Strategies for Cost Reduction in Procuring Trucking Services

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Abstract

This thesis analyzed truckload shipment transactions from 2006 to 2008 in order to compare planned procurement activity to actual procurement activity. The research specifically focused on three costs: Primary, Actual and Market. Primary cost is the cost agreed to pay to the primary carrier and is usually contractually fixed in advance. The actual cost is the cost paid to the carrier that hauls the load and the market cost is the average cost for the lane that a shipper should pay. This market cost is a benchmarking cost available to the shippers. The comparison of planned and actual is important because it helps to develop a strategy that decreases transportation costs by identifying overpaid lanes and carriers and it helps to monitor and make corrective decisions. The research suggests that the matching of planning and execution occurred in less than 10% of the lanes and there are under and overpaid lanes. The execution rendered more than 50% of overpaid lanes and the planning showed a commitment to overpay in 45% or more of lanes. Finally this research proposes ideas to improve the truckload procurement strategy because shippers cannot afford to "plan to waste".

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1 Introduction

Shippers procure transportation services throughout the year to move their loads. The volume of transportation procured is based on a freight forecast and a planned freight cost. The estimated cost helps shippers stay within budget, analyze performance, and facilitate future transportation procurement by identifying carriers that can support their business. Deviations from the planned freight costs occur frequently, and are the result of inaccurate freight forecasts, unexpected lanes, or primary carrier failure. These deviations in cost per load (CPL) change the total estimated transportation cost. In addition, shipment data, widely available to shippers, is seldom used to the fullest extent in transportation procurement, limiting the cost savings available to the shippers.

This thesis includes five chapters. Chapter 1 explains the motivation for this research and briefly describes current transportation practices in the truckload industry. Chapter 2 includes a short literature review and presents ideas, references and other reference material. Chapter 3 describes the methods used for analysis and Chapter 4 presents results of the analysis. Finally, Chapter 5 provides the conclusions of this research.

1.1 Motivation

This research analyzes transportation costs of a truckload (TL) company, measures the procurement performance during planning and execution, and proposes strategies to reduce overall cost when procuring TL services. For example, one company may choose as a strategy finding primary carriers performing better than the market average for all lanes or a subset of lanes. Another strategy is to bundle overpaid lanes

with underpaid lanes in order to ensure the reduction of transportation costs. In other words, this thesis will provide a methodology to measure the performance of carriers and lanes during planning and execution.

Matching planned and actual transportation costs is important because it helps to develop a strategy to decrease transportation spending by identifying overpaid lanes and carriers, monitor and make corrective decisions, and keep customers satisfied. This is important to the sponsor company, C.H Robinson, one of the largest public transportation and logistics company in the US. C.H. Robinson manages planning and transportation execution for many clients using a Transportation Management Center (TMC). The TMC relies on a centralized transportation management system (TMS) to plan, manage, and monitor all transportation activities for its client as well as to standardize the data collection and share best practices across clients and carriers. The results of this research are applicable to truckload industry because TMC's are widely used manage freight, and a carrier behavior represents the others.

This research is beneficial to shippers and carriers in order to optimize the planning and execution in all lanes. Shippers could estimate overspending or savings during the planning and execution and make adjustments accordingly to reduce the transportation costs. Carriers could set better the bidding price without overestimating or underestimating. A better estimate secures proper placement in the routing guide. An overestimation prevents carriers to be in routing guide's preferred places and an underestimation reduces tender rejection.

1.2 *Current practices*

Most shippers sign contracts with carriers to transport the products in truckloads. The shipper maintains a routing guide for every route or unique origin-destination combination. The routing guide is a list of carriers that have agreed to haul loads for a specific route and an agreed upon price. Shippers rank carriers in order of preference using costs, expected product volume and carrier reliability. Cost is the most important driver in the carrier ranking therefore as the routing guide depth increases so does the cost.

The shipper consults the routing guide every time he needs to ship a load in a lane. The shipper chooses the first carrier in the routing guide and sends out a tender offer to it either electronically or manually. When the carrier receives the tender he can then accept or reject the tender. The transportation cost at which the carrier accepts to haul the load has been pre-established in the contract. The carrier can decline hauling the load due to limited capacity at the required date. The shipper gives carriers a limited time to accept or decline because a carrier's decline means that the shipper needs to go back to the routing guide and tender the load to the next carrier.

This research is limited to long-haul, dry van, full truckload shipments of over 250 miles because long-haul dry shipments are the greatest percent in terms of number of loads and total dollars spent. Another constraint added is using lanes with a minimum of 20 loads per year because lanes with less than 20 loads per year are not reliable predictors of cost or service.

2 Literature Review

2.1 Truckload Transportation Market

The 2009 Standard & Poor's Industry Survey for Commercial Transportation highlights that the trucking market is valued at $646 billion (latest figure available) and it is divided into two sectors: private carriage and for-hire. The American Trucking Association estimates that companies running their own shipping operations (i.e. private carriage) are valued at $288 billion (45% of the total). The for-hire sector is valued at $358 billion (55%). The for-hire sector is further subdivided into truckload (TL) and less-than-truckload (LTL). Truckload (TL) shipments are valued at $310 billion (87%) and the less-than-truckload (LTL) shipments are valued at $48 billion (13%).

The TL sector is privately owned for the most part, with the exception of some of the largest companies. In 2007, the three largest public companies based on revenue were J.B. Hunt Transportation Services Inc. ($3.5 billion), Landstar System Inc. ($2.5 billion), and Werner Enterprises, Inc ($2.1 billion). The two largest private companies were Schneider National Inc. ($3.4 billion), and Swift Transportation Co. Inc. ($3.2 billion). These top five carriers account for 5% of the TL value. The majority of the TL carriers (about 30,000 of an estimated 45,000 companies) had annual revenues of less than $1 million.

Truckload (TL) carriers mostly transport large shipments from point of origin to destination with no intermediate stops or handling. About 50% of the TL market, as measured by tons shipped, involves the movement of general packaged merchandise. TL carriers compete with private fleets, rail intermodal and LTL carriers. The other 50% of

the TL market includes heavy haulers, auto carriers, tankers, flatbed, bulk commodity, temperature-controlled, and other specialized carriers, and all of which compete against railroads, barges, and even pipelines. About 70% of the TL hauls measure less than 500 miles and the Truckload Carrier Association reports an average haul length of 350 miles.

In addition, the transportation cost is a significant supply chain component and a small percentage of cost reduction would create significant savings due to the large TL market size ($318 billion). Therefore identifying performance improvements during the planning and execution of transportation procurement is essential.

2.2 *Truckload Procurement Practices*

The process by which shippers procure and manage their transportation can be divided into two phases: Planning and Execution. Caplice (1996) describes the procurement process in five steps: carrier screening, information exchange, carrier assignment, load tendering and performance review. The first three steps make up the planning phase and the last two steps are components of the execution phase. Figure 1 shows the five steps of the transportation procurement process and groups the steps in planning and execution phase. The next subsections describe the planning and execution phases.

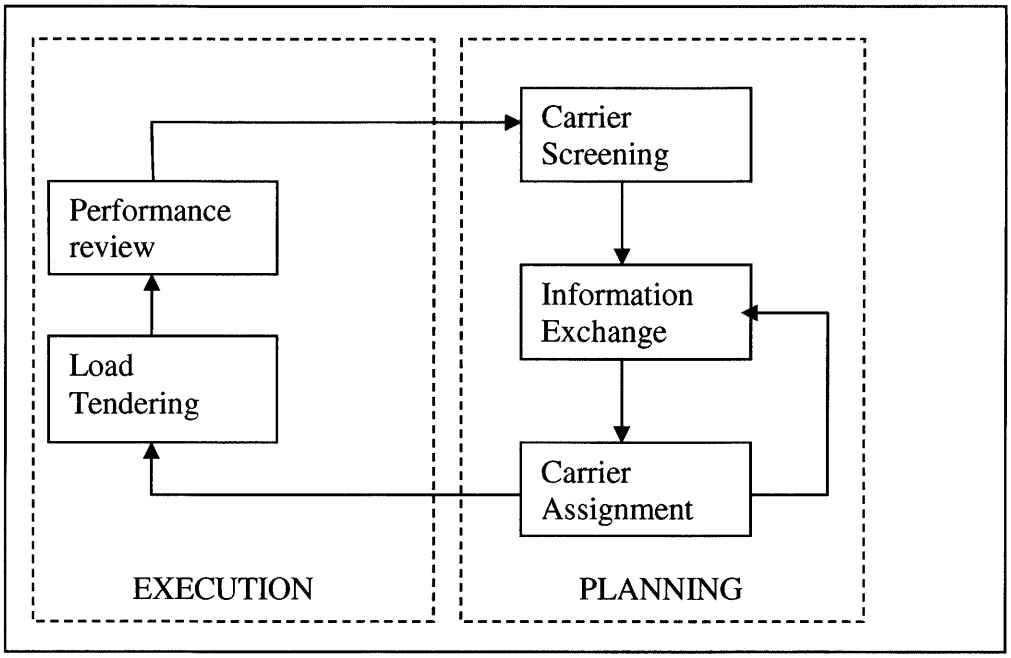

Figure 1 - Transportation procurement process

Source: Caplice (2006)

2.2.1 Planning Phase

The first step in the planning phase is carrier screening. In this step, the shipper reduces the number of potential carriers to decrease complexity, lower cost and increase service level. The second step is the iterative process of information exchange in which shippers and carriers exchange network details (e.g. lanes, volume, etc) and prices. After the information exchange has been completed, the shipper assigns carriers to its network and assembles the routing guide. The routing guide ranks which carrier is assigned to a specific load based on the lane and capacity of the carrier during execution. Routing guides can vary in complexity and can range from a paper-based system to a central electronic database that uses sophisticated software to integrate the shipper to the carrier Enterprise Resource Planning (ERP) system. These systems are known in this industry as

a Transportation Management System (TMS) and have many capabilities to manage transportation planning and execution.

Caplice and Sheffi (2003) research the carrier assignment process and describe how to find the optimal assignment of carriers to lanes within the network. They present two optimization models (1) General Carrier Assignment Model and (2) Carrier Assignment Model with Conditional Bids. They pointed out that the carrier screening step was the focus of most previous research and that it applied generic purchasing strategies to transportation applications such as reducing the number of carriers and applying certification programs.

2.2.2 Execution Phase

The execution phase has two steps: load tendering and performance review. Load tendering selects which carrier to use for each load as it becomes ready to ship. Organizations must make real time choices picking alternative carriers to mitigate changes between planning and execution. These changes include adding, moving, adjusting and deleting freight volume as a result of anticipated activities such as closing of facilities, acquiring new suppliers or mergers with other companies. The final step is the performance review of the carrier. The performance review includes carrier refusal rates, on-time rates, and other measures.

There have been efforts to reduce the cost by optimizing some of the steps in the transportation procurement process. For example, shippers have optimization tools available to select the primary carrier. These tools are benchmarking computer programs that use distance, origin and destination to provide an estimated best market cost per load (CPL) for a lane. Another example is the study conducted by Harding (2005) that points

out that some transportation contracts using optimization software may yield more expensive freight expenditures due to unplanned events during execution. He developed a transportation procurement plan that minimized unplanned events and quantifies the cost of service. Caldwell and Fisher (2008) found that truckload shipment rates are impacted by tender lead time and loads with short lead time increased tender rejections and cost.

2.3 *Transportation metrics*

Shipment data can be used to measure the performance of past procurement processes. Carriers that overbid can be replaced during transitions to the new contracts. The performance analysis can easily be made by comparing the shipment data to the initial version of the routing guide and can show where failures occurred. Organizations can then make recommendations to the shippers to adopt practices which prevent similar outcomes and to make better choices prior to transitioning.

The shipment data can be used to find transportation metrics for specific carriers. Shipment data includes origin, destination, shipment date, assigned carrier and line-haul cost. Harding (2005) listed the following useful metrics: volume flexibility or surge capability, adherence to planned costs, relative costs, relative costs between same service and capacity of primary and backup carriers. He also emphasized that there is a limitation to using this information. The limitation is that the metrics focus only on what was shipped and not the decisions that lead to the carrier assignments.

Harding (2005) describes 3 metrics to measure carrier performance: Relative Cost Index (RCI), Price-based Coefficient of Variation (PCV) and Correlation to Total Volume (CTV). The RCI is the ratio between the percent of lane costs and the percent of freight hauled. RCI values less than 1 correspond to carriers with lower rates than other

carriers serving the lane. RCI compares the relative cost of one carrier to another and fails to use a benchmarking rate. The PCV shows carrier cost variability on a given lane and this metric typically uses only the line-haul portion of the costs. PVC is defined as the standard deviation of all costs for a carrier-lane divided by the average cost of that carrier-lane. PCV only measures the variation between shipments with different rates. Finally, CTV is calculated by measuring the correlation of a carrier's volume per period on a lane to the total volume that was available on the lane. CTV also measures a carrier's responsiveness to the variability of demand and is a characterization of the type of capacity being purchased by the shipper. CVT fails to capture the decisions made between shippers and carriers because it ignores the accept-reject information and it only uses shipment data.

These three metrics are limited to compare rates from one carrier to another, variations between shipments with different rates and volume of one carrier with respect to total volume in the lane. Harding (2005) proposes the use of planned and unplanned accept-reject metrics. He argues that carriers can accept or reject the tenders and shippers expect that the percent of rejected freight will be taken it by shippers not included in the routing guide. He also points out that carriers expect increases or decreases in volume at lanes they are serving. Harding (2005) concludes that the frequency and severity of the cost overruns for unplanned freight define the degree to which rejected volume affects budgeted transportation expense. He proposes the use planned and unplanned accept ratios. This previous attempt focuses on optimizing the planning phase to reduce the overall cost by including accept and reject ratios.

The metrics described earlier fail to match planning and execution of transportation procurement and are focused on improving the planning. The metrics share the common shortcoming of excluding benchmarking market costs to measure the performance planning phase and failing to account overspending or savings in freight expenses during execution.

3 Methods

The data for truckload transportation was collected by a Transportation Management System (TMS) and provided by C.H. Robinson, the sponsor company. Data for 3 years (2006, 2007 and 2008) was compiled and provided as a database file in Microsoft Access and includes more than 2 million entries. The data collected and managed by the TMS included load number, origin, destination, carrier, cost per load, tender sequence and pick up dates. One of the critical parts in TMS systems is the routing guide, a list of carriers ranked in order of preferred tender sequence. The tender sequence starts with the carrier to whom the load is offered to first and moves down to the least favorite. The tender sequence is determined by the price and reliability of the carrier.

The data preparation included selecting a customer, removing invalid entries and applying filters to the data. These steps produced the data subset for the analysis. In the customer selection, one customer was selected among 25 because one customer is representative of the entire set of customers. Customer 1 in particular was selected because it had the greatest number of loads moved in the three consecutive years. Removing invalid entries included those with empty and content-equal-to-zero cells in the zip codes and cost per load fields. Other data errors found were loads offered twice to the same carrier and loads missing the initial carrier-tender (i.e. no initial carrier). The

filters applied excluded Canadian origins and destinations, invalid origin and destination zip codes. The filters also limited the study to long truck haul moves (over 250 miles) within the US.

3.1 Data Calculations

3.1.1 Lane Definition

A lane is defined as a unique combination of origin and destination ZIP codes served by one or more carriers. In a lane, the cost per load charged and distance driven by a carrier is not expected to vary over the year because of contractual agreements. The average cost per load is calculated to account for changes to the cost per load agreed upon. Lanes can be added and deleted each year because each node in the network including suppliers, distribution centers, and customers is subject to change. Suppliers may be added or deleted from networks requiring significantly different flows. Also, inventories may be repositioned between distribution centers impacting transportation flows.

3.1.2 Primary carrier and Primary Ratio (PR)

Every lane has three costs: actual cost, primary cost, and market cost. The actual cost is the amount paid to the carrier that takes the load. It is the execution cost of the carrier accepting the tender during execution. The primary cost is the planning cost of the first carrier (i.e. primary carrier) in the routing guide. It is the rate agreed upon with the primary carrier in the contract and is different from the actual cost only if the primary carrier rejects the load due to an unexpected increase in load volume or lack of capacity. The market cost is the estimated average industry cost for that lane and is calculated with

a bench marking tool that requires the origin, destination and miles as input. The market cost is what we expect most shippers, on average, would pay.

This research assumes that the primary carrier of a lane is the carrier with the most tendered loads. The TMS records the tender sequence with a tender number. A tender sequence of zero means that the load was tendered to this particular carrier first. If this carrier does not accept the load, then the load is tendered to the next carrier with a tender sequence equal to 1. As the tender depth increases the tender sequence increases. The primary carrier of a lane is usually the first carrier in the routing guide. If two or more carriers serving a lane have equal number of loads, the primary carrier is the one with the lowest cost per load. If two carriers have equal number of loads and the cost per load then the primary carrier is selected by alphabetical order. Figure 2 shows the process of primary carrier selection described in this paragraph. For example, in 2008 there were 2,218 unique lanes and only 609 lanes have volumes higher than 20 loads per year. Lanes served by one carrier (i.e. SCAC) are 23 and by multiple carriers 586. From the lanes served by multiple carriers, 575 lanes have with unique maximum loads and 11 lanes with equal maximum loads. In this case, the primary carrier in each of the 11 lanes is the carrier with the lowest rate.

Figure 2 shows that most lanes hauled volumes less than 20 loads per year. The high volume lanes (equal or greater than 20 loads per year) less than are served by multiple carriers and these carriers have different rates. Defining primary carriers is a very important step in the planning and execution. Transportation managers need to select primary carriers with rates at market cost to have a successful planning. Selecting carriers with the lowest rates as primary carriers does not translate in good planning

because these primary rates might not be available at the time of execution. Also selecting carriers with higher rates as primary carriers would become overspending when the primary carrier hauls the loads.

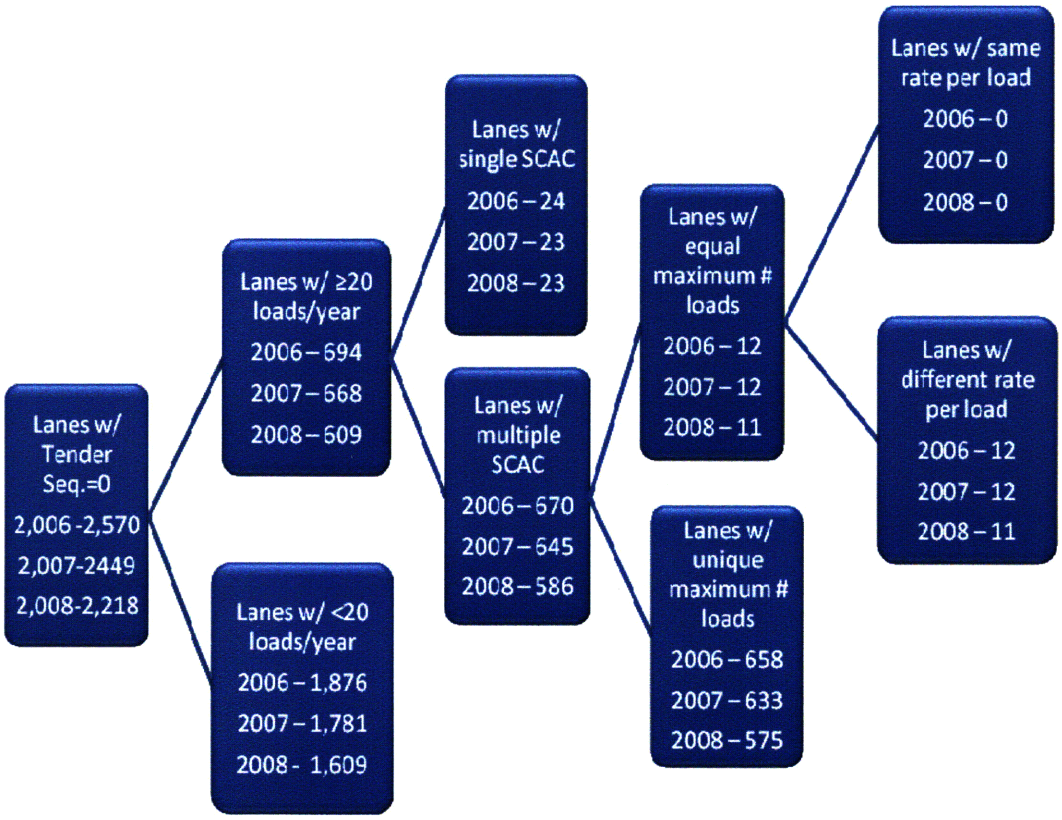

Figure 2 - Primary Lane breakdown

Next, the primary ratio is calculated. The primary ratio expresses each carrier's cost per load in terms of the primary carrier's cost per load. The primary ratio is the weighted average CPL (Cost per load) between the actual and the primary cost per lane. The formula below was used to calculate the primary ratio.

$$Primary\ Ratio = \frac{\sum_i^n \left(\frac{CPL_i}{CPL_{Primary}}\right)(Volume_i)}{\sum_i^n Volume_i}$$

Where:

CPL_i is the actual cost per load of carrier "i" which hauled the load

$CPL_{Primary}$ is the cost per load of primary carrier

$Volume_i$ is the loads hauled by carrier "i"

n is the number of carrier serving the lane

i is carrier "i"

For example, let's assume the Boston-New York lane is served by various carriers. The primary carrier, Carrier A, has a CPL of $150 and at the time of the load tendering, Carrier A does not have trucks available. The shipper goes deeper in the routing guide and finds carrier D with a CPL $200. At the end of the year, carrier A moved 40 of the 50 loads. The rest of the loads were moved by Carrier D. Therefore the primary ratio for the Boston-New York lane is calculated as follows:

Primary ratio = [($200/$150) (10) + ($150/$150) (40)] / 50 = 1.07

In other words, the primary ratio measures performance of each lane during execution. In the example above, the lane Boston-New York, the primary ratio shows an overspending since it is greater than 1.0. The shipper is spending 7% more than his planned primary carrier would cost.

3.1.3 Market Cost and Market Ratio (MR)

The market cost per load of a lane is the expected market optimum cost. The market optimum is calculated using a benchmarking tool developed by Chainalytics. This benchmarking tool calculates the cost per load for a specific lane. Comparing the primary CPL and the market CPL is important for procurement planning. The Market Ratio (MR) measures performance of each lane during planning. The Market Ratio (MR) is calculated by dividing the primary carrier CPL by the market optimum CPL for each lane.

$$Market\ Ratio = \frac{CPL_{Primary}}{CPL_{Market}}$$

Where:

$CPL_{Primary}$ is the cost per load of primary carrier

CPL_{Market} is the average market cost per load in the specific lane

If in the same example suppose the market CPL is $180. Then MR = $150 / $180 = 0.83 and this means that the primary is below market.

3.2 Planning Performance

Procurement of trucking services involves assembling routing guides and selecting primary carriers to set up contracts. Selecting a primary carrier with a CPL more expensive than the market CPL shows poor planning because it locks the sourcing to a more expensive price and can only be re-set after the contract expires (usually one year).

The Market Ratio compares the Primary CPL and the Market CPL. Market ratios equal to 1 (± 2%) indicate that sourcing planning is on-target because it chooses the market optimum CPL. Market ratios above 1.02 or below 0.98 are off-target because the planning did not take the market CPL. Figure 3 shows the market ratio on- and off-target areas in green and red color respectively.

Figure 3 – Market ratio on- and off-target areas

3.3 Execution Performance

Executing procurement for trucking involves tendering loads to carriers using the routing guide assembled in the planning phase. Tendering starts with the primary carrier and it moves down the routing guide until a carrier accepts the load. Comparing the CPL of the carrier that accepted the load (i.e. actual) to the CPL of the primary carrier provides a measure of the execution performance. The Primary Ratio compares the Actual CPL and Primary CPL. Primary ratios equal to 1 (± 2%) indicate sourcing execution is on-target because the primary carrier moved the load. Primary ratios above 1.02 or below 0.98 are off-target because the execution did not take the primary CPL. Figure 4 shows the primary ratio on- and off-target areas in green and red respectively.

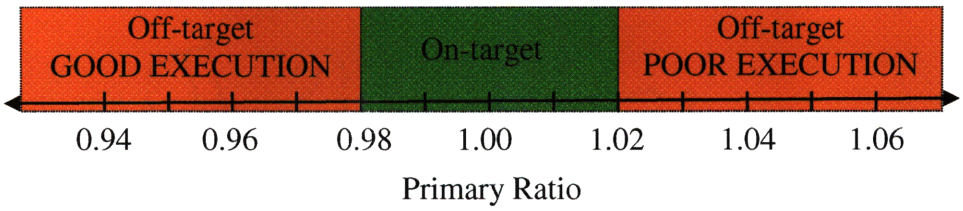

Figure 4 – Primary ratio on- and off-target areas

3.4 Matching planning and execution

In the planning phase a primary carrier is assigned to each lane and during execution the load is tendered to carriers. The actual carrier transporting the load may vary from the primary carrier. As described earlier, three costs were tracked; market, primary and actual. Also two ratios, market and primary, that explain the costs' relationship were tracked. Therefore each lane has two ratios associated with it; market and primary.

Using these market and primary ratios any lane can be plotted in a Cartesian coordinate system. The primary and market ratios were assigned to X-axis and Y-axis respectively. As seen in Figure 5, the point of intersection is set to (1, 1) and the lines create four quadrants. The green square is the on-target CPL and the rest is the off-target CPL. Lanes plotted in the green square represent lanes planned with primary CPL equal to the market CPL and executed as planned using primary CPL.

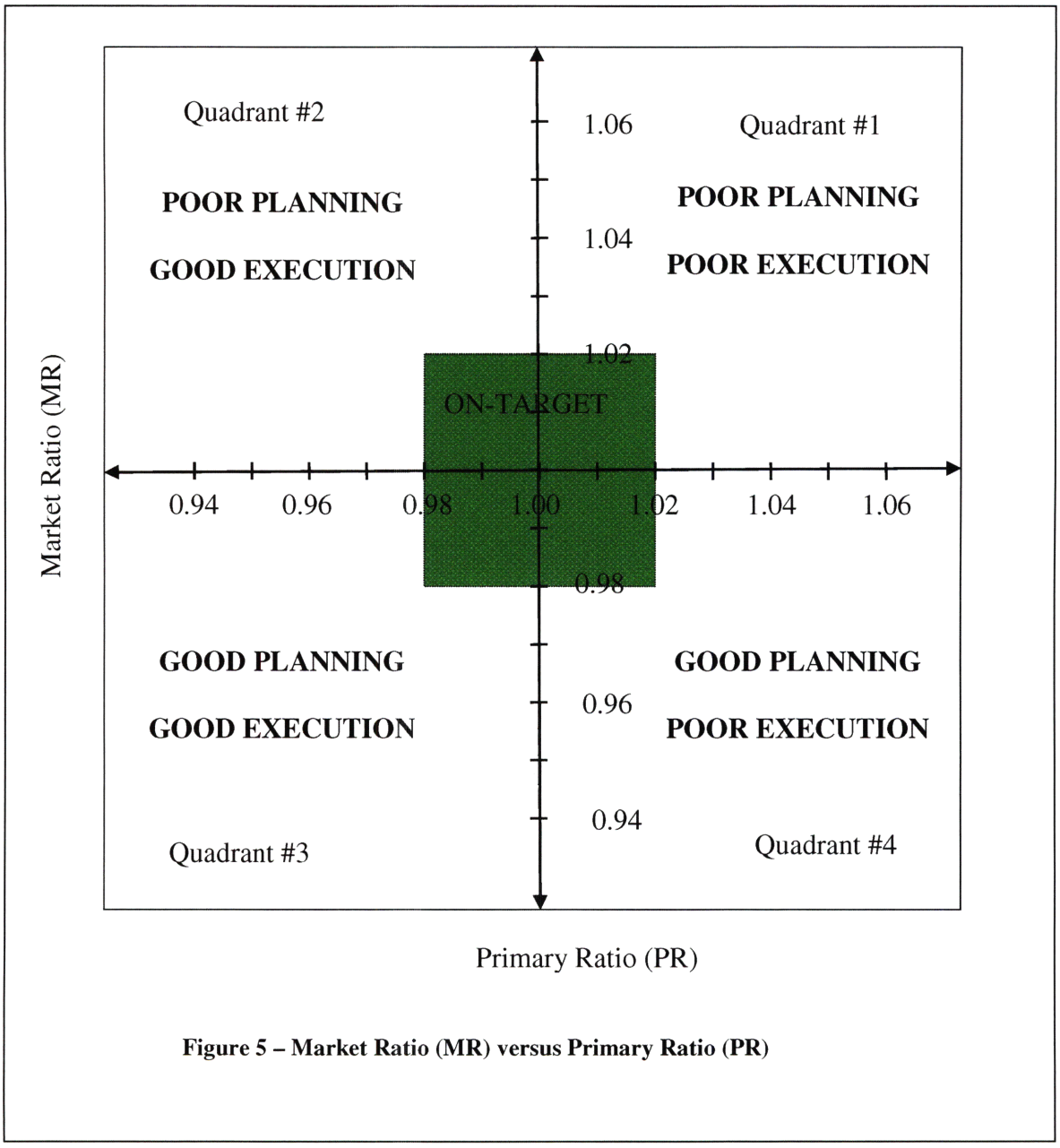

Figure 5 – Market Ratio (MR) versus Primary Ratio (PR)

Quadrant # 0 – Reliable Planning and Reliable Execution

The on-target quadrant (i.e. quadrant 0) can be an overspending or savings. Quadrant 0 collects lanes where planning matches execution and considers the variability

(2%) the shipper wants in his budget. Shippers can select a greater variability when they are comfortable with a greater potential overspending or savings.

Quadrant #1 – Poor Planning and Poor Execution

Lanes in quadrant 1 have primary ratio ≥ 1.02 and market ratio ≥ 1.02. and are not desirable because they were planned using a primary carrier CPL more expensive than the market CPL. A MR greater than one means that the shipper is committing to overpay in this lane for the entire length of the contract and only the tender rejection by the primary carrier can prevent the overpaying. Primary ratios (PR) greater than 1 show that the sourcing was executed using more expensive carriers than primary carrier. Also includes situations where the primary carrier reject the tender, and the transportation manager finds a carrier with a greater rate. In summary, these lanes show a poor sourcing planning and execution and show overspending.

Quadrant #2 – Poor Planning and Good Execution

Lanes in quadrant 2 have primary ratio ≤ 0.98 and market ratio ≥ 1.02 and are desirable because they were planned with a CPL (primary carrier) more expensive than the market CPL but executed at a lower rate. Lanes in quadrant #2 have a MR greater than one and it shows that the shipper has committed to overpay. Fortunately, primary carriers reject the loads and the transportation manager looks for alternatives carriers. The PR less than one shows that the selected carrier provides a cheaper CPL than the one provided by the primary. Therefore this execution is favorable to the shipper and can be categorized as lanes with poor planning but good execution and provides savings.

Quadrant #3 – Good planning and good execution

Lanes in quadrant 3 have primary ratio ≤ 0.98 and market ratio ≤ 0.98 and are the most desirable because these lanes were planned with a primary CPL cheaper than the market CPL and they were executed with a cheaper carrier than the primary. It also includes lanes where the carrier rejects the tender and the transportation manager selects a carrier with a CPL cheaper than the primary carrier. These lanes show and good planning and execution and provides savings.

Quadrant #4 – Good planning and poor execution

Lanes in this quadrant have primary ratio ≥ 1.02 and market ratio ≤ 0.98 and are not desirable because these lanes were planned with a primary CPL cheaper than the market and were executed with a more expensive carrier CPL than the primary. Lanes in quadrant #4 show good planning and poor execution and provides overspending.

In the next chapter, these metrics and ratios are used to understand the relationship between planning and execution performance.

4 Results

This section presents the results found after processing the data. As discussed in Chapter 3, there are three ways to measure costs for each lane include: actual cost, primary cost, and market cost. Actual cost is the cost paid to the carrier that takes the load. The primary cost is the contract cost or the cost of the primary carrier. This primary cost is the rate that has been agreed upon with the primary carrier and might be different only if the primary carrier is unable to take the load due to an unexpected increase in load volume or lack of capacity. The primary cost is a planned cost and it is expected to match the market cost. The market cost is the average cost for that lane and is calculated with a bench marking tool that requires the origin, destination and miles as input. Having a primary cost greater than the market cost means that the shipper has agreed to overpay for a carrier to move its loads for an entire year. On the other hand a primary cost lower than the market cost implies that the shipper is doing an excellent job planning because it is committing to paying less by using shippers with lower costs.

Using these three costs, two ratios were calculated for each lane. The MR (Market ratio) and the PR (Primary ratio) help to classify each lane. For example a high MR indicates poor planning because the primary carrier that was selected for the lane was actually priced above the leading market rate for that year. This implies that the shipper will overpay for the transportation services at the planning stage and it commits to do so for the entire length of the contract. On the other hand, a high PR indicates that the actual amount paid is much higher than the primary carrier. This shows that the primary carrier did not haul all of the business it should have. Usually the new carrier will be more costly

and it cannot be predicted with certainty which carriers will have a shortage in capacity that may prevent them from taking a load.

4.1 Cumulative Percent Distribution

After the data was prepared and the primary ratio was calculated, a cumulative percent distribution was made to visually locate how many primary ratios were within ± 2% primary ratio boundary. The 2% boundary was selected because 2% above and below the ratio would give a range of less than 5%. The table below presents the cumulative percent distribution data for the 2006-2008. From the graph, we can see that 40% of the lanes have primary ratios equal 1± 2% (from 25% at 0.98 to 65% at 1.02).

After the primary carrier for a lane was identified, the analysis looked at the carriers with a tender sequence of zero and a rejected value of zero. The tender sequence and rejected value of zero means that the carrier was offered the lane first and the carrier accepted the bid. For a lane, the rate of carriers compared against the rate of the primary carrier. Since the rate could change, the study used the average rate in that year. The primary ratio was calculated for each lane and a Cumulative Percent Distribution was plotted to see the frequency distribution for each year.

Primary Ratio	2006	2007	2008	Average
≤ 0.80	0.15%	0.00%	0.00%	0.05%
≤ 0.85	0.15%	0.00%	0.33%	0.16%
≤ 0.90	2.64%	2.74%	2.64%	2.67%
≤ 0.95	11.00%	11.70%	9.90%	10.87%
≤ 0.98	24.63%	25.38%	20.96%	23.66%
≤ 1.00	44.28%	42.71%	44.22%	43.74%
≤ 1.02	62.02%	60.18%	68.48%	63.56%
≤ 1.05	77.86%	76.14%	81.85%	78.62%
≤ 1.10	91.06%	89.97%	94.22%	91.75%
≤ 1.15	96.48%	95.90%	97.52%	96.63%
≤ 1.20	98.83%	98.78%	99.17%	98.93%
≤ 1.25	99.41%	99.39%	99.67%	99.49%
≤ 1.30	100.00%	99.85%	100.00%	99.95%
≤ 1.35	100.00%	99.85%	100.00%	99.95%
≤ 1.40	100.00%	100.00%	100.00%	100.00%

Table 1 - Cumulative Percent Distribution for 2006-2008

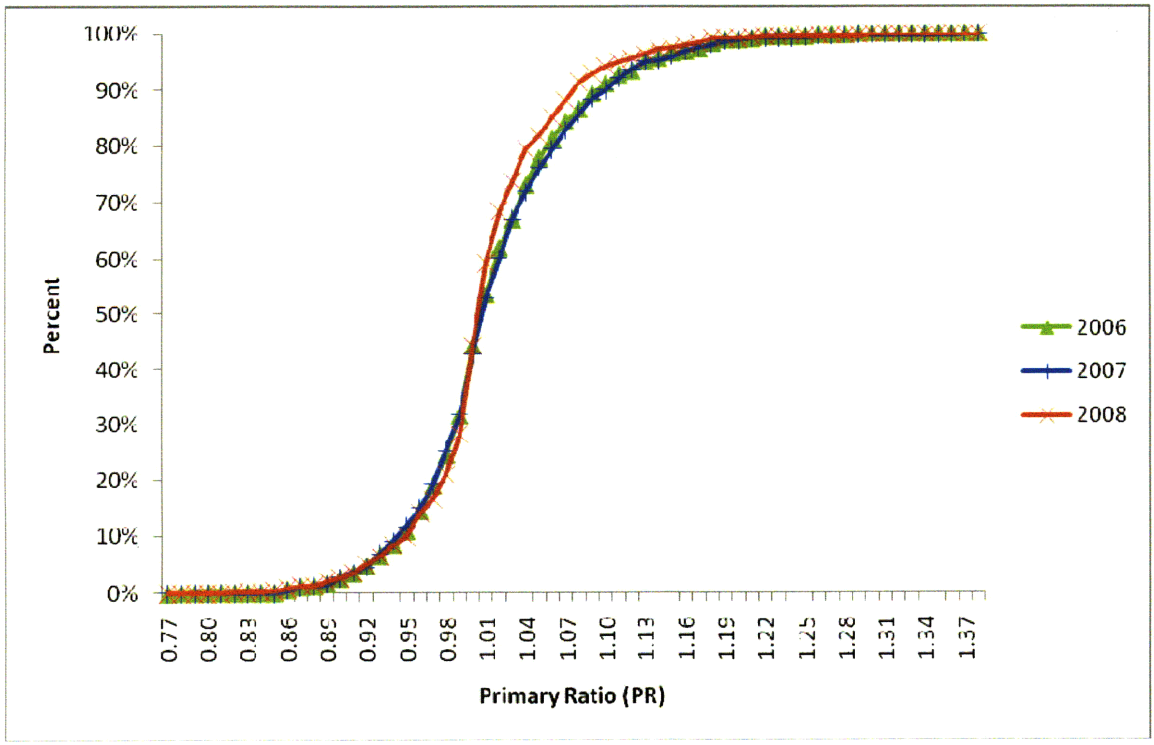

Figure 6 - Cumulative Percent Distribution Graph for 2006-2008

Figure 6 shows 24% of lanes have primary ratios less equal or less than 0.98. This percentage indicates that 24% of the lanes are planned below market rate. On the other hand, 36% of the lanes have primary ratios greater than 1.02 and these lanes are planned above market. Only 40% of lanes are on-target and planning rates are close to the benchmarking rates. The next section describes how planning information is merged to execution.

4.2 On-target versus Off-target

Classifying the lanes using primary and market ratios allowed for evaluation of the sourcing strategy performance. One of the first analyses was to find the on- and off-target lanes for each year. The percent of lanes and volume on-target are smaller than 10% for 2006, 2007 and 2008. The next three tables show percent of lanes and number of loads carried that were within target.

Region	2006		2007		2008	
	% Lanes	% Loads	% Lanes	% Loads	% Lanes	% Loads
On-target	5%	4%	8%	7%	7%	4%
Off-target	95%	96%	92%	93%	93%	96%
Total	100%	100%	100%	100%	100%	100%

Table 2 – On- and off-target lanes and volume for 2006-2008

Table 2 shows that on target (i.e. good planning and good execution) lanes are below 10% during the last three years. On the other hand off-target lanes are more than 90% and next table show how these lanes are distributed in the quadrants. Table 2 also indicates that on-target lanes are reduced from 40% in planning to less than 10%.

4.3 Off-target lanes distribution

This section shows the distribution of off-target lanes in the four quadrants. The tables below present the lane distribution in each quadrant. Quadrant 0 is the on target area (green square of Figure 4).

Quadrant	2006		2007		2008	
	% Lanes	% Loads	% Lanes	% Loads	% Lanes	% Loads
Q0: On-target	5%	4%	8%	7%	7%	4%
Q1: Poor planning & Poor execution	16%	16%	21%	18%	23%	19%
Q2: Poor planning & Good execution	29%	36%	31%	37%	32%	37%
Q3: Good planning & Good execution	13%	10%	7%	8%	8%	9%
Q4: Good planning & Poor execution	37%	34%	33%	30%	29%	31%
Total	100%	100%	100%	100%	100%	100%

Table 3 - Lane Summary for 2006-2008

The table shows that the lanes in the good planning and execution quadrant are less than 10% and the poor planning and execution ranges between 16-19%. In addition, poor planning and good execution (Quadrant #2) is beneficial to the overall performance and it ranges from 36-37%. Good planning and poor performance (Quadrant #4) is detrimental to the sourcing performance and the detrimental effect on ranges from 30-34%. Combining the quadrants with poor performance (1 and 4), I found that 48-50% of the lanes show poor sourcing performance. This large percentage of lanes indicates that there is a potential to save money in procurement.

The next three graphs show how the lanes are distributed in the Cartesian coordinate system. A linear regression was performed to find the trend of the data and the linear equation and R^2 value were calculated.

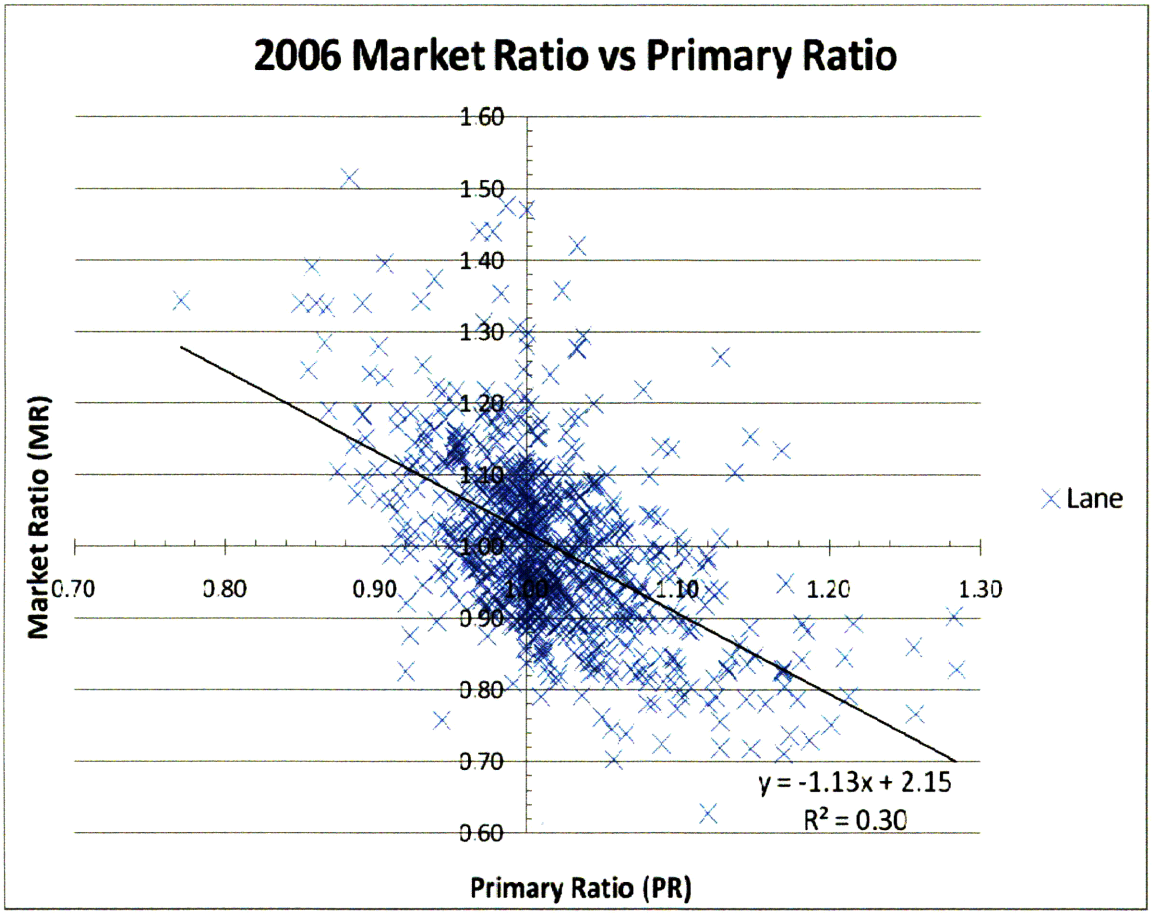

Figure 7 – Market ratio vs Primary ratio for lanes in 2006

Figure 7 shows that most lanes are located in quadrants 1, 2 and 4. Lanes in quadrant 3 are a small number.

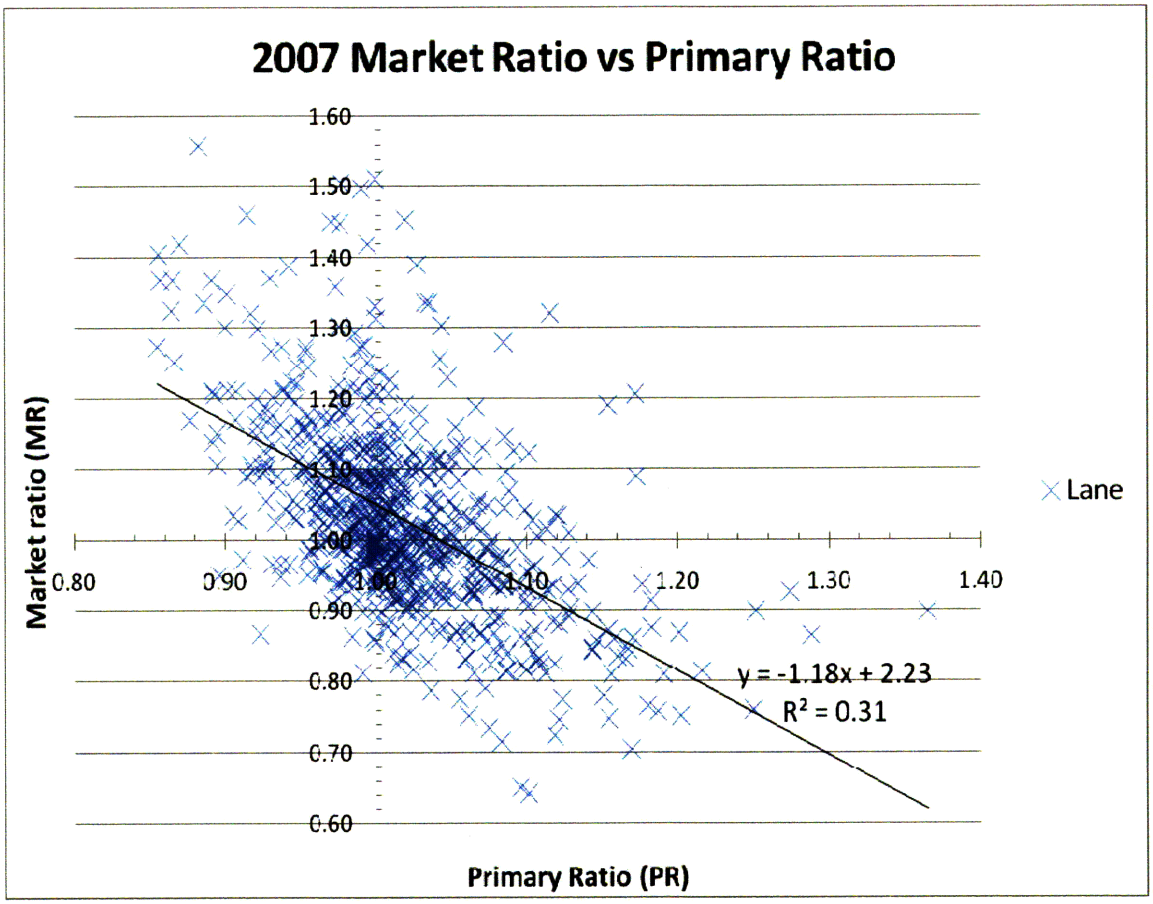

Figure 8 - Market ratio versus Primary ratio for lanes in 2007

Figure 8 shows the same behavior where most lanes are located in quadrants 1, 2 and 4. Quadrant 1 also shows fewer lanes than quadrant 2 and 4.

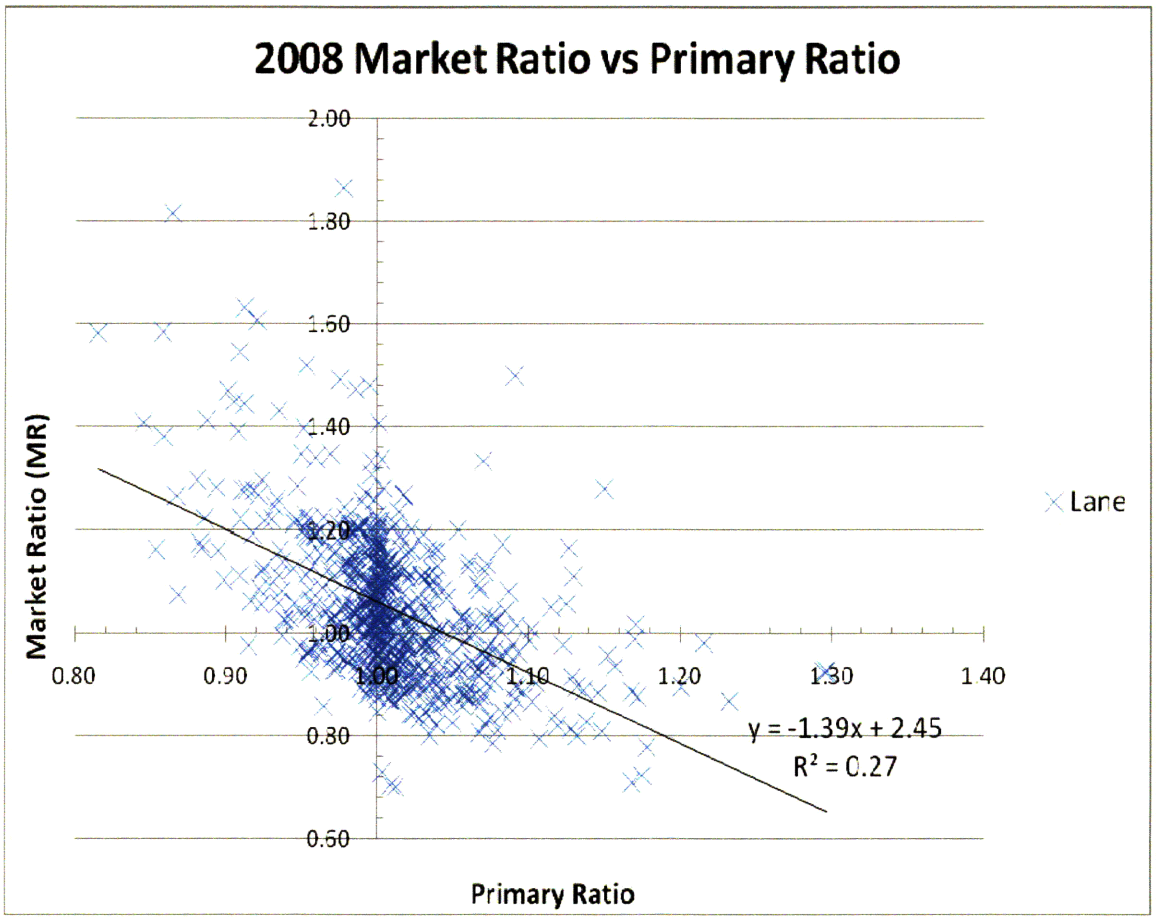

Figure 9 - Market ratio versus Primary ratio for lanes in 2008

Figure 9 is similar to the previous two figures. These results suggest that this situation is prevalent in lanes served by multiple carriers. Lanes shift over time therefore the analysis identifies lanes consistently located in a specific quadrant. If certain lanes are likely to be over or underperforming lanes over time, these lanes might be categorized as lanes that required special attention during planning and execution. The next section discusses and analyzes the behavior of lanes over time.

4.4 How lanes behave over time

The next step in the analysis is to identify which lanes remained in the same quadrant for three consecutive years (2006-2008). Table 4 summarizes the results and shows that only 23% of lanes remained constant over time. The rest (77%) of the lanes change quadrants from year to year, or are not active every year. This indicates a large amount of shifting from year to year. Businesses are dynamic entities and their transportation requirements change over time. Closing or opening warehouses, gaining or losing customers, mergers or acquisitions, consolidating operations are some of the reasons behind the large amount of lane shifting.

Lane Type	%
Constant over Time	23%
Change over time	77%
Total	100%

Table 4 – Lane distribution with respect to time

Lanes that are constant over time might point to lanes that can be labeled as semi-permanent. Looking at how they are distributed in the quadrants might help to plan for these "semi-permanent" lanes. The distribution of the "semi-permanent" lanes (i.e. 23% of the lanes) is captured in Table 5.

Quadrant	%
Q0: On-target	2%
Q1: Poor planning & Poor execution	21%
Q2: Poor planning & Good execution	39%
Q3: Good planning & Good execution	3%
Q4: Good planning & Poor execution	36%
Total	100%

Table 5 – Distribution of lanes constant over time

Table 5 captures the distribution of "semi-permanent" lanes and only 2% stay on-target. This very small amount illustrates the difficulty to manage transportation even though these lanes are present in 3 years and are considered semi-permanent. These semi-permanent lanes are easier to plan because these lanes appear every year. From Table 5, lanes with poor execution (quadrants 1 and 4) make up 57% of the lanes. Identifying these lanes is important because these lanes have shown the same behavior for three consecutive years. This may point to lanes that are challenging to execute. Knowing that these lanes are likely to be present every year helps the transportation manager plan well.

4.5 Overspending or savings

Previous sections presented how lanes behave during planning and execution. To properly convey the magnitude of the planning and execution performance this section estimates the amount of dollars overspent or saved. Lanes with poor planning and poor execution are classified as overspent because the actual cost paid to haul the load was higher than the primary cost and the market cost.

Quadrant	$ Amount	Category
Q0: On-target	$ 9,316	Savings
Q1: Poor planning & Poor execution	$ (718,788)	Overspending
Q2: Poor planning & Good execution	$ 3,254,268	Savings
Q3: Good planning & Good execution	$ 241,869	Savings
Q4: Good planning & Poor execution	$ (3,196,493)	Overspending
Total	$ (409,827)	Overspending

Table 6 – 2006 Amount of savings or overspending

Table 6 shows that in 2006, matching planning and execution saved $9,316. This amount is not a significant saving because the transportation budget for these lanes was

accurate. Looking at quadrant 1, there was an overspending of more than $700,000 due to poor planning (i.e. using a primary cost higher than the market cost) and poor execution (i.e. when the primary carrier declined the tender, the actual cost was higher than the primary cost). This is a large amount not budgeted in the transportation annual budget and it presents a large risk because it makes the supply chain more expensive.

Quadrant	$ Amount	Category
Q0: On-target	$ 6,056	Savings
Q1: Poor planning & Poor execution	$(768,690)	Overspending
Q2: Poor planning & Good execution	$2,817,385	Savings
Q3: Good planning & Good execution	$194,149	Savings
Q4: Good planning & Poor execution	$(2,704,700)	Overspending
Total	$(455,799)	Overspending

Table 7 – 2007 Amount of savings or overspending

Table 7 shows in 2007, savings of more than $2 million in quadrant 2. It is a significant saving in the transportation cost and it comes from poor planning and a good execution. These lanes present poor planning and if the primary carrier had not rejected the tender, these savings would have moved to the overspending in quadrant 1. The savings found in quadrant 2 can be considered a risk or liability because the savings on these lanes become savings only if the primary carrier rejects the load. This significant dollar savings highlights the importance of good planning. Saving $2.8 million is very different than spending it. Savings in quadrant 3 are small and it shows how difficult it is to have good planning and good execution.

Quadrant	$ Amount	Category
Q0: On-target	$(29,1845)	Overspending
Q1: Poor planning & Poor execution	$(615,955)	Overspending
Q2: Poor planning & Good execution	$2,473,865	Savings
Q3: Good planning & Good execution	$237,723	Savings
Q4: Good planning & Poor execution	$(2,001,914)	Overspending
Total	$64,534	Savings

Table 8 - 2008 Amount of savings or overspending

Table 8 shows an overspending of more than $2 million and comes from good planning and poor execution but this is more than offset by savings in Q2. This disadvantageous position is caused by the tender rejection of the primary carrier which forces the transportation manager to go deeper in the routing guide. The carrier rejection of the tender can come from a lack of carrier capacity, an increase of capacity demanded by shipper (i.e. poor demand planning) or the carrier finding out that its bid was lower than the market price. Lanes in this quadrant needs to be watched carefully and selecting a primary carrier with a higher cost might reduce its rejection during execution. Another way to reduce this overspending is to move deeper in the routing guide.

Tables 6 thru 8 show that lanes savings and overspending from quadrants 2 and 4 cancel out each other but this approach is dangerous because savings from quadrant 2 can easily move to quadrant 1. There is also a shift from overspending in 2006 to savings in 2008. The difficult economic situation created the shift and made 2008 a more buyers' market where carriers decreased tender rejection and shippers planned and executed better.

4.6 Carrier Analysis

Earlier, the analysis focused on how lanes are classified according to their planning (i.e. market ratio) and execution (i.e. primary carrier) performance. Carriers usually handle more than one lane; likewise lanes are handled by more than one carrier. One procurement strategy is to address poor performing carriers; therefore the analysis needs to include each carrier to complement the lane analysis. Each carrier handles a number of lanes distributed in the quadrants. The carrier analysis finds the number of lanes in each quadrant for every carrier used during 2006-2008. Poor performing lanes during planning are lanes in quadrants #1 and #2, and during execution lanes in #1 and #4. The analysis shows the percent of overcharged lanes during planning and execution of each carrier. Lower percentage indicates better performance. Table 9 shows 73 carriers during 2006-2008 and only 49 carriers worked during three consecutive years. Inactive carriers during a particular year show a N/A (not applicable) entry in the table. For example, SCAC (Carrier) # 5 moves 373 loads in 2006 with 16% of the lanes showing poor planning and 6% poor execution. Another example, SCAC (Carrier) #16 shows 0%, 10% and 37% of poor planning in 2006, 2007 and 2008 respectively. In 2006, carrier #16 offers rates equal or below the average market rates. In 2007 and 2008, 10% and 37% of the loads have greater rates than the market rates. During execution, carrier #16 overcharges in every load hauled (100%). In fact, carrier #16 has greater rates than the primary rate and overcharges when called as primary as well as backup carrier.

SCAC	2006			2007			2008		
	Exec	Plan	Loads	Exec	Plan	Loads	Exec	Plan	Loads
1	38%	100%	267	62%	100%	239	N/A	N/A	N/A
2	75%	86%	4,827	72%	88%	4,372	54%	96%	4,524
3	15%	100%	230	15%	100%	230	N/A	N/A	N/A
4	100%	0%	1,444	100%	0%	1,065	100%	15%	1,626
5	6%	16%	373	0%	17%	338	N/A	N/A	N/A
6	100%	9%	601	100%	9%	570	N/A	N/A	N/A
7	31%	56%	5,183	28%	67%	5,014	18%	100%	658
8	44%	66%	4,626	46%	85%	4,127	43%	73%	3,010
9	0%	100%	854	0%	100%	761	N/A	N/A	N/A
10	100%	4%	857	100%	4%	784	100%	0%	195
11	52%	18%	2,202	22%	21%	4,228	71%	41%	3,996
12	87%	43%	4,118	88%	43%	3,753	90%	69%	3,464
13	92%	60%	2,100	100%	87%	1,647	82%	65%	2,179
14	48%	68%	5,760	51%	67%	5,164	66%	55%	588
15	83%	20%	850	96%	30%	763	97%	13%	894
16	100%	0%	259	100%	10%	229	100%	37%	929
17	77%	100%	311	83%	100%	253	67%	100%	422
18	56%	44%	4,371	N/A	N/A	N/A	36%	64%	5,749
19	35%	0%	967	100%	42%	772	54%	46%	1,682
20	0%	98%	12,195	0%	98%	11,346	3%	100%	8334
21	100%	0%	27	100%	0%	25	N/A	N/A	N/A
22	64%	29%	3,130	66%	27%	2,907	97%	97%	742
23	100%	0%	43	100%	0%	21	N/A	N/A	N/A
24	0%	66%	414	0%	66%	288	97%	68%	854
25	100%	0%	699	100%	52%	901	100%	0%	654
26	100%	0%	21	100%	59%	139	N/A	N/A	N/A
27	15%	19%	470	19%	32%	450	N/A	N/A	20
28	N/A	N/A	N/A	100%	100%	38	N/A	N/A	N/A
29	51%	73%	1,430	54%	75%	1,271	15%	89%	2,364
30	28%	46%	6,374	28%	48%	5,775	7%	33%	5,117
31	59%	74%	3,275	53%	95%	2,578	51%	80%	2,830
32	100%	0%	38	100%	0%	36	N/A	N/A	N/A
33	95%	0%	534	95%	7%	497	100%	0%	1,477
34	97%	0%	3,055	87%	19%	2,826	53%	0%	666
35	29%	29%	110	40%	24%	131	N/A	N/A	N/A
36	N/A	N/A	N/A	N/A	N/A	N/A	0%	100%	765
37	16%	68%	953	12%	80%	1,165	23%	100%	94

SCAC	Exec	Plan	Loads	Exec	Plan	Loads	Exec	Plan	Loads
38	100%	0%	668	100%	0%	639	100%	0%	36
39	100%	89%	422	100%	100%	385	100%	28%	724
40	91%	9%	235	90%	10%	226	N/A	N/A	N/A
41	45%	24%	644	65%	35%	595	43%	100%	209
42	74%	7%	1,110	80%	9%	946	41%	66%	2,160
43	100%	0%	39	100%	0%	39	N/A	N/A	N/A
44	0%	100%	469	0%	100%	437	16%	22%	2,566
45	68%	36%	1,685	74%	59%	1,656	N/A	N/A	N/A
46	66%	27%	1,016	67%	69%	1,011	83%	74%	783
47	53%	70%	3,860	57%	68%	3,443	14%	74%	1298
48	97%	9%	10,877	98%	10%	9,415	95%	13%	11,896
49	76%	100%	169	100%	100%	113	100%	35%	181
50	64%	83%	296	54%	47%	430	75%	35%	178
51	85%	5%	549	87%	9%	540	100%	0%	104
52	100%	100%	343	100%	100%	310	100%	33%	236
53	33%	72%	304	16%	96%	645	N/A	N/A	N/A
54	90%	0%	699	92%	0%	776	100%	0%	614
55	100%	0%	1,074	100%	0%	594	92%	0%	1,644
56	100%	0%	383	100%	0%	320	0%	0%	300
57	100%	69%	170	100%	69%	154	N/A	N/A	N/A
58	34%	66%	1,724	80%	20%	3,326	N/A	N/A	N/A
59	0%	0%	55	0%	0%	54	N/A	N/A	N/A
60	0%	82%	698	41%	100%	628	0%	100%	1,140
61	N/A	N/A	N/A	N/A	N/A	N/A	0%	100%	358
62	26%	95%	887	28%	94%	730	22%	97%	2,130
63	47%	46%	1,447	51%	57%	1,317	86%	65%	799
64	22%	90%	18,106	25%	90%	16,511	30%	86%	12,121
65	N/A	N/A	N/A	N/A	N/A	N/A	100%	57%	360
66	77%	23%	285	76%	100%	268	71%	33%	1536
67	0%	0%	54	0%	0%	51	N/A	N/A	N/A
68	0%	100%	77	0%	100%	63	0%	100%	108
69	0%	100%	314	0%	100%	282	0%	100%	237
70	59%	23%	361	69%	31%	188	40%	93%	2,542
71	100%	15%	654	100%	14%	613	76%	48%	3,098
72	100%	0%	400	100%	0%	362	63%	40%	1,064
73	100%	0%	2,888	100%	0%	2,655	100%	0%	1,244

Table 9 – Percent of overpaid lanes during planning and execution of each carrier

On the other hand, the shipper using carrier #17 shows poor planning in all loads hauled because its rates are greater than market rates. Carrier #17 hauls 77% of the loads as primary carrier with rates greater than the market rate. When called as a backup carrier (33%) its rates are cheaper than the primary carrier but still more expensive than the market rates.

Each carrier in Table 9 was plotted using the overpaid percent in planning and execution. Only carriers active in the three consecutive years were plotted. The next three graphs represent the carriers in 2006-2008. Carriers are located in the y-axis using their SCAC number. Each carrier show the percent of loads poorly planned on the left side (i.e. green bars) and the percent of loads poorly executed on the right side (i.e. red bars). Poorly planned loads come from using carriers with rates at market rates or above and poorly executed loads come from using carriers with higher rates than the primary rates. During poor execution, loads are moved by primary carriers at higher primary rates than market rates or moved by backup carriers at higher rates than primary rates.

Carriers move loads as a primary carrier or as a backup carrier. A carrier which hauls loads during execution at higher rates than market rates does it as a primary or backup carrier. For example, in 2006 carrier # 30 hauled 28% of the loads at higher rates than primary rates. It also shows that carrier #30 is a good carrier because when it is used as a backup carrier (72%) is cheaper than the primary carrier. Low numbers of poor performance points out carriers than are looking to become primary carriers and want more business. Looking at this number alone could mislead the transportation manager during planning because while it is true that smaller percentages of poor execution would

indicate savings, it tells little about the planning. Therefore, the transportation manager must look at the percentage of poor planning. Reviewing carrier #30 shows that 46% of the loads have rates greater than the market rates. In other words, the percent of poor planning indicates that the transportation manager needs to review the primary rates chosen and actual rates with the backup carriers. The next figures show carriers and the percent of poor planning and poor execution.

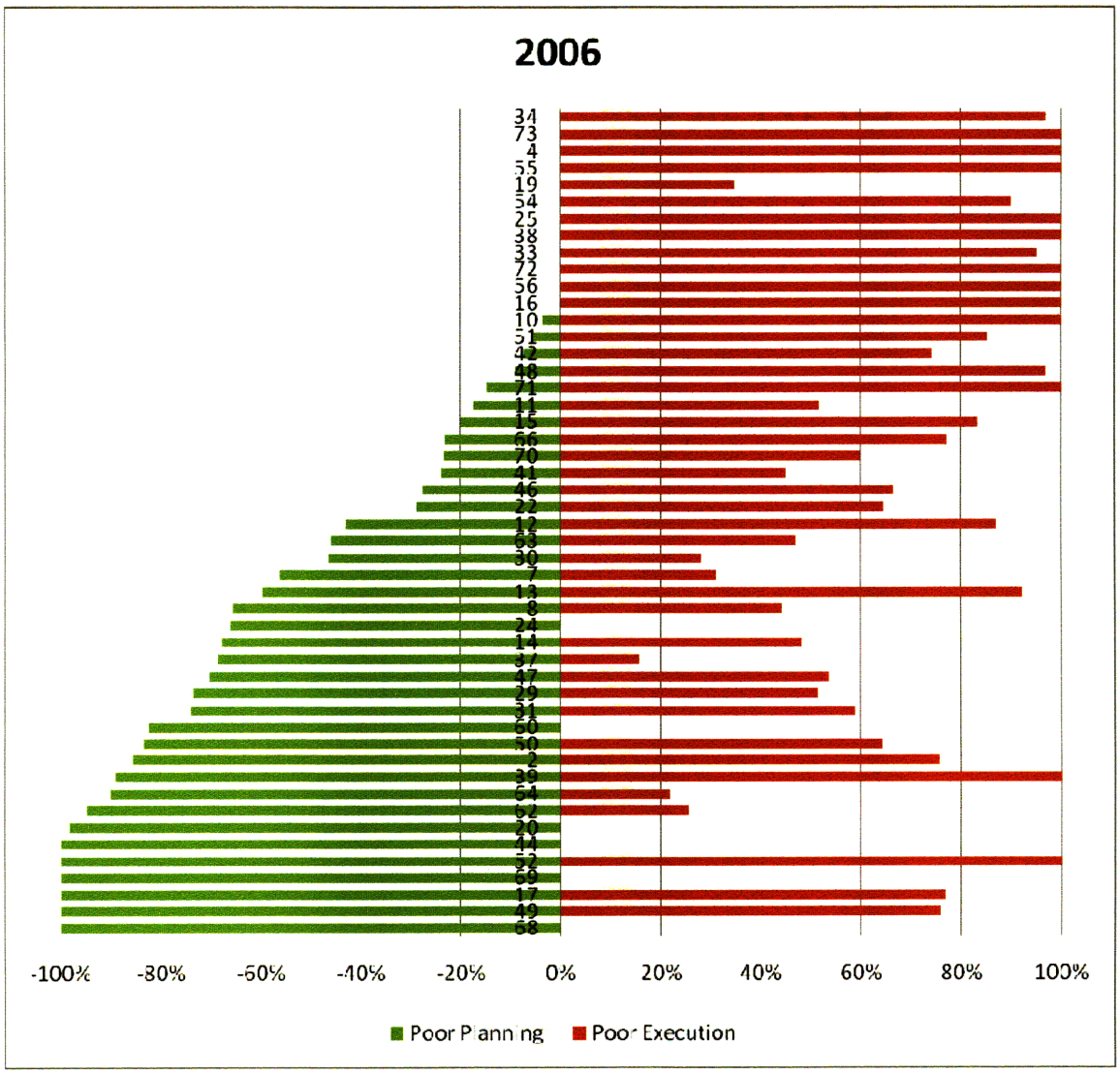

Figure 10 – 2006 Carriers with overcharged planned and executed lanes

Figure 10 orders the carriers based on their percent of loads with poor performance, starting with the lowest percent of poor performance at the top and finishing with the highest percent of poor performance at the bottom.

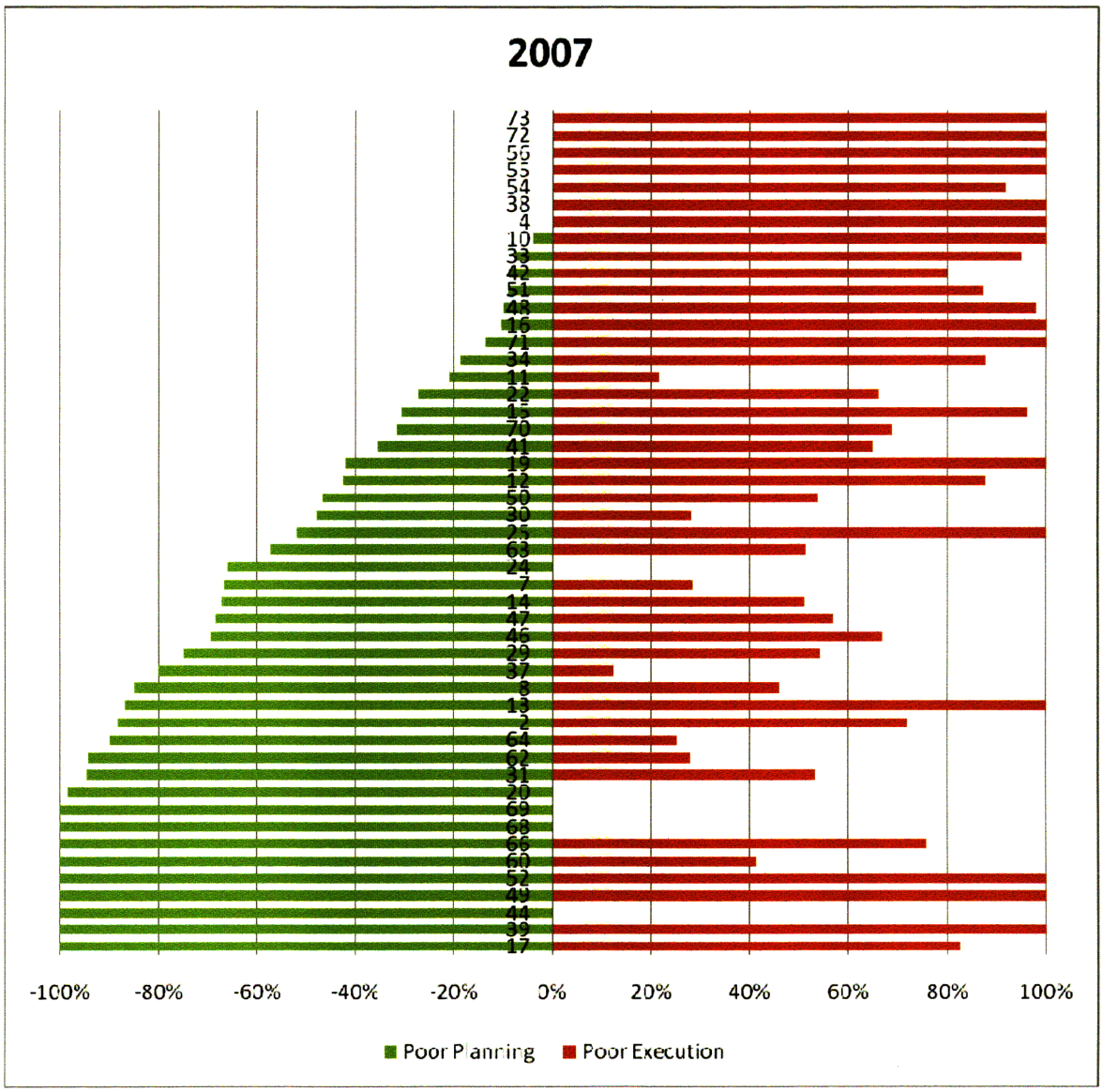

Figure 11 – 2007 Carriers with overcharged planned and executed lanes

Figure 11 shows that in 2007, carriers #72 and #73 are good backup carriers because they offered rates higher than primary rates in all loads during execution and their rates were lower than market rates.

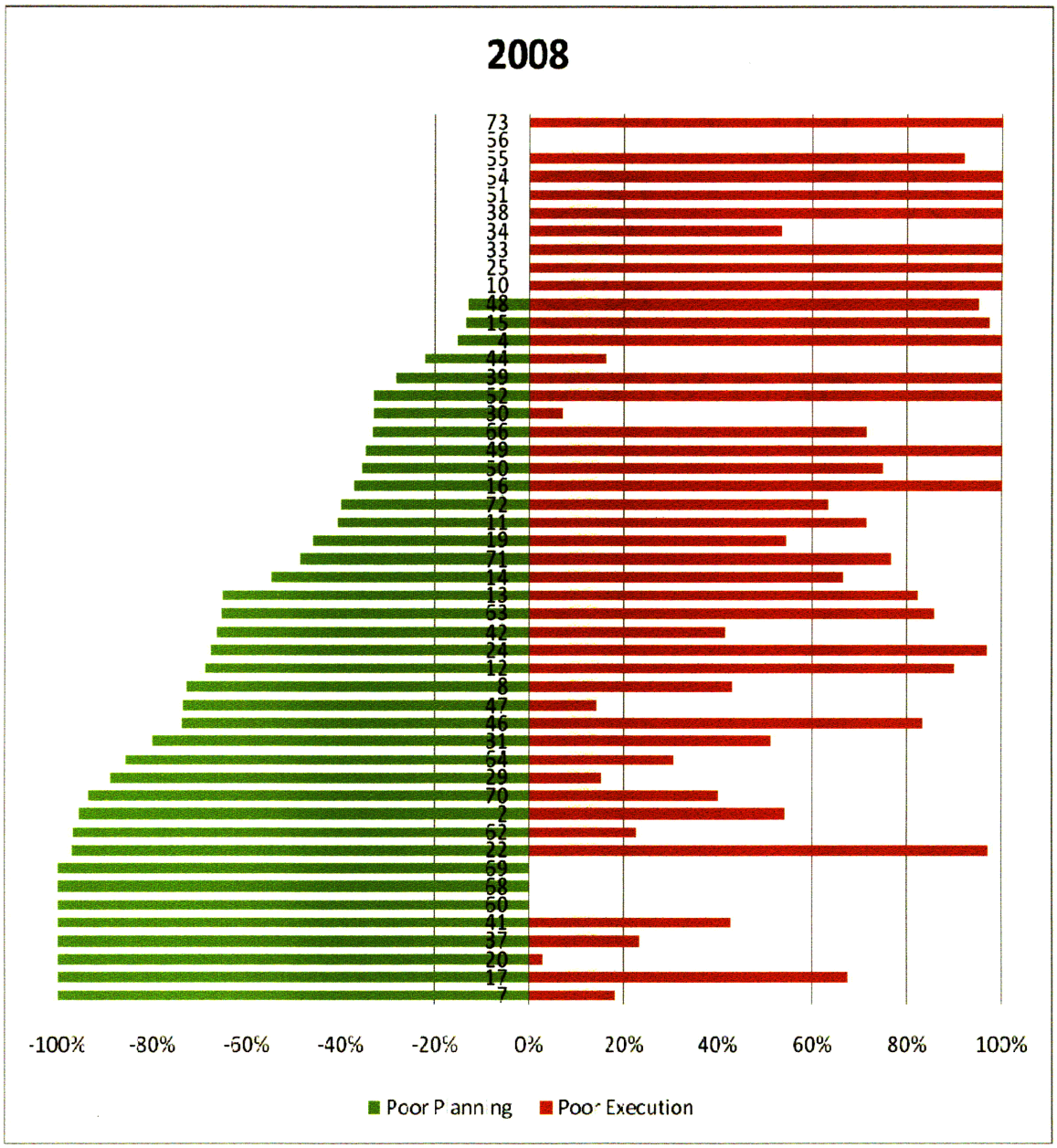

Figure 12 – 2008 Carriers with overcharged planned and executed lanes

Figure 12 shows that in 2008, carrier #7 moves all loads at higher rates than market rates and 18% of the loads were above primary carrier.

5 Conclusions

The study reveals that the planning of transportation sourcing is inefficient because more than 90% of the lanes and loads are off-target. While there are tools available to effectively choose the right market cost per load in each lane, they are used incorrectly or not at all, due to their complexity or cost. Shippers must start using benchmarking tools to select primary carriers at market costs. The study also reveals that good planning does not guarantee good execution. Lanes with good planning are about 37% and are divided in good execution and poor execution. Only 9% of the lanes with good planning show good execution and 33% poor execution. Therefore, transportation managers should not exhaust their efforts to get the lowest primary rate because this strategy leads to higher tender rejection.

Conversely, there are many examples of transportation managers who plan poorly by making inefficient carrier selections, yet are successful because they do not execute according to the plan. Lanes with poor planning are about 50% and are divided in poor execution and good execution. Lanes with poor execution are 20% and the lanes with good execution are 30%. Transportation managers should find primary carriers with lower rates to ensure that overspending planning is minimized.

The research shows a large amount of lane shifting. Only 23% of the lanes remain constant over time. The 77% of the lanes that show shifting emphasizes the importance of the benchmarking tools for the transportation manager. Transportation managers closely watch a large number of lanes and lane shifting makes difficult their job difficult because they might not be familiar with the rates of the new lanes. Shippers can plan better in the

23% of lanes that remain constant over time because these lanes are likely to appear for few years and can be tendered to carriers which cannot handle much flexibility in demand. Shippers also have the opportunity to negotiate with carriers and select the primary carrier at market rates.

Lanes that have consistently shown either poor or good execution are attractive to shippers because these lanes can be bundled to create a balanced sourcing strategy. Primary carriers need to be more engaged in the successful execution of the transportation plan. The research shows that market ratio and primary ratio help shippers to evaluate lanes and loads of each carrier by presenting percents in each quadrant. This is a powerful tool because shippers can evaluate planning, execution and their relationship. Market ratio links the primary rate and the market rate and evaluates the selection of the primary carrier and the robustness of the guiding route. Primary ratio links the actual rate to the primary rate. Market ratio evaluates planning and primary ratio evaluates execution. Market ratio is an absolute comparison because market rate are not expected to change and should reflect the average market rate. Primary rate is a relative comparison because it evaluates the actual rate to the primary rate.

Lanes and loads, located at the poor planning and poor execution quadrant, need to be reduced because they create overspending. Lanes ad loads located at the poor planning and good execution also need to be reduced because if primary carriers execute according to plan, the savings become overspending. Transportation managers should use market and primary ratios to evaluate lanes and loads of each carrier. Carriers with the greatest number of loads should be targeted by shippers to renegotiate the terms of the procurement contract.

Future Research

Further research should focus on the application of the tools presented in this thesis to assist transportation managers to renegotiate contracts. There are few areas where additional research shall be conducted to increase the robustness of the metrics: market and primary ratio. Some of the future areas of research include:

1) To use greater on-target areas by adjusting the percentage above and below the primary and market ratios. Using different percentages would account for the risk associated to various shippers or industries that required a tighter or looser transportation cost variation.
2) To challenge the assumption that benchmarking market rate is accurate. The research suggests that planning should select the market rate as a primary rate.
3) To change the minimum loads per year required to analyze carriers. Are carriers with greatest number of loads overcharging? Are carriers with few loads providing lower rates to gain business during planning? Are backup carriers overcharging during execution because they are not primary carriers? what affects primary carrier tender rejection? Is it lack of capacity or committing to contractual primary rates lower than market rates?
4) To link demand patterns and transportation planning and execution. Linking low variability demand to less responsive carriers and high variability demand to highly responsive carriers. Transportation procurement strategy for semi permanent lanes can help to achieve the goal of low transportation costs.

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Appendices

Appendix 1 –Carriers' planning and execution distribution in 2006

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
64	6%	17%	68%	6%	4%	100%	18,106
20	0%	0%	98%	2%	0%	100%	12,195
48	0%	6%	3%	0%	91%	100%	10,877
30	7%	7%	36%	31%	19%	100%	6,374
14	3%	19%	47%	4%	28%	100%	5,760
7	1%	25%	31%	37%	6%	100%	5,183
2	0%	61%	24%	0%	14%	100%	4,827
8	4%	24%	38%	15%	18%	100%	4,626
18	0%	0%	44%	0%	56%	100%	4,371
12	6%	34%	7%	6%	48%	100%	4,118
47	6%	45%	21%	22%	5%	100%	3,860
31	8%	36%	32%	6%	18%	100%	3,275
22	0%	0%	29%	7%	64%	100%	3,130
34	0%	0%	0%	3%	97%	100%	3,055
73	0%	0%	0%	0%	100%	100%	2,888
11	41%	0%	10%	18%	31%	100%	2,202
13	0%	59%	1%	7%	33%	100%	2,100
58	56%	0%	29%	0%	15%	100%	1,724
45	0%	28%	8%	24%	41%	100%	1,685
63	0%	10%	36%	17%	37%	100%	1,447
4	0%	0%	0%	0%	100%	100%	1,444
29	2%	35%	37%	11%	15%	100%	1,430
42	0%	7%	0%	26%	67%	100%	1,110
55	0%	0%	0%	0%	100%	100%	1,074
46	0%	18%	10%	24%	49%	100%	1,016
19	0%	0%	0%	65%	35%	100%	967
37	0%	0%	68%	16%	16%	100%	953
62	6%	24%	65%	5%	0%	100%	887
10	0%	4%	0%	0%	96%	100%	857
9	0%	0%	100%	0%	0%	100%	854
15	0%	14%	6%	11%	69%	100%	850
25	0%	0%	0%	0%	100%	100%	699
54	0%	0%	0%	10%	90%	100%	699
60	43%	0%	47%	10%	0%	100%	698
38	0%	0%	0%	0%	100%	100%	668

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
71	3%	14%	0%	0%	82%	100%	654
41	0%	0%	24%	31%	45%	100%	644
6	0%	9%	0%	0%	91%	100%	601
51	4%	5%	0%	14%	77%	100%	549
33	7%	0%	0%	5%	88%	100%	534
27	0%	0%	19%	66%	15%	100%	470
44	8%	0%	92%	0%	0%	100%	469
39	0%	89%	0%	0%	11%	100%	422
24	0%	0%	66%	34%	0%	100%	414
72	0%	0%	0%	0%	100%	100%	400
56	0%	0%	0%	0%	100%	100%	383
5	0%	0%	16%	78%	6%	100%	373
70	25%	0%	17%	13%	44%	100%	361
52	0%	100%	0%	0%	0%	100%	343
69	0%	0%	100%	0%	0%	100%	314
17	0%	77%	23%	0%	0%	100%	311
53	0%	16%	56%	12%	17%	100%	304
50	0%	48%	36%	0%	17%	100%	296
66	0%	0%	23%	0%	77%	100%	285
1	0%	38%	62%	0%	0%	100%	267
16	0%	0%	0%	0%	100%	100%	259
40	0%	0%	9%	0%	91%	100%	235
3	0%	15%	85%	0%	0%	100%	230
57	0%	69%	0%	0%	31%	100%	170
49	0%	76%	24%	0%	0%	100%	169
35	0%	29%	0%	71%	0%	100%	110
68	0%	0%	100%	0%	0%	100%	77
59	0%	0%	0%	100%	0%	100%	55
67	0%	0%	0%	100%	0%	100%	54
23	0%	0%	0%	0%	100%	100%	43
43	0%	0%	0%	0%	100%	100%	39
32	0%	0%	0%	0%	100%	100%	38
21	0%	0%	0%	0%	100%	100%	27
26	0%	0%	0%	0%	100%	100%	21

Appendix 2 - Carriers' planning and execution distribution in 2007

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
64	3%	18%	69%	4%	6%	100%	16,511
20	0%	0%	98%	2%	0%	100%	11,346
48	1%	8%	2%	0%	89%	100%	9,415
30	10%	7%	36%	29%	18%	100%	5,775
14	0%	20%	48%	2%	31%	100%	5,164
7	1%	26%	40%	31%	2%	100%	5,014
2	3%	59%	27%	0%	11%	100%	4,372
11	7%	5%	15%	58%	16%	100%	4,228
8	8%	34%	44%	6%	8%	100%	4,127
12	5%	35%	6%	6%	49%	100%	3,753
47	5%	37%	28%	13%	17%	100%	3,443
58	34%	0%	13%	0%	53%	100%	3,326
22	0%	0%	27%	7%	66%	100%	2,907
34	76%	4%	0%	3%	16%	100%	2,826
73	0%	0%	0%	0%	100%	100%	2,655
31	21%	38%	37%	0%	4%	100%	2,578
45	8%	37%	17%	7%	31%	100%	1,656
13	0%	87%	0%	0%	13%	100%	1,647
63	5%	10%	44%	2%	38%	100%	1,317
29	2%	38%	36%	9%	15%	100%	1,271
37	2%	3%	76%	10%	9%	100%	1,165
4	0%	0%	0%	0%	100%	100%	1,065
46	0%	36%	33%	0%	31%	100%	1,011
42	7%	8%	0%	19%	66%	100%	946
25	28%	37%	0%	0%	35%	100%	901
10	0%	4%	0%	0%	96%	100%	784
54	0%	0%	0%	8%	92%	100%	776
19	67%	14%	0%	0%	19%	100%	772
15	0%	27%	4%	0%	70%	100%	763
9	0%	0%	100%	0%	0%	100%	761
62	4%	27%	64%	5%	0%	100%	730
53	5%	11%	80%	0%	4%	100%	645
38	0%	0%	0%	0%	100%	100%	639
60	28%	30%	42%	0%	0%	100%	628
71	0%	14%	0%	0%	86%	100%	613
41	31%	0%	24%	0%	45%	100%	595
55	0%	0%	0%	0%	100%	100%	594
6	0%	9%	0%	0%	91%	100%	570

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
51	5%	5%	4%	8%	78%	100%	540
33	0%	7%	0%	5%	88%	100%	497
27	22%	6%	20%	43%	10%	100%	450
44	7%	0%	93%	0%	0%	100%	437
50	0%	29%	18%	29%	25%	100%	430
39	0%	100%	0%	0%	0%	100%	385
72	0%	0%	0%	0%	100%	100%	362
5	0%	0%	17%	83%	0%	100%	338
56	59%	0%	0%	0%	41%	100%	320
52	0%	100%	0%	0%	0%	100%	310
24	0%	0%	66%	34%	0%	100%	288
69	0%	0%	100%	0%	0%	100%	282
66	0%	76%	24%	0%	0%	100%	268
17	0%	83%	17%	0%	0%	100%	253
1	0%	62%	38%	0%	0%	100%	239
3	0%	15%	85%	0%	0%	100%	230
16	0%	10%	0%	0%	90%	100%	229
40	0%	0%	10%	0%	90%	100%	226
70	0%	0%	31%	0%	69%	100%	188
57	0%	69%	0%	0%	31%	100%	154
26	0%	59%	0%	0%	41%	100%	139
35	0%	24%	0%	60%	16%	100%	131
49	0%	100%	0%	0%	0%	100%	113
68	0%	0%	100%	0%	0%	100%	63
59	0%	0%	0%	100%	0%	100%	54
67	0%	0%	0%	100%	0%	100%	51
43	0%	0%	0%	0%	100%	100%	39
28	0%	100%	0%	0%	0%	100%	38
32	0%	0%	0%	0%	100%	100%	36
21	0%	0%	0%	0%	100%	100%	25
23	0%	0%	0%	0%	100%	100%	21

Appendix 3 - Carriers' planning and execution distribution in 2008

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
64	7%	23%	56%	8%	5%	100%	12,121
48	1%	11%	2%	3%	83%	100%	11,896
20	2%	3%	95%	0%	0%	100%	8,334
18	0%	0%	64%	0%	36%	100%	5,749
30	2%	4%	28%	63%	3%	100%	5,117
2	5%	52%	40%	4%	0%	100%	4,524
11	11%	20%	17%	9%	44%	100%	3,996
12	11%	55%	7%	2%	25%	100%	3,464
71	5%	40%	6%	16%	33%	100%	3,098
8	9%	18%	48%	4%	21%	100%	3,010
31	17%	32%	35%	6%	11%	100%	2,830
44	0%	4%	18%	66%	12%	100%	2,566
70	6%	33%	55%	2%	5%	100%	2,542
29	4%	10%	75%	6%	5%	100%	2,364
13	0%	59%	6%	12%	23%	100%	2,179
42	2%	8%	57%	0%	33%	100%	2,160
62	6%	18%	73%	0%	3%	100%	2,130
19	0%	0%	46%	0%	54%	100%	1,682
55	2%	0%	0%	8%	90%	100%	1,644
4	30%	11%	0%	0%	59%	100%	1,626
66	1%	15%	18%	11%	55%	100%	1,536
33	0%	0%	0%	0%	100%	100%	1,477
47	6%	2%	68%	13%	11%	100%	1,298
73	0%	0%	0%	0%	100%	100%	1,244
60	0%	0%	100%	0%	0%	100%	1,140
72	0%	11%	29%	8%	52%	100%	1,064
16	0%	37%	0%	0%	63%	100%	929
15	7%	12%	0%	2%	78%	100%	894
24	0%	64%	3%	0%	32%	100%	854
63	0%	51%	14%	0%	35%	100%	799
46	0%	57%	17%	0%	26%	100%	783
36	0%	0%	100%	0%	0%	100%	765
22	0%	97%	0%	3%	0%	100%	742
39	0%	28%	0%	0%	72%	100%	724
34	23%	0%	0%	36%	41%	100%	666
7	0%	18%	82%	0%	0%	100%	658
25	0%	0%	0%	0%	100%	100%	654
54	0%	0%	0%	0%	100%	100%	614

SCAC	Q0	Q1	Q2	Q3	Q4	Total	Loads
14	0%	31%	24%	10%	35%	100%	588
17	0%	67%	33%	0%	0%	100%	422
65	0%	57%	0%	0%	43%	100%	360
61	0%	0%	100%	0%	0%	100%	358
56	0%	0%	0%	100%	0%	100%	300
69	0%	0%	100%	0%	0%	100%	237
52	0%	33%	0%	0%	67%	100%	236
41	0%	43%	57%	0%	0%	100%	209
10	0%	0%	0%	0%	100%	100%	195
49	16%	29%	0%	0%	55%	100%	181
50	0%	22%	13%	12%	53%	100%	178
68	0%	0%	100%	0%	0%	100%	108
51	0%	0%	0%	0%	100%	100%	104
37	0%	23%	77%	0%	0%	100%	94
38	0%	0%	0%	0%	100%	100%	36
27	100%	0%	0%	0%	0%	100%	20