform price, like diversion limits, is unknown.

This study focuses on how both the amount of milk diverted into lower classes (any class other than Class I) and the sum of money paid to processors/handlers for transportation credits affect the Southeast Order's uniform (or blend) price. The uniform price and blend price are the same and will be used interchangeably throughout this study. The original intent was to focus on both the Appalachian and Southeast orders, but because of a difference in data availability between the orders, this was not possible. However, because of the similarities between the Southern orders the research findings should have implications for the Appalachian, Florida, and Southeast Orders.

Since the Southeast Order is a milk deficit region, it is hypothesized that lowering diversion limits, which will reduce the amount of milk diverted into lower classes, will help to increase the blend price by increasing Class I utilization. The second hypothesis is that transportation credits have a negative effect on uniform price because they encourage processors/handlers to bring in excess amounts of milk from outside the order, which can then be diverted into lower classes of milk. This study will test that theory by looking at whether the pounds of milk diverted into Classes II, III, and IV cause the order's uniform price to decrease and then looking at the impact of the dollars paid for transportation credits on Order 7's uniform price.

The structure of the thesis is as follows: Chapter 1 provides an overview of the federal milk marketing order. Chapter 2 discusses the history of federal milk marketing more extensively and details the way classes of milk are priced. Chapter 3 describes how the Southern milk marketing orders are unique. Chapter 4 provides analytical models that detail the effects of diversions and transportation credits on the uniform price, and Chapter 5 summarizes the conclusions and implications of the discussion and research presented in this paper.

1.1 Federal Milk Marketing Order History

The history of the federal milk marketing orders (FMMOs) is a long one that has gone through many transformations since the orders were first organized. The purpose of the orders is to provide market stability for both milk producers and processors due to milk's perishability and seasonal fluctuations. Additionally, there was a desire to strengthen the bargaining position of producers against handlers (Christensen, 1978). The start of FMMOs began in 1933 with the Agricultural Adjustment Act that granted the federal government authority to regulate the handling of milk. The order language for the FMMOs was first developed in 1937 by the Agricultural Marketing Act (Figure 1). As time has gone by, the FMMOs have added a new class of milk (Class IV) with the

Consolidated Appropriations Act of 2000 and incorporated transportation credits in some orders. There have also been dramatic changes in the way the milk price is calculated. From the 1960s to 1995 the Minnesota-Wisconsin (M-W) price determined milk pricing, but in 1995 the Basic Formula Price (BFP) was used, and then in 2000 Multiple Component Pricing (MCP) became the new standard formula.

Federal Milk Marketing Order Timeline

1933 – *Agricultural Adjustment Act*
Gave federal authority to regulate the handling of milk

1937 – *Agricultural Marketing Agreement Act*
Authorized the Secretary of Agriculture to issue milk orders

1996 – *Federal Agricultural Improvement and Reform Act* (
Instructed the Secretary of Agriculture to consolidate the number of milk orders to between 10 and 14

2000 – *Consolidated Appropriations Act of 2000*
Consolidated the number of federal orders from 31 to 11, replaced the basic formula price (BFP) with a new milk price formula, and created a new class of milk (Class IV)

Figure 1. Federal Milk Marketing Order Timeline

The Agricultural Marketing Act of 1937 addressed some commodities, but a primary focus of the law discussed regulating milk and milk products. Interestingly, the word “diversion” is not written anywhere within the Agricultural Marketing Agreement Act of 1937. Since 1937, the number of orders has varied; there were 83 orders at one time in 1962 (Christensen, 1978). As transportation costs have decreased and milk hauling has become more efficient, milk distribution has widened, which in effect has decreased the need for a large number of marketing orders. A 2014 study showed that the transportation credits were having the intended effect by encouraging the movement of milk from low to high utilization markets (Seo & McCarl, 2014). The orders have also shifted from being centered around cities to becoming regionally based.

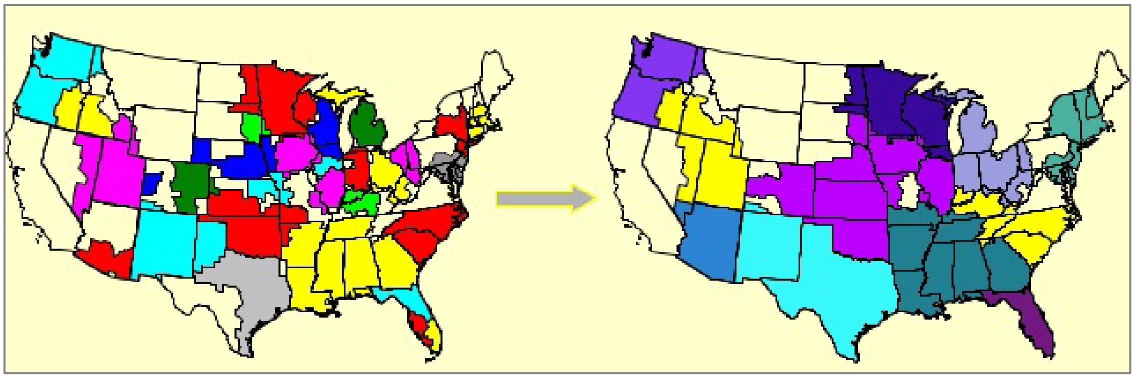

Figure 2. Change in Federal Milk Marketing Orders After Consolidated Appropriations Act of 2000 (Cropp, 2001)

It seems most transformations to the orders have happened more recently. The 1996 Farm Bill (Federal Agriculture Improvement and Reform Act of 1996) encouraged the Secretary of Agriculture to consolidate the 31 orders to between 10 and 14, and the Secretary came back with a recommendation of 11 milk marketing orders. Once the federal milk marketing orders were consolidated there were a total of 11 orders. However, the Western FMMO, which consisted of Utah and parts of Nevada, Idaho, and Oregon, was terminated in April 2004, reducing the number of orders to 10 which is where it has stayed for over 10 years[1]. The difference between the original 31 orders and the present 10 orders is striking in some areas and has no difference in others. The Southeast Order (Order 7) and Pacific Northwest Order (Order 124) are two whose marketing areas are very similar to their originals. The current Central Order (Order 32)

1. The Western FMMO, Order 135, was terminated because a set of proposed changes was voted on, and because the changes did not get 2/3 of the vote the order was dissolved.

had consisted of over six different orders before it was consolidated. Additionally, the Appalachian Order (Order 5) is a marketing area that was originally made up of two orders and some non-order area. Order 5 now covers all of North Carolina, South Carolina, and the majority of Kentucky, and the eastern side of Tennessee. The changes in the federal orders after the Consolidated Appropriations Act of 2000 can be viewed above in Figure 2.

1.2 The Classification of Milk

As the orders have changed, so has the classification of milk. The Consolidated Appropriations Act of 2000 added a fourth class of milk when there were originally three.

Classes of Milk	
Pre Consolidated Appropriations Act	Post Consolidated Appropriations Act
Class I – Fluid Use	Class I – Fluid use
Class II – Soft manufacturing products	Class II – Soft manufacturing products
Class III – Hard manufacturing products	Class III – Cheese
	Class IV – Butter and dry milk

Table 1. The Classes of Milk Pre and Post Consolidated Appropriations Act

As can be seen from Table 1 detailing the pre and current classes of milk, the main change resulting from the Consolidated Appropriations Act was that Class III was divided into two classes separating cheese from butter and dry milk. Along with different classes of milk, there are different grades of milk: Grades A and B. Grade A milk has stricter sanitary standards so that it can be used for fluid milk, and because Grade B milk has less stringent standards it is only able to be used in manufacturing products. By 1999, however, 97% of U.S. milk met Grade A standards (Sumner & Balagtas, 2002).

Since most U.S. milk is Grade A, the grade is not as much of an issue. Classification of Milk is a crucial part of milk orders though since the class is a component of milk price discovery. Each order has different class utilizations depending on what type of milk processors are located within a region and how much milk they each individually process. The Midwest Order (Order 30), for example, is dominated by manufacturing plants, such as cheese and thus has the lowest Class I utilization of any order. Due to the high volume of manufacturing plants, the milk that is pooled in the Midwest Order has a very high-Class III utilization often over 80% (USDA-AMS, Federal Milk Marketing Order Marketing and Utilization Summary). The Appalachian and Southeast Orders both have high Class I utilizations because the processors within that region are mostly fluid milk plants. The Appalachian, Southeast, and Florida Orders have the largest Class I utilization out of the 10 orders with utilization consistently above 60%. Most other milk orders, except the Midwest Order, range from 20-40% for their Class I utilization. Class I milk is priced the highest out of the four which allows the Southern orders to have a relatively higher blend price. Class II typically follows Class I with the second highest price. While the Class IV price is usually the lowest, occasionally, the Class III milk has a lower price.

1.3 Class I Differentials

Many parts of the federal milk marketing orders are integral to the current regulatory system. An important part to discuss is the Class I differentials, which are also known as location differentials. The goal of the Class I differentials is to "generate sufficient revenue to assure an adequate supply of milk while maintaining equity among handlers in the minimum prices they pay for milk bought from dairy farmers (USDA-AMS, Class I Pricing Structure).” Simply put, Class I differentials attempt to ensure an adequate supply of milk wherever a plant is located.

When the Secretary of Agriculture consolidated the 33 milk orders in 2000 to 11 orders, the marketing areas for each order understandably changed. This consolidation also altered the Class I differentials, which is why an adjusted Class I pricing structure was developed with the Consolidated Appropriations Act of 2000. There were two options to set the Class I differentials: option 1A, which focused on location, and option 1B, which focused on relative value. Option 1A is the option that Congress approved even though the Secretary of Agriculture recommended Option 1B. Option 1A is “location-specific Class I differentials reflecting the relative economic value of milk by location (USDA-AMS, Class I Pricing Structure).” An important part of Class I differentials is that they differ by county. This means that a dairy producer who ships their milk to a processing plant in County A and their neighbor who sends their milk to a plant in County B could receive a different price for their milk if the Class I differential is higher in County A than B.

1.4 Milk Deficit Orders

Since Option 1A focused on location and economic value the Class I differentials are comparably higher in the Florida, Appalachian, and Southeast orders. This option also included a component that reflected “regional differences of fluid and manufacturing milk (USDA-AMS, Class I Pricing Structure).” Within these southern orders along with a high Class I utilization and there is also a milk deficit. All three orders have been milk deficit since the FMMOs were consolidated from 33 orders to 11 (USDA,Marketing Service Bulletin, 2002). The term “milk deficit” refers to a region’s inability to meet milk demand and having to meet pool distributing plant demand by bringing in milk from out of the area. Transportation credits and a higher blend price in Orders 5 & 7 help to attract milk from outside of the area to meet processors milk demand. However, as consumer’s demand for fluid milk continues to decrease, Class I utilization will also drop, meaning that the blend price could fall low enough to potentially force out small dairy farms within Orders 5 & 7. The decline in fluid milk sales in the Southeast order’s uniform milk price is displayed in Figure 3.

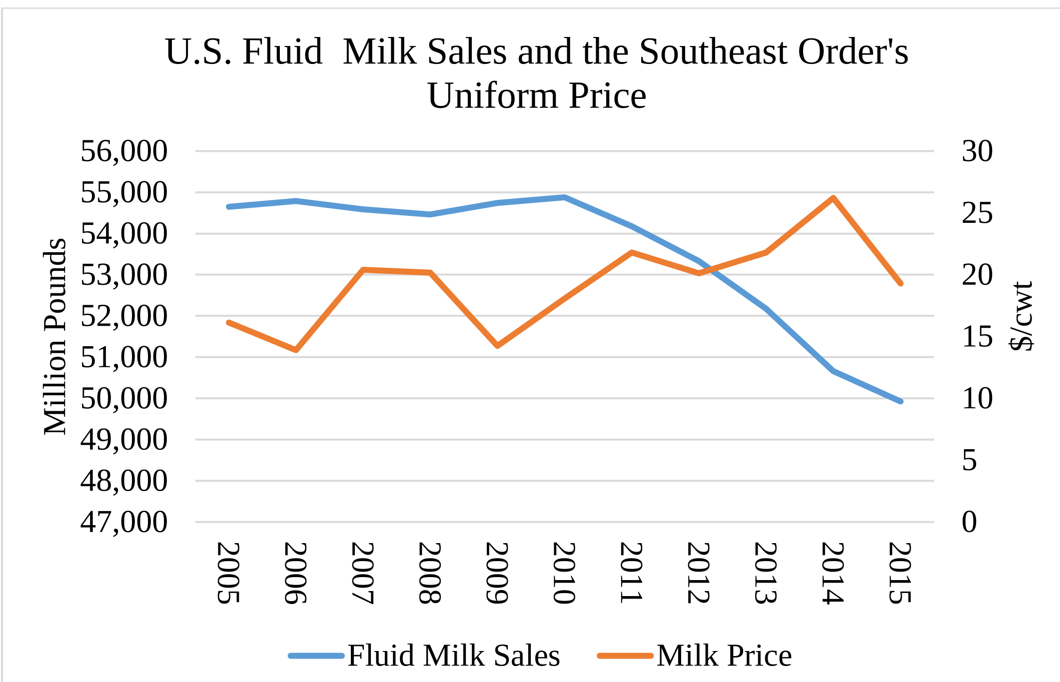

Figure 3. U.S. Fluid Milk Sales and Southeast Uniform Price (USDA-ERS, Dairy Data; USDA-AMS, Florida and Southeast Marketing Areas)

1.5 Milk Pricing

The blend price can be calculated one of two ways depending on the order. If a producer sends their milk to an order that uses skim-fat pricing, then the blend price will be the same as the uniform price (not including premiums). However, a majority of orders within the federal milk marketing system use Multiple Component Pricing (MCP). The difference between skim-fat pricing and MCP can be seen below in Table 2. There are currently four orders out of the ten that do not use MCP, and those are Order 5, 6, 7, and 131 (Arizona Order). The MCP system bases the milk price on pounds of proteins, butterfat, and other solids. Essentially, the MCP rewards producers who make high-quality milk by paying them a higher milk price. One could also assume that producers who do not produce high-quality milk are either forced to produce better quality milk or leave the dairy industry. The current pricing formulas can be found in the appendix.

Skim-Fat Pricing	Multiple Component Pricing
Handlers: Pay for pounds of butterfat and skim for all classes	Handlers: Pay for pounds of butterfat (all classes), Class I pounds of skim, Class II pound of nonfat solids, Class III pounds of protein and other solids, Class IV pounds of nonfat solids
Producers: Are paid for pounds of butterfat and skim of the weighted average of all four classes	Producers: Are paid for pounds of butterfat, protein, other solids, any residual value

Table 2. Skim-Fat Pricing vs. Multiple Component Pricing

1.6 Appalachian and Southeast Milk Marketing Orders

Both the Appalachian and Southeast orders have a Transportation Credit Balancing Fund. This transportation fund automatically accumulates $0.15 for the Appalachian order and $0.30 for the Southeast Order per hundredweight of designated fluid use milk that a handler receives or handles (USDA-AMS, A Primer on Federal Order Transportation Credits, 2010). The fund is then available for processors to use to aid with their transportations costs that were incurred transporting in supplemental milk in the case that the marketing area is not able to sufficiently meet the processor's milk demand.

Due to the Appalachian and Southeast orders having been milk deficit for multiple years, the high Class I differentials and transportation credits were and are used as incentives to increase the milk supply. These two orders struggle to maintain a high blend price and meet market area milk demand simultaneously. Within both of these orders, there is a one-day delivery requirement per month. The delivery day requirement means that an out of area producer needs to only supply one day of milk production within either of those orders to qualify for the higher blend price for the rest of the month. An important note is that a producer who takes their milk to more than one order will automatically qualify for the order with the higher blend price. The one-day delivery requirement is good for the out of area producers who might be in an area that has more manufacturing plants such as cheese plants and would, therefore, receive a lower price for their milk if they stayed within their order the whole month. However, this has a potentially adverse effect on the blend price for all producers who have their milk processed within the Appalachian and

Southeast orders. For example, an out of order producer who only delivers one day a month to a regulated plant in Order 7 can have their milk be pooled on Order 7. That producer's milk can then take his/her milk the rest of the month to a non-pool plant and still receive the pooled high blend price. Since this milk is from another area, meaning they're from within another order, the chances of this producer having their milk be processed for a class other than Class I is higher than if all of the out of order producer's milk came to Order 7. The out of area milk from this producer that is taken to non-pool plant will then be pooled on Order 7 and has a high chance of lowering the Class I utilization, which then consequently reduces the blend price as well.

1.7 Delivery Day Requirements

The delivery day requirements vary by order. The Florida Order, for example, has a ten-day delivery day requirement. By requiring that producers have to deliver ten days worth of milk to a plant within the marketing area, the Florida order is ensuring that the out of order milk is processed in a plant that has a higher chance of being a fluid milk processing plant. The stringent delivery day requirement keeps their Class I utilization high, and therefore the blend price relatively high as well. Florida is an outlier among other orders when it comes to delivery day requirements. Most orders have a one-delivery requirement. The delivery day requirement may be temporarily increased or decreased by the market administrator if an investigation, which can be prompted by the administrator or an individual, finds that change is needed (USDA-AMS, Order Regulating the Handling of Milk in the Southeast Marketing Area, 2014).

The delivery day requirement can be a point of contention between producers and processors. However, the diversion limit is a regulation that can be even more of concern for producers. Like delivery day requirements, diversion limits vary from order to order and can be temporarily adjusted by the market administrator of each order. The market administrator can change the diversion limits temporarily, but a proposal to change the diversion limits permanently must pass “either two-thirds of the dairy farmers voting or producers representing two-thirds of the milk that would have been pooled during a designated month must approve” the change (USDA-AMS, Questions and Answers on a Potential Proposal for a California Federal Milk Marketing Order, 2015).” Diversion limits are often higher in the fall and winter months when supply is heavier, and demand is lower compared to lower diversion limits in the spring and summer months where supply is lower, and demand is higher. The lower diversion limits in the spring and summer are to ensure that there is a sufficient supply of milk within the order. Diversions can be a complicated matter but described simply it is the amount of milk that can be delivered directly from a farm to a non-pool plant but still pooled on the order and qualify for the blend price (Figure 4).

What is a non-pool plant?*
A non-pool plant is a plant that is:

1. Fully regulated by another Federal order
2. Producer-handler plant
3. Partially regulated distributing plant
4. Unregulated supply plant
5. An exempt plant

What is a pool plant?
A pool plant is a fully regulated plant that is:

1. A distributing plant
2. A supply plant
3. A plant within the marketing area operated by a coop
4. Two or more plants operated by the same handler and within the same marketing area

For full definitions refer to order language ((USDA-AMS, Order Regulating the Handling of Milk in the Southeast Marketing Area, 2014)

*These definitions have been simplified.

Figure 4. Pool and Non-Pool Plant Definitions

Diversion limits can have different effects on an order depending on the order's current milk status. In 2005 there was a hearing held to determine if Order 33, the Mideast Order, should lower their diversion limits from 60% to 50% from August to February and 70% to 60% from March to July. There were some that were concerned that lowering these diversion rates would cause the cooperatives within the area to gain an even larger share of the market share (Cotterill, 2005). However, other witnesses supported amending the diversion limits to get a better understanding of the market's Class I needs and to prevent out of area producers from lowering the order's blend price. Order 33 is an order that is not a milk deficit area, unlike Orders 5, 6, and 7. The concern that out of area pooling will lower Class I utilization and therefore reduce the blend price is a mutual concern among the four orders: 5, 6, 7, and 33. As mentioned earlier, this is why the Florida Order has such high delivery day requirements. Due to Orders 5 and 7 having a different milk status than Order 33, the impacts of lowering the diversion limits could potentially be different. A milk deficit status means that all of the milk produced within the marketing area needs to stay in the area and plants should preferably only be bringing in milk that is needed. While Orders 5 and 7 have the lowest diversion limits out of all the orders, except Florida, they are still struggling within producing enough milk to supply processors demands. Milk that is coming from out of the area from places such as Texas or Illinois only has to deliver one day worth of milk to Orders 5 or 7, where the milk could be diverted into a lower class, to be pooled on Order 5 or 7.

The issues of diversions is not a simple task to explain. However, because their impact on producers within an order is unknown, it is important to attempt to quantify what is potential effect on price. The next few chapters will go into more detail about the history of the federal milk marketing orders and what makes the southern orders unique. Additionally, Chapter 4 will take an analytical look at the impact of both diversions and transportation credits on Order 7's uniform price.

Chapter 2: The History and Class Pricing of Federal Milk Marketing Orders

The regulation of milk is an important part of the development of the milk industry, and an understanding of the history of milk regulation is critical to understanding the pros and cons of the current industry. Additionally, to understand milk pricing, it is important to understand the history of the federal milk marketing orders. This chapter will provide information on how milk became regulated and how the class pricing system works. A glossary (Appendix 1) is provided at the end for reference.

2.1 Background

In 1933, the Agricultural Adjustment Act gave the federal government the authority to regulate the handling of milk. The Agricultural Marketing Agreement of 1937 then gave the Secretary of Agriculture the authority to issue marketing orders, and one of those marketing orders was for milk. The Federal Milk Marketing Orders (FMMOs) have evolved considerably since they were authorized in 1937.

Initially, the marketing orders were designed to coordinate the supply and demand of milk. Since milk is a perishable commodity regional boundaries were established to help ensure that milk produced could meet demand from local economies. Both technology and transportation have improved over the last 80 years, and this has allowed regional boundaries to expand. The milk marketing orders have consolidated to as low as 10 orders, as of 2016, and under these 10 milk marketing orders roughly “60 percent of all milk marketed in the United States is marketed… (Federal Milk Marketing Orders, Section 10 Review, 2015)." Roughly, one-fifth of the remaining 40% of milk marketed comes from California (California Milk Advisory Board, 2016). The figure below shows the current regional boundaries of the 10 FMMOs (Figure 5), and the table below (Table 3) details the names and number of each milk marketing order.

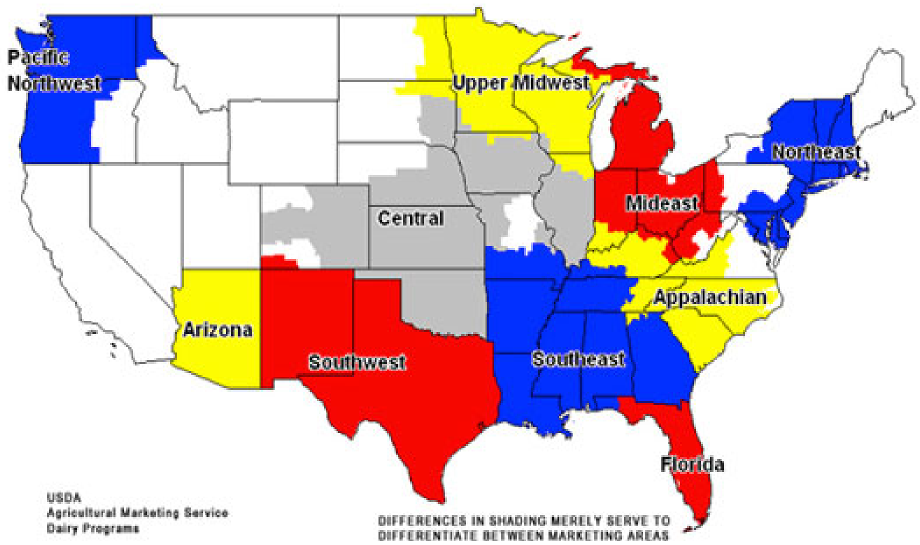

Figure 5. Map of Federal Milk Marketing Orders

Federal Milk Marketing Orders	
Order 1	Northeast
Order 5	Appalachian
Order 6	Florida
Order 7	Southeast
Order 30	Upper Midwest
Order 32	Central
Order 33	Mideast
Order 124	Pacific Northwest
Order 126	Southwest
Order 131	Arizona

Table 3. List of Federal Milk Marketing Orders

The current orders were shaped by the 1996 Farm Bill, also known as the Federal Agriculture Improvement and Reform (FAIR) Act of 1996. This bill required the Secretary of Agriculture to reduce the 31 milk marketing orders to between 10 and 14. The Secretary initially consolidated the orders to 11 under the Consolidated Appropriations Act of 2000. In 2004 the Western FMMO – Utah, and parts of Nevada, Idaho, and Oregon – was terminated, which is why there are currently only 10 Orders. The full federal milk marketing order timeline can be viewed below in Figure 6.

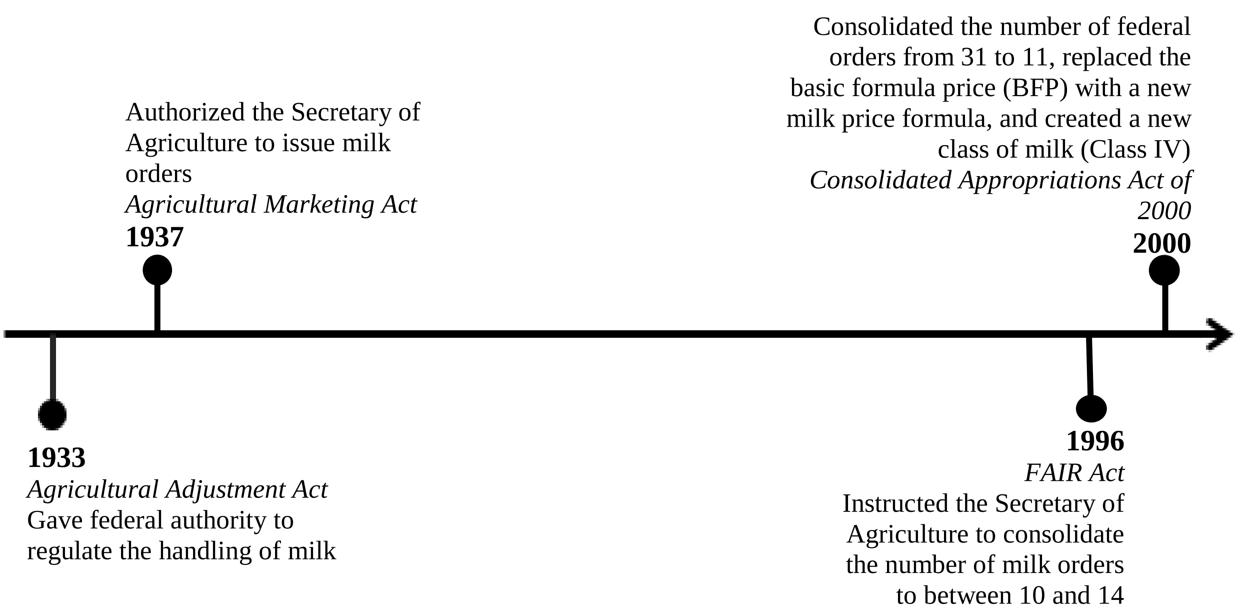

Figure 6. Federal Milk Marketing Order Timeline

2.2 Class Pricing

Originally, there were only three classes of milk, but after the Consolidated Appropriations Act of 2000, the third class of milk was divided up into Class III and IV. These four classes of milk are:

Class I – fluid milk

Class II – Soft manufacturing products (ice cream, cottage cheese, etc.)

Class III – Hard cheese and cream cheese

Class IV – Butter and dry milk.

Each of the four classes of milk has a specific pricing formula that is calculated using a set of component prices (see Appendix 1). Class I and II have advanced pricing and are "based on the previous month's end product pricing (McCullock, 2011)." Class I incorporates the higher of the advanced Class III, and IV skim milk prices. Advanced prices are based on the first two weeks of the preceding month. The Class II formula uses the advanced Class IV skim milk price. For example, Class III pricing uses the components of other solids, protein, and butterfat, while Class IV uses butterfat and nonfat solids as can be seen below (USDA-AMS, Current Price Formulas).

The Class III and IV prices are determined using three steps (Jesse & Cropp, 2008). The first stage of formulating the Class III and IV price involves setting prices for milk components – butterfat, protein, nonfat milk solids, and other milk solids – by developing product price formulas. Jesse and Cropp (2008) describe the product price formula as:

$$\frac{Component\ price}{lb} = \left(\frac{product\ price}{lb} - \frac{make\ allowance}{lb}\right) x\ yield$$

Breaking that formula up, there are three important parts: product price, make allowance, and yield. The product price is the monthly average of the wholesale prices for each product – cheese, dry whey, butter, and nonfat dry milk (Jesse & Cropp, 2008). The cheese component of the product price is specifically the wholesale prices of block and barrel cheddar cheese, and butter is Grade AA butter (Jesse & Crop, 2008). The second part of the product price, the make allowance, is the estimated manufacturing cost per pound and is determined through a survey of processors' costs. The current make allowance for butter, for example, is $0.1715 (Class III butterfat price formula below) (Stephenson, 2007), which suggests that it costs roughly 17 cents to make one pound of butter.

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

Lastly, the yield factor estimates how much of a product can be produced from one pound of a component. For example, from the Class III butter price formula the yield factor for butter is 1.211. This suggests that one pound of butterfat (the component) can yield 1.211 pounds of butter (the product). After the component prices have been determined, stage one has been completed.

In the second stage, the skim milk price is determined using the component prices that were previously discussed. Since a hundredweight of Class IV skim milk has been calculated to "contain 9 pounds of nonfat milk solids", Class IV skim milk price is as follows:

$$Class\ IV\ Skim\ Price\ Price = Nonfat\ Solids\ Price\ x\ 9$$

The skim milk prices for Class III and IV are important because they are also part of Class I and II pricing formulas. Class II uses the advanced Class IV skim milk price to help determine Class II skim milk price, and Class I uses the higher of the advanced Class III or IV skim milk price to as part of the Class I skim milk price.

The third and final stage in determining the Class III and IV prices is dependent on butterfat content. The Class III butterfat component price that was derived in the first stage is used with the Class III skim milk price that was discussed in the second stage to come up with the final Class III and IV prices. The Class IV price also uses the Class III butterfat price to determine its final price. Figure 3 below shows applicable pricing formulas for all four classes of milk.

Class I:

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

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

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

Class II:

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

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

$$\text{Class II Butterfat Price} = \text{Butterfat price} + \$0.007.$$

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

Class III:

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

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

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

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

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

Class IV:

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

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

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

$$\text{Butterfat Price} = \text{See Class III}.$$

Figure 7. Current Pricing Formulas (USDA-AMS, Current Price Formulas)

Class utilization refers to the share of milk that is processed in each class. Regions with a relatively low level of milk production will see a larger proportion of their milk sold for fluid use and areas with relatively higher milk production will see more of their milk sold into the lower classes. For example, 70% Class 1 utilization would mean that 70% of the milk is processed as Class I, meaning it is processed for fluid consumption. Since the Appalachian, Florida, and Southeast Orders are milk-deficit orders, more of the milk produced is processed as Class I for these regions. The Upper Midwest Order, Order 30, has minimal Class I utilization compared to the Southern orders, as can be seen in Table 4 below.

	2016 Class I Utilization			
	Appalachian	Southeast	Florida	Upper Midwest
Jan	70.46	72.83	84.57	9.14
Feb	69.8	73.25	83.37	9.16
Mar	67.23	65.61	84.37	9.44
Apr	66.02	64.29	84.48	8.88
May	63.96	64.46	81.11	8.85
June	64.84	64.79	83.56	8.64
July	67.84	68.71	83.32	9.53
Aug	74.23	80.98	84.14	13.2
Sept	74.07	78.91	87.88	12.54
Oct	70.57	74.29	83.09	10.24
Nov	75.09	78.81	83.14	15.74
Dec	71.53	71.64	83.24	14.5

Table 4. 2016 Class I Utilization Percentages (USDA-AMS, 2016 Class I Utilization Percentage of Producer Milk, 2016)

The Upper Midwest Order, for example, has a high Class III utilization, given a large number of cheese processing plants located within the order. Florida has the largest Class I utilization because a majority of their pool plants process Class I milk and the order has very low diversion limits compared to the rest of the orders. Florida's diversion limits, set between 10% and 20% depending on the month, limit excess milk being pooled on the order. This prevention of excess amount of milk means a lower amount of milk will be potentially diverted into a lower class of milk which would lower the Class I utilization.

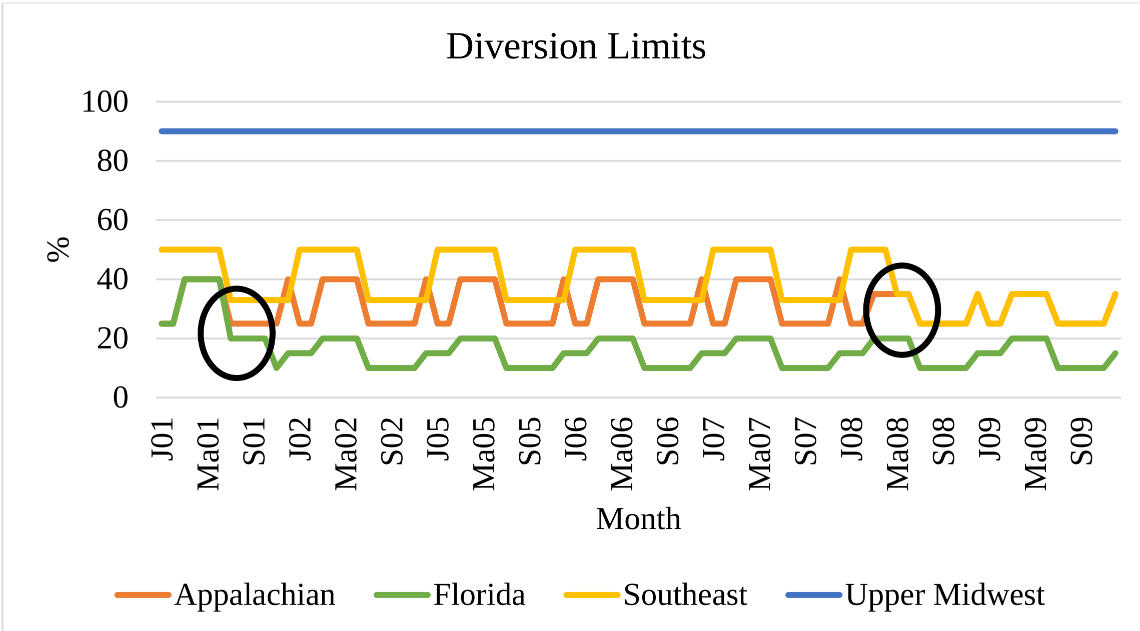

Figure 8. Diversion Limits (USDA-AMS, Diversion Limit)

Diversions are excess milk that is not needed at a pool plant, so it is diverted to a non-pool plant. Each order is allowed a certain percentage of the total amount of pooled milk to divert, which can be seen from Figure 8. Two relevant points of time circled in Figure 4 represent changes in diversion limits. The circle on the left highlights when the diversion limits were lowered for the Florida Order from diversion limits of 20%, 25%, and 40% to 10%, 15%, and 20%. The second circle on the right side of Figure 4 depicts the 2008 lowering of the Appalachian and Southeast Orders diversion limits. This change also created consistent limits between the two orders. For the southern orders – the Appalachian, Florida, and Southeast – the lower the diversion limits, the less likely milk will be utilized for a class other than Class I.

Class I differentials were intended to encourage the movement of milk from high supply areas to low supply areas. The differentials were meant to approximate estimated transportation costs from these high supply areas to the low supply areas (Jesse & Cropp, 2008). Under the Consolidated Appropriations Act of 2000, there was an alteration of Class I differentials. Currently, the federal milk marketing order system has location-specific Class I differentials. These differentials focus on location and economic value. Orders that are milk deficit – like the Appalachian, Florida, and Southeast Orders – have higher Class I differentials than most other regulated areas. These differentials can differ by county. Two producers that are under the same milk marketing order and live in the same county can receive different prices for their milk if they happen to deliver to plants that are located in different counties because of the Class I differential.

Due to Class I differentials being included in the Class I price, milk that is sold for fluid use will net the highest price per hundredweight. Typically, Class II prices will be the second highest price and Class III, and IV prices can vary behind Class I and II. The blend price is a weighted average price for all milk that is sold. So, the more milk that is sold into higher classes, the higher the blend price will be. For this reason, blend prices are higher in regions where Class I utilization is higher. Diversions are important because they have the potential to impact class utilizations. Every pound of excess milk that is pooled on the order has the potential to be used for Class II, III, or IV, which could lower the blend price. This is especially true in the south where Class I utilization is typically higher.

Beyond the uniform price, the term mailbox price is often used in milk marketing. Similar to blend prices, mailbox prices can differ based on which order a producer pools their milk on. The term pooled means an order's total amount of milk that was received at a regulated pool plant. Pooled milk is eligible to receive federal order milk pricing. There are types of plants other than pool plants, but only pool plants are regulated by an order. Pooling can impact class utilization which then can impact the blend price that milk producers will receive in an order.

The blend price is the price based on how much milk was used in each class of milk that was pooled in an order. However, while the blend price should be the same for all producers, the amount that producers actually receive will be impacted by the Class I differential and other costs. These other costs are incorporated into the mailbox price. The term mailbox price can be "defined as the net price received by dairy farmers for milk, including all payments received for milk sold and deducting costs associated with marketing the milk. All payments for milk sold include: over-order premiums; quality, component, breed, and volume premiums; payouts from state-run over-order pricing pools; payments from superpool organizations or marketing agencies in common; payouts from programs offering seasonal production bonuses; and, monthly distributions of cooperative earnings (USDA-AMS, Mideast Marketing Area, Mailbox Prices). Essentially, the mailbox price includes a wide number of additional payments that are not calculated within the blend price, but it is more representative of what is truly received by producers for milk.

Additionally, mailbox prices are determined by different regions, and these regions do not align with federal milk marketing order regional boundaries. Figure 9 is a representation of the current federal milk marketing orders and Figure 10 depicts areas on which mailbox prices are reported. While the regions are remarkably similar, there are some areas where the differences are significant. Some mailbox price regions are a state such as Minnesota and Wisconsin (which are both a part of the Upper Midwest Order) and New York (which is within the Northeast Order's boundaries). The Southeast mailbox price, for example, includes the states: Alabama, Arkansas, Georgia, Louisiana, and Mississippi. However, the Southeast marketing order's region includes parts of Tennessee, Kentucky, and southern Missouri.

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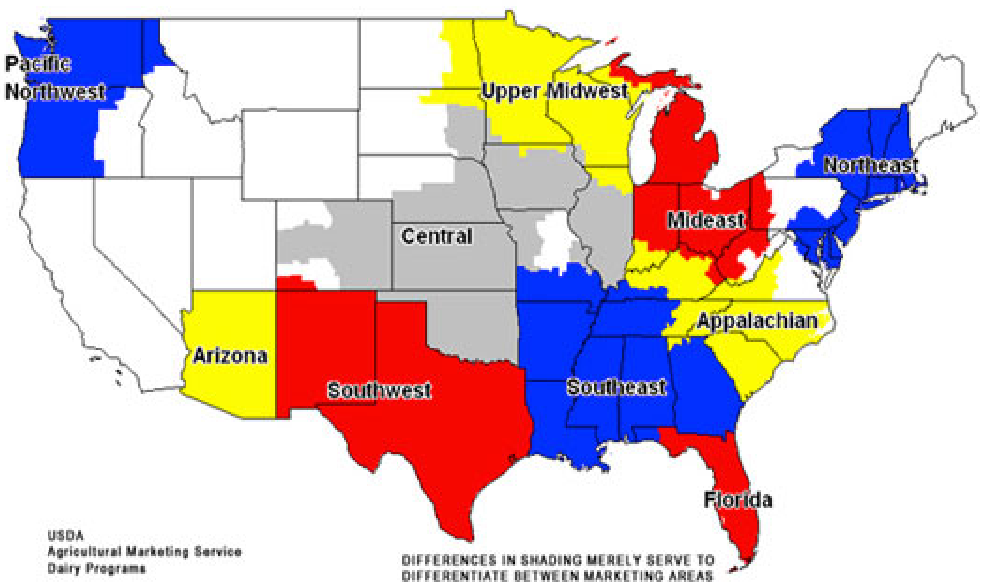

Figure 9. Map of Federal Milk Marketing Orders

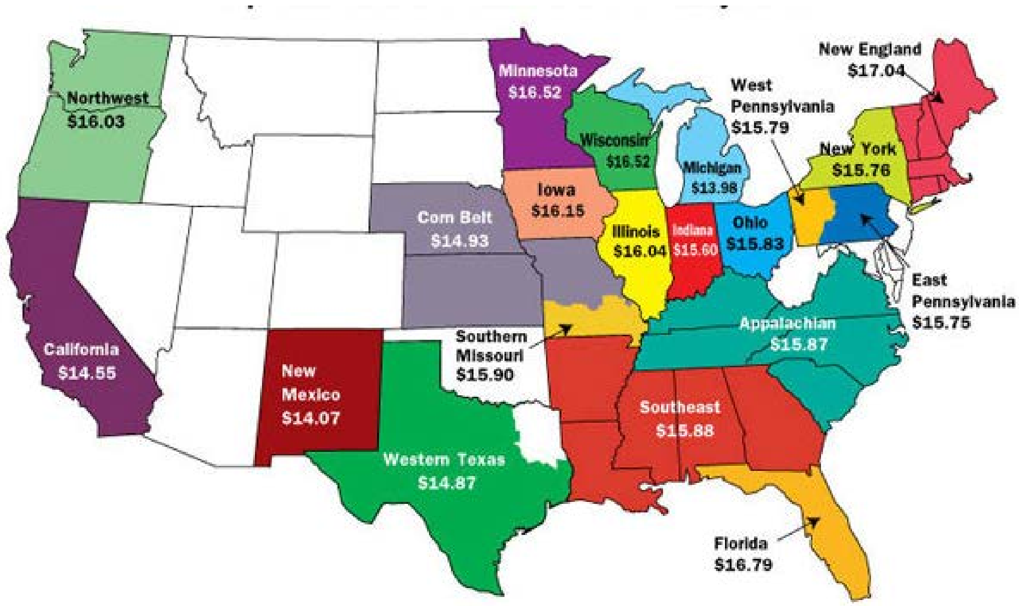

Figure 10. July 2016 Mailbox Prices (Hoard's Dairyman, Mailbox Prices; USDA-AMS, Mailbox Milk Prices)

The pricing of milk can be complicated with the different kinds of prices, the range of prices across FMMOs, and the various regulations that affect the amount of milk regulated under an order. However, these differences are put in place to benefit both producers and processors within an order's regional boundaries. This publication explained how the federal milk marketing orders developed into their current state and summarized how milk prices are determined via those milk marketing orders. The goal was to make the complicated nature of the regulation of milk a little less complicated.

Chapter 3: The Unique Qualities of the Southern Milk Marketing Orders

Milk is a heavily regulated commodity, and therefore there are a large number of rules that pertain to its production and processing. These regulations are enforced within regional boundaries called federal milk marketing orders. Most milk marketing orders have similar rules, but the Appalachian, Florida, and Southeast Orders are somewhat unique when it comes to diversion limits, transportation credits, and delivery day requirements. This chapter will highlight these distinctive qualities of Southern milk marketing orders and how those qualities can influence production and processing in those orders. A glossary is at the end for reference (Appendix 2).

3.1 Diversion Limits

Every Federal Milk Marketing Order (FMMO), out of the current 10, has diversion limits. These diversion limits are explained within each federal milk marketing order's language (USDA-AMS Historical Documents). Each order is a little different, so these documents outline the definitions and details used to regulate the order. This language and any changes in the order language are voted on by producers through a referendum. In order to pass a referendum "either two-thirds of the dairy farmers voting or producers representing two-thirds of the milk that would have been pooled during a designated month must approve" the change (USDA-AMS, Questions and Answers on a Potential Proposal for a California Federal Milk Marketing Order, 2015). Due to many milk producers being members of dairy cooperatives, these votes are often cast within a bloc vote. A bloc vote allows the co-op to vote for all of its members at once.

Diversion limits are the maximum amount of pooled milk that a pool plant can divert to a non-pool plant. These diversion limits vary by order and range from as high as 90% to as low as 10%. In Figure 11, the definitions of the pool and non-pool plants are detailed. Out of the total amount of milk that is gathered (or pooled) by plants regulated under a specific order (pool plants) only a certain percentage of that milk can be diverted to a plant that is not regulated by that order (non-pool plant). A pool plant is regulated under a federal milk marketing order, while a non-pool plant can be regulated under an order, but can receive diverted milk from other orders that classify the plant as non-pool. As an example, a plant that is regulated in the Appalachian Order but also receives diversions from the Southeast Order would be considered an Appalachian Order pool plant, but a Southeast Order non-pool plant.

What is a pool plant?
A pool plant is a fully regulated plant that is:

5. A distributing plant
6. A supply plant
7. A plant within the marketing area operated by a coop
8. Two or more plants operated by the same handler and within the same marketing area

What is a non-pool plant?
A non-pool plant is a plant that is:

6. Fully regulated by another Federal order
7. Producer-handler plant
8. Partially regulated distributing plant
9. Unregulated supply plant
10. An exempt plant

(Federal Order language)

*Please refer to glossary for full definition.

Figure 11. Plant Definitions

The percentage of milk that can be diverted seems to coordinate closely with how much milk is produced or available within a milk marketing order's boundaries. The Upper Midwest Order, for example, has the highest diversion limits with 90% of their pooled milk being able to be diverted. This order also has a large number of big dairy farms and produces a larger amount of milk. Due to their high production levels, they often have excess milk that needs to be processed, and plants have practical limits on the amount that they can handle. The large diversion limit allows the excess milk that plants within the order cannot process to be taken to another plant that is not regulated by the order. When this milk is diverted, producers are still able to receive the same price as if their milk had been processed at a plant regulated by their order as long as the percentage of milk diverted stays within the diversion limits.

However, not all orders have excess milk within their regional boundaries. The Southern orders – Appalachian, Southeast, and Florida orders – do not have excess milk, and their orders would be labeled as milk deficit. Their milk deficit status means that they have much lower diversion limits than the Upper Midwest Order. The Appalachian and Southeast orders have diversion limits of 25% and 35% depending on the month, and the Florida order has even lower diversion limits at 10%, 15%, and 20% depending on the month.

Lower diversion limits support Class I utilization by preventing excess milk from being processed as a lower class. The southern milk marketing orders have a high number of fluid milk (Class I) processing plants. With the low diversion limits preventing a high percentage of surplus milk from being processed as Class II, III, or IV the blend price is also supported, compared to other orders. Ideally, the higher the Class I utilization percentage, the higher the uniform (or blend)[2] price for that order, which further means that the milk producers within the Appalachian, Florida, or Southeast orders should receive a higher price for their milk per hundredweight. However, there are two different types of pricing within the milk marketing orders. There is multiple component pricing and skim-fat pricing. Skim-fat pricing is based on skim milk and butterfat pounds, while multiple component pricing is based on skim milk, butterfat, protein, nonfat solids, and other solids pounds. A 2014 study analyzed how multiple component pricing would affect the Southern milk marketing orders (Newton, 2014). For the Appalachian and Southeast Orders there would be an increase in money received, but a decrease for the Florida Order.

Figure 12 and 13 below shows the mailbox prices for July 2016 and September 2016, respectively, which display that even though the Southern milk marketing orders have the highest Class I utilization out of the 10 orders, they do not consistently receive the highest mailbox price. Since mailbox prices include over-order premiums, an assumption could be made that regions such as New England or Wisconsin have farms that are producing large quantities of milk during the summer when supply often goes down that are earning them a milk price higher than their order's uniform price.

[2] The uniform price and blend price are the same and will be used interchangeably within this chapter.

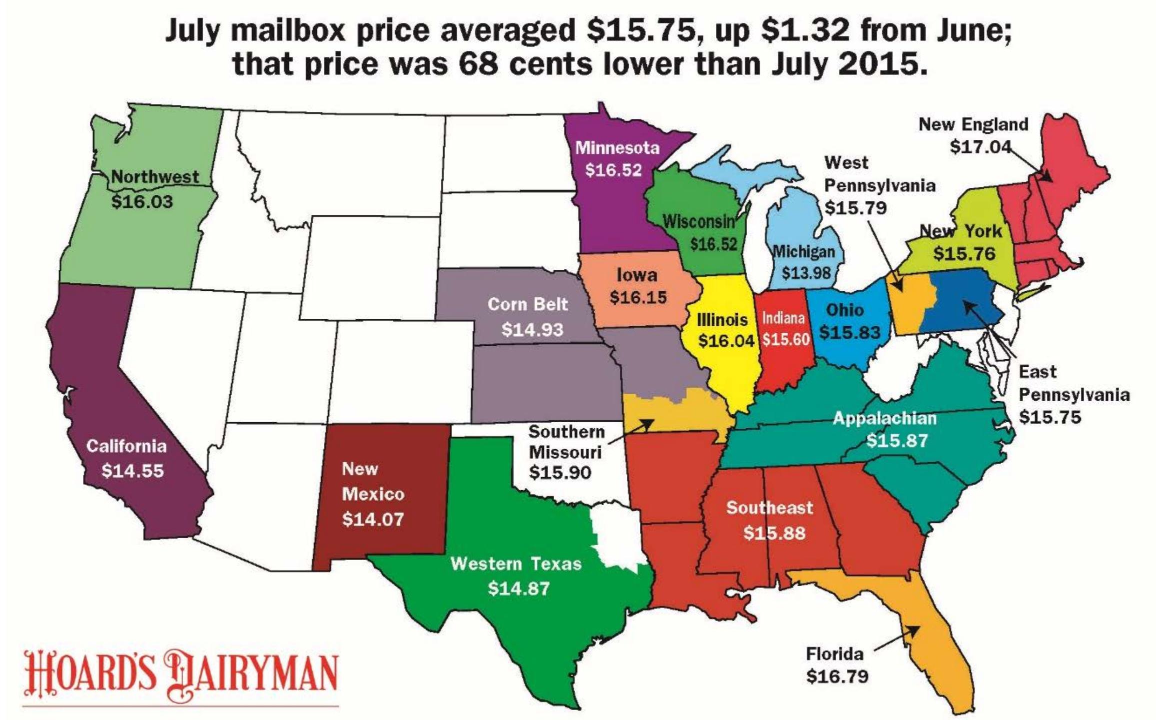

Figure 12. July 2016 Mailbox Prices (Hoard's Dairyman, Mailbox Prices; USDA-AMS, Mailbox Milk Prices)

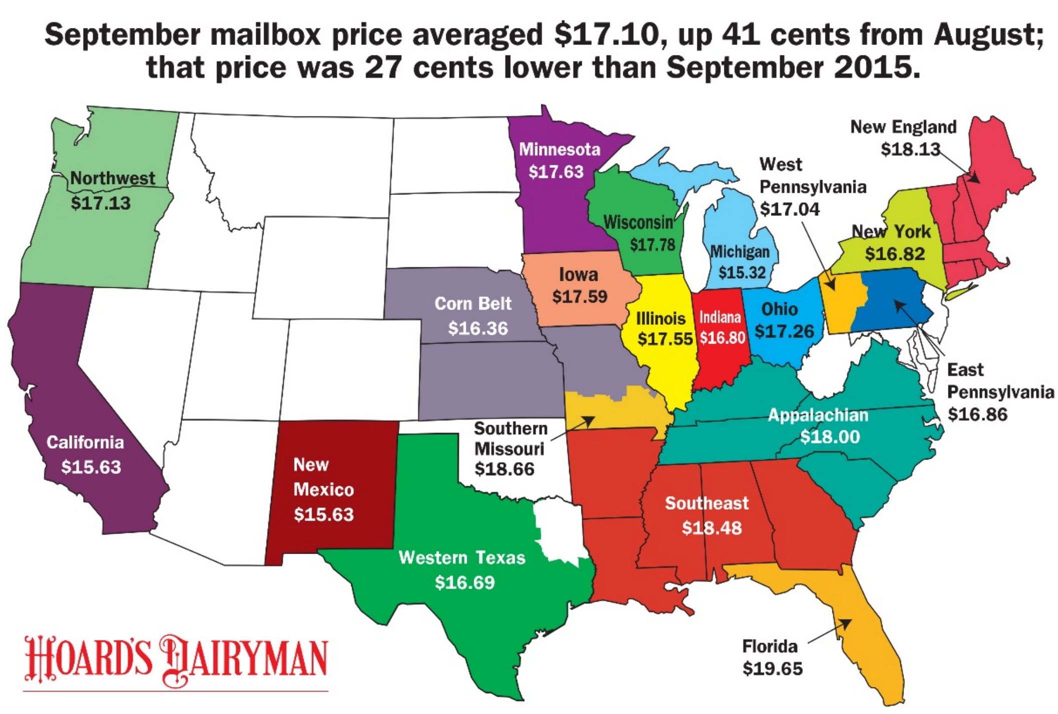

Figure 13. September 2016 Mailbox Prices (Hoard's Dairyman, Mailbox Prices; USDA-AMS, Mailbox Milk Prices)

Diversion limits have the potential to benefit both producers and processors, but their impact on producers in milk-deficit areas has been subject to much debate. For producers in milk-surplus areas, diversions are helpful because they allow those producers within the regional boundaries to receive a potentially higher price than if they had to transport their milk to another order.

The diversion limits also benefit the milk processors by allowing them to have a "cushion" in their milk supply. Processors need to acquire a certain amount of milk to meet their demand. For processors to successfully meet that demand, they have to obtain more milk than what they plan to process. One reason for this is because milk that is brought in to be processed has to be tested for antibiotics. If a truck comes in that tests positive for antibiotics that milk will have to be turned away and discarded or used for a different purpose. The diversion limits allow processors and cooperatives to plan and prepare for the amount of milk that could arrive and test positive for antibiotics. However, an FDA study showed that less than 1% of milk tests positive for antibiotics though (FDA, 2015). Another reason for diversion limits is that they also help provide a supply cushion in case a producer is not able to produce as much milk as they have in the past or are contracted to produce. However, in orders like the south where milk supply is not as high, higher diversion limits negatively impact the price that producers receive for the milk they produce as a portion of this milk is diverted to lower classes. The attractiveness or unattractiveness of diversion limits depends on an orders milk supply market and the type of plants located within the order (Cotterill, 2005).

3.2 Transportation Credits

Along with diversion limits, transportation credits are another distinctive trait of the Appalachian and Southeast Orders. The Appalachian, Florida, and Southeast Orders are unique in their milk deficit status. Each order's inability to produce enough milk for the processor's demand within each of their regions causes cooperatives and processors to have to look elsewhere for milk in order to obtain enough each month for their demands. The need to procure milk from outside the order creates an added transportation expense for milk processors. Due to the milk deficit status of both the Appalachian and Southeast Orders, transportation credits have been implemented within each order. The Appalachian and Southeast Orders are the only orders out of the 10 that have transportation credits, at the time this publication was written (USDA-AMS, A Primer on Federal Order Transportation Credits, 2010).

So where does the money come from to pay for the transportation credits? Dairy processors and milk handlers pay a set amount each month based on how much Class I milk they receive or handle. This monthly payment goes into what is called a "transportation credit balancing fund" or what is also referred to as TCBF. Milk processors can then request payment from the TCBF during the months of January, February, and then July through December. These transportation credits provide another incentive for processors to bring outside milk into the southern regions. However, there are two stipulations to request money from the TCBF. A transportation credit primer that was developed to help explain transportation credits details these stipulations:

"In addition, bulk milk eligible to receive payment from the TCBF must…

1. Come from dairy farmers whose milk was not pooled on that order for more than 45 days during the immediately preceding months of March through May,
2. Or from farmers with not more than 50 percent of their total production pooled on that order in those three months. (USDA-AMS, A Primer on Federal Order Transportation Credits, 2010)."

The current monthly assessment rates for the Appalachian and Southeast Orders are $0.15 and $0.30, respectively. The transportation credit monthly rates have varied in the past since when the fund was established in 1996.

3.3 Delivery Day Requirements

The third unique quality of the Southern orders are delivery day requirements. Delivery day requirements are a number of days out of a month that a producer has to deliver their milk to an order to be able to have their milk pooled in that order. Most orders have a delivery day requirement of one day, including the Appalachian and Southeast Orders. However, Florida is an exception because they have a ten-day delivery requirement. This means that a producer has to have their milk delivered to Florida ten days out of the month to have their milk pooled on the Florida Order.

Since Florida has high Class I utilization, the delivery day requirements are good for milk producers within the order by discouraging excess milk. On the other hand, the ten-day delivery requirement could be good for plants within Florida's regional boundaries since it potentially could ensure they have enough supply. Florida has a very high uniform price thanks to their high Class I utilization, and this can attract milk from outside of the order, but producers or cooperatives who want to receive Florida's high uniform price have to make a commitment to the pool plants for a longer period.

3.4 The Florida Order

Florida is a very different order than the other nine milk marketing orders. The main differences are a high (if not, the highest average) Class I utilization percentage, extremely low diversion limits, and ten-day delivery day requirements. Florida is also different because of its geographical borders, except a small area in the Western Panhandle, is simply the state of Florida. All the other milk marketing orders are comprised of multiple states. Florida has the highest Class I differentials in the country, in addition to its high Class I utilization levels. The result is that producers receive higher milk prices in Florida than the other orders. Due to their uniqueness, Florida is an excellent example to consider when exploring whether lower diversion limits are an efficient way to handle the Appalachian and Southeast Orders increasing milk deficit status.

While milk production in the Southeast Order has been decreasing, the Florida Order's production has been able to stay relatively constant ranging between 2,127 and 2,536 million pounds over the past 21 years from 1990 and 2011. At the same time, the Southeast's milk production has decreased from 14,440 million pounds in 1980 to 9,096 in 2011 (Covington, 2012).

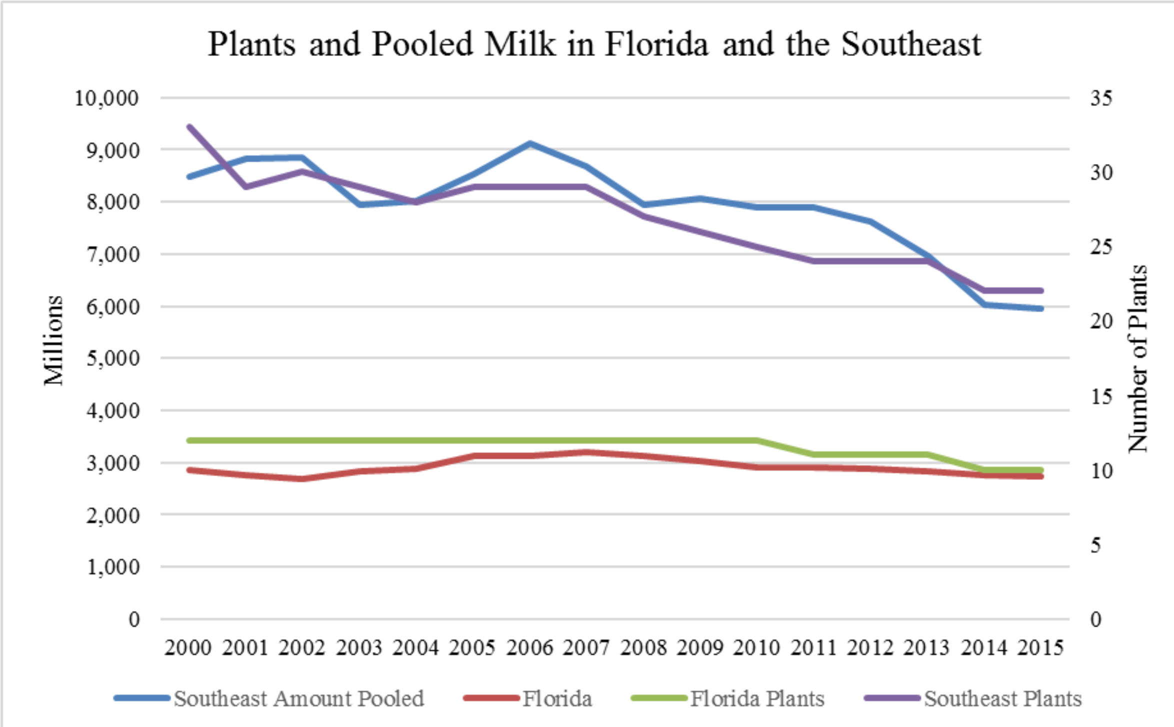

Figure 14. Pooled Milk and Plants in Florida and Southeast Orders (USDA-AMS, Florida and Southeast Marketing Areas, Statistical Reports)

Florida has a few pool plants compared to the other orders. Between 2000 & 2015 the Florida Order, Order 6, has decreased from 12 pool plants to 10 pool plants. The Upper Midwest Order, Order 30, had as many as 66 pool plants in 2014 and the Southeast Order, Order 7, had 22 pool plants in 2015. The small number of pool plants coincides with the lower amount of milk that is pooled on Order 6. It is also interesting that the number of cooperatives operating as pool handlers in Florida increased from 2 in 2000 to 7 in 2013 and then 6 in 2015. This shows that it is possible for cooperatives to process and obtain enough milk for pool plants to meet their demand despite low diversion limits. The amount of pooled milk and number of plants in the Florida and Southeast Order can be viewed in Figure 14.

In 2000, the Florida diversion limits alternated between 20%, 25%, and 40%. Starting in November 2001 the diversion limits were lowered to 10%, 15%, and 20%. The diversion limits vary seasonally based on supply and demand. The months of July through November have a diversion limit of 10%, December through February are 15%, and March through June are 20%. The lowest diversion limit of 10% signals that demand could either be lower or supply could be higher during those months. A higher diversion limit of 20% could be because supply is low or demand is high meaning that processors need to secure a larger amount of milk.

Florida lowered their diversion limits after a request from a cooperative that marketed a majority of the Florida Order's milk. The request came before the market administrator, and an investigation was conducted. The market administrator's investigation concluded that financial damage could occur to milk producers who regularly supply plants that are regulated on the Florida Order (USDA-AMS, Notice of Decision to Revise Diversion Percentage Limits, 2001). This financial damage could occur because of an excess amount of milk being pooled that is "not needed to meet the fluid demands of the market (USDA-AMS, Notice of Decision to Revise Diversion Percentage Limits, 2001)." The market administrator did not discuss what the details of the financial damage could be. However, the memo that announced the decreased diversion limits as a result of the request mentioned that the cooperative that made the request supplied 97 percent of the milk on the Florida Order.

3.5 Florida Compared to the Appalachian and Southeast Orders

The Florida Order has some similarities to the Appalachian and Southeast Orders. All three orders suffer from milk deficits and have lower diversion limits than the rest of the milk marketing orders. While there have been requests to lower the diversion limits on the Southeast Order, the most recent request was to lower the limit to 0%, which is not a feasible percentage, and was denied (USDA-AMS, Florida and Southeast Marketing Areas, Combined Comments, 2014). Part of the discussion with changing/lowering the diversion limits for Orders 5 and 7 is whether lowering the diversion limits is a feasible task that would not hinder supply and demand within the regional boundaries. While the Florida Order is not the same in all aspects as the Appalachian and Southeast Orders, Order 6 does show that it is possible to have lower diversion limits and still meet processors demand, while at the same time providing a "cushion" to make sure plants can obtain enough milk to process.

Comparing the Florida Order with the Appalachian and Southeast Orders we see lower diversion limits, higher delivery day requirements, and a much smaller regional boundary. The Florida Order has been able to maintain relatively stable milk production over the past 15 years. There has also been a decrease in pool plants, though there has been an increase in cooperative-handler plants. While Florida's low diversion limits and extremely high delivery day requirements have not been statistically proven to be the reason for Florida being a successful order – it is still milk deficit – the state has been able to maintain production over the years. The high delivery day requirements can be assumed to help the plants with the low diversion limits by ensuring a commitment is made on the producer's side to guarantee at least ten days of milk to the order. These tools could have implications for the Appalachian and Southeast Orders to potentially modify their marketing orders in the future.

Chapter 4: What Evidence Is There That Diversions And Transportation Credits Impact The Uniform Price for Order 7?

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 result 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. 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.

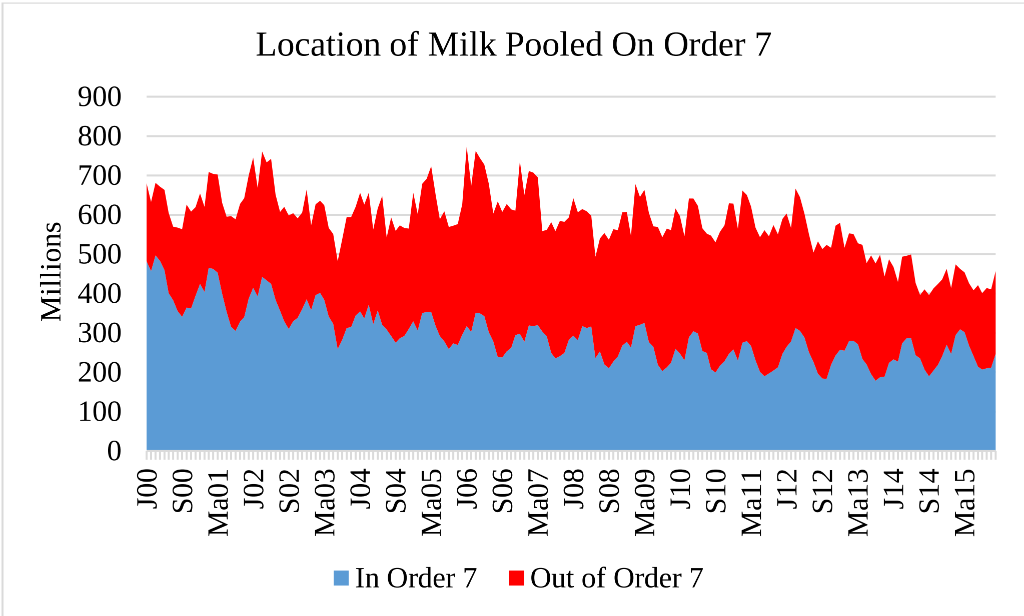

Figure 15. Milk Pooled On Order 7 (USDA-AMS, Florida and Southeast Marketing Areas, Market Administrator)

The amount of literature that focuses on analyzing federal milk marketing order 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 a number of dollars paid out for transportation credits on Order 7's uniform price.

4.1 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 a 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 (2003) 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 a significant 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 the industry for the area.

Fixed Effects Models

Time has been found to be an important component of dairy research. Due to time being such an important factor this model uses panel data to analyze both the time series element 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:

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

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. The cross-sectional units for this model are: Class II, Class III, and Class 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 each 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.

4.2 Data

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 16. 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 significant 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 independent 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 site.

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 influences 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, Kraus, Jesse, 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 were 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.

4.3 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 are 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 5. 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 diversions having a negative impact on uniform price 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 important 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 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	$18.6
	20,000	$0.36	$21.6
	25,000	$0.45	$27.0
	30,000	$0.54	$32.4

Table 6. 5% Increase in Class II Diversions

		Uniform Price - $16.00	
Pounds of Milk Produced	**10%**	**Per cow**	**60 Cow Farm**
	17,000	$0.65	$39.0
	20,000	$0.76	$45.6
	25,000	$0.95	$57.0
	30,000	$1.14	$68.4

Table 7. 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 constant usage of Class IV (Butter, dry whole milk, nonfat dry milk, and dry buttermilk as listed in ERS).

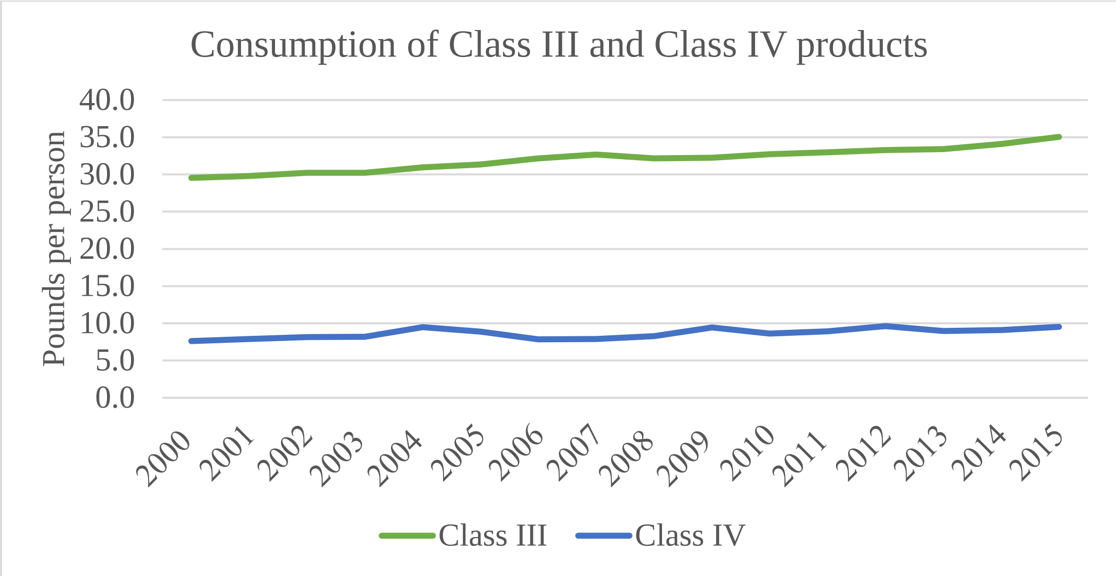

Figure 17. Class III and IV Consumption (USDA-ERS, Dairy Data 2016)

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 Class III is a driver of uniform price.

Though Kentucky corn shows a positive sign for Order 7's uniform price the variable is not statistically significant. The result of not being significant is not what we would expect, though the positive sign is. 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, and the uniform price experienced greater volatility than Kentucky corn.

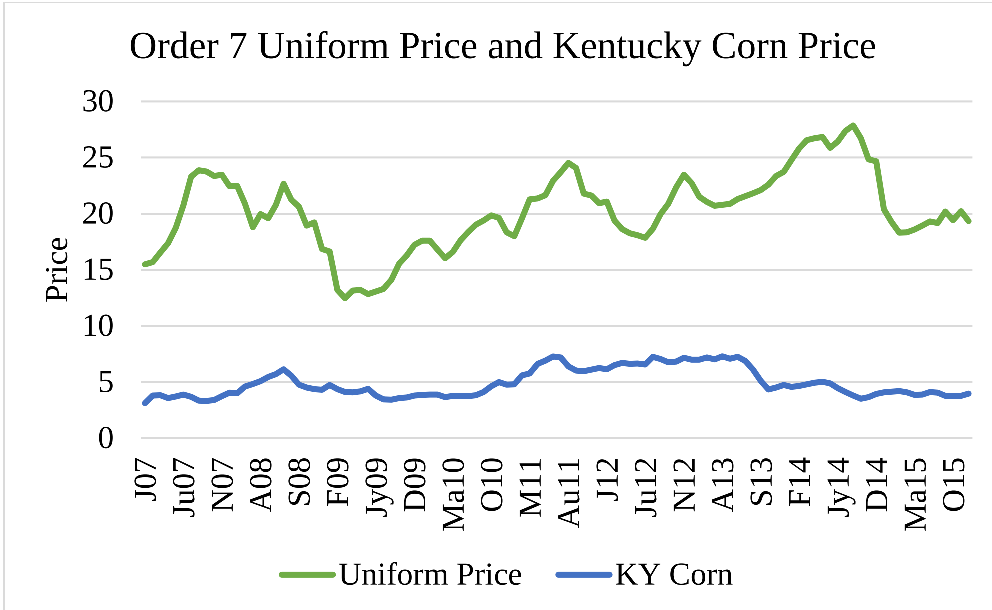

Figure 18. Uniform and KY Corn Price (University of Wisconsin Dairy Marketing and Risk Management Program, Understanding Milk Markets)

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, the uniform price should 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 8. 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 some 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 not to 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.

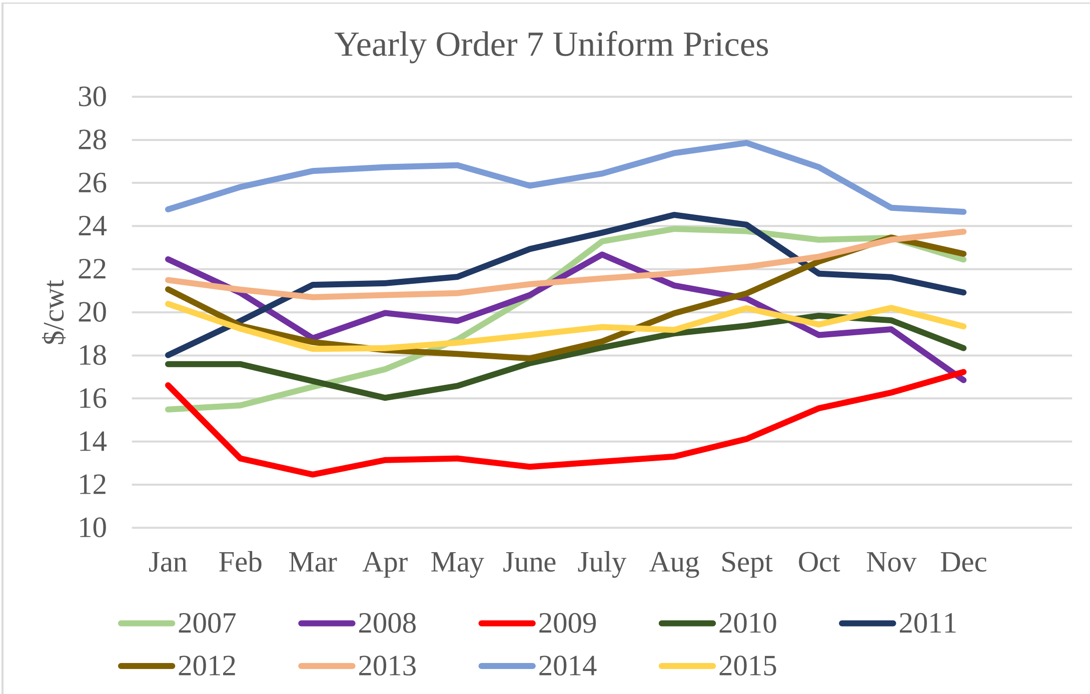

Figure 19. Yearly Prices By Month for Order 7 Uniform Price (USDA-AMS, Florida and Southeast Marketing Areas)

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

4.4 Conclusion

This study addressed the effect of lower class diversions and transportation credits on the Southeast Order's uniform price. 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 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 publicly 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.

Chapter 5: Summary

Within this study, a history of the federal milk marketing orders has been presented, a case study of the southern milk marketing orders, and an analytical look at the effects of lower class diversions and transportation credits on the Southeast Order's uniform price. The federal milk marketing orders have evolved extensively since their implementation in 1937 under the Agricultural Marketing Agreement. Since that time the regional boundaries of the marketing orders have grown to the current 10 milk marketing orders we have.

Three out of the ten orders, the Southern orders, have unique qualities that make them stand out compared to the other orders. In particular, the Southern orders have low diversion limits relative to the seven other orders. These diversion limits have been set to curb the "milk deficit" status that currently describes these orders. Farmers within the Appalachian and Southeast Orders have been concerned that the diversion limits are set too high and are negatively affecting their uniform price. A 2014 request to lower diversion limits to 0% opened the order to comments from both producers and processors. While a majority of processors were not open to the request of lowering the (USDA-AMS, Florida and Southeast Marketing Areas, Combined Comments, 2014). There has also been anecdotal evidence that farmers have been feeling contention towards transportation credits as well.

Part of this study addressed farmer concerns by using panel data to analyze the effects of lower class diversions and transportation credits on Order 7's uniform price. While the transportation credits were found to have no effect on the uniform price, Class II diversions were found to have a negative and statistically significant impact. This finding suggests that more research should happen to ensure that both producers and processors are being treated equally within the federal milk marketing system.

The research within this study sets up a foundation for future research on diversions and transportation credits and discusses results that could have policy implications. Overall, this study presented an inclusive view of the federal milk marketing system with a special focus on the southern orders.

Appendices

Appendix 1:

Glossary

Class I Differentials: A differential that is added to the Class I Skim Milk Price. The differential is based on location and can range from $0.00 to $4.50.

Class Utilization: The percentage of pooled milk that is processed per class within a federal milk marketing order

Component Prices: The price of butterfat, protein, nonfat milk solids, and other milk solids using the product price, make allowance, and yield.

Make Allowance: The estimated manufacturing cost of a component per pound produced.

Mailbox Price: The net price received by dairy farmers at their farm gates. This includes all payments received for milk sold less the cost associated with marketing the milk (ERS, 2016).

Diversion Limits: The maximum percentage of pooled milk within a federal milk marketing order that a pool plant may divert to a non-pool plant.

Uniform (Blend) Price: The minimum price in a federal milk marketing order that a milk producer can receive if they pool their milk in that order.

Yield Factor: How much one pound of a milk component can produce a certain product.

Appendix 2

Glossary

Class I Differentials: A differential that is added to the Class I Skim Milk Price. The differential is based on location and can range from $0.00 to $4.50.

Diversion Limits: The maximum percentage of pooled milk within a federal milk marketing order that a pool plant may divert to a non-pool plant.

Mailbox Price: The net price received by dairy farmers at their farm gates. This includes all payments received for milk sold less the cost associated with marketing the milk (Mark, et al., 2016).

Non-pool Plant: A plant that is fully regulated by another federal order, a producer-handler plant, a partially regulated distributing plant, an unregulated supply plant, or an exempt plant (USDA-AMS, Order Regulating the handling of Milk in the Southeast Marketing Area, 2014).

Pool Plant: A fully regulated plant that is either a distributing plant, a supply plant, a plant within the marketing area operated by a coop, or two or more plants operated by the same handler and within the same marketing area (USDA-AMS, Order Regulating the handling of Milk in the Southeast Marketing Area, 2014).

Uniform (Blend) Price: The minimum price in a federal milk marketing order that a milk producer can receive if they pool their milk on that order.

Transportation Credits: Funds that are gathered into a Transportation Credit Balancing Fund and can be used to aid plants in bring in milk from out of the order

Delivery Day Requirements: The amount of days a producer or cooperative is required to deliver milk to a pool plant in order for their milk to be pooled on an order.

Appendix 3

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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Vita

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EDUCATION

University of Kentucky — August 2009 – May 2013

Bachelor of Science in Economics

University Honors Program, Economics Dept. Honors, Magna Cum Laude

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University of International Business and Economics — Feb. 2012 – June 2012

Beijing, China

Study Abroad Program

CERTIFICATIONS

Microsoft Office Specialist

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LEADERSHIP AND INVOLVEMENT

Continuous Recruitment officer for Alpha Gamma Delta

2010

Member of the Resident Advisor Advisory Board

2012 -2013

Agricultural Economics representative on the Graduate Student Council

2014-2015

WORK HISTORY

Compliance/Project Manager

GOVERNOR'S OFFICE OF AGRICULTURAL POLICY

Front Desk Operations Coordinator

UNIVERSITY OF KENTUCKY RESIDENCE LIFE

Research Assistant

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VOLUNTEER EXPERIENCE

Habitat for Humanity	October 2014
Thanksgiving Meals for the Needy	November 2013
DanceBlue	February 2013
Chinese-English Tutoring	April 2012 – June 2012
Mission Trip Volunteer	June 2007

HONORS and AWARDS

University of Kentucky Dean's List	Fall 2010, 2011, Fall 2012, Spring 2013
Presidential Scholarship	Fall 2009
Robert C. Byrd Scholarship	Fall 2009
Kentucky Governor's Scholar	2008

INTERESTS
Reading non-fiction books relating to history or politics
Traveling to international places