INBOUND WHEAT RAILCAR LOADING OPTIMIZATION: AN OPPORTUNITY COST STUDY FOR CONAGRA MILLS

by

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ABSTRACT

The objective of this thesis is to examine the opportunity cost, both financial and efficiency, of inbound railcars of wheat that are not optimally loaded and shipped to ConAgra Mills' facilities. In performing an analysis of data showing actual versus optimal weights, a cost will be assigned to determine how much "dead freight" or extra freight is being paid to railroads for space not utilized. Throughout the analysis, it can be determined which shippers are lacking efficiencies in loading as well as those who are meeting ConAgra Mills' expectations.

To accomplish this objective, data were extracted from various sources for an entire fiscal year and 22,351 data observations were analyzed. The information was specific to both individual railcars as well as the shipments as a whole. These data points were analyzed in two ways, financial and capacity/efficiency. Financially, a cost was assigned to each railcar that was under the railcar's goal weight. From a capacity perspective, railcars were analyzed on a shipment basis to indicate if equipment could be saved by more efficient loading.

The study determined that savings could be found in every situation analyzed. It was determined that in addition to inbound shipments from outside shippers, inter-mill shipments between ConAgra Mills facilities were affected by loading inefficiencies. There could be an opportunity for further analysis to determine the full scope of savings beyond the limitations of this study. The main limitation of this thesis was the primary source of data.

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CHAPTER I: INTRODUCTION

1.1 Introduction

Efficiency is a cornerstone of any business model today. Whether its production, human, or energy efficiency, many businesses strive to operate at a high level or are improving to meet efficiency goals as set by company management. Efficiency can be defined as effective operation as measured by a comparison of production with cost (Merriam-Webster 2012). However, being efficient does not necessarily mean that operations are performing at an optimal level. Optimization can be defined as an act, process, or methodology of making something as fully perfect, functional, or effective as possible (Merriam-Webster 2012). Often, these two principles work together by using optimization methods or programs to improve efficiencies. In the agricultural sector, efficiencies are just as important as any other industry. Within the flour milling industry, for example, crop yields and quality, milling yields, and supply chain issues can all affect the bottom line if efficiencies are not carefully monitored and continually improved. Unfortunately, no one player in the supply chain can have control over these factors. It is the responsibility of parties throughout the supply chain to ensure their operations and procedures are producing optimal efficiencies.

1.2 Research Problem

ConAgra Mills does not own or lease a fleet of railcars used to transport wheat inbound from shippers across the country. Our merchandisers buy railcars of wheat from sellers; farmers, coops, competitors or brokerage houses. Often, sellers of the wheat also do not own or lease a fleet of cars to transport their grain. This leaves a dependency on the railroad companies to supply railcars on demand. By using this kind of system, shippers often do not know the size or condition the cars will be in upon arrival. Unless the car is rendered unusable by damage or cleanliness, shippers are left with no choice but to load the cars. Without much advance notice, shippers rely on the information printed on the railcar to understand its characteristics (Figure 1.1). These characteristics include load limit or net weight limit (pictured 220,800) and light weight or tare weight (pictured 65,200).

Figure 1.1: Railcar Stencil (Eisenbeisz 2012)

The characteristics for all railcars in service across all railroads are kept in the Universal Machine Language Equipment Register (UMLER) database maintained by the company RailInc. This information is used by all users of rail transportation and is the industry standard (RailInc 2008). It is the shipper's responsibility to know and understand a railcar's characteristics to ensure they do not overload a railcar to avoid heavy penalties imposed by the railroads. Because of this fear of overloading, shippers may choose to be conservative and under load a railcar. This decreases optimal efficiencies in loading. Because a flat rate is charged per railcar, shippers and consignees are paying the same price for a railcar that is optimally loaded as one that is not.

1.3 Objectives

This thesis will examine the opportunity cost of those railcars of wheat that are not being optimally loaded and shipped to ConAgra Mills' facilities. In performing an analysis of data showing actual versus optimal weights, a cost will be assigned to determine how much "dead freight" or extra freight is being paid for space not utilized. Throughout the analysis, it will be determined which shippers are lacking efficiencies in loading as well as those who are satisfying ConAgra Mills' expectations.

1.4 Hypotheses

The objectives of this thesis lend themselves to three hypotheses that will be tested through data analysis. The first hypothesis is that there are financial benefits to the shipper by increasing the level at which they load railcars of wheat. Because one rate is paid per railcar, the dollar per pound spent ratio decreases as the capacity loaded increases.

The second hypothesis is that there are financial benefits for ConAgra Mills when shippers increase the level at which they load railcars of wheat. ConAgra Mills is often responsible for paying portions of freight costs to shippers dependent on the freight basis of which the cars were contracted. For example, a railcar is shipped from an origin in Kansas and travels over East St Louis, IL to interchange with the next railroad carrier. The basis on the contract with the shipper is Kansas City, MO. ConAgra Mills will owe to the shipper the difference in freight expense from the origin to East St Louis and the origin to Kansas City. Also, ConAgra Mills pays freight to the railroads on contracted rates which again, are fixed, regardless of weight loaded.

The third hypothesis is that there is an efficiency benefit by loading more into the railcars to fully utilize the railcar's capacity. This benefit is in the form of equipment, fuel, and time savings. Equipment savings may be realized by using less overall railcars when each railcar is filled to capacity. Each railcar is charged a fuel surcharge, so fuel savings will be both monetary and environmental. The fewer cars needing to be moved, the lower the amount of energy required in terms of locomotive fuel use. Finally, shippers will need to load fewer railcars which equates to less moving of equipment within their facility saving time and effort of employees.

CHAPTER II: LITERATURE REVIEW

2.1 Railroad Efficiency

2.1.1 Background

There are three types of railroad carriers. First is the Class I railroads. These carriers are only 1% of freight railroads in business, however, they account for 67% of the railroad industry's mileage, 90% of employees, and 93% of freight revenue. These railroads operate all over the country and specialize in long haul, high density lanes. Regional carriers are categorized as having at least 350 miles of infrastructure. In 2006, there were 33 regional carriers. Often, regional carriers will operate in several states (2-4) and concentrate their business (i.e., the Northeast or Midwest United States). Local linehaul carriers operate on less than 350 miles of infrastructure and there were 323 local linehaul carriers in 2006. Many of these local carriers operate in one state. Railroads accounted for 41% of freight ton-miles in 2008 which is more than any other mode of transportation (Association of American Railroads 2008).

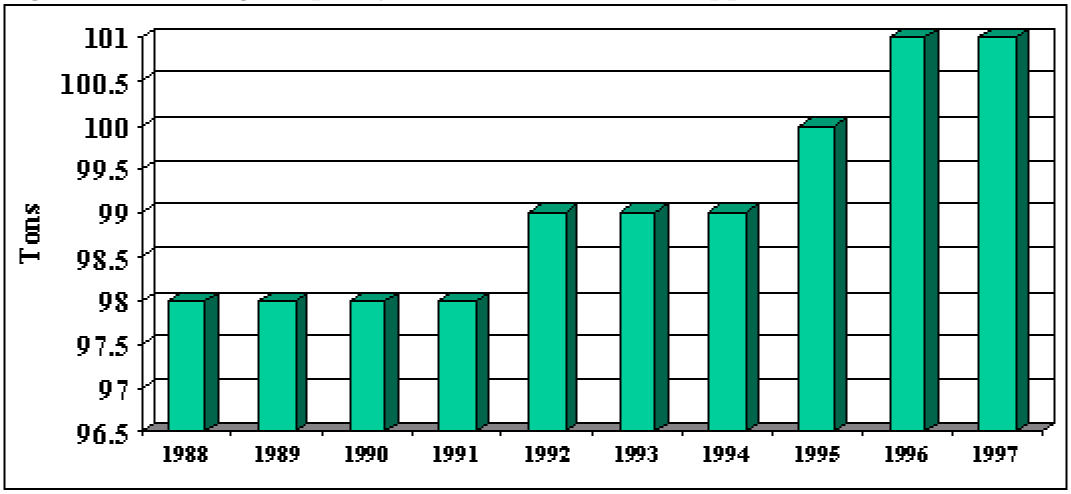
According to an overview of U.S. Railroad Efficiency (McCullough 2007), railroad efficiency can be categorized as productive or allocative efficiency. Productive efficiency of railroads asks what needs to be done to enable railroads to provide service at the minimum average cost possible. McCullough (2007) determines that changes in the industry, including consolidations and technology, have increased overall traffic densities, lengthened linehauls, and created an overall shift in train operations. Also with these changes, railroads have been able to increase their revenues while increasing fuel productivity. Despite all of these changes, however, McCullough (2007) concludes that rail continues to be the slowest growing mode of transportation.

The allocative efficiency of the transportation system asks if the rail network's potential within the overall transportation industry is being used. Through his analysis of the industry, McCullough (2007) finds that it is difficult to determine if transportation investment generates economic activity or if economic activity advocates transportation investment. The railroads are generating lower marginal costs than other modes which show an advantage in allocative efficiency. One concern is the way the industry is highly consolidated. Consolidation increases rail market power. The question posed is whether this consolidation is helping or hurting the efficiency of the railroad industry. The number of Class 1 railroads dropped from 36 in 1978 to 7 in 2004. McCullough (2007) concludes that freight railroads have an allocative efficiency advantage.

2.1.2 Changing Railcar Economics

Over the last two decades, both railroads and shippers have been changing their fleets of grain railcars to handle larger capacities of grain. In the late 1990s, it was estimated that 25% of the entire grain railcar fleet was capable of a 286,000lb gross weight as opposed to the previously used 263,000lb or 268,000lb gross weight (Baumel 1997). This growth in the capacity of the overall covered hopper fleet over time can be seen in Figure 2.1.

Figure 2.1: Average Capacity of the U.S. Covered Hopper Car Fleet: 1988-1997



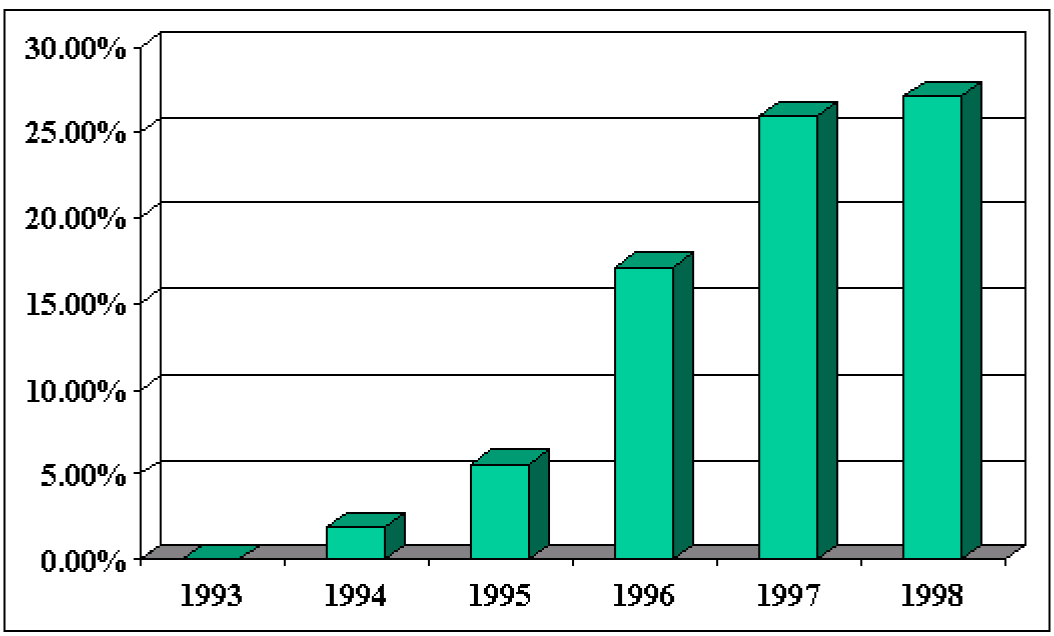
(Bitzan 2001)

The current majority of railcars being built have this larger volume capacity. Railroad freight volume has almost doubled since 1980. Railroad fuel efficiency is up 106% since 1980 because of improving technology, railcar design, and operating practices. These improvements increase the volume of freight in an average railcar and on an average train while keeping fuel costs constant, creating substantial fuel savings (Association of American Railroads 2011).

With a fleet of heavier grain railcars, the railroads are able to carry more commodity weight with only a small increase in the weight of the equipment needed to haul the commodity creating an increased net-to-tare ratio. This means that more of a commodity is able to be hauled using fewer locomotives which saves fuel, labor and maintenance costs (Bitzan 2001). Similarly, shippers on higher capacity rail lines benefit from savings by being able to ship more grain in a railcar. This increases their per bushel rate savings (Bitzan 2001). The rate differences between shipping a smaller railcar versus a larger railcar is less than the volume difference between the two types of railcars.

Smaller operations, such as country elevators or farmer's cooperatives, sometimes struggle with the increasing trend of larger railcars replacing grain railcar fleets. The reason many of these shippers struggle is because they are serviced by regional or local linehaul carriers (shortlines) whose infrastructure does not support the heavier weight railcars. Larger cars can be light loaded, but this can hurt the economics of rail transportation because more equipment is needed to move the same amount of freight (Argus Media 2012). Often, larger railcars are used solely for railroad mainline service, but occasionally, there is no choice in the railcars an elevator receives to load. Because of increasing competition and governmental regulations on safety and reliability, many shortlines will be forced to decide whether they will upgrade their lines to accommodate larger capacity railcars or cease operations (Bitzan 2001). The increasing percentage of railcars originating in these larger capacity cars can be seen in Figure 2.2.

Figure 2.2: Percentage of Grain Hopper Cars Originating in 286,000 Pound Cars - U.S.



(Bitzan 2001)

In 2005, the United States Government offered a tax credit to smaller operating lines for upgrading their infrastructure to handle the new industry standard of 286,000lbs. In early 2012, however, the shortlines are asking for an extension of the credit because they are continuing to face high costs in upgrading (Argus Media 2012).

2.2 Shipping Grain

In the United States, wheat travels from farm to processor by three modes: rail, truck, or barge. Grain transportation encompasses more commodities than just wheat, but all of the grain commodities face the same challenges. The amount of grain transported over the last few decades has increased 70%. Of the grain transported, about 1/3 of the annual amount is shipped by rail. Farmers face challenges like railcar shortages and train delays which they believe negatively impacts their potential profits especially during busy harvest seasons. The railroad's argument, however, is that they cannot be expected to expand their operations because of a short-lived spike in demand that only occurs once or twice per year (Frittelli 2005).

Rail competes with other modes when moving grain from origin to destination. Most grain will have been handled by at least two modes of transportation to reach its final destination. Between 1978 and 2000, trucks increased grain hauling by 170%, barges increased by 43% and rail increased by 13%. Each mode increased but at different rates because of various reasons. Trucks are more economical for hauling grain over short distances (<250 miles). Rail and barge favor hauling larger quantities over longer distances. Looking at rail specifically, farms are consolidating as well as the railroads which impacts smaller farmers and elevators because the shortline (regional) railroads are being bypassed in the supply chain. The industry is moving away from single shipments and towards unit and shuttle train operations (25 and 100 railcars, respectively). In 1999, 10% of wheat shipments were handled by unit trains and that number continues to grow today because of railroad incentives for shippers (Frittelli 2005).

2.3 The Outbound Perspective

The Director of Transportation at ConAgra Mills in 2002 began raising the questions "what are we shipping?" and "how do we improve?". At the time, ConAgra Mills was focused on its bulk truck shipments from the mills to its customers. As an analysis was done, it was discovered that the weights on the trucks being shipped created a normal distribution bell curve. So by asking the question "how do we improve?" a newly designed team created goals that began with the concept that if 50% of loads could be loaded at the average of the distribution or better, why couldn't 100% be better than average?

Even further than just improving the lower half of the distribution, the team created goals by mill location to increase the average weight of trucks loaded. This landed at about 1 standard deviation point from the previous average. Finally, to improve even more, ConAgra Mills engaged our vendors, in this case trucking companies, to "trim the fat" by improving and lightening equipment to reach lower tare weights. Through many iterations and some difficulties in getting all of the mills onboard with the project, by 2006 each mill had a goal to reach when loading bulk trucks. The financial gain during the first year exceeded $2 million dollars. So, after all of this success, ConAgra Mills wanted to see how they could improve their other mode of moving bulk flour – rail.

To keep momentum for this project on the outbound rail side of the business, the mills had to know how much they should be loading into a railcar. The goal of the program is simply, the more flour shipped in each railcar, savings would eventually occur when one less railcar is needed to fulfill customer demand. These encompass financial and operational savings. With each railcar having different characteristics related to load limit, a tool needed to be developed that could show the mills by car, what their goal would be. ConAgra Mills leases all of the railcars used to ship flour to customers, truck transfer terminals, and between mills. With the knowledge of all of the possible railcars that could be shipped, the UMLER information for each railcar was easily accessed. Then, it needed to determine what the goal weight should be. These goals were set based on varying factors but mainly historical performance with a stretch goal.

A database tool was created so that the mill could easily calculate the goal for each individual railcar as equipment was being assigned to orders. This tool took into account the originating mill, railcar number, and destination customer due to any customer specific exceptions. Exceptions are always possible, whether it is a weight restriction at the origin mill or customer destination, or a special customer request. These are accounted for in exception tables so that they are not counted against a mill's performance. Each mill was then score carded against their goal and the results were factors in their key performance metrics which leads to the awarding of "plant of the year." This created a lot of motivation for plants to perform well. As the program proved its effectiveness, ConAgra Mills integrated the goals into the systems used to manage customer orders. Development of the program led to these goal values being available for the mills to see in the order management system. Most recently, ConAgra Mills transitioned to a new order management system, and from the beginning of the design, these goals were required because they are an integral part of mill operations.

CHAPTER III: METHODS

3.1 Opportunity Cost

In economics, the opportunity cost in terms of a resource is the value of the next highest-valued alternative use of that resource (Henderson 2007). In this case, the resource is the railcar the shippers are using to load wheat which is then sold to ConAgra Mills. By using the issue of under-filling railcars short of their actual capacity as a study in opportunity cost, ConAgra Mills will be better able to show shippers the value in utilizing railcar capacity to the fullest. In this study, the opportunity cost will be represented as a dollar per pound figure. Another way that opportunity cost will be shown is in the calculation both of how many railcars could have been saved when shipping the same volume of grain and how much more grain could have been shipped using the same number of railcars.

3.2 Data Collection

ConAgra Mills uses a grain accounting system that stores all pertinent information about a railcar of wheat. Through an export of the data, the following information are extrapolated for analysis: railcar number, shipper name, origin, destination, unload date, and unload weight. Information from the contracts to which each railcar is applied can also assist in understanding the freight basis. The freight basis shows the allocation and responsibility of paying freight charges between ConAgra Mills and the shipper. However, there are some data that will need to be excluded from the financial portion of this study. In some situations, ConAgra Mills buys wheat in railcars from non-traditional origins. The reasons for this activity could be variance in the crop quality and size or a geographic convenience that cannot be ignored. Either way, most of these shipments are bought on a delivered freight basis which means the shipper is responsible for all of the freight. ConAgra Mills also buys approximately 8% of wheat from Canadian origins. Some of those shipments are bought on a delivered freight basis. Others are bought on a Rule 11 freight basis where ConAgra Mills takes over possession and responsibility of freight charges at a major junction city, i.e. Chicago. In either situation, ConAgra Mills does not traditionally manage the freight expenses on the delivered shipments and the origin carriers of the Rule 11 shipments. Therefore, those expenses are unknown. Those bought on a Rule 11 freight basis can be included for the portion of freight ConAgra Mills is paying to the delivering railroad. All of the data, however, can be used in determining volume variances in the railcars.

Each railcar has a set of characteristics maintained in the UMLER database. ConAgra Mills currently receives updates on a yearly basis of UMLER characteristics from a third party provider. This information is kept in a SQL file that can be imported into a database for analysis. This file holds the maximum load limit for every railcar that will be compared to the actual loaded amount of wheat to determine the loading variance. There are several reasons that a railcar may not have a record in the UMLER database. Newly constructed railcars since the last file update and railcars currently out of service for repair or in storage will not be in the file. If these cars were shipped in the time frame of the data used in this analysis, there are other ways to determine the UMLER characteristics. Each railroad maintains an UMLER application found on their website. Any needed information can be found from the railroad directly.

There are several ways to determine and assign a freight cost per railcar. ConAgra Mills receives railcars shipping on tariff and contract rates. Tariffs are public documents published by each railroad outlining costs per railcar based on origin and destination pairs. These are usually grouped by origin region or destination region as well as by commodity shipped, number of cars in the shipment, and any other criteria that distinguishes those rates from others. For example, on the BNSF, the rate from Jamestown, North Dakota to Chicago, Illinois is found in a tariff with all BNSF origins in North Dakota, South Dakota, Minnesota, and Montana. Each railroad publishes a large volume of tariffs. Often, for shippers of commodities, daily checking of tariffs is the only way to stay current on the changing rates. ConAgra Mills enters into contracts mainly with carriers in the eastern United States. This is because a large volume of wheat is shipped in railcars to the eastern part of the country and contract rates allow ConAgra Mills to maintain a consistency when it comes to the highest volume locations and therefore, the largest freight expenses.

In addition to freight rates per railcar shipped, the fuel surcharge paid to move the railcar is factored in. Fuel surcharge is based on oil prices and is published by each railroad every month. Different railroads use different ways to charge for fuel. Five of the six carriers ConAgra Mills uses calculate fuel as cents per mile. This means the calculation of fuel surcharge per railcar is the number of miles multiplied by the cents per mile figure. One railroad, the Norfolk Southern, charges fuel surcharge as a percentage of the rate per railcar. Either way, the railroads calculate the figure based on oil prices, which is called a fuel peg. Because this contributes to the expense involved in shipping a railcar, the fuel surcharge is always determined for each shipment.

3.3 Data Analysis

The first step in the analysis is to understand ConAgra Mills' weight goal. After consulting with the ConAgra Mills grain buyers, it was determined that a realistic goal that all shippers should be able to meet is 98.5% of actual capacity. This is based on the experience of shippers, availability of track scales to weigh the railcars and knowledge of specific shipper practices. To then determine a railcar's goal net weight, each railcar that ConAgra Mills received is be compared to its UMLER statistics and the actual net capacity will be multiplied by the goal, resulting in the fill goal net weight. Once the fill goal net weight is determined, a comparison is done between the shipped net weight of the car and its goal net weight. This variance will be calculated as both a pounds, and percentage per railcar, figure. It can then be determined how many railcars currently meet this goal and how many do not. By knowing this variance per railcar, a variety of other analyses can be performed to present different opportunities.

The first opportunity that can be presented to shippers is loading efficiency. There are two ways this can be achieved. The first is by showing shippers how much additional grain could have been loaded into a shipment of railcars. For example, if a shipper is under-filling a jumbo railcar (approximately 222,000 pound load limit) by 10%, they are missing the opportunity to ship 22,200 more pounds of grain for the same price. Alternatively, the second way to highlight loading efficiency is by showing shippers how many railcars they would not have needed to ship if they loaded all of the railcars to capacity. For example, if a shipper sends a group of 11 jumbo railcars all under-filled by 10%, they could have saved shipping an entire railcar if they filled the other 10 to capacity.

The second opportunity is for ConAgra Mills to understand shipper performance and how much additional grain could be shipped to each mill. This can be achieved by sorting the data by shipper and averaging the percentage of under-fill per car. A further analysis could be done by origin so that within each shipper, the performance of each origin can be determined. These analyses offer ConAgra Mills an opportunity to have a discussion with shippers about the organization's expectations of shipper performance. These discussions can lead to productive collaborations with shippers to help improve their overall loading efficiencies. The other opportunity for ConAgra Mills is to understand how much more overall grain could be shipped to the mills. By analyzing each mill location and the cars shipped, how much more grain could have been brought in if all railcars were loaded to capacity can be determined, as well as potential operational efficiency savings that could have been achieved if the same amount of grain was shipped in fewer railcars. These savings could come in the form of demurrage, time, and labor costs.

The third opportunity that could be calculated is the freight and fuel valuation of the under-fill of each railcar. The cost to ship a railcar is based on the UMLER statistic gross weight on rail. This is the total allowable weight of the railcar. The price per railcar, however, is the same even if a car is under-filled by 10%. This offers an opportunity to understand the value of the percentage under-filled in each railcar by multiplying that amount with the freight and fuel rates. These figures apply a dollar amount to each railcar and show shippers the potential savings opportunity for those cars on which they pay the railroad's freight invoices. It also shows ConAgra Mills their savings opportunity for those cars for which they pay the freight to the railroad. Depending on the contracted freight basis, a figure could also be calculated for ConAgra Mills to understand the opportunity when freight and fuel is rebated to the shipper. Because of constraints in data availability, this will not be in the scope of this analysis. Financially, only those shipments where freight was paid directly to the railroad will be analyzed for potential opportunity.

3.4 Data Used

The data used in the analysis of this study were sourced from multiple locations. The first source was ConAgra Mills' wheat financial accounting system, Agris. This system holds all of the data for every inbound shipment of grain received by any of ConAgra Mills' facilities. Using two reports modified specifically for this study, The following pieces of information about each railcar of wheat shipped was extracted: origin, destination, railcar ID (letters and numbers), ship date, lead railcar ID, and net weight. Each of these pieces of information is manually entered into Agris by a ConAgra Mills employee. Most of the data entry and management is handled by the financial settlements group. This study uses a complete set of data from ConAgra Mills' fiscal year 2011 which spans from May 31, 2010 through May 29, 2011. In this fiscal year, there were 22,351 observations.

The second source of information used in these analyses was Open Database Connectivity (ODBC) tables. These are stored on ConAgra Mills' servers for use in database analysis. Specifically, the UMLER database file that ConAgra Mills sources from a third party was utilized. Through a series of queries in Microsoft Access, the following characteristics for each railcar shipped were extracted: total weight on rail (gross weight limit), tare weight (weight of the physical railcar), and load limit (total weight on rail minus tare weight). All 22,351 observations from Agris were matched to their unique UMLER data.

The third source of information is railroad issued freight tariffs and contracts and was used mainly for the financial piece of this analysis. The first use of this tariff information was to determine which potential origins cannot handle heavy capacity railcars for loading. Within a tariff item, rates are separated by weight capacity and if an origin cannot handle heavy capacity railcars, a rate will not be published for that heavier capacity. Some railroads also publish a list of these origins for easier reference. The origins determined to be not heavy capable were recorded into a table within the database used for this analysis. ConAgra Mills utilizes railroad tariff offerings as well as entering into contracted rate agreements with carriers. To understand potential financial opportunities on a select group of movements, the following information from those tariffs and contracts was extracted: rate, fuel surcharge, and mileage. This led to the fourth source of information which was ConAgra Mills' freight payables records. For the inbound shipments of wheat, the freight expense is recorded in Agris, but not separated by type of expense. So, by using both the tariffs and contracts and the freight payables records, it was possible to cross reference and record the expense per shipment paid to a railroad. Because of the capacity restrictions for recording freight expense in Agris, it was necessary to limit the financial analysis to only those shipments where the railroad was paid directly due to the limited system ability to cross reference freight payables records. Of the total number of observations, 22,351, this was possible for 2,537 observations.

3.5 Data Cleansing and Preparation

To prepare the data extracted from these systems for analysis, some data cleansing and preparation through various queries in Access were necessary. To begin, it was necessary to bring together the information from the reports run out of Agris. By linking together the key fields from both reports, it was possible to pull in net weight to create a complete table with each railcar's origin, destination, railcar ID, lead railcar ID, ship date, shipper name, and net weight. The next step was to bring in the railcar characteristics from the UMLER table. After linking this table to the database, it was realized that the table formats the railcars with their prefix (letters) and number (6 digits) in different fields. This required some reformatting of data, so a modification to a set of visual basic code was developed in a different database and was used. After modification of this code, it was possible to create a table, adding two fields matching the formatting in the UMLER table. From this point, it was possible to add the total weight on rail, tare weight, and load limit characteristics for each railcar to a new table.

The next step required analyzing those origins that could not handle heavy cars for loading. Those origins were loaded into a table and the railcars from those origins were pulled so that it could be determined if any heavy capacity railcars were affected. The total weight on rail and therefore load limit characteristics were manually modified to account for those origin restrictions. These original records were deleted from the master table containing all of the data and the new modified records were appended. There is also one of ConAgra Mills' destination locations that cannot handle heavy capacity railcars. Those records affected were also replaced with modified load limits and total weight on rail capacities.

Before the analysis could begin, some time was spent ensuring that the data were as accurate as possible. In Agris, when contracts are written, they could be filled for a mill location where the cars are not actually going to be unloaded. For example, 25 railcars are bought to be sent to York, PA but are filled under a Martins Creek, PA contract because of the agreement between ConAgra Mills and the shipper. Agris needs to record those cars as inbound to Martins Creek, and then as if York bought those cars from Martins Creek, the cars are recorded as outbound from Martins Creek and inbound to York, PA which is their actual unloading destination. This is called a track-trade. So, when the data were extracted from Agris, some of the shipper names were incorrect, displaying, for example, ConAgra Martins Creek instead of the true original shipper. Therefore, the data were cleansed by looking up the original shippers and replacing those records. There were also records with fields missing data. This could have happened if an origin was not set up in Agris at the time of entry or if the same had been true of a shipper. Assistance from the grain settlements and merchandisers was utilized to research these records and correct them in the master data table.

CHAPTER IV: RESULTS

4.1 Background Analysis

In the beginning of the analysis, there were several pieces of information that could be determined relating to the demographics of ConAgra Mills' shipments. ConAgra Mills brought in 22,350 railcars of wheat in fiscal year 2011 (FY11). Those 22,350 railcars were part of 3,005 shipments. A shipment is a grouping of cars from one origin to one destination and shipped on the same bill of lading. The average number of railcars shipped in a shipment was seven. ConAgra Mills has 22 mill locations and one does not receive rail, leaving 21 locations plus three non-mill locations. The first non-mill location is Sauget, IL where railcars are loaded into barges for more economical shipping to the southeastern mills that can unload by water. The second non-mill location is South Sioux City, NE, where ConAgra Mills ships barley to be processed into a specialty grain product. These two non-mill locations account for a small number of the total railcars shipped. The third non-mill location is an elevator owned by Cargill that ConAgra Mills uses to store wheat until the mill needs it.

The top five receiving mill locations were Martins Creek, PA, Alton, IL, Commerce City, CO, Decatur, AL, and Cargill Tampa, FL (Appendix Table A.1.). They received 46% of all inbound grain railcars (Figure 4.1). On the shipment side, the top receivers were Alton, IL, Hastings, MN, Colton, CA, Commerce City, CO, and Martins Creek, PA (Figure 4.2 and Appendix Table A.2.). These differences can be accounted for by shipment size. For example, Alton, IL receives a larger amount of smaller sized shipments but less total railcars than Martins Creek, PA.

Figure 4.1: FY11 Top Inbound Receiving Mills (Total Railcars)

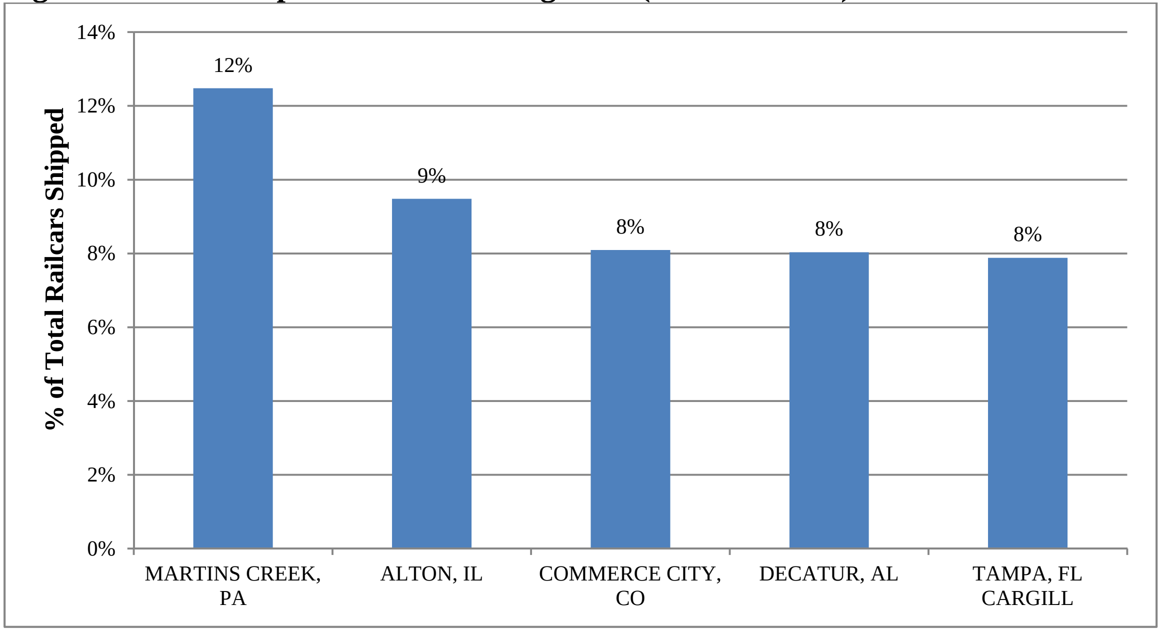
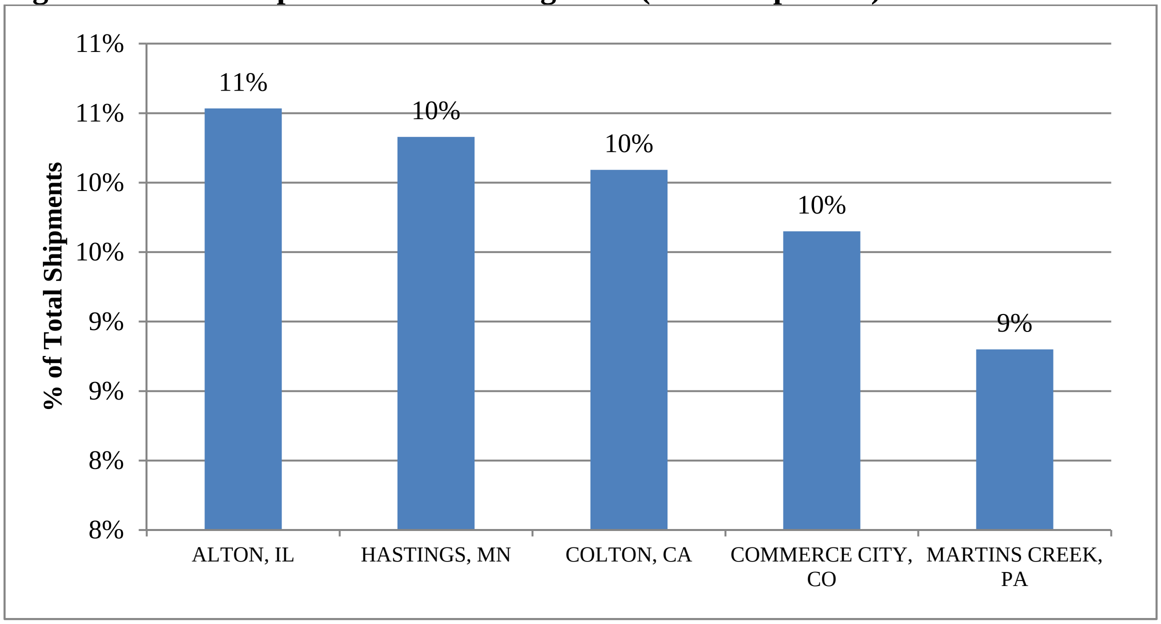


Figure 4.2: FY11 Top Inbound Receiving Mills (Total Shipments)



When looking at shippers, ConAgra Mills bought from 89 different shippers in FY11 but the top ten shippers shipped 75.75% of the inbound railcars (Figure 4.3 and Appendix Table A.3.). The same indication of shipment size can be determined by observing the difference in the percentage of total railcars shipped by shipper versus the percentage of total shipments. For example, the Canadian Wheat Board (CWB) shipped almost 12% of the total railcars but only 5% of the total shipments, indicating that their shipments have a larger number of railcars than other shippers (Figure 4.4 and Appendix Table A.4.).

Figure 4.3: FY11 Top 10 Shippers (Total Railcars)

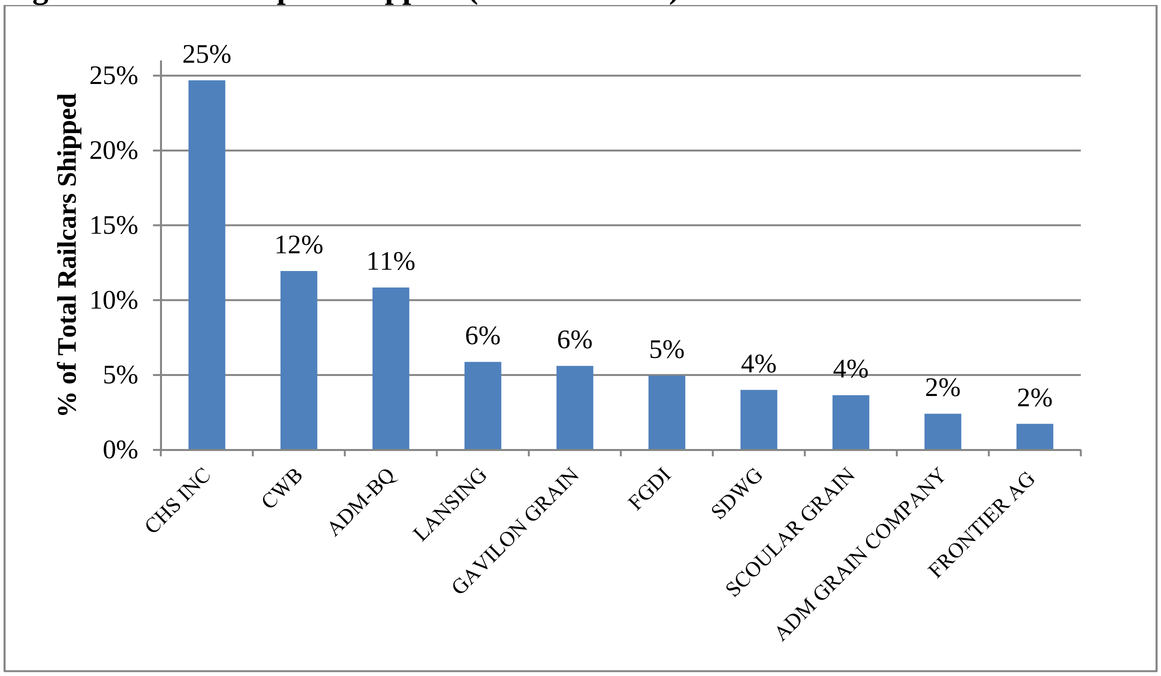
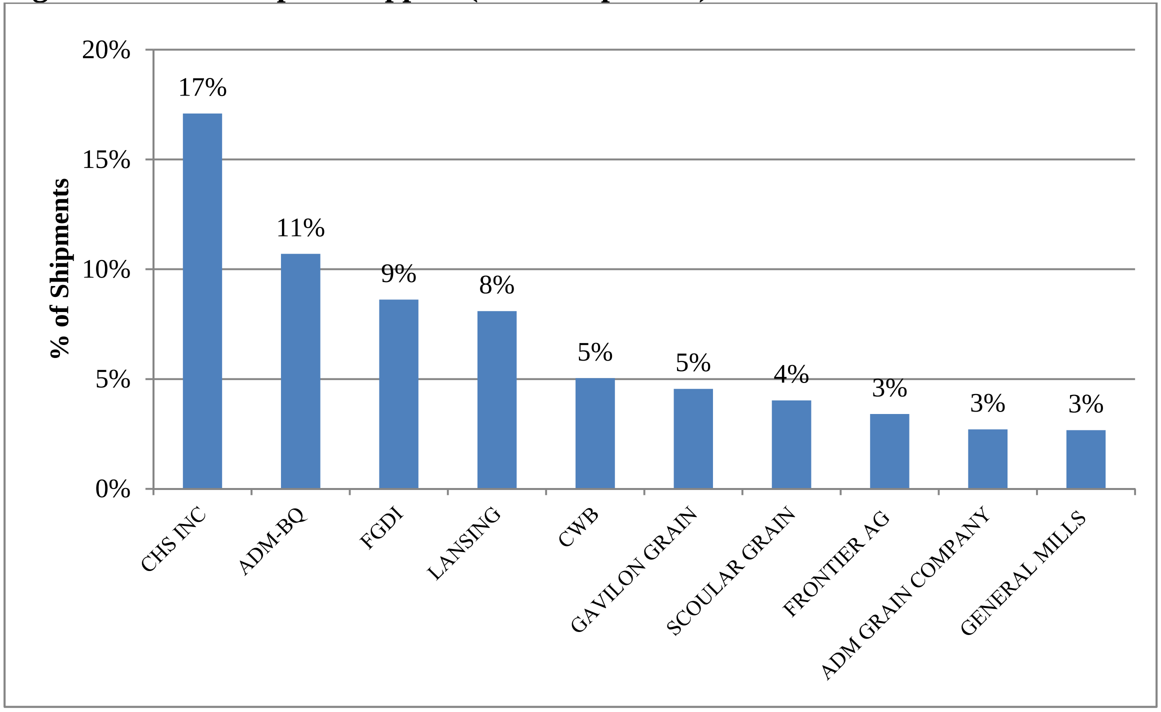


Figure 4.4: FY11 Top 10 Shippers (Total Shipments)



4.4 Capacity Analysis

To analyze railcar loading capacity, a fill goal needed to be applied to every railcar. As stated earlier, the fill goal of a railcar in this study is 98.5% of load limit. Through a set of queries and tables, the fill goal was applied and the net weight from Agris was compared to that goal. Of the total railcars shipped, 34%, or 7,656 railcars, did not meet the fill goal assigned. Of those railcars, the average percentage under-filled was 3.37% (Table 4.1). From a shipment perspective, 68%, or 2,049 shipments, had one or more railcars under-filled. The average number of cars per under-filled shipment was four. Of the 22,351 railcars shipped, 65.73% met or exceeded the fill goal. On average, they exceeded the fill goal by 1.55% (Table 4.1).

Table 4.1: Capacity Demographics

	Mean	Median	% Of Total Cars
Railcars Under Goal Weight	3.37%	1.73%	34.27%
Railcars Above Goal Weight	1.55%	1.33%	65.73%

There are several reasons for a railcar to be dramatically under the goal weight. First, there could have been an equipment issue where grain was lost in transit and so the unload weight recorded by the mill is less than the weight recorded by the shipper. Second, a weight could have been recorded incorrectly. With many of these processes being manual, whether it is filling out a weight certificate by hand or keying weights into Agris, mistakes can be made. Third, the shipper could have made an operational mistake where they thought they loaded more into the railcar than they actually did or they did not have scales to weigh the cars before they shipped. Fourth, there could have been an exception agreement between the merchandiser and shipper to intentionally ship a railcar light. With the reason unknown, the analysis indicated that there were four railcars that were loaded to less than 50% to goal capacity. These could be outliers in the sample of 7,660 railcars or one of the above reasons could be applied. Twenty-seven railcars were loaded between 50-80% of goal capacity. This leaves the majority of railcars, 7,628 or 99.5%, loaded 80% or more of goal capacity.

When analyzing the actual weight discrepancy between actual net weight and fill goal, the following was observed. There were 38 shipments where the total weight "lost" was that of an entire railcar. For example, the top under-filled shipment consisted of 31 railcars. All 31 railcars were under-filled and the total weight "lost" was 789,344lbs. This amount could have saved almost four railcars from that shipment if the other 27 railcars were filled to goal capacity. From a weight perspective, this shipper could have sent

789,000 more pounds of grain in the same number of equipment. While the average percentage for all under-filled railcars is 3.44%, these top 38 shipments were under-filled by an average of 9.2%. Based on these results, it is concluded that the hypothesis that there are potential operational efficiencies to be gained by our shippers is not rejected. Some shippers could be saving on equipment as well as time and labor in addition to cost saving on their expenses to the railroads.

Of the 89 shippers from whom ConAgra Mills bought grain, 78 of them had at least one shipment with one or more under-filled railcars. Seventy of these shippers had 50% or more of their shipments arrive at a ConAgra Mills facility with a light loaded car. Those with 100% of shipments arriving light are some of the smallest shippers, shipping less than 20 shipments; however, these results could enable ConAgra Mills to open a dialogue to understand why this is happening and how improvements could be made (Appendix Table B.1.).

From a mill perspective, there is a potential savings to be had by loading these railcars to capacity. By bringing in fewer, but fuller railcars to unload every year, there are potential savings in demurrage expenses as well as labor time and effort. At Alton, IL, which was the receiver of the most shipments in FY11, approximately 38 railcars could have been saved from unloading if the others had been fully loaded. This is assuming optimal capacity for all shipments. If one were to look at it from a weight perspective, instead of saving 38 railcars, Alton could have unloaded 7.6 million more pounds in FY11 in the same number of equipment if all railcars shipped to them were loaded to capacity (Appendix Table B.3.). Based on these results, the hypothesis that there are potential mill efficiency savings for ConAgra Mills is not rejected.

Over time, the trend of shipments with under-filled railcars follows that of total shipments; however, there are certain periods where loading percentages are higher and lower. Figure 4.5, illustrates that at some points, for example period 6 (10/25-11/28), shipping levels were better because the amount of shipments with under-filled cars did not rise from period 5 with the overall shipment levels. Period start and ending dates can be found in appendix table C.1.

Figure 4.5: FY11 Shipments by Fiscal Period

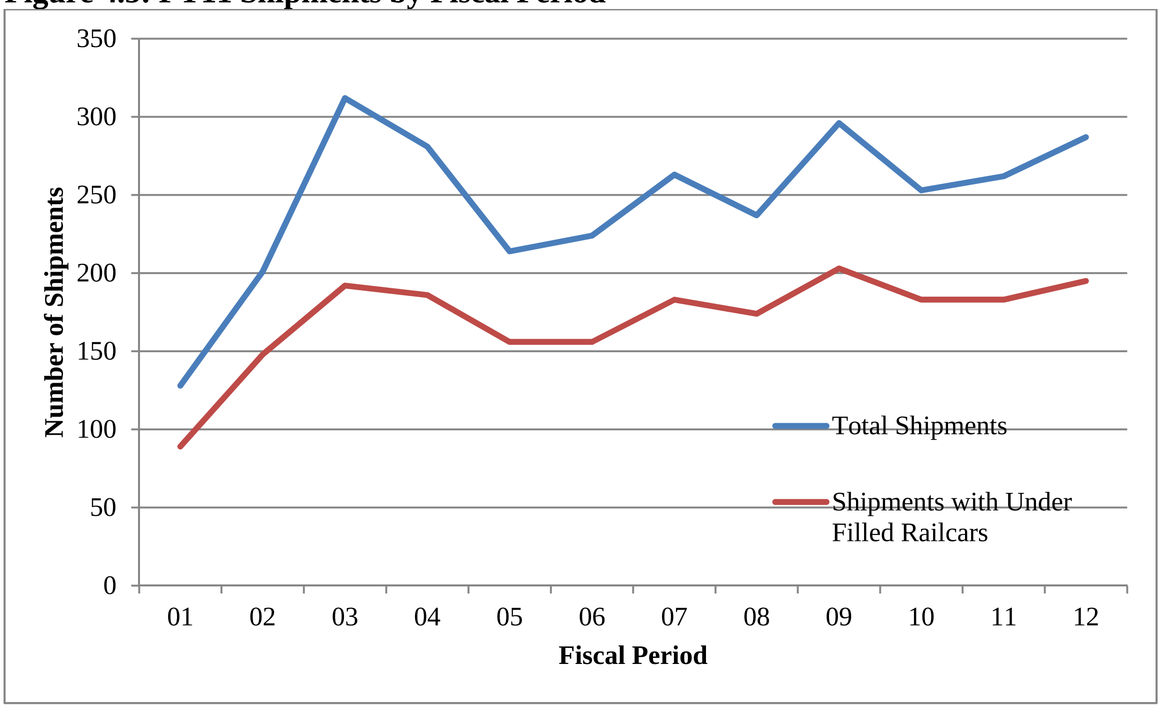
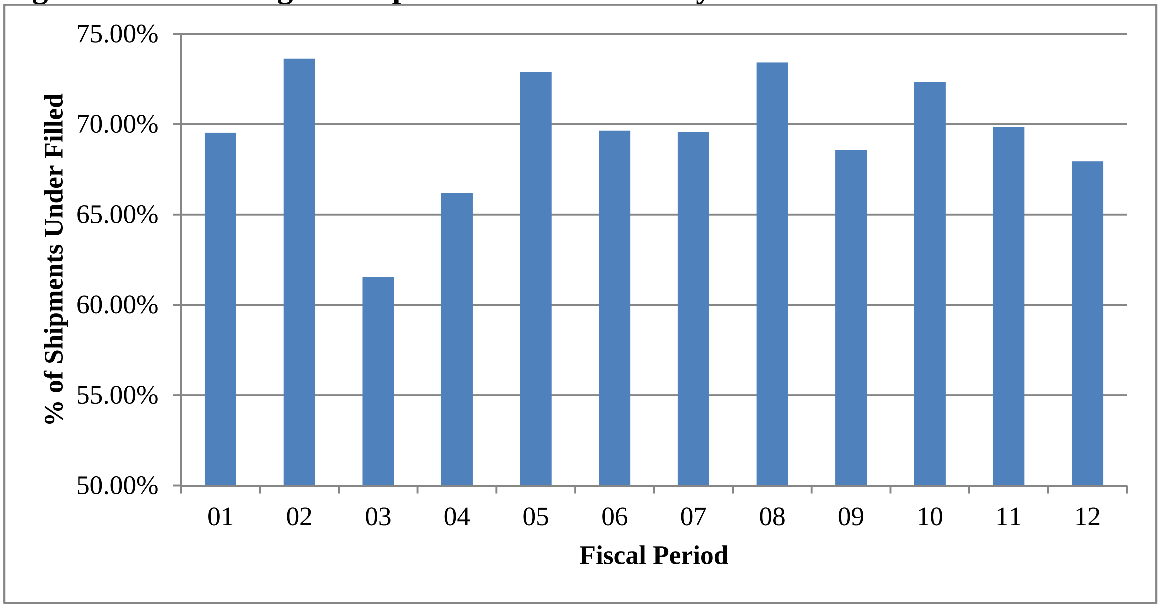


Figure 4.6, outlines the percentage of those shipments that were under-filled versus the total number of shipments (Appendix Table C.2.). The variation in performance between periods could be attributed to time of year. The busier harvest times (period one through period six) may produce higher efficiencies in loading versus other times of year like winter when efficiencies generally drop in industries where workers spend a lot of time working outdoors.

Figure 4.6: Percentage of Shipments Under-Filled by Period



4.5 Financial Implications

Of the 7,656 railcars that were under-filled, ConAgra Mills paid freight to a railroad for 2,537, or 33%. To assign a cost to each railcar, railroad tariffs and contracted rates were used to calculate an opportunity cost (Appendix Table D.1.). The concept of an opportunity cost comes from the fact that one price is paid per railcar regardless of whether the railcar is loaded to capacity or not. Therefore, by under-filling the railcar, there is a dollar amount that can be associated with that lost capacity. To arrive at the cost assigned to each railcar, the total expense paid for the railcar was multiplied by the percentage that the railcar was under-filled.

$$Dead\ Freight = total\ freight\ expense * \%\ underfilled$$

Equation 4.1: Dead Freight Calculation

For the 33% of railcars where expenses were paid to the railroad, the total opportunity cost is $253,500. That is approximately 3.5% of the total expense of these railcars which was $7.2 million. Based on these calculations, the hypothesis that there are potential financial opportunities for ConAgra Mills by encouraging and working with shippers to more efficiently load railcars is not rejected.

Performing a statistical analysis of these financial results further supports the hypothesis that there are savings to be had when railcars are under-filled. The null hypothesis tested was H_0: $\mu = 0$. This was a one-sided t-test because if a railcar is under-filled, the expected result is for there to be positive savings found for that railcar. The equation for t is as follows:

$$t = \frac{\mu}{\sigma/\sqrt{n}}$$

4.2: One-Tailed T-Test

where μ is the mean of the sample, σ is the standard deviation of the sample, and n is the sample size. The T statistic was calculated to be 28.87 (Table 4.2).

Table 4.2: One-Tailed T-Test Results

One-Tailed T-test	
Mean	$99.92
Std Dev	174.36
Sample Size	2537
T-stat	28.87

Because of the large number of degrees of freedom (sample size – 1= 2536), the observed value from the t-table (t-critical) is smaller than the calculated t-value of 28.87. Therefore, $t_{calc} > t_{crit}$ and the null hypothesis of zero savings in this statistical test is rejected. It is statistically supported that there are savings to be had when railcars are under-filled.

CHAPTER V: CONCLUSIONS

5.1 Summary

The objective of this thesis was to examine the opportunity cost of inbound railcars that are not being optimally loaded with wheat and shipped to ConAgra Mills' facilities. An analysis of data from the entire fiscal year of 2011 was conducted, comparing actual versus optimal weights. Of those railcars that did not meet that optimal weight, a cost was assigned based on total freight expenses paid, to determine how much "dead freight" or extra freight was being paid for space not utilized.

The data utilized were sourced from multiple locations, both internal and external to ConAgra Mills. The accounting system, Agris, supplied origin, destination, shipper, railcar ID, shipment ID, and net weight. UMLER data was extracted from an external database file and supplied total weight on rail, tare weight, and load limit characteristics for each railcar. Finally, railroad freight tariffs and ConAgra Mills' contracts were used to assign freight expenses to each railcar not meeting the goal weight where a railroad was paid directly.

Three hypotheses were examined for this thesis. The first expected that there were financial benefits to the shipper by increasing the level at which they load railcars of wheat. This was supported as it was observed that in some cases, fewer railcars would have been necessary to haul the same number of pounds of wheat if all the railcars of the shipment were loaded to capacity. This saves on total freight expenses. The second hypothesis predicted that there were financial benefits for ConAgra Mills when shippers increase the level at which they load railcars of wheat. This was supported by cases where ConAgra Mills paid freight to the railroads directly. If the shippers optimize the weight shipped per railcar, there is opportunity to decrease the number of railcars shipped or more grain could be shipped in the same number of equipment. The total opportunity cost for the sample of observations where ConAgra Mills directly paid the railroad was $253,500. Hypothesis three was that there could be an efficiency benefit by loading more into the railcars to fully utilize the railcar's capacity. This was supported because of the potential to decrease equipment used to ship the same amount of grain or ship more grain in the same amount of equipment. This creates operational efficiencies and can decrease loading demurrage and switching expenses.

5.2 Limitations

The limitations of this study begin with the reporting and information capabilities of Agris. ConAgra Mills uses Agris as the central accounting system for inbound grain. The way that ConAgra Mills chooses to use Agris reduces the effectiveness of reporting, and therefore its analytical capabilities. The first limitation is that freight expenses are summed together for the entire shipment instead of each expense (linehaul, fuel surcharge) separated on a per car basis. This one expense is applied only to the lead railcar of the shipment. Therefore, trying to extract the expense per railcar is difficult with extreme time and effort. Also, the inconsistencies with which contracts with shippers are written make analyzing freight basis information a challenge. It was not possible to extract the freight basis information for the contract applied to each railcar because of reporting constraints. That field would be a valuable piece of any further analysis, if it was consistent in nomenclature and format.

The reporting functions of Agris are not very user friendly for daily users. Its limitations with page width and the vast number of field choices makes creating and modifying reports very cumbersome. Also, understanding what each field choice represents can be difficult if the field in the reporting application differs from what the field name is in the everyday operational applications. If future applications for this study arise, the assistance of an Agris expert may need to be employed to extract the most accurate data from the system. Also, if Agris is going to continue to be ConAgra Mills' inbound accounting system, a re-design of the way information is entered such as freight expenses may need to be considered for easier and more accurate analysis.

Other limitations of this study include some operational and technical knowledge that was not considered. For example, each crop, or batch, of wheat has a characteristic of test weight. Test weight is the pounds per bushel of wheat. This characteristic can be influenced by environmental factors that each crop could endure such as drought, moisture, temperature, and insect damage (Rankin). If the test weight is extremely low for whatever reason, the railcar could be physically full and the weight could never reach the goal weight set by this study. This factor was not considered as a possible exception to the fill goals. If future applications are found for this study, an exception system for situations like this would need to be established.

5.3 Incentives

This data could better equip ConAgra Mills in discussing operational and financial efficiencies with shippers. It can also open the door for discussions around incentives for improvement. The capacity analysis results could incentivize shippers to invest in better loading equipment, such as railroad track scales for more accurate weighing or more automated loading systems. From an efficiency standpoint, shippers could be incentivized to be more precise in loading railcars to capacity to save on time switching and loading if they can load less equipment to hold the same amount of grain. Their financial savings can be observed once they understand that they can ship more grain for the same price in every railcar and that those dollars are measurable and are substantial over time. There are potential savings in demurrage costs as well.

ConAgra Mills can also benefit from this analysis in the inter-mill shipments of grain. ConAgra Flour Milling is the shipper with the highest opportunity cost at almost $34,000 in FY11 (Appendix D). Commerce City Grain, a joint venture between ConAgra Mills and another elevator in Commerce City, CO, has also shipped cars that were under-filled. Holding internal movements to the same standard as outside shippers will help to improve operational efficiencies when it is required to ship grain from one facility to another.

5.4 Future Applications

There are many potential future applications for analysis similar to this on a daily basis. In 2012, ConAgra Mills is embarking on a software implementation for transportation management that will eventually import and store most, if not all, of the data used in this analysis via an interface with Agris. By beginning this implementation from the initial design, there could be the potential to incorporate these points of analysis so that frequent reporting can be done to monitor progress and scorecard shippers. This opportunity will allow ConAgra Mills to more effectively communicate with and demonstrate to shippers how their efficiency in loading railcars can benefit both themselves and ConAgra Mills. Using current data to show a virtual real time snapshot of performance and opportunity from both a fiscal and efficiency standpoint can allow for better reaction and corrective action to be taken by shippers.

Once ConAgra Mills' expectations are communicated and understood, shippers can begin to work toward meeting those expectations. ConAgra Mills can then decide whether shippers should be responsible for lost freight expenses due to railcars being under-filled. Some suggestions would be assessing responsibility based on past performance, after a grace period of adjustment, or on a percentage basis. Assessing based on past performance would incentivize shippers to improve over a certain time period and keep improving until the goal has been met. After so many periods of continual improvement, their responsibility for freight expenses would lessen or stop. Allowing all shippers a grace period to understand ConAgra Mills' expectations will also give them time to implement their own procedures to ensure that they are performing as efficiently as possible. Finally, assessing responsibility for expenses on a percentage basis, i.e., owing a percentage of the total opportunity cost for under-filled railcars which could lessen and stop over a period of time with continual improvement, could also incentivize shippers to modify or re-design their processes to improve performance.

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APPENDIX A: DEMOGRAPHIC DATA

Table A.1: Railcars Unloaded per Mill Location

Destination	# of Railcars
MARTINS CREEK, PA	2,789
ALTON, IL	2,119
COMMERCE CITY, CO	1,809
DECATUR, AL	1,796
TAMPA, FL CARGILL	1,762
HASTINGS, MN	1,627
SAGINAW, TX	1,591
COLTON, CA	1,394
OAKLAND, CA	1,271
YORK, PA	1,058
COLUMBUS, OH	680
LOUDONVILLE, OH	671
MACON, GA	574
SHERMAN, TX	542
TREICHLERS, PA	464
OMAHA B MILL	459
TAMPA, FL	417
FREMONT, NE	381
SAUGET, IL	305
OMAHA A MILL	265
DENVER, CO	196
CHESTER, IL	76
SOUTH SIOUX CITY, NE	57
NEW PRAGUE, MN	48

Table A.2.: Shipments Arrived per Mill Location

Destination	# Shipments
ALTON, IL	310
HASTINGS, MN	304
COLTON, CA	297
COMMERCE CITY, CO	284
MARTINS CREEK, PA	259
OAKLAND, CA	258
DECATUR, AL	186
TAMPA, FL CARGILL	163
MACON, GA	119
TREICHLERS, PA	107
SAGINAW, TX	106
COLUMBUS, OH	85
YORK, PA	78
DENVER, CO	60
SHERMAN, TX	57
LOUDONVILLE, OH	53
OMAHA B MILL	42
SAUGET, IL	36
FREMONT, NE	31
OMAHA A MILL	29
CHESTER, IL	25
TAMPA, FL	22
SOUTH SIOUX CITY, NE	18
NEW PRAGUE, MN	14

Table A.3.: Top 10 Shippers by Number of Railcars Shipped

Shipper Name	# of Railcars
CHS INC	5,517
CWB	2,671
ADM-BQ	2,425
LANSING	1,314
GAVILON GRAIN	1,254
FGDI	1,109
SDWG	895
SCOULAR GRAIN	818
ADM GRAIN COMPANY	540
FRONTIER AG	389

Table A.4.: Top 10 Shippers by Number of Shipments Shipped

Shipper Name	# Shipments
CHS INC	492
ADM-BQ	308
FGDI	248
LANSING	233
CWB	145
GAVILON GRAIN	131
SCOULAR GRAIN	116
FRONTIER AG	98
ADM GRAIN COMPANY	78
GENERAL MILLS	77

APPENDIX B: CAPACITY DATA

Table B.1.: Percentage of Shipments with Under-Filled Railcars by Shipper

Shipper	Shipments with Under-Filled Cars	Total Shipments	% w/ Cars Under
CHS INC	326	492	66.26%
ADM-BENSON QUINN	184	308	59.74%
FGDI LLC	184	248	74.19%
LANSING TRADE GROUP LLC	172	233	73.82%
THE CANADIAN WHEAT BOARD	123	145	84.83%
GAVILON GRAIN LLC	85	131	64.89%
SCOULAR GRAIN	75	116	64.66%
FRONTIER AG INC	78	98	79.59%
ADM GRAIN COMPANY	43	78	55.13%
GENERAL MILLS OPERATIONS LLC	55	77	71.43%
SOUTH DAKOTA WHEAT GROWERS	22	64	34.38%
MORELAND GRAIN & SEED	43	59	72.88%
PARRISH & HEIMBECKER INC	52	55	94.55%
PASLEY'S GRAIN SEED & FEED	25	55	45.45%
MAYCO EXPORT	43	52	82.69%
CENTENNIAL GRAIN LLC	44	50	88.00%
COLUMBIA GRAIN INTL INC	12	45	26.67%
FRENCHMAN VALLEY FARMERS COOP	35	42	83.33%
COLUMBIA GRAIN	22	39	56.41%
COMMERCE CITY GRAIN	23	36	63.89%
AGRISOURCE INC	30	34	88.24%
EAST BENCH GRAIN & MACHINERY	12	29	41.38%
VITERRA	21	23	91.30%
ALABAMA FARMERS COOPERATIVE	21	22	95.45%
CONAGRA FLOUR MILLING	18	18	100.00%
WEST PLAINS COMPANY	17	17	100.00%
SHAY GRAIN COMPANY	10	17	58.82%
DAKOTA MILL & GRAIN	15	16	93.75%
SNYDER & COUNTS FEED SEED & SUPPLY CO	13	15	86.67%
ADAMS GRAIN COMPANY	8	13	61.54%
ATTEBURY GRAIN	7	13	53.85%
FLAGLER COOPERATIVE ASSOCIATION	12	12	100.00%
WESTERN SKY FARMS	7	12	58.33%
DECATUR COOP ASSN	10	11	90.91%
GRAINLAND COOP	6	11	54.55%
BARTLETT & COMPANY LP	9	10	90.00%
MERCER LANDMARK, INC.	4	10	40.00%

BUNGE NORTH AMERICA	7	9	77.78%
DEBRUCE GRAIN	6	9	66.67%
FARMERS GRAIN ELEVATOR	3	9	33.33%
FARMERS COOPERATIVE GRAIN & SUPPLY	6	7	85.71%
SKYLAND GRAIN LLC	6	7	85.71%
UNITED AG SERVICE	6	6	100.00%
CARGILL INC	4	6	66.67%
CROSSROADS COOP	3	6	50.00%
AGCO INC	5	5	100.00%
HUMPHREYS COOP	5	5	100.00%
STRATTON EQUITY COOP	5	5	100.00%
WATERS FARMS	4	5	80.00%
UNITED GRAIN CORPORATION	2	5	40.00%
ELKHART COOP EQUITY EXCHANGE	4	4	100.00%
ST FRANCIS EQUITY	4	4	100.00%
CENTRAL OHIO FARMERS COOP	3	4	75.00%
GRAIN MILLERS	2	4	50.00%
HUBBARD FEEDS INC	2	4	50.00%
PARDUE GRAIN INC	2	4	50.00%
SOUTH CENTRAL GRAIN	2	4	50.00%
WHEELER COOP - MERC EQUITY UNION	2	4	50.00%
PARDUE GRAIN	3	3	100.00%
CHICAGO & ILLINOIS RIVER MARKETING LLC	3	3	100.00%
CIRCLE S SEEDS OF MONTANA INC	3	3	100.00%
KANORADO COOP	3	3	100.00%
SEIBERT EQUITY CO-OP ASSO	3	3	100.00%
FALKIRK FARMERS ELEVATOR	2	3	66.67%
REINKE GRAIN CO.	1	3	33.33%
CENTRAL PLAINS COOP SERVICE COLBY	2	2	100.00%
M&M COOP	2	2	100.00%
MONTE VISTA COOPERATIVE	1	2	50.00%
AMBER ACRES	1	1	100.00%
AMHERST COOP	1	1	100.00%
CHUCK REID	1	1	100.00%
COOK NATURAL PRODUCT	1	1	100.00%
FARMERS COOP GRAIN & SUPP	1	1	100.00%
FRY FARMS	1	1	100.00%
HORIZON MILLING LLC	1	1	100.00%
MISSION TERMINAL INC	1	1	100.00%
RIVERLAND AG	1	1	100.00%

ROWLAND SEEDS	1	1	100.00%

Table B.2.: Railcar and Weight Opportunities by Shipment

Shipper Name	Lead Car	Sum Of Net Weight (lbs)	Sum of Fill Goal (lbs)	Total Weight Difference (lbs)	Avg % Under	Total Cars	# Cars Under	Railcars Saved
ADM-BQ	BNSF488342	5,379,500	5,918,471	538,971	9.00%	27	27	2.69
ADM-BQ	EEC61318	3,610,610	3,903,949	293,339	7.36%	25	18	1.47
ADM-BQ	BN460725	2,715,265	2,948,499	233,234	7.68%	25	14	1.17
ADM-BQ	AOK66592	447,004	660,639.5	213,635.5	32.17%	62	3	1.07
ADM-BQ	EEC60187	3,217,020	3,429,868.5	212,848.5	6.01%	25	16	1.06
CHS	BN471802	4,921,330	5,287,775.5	366,445.5	6.89%	26	26	1.83
CHS	NOKL832468	4,154,700	4,442,153	287,453	6.25%	26	21	1.44
CHS	CMO515308	1,983,520	2,201,869	218,349	9.86%	12	10	1.09
CIRCLE S SEEDS OF MONTANA	MRL50080	769,637	1,010,413	240,776	22.76%	5	5	1.20
DAKOTA MILL & GRAIN	DME515041	2,192,834	2,419,948	227,114	9.35%	13	11	1.14
FGDI	BN467889	5,981,940	6,771,284	789,344	11.61%	31	31	3.95
FGDI	BN456472	6,520,614	7,035,658	515,044	7.16%	35	34	2.58
FGDI	BNSF430302	2,455,060	2,672,403.5	217,343.5	8.02%	13	13	1.09
FGDI	BNSF466819	1,532,760	1,746,897.5	214,137.5	12.20%	8	8	1.07
GAVILON GRAIN	FCTX998	4,177,930	4,594,631	416,701	8.98%	23	21	2.08
GAVILON GRAIN	UP91723	2,969,490	3,289,604.5	320,114.5	9.68%	16	15	1.60
GAVILON GRAIN	UP89869	3,006,070	3,295,022	288,952	8.72%	25	15	1.44
GAVILON GRAIN	UP77307	2,586,520	2,848,521.5	262,001.5	9.15%	15	13	1.31
GAVILON GRAIN	UP89495	2,598,900	2,856,204.5	257,304.5	8.95%	18	13	1.29
GAVILON GRAIN	BNSF430846	3,644,370	3,876,960	232,590	5.87%	24	19	1.16
HUMPHREYS COOP	CMO13630	4,621,380	5,147,905.5	526,525.5	10.11%	24	24	2.63
KANORADO COOP	NOKL823770	5,371,400	5,991,459.5	620,059.5	10.29%	30	30	3.10
PARRISH & HEIMBECKER	NDYX515059	3,991,790	4,373,104.5	381,314.5	8.62%	23	20	1.91
SCOULAR GRAIN	BNSF478797	2,972,250	3,310,191	337,941	10.17%	15	15	1.69

SDWG	CP601832	4,602,340	5,021,530	419,190	8.23%	25	23	2.10
CWB	CN388974	4,569,437	4,950,708.5	381,271.5	7.48%	25	23	1.91
CWB	CN110750	3,762,633	4,105,874	343,241	8.15%	23	19	1.72
CWB	CNA385517	3,702,954	4,038,303	335,349	8.16%	25	19	1.68
CWB	CN110474	3,377,947	3,713,056	335,109	8.88%	25	17	1.68
CWB	SKNX397347	3,787,098	4,107,942.5	320,844.5	7.61%	23	19	1.60
CWB	CEFX13542	5,573,882	5,874,737	300,855	4.90%	28	28	1.50
CWB	CNA385023	3,999,043	4,267,808	268,765	6.06%	25	20	1.34
CWB	CP601422	4,913,290	5,180,213.5	266,923.5	4.99%	25	25	1.33
CWB	NOKL830507	2,995,365	3,226,761.5	231,396.5	6.96%	21	15	1.16
CWB	CN109059	2,860,495	3,091,422.5	230,927.5	7.41%	29	14	1.15
CWB	CP601260	4,600,012	4,814,680	214,668	4.23%	23	23	1.07
CWB	CN395269	2,872,641	3,083,838	211,197	6.81%	25	14	1.06
CWB	IC798033	3,179,953	3,389,483.5	209,530.5	5.91%	25	16	1.05

Table B.3.: Railcar and Weight Opportunity by Unloading Mill

Destination	Total Weight	Fill Goal Weight	Weight Difference	# Railcars Saved
ALTON, IL	194,061,210	201,675,105.5	7,613,895.5	38
COMMERCE CITY, CO	163,129,465	169,236,002	6,106,537	31
DECATUR, AL	144,436,777	150,096,467	5,659,690	28
TAMPA, FL CARGILL	158,653,909	164,167,684.5	5,513,775.5	28
HASTINGS, MN	134,379,352	139,114,997.5	4,735,645.5	24
COLTON, CA	95,258,706	99,018,011.5	3,759,305.5	19
OAKLAND, CA	82,889,588	86,264,133	3,374,545	17
MARTINS CREEK, PA	130,379,910	133,725,274.5	3,345,364.5	17
SAGINAW, TX	70,712,438	73,669,824.5	2,957,386.5	15
SAUGET, IL	25,672,884	27,362,315	1,689,431	8
MACON, GA	56,127,882	57,708,293.5	1,580,411.5	8
YORK, PA	43,374,333	44,773,667.5	1,399,334.5	7
SHERMAN, TX	30,223,174	31,474,197.5	1,251,023.5	6
TAMPA, FL	49,506,847	50,746,806	1,239,959	6
COLUMBUS, OH	30,873,084	31,873,713.5	1,000,629.5	5
LOUDONVILLE, OH	32,328,292	33,264,829	936,537	5
OMAHA B MILL	20,832,264	21,741,806.5	909,542.5	5
SOUTH SIOUX CITY, NE	7,984,690	8,596,193.5	611,503.5	3
DENVER, CO	14,841,804	15,407,468.5	565,664.5	3
OMAHA A MILL	13,203,899	13,682,832	478,933	2
TREICHLERS, PA	16,576,594	17,031,339.5	454,745.5	2
FREMONT, NE	15,774,634	16,191,922.5	417,288.5	2
CHESTER, IL	7,073,550	7,302,396	228,846	1
NEW PRAGUE, MN	5,188,780	5,350,323	161,543	1

APPENDIX C: FISCAL YEAR DATA

Table C.1.: Fiscal Year and Period Dates

Period	FY	Begin Date	End Date
01	2011	5/31/2010	6/27/2010
02	2011	6/28/2010	7/25/2010
03	2011	7/26/2010	8/29/2010
04	2011	8/30/2010	9/26/2010
05	2011	9/27/2010	10/24/2010
06	2011	10/25/2010	11/28/2010
07	2011	11/29/2010	12/26/2010
08	2011	12/27/2010	1/23/2011
09	2011	1/24/2011	2/27/2011
10	2011	2/28/2011	3/27/2011
11	2011	3/28/2011	4/24/2011
12	2011	4/25/2011	5/29/2011

Table C.2.: Percentage Under-Filled Railcars by Period

Period	# Total Shipments	# Shipments with Under-Filled Cars	% Under-Filled
01	128	89	69.53%
02	201	148	73.63%
03	312	192	61.54%
04	281	186	66.19%
05	214	156	72.90%
06	224	156	69.64%
07	263	183	69.58%
08	237	174	73.42%
09	296	203	68.58%
10	253	183	72.33%
11	262	183	69.85%
12	287	195	67.94%

APPENDIX D: FINANCIAL DATA

Table D.1.: Opportunity Dollars by Shipper

Shipper Name	Dollars
CONAGRA FLOUR MILLING	$33,941.26
CHS INC	$29,765.60
THE CANADIAN WHEAT BOARD	$25,882.54
FRENCHMAN VALLEY FARMERS COOP	$21,694.29
GENERAL MILLS OPERATIONS LLC	$19,867.00
ADM-BENSON QUINN	$18,284.13
AGRISOURCE INC	$13,751.04
PARRISH & HEIMBECKER INC	$8,488.48
SCOULAR GRAIN	$8,223.09
CIRCLE S SEEDS OF MONTANA INC	$7,062.42
LANSING TRADE GROUP LLC	$6,628.68
COMMERCE CITY GRAIN	$5,845.99
DAKOTA MILL & GRAIN	$5,620.45
SOUTH DAKOTA WHEAT GROWERS ASN	$5,238.60
PASLEY'S GRAIN SEED & FEED	$4,565.22
FRONTIER AG INC	$4,459.43
GAVILON GRAIN LLC	$4,325.69
FGDI LLC	$3,414.17
STRATTON EQUITY COOP	$2,675.44
DEBRUCE GRAIN	$2,663.20
AGCO INC	$2,622.13
MAYCO EXPORT	$2,400.02
FLAGLER COOPERATIVE ASSOCIATION	$2,111.19
PARDUE GRAIN	$1,818.95
WEST PLAINS COMPANY	$1,317.02
GRAINLAND COOP	$1,272.94
DECATUR COOP ASSN	$1,202.80
BARTLETT & COMPANY LP	$1,025.78
COLUMBIA GRAIN	$1,024.79
CHUCK REID	$891.86
AMHERST COOP	$801.50
EAST BENCH GRAIN & MACHINERY	$740.66
UNITED AG SERVICE	$567.65
ADM GRAIN COMPANY	$566.64
WATERS FARMS	$396.04
ROWLAND SEEDS	$355.33
PARDUE GRAIN INC	$313.18
ST FRANCIS EQUITY	$305.15
HORIZON MILLING LLC	$237.07

HUBBARD FEEDS INC	$201.00
CARGILL INC	$194.00
AMBER ACRES	$193.87
FARMERS COOPERATIVE GRAIN & SUPPLY	$146.44
FRY FARMS	$135.49
WHEELER COOP - MERC EQUITY UNION	$111.51
CROSSROADS COOP	$107.83
SOUTH CENTRAL GRAIN	$17.41
MORELAND GRAIN & SEED	$16.22
SHAY GRAIN COMPANY	$9.96
M&M COOP	$5.89