

OPTIMAL WHEAT FLOW PATTERNS FOR OKLAHOMA  
UNDER THE CURRENT TRANSPORTATION  
ENVIRONMENT AND UNDER PROPOSED  
CHANGES TO THIS ENVIRONMENT

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## PREFACE

The grain transportation system has faced many changes in the past ten years. Deregulation of the transportation system has caused a significantly different environment within the transportation system.

The purpose of this study is to develop a series of models to determine least cost flow patterns for Oklahoma-produced wheat under different assumptions. Each model will determine an optimal transportation mode and route for movements of Oklahoma-produced wheat under different alternatives.

Results from this study show optimal flows under forty different alternatives. Although the algorithm used in this work does not have sensitivity analysis, the sensitivity of the wheat transportation system in Oklahoma can be determined by looking at the effects of changing assumptions upon results. Before grain handling firms can make long-term capital investments, these firms need to know what flows are optimal and how sensitive these optimal flows are to potential changes. These results should help provide this information to firms in the grain transportation industry.

I would like to thank all those people who have helped me with this thesis. Special thanks go to my committee members, Dr. Robert Oehrtman, Dr. Francis Epplin, and Dr. Kim Anderson, who helped me through many problems. Thanks also to Dr. Jim Russell, who was a member of my committee through the majority of this project before leaving Oklahoma State University, to Dr. Larry Makus, who helped in the early stages before he left Oklahoma State University, and to Dr. Daniel Tilley, who encouraged and supported me although he was not a committee member. I would also like to thank my family and countless friends who gave me encouragement throughout this project.



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## CHAPTER I

### INTRODUCTION

The transportation industry is undergoing many changes. Deregulation has allowed more flexibility in entry and exit, rate pricing, and services made available. Rail line abandonment and railroad mergers have altered the cost structure for the rail industry. These items, combined with more competitive pricing, have led to a considerably different environment for the grain transportation system. These changes have affected and will continue to affect the movement of hard red winter wheat from producers to domestic and export markets.

Transportation of wheat is important to the economy of Oklahoma. Three factors make the Oklahoma economy highly susceptible to changes in the grain transportation system. These factors are:

1. Hard red winter wheat is a major cash crop in Oklahoma,
2. Large volumes of grain are transported in Oklahoma,
3. The existence of the McClellan-Kerr Arkansas River System and the proposal for the Poteau-Deep Fork River System, both of which will be sensitive to some proposed changes in transportation policies.

The Oklahoma Department of Agriculture (1986) reported winter wheat to be the biggest cash crop in Oklahoma. The

average value of wheat production for years 1981 through 1985 was 638 million dollars. Oklahoma ranked second in the nation in production of hard red winter wheat six of nine years from 1977 through 1985 and never ranked lower than fourth during this period. Leath et al. (1981) showed Oklahoma supplied 9.6 percent of U.S. wheat exports or about 103 million bushels in 1977. This was about 58.7 percent of 1977 production for Oklahoma.

Oklahoma plays another role in the wheat system; it is the home of several large terminal elevators as well as several flour mills and feed processors. As a result, high levels of wheat movement occur in and through this state. Table 1.1 compares the volume of wheat moving into, through, and out of the state by mode of transportation for the two years, 1977 and 1985.

Transportation costs have a direct affect on the price of wheat in Oklahoma. The gulf basis is the difference between the local elevator wheat price and the gulf price. The basis is approximately equal to the transportation cost from the local point to the gulf plus an operating margin for the elevator. An inefficient transportation system leads to higher transportation cost; therefore, a lower Oklahoma wheat price than would exist under a more efficient system.

The McClellan-Kerr Arkansas River Navigation System was officially opened in December 1970. Warner (1981) reported that by 1980, the Arkansas River system transported 3.7

million tons of outbound freight on the Oklahoma portion of the waterway. Of this, farm products represented 852 thousand tons, mostly in the form of outgoing wheat. Warner also estimated that the waterway reduced the cost of transporting grain by \$14.558 million in 1978.

### Purpose

The purpose of this study is to develop a series of models to determine least cost flow patterns for Oklahoma produced wheat under different assumptions. Each model will determine an optimal transportation mode and route for wheat

Table 1.1. Oklahoma Wheat Shipments by Mode.

Wheat Shipments	1977		1985 (est)	
	Thousand Bushels	Percent	Thousand Bushels	Percent
Into Oklahoma	35,000		23,356	
By Rail	24,500	70%	10,806	46%
By Truck	10,500	30%	12,550	54%
By Barge	0	0%	0	0%
Intrastate	123,660		195,362	
By Rail	89,035	72%	53,059	27%
By Truck	34,625	28%	142,303	73%
By Barge	0	0%	0	0%
Out of Oklahoma	134,000		86,066	
By Rail	103,180	77%	63,084	73%
By Truck	24,120	18%	16,696	20%
By Barge	6,700	5%	6,286	7%

Source: 1977 data from Mack N. Leath, Lowell D. Hill, and Stephen W. Fuller, 1981.  
1985 estimates from questionnaire data.

movements through Oklahoma under different alternatives. Alternatives to be tested include the effects of contract rail rates, of increasing maximum highway weight limits, of constructing the proposed Poteau-Deep Fork River System, and of increased barge user fees by either a fuel tax or a segmented-specific ton-mile method.

This study considers only a small part of a large transportation system. These results are for Oklahoma but should be valuable throughout the southern plains since Oklahoma is a key state in both wheat production and transportation. As shown earlier, wheat grown outside Oklahoma is shipped through terminal elevators in Oklahoma. Furthermore, Oklahoma has access to three major modes of transportation, truck, rail, and barge. Barges give Oklahoma access to the Mississippi River system as well as sea ports in New Orleans and Houston.

Many factors affect such a model; however, the size of the model if these factors were endogenous would be prohibitive. Therefore, these variables will be introduced as exogenous constraints to these models.

### Objectives

The objectives of this study are to:

1. Develop a least cost model of the wheat transportation system in Oklahoma under current conditions,
2. Analyze the internal effect of contract rates on the structure of the wheat transportation system,

3. Analyze the internal effect of increasing the legal maximum highway weight limits,
4. Analyze the effect of a full cost recovery user fee on the barge system by either a fuel tax or a segment-specific ton-mile tax,
5. Analyze the effect of a waterway system if it were developed along the Deep Fork of the Canadian River as presently under study.

These objectives will be accomplished through a series of eight models. These models will be variations in these assumptions for the model in objective one. The eight models will be:

1. Least cost flow with contract rates between terminal elevators,
2. Model 1 without contract rates for terminal elevators,
3. Model 1 with truck net weights increased from 55,000 pounds to 65,000 pounds,
4. Model 1 plus ports in McAlester, Poteau, and Eufaula on the Poteau-Deep Fork River System,
5. Model 1 plus full recovery fuel tax on existing ports,
6. Model 5 plus Poteau-Deep Fork River ports,
7. Model 5 with the segment-specific tax instead of the fuel tax,
8. Model 6 with segment-specific tax instead of the fuel tax.

Furthermore, these eight models will be developed under five sets of assumptions. These sets are:

- A. Handling costs of ten cents into and ten cents out of an elevator, with farm storage equal to five percent of production,
- B. Handling costs of fifteen cents in and fifteen cents out, with farm storage as specified in Set A,

- C. Handling costs of ten cents in and ten cents out, with farm storage of 130,551 thousand bushels, divided among counties according to county production levels,
- D. Set C plus a constraint on flows through New Orleans such that flow above 6,286 thousand bushels must be shipped on to Houston at an additional cost of \$120 per thousand bushels,
- E. Handling costs of fifteen cents in and fifteen cents out, with farm storage of 130,551 thousand bushels, divided among counties according to county production levels.

Models will be specified by a model number and letter. The number will refer to the model, 1 through 8, and the letter will refer to the assumption set used, A through E.

The objectives of this study will be met by comparing flows and costs from different models. Models one and two will be used to test the effect of contract rates on the structure of the grain system. Models one and three will determine the potential effects of increased highway weights. Models one and four will test the potential effects of the proposed Poteau-Deep Fork System. Models five through eight will be compared to models one and four to determine effects of inland barge system user fees upon the Oklahoma wheat transportation system.

The remainder of this study will consist of a literature review of issues in grain transportation and work related to this study in Chapter 2. It will also review the relationship between transportation cost and wheat price and some work done in transportation research. Chapter 3 will present the Out-of-Kilter Algorithm used to solve these models. Chapter 4 will outline the structure of models used

in this study and present data used in these models.

Chapter 5 will present the results of these models. Summary and conclusions will be presented in Chapter 6.

## CHAPTER II

### ISSUES IN GRAIN TRANSPORTATION

Wheat is transported from production regions to consuming regions throughout the world. Oehrtman (1974) states:

Transportation is not desired for its own sake but rather for its capacity to contribute ultimately to the satisfaction of human wants.

The grain system, prices, flow patterns, and facility locations are all related to transportation rates and modes available. Research in grain transportation is important because the transportation system must be efficient for the U.S. to be competitive with other nations in grain exporting, states Fuller et al. (1981).

#### Theoretical Role of Transportation Costs

Transportation costs are important in determining the price of wheat at county elevators. Figure 2.1 shows a hypothetical supply and demand curve for wheat. The equilibrium price and quantity assuming zero transportation cost (point e) is  $OP^*$  and  $OQ^*$ , respectively. Assuming transportation cost of  $ab$ , the price paid by consumers is  $OP_c$ , received by farmers is  $OP_f$ , and quantity supplied is  $OQ_s$ .



Portions of transportation costs are paid by farmers and portions are paid by consumers. The portion paid by each group can be determined from the elasticity of supply,  $E_S$ , and elasticity of demand,  $E_D$ . Using this method, Koo (1983) concluded that the cost of transporting domestically consumed wheat would be shared nearly equally by wheat producers and consumers, but wheat producers would pay a higher percentage of transportation cost for export wheat. This is important to Oklahoma wheat producers since a large percentage of wheat produced in Oklahoma goes to export markets.

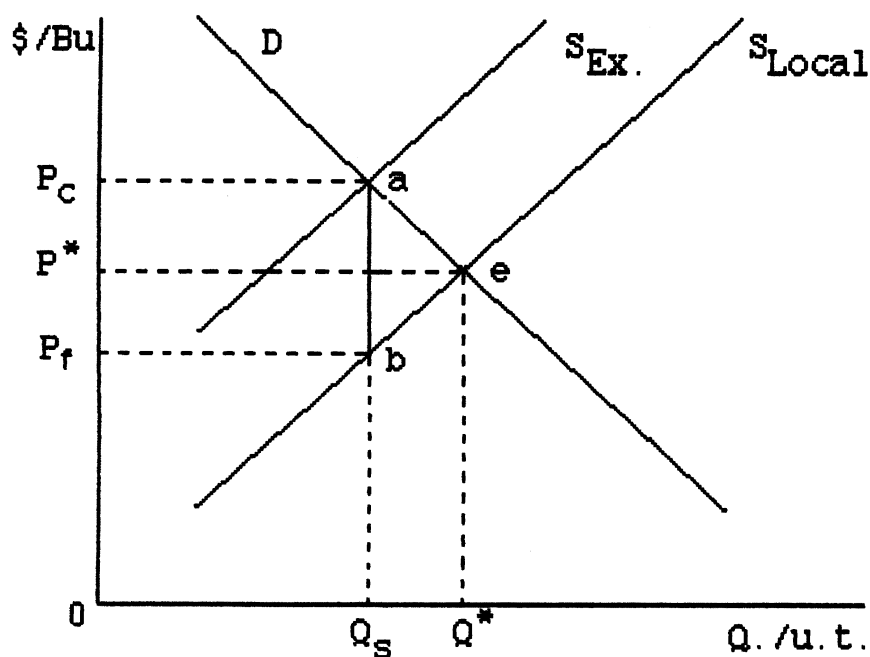


Figure 2.1. Hypothetical Supply, Demand and Transportation Cost for Wheat.

## Rail Rate Regulation

The transportation industry has been heavily regulated for many years. One reason for regulation of the industry is to protect captive shippers. Captive shippers have no feasible source for transportation service except through the service of one railroad. Rate regulations limit the ability of the rail industry to monopolize these situations.

In recent years, deregulation has changed the transportation industry significantly. This began with the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) and was furthered by the Staggers Act of 1980. These two acts have allowed more flexibility in railroad pricing. One major concern with deregulation is that captive shippers still exist in areas far from markets or alternative transportation modes. Although some deregulation has occurred, the need for regulation still exists. As Sorenson (1984, p. 646) states:

It is not a regulation versus deregulation debate but rather a search for that set of operating rules that most nearly fits collective concepts of equity, economic efficiency, and productivity growth.

Before the Staggers Act, the rail industry operated under strict rules regarding entry and exit, rate pricing, and service. The railroad industry could not make price adjustments rapidly because rate increases required approval of the ICC first.

Since the passage of Staggers, rail companies can make contracts with individual shippers at reduced rates. These

contract rates must exceed the variable cost (as defined by the ICC in Rail Form A) of the haul but can be below the prevailing rate. These contracts must be filed with the ICC but are confidential. Staggers has allowed the railroad to respond to necessary rate changes more quickly. Staggers allows contesting of contract rates within thirty days by other shippers or carriers, but with confidentiality of these contracts, contesting a contract is difficult.

Contract usage has the potential to cause structural changes in the grain transportation system and in the grain handling and storage system. These contracts make it possible for large terminal elevators to ship wheat cheaper through the use of unit trains. These rates are also available to country elevators which can assemble volumes of grain needed for multicar rates. This allows firms to bypass terminal elevators. Researchers are concerned with impacts this may have on the grain transportation system. Kriebel and Baumel (1983) report that between passage of the Staggers Act, on October 14, 1980, and the end of 1982, 4400 contracts had been filed with the ICC. Preliminary survey results from 1985 grain flow study shows that 19 percent of rail grain movements in Oklahoma were under contract rates.

Rail deregulation was enacted to make rail rates more responsive. Proponents of deregulation claim that price competition caused by deregulation will cause lower rates and improve the efficiency of the transportation industry. They claim the PreStaggers rate structure reduced incentives

for carriers to improve productivity and to lower cost. Koo (1983) has determined that key variables in the determination of rail rates under deregulation are:

1. Distance to be hauled,
2. Shipment size,
3. Frequency of shipments,
4. Levels of intermodal and intramodal competition,
5. Market characteristics of the origin and destination.

Little empirical research has been done on the effects of the Staggers Act. Provisions for confidential contracts and flexible rates make such research difficult. Some research has been done on its effect upon grain prices. Arguments by Koo (1983) and by Johnson (1983) suggest that grain prices will be higher, but more volatile under these new regulations. Fruin (1983) argues that even if prices are more volatile, grain producers will be better off because of these higher prices. Adams and Anderson (1985) tested these arguments by comparing PreStaggers basis with PostStaggers basis for corn and soybeans. They concluded that prices were higher and that corn prices were more volatile. Evidence did not show that soybean prices were more volatile. A study by Koo (1982) estimated that average shipping costs for wheat under nine different scenarios would decrease from 51.68 cents to 38.34 cents per bushel given a change from a rate based to a cost based transportation pricing system.

## Rail Line Abandonment

Rail line abandonment is a major issue for the midwestern states. Because of low density of rail lines throughout the southern plains, this is not a major issue in Oklahoma at this time. ICC regulations make the abandonment of rail lines a difficult process. American railroads have many miles of track which are old and in poor condition. This track normally has very low traffic volume and is not capable of handling the larger 100 ton grain hoppers. Continued use and maintenance on these tracks generate large losses for railroads. Upgrading these lines will also cause large losses. Therefore, railroads do not want to continue using these lines.

Kriebel and Baumel (1979) present arguments between shippers and rail industry leaders. Shippers on lines targeted for abandonment argue that rail service is vital to their business and that a loss of rail service will result in efficiency losses for the transportation system. These shippers claim that loss of these lines would make shipping products considerably more expensive, maybe impossible. Communities on these lines claim that rail service is vital to the survival of these towns. Railroad operators counter with their own arguments. Their studies show that abandonment will be offset by lower costs on main lines. These lower costs will be enough to offset efficiency lost by relying on trucks to haul grain to rail lines. They state that sixty-four percent of U.S. communities do not

have rail service. Furthermore, that communities on abandoned lines have continued to prosper.

A study by Baumel, Miller, and Drinka (1977) looked at rail line abandonment in Iowa. Of seventy-one lines that were under consideration for abandonment, ten were determined as feasible to operate. For a line to be feasible, it had to meet at least one of the following criteria:

1. The line must carry sizable volume,
2. The line must have one sizable or several smaller nonagricultural shippers to maintain volume,
3. The line must be in a relatively good state of repair which reduces upgrading cost,
4. The line must be one of a few left in an area so that it can draw volume from other abandoned lines.

Losses from operating low volume lines have made competition with other modes of transportation difficult for railroads. Kriebel and Baumel (1979) state the rail industry average return on investment for 1978 was 1.6 percent. Since trucks are more efficient on the shorter, smaller hauls, the rail industry loses traffic to the truck industry. Anytime the rail industry was granted an increase to cover losses on these tracks, the truck industry would benefit from a little more traffic. The loss of traffic made more miles of unfeasible track and made another rate increase necessary to cover higher fixed cost per unit. This had become a cycle but may be broken with the Staggers Act. A study by Michals, Levins, and Fruin (1982) of

sixty-nine counties in Minnesota determined which mode of transportation would be the cheapest for each county to use for grain shipments to Minneapolis. Table 2.1 shows the number of counties where rail was least cost, truck was least cost, and cost was equal for the two modes. Notice how rail dominated through 1973, and how trucks have come to dominate since that time.

#### User Charges

User charges are a major issue in the barge industry and to a lesser extent in the trucking industry. Unlike rail lines which are built and maintained by the railroads, the highways and inland water system are built and maintained by the government. Shafer (1979) argues a user charge which could recover the cost of these resources would create an incentive to use the least cost method. One problem is in assigning these costs. What percentage of highway costs should trucks pay?

Table 2.1. Number of Minnesota Counties By Least Cost Mode of Transportation.

Dominant Mode	Year				
	1970	1973	1975	1977	1979
Rail	30	58	0	0	0
Truck	18	8	66	69	69
Equal	21	3	3	0	0

The barge industry presently has a user fee in the form of a surcharge on fuel which was introduced at 4 cents per gallon in 1980 and increased slowly to 10 cents per gallon by 1985. The Reagan Administration has proposed that user fees be increased to recover full cost of the inland barge system.

Hauser, Beaulieu, and Baumel (1985) studied the effect of this charge under two proposed methods, a fuel tax and a segment-specific ton-mile tax. A segment-specific ton-mile tax would charge a user fee on a ton-mile basis which would vary with the development and maintenance costs on each segment of the inland waterway system. They used a linear programming model to determine optimal flows under the present tax, the fuel tax, and the segment tax. Their study showed that nationwide, the barge system would lose 14 percent of its current volume with a fuel tax and 18 percent given the segment tax. Rail and trucking industries would gain 9.4 and 10.8 percent, respectively, with the fuel tax and would gain 11.4 and 16.7 percent, respectively, under the segment tax. On the Arkansas River system, a price increase of 10.9 and 52.9 percent would be needed to cover the fuel tax and the segment tax, respectively. These rate increases would result in a decrease from 21.9 million bushels grain moving by barge to 5.2 million for the fuel tax and no grain movement for the segment tax.

Barges under the present structure can provide competition for the rail system. A study by Johnson and



Mennem (1976) determined that a combination of truck and barge could transport wheat at cost equal to or below the cost of rail from all parts of Kansas except for some southwestern portions.

Fuller, Makus, and Taylor (1983) considered the maximum revenue-to-variable cost (as defined in Rail Form A by the ICC) ratio which the rail industry could charge before losing traffic to other modes. Results from their study concerning wheat grown in the southern plains region showed that as distance from the barge system increased, so did the allowable ratio. The ratios for Oklahoma were 1.3, 1.6, and 1.9 times variable cost for eastern, central, and western Oklahoma, respectively. Although the barge industry is competitive under the present structure, Fruin (1981) argues that the barge industry may not be competitive if user fees are enacted to recover the full cost of the inland waterway system.

## CHAPTER III

### THE OUT-OF-KILTER ALGORITHM

The models used in this thesis will be solved through use of the Out-of-Kilter Algorithm (OKA). Since OKA is based upon network procedures, the network procedure concept will be discussed briefly before discussing OKA. Readers desiring a more in-depth discussion should refer to Ford and Fulkerson (1962), Potts and Oliver (1972), Plane and McMillan (1971), or Stegelin (1979).

Applications in network procedure are discussed by Anderson et al. (1982). Two well known network analysis techniques are Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM). These two techniques are used in planning, scheduling, and controlling large scale projects. Network analysis can be used in finding the shortest path between locations (the shortest highway route between two cities), finding maximum flows through a system, and designing communication systems. However, the emphasis here is upon its use in finding minimum cost flows.

Nodes and arcs provide the basis for work in OKA. Nodes represent shipping or source locations ( $i$ ) and receiving or sink locations ( $j$ ). Arcs are flows between nodes and are named based upon the nodes they connect ( $i,j$ ).

Each arc has a cost ( $C_{ij}$ ) associated with its use plus lower and upper bounds. The minimum cost problem is to find the flow which will minimize total cost of the flow:

$$\text{Minimize } \sum C_{ij}X_{ij}, \text{ for all } i \text{ and } j \quad (3.1)$$

while not violating the constraints:

$$L_{ij} \leq X_{ij} \leq U_{ij}, \text{ for all } i \text{ and } j, \quad (3.2)$$

$$\sum_j X_{ji} - \sum_j X_{ij} = 0 \text{ for all } i. \quad (3.3)$$

where:

$C_{ij}$  is a matrix of flow costs,  
 $X_{ij}$  is a matrix of flows,  
 $L_{ij}$  is a matrix of lower bounds,  
 $U_{ij}$  is a matrix of upper bounds.

Stated verbally, this is find the minimum total flow cost (3.1) such that flows are within the lower and upper bounds, inclusively (3.2) and such that outbound flows are equal to inbound flows for all nodes (3.3).

A feasible solution occurs when Equations (3.2) and (3.3) hold. However, an optimal solution requires a feasible solution where equation (3.1) is minimized.

OKA uses node "prices" ( $P_i$  and  $P_j$ ) in its solution process. The algorithm tries to bring arcs into "kilter" by first adjusting flows and second by adjusting node prices for arcs which are out-of-kilter. The algorithm starts with all flows and prices set to zero and increases them as necessary. The net cost of flow over an arc becomes:

$$\bar{C}_{ij} = C_{ij} + P_i - P_j \quad (3.4)$$

The cost  $\bar{C}_{ij}$  becomes the total cost to the system to shipping from  $i$  to  $j$ . Using equations (3.2) and (3.4), three equations can be developed to represent optimal cases:

$$\text{If } \bar{e}_{ij} < 0, \text{ then } X_{ij} = U_{ij} \quad (3.5)$$

$$\text{If } \bar{e}_{ij} = 0, \text{ then } L_{ij} \leq X_{ij} \leq U_{ij} \quad (3.6)$$

$$\text{If } \bar{e}_{ij} > 0, \text{ then } X_{ij} = L_{ij} \quad (3.7)$$

If one of Equations 3.5, 3.6, or 3.7 hold for a given arc, the arc is in-kilter. Table 3.1 shows these cases plus the other possibilities for arcs which may occur in OKA. In this table, The first letter is either K, for arcs in-kilter (equations 3.5 through 3.7), or N for arcs not in-kilter. Some have labels of F, R, or both. F (forward) indicates that the flow over that arc can increase without bringing it out-of-kilter or needs to increase to bring it into kilter. R (reverse) means flow may decrease and remain in-kilter or must decrease to come into kilter. For both to occur, the arc must be in-kilter. Flow may be increased or decreased without forcing the arc out-of-kilter for this case.

Each arc has a corresponding kilter number which is non-negative. If the arc is in-kilter, this number is zero. In cases where equation 3.2 does not hold (the case in the left-most and right-most columns in Table 3.1), the kilter

Table 3.1. Possibilities for Arcs in the Out-of-Kilter Algorithm.

	$X_{ij} < L_{ij}$	$X_{ij} = L_{ij}$	$L_{ij} < X_{ij} < U_{ij}$	$X_{ij} = U_{ij}$	$X_{ij} > U_{ij}$
$\bar{e}_{ij} < 0$	NF	NF	NF	K	NR
$\bar{e}_{ij} = 0$	NF	KF	KFR	KR	NR
$\bar{e}_{ij} > 0$	NF	K	NR	NR	NR

number is a measure of infeasibility. If the optimality equations (3.5 through 3.7) do not hold (the out-of-kilter arcs in the center three columns of Table 3.1), the kilter number becomes a measure of the degree by which they fail to be optimal. The equations needed to calculate kilter numbers are:

$$L_{ij} - X_{ij} \quad (3.8)$$

$$\bar{e}_{ij} [X_{ij} - U_{ij}] \quad (3.9)$$

$$\bar{e}_{ij} [X_{ij} - L_{ij}] \quad (3.10)$$

$$X_{ij} - U_{ij} \quad (3.11)$$

Table 3.2 shows which equation is used to calculate kilter number or the equation which determines that the arc is optimal.

Ford and Fulkerson (1962, p. 164) report kilter numbers in the OKA solution process are monotonic, nonincreasing. This is with each iteration of the solution process, no kilter number will increase; although, it is possible that no kilter number will decrease. Once an arc is in-kilter,

Table 3.2. Equation Used to Calculate Kilter Number for Out-of-Kilter Arcs or to determine that arcs are In-Kilter.

	$X_{ij} < L_{ij}$	$X_{ij} = L_{ij}$	$L_{ij} < X_{ij} < U_{ij}$	$X_{ij} = U_{ij}$	$X_{ij} > U_{ij}$
$\bar{e}_{ij} < 0$	3.8	3.9	3.9	3.5*	3.11
$\bar{e}_{ij} = 0$	3.8	3.6*	3.6*	3.6*	3.11
$\bar{e}_{ij} > 0$	3.8	3.7*	3.10	3.10	3.11

\* Indicates that arc is in-kilter.

the arc will never become out-of-kilter. When all arcs are brought into kilter, the optimal solution has been found and the process completes.

An out-of-kilter arc indicates that it is necessary, profitable or both to forward (increase) flow or reverse (decrease) flow. The algorithm arbitrarily selects an out-of-kilter arc  $(i,j)$ . Forward flow indicates a need for shipments from  $i$  to  $j$ ; reverse flow indicates need for flow from  $j$  to  $i$ . Table 3.1 has shown the cases where forward and reverse flows may be needed.

To change flow on an arc  $(i,j)$  yet keep equation 3.3 equal, a path from  $j$  to  $i$  that will allow this flow change must be found. To keep flows in balance when constructing new paths, OKA "labels" each node. This label is kept with the receiving node  $(j)$ . This label identifies the shipping node, the amount of flow, and the direction of flow. The labels pattern is  $[i \pm, K_j]$  where  $i$  is the shipping node, the plus and minus indicate forward and reverse flow, respectively, and  $K_j$  represents the amount of flow necessary.

Failure to find such a path is termed non-breakthrough. If this occurs, OKA will increase node prices. The results of the changing the node price will be:

- a. another node is labeled in the  $j,i$  path,
- b. one less arc is included in the  $j,i$  path,
- c. no arcs remain to develop a path.

If case a or b occurs, OKA will continue its attempt to find a path from  $j$  to  $i$ . However, if case c occurs, no path can be found and the problem is determined to be infeasible.

OKA has several rules needed for labeling nodes. These rules are:

- Rule 1: Before a node can be labeled, it must
- a. be connected to a labeled node, and
  - b. either be:
    1. the sink of an arc with additional forward flow possible, or
    2. the source of an arc with additional reverse flow possible.
- Rule 1a: When no nodes are labeled, OKA arbitrarily selects an out-of-kilter arc and either
- a. labels the sink of the arc if additional forward flow is possible, or
  - b. labels the source of this branch if additional reverse flow is possible.
- Rule 2: Find the smallest  $|E|$  (to be labeled as  $I$ ) from among all arcs which:
- a. connects a labeled node to an unlabeled node, and
  - b. either
    1.  $E > 0$ , the source is labeled, and  $X \leq U$ , or
    2.  $E < 0$ , the source is not labeled, and  $X \geq L$

Increase all unlabeled node prices by  $I$ .  
 NOTE: Do not change prices of labeled nodes.  
 If no node can meet the criteria set in a and b, no flow will satisfy the requirements.

- Rule 3: If node  $l$  is labeled and connected to node  $m$ , and if node  $m$  is susceptible to being labeled in accordance to rule 1, OKA labels node  $m$  as

$[l \text{ } \neq, K_m]$  where the sign  $\neq$  indicates the possible direction of flow for  $(l,m)$  and  $K_m$  is equal to the smaller of

- a.  $K_l$ , from the label for  $l$ , and
- b. either  $X_{lm} - L_{lm}$  or  $U_{lm} - X_{lm}$ , depending upon whether a "L" or a "U" is in the arc description found in Table 3.3.

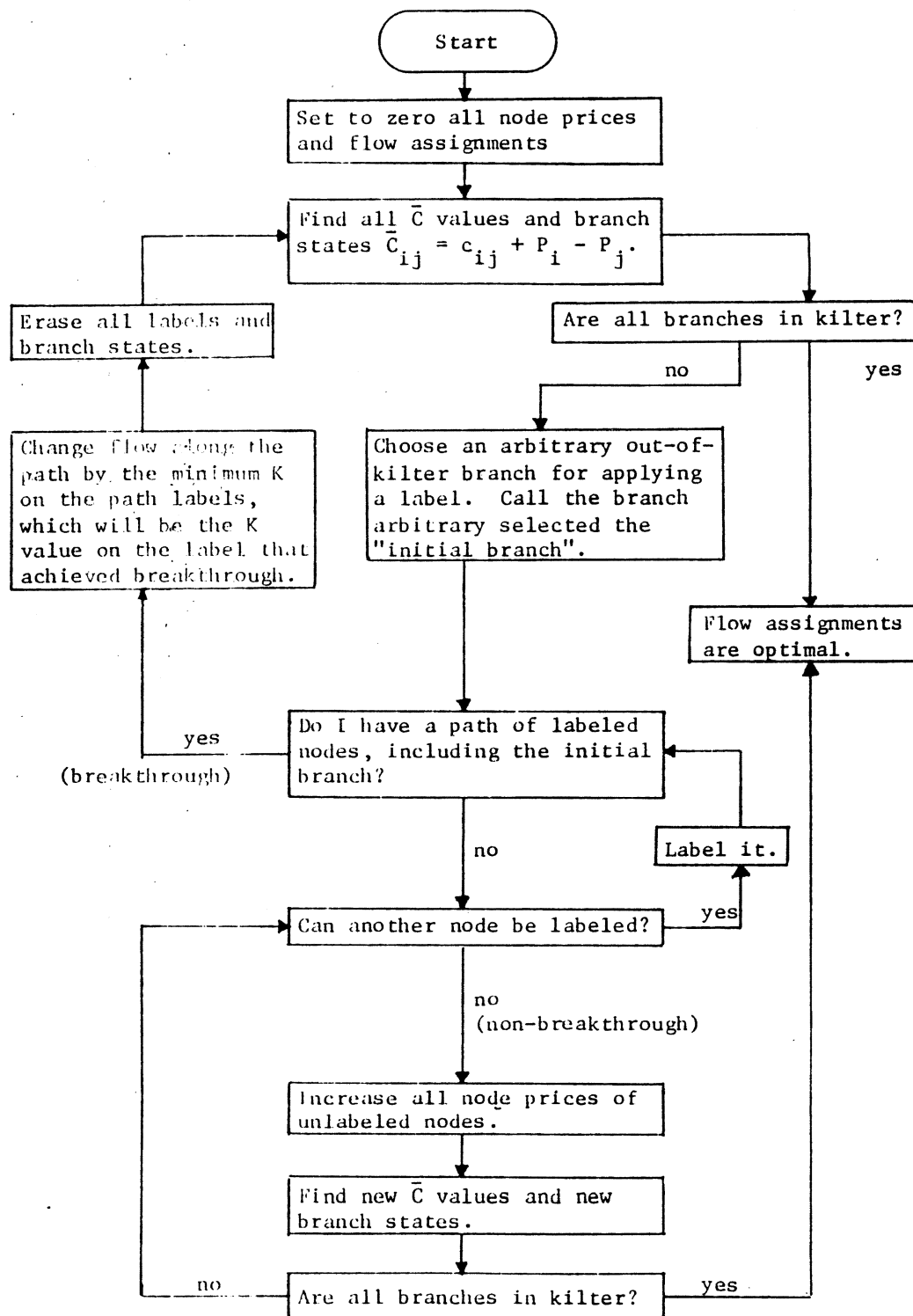
Rule 3a: If all nodes are unlabeled (the labeling process is just beginning), node  $m$  will not be connected with a labeled node. In this case, node  $m$  will be labeled as:  $[h \text{ } \neq, K_m]$  where  $h$  is an arbitrarily selected node  $l$ . The other details of the label are the same as rule 3.

Figure 3.1 diagrams the OKA solution process. This diagram provides a summary of the OKA process. Proof that the OKA algorithm terminates with an optimal solution can be found in Ford and Fulkerson (1962), Potts and Oliver (1972), or Bazaraa and Jarvis (1977).

Table 3.3. Upper and Lower Labels Used in Determining the Value for  $K_m$  in Rule 3 and Rule 3a.

	$X_{ij} < L_{ij}$	$X_{ij} = L_{ij}$	$L_{ij} < X_{ij} < U_{ij}$	$X_{ij} = U_{ij}$	$X_{ij} > U_{ij}$
$\bar{e}_{ij} < 0$	U	U	U		U
$\bar{e}_{ij} = 0$	U	U	U or L	L	L
$\bar{e}_{ij} > 0$	L		L	L	L





Source: Stegelin, 1979, p. 76.

Figure 3.1. Flow Diagram of the Out-of-Kilter Algorithm.

## CHAPTER IV

### DESCRIPTION OF MODELS AND DATA

This chapter discusses models considered in this project. The first section discusses the structure of these models developed. Nodes used in these models are enumerated and the methods used to link these nodes to form arcs is presented. This structure holds for all models included in this study. Different models are developed by changing cost assumptions.

The second major section is subdivided by model. Each subdivision will focus on characteristics which make that model unique in this study.

#### Model Structure

Oklahoma has thousands of wheat producers scattered throughout the state. Therefore, it is not practical to model the wheat transportation system beginning at producer level. To reduce the size of the model, all wheat is considered to originate at one location per county; the county seat. County seats were chosen since they tend to be the largest community in any county, to be centrally located, and to have best access to highways and railways.

Wheat production, like farmers, is also scattered throughout the state. Production is not equally dispersed throughout the state. Wheat production in Oklahoma is concentrated in the western half of the state with the largest producing counties normally in the northcentral part of the state. The eastern half of the state only produces a small percentage of production. To reduce the size of the model, fifteen eastern counties were removed from the model by combining production from that county with production in an adjacent county. A county was never combined with an adjoining county if production exceeded 240,000 bushels. Table 4.1 shows which counties were eliminated, which county received its production, and the shifted production level of the county eliminated. The elimination of these fifteen counties reduces the model to 62 originating county nodes.

In some counties, production exceeds storage capacity. Since harvest occurs over a short time period, usually about two weeks in any county and a month for the entire state, some wheat shipments must be made during harvest. During harvest, the transportation system runs at full capacity. One result of this is higher transportation costs during harvest periods. To model this occurrence, county production was split into two nodes, one for production which must move during harvest and one for production which can be shipped later. Wheat which requires movement during harvest will be referred to as harvest grain and wheat which can be stored locally through the harvest period will be

Table 4.1. Counties Eliminated from Study.<sup>a</sup>

Eliminated County	County Receiving Production	County Production
Adair	Cherokee	33
Coal	Johnston	23
Delaware	Mayes	132
Haskell	Sequoyah	35
Hughes	Pittsburg	92
Latimer	Leflore	13
Love	Carter	235
Marshall	Bryan	110
McIntosh	Okmulgee	61
Murray	Pontotoc	68
Nowata	Rogers	182
Okfuskee	Creek	133
Pushmataha	Atoka	10
Seminole	Pottawatomie	102
Washington	Tulsa	218

Source: Oklahoma Agricultural Statistics, 1985

<sup>a</sup> In thousands of bushels.

referred to as nonharvest grain. This distinction will be maintained until the grain reaches a terminal elevator location.

Four rules were used to determine the amount of wheat which had to be shipped during harvest for models without farm storage. These rules are:

1. Ten percent of county storage capacity had to be maintained for working room leaving ninety percent available for grain storage,
2. Each county had farm storage equal to five percent of production so that only ninety-five percent of production would need commercial storage during harvest,
3. Storage was empty at start of harvest,

4. Excess storage capacity of one county could not be used by other counties (unless these counties were combined).

Rules used for models including farm storage are:

1. Farm storage was equal to county production divided by state production times total Oklahoma farm storage of 130,551 thousand bushels.
2. Stocks held in farm storage were equal to county production divided by state production times Oklahoma farm stocks of 8,586 thousand bushels.
3. The percentage of commercially-stored stocks to be allocated to each county was computed by dividing commercial storage capacity in a county by total commercial storage capacity in the state (computed as total county-level commercial storage capacity plus terminal storage of 75 million bushels). This percentage was then multiplied by total commercially-stored stocks in Oklahoma of 88.5 million bushels.
4. Available storage at the county level was equal to commercial storage plus farm storage less commercial and farm held stocks.

Table 4.2 lists each county in the model with its storage capacity, production level, nonharvest grain flow, and harvest grain flow level.

Data used for Table 4.2 came from several sources. Storage capacities were taken from those firms listed in the Oklahoma Grain and Feed Association Handbook. Terminal elevators and feed processors were removed for this calculation. Production levels came from Oklahoma Agricultural Statistics, 1985. The working space estimates and the farm storage estimates used to determine county storage excluding farm storage were determined using a 1977 survey conducted by Dr. Robert Oehrtman. Farm and commercially-stored stocks, and farm storage estimates used

Table 4.2. Storage Capacity, Wheat Production, Harvest and Nonharvest Grain Movements Necessary for Commercial and Commercial plus Farm Storage Models.<sup>a</sup>

County	Storage Capacity	Wheat Production	Commercial Storage		Commercial and Farm Storage	
			Nonharvest Grain	Harvest Grain	Nonharvest Grain	Harvest Grain
Alfalfa	5,406	6,890	5,210	1,680	6,890	
Atoka	0	20	1	19	15	5
Beaver	2,492	5,818	2,534	3,284	5,740	78
Beckham	1,072	3,277	1,129	2,148	3,042	235
Blaine	8,948	6,333	6,333		6,333	
Bryan	400	191	191		191	
Caddo	5,199	5,344	4,946	398	5,344	
Canadian	11,467	5,543	5,543		5,543	
Carter	304	272	272		272	
Cherokee	20	42	20	22	42	
Choctaw	0	288	14	274	213	75
Cimarron	2,375	4,950	2,385	2,565	4,950	
Cleveland	0	321	16	305	237	84
Comanche	494	2,319	561	1,758	2,000	319
Cotton	2,097	4,473	2,111	2,362	4,473	
Craig	551	644	528	116	644	
Creek	0	196	10	186	145	51
Custer	7,827	5,728	5,728		5,728	
Dewey	1,133	3,248	1,182	2,066	3,055	193
Ellis	1,856	2,886	1,815	1,071	2,886	
Garfield	8,150	9,778	7,824	1,954	9,778	
Garvin	220	711	234	477	653	58
Grady	1,670	1,746	1,590	156	1,746	
Grant	5,150	9,720	5,121	4,599	9,720	
Greer	406	2,567	494	2,073	2,132	435
Harmon	15	1,770	102	1,668	1,317	453
Harper	445	3,696	585	3,111	2,989	707
Jackson	4,933	5,967	4,738	1,229	5,967	
Jefferson	366	1,042	382	660	982	60
Johnston	0	61	3	58	45	16
Kay	6,882	6,198	6,198		6,198	
Kingfisher	5,141	6,589	4,956	1,633	6,589	
Kiowa	3,349	5,873	3,308	2,565	5,873	
Leflore	0	209	10	199	154	55
Lincoln	151	245	148	97	245	
Logan	2,414	2,538	2,300	238	2,538	
Major	2,853	4,183	2,777	1,406	4,183	
Mayes	40	520	62	458	407	113
McClain	120	531	135	396	462	69
McCurtain	164	363	166	197	363	
Muskogee	760	371	371		371	
Noble	4,024	3,152	3,152		3,152	
Oklahoma	1,761	571	571		571	
Okmulgee	40	323	52	271	262	61
Osage	0	621	31	590	459	162

Table 4.2. continued.

County	Storage Capacity	Wheat Production	Commercial Storage		Commercial and Farm Storage	
			Nonharvest Grain	Harvest Grain	Nonharvest Grain	Harvest Grain
Ottawa	2,398	890	890		890	
Pawnee	440	316	316		316	
Payne	1,389	876	876		876	
Pittsburg	421	126	126		126	
Pontotoc	530	80	80		80	
Pottawatomie	500	344	344		344	
Roger Mills	467	1,514	496	1,018	1,389	125
Rogers	490	372	372		372	
Sequoyah	500	98	98		98	
Stephens	358	534	349	185	534	
Texas	9,118	11,150	8,764	2,386	11,150	
Tillman	4,590	5,427	4,402	1,025	5,427	
Tulsa	266	529	266	263	529	
Wagoner	0	483	24	459	357	126
Washita	2,856	4,850	2,813	2,037	4,850	
Woods	6,502	7,179	6,211	968	7,179	
Woodward	3,046	2,105	2,105		2,105	
Totals	134,566	165,001	114,369	50,632	161,521	3,480

Source: Storage capacity from Oklahoma Grain and Feed Association Handbook.

Wheat production from Oklahoma Agricultural Statistics, 1985

<sup>a</sup> All data in thousands of bushels.

to determine county storage for models including increased farm storage were taken from Grain Stocks June, 1986 and January, 1987.

Since the system is not at capacity limits, nonharvest grain shipments are not constrained. In these models, county elevators may ship nonharvest wheat to terminals, flour millers, feed processors, or to other country elevators to meet model requirements. The following

guidelines were used throughout the development of these models:

1. Rail could be used to ship to any terminal or to mills in Shawnee and Enid (if rail is available at county seat) if destination is within one hundred miles,
2. Any country elevator, terminal, or barge location can ship by rail direct to Houston for export,
3. Trucks could be used to haul to any terminal or to millers listed above only if within 250 miles,
4. Trucks could be used to haul to another country elevator if the distance of this haul did not exceed 100 miles,
5. Maximum wheat receipt limits were not imposed on country elevators, millers, or terminals,

Harvest flows had to be modeled differently. Each terminal has a maximum receiving capacity for the harvest period. This constraint is normally caused by the elevator leg which has limited capacity. During harvest, these terminals receive grain at maximum capacity. Since separate legs are often used for truck and rail receipts, these capacities must be kept separate. To do this, two sets of nodes were added to the model for each terminal. These sets represent truck receiving and rail receiving locations for each terminal. Using harvest time trucking and rail costs, country elevators may ship to the truck receiving node, the rail receiving node, or both. These nodes then ship at no cost to the terminal which they represent; however, they are constrained to only allow the maximum capacity for that terminal to be received during harvest. Harvest capacity



for truck and rail receipts for each terminal in the model is shown in Table 4.3.

Counties with rail facilities are further restricted so that only two million bushels may be shipped during harvest by truck before rail must be used. This restriction has been placed in these models since the availability of trucks may be limited during harvest. Locations which do not have rail access were not restricted.

Once wheat has arrived at a terminal elevator, the distinction of harvest or nonharvest grain is removed. Any

Table 4.3. Capacity Constraints Used In Models for Terminals.<sup>a</sup>

Terminal	Capacity	
	Truck	Rail
-----		
Oklahoma Terminals:		
Enid	30000	30000
Shawnee <sup>b</sup>	0	0
River Ports:		
Eufaula <sup>c</sup>	1500	2500
McAlester <sup>c</sup>	1500	2500
Muskogee	700	300
Poteau <sup>c</sup>	1500	2500
Catoosa	1500	2500
Wagoner	700	300
Texas Terminals:		
Paris	3000	12000
Amarillo	3000	12000
Lubbock	3000	12000
Wichita Falls	3000	12000
Ft. Worth	30000	30000
Houston	0	20000
-----		

<sup>a</sup> All data in thousands of bushels.

<sup>b</sup> Milling center.

<sup>c</sup> Proposed port site.

terminal, except for Houston and New Orleans, is allowed to ship to other terminals. These shipments are done using multicar rail rates. River ports may also ship to New Orleans by barge. In this model, no shipments are allowed to New Orleans except barge shipments. No other constraints have been placed on shipments between terminals.

The Out-of-Kilter Algorithm requires a complete flow cycle to solve a model. To do this, two additional nodes are used. These nodes act as a supply point and a demand point. Arcs allocate wheat from the supply to the harvest and nonharvest county nodes. The demand node collects the grain from export elevators and domestic consumption nodes included in the model. Arcs have been included to move wheat from milling centers in Oklahoma to the demand node. Arcs also move wheat from New Orleans and from Houston to the demand node. An arc connects the demand node to the supply node to complete the cycle. On this arc, the minimum and maximum allowable flows are both set to 165,001,000 bushels, the wheat production in Oklahoma for 1985. This forces the flow of wheat through the system. This structure also allows the model to determine how much wheat should move through Houston and through New Orleans.

This structure remain constant through all models except Set D. In Set D, terminals in New Orleans are restricted to 6,286 thousand bushel capacity. This amount is equivalent to flows to New Orleans in preliminary survey results of 1985 grain flow. Once this limit is reached,

additional amounts can be barged to Houston for an additional cost of \$120 per thousand bushel. This charge is to pay higher barge costs to Houston. No additional handling costs are included for flows through New Orleans to Houston.

### Individual Models

#### Model 1

Model 1 is the "base" model for this study. The objective of this model is to determine the optimal flow pattern under current operating conditions. Since other models are compared to this model, an in-depth discussion of costs will be presented in this section. Subsequent sections will focus on how these other models differ from the base model.

Arc costs are a combination of several components. Included in each arc cost is a loadout charge for the shipping node, fixed and variable costs for transportation of the grain, and an unloading charge for the receiving node. Assumption sets A, C, and D include ten cents each for loadout and unloading, and sets B and E include fifteen cents each.

Table 4.4 shows truck and rail published rates per hundred weight for hauls of 5 to 100 miles. These rates are converted from hundred weight units to thousand bushel units, and handling costs are added by the equation:

$$\text{Rate} = \text{HC} + 600 \text{ R} \quad (4.1)$$

Where:

Rate = Cost in dollars per 1000 bushel on arc,

R = Transportation costs per hundred weight,

HC = Handling costs of \$200 or \$300.

The rate in hundred weights is multiplied by 600 to convert from hundred weight into 1000 bushels. These published rates are used for shipment of less than one hundred miles, originating at county elevators for harvest and nonharvest shipments. Table 4.5 shows rates used for shipments from county locations to Houston. For locations without rail service, truck subsidy rates were calculated.

Truck costs for over 100 miles are calculated using two different equations, one for harvest and one for nonharvest shipments. In model one, the equations for truck cost are:

Table 4.4. Published Truck and Rail Rates for Selected Mileages in Cents per Hundred Weight.

Miles Hauled	Truck Costs	Rail Costs
5	13	90
10	14	90
20	15	90
30	17	90
40	18	90
50	20	90
60	24	90
70	25	90
80	28	90
90	30	92
100	31	92

Source: Jim Irlandi, Transportation Consultant.

$$TC_H = HC + 1.64 \text{ Miles} \quad (4.2)$$

$$TC_N = HC + 0.93 \text{ Miles} \quad (4.3)$$

Where:

$TC_H$  = Truck costs during harvest,

$TC_N$  = Truck costs other than during harvest,

HC = Handling costs of \$200 or \$300.

These equations are based upon trucking rates from Irlandi (1987) of \$1.50 per mile during harvest and \$0.85 per mile during nonharvest, and net weight of 55,000 pounds.

In Model 1, contract rates are available for larger volume shippers. Since contract rates are confidential, these are only estimated values. Table 4.6 shows the rates used in Model 1 for shipments between terminal elevators.

Also included in this model are arcs allowing flow from river terminals to New Orleans. Like truck and rail modes, the barge arcs must include a loadout and a unloading charge.

Table 4.7 shows the barge costs used in Model 1. All shipments have a New Orleans destination. Although costs are shown for proposed ports on the Poteau-Deep Fork System, these arcs are limited to zero flow in Model 1.

## Model 2

Model 2 and subsequent models use Model 1 as a beginning point. In each model, an assumption has been changed from those in Model 1. In Model 2, contract rail

Table 4.5. Rail Rate From County Seat Locations to Houston for Export.<sup>a</sup>

County	Town	Rail Rate
Alfalfa	Cherokee	\$582
Atoka	Atoka	\$480
Beaver	Beaver <sup>b</sup>	\$631
Beckham	Sayre	\$600
Blaine	Watonga	\$522
Bryan	Durant	\$450
Caddo	Anadarko	\$546
Canadian	El Reno	\$564
Carter	Ardmore	\$450
Cherokee	Tahlequah <sup>b</sup>	\$634
Choctaw	Hugo	\$474
Cimarron	Boise City	\$648
Cleveland	Norman	\$552
Comanche	Lawton	\$516
Cotton	Walters	\$468
Craig	Vinita	\$582
Creek	Sapulpa	\$582
Custer	Arapaho	\$594
Dewey	Taloga <sup>b</sup>	\$642
Ellis	Arnett <sup>b</sup>	\$618
Garfield	Enid	\$564
Garvin	Pauls Valley	\$504
Grady	Chickasha	\$546
Grant	Medford	\$564
Greer	Mangum <sup>b</sup>	\$548
Harmon	Hollis <sup>b</sup>	\$553
Harper	Buffalo <sup>b</sup>	\$619
Jackson	Altus	\$516
Jefferson	Waurika	\$450
Johnston	Tishamingo <sup>b</sup>	\$433
Kay	Newkirk	\$582
Kingfisher	Kingfisher	\$564
Kiowa	Hobart	\$558
LeFlore	Poteau	\$492
Lincoln	Chandler	\$480
Logan	Guthrie	\$564
Major	Fairview	\$594
Mayes	Pryor	\$570
McClain	Purcell	\$540
McCurtain	Idabel	\$438
Muskogee	Muskogee	\$570
Noble	Perry	\$564
Oklahoma	Oklahoma City	\$558
Okmulgee	Okmulgee	\$612
Osage	Pawhuska <sup>b</sup>	\$576
Ottawa	Miami	\$582
Pawnee	Pawnee	\$564
Payne	Stillwater	\$564

Table 4.5. continued.

Pittsburg	McAlester	\$540
Pontotoc	Ada	\$612
Pottawatomie	Shawnee	\$558
Roger Mills	Cheyenne <sup>b</sup>	\$566
Rogers	Claremore	\$582
Sequoyah	Sallisaw	\$570
Stephens	Duncan	\$480
Texas	Guymon	\$690
Tillman	Fredrick	\$516
Tulsa	Tulsa	\$582
Wagoner	Wagoner	\$492
Washita	Cordell	\$576
Woods	Alva	\$594
Woodward	Woodward	\$612

Source: Jim Irlandi, Transportation Consultant.

Enid Board of Trade.

<sup>a</sup> Rates for 1000 bushels excluding handling charges.

<sup>b</sup> Location uses Truck Subsidy Rates.

Table 4.6. Contract Rail Rates Used in Model 1.<sup>a</sup>

Shipper	Receiver							
	Eufaula	McAlester	Muskogee	Poteau	Catoosa	Wagoner	Ft.Worth	Houston
Enid	264	264	246	300	234	246	666	450
Eufaula							300	516
McAlester							282	498
Muskogee							312	516
Poteau							558	444
Catoosa							360	516
Wagoner							330	516
Paris	312	300	330	540	480	480	300	336
Amarillo							378	504
Lubbock							396	468
Wichita								
Falls	282	282	300	312	312	312	234	408
Ft. Worth								288

Source: Jim Irlandi, Transportation Consultant.

<sup>a</sup> All costs in dollars per thousand bushels.

Table 4.7. Cost Used for Barge Shipments from River Ports to New Orleans in Model 1.<sup>a</sup>

Port Location	Costs to New Orleans
Catoosa	160
Muskogee	151
Wagoner	154
Eufaula	151
McAlester	155
Poteau	150

Source: Jim Irlandi, Transportation Consultant.

<sup>a</sup> All costs in dollars per thousand bushels.

rates are no longer allowed for interterminal shipments.

Instead, a higher noncontract rate has been assumed.

Table 4.8 shows the noncontract rail rates used in Model 2. Other costs have remained the same as in Model 1. Results from Model 1 and Model 2 will be compared to analyze the effects of contract rates on the wheat transportation system.

### Model 3

In Model 3, the loaded net weight for trucks has been increased from 55,000 pounds to 65,000 pounds. A net load weight of 65,000 would result in a gross truck weight of 90,000 to 95,000 pounds depending on the empty weight of the truck. The truck costs equation for these higher weights are:

$$TC_H = HC + 1.38 \text{ Miles} \quad (4.4)$$

$$TC_N = HC + 0.78 \text{ Miles} \quad (4.5)$$



Where:

$TC_H$  = Truck costs during harvest.

$TC_N$  = Truck costs other than during harvest.

HC = Handling costs of \$200 or \$300.

These costs are based upon trucking costs estimates by Irlandi (1987) of \$1.50 per mile during harvest and \$0.85 per mile during nonharvest. Other costs and assumptions remain the same as in Model 1.

#### Model 4

All costs in Model 1 are also used in Model 4. In Model 1, the Poteau-Deep Fork ports have a maximum flow of

Table 4.8. Noncontract Rail Rates Used in Model 2.<sup>a</sup>

Shipper	Receiver							
	Eufaula	McAlester	Muskogee	Poteau	Catoosa	Wagoner	Ft. Worth	Houston
Enid	294	294	276	330	258	276	744	498
Eufaula							330	516
McAlester							312	498
Muskogee							348	570
Poteau							618	492
Catoosa							402	570
Wagoner							366	492
Paris	348	330	366	600	384	384	330	336
Amarillo							420	564
Lubbock							438	528
Wichita Falls	312	312	330	348	348	348	258	408
Ft. Worth								318

Source: Jim Irlandi, Transportation Consultant.

<sup>a</sup> All costs in dollars per thousand bushels.

zero to keep the model from using these ports. In Model 4, the maximum flow constraint is increased to 70 million bushels for each port. This model assumes that these proposed ports have been built and are operational. This model will be compared with Model 1 to analyze the effects of this proposed river system on the Oklahoma wheat transportation system.

#### Models 5 through 9

Barge user fees are a major issue in grain transportation. The next four models test the effects of changing user fees on the inland barge system.

Two methods commonly considered for implementing the barge fee are a fuel tax and a segment-specific ton-mile user fee. The fuel tax would be applied such that all sections of the inland barge system paid equally, despite the development and maintenance costs necessary for each particular section. The segment-specific fee would charge a fee such that each section or segment of the river would pay a fee to offset the development and maintenance costs associated with that segment. Since the McClellan Kerr River System has high development and maintenance costs, the segment-specific tax for it would be much higher. The proposed Poteau-Deep Fork System would also have high fees by this method.

A study by Hauser, Beaulieu, and Baumel (1985) estimated that costs on the Arkansas River would increase

11% if a fuel tax were implemented and by 53% if a segment-specific tax were implemented. These estimates have been applied to the barge costs shown in Table 4.7 to compute the barge costs for models 5 through 9. Table 4.9 shows the costs used in these models.

Models 5 and 6 assume the fuel tax is implemented. Model 5 constrains the proposed ports out of the system where Model 6 allows those proposed ports to enter the system as well. Models 7 and 8 assume the segment-specific tax has been implemented. As in models 5 and 6, models 7 and 8 assume the proposed ports are not in the system, and in the system, respectively. In each of these four models, all other factors remain the same as in Model 1.

Table 4.9. Cost Used for Barge Shipments from River Ports in Models 5 through 9.<sup>a</sup>

Port Location	Fuel Tax	Segment Specific
Catoosa	178	235
Muskogee	168	231
Wagoner	171	236
Eufaula	168	231
McAlester	172	237
Poteau	167	230

Source: Jim Irlandi, Transportation Consultant.

<sup>a</sup> All costs in dollars per 1000 bushels.

## CHAPTER V

### RESULTS FROM SURVEY AND MODELS

This chapter will present results of models developed within this project. Before this is done, the results of a 1985 survey of the Oklahoma grain transportation system will be presented. Results of that survey were included to give the reader a "feel" for the actual flow patterns of Oklahoma produced wheat.

#### Survey Results

The 1985 survey was conducted as part of a nationwide grain flow study. The purpose of that study was to update a 1977 study. Results of the 1977 study were published by Mack N. Leath, Lowell D. Hill, and Stephen W. Fuller (1981). To protect the confidentiality of data, this survey will be discussed on a regional bases.

The 1977 and 1985 surveys divide Oklahoma into four regions, coded as 3601, 3602, 3603, 3604. Figure 5.1 shows those areas of the state represented by each region. A survey form was mailed to each country elevator listed in the Oklahoma Grain and Feed Association Handbook. This form asked for those origins of grain purchases and destinations

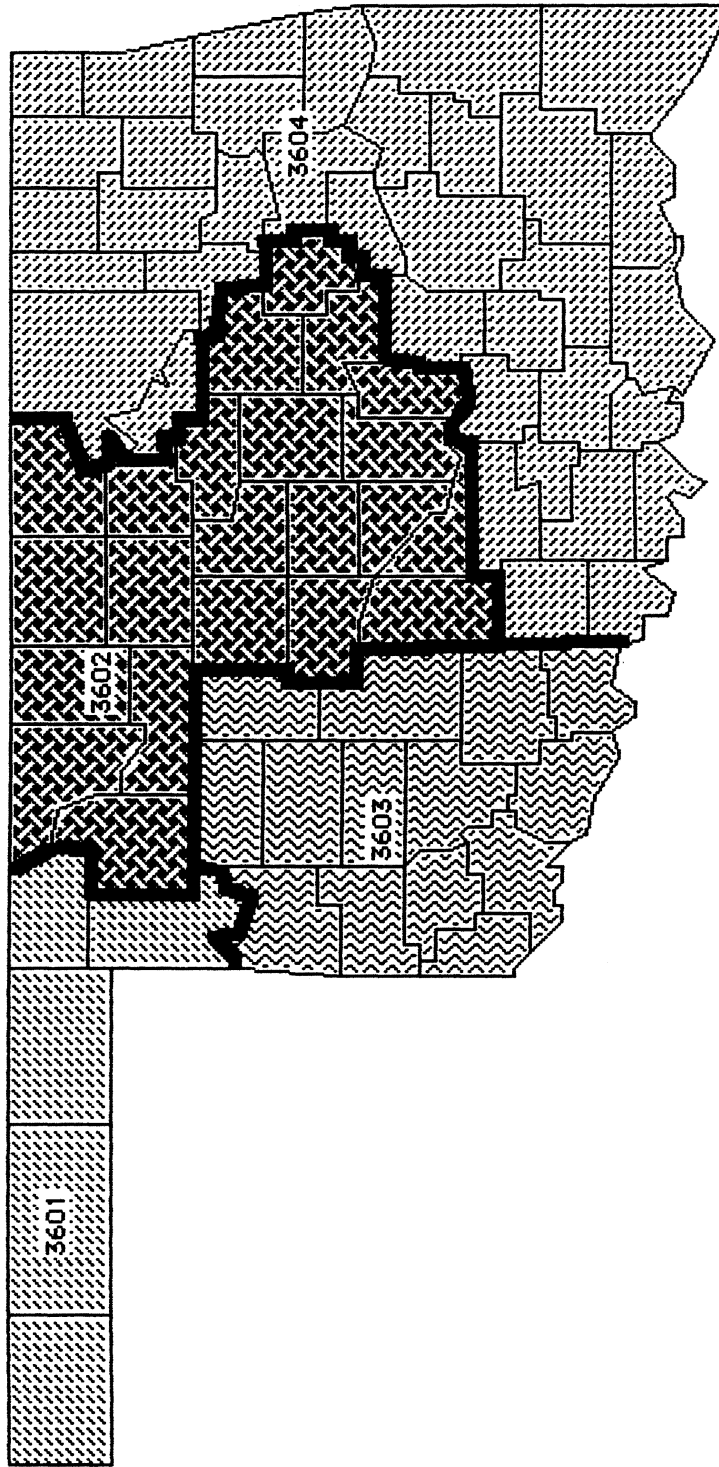


Figure 5.1. Regions Used in 1985 Grain Flow Survey for Oklahoma.

of grain shipments by region. The survey also asked what mode of transportation was used to ship the grain.

Mail surveys followed by personal visits were used for terminal elevators, river port sites, and large mills and feed processors. These surveys asked for the same basic information. Included in this survey was a breakdown of grain purchased from farm organizations or from other elevators.

Table 5.1 shows those shipments among the Oklahoma regions, to Texas terminals, and to export, by mode based upon this survey. Shipments into Oklahoma have been removed from this table. These are preliminary results from the survey. Figure 5.2 shows regions used in Texas. This figure is helpful in interpreting Table 5.1.

## Model Results

### Model 1

As discussed in Chapter 4, Models 1A through 1E are base models. Results of these models can be compared to the survey results since 1985 production data were used.

Tables 5.2 through 5.6 show those results for Models 1A through 1E, respectively. These tables show shipment origin by county seat, destination of shipment, mode used, and bushels shipped, for harvest and nonharvest movements. These tables also show a destination, mode, and the lowest positive shadow price of a next best alternatives for both harvest and nonharvest grain.

Table 5.1. Preliminary Results of Grain Flow Survey by Region in Thousands of Bushels.

	3601	3602	3603	3604
<b>Bushels of Wheat</b>				
By Region of Origin.	15,351	83,689	59,384	6,577
<b>Shipments To 3601</b>				
By Truck	0	11	0	0
By Rail	0	0	0	0
<b>Shipments To 3602</b>				
By Truck	2,967	21,083	10,288	0
By Rail	324	19,033	9,605	0
<b>Shipments To 3603</b>				
By Truck	0	0	565	0
By Rail	0	0	0	0
<b>Shipments To 3604</b>				
By Truck	219	3,596	410	0
By Rail	0	1,384	0	1,798
<b>Shipments To 3711<sup>a</sup></b>				
By Truck	1,913	295	0	0
By Rail	674	0	2,474	0
<b>Shipments To 3723<sup>b</sup></b>				
By Truck	0	0	1,663	536
By Rail	0	0	0	43
<b>Shipments To 3745<sup>c</sup></b>				
By Truck	0	827	6,816	414
By Rail	0	467	16,063	90
To Export by Truck	0	2,916	1,316	0
To Export by Rail	288	26,693	4,225	0
To Export by Barge	--	--	--	6,286

<sup>a</sup> Includes Amarillo and Lubbock.

<sup>b</sup> Includes Paris.

<sup>c</sup> Includes Wichita Falls and Ft. Worth.

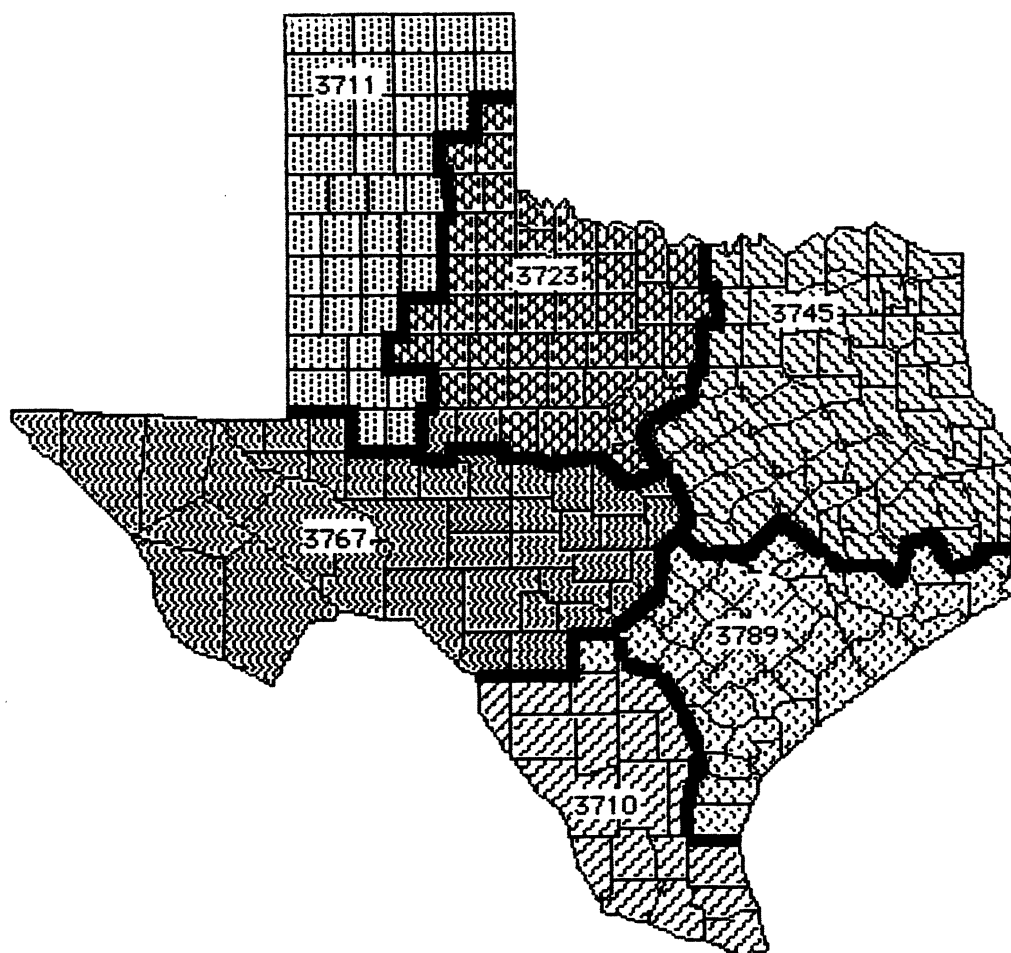


Figure 5.2. Regions Used in 1985 Grain Flow Survey for Texas.



Table 5.2. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 1A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	109
Alva	Enid	Truck	968	Catoosa	Truck	6211	Enid	Rail	22	Houston	Rail	15
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Catoosa	Truck	22
Arapaho				Processor	Truck	2527				Houston	Rail	16
				Catoosa	Truck	3201						
				Houston	Rail	272				Muskogee	Truck	109
Ardmore				Catoosa	Truck	1815	Houston	Rail	69	Hogener	Truck	31
Arnett	Enid	Truck	1071							Processor	Truck	31
				Houston	Rail	1	Muskogee	Truck	33	Muskogee	Truck	13
Atoka	Paris	Truck	19	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	30
Beaver	Enid	Truck	3202				Lubbock	Truck	39			
	Houston	Rail	82	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	125
Boise City	Houston	Rail	2565				Lubbock	Truck	0			
				Catoosa	Truck	585	Houston	Rail	67	Processor	Truck	32
Buffalo	Enid	Truck	3111	Hogener	Truck	148	Catoosa	Rail	0	Processor	Truck	55
Chandler	Catoosa	Truck	97	Catoosa	Truck	5210	Enid	Rail	45	Houston	Rail	19
Cherokee	Enid	Truck	1680	Houston	Rail	496	Enid	Truck	27	Catoosa	Truck	9
Chayenne	Houston	Rail	1018	Processor	Truck	293	Processor	Rail	0	Catoosa	Truck	6
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1297						
				Catoosa	Truck	372				Hogener	Truck	0
Claremore				Houston	Rail	2813	Enid	Truck	25	Processor	Truck	5
Cordell	Houston	Rail	2037	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	84
Duncan	Houston	Rail	185	Houston	Rail	191				Muskogee	Truck	73
Durant				Catoosa	Truck	5543				Processor	Truck	2
El Reno				Catoosa	Truck	7824	Catoosa	Truck	82	Hogener	Truck	32
Enid	Enid	Truck	1954	Catoosa	Truck	2777	Catoosa	Truck	56	Hogener	Truck	32
Fairview	Enid	Truck	1406	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	101
Fredrick	Houston	Rail	1025	Muskogee	Truck	2300	Muskogee	Truck	30	Hogener	Truck	1
Guthrie	Catoosa	Truck	238	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
Guymon	Amarillo	Truck	2000									
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	41
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	61
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Muskogee	Truck	65

Table 5.2. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1632	Catoosa	Truck	4956	Processor	Rail	36	Wagoner	Truck	29
	Catoosa	Truck	1							Muskogee	Truck	29
Lauton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	58
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	37
McAlester				Catoosa	Truck	126				Muskogee	Truck	38
Medford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Wagoner	Truck	31
	Houston	Rail	2599									
Miani				Wagoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	32
							Processor	Truck	3000			
Nornan	Ft.Worth	Truck	305	Processor	Truck	16	Processor	Truck	0	Catoosa	Truck	4
Oklahoma City				Processor	Truck	571				Catoosa	Truck	48
Okmulgee	Muskogee	Truck	146	Muskogee	Truck	52	Wagoner	Truck	37	Catoosa	Truck	4
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Muskogee	Truck	36
										Catoosa	Truck	36
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	33	Catoosa	Truck	45
Pawnee				Muskogee	Truck	316				Houston	Rail	11
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Muskogee	Truck	199	Catoosa	Truck	10	Houston	Rail	14	Houston	Rail	6
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Catoosa	Truck	135	Processor	Rail	44	Processor	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	19
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10	Muskogee	Truck	40	Wagoner	Truck	31
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Catoosa	Truck	9
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Muskogee	Truck	2
Stillwater				Wagoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
				Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Tahlequah	Muskogee	Truck	22	Catoosa	Truck	1182	Catoosa	Truck	28	Wagoner	Truck	32
Taloga	Enid	Truck	2066							Processor	Truck	32



Each table has two major sections, optimal flows, and shadow prices, each subdivided into harvest and nonharvest periods. The shipper column shows the county seat or terminal which is shipping the grain. The receiver column contains those terminals or county seats which are receiving shipments. Entries in the mode column tell whether a shipment was by truck, rail, barge. If shadow price was the same for both truck and rail, the notation (T/R) was used. Bushels show amount of shipment in thousands of bushels, and price refers to the shadow price value of the next lowest alternative in dollars per thousand bushels.

Results of Table 5.2 will be interpreted using shipments from Altus since Ada has no harvest grain. Optimal flows for Altus show rail shipments to Houston during harvest amounting to 1229 thousand bushels and nonharvest shipments to Houston by rail of 4738 thousand bushels.

The shadow prices give additional information about the results. These shadow prices are the " $\bar{e}$ 's" which are discussed in Chapter 3. Using the Altus example, if 1000 bushels of harvest flow wheat were sent to Lubbock by truck, leaving 1228 thousand to send to Houston, the total cost of wheat flows in this model (value of the objective function) would increase by 103 dollars. Likewise, if 1000 bushels of nonharvest wheat were shipped to Shawnee by truck, the objective function value would be increased by 109 dollars. This assumes the receiver can handle an additional one

Table 5.3. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 1B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Muskogee	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				Processor	Truck	198
Arnett	Enid	Truck	1071	Processor	Truck	1117	Houston	Rail	69	Catoosa	Truck	48
				Houston	Rail	698						
Atoka	Paris	Truck	19	Houston	Rail	1	Muskogee	Truck	33	Muskogee	Truck	113
Beaver	Enid	Truck	3202	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	82				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	225
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Catoosa	Truck	97	Processor	Truck	148	Muskogee	Truck	29	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Enid	Truck	25	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234				Catoosa	Truck	64
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Catoosa	Truck	238	Houston	Rail	2300	Muskogee	Truck	30	Processor	Truck	3
Guymon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	62
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Processor	Truck	145
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	12	Processor	Truck	221

Table 5.3. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1632	Houston	Rail	4956	Processor	Rail	36	Processor	Truck	15
	Catoosa	Truck	1									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				Houston	Rail	126				Catoosa	Truck	61
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	74
Muskogee				Muskogee	Truck	371				Processor	Truck	59
Newkirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Houston	Rail	16	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	146	Muskogee	Truck	52	Wagoner	Truck	37	Catoosa	Truck	4
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	33	Processor	Truck	1
Paunee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Muskogee	Truck	199	Houston	Rail	10	Houston	Rail	14	Processor	Truck	90
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	5
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Muskogee	Truck	40	Catoosa	Truck	5
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Houston	Rail	7
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Houston	Rail	46
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	26
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	45	Muskogee	Truck	156
							Houston	Rail	45			

Table 5.3. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Wagoner	Truck	86	Houston	Rail	50
Vinita	Wagoner	Truck	116	Houston	Rail	528	Muskogee	Truck	10	Wagoner	Truck	41
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	46	Houston	Rail	8
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	141
Watonga				Houston	Rail	4133				Processor	Truck	17
Haurika	Houston	Rail	660	Processor	Truck	2200						
Hoodward				Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159
				Houston	Rail	2105				Processor	Truck	35
				-----Terminals-----								
Enid				Houston	Rail	7590				Catoosa	Rail	244
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1154				Houston	Rail	365
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	1864				Houston	Rail	356
Wagoner				N.Orleans	Barge	806				Houston	Rail	290
Paris				Houston	Rail	490				Muskogee	Rail	445
Amarillo				Houston	Rail	2000				Ft.Worth	Rail	462
Lubbock												
Michita												
Falls				Houston	Rail	3000				Muskogee	Rail	343
Ft. North				Houston	Rail	3150				No Alternative		
Houston				Export		139097						
N.Orleans				Export		3824						

Table 5.4. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 1C.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Wagoner	Truck	16
Altus				Houston	Rail	5967				Ft.North	Truck	66
Alva				Catoosa	Truck	3709				Wagoner	Truck	17
				Houston	Rail	3470						
Anadarko				Houston	Rail	5344				Muskogee	Truck	27
Arapaho				Processor	Truck	958				Houston	Rail	1
				Catoosa	Truck	4770						
Ardenore				Houston	Rail	272				Paris	Truck	84
Arnett				Catoosa	Truck	2886				Wagoner	Truck	16
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	13
Boise City				Houston	Rail	4950				Lubbock	Truck	76
										Amarillo	Truck	76
Buffalo	Houston	Rail	707	Enid	Truck	350	Enid	Truck	43	Houston	Rail	20
				Catoosa	Truck	2639						
Chandler				Wagoner	Truck	245				Processor	Truck	68
Cherokee				Catoosa	Truck	6890				Houston	Rail	4
Chayenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	24
Chickasha				Houston	Rail	1746				Muskogee	Truck	11
Clarenore				Wagoner	Truck	372				Catoosa	Truck	15
Cordell				Houston	Rail	4850				Processor	Truck	20
Duncan				Houston	Rail	534				Ft.North	Truck	61
Durant				Houston	Rail	191				Muskogee	Truck	73
El Reno				Processor	Truck	309				Muskogee	Truck	2
				Catoosa	Truck	5234						
Enid				Catoosa	Truck	9778				Wagoner	Truck	17
Fairview				Catoosa	Truck	4183				Wagoner	Truck	17
Fredrick				Houston	Rail	5427				Ft.North	Truck	47
Guthrie				Muskogee	Truck	2538				Wagoner	Truck	1
Guyton				Enid	Truck	11150				Lubbock	Truck	0
										Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	45
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	14
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	25
Idabel				Houston	Rail	363				Paris	Truck	111



Table 5.4. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher				Catoosa	Truck	6589				Muskogee	Truck	14
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Ft.Worth	Truck	37
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	9
McFlester				Catoosa	Truck	126				Paris	Truck	0
Medford				Catoosa	Truck	9720				Wagoner	Truck	16
Miami				Wagoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	17
				Processor	Truck	3000						
Norman	Houston	Rail	84	Muskogee	Truck	237	Processor	Truck	0	Processor	Truck	6
Oklahoma City				Processor	Truck	571				Muskogee	Truck	47
Oklmulgee Pauls	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Truck	19	Catoosa	Truck	19
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	15
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	14	Catoosa	Truck	60
Pawnee				Muskogee	Truck	316				Houston	Rail	11
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	80	Paris	Truck	1
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Muskogee	Truck	462	Ft.Worth	Truck	0	Ft.Worth	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	4
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Wagoner	Truck	16	Wagoner	Truck	16
Sayre	Houston	Rail	235	Processor	Truck	3042	Amarillo	Truck	0	Mich.Flls	Truck	0
							Lubbock	Truck	0			
Shawnee				Muskogee	Truck	344				Processor	Truck	13
Stillwater				Wagoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Catoosa	Truck	3055	Enid	Truck	0	Wagoner	Truck	17
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Ft.Worth	Truck	33
Tulsa				Catoosa	Truck	529				Wagoner	Truck	58
Vinita				Wagoner	Truck	644				Muskogee	Truck	19
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Muskogee	Truck	55	Muskogee	Truck	55
Walters				Houston	Rail	4473				Ft.Worth	Truck	71

Table 5.4. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Catoosa	Truck	4133				Houston	Rail	9
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	75
				Catoosa	Truck	2105				Houston	Rail	2
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	5130				Houston	Rail	365
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	70000				Houston	Rail	341
Wagoner				N.Orleans	Barge	6724				Houston	Rail	290
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. Worth												
Houston				Export		61067						
N.Orleans				Export		81854						

Table 5.5. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 1D.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Paris	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	0	
Alva				Houston	Rail	7179			Ft.Worth	Truck	114	
Anadarko				Houston	Rail	5344			Catoosa	Truck	64	
Arapaho				Houston	Rail	5728			Processor	Truck	65	
Ardmore				Houston	Rail	272			Processor	Truck	12	
Arnett				Enid	Truck	2886			Paris	Truck	125	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Houston	Rail	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Muskogee	Truck	92
Boise City				Houston	Rail	4950			Enid	Truck	20	
Buffalo	Houston	Rail	707	Houston	Rail	4950			Lubbock	Truck	83	
Chandler				Enid	Truck	2989	Enid	Truck	43	Amarillo	Truck	83
Cherokee				Wagoner	Truck	245			Houston	Rail	13	
Cheyenne	Houston	Rail	125	Houston	Rail	6890			Processor	Truck	10	
Chickasha				Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	60
Clarenore				Houston	Rail	1746			Processor	Truck	44	
Cordell				Houston	Rail	372			Processor	Truck	34	
Duncan				Houston	Rail	4850			Catoosa	Truck	0	
Durant				Houston	Rail	534			Wagoner	Truck	0	
El Reno				Processor	Truck	309			Processor	Truck	33	
Enid				Houston	Rail	5234			Ft.Worth	Truck	109	
Fairview				Houston	Rail	9778			Ft.Worth	Truck	125	
Fredrick				Houston	Rail	4183			Catoosa	Truck	43	
Guthrie				Houston	Rail	5427			Enid	Truck	1	
Guymon				Houston	Rail	2538			Processor	Truck	23	
Hobart				Enid	Truck	5625			Ft.Worth	Truck	95	
Hollis	Houston	Rail	453	Houston	Rail	5525			Processor	Truck	3	
Hugo	Houston	Rail	75	Houston	Rail	5873			Lubbock	Truck	0	
Idabel				Houston	Rail	1317	Mich.Flls	Truck	11	Amarillo	Truck	0
Kingfisher				Houston	Rail	213	Paris	Truck	0	Mich.Flls	Truck	58
				Houston	Rail	363			Paris	Truck	27	
				Houston	Rail	6589			Paris	Truck	66	
									Processor	Truck	152	
									Processor	Truck	15	

Table 5.5. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lanton	Houston	Rail	319	Houston	Rail	2000	Hich.Flls	Truck	24	Ft.Worth	Truck	85
Mangun	Houston	Rail	435	Houston	Rail	2132	Hich.Flls	Truck	0	Hich.Flls	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	17
Medford				Houston	Rail	9720				Catoosa	Truck	46
Miami				Houston	Rail	890				Wagoner	Truck	65
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	2904				Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	294						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Rail	19	Catoosa	Truck	4
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	63
Panhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Processor	Truck	29
Pawnee				Houston	Rail	316				Muskogee	Truck	68
Perry				Houston	Rail	3152				Muskogee	Truck	34
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Rail	121	Paris	Truck	42
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	19
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	Houston	Rail	16
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Hich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	8
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	80
Tulsa				Catoosa	Truck	529				Houston	Rail	71
Vinita				Houston	Rail	644				Wagoner	Truck	20
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Wagoner	Truck	19	Houston	Rail	29
Walters				Houston	Rail	4473				Ft.Worth	Truck	119

Table 5.5. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Houston	Rail	4133				Processor	Truck	24
Maurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	123
				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1233				Houston	Rail	286
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	3889				Houston	Rail	277
Hogener				N.Orleans	Barge	1164				Houston	Rail	211
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. North												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.6. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 1E.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Processor	Truck	80			Muskogee	Truck	0	
									Paris	Truck	0	
									Ft.Worth	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	135	
Alva				Houston	Rail	7179			Processor	Truck	71	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	12	
Ardmore				Houston	Rail	272			Paris	Truck	146	
Arnett				Enid	Truck	2886			Houston	Rail	13	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	113
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950			Lubbock	Truck	83	
									Amarillo	Truck	83	
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Processor	Truck	245			Processor	Truck	7	
Cherokee				Houston	Rail	6890			Processor	Truck	65	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	44
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Clarenore				Houston	Rail	372			Processor	Truck	20	
Cordell				Houston	Rail	4850			Processor	Truck	33	
Duncan				Houston	Rail	534			Processor	Truck	112	
Durant				Houston	Rail	191			Processor	Truck	143	
El Reno				Processor	Truck	64			Catoosa	Truck	64	
				Houston	Rail	5479						
Enid				Houston	Rail	9778			Enid	Truck	1	
Fairview				Houston	Rail	4183			Processor	Truck	23	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	116	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guyton				Enid	Truck	5625			Lubbock	Truck	0	
				Houston	Rail	5525			Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	58	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	87
Idabel				Houston	Rail	363			Paris	Truck	173	
Kingfisher				Houston	Rail	6589			Processor	Truck	15	

Table 5.6. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lauton	Houston	Rail	319	Houston	Rail	2000	Hich.Flls	Truck	24	Processor	Truck	86
Mangun	Houston	Rail	435	Houston	Rail	2132	Hich.Flls	Truck	0	Hich.Flls	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	38
Madford				Houston	Rail	9720				Processor	Truck	58
Miami				Houston	Rail	890				Processor	Truck	81
Muskogee				Muskogee	Truck	371				Wagoner	Truck	66
Newkirk				Houston	Rail	3198				Processor	Truck	13
				Processor	Truck	3000						
Nornan	Houston	Rail	84	Houston	Rail	237	Processor	Truck	5	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Processor	T/R	0	Catoosa	Truck	4
							Catoosa	T/R	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	84
Pawhuska	Houston	Rail	162	Muskogee	Truck	459	Catoosa	Truck	14	Processor	Truck	8
Pawnee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	121	Paris	Truck	63
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Wagoner	Rail	0	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	12
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	1	Catoosa	Truck	5
Sayre	Houston	Rail	235	Processor	Truck	521	Amarillo	Truck	0	Hich.Flls	Truck	0
				Houston	Rail	2521	Lubbock	Truck	0			
Shaunee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	101
Tulsa				Catoosa	Truck	529				Houston	Rail	50
Vinita				Houston	Rail	644				Wagoner	Truck	41
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	40	Houston	Rail	8
Walters				Houston	Rail	4473				Ft.Worth	Truck	140

Table 5.6. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Houston	Rail	1133				Processor	Truck	21
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	111
Woodward				Houston	Rail	2105				Processor	Truck	42
----- Terminals -----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1153				Houston	Rail	365
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	627				Houston	Rail	356
Wagoner				N.Orleans	Barge	919				Houston	Rail	290
Paris												
Anarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		140222						
N.Orleans				Export		2699						



thousand bushels without violating any constraints. The last two rows show the total amount of wheat from the model received at Houston and at New Orleans for export.

Figures 5.3 through 5.7 show destinations of nonharvest wheat movements out of each county for Models 1A through 1E, respectively. Shipments to processors are shown only if the county ships to no other location. If a county ships to more than one non-processor, that receiving the largest shipment is used. Figures 5.8 through 5.12 show destinations of harvest wheat movements out of each county for Models 1A through 1E, respectively. The rules discussed for Figures 5.3 through 5.7 also apply for these figures.

### Model 2

Model 2 tests the effect of contract rates upon the Oklahoma wheat transportation system. Contract rates have been removed from Model 1 and replaced with noncontract rates in Model 2. Comparing these two sets of models will test the impact of contract rates. Tables 5.7 through 5.11 show the results for Models 2A through 2E. The objective function value for Model 2A is \$114,823,024. This is \$655,744 higher than Model 1A.

Flow patterns of these models differ little from the base models. In these models, contract rates are only used for shipments between terminals. Since terminals are handling low volumes of grain in the base models, increasing rail rates between terminals has little effect on flows.

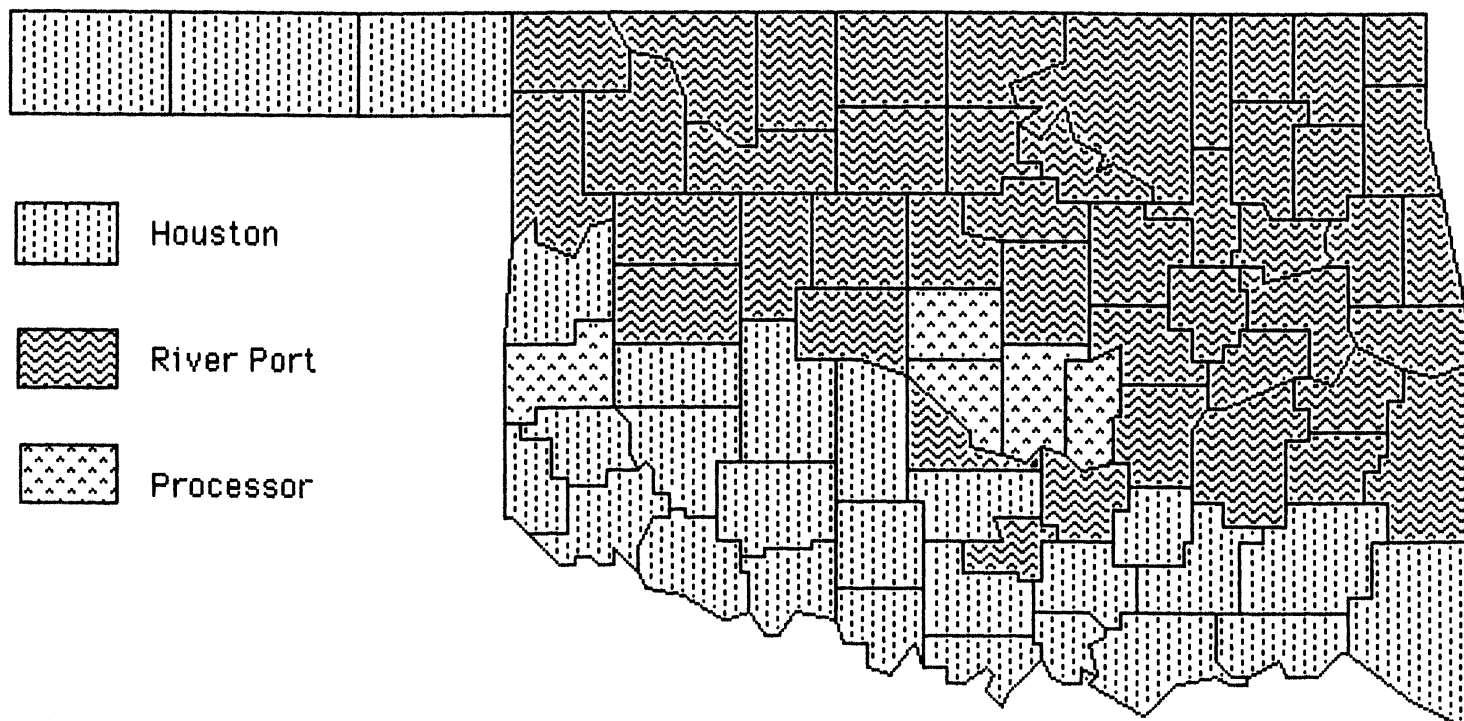


Figure 5.3. Destination of Wheat Shipments by County for Nonharvest Flows in Model 1A.

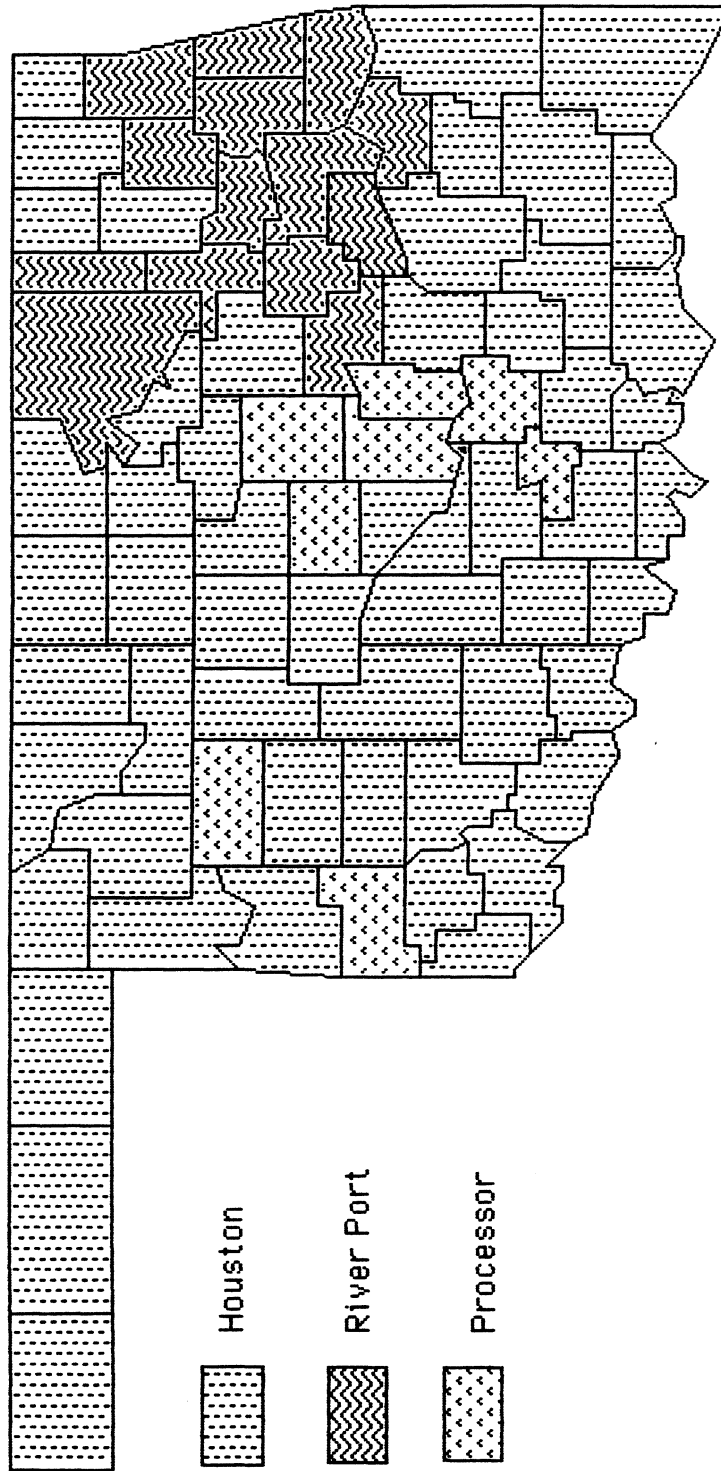


Figure 5.4. Destination of Wheat Shipments by County for Nonharvest Flows in Model 1B.

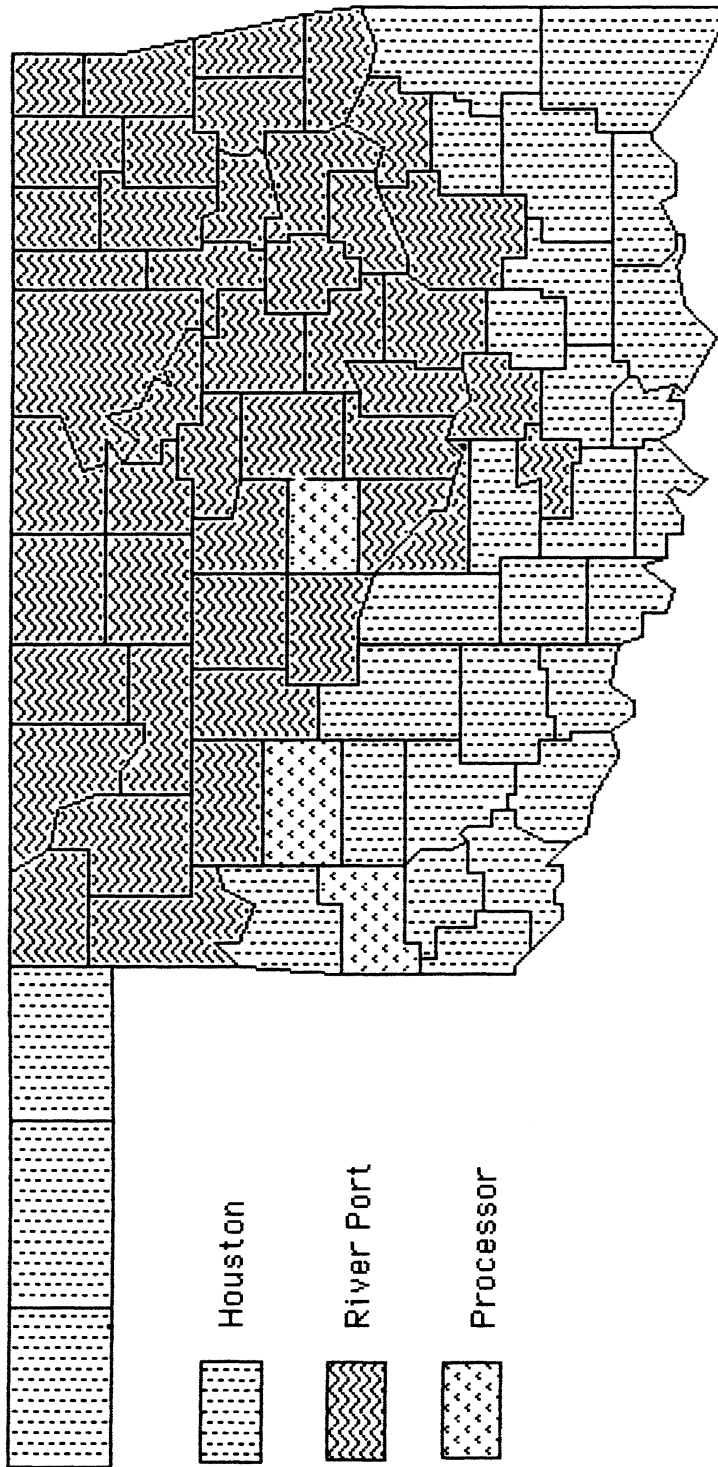


Figure 5.5. Destination of Wheat Shipments by County for Nonharvest Flows in Model 1C.

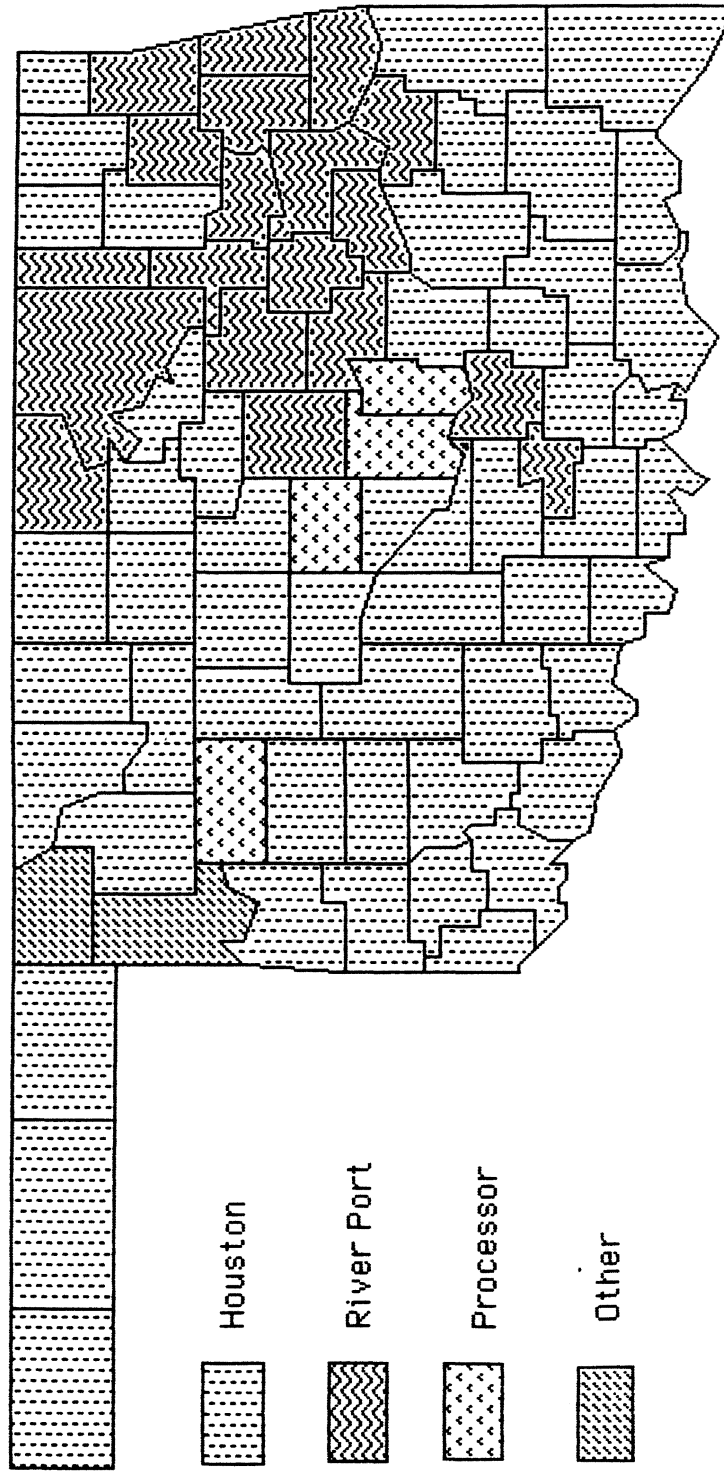


Figure 5.6. Destination of Wheat Shipments by County for Nonharvest Flows in Model 1D.

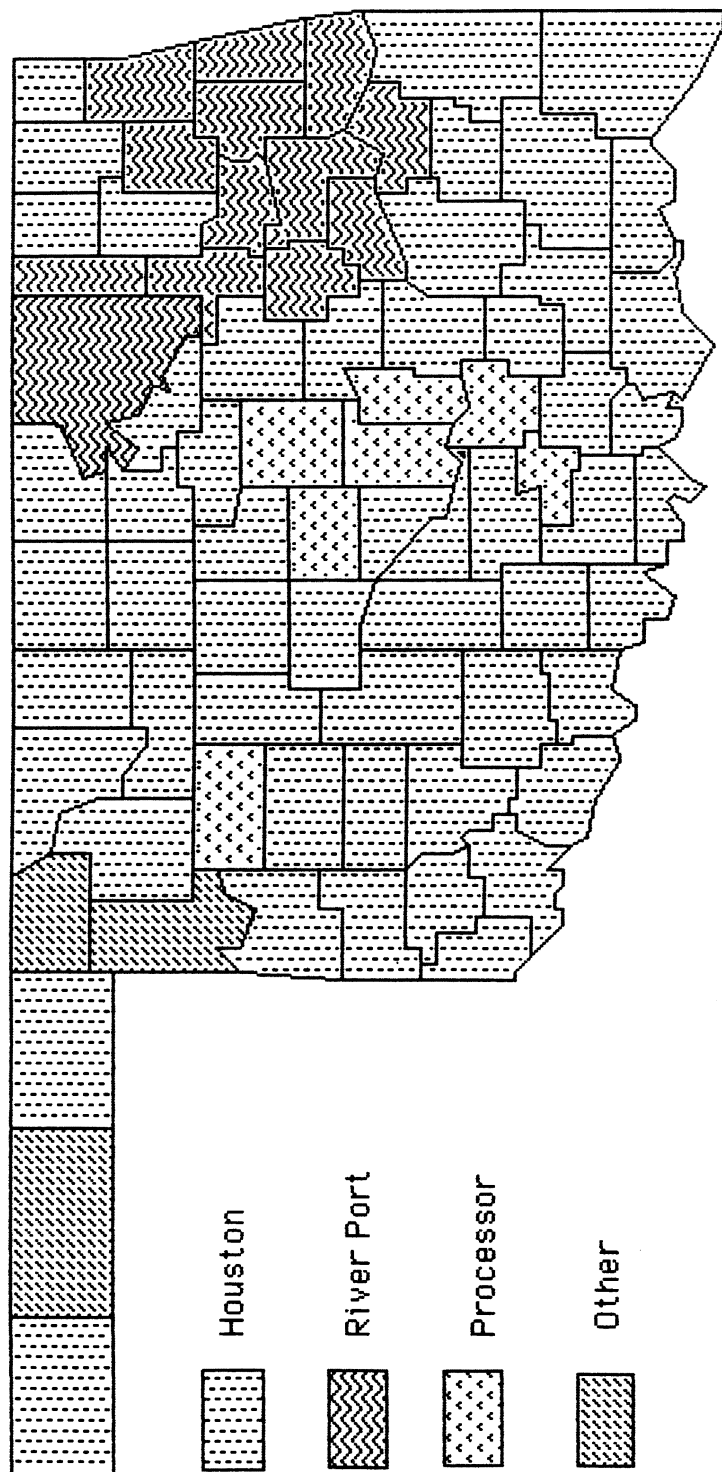


Figure 5.7. Destination of Wheat Shipments by County for Nonharvest Flows in Model 1E.

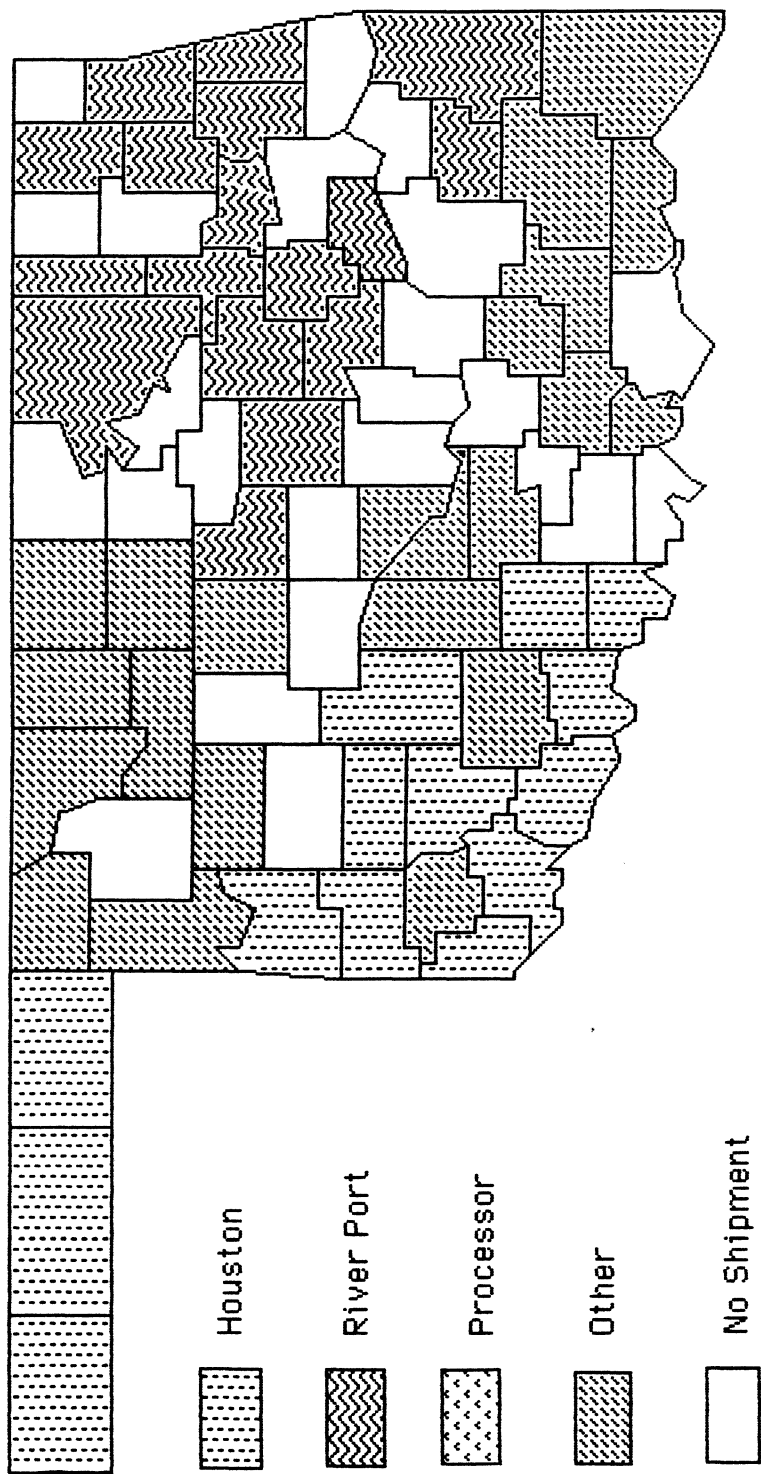


Figure 5.8. Destination of Wheat Shipments by County for Harvest Flows in Model 1A.

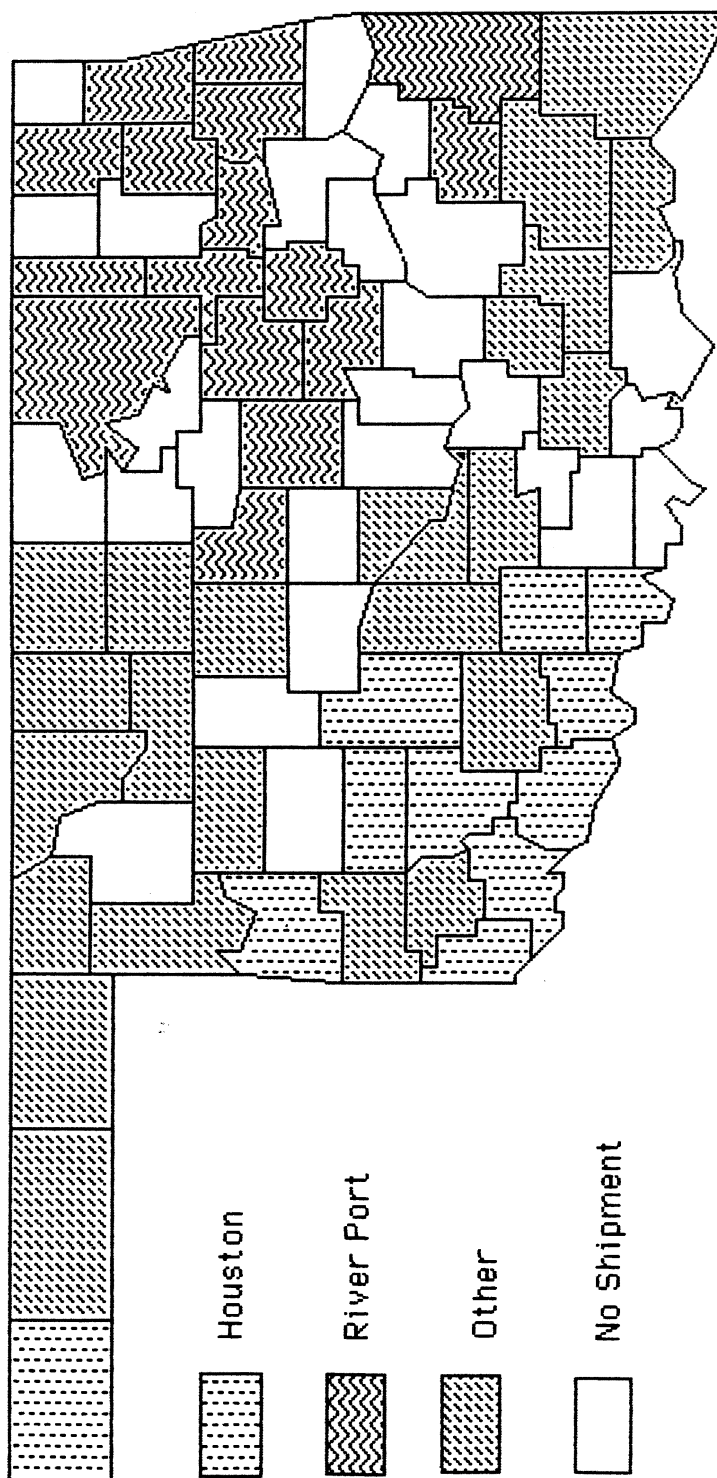


Figure 5.9. Destination of Wheat Shipments by County for Harvest Flows in Model 1B.



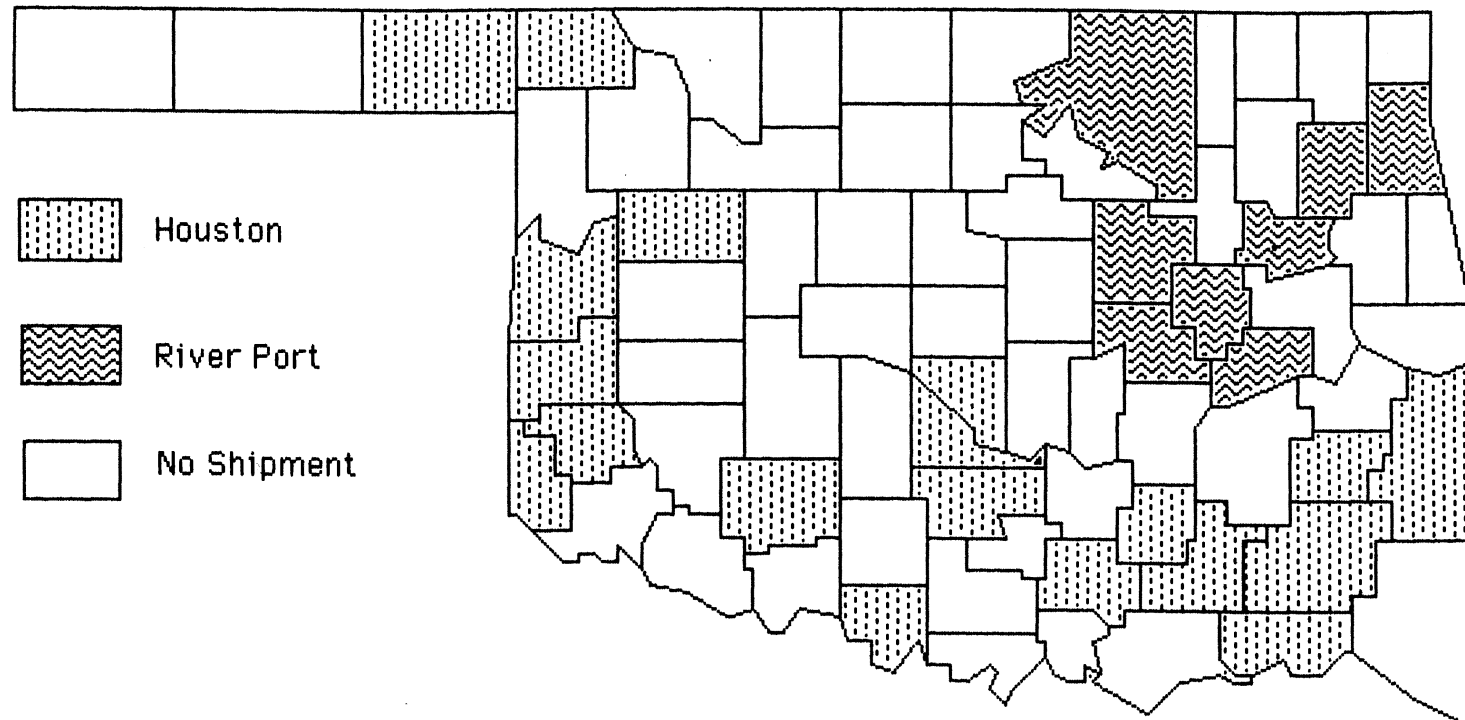


Figure 5.10. Destination of Wheat Shipments by County for Harvest Flows in Model 1C.



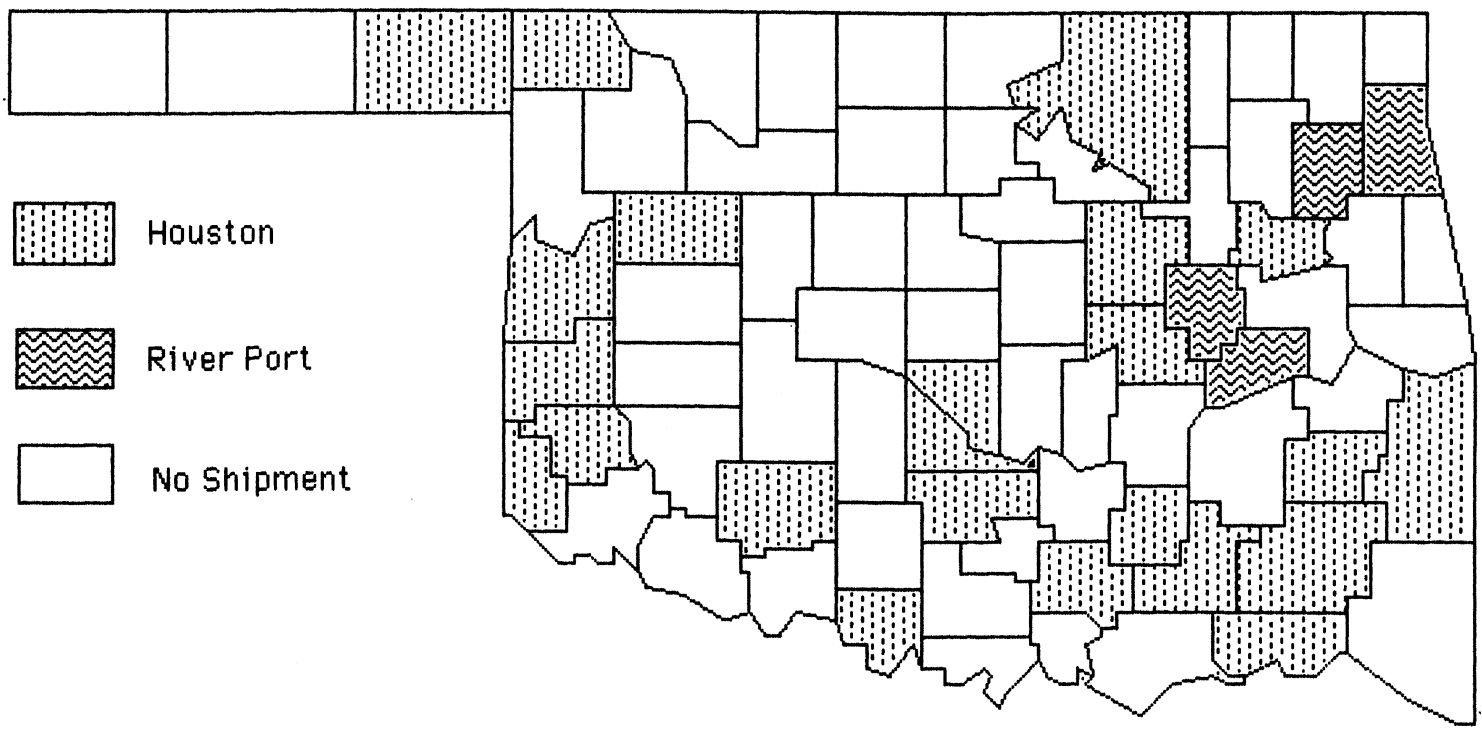


Figure 5.12. Destination of Wheat Shipments by County for Harvest Flows in Model 1E.

Table 5.7. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 2A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Mich.Flls	Rail	126	Processor	Truck	111
Alva	Enid	Truck	968	Catoosa	Truck	6211	Enid	Rail	1	Houston	Rail	15
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	20	Catoosa	Truck	22
Arapaho				Processor	Truck	2527				Processor	Truck	2
				Catoosa	Truck	3201						
				Houston	Rail	272				Muskogee	Truck	109
Ardmore				Catoosa	Truck	1815	Catoosa	Truck	75	Hogoner	Truck	31
Arnett	Enid	Truck	1071	Houston	Rail	1	Houston	Rail	64	Muskogee	Truck	13
Atoka	Paris	Truck	19	Processor	Truck	2534	Houston	Rail	49	Houston	Rail	16
Beaver	Enid	Truck	3284	Houston	Rail	2385	Amarillo	Truck	33	Lubbock	Truck	185
Boise City	Houston	Rail	2565				Lubbock	Truck	33			
				Catoosa	Truck	585	Catoosa	Truck	105	Processor	Truck	34
Buffalo	Enid	Truck	3111	Hogoner	Truck	148	Catoosa	Rail	0	Processor	Truck	55
Chandler	Catoosa	Truck	97	Catoosa	Truck	5210	Enid	Rail	24	Houston	Rail	19
Cherokee	Enid	Truck	1680	Houston	Rail	496	Enid	Truck	48	Catoosa	Truck	9
Cheyenne	Houston	Rail	1018	Processor	Truck	293	Processor	Rail	0	Catoosa	Truck	6
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1297						
				Catoosa	Truck	372				Hogoner	Truck	0
Clarenore				Houston	Rail	2813	Processor	Truck	43	Processor	Truck	7
Cordell	Houston	Rail	2037	Houston	Rail	349	Ft.Worth	Truck	12	Processor	Truck	86
Duncan	Houston	Rail	185	Houston	Rail	191				Muskogee	Truck	73
Durant				Catoosa	Truck	5543				Processor	Truck	2
El Reno				Catoosa	Truck	7824	Catoosa	Truck	83	Hogoner	Truck	32
Enid	Enid	Truck	1954	Catoosa	Truck	2777	Catoosa	Truck	56	Hogoner	Truck	32
Fairview	Enid	Truck	1406	Houston	Rail	4402	Ft.Worth	Truck	16	Processor	Truck	103
Fredrick	Houston	Rail	1025	Muskogee	Truck	2300	Muskogee	Truck	23	Hogoner	Truck	1
Guthrie	Catoosa	Truck	238	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	102
Guynon	Amarillo	Truck	2000									
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	43
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	63
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	125	Muskogee	Truck	65
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	39	Muskogee	Truck	130
Kingfisher	Enid	Truck	1507	Catoosa	Truck	4956	Processor	Rail	18	Hogoner	Truck	29
	Catoosa	Truck	126							Muskogee	Truck	29

Table 5.7. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	2	Processor	Truck	60
Mangum	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	39
Madford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Wagoner	Truck	31
	Houston	Rail	2599									
McAlester				Catoosa	Truck	126				Muskogee	Truck	38
Miami				Wagoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	32
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Processor	Truck	16	Processor	Truck	0	Catoosa	Truck	4
Oklahoma City				Processor	Truck	571				Catoosa	Truck	48
Okmulgee	Muskogee	Truck	271	Muskogee	Truck	52	Catoosa	Truck	7	Catoosa	Truck	4
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	51	Muskogee	Truck	36
										Catoosa	Truck	36
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	26	Catoosa	Truck	45
Paunee				Muskogee	Truck	316				Houston	Rail	11
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Muskogee	Truck	74	Catoosa	Truck	10	Wagoner	Truck	23	Houston	Rail	6
	Paris	Truck	43									
	Houston	Rail	82									
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	17	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Catoosa	Truck	135	Processor	Rail	44	Processor	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	19
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10	Muskogee	Truck	33	Wagoner	Truck	31
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Mich.Flls	Rail	0	Catoosa	Truck	7
	Houston	Rail	1221									
Shaunee				Processor	Truck	337				Wagoner	Truck	16
				Muskogee	Truck	7						
				Wagoner	Truck	376				Muskogee	Truck	7
Stillwater			Processor	Truck	500							
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Catoosa	Truck	1182	Catoosa	Truck	28	Wagoner	Truck	32
										Processor	Truck	32
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	15	Muskogee	Truck	26

Table 5.7. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Muskogee	Truck	83	Wagoner	Truck	73
Vinita	Wagoner	Truck	116	Wagoner	Truck	528	Wagoner	Rail	0	Muskogee	Truck	19
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	46	Muskogee	Truck	55
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	21	Processor	Truck	122
Watonga				Catoosa	Truck	4133				Processor	Truck	22
Haurika	Houston	Rail	660	Processor	Truck	2200						
Woodward				Houston	Rail	382	Ft.Worth	Truck	15	Processor	Truck	140
				Catoosa	Truck	2105				Houston	Rail	17
				-----Terminals-----								
Enid				Houston	Rail	7547				Catoosa	Rail	126
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	3857				Houston	Rail	419
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	58905				Houston	Rail	410
Wagoner				N.Orleans	Barge	5900				Houston	Rail	338
Paris				Houston	Rail	533				Muskogee	Rail	381
Amarillo				Houston	Rail	2000				Ft.Worth	Rail	374
Lubbock												
Michita												
Falls				Houston	Rail	3000				Muskogee	Rail	273
Ft. North				Houston	Rail	3150				No Alternative		
Houston				Export		74259						
N.Orleans				Export		68662						

Table 5.8. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 2B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	6				Houston	Rail	4
				Processor	Truck	74						
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	136	Processor	Truck	137
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	1	Processor	Truck	71
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	20	Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	12
Ardmore				Houston	Rail	272				Processor	Truck	198
Arnett	Enid	Truck	1071	Processor	Truck	1815	Catoosa	Truck	75	Catoosa	Truck	41
										Houston	Rail	41
Atoka	Paris	Truck	19	Houston	Rail	1	Houston	Rail	64	Muskogee	Truck	113
Beaver	Enid	Truck	3284	Houston	Rail	2534	Houston	Rail	49	Processor	Truck	10
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	33	Lubbock	Truck	285
							Lubbock	Truck	33			
Buffalo	Enid	Truck	3111	Processor	Truck	585	Catoosa	Truck	105	Houston	Rail	23
Chandler	Catoosa	Truck	97	Processor	Truck	148	Muskogee	Truck	22	Processor	Truck	7
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	24	Processor	Truck	65
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	48	Processor	Truck	44
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	20
Cordell	Houston	Rail	2037	Houston	Rail	2813	Processor	Truck	43	Processor	Truck	33
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	12	Processor	Truck	112
Durant				Houston	Rail	191				Processor	Truck	143
El Reno				Processor	Truck	161				Catoosa	Truck	64
				Houston	Rail	5382						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	37
Fairview	Enid	Truck	1406	Houston	Rail	2777	Enid	Rail	53	Processor	Truck	23
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	16	Processor	Truck	129
Guthrie	Catoosa	Truck	238	Houston	Rail	2300	Muskogee	Truck	23	Processor	Truck	3
							Processor	Rail	23			
Guynon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	202
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	69
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	89
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	125	Processor	Truck	152
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	39	Processor	Truck	228

Table 5.8. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1507	Houston	Rail	4956	Processor	Rail	18	Processor	Truck	15
	Catoosa	Truck	126									
Lauton	Ft.North	Truck	1758	Houston	Rail	561	Houston	Rail	2	Processor	Truck	86
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	65
McFlester				Houston	Rail	126				Catoosa	Truck	61
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	58
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	81
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Houston	Rail	3198				Processor	Truck	13
				Processor	Truck	3000						
Norman	Ft.North	Truck	305	Houston	Rail	16	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	271	Muskogee	Truck	52	Catoosa	Truck	7	Catoosa	Truck	4
Pauls Valley	Ft.North	Truck	477	Houston	Rail	234	Houston	Rail	51	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	26	Processor	Truck	8
Paunee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Muskogee	Truck	74	Houston	Rail	10	Wagoner	Truck	23	Catoosa	Truck	94
	Paris	Truck	43									
	Houston	Rail	82									
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	17	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.North	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	12
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Muskogee	Truck	33	Catoosa	Truck	5
Sayre	Mich.Flls	Truck	927	Houston	Rail	1129	Ft.North	Truck	16	Processor	Truck	0
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	19



Table 5.8. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest			Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price	
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	15	Muskogee	Truck	126	
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Wagoner	Truck	0	Houston	Rail	50	
Vinita	Wagoner	Truck	116	Houston	Rail	528	Muskogee	Truck	10	Wagoner	Truck	41	
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	46	Houston	Rail	8	
Malters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	21	Processor	Truck	148	
Matonga				Houston	Rail	4133				Processor	Truck	24	
Haurika	Houston	Rail	660	Processor	Truck	2200							
Woodward				Houston	Rail	382	Ft.Worth	Truck	15	Processor	Truck	166	
				Houston	Rail	2105				Processor	Truck	42	
				Terminals									
Enid				Houston	Rail	7547				Catoosa	Rail	226	
Eufaula													
McAlester													
Muskogee				N.Orleans	Barge	1160				Houston	Rail	419	
Poteau													
Shaunee													
Catoosa				N.Orleans	Barge	1864				Houston	Rail	410	
Wagoner				N.Orleans	Barge	806				Houston	Rail	338	
Paris				Houston	Rail	533				Muskogee	Rail	481	
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	474	
Lubbock													
Wichita													
Falls				Houston	Rail	3000				Muskogee	Rail	373	
Ft. Worth				Houston	Rail	3150				No Alternative			
Houston				Export		139091							
N.Orleans				Export		3830							

Table 5.9. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 2C.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Wagoner	Truck	16	
Altus				Houston	Rail	5967			Ft.Worth	Truck	66	
Alva				Catoosa	Truck	3166			Wagoner	Truck	17	
				Houston	Rail	4013						
Anadarko				Houston	Rail	5344			Muskogee	Truck	27	
Arapaho				Processor	Truck	958			Houston	Rail	1	
				Catoosa	Truck	4770						
Ardmore				Houston	Rail	272			Paris	Truck	84	
Arnett				Catoosa	Truck	2886			Wagoner	Truck	16	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	13
Beaver	Houston	Rail	78	Enid	Truck	5740	Amarillo	Truck	0	Processor	Truck	25
							Lubbock	Truck	0			
Boise City				Houston	Rail	4950			Lubbock	Truck	83	
									Amarillo	Truck	83	
Buffalo	Houston	Rail	707	Catoosa	Truck	2989	Enid	Truck	11	Enid	Truck	7
Chandler				Wagoner	Truck	245			Processor	Truck	68	
Cherokee				Catoosa	Truck	6890			Houston	Rail	4	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Mich.Flls	Truck	110	Catoosa	Truck	24
Chickasha				Houston	Rail	1746			Muskogee	Truck	11	
Claremore				Wagoner	Truck	372			Catoosa	Truck	15	
Cordell				Houston	Rail	4850			Processor	Truck	20	
Duncan				Houston	Rail	534			Ft.Worth	Truck	61	
Durant				Houston	Rail	191			Muskogee	Truck	73	
El Reno				Processor	Truck	309			Muskogee	Truck	2	
				Catoosa	Truck	5234						
Enid				Catoosa	Truck	9778			Wagoner	Truck	17	
Fairview				Catoosa	Truck	4183			Wagoner	Truck	17	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	47	
Guthrie				Muskogee	Truck	2538			Wagoner	Truck	1	
Guymon				Enid	Truck	5760			Lubbock	Truck	0	
				Houston	Rail	5390			Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	45	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	14
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	25
Idabel				Houston	Rail	363			Paris	Truck	111	

Table 5.9. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher				Catoosa	Truck	6589				Muskogee	Truck	14
										Wagoner	Truck	14
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Ft.Worth	Truck	37
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	9
McAlester				Catoosa	Truck	126				Paris	Truck	0
Madford				Catoosa	Truck	9720				Wagoner	Truck	16
Miami				Wagoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	17
				Processor	Truck	3000						
Norman	Houston	Rail	84	Muskogee	Truck	237	Processor	Truck	19	Processor	Truck	6
Oklahoma City				Processor	Truck	571				Muskogee	Truck	47
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Truck	19	Catoosa	Truck	19
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	38	Ft.Worth	Truck	15
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	14	Catoosa	Truck	60
Paunee				Muskogee	Truck	316				Houston	Rail	11
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	80	Paris	Truck	1
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Muskogee	Truck	462	Ft.Worth	Truck	29	Ft.Worth	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	4
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Wagoner	Truck	16	Wagoner	Truck	16
Sayre	Houston	Rail	235	Processor	Truck	3042	Mich.Flls	Truck	1	Mich.Flls	Truck	0
Shawnee				Muskogee	Truck	344				Processor	Truck	13
Stillwater				Wagoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Catoosa	Truck	193	Catoosa	Truck	3055	Enid	Truck	0	Wagoner	Truck	17
							Processor	Truck	0			
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	0	Ft.Worth	Truck	3
Tulsa				Catoosa	Truck	529				Wagoner	Truck	58
Vinita				Wagoner	Truck	644				Muskogee	Truck	19
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Muskogee	Truck	55	Muskogee	Truck	55
Walters				Houston	Rail	4473				Ft.Worth	Truck	71

Table 5.9. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Catoosa	Truck	4133				Houston	Rail	9
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Nich.Flls	Truck	65	Ft.Worth	Truck	75
				Catoosa	Truck	2105				Houston	Rail	2
----- Terminals												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	5130				Houston	Rail	419
Poteau												
Shaunee												
Catoosa				N.Orleans	Barge	70000				Houston	Rail	395
Wagoner				N.Orleans	Barge	6724				Houston	Rail	338
Paris												
Amarillo												
Lubbock												
Nichita												
Falls												
Ft. Worth												
Houston				Export		61067						
N.Orleans				Export		81854						

Table 5.10. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 20.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Paris	Truck	0
										Ft.Worth	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	114
Alva				Houston	Rail	7179				Catoosa	Truck	64
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	12
Ardmore				Houston	Rail	272				Paris	Truck	125
Arnett				Enid	Truck	2771				Catoosa	Truck	20
				Processor	Truck	115						
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	92
Beaver	Houston	Rail	78	Enid	Truck	5740	Amarillo	Truck	0	Houston	Rail	8
							Lubbock	Truck	0			
Boise City				Houston	Rail	4950				Lubbock	Truck	83
										Amarillo	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	28	Processor	Truck	18
Chandler				Wagoner	Truck	245				Processor	Truck	10
Cherokee				Houston	Rail	6890				Catoosa	Truck	60
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	111	Processor	Truck	44
Chickasha				Houston	Rail	1746				Processor	Truck	34
Claremore				Houston	Rail	372				Catoosa	Truck	0
										Wagoner	Truck	0
Cordell				Houston	Rail	4850				Processor	Truck	33
Duncan				Houston	Rail	534				Ft.Worth	Truck	109
Durant				Houston	Rail	191				Ft.Worth	Truck	125
El Reno				Processor	Truck	309				Catoosa	Truck	43
				Houston	Rail	5234						
Enid				Houston	Rail	9778				Enid	Truck	21
Fairview				Houston	Rail	4183				Processor	Truck	23
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	95
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guymon				Houston	Rail	11150				Lubbock	Truck	0
										Amarillo	Truck	0
Hobart				Houston	Rail	5873				Hich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	25	Hich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	66

Table 5.10. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel				Houston	Rail	363				Paris	Truck	152
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lanton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	38	Ft.Worth	Truck	85
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	14	Mich.Flls	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	17
Medford				Houston	Rail	9720				Catoosa	Truck	46
Miani				Houston	Rail	890				Wagoner	Truck	65
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	2904				Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	294						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Rail	30	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Wagoner	Truck	64
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Rail	0	Catoosa	Truck	4
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	34	Ft.Worth	Truck	63
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	29	Processor	Truck	29
Pawnee				Houston	Rail	316				Muskogee	Truck	68
Perry				Houston	Rail	3152				Wagoner	Truck	26
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Rail	121	Paris	Truck	42
Pryor	Wagoner	Truck	113	Houston	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	29	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	19
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	Houston	Rail	16
							Wagoner	Truck	16			
Sayre	Houston	Rail	235	Processor	Truck	486	Mich.Flls	Truck	15	Mich.Flls	Truck	0
				Houston	Rail	2556						
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	8
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
							Processor	Truck	0	Catoosa	Truck	19
							Mich.Flls	Truck	0			
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	0	Paris	Truck	50

Table 5.10. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tulsa				Catoosa	Truck	529				Houston	Rail	71
Vinita				Houston	Rail	644				Wagoner	Truck	20
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Wagoner	Truck	19	Houston	Rail	29
Walters				Houston	Rail	4473				Ft.Worth	Truck	119
Watonga				Houston	Rail	4133				Processor	Truck	24
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Falls	Truck	79	Ft.Worth	Truck	123
				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1233				Houston	Rail	340
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	3889				Houston	Rail	331
Wagoner				N.Orleans	Barge	1164				Houston	Rail	259
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.11. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 2E.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Muskogee	Truck	0
										Paris	Truck	0
										Ft.Worth	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	135
Alva				Houston	Rail	7179				Processor	Truck	71
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	12
Ardmore				Houston	Rail	272				Paris	Truck	146
Arnett				Enid	Truck	2771				Houston	Rail	41
				Houston	Rail	115				Catoosa	Truck	41
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	113
Beaver	Houston	Rail	78	Enid	Truck	5740	Anarillo	Truck	0	Houston	Rail	8
							Lubbock	Truck	0			
Boise City				Houston	Rail	4950				Lubbock	Truck	83
										Anarillo	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	28	Processor	Truck	18
Chandler				Processor	Truck	245				Processor	Truck	7
Cherokee				Houston	Rail	6890				Processor	Truck	65
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	111	Processor	Truck	44
Chickasha				Houston	Rail	1746				Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	20
Cordell				Houston	Rail	4850				Processor	Truck	33
Duncan				Houston	Rail	534				Processor	Truck	112
Durant				Houston	Rail	191				Processor	Truck	143
El Reno				Processor	Truck	64				Catoosa	Truck	64
				Houston	Rail	5479						
Enid				Houston	Rail	9778				Enid	Truck	21
Fairview				Houston	Rail	4183				Processor	Truck	23
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	116
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guymon				Houston	Rail	11150				Lubbock	Truck	0
										Anarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	25	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	87



Table 5.11. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel				Houston	Rail	363				Paris	Truck	173
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	38	Processor	Truck	86
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	14	Mich.Flls	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	38
Medford				Houston	Rail	9720				Processor	Truck	58
Miami				Houston	Rail	890				Processor	Truck	81
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Houston	Rail	3198				Processor	Truck	13
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	36	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Oklmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Processor	Rail	0	Catoosa	Truck	4
							Catoosa	Rail	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	34	Ft.Worth	Truck	84
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	29	Processor	Truck	8
Pawnee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	121	Paris	Truck	63
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Wagoner	Rail	0	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	29	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	12
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	5	Catoosa	Truck	5
Sayre	Houston	Rail	235	Processor	Truck	406	Lubbock	Truck	40	Mich.Flls	Truck	0
				Houston	Rail	2636						
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
							Mich.Flls	Truck	0			
							Processor	Truck	0			
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	0	Paris	Truck	71
Tulsa				Catoosa	Truck	529				Houston	Rail	50

Table 5.11. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Houston	Rail	644				Wagoner	Truck	41
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	40	Houston	Rail	8
Walters				Houston	Rail	443				Ft.Worth	Truck	140
Watonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	79	Ft.Worth	Truck	144
Woodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1153				Houston	Rail	419
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	789				Houston	Rail	410
Wagoner				N.Orleans	Barge	919				Houston	Rail	338
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. North												
Houston				Export		14060						
N.Orleans				Export		2861						

### Model 3

Model 3 tests the effect of higher legal weight limits for trucks. Tables 5.12 through 5.16 list the results of these models. This set of models have the lowest total cost of all sets. Cost for Model 3A is \$111,473,920, \$2,693,360 less than Model 1A.

Lower truck costs for shipments of over one hundred miles enabled river ports to draw grain from a wider area. New Orleans received more grain in Model 3 than in any other model except for in Set B, where models including the proposed river system ports handled more grain.

### Model 4

Model 4 adds three river port sites to the base model. These sites are Eufaula, McAlester, and Poteau and are located on the proposed Poteau-Deep Fork System. The cost of the flow pattern in Model 4A is \$113,363,952. Including these three sites reduced the cost of grain transportation and handling by \$803,328 from the cost in Model 1A.

A key reason for flow changes in these models is the increased combined capacity of river ports during harvest. These ports pull harvest flows which in earlier models went to Enid, Paris Tx, and Ft. Worth Tx. This effect was not seen in models where farm storage was included. In Model 4A, New Orleans handles 5797 thousand more bushels than in the base model. Results of these models are found in Tables 5.17 through 5.21.

Table 5.12. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 3A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Hich.Flls	Rail	0	Processor	Truck	72
Alva	Enid	Truck	968	Catoosa	Truck	6211	Enid	Rail	0	Muskogee	Truck	32
Anadarko	Ft.Worth	Truck	398	Catoosa	Truck	4946	Houston	Rail	13	Muskogee	Truck	2
Arapaho				Processor	Truck	58				Muskogee	Truck	20
				Catoosa	Truck	5670						
Ardmore				Houston	Rail	272				Muskogee	Truck	83
Arnett	Enid	Truck	1071	Catoosa	Truck	1815	Houston	Rail	32	Wagoner	Truck	26
										Processor	Truck	26
Atoka	Paris	Truck	19	Muskogee	Truck	1	Ft.Worth	Truck	4	Houston	Rail	3
Beaver	Houston	Rail	3284	Houston	Rail	2534	Enid	Truck	40	Processor	Truck	28
Boise City	Houston	Rail	1565	Houston	Rail	2385	Lubbock	Truck	1	Lubbock	Truck	130
	Anarillo	Truck	1000									
Buffalo	Enid	Truck	3111	Catoosa	Truck	585	Houston	Rail	32	Processor	Truck	26
Chandler	Catoosa	Truck	97	Wagoner	Truck	148	Catoosa	Rail	0	Processor	Truck	53
Cherokee	Enid	Truck	1680	Catoosa	Truck	5210	Enid	Rail	23	Wagoner	Truck	25
Chayenne	Houston	Rail	1018	Catoosa	Truck	496	Enid	Truck	81	Processor	Truck	5
Chickasha	Ft.Worth	Truck	156	Processor	Truck	293	Processor	Rail	33	Muskogee	Truck	2
				Catoosa	Truck	1297						
				Catoosa	Truck	372				Wagoner	Truck	0
Claremore				Processor	Truck	2813	Hich.Flls	Truck	5	Catoosa	Truck	11
Cordall	Houston	Rail	2037	Houston	Rail	349	Houston	Rail	9	Processor	Truck	58
Duncan	Ft.Worth	Truck	185	Houston	Rail	191				Muskogee	Truck	52
Durant				Catoosa	Truck	5543				Processor	Truck	4
El Reno				Catoosa	Truck	7824	Catoosa	Truck	82	Wagoner	Truck	26
Enid	Enid	Truck	1954	Catoosa	Truck	2777	Catoosa	Truck	47	Wagoner	Truck	26
Fairview	Enid	Truck	1406	Catoosa	Truck	4402	Houston	Rail	12	Processor	Truck	66
Fredrick	Ft.Worth	Truck	1025	Houston	Rail	2300	Processor	Rail	0	Muskogee	Truck	11
Guthrie	Muskogee	Truck	238	Wagoner	Truck	8764	Lubbock	Truck	0	Lubbock	Truck	47
Guynon	Anarillo	Truck	2000	Houston	Rail							
	Houston	Rail	386									
Hobart	Hich.Flls	Truck	852	Houston	Rail	3308	Ft.Worth	Truck	13	Processor	Truck	8
	Houston	Rail	1713									
Hollis	Houston	Rail	1668	Houston	Rail	102	Hich.Flls	Truck	18	Processor	Truck	55
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	76	Muskogee	Truck	41
Idabel	Houston	Rail	197	Houston	Rail	166	Paris	Truck	10	Muskogee	Truck	102

Table 5.12. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1433	Catoosa	Truck	4956	Processor	Rail	22	Wagoner	Truck	23
	Catoosa	Truck	200							Muskogee	Truck	23
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	27	Processor	Truck	30
Mangun	Houston	Rail	2073	Houston	Rail	494	Hich.Flls	Truck	18	Processor	Truck	37
McFlester				Catoosa	Truck	126				Muskogee	Truck	54
Medford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Wagoner	Truck	26
	Houston	Rail	2599									
Miami				Wagoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Maskirk				Catoosa	Truck	3198				Wagoner	Truck	25
				Processor	Truck	3000						
				Processor	Truck	16	Processor	Truck	23	Catoosa	Truck	2
Norman	Ft.Worth	Truck	305									
Oklahoma				Processor	Truck	571				Catoosa	Truck	49
City				Muskogee	Truck	52	Wagoner	Truck	37	Catoosa	Truck	4
Oklmulgee	Muskogee	Truck	107									
	Catoosa	Truck	164									
Pauls	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	66			
Valley										Muskogee	Truck	12
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	6	Catoosa	Truck	61
Pawnee				Muskogee	Truck	316				Houston	Rail	28
Perry				Wagoner	Truck	3152				Muskogee	Truck	5
Poteau	Houston	Rail	199	Catoosa	Truck	10	Paris	Truck	12	Houston	Rail	27
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	9
	Wagoner	Truck	125									
	Ft.Worth	Truck	396	Muskogee	Truck	135	Processor	Rail	63	Catoosa	Truck	0
Purcell				Catoosa	Truck	98				Muskogee	Truck	34
Sallisaw				Catoosa	Truck	10	Muskogee	Truck	40	Wagoner	Truck	31
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10				Catoosa	Truck	8
Sayre	Hich.Flls	Truck	2148	Processor	Truck	1129	Ft.Worth	Rail	0	Processor	Truck	5
Shawnee				Muskogee	Truck	344				Processor	Truck	5
Stillwater				Wagoner	Truck	376				Muskogee	Truck	6
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Catoosa	Truck	1182	Houston	Rail	10	Wagoner	Truck	26
										Processor	Truck	26
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Houston	Rail	7	Muskogee	Truck	68
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Wagoner	Truck	86	Wagoner	Truck	73



Table 5.13. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 3B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Mich.Flls	Rail	0	Processor	Truck	117
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	0	Processor	Truck	49
Anadarko	Ft.Worth	Truck	398	Houston	Rail	4946	Houston	Rail	13	Processor	Truck	65
Arapaho				Houston	Rail	4383				Processor	Truck	49
				Processor	Truck	1345						
Ardmore				Houston	Rail	272				Muskogee	Truck	183
Arnett	Enid	Truck	1071	Houston	Rail	1815	Houston	Rail	32	Processor	Truck	19
Atoka	Paris	Truck	19	Houston	Rail	1	Ft.Worth	Truck	4	Muskogee	Truck	97
Beaver	Houston	Rail	3284	Houston	Rail	2534	Anarillo	Truck	91	Processor	Truck	73
Boise City	Houston	Rail	1565	Houston	Rail	2385	Lubbock	Truck	1	Lubbock	Truck	230
	Anarillo	Truck	1000									
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	32	Processor	Truck	34
Chandler	Catoosa	Truck	97	Wagoner	Truck	148	Catoosa	Rail	0	Processor	Truck	5
							Processor	Rail	0			
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	23	Processor	Truck	47
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	81	Processor	Truck	24
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	33	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	8
Cordell	Houston	Rail	2037	Houston	Rail	2813	Mich.Flls	Truck	5	Processor	Truck	21
Duncan	Ft.Worth	Truck	185	Houston	Rail	349	Houston	Rail	9	Processor	Truck	103
Durant				Houston	Rail	191				Processor	Truck	133
El Reno				Processor	Truck	309				Catoosa	Truck	44
				Houston	Rail	5234						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	82	Processor	Truck	26
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	47	Processor	Truck	10
Fredrick	Ft.Worth	Truck	1025	Houston	Rail	4402	Houston	Rail	12	Processor	Truck	111
Guthrie	Muskogee	Truck	238	Houston	Rail	2300	Processor	Rail	0	Processor	Truck	3
Guymon	Anarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	147
	Houston	Rail	386									
Hobart	Houston	Rail	1713	Houston	Rail	3308	Ft.Worth	Truck	13	Processor	Truck	53
	Mich.Flls	Truck	852									
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	18	Processor	Truck	100
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	76	Processor	Truck	137
Idabel	Houston	Rail	197	Houston	Rail	166	Paris	Truck	10	Muskogee	Truck	202

Table 5.13. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1433	Houston	Rail	4956	Processor	Rail	22	Processor	Truck	15
	Catoosa	Truck	200									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	27	Processor	Truck	75
Mangum	Houston	Rail	2073	Houston	Rail	494	Mich.Flls	Truck	18	Processor	Truck	82
McAlester				Houston	Rail	126				Catoosa	Truck	45
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	44
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	60
Muskogee				Muskogee	Truck	371				Processor	Truck	56
Newkirk				Houston	Rail	3198				Processor	Truck	3
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Houston	Rail	16	Processor	Truck	23	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	107	Muskogee	Truck	52	Wagoner	Truck	37	Catoosa	Truck	4
	Catoosa	Truck	164									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	66	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	6	Processor	Truck	13
Paumotu				Houston	Rail	316				Muskogee	Truck	72
Perry				Houston	Rail	3152				Wagoner	Truck	29
Poteau	Houston	Rail	199	Houston	Rail	10	Paris	Truck	12	Catoosa	Truck	73
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Truck	63	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	15
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Muskogee	Truck	40	Catoosa	Truck	5
Sayre	Mich.Flls	Truck	2148	Houston	Rail	1129	Enid	Truck	33	Houston	Rail	17
Shawnee				Processor	Truck	344				Houston	Rail	32
Stillwater				Houston	Rail	376				Wagoner	Truck	13
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Processor	Truck	1182	Houston	Rail	10	Catoosa	Truck	29
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Houston	Rail	7	Muskogee	Truck	168
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Wagoner	Truck	86	Houston	Rail	50
Vinita	Wagoner	Truck	116	Houston	Rail	528	Wagoner	Truck	0	Processor	Truck	36



Table 5.13. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest			Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price	
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	46	Houston	Rail	8	
Walters	Houston	Rail	2032	Houston	Rail	2111	Nich.Falls	Truck	39	Processor	Truck	135	
	Ft.Worth	Truck	330							Processor	Truck	15	
Watonga				Houston	Rail	4133							
				Processor	Truck	2200							
Haurika	Ft.Worth	Truck	660	Houston	Rail	382	Houston	Rail	3	Processor	Truck	153	
Woodward				Houston	Rail	2105				Processor	Truck	22	
				-----Terminals-----									
Enid				Houston	Rail	4189				Catoosa	Rail	244	
Eufaula													
McAlester													
Muskogee				N.Orleans	Barge	1234				Houston	Rail	365	
Poteau													
Shaunee													
Catoosa				N.Orleans	Barge	1864				Houston	Rail	356	
Wagoner				N.Orleans	Barge	954				Houston	Rail	290	
Paris				Houston	Rail	293				Muskogee	Rail	445	
Amarillo				Houston	Rail	3000				Ft.Worth	Rail	462	
Lubbock													
Michita													
Falls				Houston	Rail	3000				Muskogee	Rail	343	
Ft. North				Houston	Rail	5748				No Alternative			
Houston				Export		138869							
N.Orleans				Export		4052							

Table 5.14. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 3C.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Wagoner	Truck	14	
Altus				Houston	Rail	5967			Ft.North	Truck	41	
Alva				Catoosa	Truck	7179			Wagoner	Truck	6	
Anadarko				Muskogee	Truck	5344			Houston	Rail	2	
Arapaho				Muskogee	Truck	575			Processor	Truck	0	
				Catoosa	Truck	5153						
Ardmore				Houston	Rail	272			Paris	Truck	76	
Arnett				Catoosa	Truck	2886			Wagoner	Truck	11	
Atoka	Houston	Rail	5	Muskogee	Truck	15	Paris	Truck	61	Houston	Rail	3
Beaver	Houston	Rail	78	Houston	Rail	5740	Enid	Truck	72	Enid	Truck	22
Boise City				Houston	Rail	4950			Lubbock	Truck	31	
									Amarillo	Truck	31	
Buffalo	Houston	Rail	707	Enid	Truck	350	Enid	Truck	0	Houston	Rail	17
				Catoosa	Truck	2639						
Chandler				Wagoner	Truck	245			Processor	Truck	61	
Cherokee				Catoosa	Truck	6890			Wagoner	Truck	5	
Cheyenne	Houston	Rail	125	Catoosa	Truck	1389	Enid	Truck	113	Muskogee	Truck	3
Chickasha				Muskogee	Truck	1746			Processor	Truck	6	
Claremore				Wagoner	Truck	372			Muskogee	Truck	17	
Cordell				Processor	Truck	4000			Houston	Rail	4	
				Muskogee	Truck	850						
Duncan				Houston	Rail	534			Ft.North	Truck	42	
Durant				Houston	Rail	191			Muskogee	Truck	52	
El Reno				Processor	Truck	309			Catoosa	Truck	8	
				Muskogee	Truck	5234						
Enid				Catoosa	Truck	9778			Wagoner	Truck	6	
Fairview				Catoosa	Truck	4183			Wagoner	Truck	6	
Fredrick				Houston	Rail	5427			Ft.North	Truck	25	
Guthrie				Wagoner	Truck	2538			Muskogee	Truck	11	
Guynon				Enid	Truck	11150			Lubbock	Truck	0	
									Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	20	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	64	Mich.Flls	Truck	22
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	38

Table 5.14. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel				Houston	Rail	363				Muskogee	Truck	102
Kingfisher				Catoosa	Truck	6589				Hogoner	Truck	3
Lauton	Houston	Rail	319	Houston	Rail	2000	Ft.Worth	Truck	49	Ft.Worth	Truck	17
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	64	Mich.Flls	Truck	22
McAlester				Catoosa	Truck	126				Paris	Truck	6
Medford				Catoosa	Truck	9720				Hogoner	Truck	6
Miami				Hogoner	Truck	890				Muskogee	Truck	10
Muskogee				Muskogee	Truck	371				Hogoner	Truck	61
Newkirk				Catoosa	Truck	3198				Hogoner	Truck	5
				Processor	Truck	3000						
Norman	Houston	Rail	84	Muskogee	Truck	237	Processor	Truck	0	Processor	Truck	4
Oklahoma City				Processor	Truck	571				Muskogee	Truck	50
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Truck	24	Catoosa	Truck	24
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	10	Ft.Worth	Truck	0
Pawhuska	Muskogee	Truck	162	Muskogee	Truck	459	Catoosa	Truck	18	Catoosa	Truck	81
Paunee				Muskogee	Truck	316				Houston	Rail	28
Perry				Hogoner	Truck	3152				Muskogee	Truck	5
Poteau	Houston	Rail	55	Catoosa	Truck	154	Muskogee	Truck	80	Houston	Rail	7
Pryor	Hogoner	Truck	113	Hogoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Muskogee	Truck	462	Ft.Worth	Truck	0	Ft.Worth	Truck	6
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	14
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Hogoner	Truck	11	Hogoner	Truck	11
Sayre	Houston	Rail	235	Muskogee	Truck	3042	Amarillo	Truck	0	Mich.Flls	Truck	0
							Lubbock	Truck	0	Processor	Truck	0
Shawnee				Muskogee	Truck	344				Hogoner	Truck	14
Stillwater				Hogoner	Truck	376				Muskogee	Truck	6
				Processor	Truck	500						
Tahlequah				Hogoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Catoosa	Truck	3055	Enid	Truck	22	Hogoner	Truck	6
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	69	Ft.Worth	Truck	54
Tulsa				Catoosa	Truck	529				Hogoner	Truck	53
Vinita				Hogoner	Truck	644				Muskogee	Truck	19
Hogoner	Hogoner	Truck	126	Hogoner	Truck	357	Muskogee	Truck	55	Muskogee	Truck	55
Walters				Houston	Rail	4473				Ft.Worth	Truck	53

Table 5.14. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Catoosa	Truck	4133				Hogener	Truck	4
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Ft.Worth	Truck	73	Ft.Worth	Truck	59
Woodward				Catoosa	Truck	2105				Hogener	Truck	6
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	19560				Houston	Rail	365
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	70000				Houston	Rail	336
Hogener				N.Orleans	Barge	9262				Houston	Rail	290
Paris												
Anarillo												
Lubbock												
Michita												
Falls												
Ft. Worth												
Houston				Export		11099						
N.Orleans				Export		98822						

Table 5.15. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 30.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Paris	Truck	0	
									Ft.Worth	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	105	
Alva				Houston	Rail	7179			Catoosa	Truck	51	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	17	
Ardnore				Houston	Rail	272			Paris	Truck	125	
Arnett				Houston	Rail	2886			Enid	Truck	2	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	92
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	74	Enid	Truck	41
Boise City				Houston	Rail	4950			Lubbock	Truck	50	
									Amarillo	Truck	50	
Buffalo	Houston	Rail	707	Houston	Rail	2989	Enid	Truck	25	Enid	Truck	2
Chandler				Wagoner	Truck	245			Processor	Truck	10	
Cherokee				Houston	Rail	6890			Catoosa	Truck	50	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	135	Processor	Truck	41
									Enid	Truck	41	
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Claremore				Houston	Rail	372			Catoosa	Truck	16	
									Wagoner	Truck	16	
Cordell				Houston	Rail	4850			Processor	Truck	38	
Duncan				Houston	Rail	534			Ft.Worth	Truck	106	
Durant				Houston	Rail	191			Ft.Worth	Truck	125	
El Reno				Processor	Truck	309			Catoosa	Truck	39	
				Houston	Rail	5234						
Enid				Houston	Rail	9428			Catoosa	Truck	30	
				Enid	Truck	350						
Fairview				Houston	Rail	4183			Catoosa	Truck	24	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	89	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guynon				Enid	Truck	11150			Lubbock	Truck	0	
									Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	62	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	64	Mich.Flls	Truck	64
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	87

Table 5.15. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel				Houston	Rail	363				Paris	Truck	173
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lawton	Houston	Rail	319	Houston	Rail	2000	Ft.Worth	Truck	49	Ft.Worth	Truck	81
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	64	Mich.Flls	Truck	64
McAlester				Houston	Rail	126				Paris	Truck	20
Madford				Houston	Rail	9720				Catoosa	Truck	41
Miami				Houston	Rail	890				Processor	Truck	77
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3066				Processor	Truck	20
				Processor	Truck	3000						
				Houston	Rail	132						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	10	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Rail	0	Catoosa	Truck	4
							Processor	Rail	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	10	Ft.Worth	Truck	64
Pawhuska	Houston	Rail	162	Muskogee	Truck	459	Processor	Truck	0	Processor	Truck	35
Pawnee				Houston	Rail	316				Muskogee	Truck	67
Perry				Houston	Rail	3152				Wagoner	Truck	24
Poteau	Houston	Rail	55	Houston	Rail	154	Paris	Truck	88	Paris	Truck	42
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Wagoner	Rail	0	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	34
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	0	Houston	Rail	0
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Mich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
							Mich.Flls	Truck	0			
Shaunee				Processor	Truck	344				Houston	Rail	15
Stillwater				Houston	Rail	376				Wagoner	Truck	8
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	47	Catoosa	Truck	7
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	69	Ft.Worth	Truck	118
Tulsa				Catoosa	Truck	529				Houston	Rail	55

Table 5.16. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Houston	Rail	644				Wagoner	Truck	36
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	35	Houston	Rail	13
Halters				Houston	Rail	4473				Ft.North	Truck	117
Matonga				Houston	Rail	4133				Processor	Truck	32
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	902	Mich.Flls	Truck	73	Ft.North	Truck	123
Woodward				Houston	Rail	2105				Processor	Truck	39
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				M.Orleans	Barge	1233				Houston	Rail	270
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	3009				Houston	Rail	261
Wagoner				N.Orleans	Barge	1164				Houston	Rail	195
Paris												
Ararillo												
Lubbock												
Michita												
Falls												
Ft. North												
Houston				Export		136635						
N.Orleans				Export		6206						

Table 5.16. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 3E.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in 5/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Ft.Worth	Truck	0	
									Paris	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	110	
Alva				Houston	Rail	7179			Catoosa	Truck	56	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	17	
Ardmore				Houston	Rail	272			Paris	Truck	130	
Arnett				Houston	Rail	2886			Enid	Truck	2	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	97
Beaver	Houston	Rail	78	Houston	Rail	5740	Anarillo	Truck	74	Enid	Truck	41
Boise City				Houston	Rail	4950			Lubbock	Truck	50	
									Anarillo	Truck	50	
Buffalo	Houston	Rail	707	Houston	Rail	2989	Enid	Truck	25	Enid	Truck	2
Chandler				Wagoner	Truck	245			Processor	Truck	5	
Cherokee				Houston	Rail	6890			Catoosa	Truck	55	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	135	Processor	Truck	41
									Enid	Truck	41	
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Claremore				Houston	Rail	372			Catoosa	Truck	21	
									Wagoner	Truck	21	
Cordell				Houston	Rail	4850			Processor	Truck	38	
Duncan				Houston	Rail	534			Ft.Worth	Truck	111	
Durant				Houston	Rail	191			Ft.Worth	Truck	130	
El Reno				Processor	Truck	309			Catoosa	Truck	44	
				Houston	Rail	5234						
Enid				Houston	Rail	9428			Catoosa	Truck	35	
				Enid	Truck	350						
Fairview				Houston	Rail	4183			Processor	Truck	27	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	94	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guymon				Enid	Truck	11150			Lubbock	Truck	0	
									Anarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	62	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	64	Mich.Flls	Truck	64
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	92



Table 5.16. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel				Houston	Rail	363				Paris	Truck	178
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lawton	Houston	Rail	319	Houston	Rail	2000	Ft.Worth	Truck	49	Ft.Worth	Truck	86
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	64	Mich.Flls	Truck	64
McAlester				Houston	Rail	126				Paris	Truck	25
Madford				Houston	Rail	9720				Catoosa	Truck	46
Miami				Houston	Rail	890				Processor	Truck	77
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Houston	Rail	3198				Catoosa	Truck	5
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	10	Processor	Truck	1
Oklahoma												
City				Processor	Truck	571				Houston	Rail	64
Oklmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Processor	Rail	0	Catoosa	Truck	4
							Catoosa	T/R	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	10	Ft.Worth	Truck	69
Pawhuska	Houston	Rail	162	Muskogee	Truck	459	Enid	Truck	0	Processor	Truck	30
							Processor	Truck	0			
Pawnee				Houston	Rail	316				Muskogee	Truck	72
Perry				Houston	Rail	3152				Wagoner	Truck	29
Poteau	Houston	Rail	55	Houston	Rail	154	Paris	Truck	88	Paris	Truck	47
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Wagoner	Rail	0	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Paris	Truck	28
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	1	Catoosa	Truck	5
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Mich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
							Mich.Flls	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	15
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	47	Catoosa	Truck	12
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	69	Ft.Worth	Truck	123
Tulsa				Catoosa	Truck	529				Houston	Rail	50

Table 5.16. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Houston	Rail	644				Wagoner	Truck	41
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	40	Houston	Rail	8
Halters				Houston	Rail	4473				Ft.Worth	Truck	122
Watonga				Houston	Rail	4133				Processor	Truck	32
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	73	Ft.Worth	Truck	128
Woodward				Houston	Rail	2105				Processor	Truck	39
-----Terminals-----												
Enid												
Eufaula												
McFlester												
Muskogee				N.Orleans	Barge	1233				Houston	Rail	365
Poteau												
Shaunee												
Catoosa				N.Orleans	Barge	627				Houston	Rail	356
Wagoner				N.Orleans	Barge	1164				Houston	Rail	290
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. Worth												
Houston				Export		139897						
N.Orleans				Export		3024						

Table 5.17. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 4A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Mich.Flrs	Rail	0	McAlester	Truck	96
Alva	Enid	Truck	968	Catoosa	Truck	6211	Enid	Rail	22	Houston	Rail	15
Anadarko	Eufaula	Truck	76	Houston	Rail	4946	Poteau	Truck	39	McAlester	Truck	1
Arapaho										Eufaula	Truck	12
Ardmore				Processor	Truck	2527						
Arnett	Enid	Truck	1071	Catoosa	Truck	3201				McAlester	Truck	54
				Houston	Rail	272	Houston	Rail	69	Wagoner	Truck	31
Atoka	Poteau	Truck	19	Catoosa	Truck	1815	McAlester	Truck	10	Processor	Truck	31
Beaver	Enid	Truck	1820	Houston	Rail	1	Amarillo	Truck	39	Muskogee	Truck	13
	Houston	Rail	1464	Houston	Rail	2534	Lubbock	Truck	39	Processor	Truck	30
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	125
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Catoosa	Truck	585	Houston	Rail	67	Processor	Truck	32
Chandler	Eufaula	Truck	97	Eufaula	Truck	148	Catoosa	Rail	0	Wagoner	Truck	1
Cherokee	Enid	Truck	1680	Catoosa	Truck	5210	Enid	Rail	45	Houston	Rail	19
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Catoosa	Truck	9
Chickasha	Eufaula	Truck	156	McAlester	Truck	1590	McAlester	Truck	1	Eufaula	Truck	1
Clarenore				McAlester	Truck	372				Wagoner	Truck	0
										Catoosa	Truck	0
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	5
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	McAlester	Truck	59
Durant				Houston	Rail	191				Eufaula	Truck	45
El Reno				Catoosa	Truck	5234				Eufaula	Truck	6
				Processor	Truck	309						
Enid	Enid	Truck	1954	Catoosa	Truck	7824	Catoosa	Truck	83	Wagoner	Truck	32
Fairview	Enid	Truck	1406	Catoosa	Truck	2777	Catoosa	Truck	56	Wagoner	Truck	32
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.North	Truck	13	Eufaula	Truck	84
Guthrie	Eufaula	Truck	187	Muskogee	Truck	2300	Wagoner	Truck	7	Wagoner	Truck	1
	McAlester	Truck	51									
Guymon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
	Houston	Rail	386									

Table 5.17. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flts	Truck	38	Processor	Truck	41
							McAlester	Truck	38			
							Eufaula	Truck	38			
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flts	Truck	10	Eufaula	Truck	48
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Eufaula	Truck	32
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Poteau	Truck	57
Kingfisher	Enid	Truck	396	Catoosa	Truck	4956	Eufaula	Truck	3	Wagoner	Truck	29
	Catoosa	Truck	1237							Muskogee	Truck	29
										Processor	Truck	29
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	McAlester	Truck	44
Mangun	Mich.Flts	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	37
McAlester				McAlester	Truck	126				Eufaula	Truck	70
Medford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Wagoner	Truck	31
	Houston	Rail	2599									
Miami				Eufaula	Truck	890				McAlester	Truck	25
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	32
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Eufaula	Truck	16	Poteau	Truck	36	McAlester	Truck	1
							Enid	Truck	36			
Oklahoma City				Processor	Truck	571				Catoosa	Truck	50
Okmulgee	Poteau	Truck	271	Poteau	Truck	52	Eufaula	Truck	12	McAlester	Truck	50
Pauls										McAlester	Truck	0
Valley	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Eufaula	Truck	7
Pawhuska	McAlester	Truck	590	Muskogee	Truck	31	Catoosa	Truck	11	Eufaula	Truck	28
Pawnee				Muskogee	Truck	316				Houston	Rail	11
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Poteau	Truck	199	Poteau	Truck	10	Poteau	Rail	193	Catoosa	Truck	101
Pryor	Poteau	Truck	333	McAlester	Truck	62	McAlester	Truck	2	Wagoner	Truck	1
	Wagoner	Truck	125									
Purcell	McAlester	Truck	396	McAlester	Truck	135	Eufaula	Truck	16	Eufaula	Truck	11
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Muskogee	Truck	59	Catoosa	Truck	10	Wagoner	Truck	2	McAlester	Truck	6
	Poteau	Truck	127									

Table 5.17. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Sayre	Eufaula	Truck	984	Processor	Truck	1129	McAlester	Truck	3	Catoosa	Truck	9
	Mich.Flls	Truck	927									
	Houston	Rail	237									
Shawnee Stillwater				Processor	Truck	344				Muskogee	Truck	2
				Wagoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah Taloga	Poteau	Truck	22	Wagoner	Truck	20	Muskogee	Truck	27	Muskogee	Truck	2
	Enid	Truck	2066	Catoosa	Truck	1182	Catoosa	Truck	28	Wagoner	Truck	32
Tishoningo Tulsa	Poteau	Truck	58	Houston	Rail	3	McAlester	Truck	5	Processor	Truck	32
	Catoosa	Truck	263	Catoosa	Truck	266	Muskogee	Truck	46	Eufaula	Truck	26
Vinita	Wagoner	Truck	116	Eufaula	Truck	528	Wagoner	Rail	0	McAlester	Truck	64
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	48	McAlester	Truck	26
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Muskogee	Truck	55
Watonga				Catoosa	Truck	4133				McAlester	Truck	98
				Processor	Truck	2200				Processor	Truck	20
				Houston	Rail	382	Ft.Worth	Truck	12	McAlester	Truck	100
Haurika	Houston	Rail	660	Catoosa	Truck	2105				Houston	Rail	17
-----Terminals-----												
Enid				Houston	Rail	1972				Catoosa	Rail	144
Eufaula				N.Orleans	Barge	3082				Houston	Rail	361
McAlester				N.Orleans	Barge	3785				Houston	Rail	343
Muskogee				N.Orleans	Barge	3798				Houston	Rail	365
Poteau				N.Orleans	Barge	1562				Houston	Rail	289
Shawnee												
Catoosa				N.Orleans	Barge	55426				Houston	Rail	356
Wagoner				N.Orleans	Barge	4272				Houston	Rail	290
Paris												
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	362
Lubbock												
Michita Falls				Houston	Rail	3000				McAlester	Rail	229
Ft. Worth										Eufaula	Rail	229
Houston				Houston	Rail	1758				No Alternative		
N.Orleans				Export		70996						
				Export		71925						

Table 5.18. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 4B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Muskogee	Truck	7
Altus	Houston	Rail	1229	Houston	Rail	4738	Hich.Flls	Rail	0	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Eufaula	Truck	76	Houston	Rail	4946	Poteau	Truck	39	Processor	Truck	65
	McAlester	Truck	322									
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				McAlester	Truck	154
Arnett	Enid	Truck	1071	Processor	Truck	1117	Houston	Rail	69	Catoosa	Truck	48
				Houston	Rail	698						
Atoka	Poteau	Truck	19	Houston	Rail	1	McAlester	Truck	10	Muskogee	Truck	113
Baaver	Enid	Truck	1820	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	1464				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	225
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Eufaula	Truck	97	Processor	Truck	148	McAlester	Truck	12	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Eufaula	Truck	156	Houston	Rail	1590	McAlester	Truck	1	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234				Catoosa	Truck	64
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Eufaula	Truck	187	Houston	Rail	2300	Wagoner	Truck	7	Processor	Truck	3
	Muskogee	Truck	51									
Guynon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Hich.Flls	Truck	38	Processor	Truck	62
							McAlester	Truck	38			
							Eufaula	Truck	38			

Table 5.18. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Poteau	Truck	132
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Poteau	Truck	157
Kingfisher	Enid	Truck	396	Houston	Rail	4956	Processor	Rail	0	Processor	Truck	15
	Catoosa	Truck	1237									
Lauton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				McAlester	Truck	126				Houston	Rail	13
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	74
Muskogee				Muskogee	Truck	371				Processor	Truck	59
Newkirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Houston	Rail	16	Poteau	Truck	36	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Poteau	Truck	271	Poteau	Truck	52	Eufaula	Truck	12	Muskogee	Truck	7
Pauls Valley	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Processor	Truck	94
Pawhuska	Muskogee	Truck	590	Muskogee	Truck	31	Catoosa	Truck	11	Processor	Truck	1
Paunee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Poteau	Truck	199	Poteau	Truck	10	Eufaula	Truck	195	Houston	Rail	7
Pryor	Poteau	Truck	333	McAlester	Truck	62	Muskogee	Truck	2	Wagoner	Truck	1
	Wagoner	Truck	125									
Purcell	McAlester	Truck	396	Houston	Rail	135	Eufaula	Truck	16	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Processor	Truck	5
Sapulpa	Muskogee	Truck	59	Houston	Rail	10	Wagoner	Truck	2	Catoosa	Truck	5
	Poteau	Truck	127									
Sayre	Eufaula	Truck	984	Processor	Truck	1129	Processor	Truck	0	Houston	Rail	7
	Mich.Flls	Truck	927									
	Houston	Rail	237									
Shawnee				Processor	Truck	344				Houston	Rail	46
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						

Table 5.18. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in 5/1000 bu.)						
	Harvest			Nonharvest			Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price	
Tahlequah	Poteau	Truck	22	Hogener	Truck	20	Muskogee	Truck	27	Muskogee	Truck	2	
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	26	
Tishomingo	Poteau	Truck	58	Houston	Rail	3	McAlester	Truck	50	Eufaula	Truck	126	
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Muskogee	Truck	46	Houston	Rail	50	
Vinita	Hogener	Truck	116	Houston	Rail	528	Eufaula	Truck	9	Eufaula	Truck	9	
Hogener	Hogener	Truck	459	Hogener	Truck	24	Muskogee	Truck	48	Houston	Rail	8	
Halters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	141	
Hatonga				Houston	Rail	4133				Processor	Truck	17	
Haurika	Houston	Rail	660	Processor	Truck	2200				Processor	Truck	159	
Woodward				Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	35	
				Houston	Rail	2105							
				-----Terminals-----									
Enid				Houston	Rail	4972				Catoosa	Rail	244	
Eufaula				N.Orleans	Barge	1500				Houston	Rail	361	
McAlester				N.Orleans	Barge	1688				Houston	Rail	343	
Muskogee				N.Orleans	Barge	1102				Houston	Rail	365	
Poteau				N.Orleans	Barge	1562				Houston	Rail	289	
Shawnee													
Catoosa				N.Orleans	Barge	1864				Houston	Rail	356	
Hogener				N.Orleans	Barge	744				Houston	Rail	290	
Paris													
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	462	
Lubbock													
Michita										Eufaula	Truck	329	
Falls				Houston	Rail	3000				McAlester	Truck	329	
Ft. North				Houston	Rail	1758				No Alternative			
Houston				Export		134461							
N.Orleans				Export		8460							



Table 5.19. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 4C.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	13
Altus				Houston	Rail	5967				Ft.Worth	Truck	51
Alva				Catoosa	Truck	7179				Houston	Rail	9
Anadarko				Houston	Rail	5344				McAlester	Truck	1
Arapaho				Processor	Truck	958				McAlester	Truck	6
				Catoosa	Truck	4770						
Ardmore				Houston	Rail	272				McAlester	Truck	54
Arnett				Catoosa	Truck	2886				Enid	Truck	17
Atoka	Houston	Rail	5	Houston	Rail	15	McAlester	Truck	0	Muskogee	Truck	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Anarillo	Truck	20	Enid	Truck	4
Boise City				Houston	Rail	4950				Lubbock	Truck	67
										Anarillo	Truck	67
Buffalo	Houston	Rail	707	Enid	Truck	350	Enid	Truck	43	Houston	Rail	29
				Catoosa	Truck	2639						
Chandler				Eufaula	Truck	245				Wagoner	Truck	1
Cherokee				Catoosa	Truck	6890				Houston	Rail	13
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	15
Chickasha				McAlester	Truck	1746				Eufaula	Truck	1
Claremore				McAlester	Truck	372				Wagoner	Truck	0
Cordell				Houston	Rail	4850				Processor	Truck	11
Duncan				Houston	Rail	534				Ft.Worth	Truck	46
Durant				Houston	Rail	191				Eufaula	Truck	45
El Reno				Processor	Truck	309				McAlester	Truck	1
				Catoosa	Truck	1890						
				Eufaula	Truck	3344						
Enid				Catoosa	Truck	9778				Wagoner	Truck	26
										Enid	Truck	26
Fairview				Catoosa	Truck	4183				Wagoner	Truck	26
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	32
Guthrie				Muskogee	Truck	2538				Wagoner	Truck	1
Guymon				Enid	Truck	11150				Lubbock	Truck	0
										Anarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	36
										Ft.Worth	Truck	36
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Ft.Worth	Truck	4

Table 5.19. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hugo Idabel Kingfisher	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	0
				Houston	Rail	363				Poteau	Truck	57
				Catoosa	Truck	6589				Muskogee	Truck	23
Lawton Mangum	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Ft.Worth	Truck	22
	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	0
McAlester Madford Miami Muskogee Newkirk				McAlester	Truck	126				Ft.Worth	Truck	0
				Catoosa	Truck	9720				Paris	Truck	64
				Eufaula	Truck	890				Wagoner	Truck	25
				Muskogee	Truck	371				McAlester	Truck	25
				Catoosa	Truck	3198				Wagoner	Truck	61
				Processor	Truck	3000				Wagoner	Truck	26
Norman Oklahoma City	Houston	Rail	84	Eufaula	Truck	237	Processor	Truck	0	McAlester	Truck	1
				Processor	Truck	571				Eufaula	Truck	44
Okmulgee Pauls Valley	Muskogee	Truck	61	Poteau	Truck	262	Eufaula	Truck	0	Muskogee	Truck	7
	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	0
Pawhuska Pawnee Perry	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	23	Eufaula	Truck	28
				Muskogee	Truck	316				Houston	Rail	11
Poteau Pryor				Wagoner	Truck	3152				Muskogee	Truck	8
	Poteau	Truck	55	Poteau	Truck	154	Houston	Rail	59	Paris	Truck	83
Purcell Sallisaw	Wagoner	Truck	113	McAlester	Truck	407	Muskogee	Truck	9	Wagoner	Truck	1
	Houston	Rail	69	McAlester	Truck	462	Ft.Worth	Truck	0	Eufaula	Truck	11
Sapulpa Sayre				Catoosa	Truck	98				Poteau	Truck	1
	Catoosa	Truck	51	Catoosa	Truck	145	Wagoner	Truck	25	McAlester	Truck	0
Shawnee Stillwater	Houston	Rail	235	Processor	Truck	3042	Anarillo	Truck	0	Mich.Flls	Truck	0
							Lubbock	Truck	0	Ft.Worth	Truck	0
				Muskogee	Truck	344				Processor	Truck	4
				Wagoner	Truck	376				Muskogee	Truck	7
Tahlequah Taloga				Processor	Truck	500						
				Wagoner	Truck	42				Muskogee	Truck	2
Tishomingo Tulsa	Houston	Rail	193	Catoosa	Truck	3055	Enid	Truck	0	Wagoner	Truck	26
	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	14
				Catoosa	Truck	529				McAlester	Truck	58

Table 5.19. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Eufaula	Truck	644				McAlester	Truck	26
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Muskogee	Truck	55	Muskogee	Truck	55
Walters				Houston	Rail	4473				Ft.Worth	Truck	56
Watonga				Catoosa	Truck	4133				Houston	Rail	18
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	60
				Catoosa	Truck	2105				Houston	Rail	11
-----Terminals-----												
Enid												
Eufaula				N.Orleans	Barge	5360				Houston	Rail	361
McAlester				N.Orleans	Barge	3113				Houston	Rail	343
Muskogee				N.Orleans	Barge	4169				Houston	Rail	365
Poteau				N.Orleans	Barge	471				Houston	Rail	289
Shaunee												
Catoosa				N.Orleans	Barge	70000				Houston	Rail	350
Wagoner				N.Orleans	Barge	4166				Houston	Rail	290
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		55642						
N.Orleans				Export		87279						



Table 5.20. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Ft.Worth	Truck	85
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	22
McAlester				McAlester	Truck	126				Houston	Rail	34
Madford				Houston	Rail	9720				Catoosa	Truck	46
Miami				Houston	Rail	890				Eufaula	Truck	16
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	1980				Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	1218						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma												
City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Poteau	Truck	262	Catoosa	Rail	0	Muskogee	Truck	7
							Eufaula	Truck	0			
							McAlester	Truck	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	63
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Eufaula	Truck	28
Paunee				Houston	Rail	316				Muskogee	Truck	68
Perry				Houston	Rail	3152				Wagoner	Truck	26
Poteau	Houston	Rail	55	Poteau	Truck	154	Poteau	Truck	0	Houston	Rail	28
Pryor	Wagoner	Truck	113	McAlester	Truck	407	Muskogee	Truck	9	Wagoner	Truck	1
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	McAlester	Truck	6
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Mich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shaunee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	8
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	80
Tulsa				Catoosa	Truck	529				McAlester	Truck	64

Table 5.20. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Eufaula	Truck	644				Houston	Rail	12
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Wagoner	Truck	19	Houston	Rail	29
Walters				Houston	Rail	4473				Ft.Worth	Truck	119
Watonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	123
Hoodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula				N.Orleans	Barge	889				Houston	Rail	282
McAlester				N.Orleans	Barge	533				Houston	Rail	264
Muskogee				N.Orleans	Barge	971				Houston	Rail	286
Poteau				N.Orleans	Barge	416				Houston	Rail	210
Shawnee												
Catoosa				N.Orleans	Barge	2965				Houston	Rail	277
Wagoner				N.Orleans	Barge	512				Houston	Rail	211
Paris												
Anarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.21. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 4E.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Muskogee	Truck	0
										Paris	Truck	0
										Ft.North	Truck	0
Altus				Houston	Rail	5967				Ft.North	Truck	135
Alva				Houston	Rail	7179				Processor	Truck	71
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	12
Ardmore				Houston	Rail	272				Paris	Truck	146
Arnett				Enid	Truck	2886				Houston	Rail	13
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	113
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950				Lubbock	Truck	83
										Amarillo	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Processor	Truck	245				Eufaula	Truck	2
Cherokee				Houston	Rail	6890				Processor	Truck	65
Chayenna	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	44
Chickasha				Houston	Rail	1746				Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	20
Cordell				Houston	Rail	4850				Processor	Truck	33
Duncan				Houston	Rail	534				Processor	Truck	112
Durant				Houston	Rail	191				Eufaula	Truck	137
El Reno				Processor	Truck	64				Eufaula	Truck	62
				Houston	Rail	5479						
Enid				Houston	Rail	9778				Enid	Truck	1
Fairview				Houston	Rail	4183				Processor	Truck	23
Fredrick				Houston	Rail	5427				Ft.North	Truck	116
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guyon				Enid	Truck	5625				Lubbock	Truck	0
				Houston	Rail	5525				Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	87
Idabel				Houston	Rail	363				Poteau	Truck	157
Kingfisher				Houston	Rail	6589				Processor	Truck	15

Table 5.21. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flrs	Truck	24	Processor	Truck	86
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flrs	Truck	0	Mich.Flrs	Truck	22
McAlester				McAlester	Truck	126				Houston	Rail	13
Medford				Houston	Rail	9720				Eufaula	Truck	29
Miami				Houston	Rail	890				Processor	Truck	81
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Houston	Rail	3198				Processor	Truck	13
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	5	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Oklmulgee	Muskogee	Truck	61	Poteau	Truck	262	Eufaula	Truck	0	Muskogee	Truck	7
							McAlester	T/R	0	Eufaula	Truck	7
							Poteau	Rail	0			
							Processor	T/R	0			
							Catoosa	T/R	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	84
Pawhuska	Houston	Rail	162	Muskogee	Truck	459	Catoosa	Truck	14	Processor	Truck	8
Pawnee				Houston	Rail	316				Muskogee	Truck	89
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Poteau	Truck	154	Poteau	Truck	0	Houston	Rail	7
Pryor	Wagoner	Truck	113	McAlester	Truck	407	Wagoner	Rail	0	Wagoner	Truck	1
							Eufaula	Rail	0			
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	1	Catoosa	Truck	5
Sayre	Houston	Rail	235	Houston	Rail	3042	Amarillo	Truck	0	Mich.Flrs	Truck	0
							Lubbock	Truck	0			
Shahee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	29
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	101
Tulsa				Catoosa	Truck	529				Houston	Rail	50



Table 5.21. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Houston	Rail	644				Eufaula	Truck	1
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	40	Houston	Rail	8
Malters				Houston	Rail	4473				Ft.North	Truck	140
Matonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Maurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.North	Truck	144
Woodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid										Houston	Rail	369
Eufaula										Houston	Rail	343
McAlester				N.Orleans	Barge	533				Houston	Rail	365
Muskogee				N.Orleans	Barge	891				Poteau	Truck	289
Poteau				N.Orleans	Barge	416						
Shawnee												
Catoosa				N.Orleans	Barge	627				Houston	Rail	356
Wagoner				N.Orleans	Barge	512				Houston	Rail	290
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. North												
Houston				Export		139942						
N.Orleans				Export		2979						

### Model 5

Model 5 tests the effects of imposing a fuel tax on the barge system. Costs in Set A increased by \$1,142,000 because of this change. The river system lost an average of over 25 percent of its volume. This percentage excludes Set D since flows through New Orleans were constrained. The flows lost were mostly nonharvest shipments. Tables 5.22 through 5.26 list results of these models.

### Model 6

Tables 5.27 through 5.31 show results of Model 6. Model 6 is a combination of Models 4 and 5 where by a fuel tax and the three port sites are added to Model 1. Combining these situations increased the costs by \$402,864 over Model 1A and \$1,224,192 when compared to Model 4A. These models also show losses mostly from nonharvest movements.

### Model 7

Model 7 adds a segment-specific users fee to the barge system in Model 1. Unlike the smaller fuel tax, this tax had a major effect upon flow and costs. Average loss of river volume excluding Set D was 88 percent compared to Model 1. Like earlier models, volume losses came from losses of nonharvest flows. Nonharvest flow only amounted to 5 million bushels in Model 7A compared to over 60 million bushels in Model 1A. Results of Model 7A through 7E are in Tables 5.32 through 5.36.

Table 5.22. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 5A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	8
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	125
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Catoosa	Truck	3
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Catoosa	Truck	40
Arapaho				Processor	Truck	2527				Catoosa	Truck	2
				Houston	Rail	3201						
Ardmore				Houston	Rail	272				Muskogee	Truck	126
Arnett	Enid	Truck	1071	Catoosa	Truck	1815	Houston	Rail	69	Processor	Truck	29
Atoka	Paris	Truck	19	Houston	Rail	1	Muskogee	Truck	33	Muskogee	Truck	30
Beaver	Enid	Truck	3202	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	46
	Houston	Rail	82				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	125
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Catoosa	Truck	585	Houston	Rail	67	Houston	Rail	17
Chandler	Catoosa	Truck	97	Hogener	Truck	148	Catoosa	Rail	0	Processor	Truck	54
Cherokee	Enid	Truck	1680	Catoosa	Truck	5210	Enid	Rail	45	Houston	Rail	1
Chayenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Catoosa	Truck	27
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Processor	Truck	16
Clarenore				Hogener	Truck	372				Catoosa	Truck	1
Cordell	Houston	Rail	2037	Houston	Rail	2813	Enid	Truck	25	Processor	Truck	21
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	100
Durant				Houston	Rail	191				Muskogee	Truck	90
El Reno				Catoosa	Truck	5250				Muskogee	Truck	16
				Processor	Truck	293						
Enid	Enid	Truck	1954	Catoosa	Truck	7824	Catoosa	Truck	83	Hogener	Truck	31
Fairview	Enid	Truck	1406	Catoosa	Truck	2777	Catoosa	Truck	56	Houston	Rail	30
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	117
Guthrie	Catoosa	Truck	238	Muskogee	Truck	2300	Muskogee	Truck	30	Hogener	Truck	1
Guymon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Nich.Flls	Truck	38	Processor	Truck	57
Hollis	Houston	Rail	1668	Houston	Rail	102	Nich.Flls	Truck	10	Processor	Truck	77
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Muskogee	Truck	82
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	12	Muskogee	Truck	147

Table 5.22. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1632	Catoosa	Truck	4956	Processor	Rail	36	Wagoner	Truck	28
	Catoosa	Truck	1							Muskogee	Truck	28
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	74
Hangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	53
McAlester				Catoosa	Truck	126				Houston	Rail	21
Madford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Houston	Rail	15
	Houston	Rail	2599									
Miani				Houston	Rail	890				Wagoner	Truck	3
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	31
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Processor	Truck	16	Processor	Truck	0	Catoosa	Truck	6
Oklahoma City				Processor	Truck	571				Catoosa	Truck	50
Okmulgee	Muskogee	Truck	146	Muskogee	Truck	52	Wagoner	Truck	37	Catoosa	Truck	5
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Muskogee	Truck	53
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	33	Catoosa	Truck	46
Paunee				Houston	Rail	316				Muskogee	Truck	6
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Muskogee	Truck	199	Houston	Rail	10	Houston	Rail	14	Catoosa	Truck	12
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	9
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	18
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10	Muskogee	Truck	40	Wagoner	Truck	30
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Catoosa	Truck	11
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Muskogee	Truck	3
Stillwater				Wagoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	2
Taloga	Enid	Truck	2066	Catoosa	Truck	1182	Catoosa	Truck	28	Processor	Truck	30
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	45	Muskogee	Truck	73
							Houston	Rail	45			

Table 5.22. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest			Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price	
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Hogoner	Truck	86	Muskogee	Truck	55	
Vinita	Hogoner	Truck	116	Hogoner	Truck	528	Hogoner	Rail	0	Muskogee	Truck	19	
Hogoner	Hogoner	Truck	459	Hogoner	Truck	24	Muskogee	Truck	46	Catoosa	Truck	162	
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	136	
Watonga				Catoosa	Truck	4133				Houston	Rail	6	
Haurika	Houston	Rail	660	Processor	Truck	2200							
Woodward				Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	154	
				Houston	Rail	2105				Catoosa	Truck	1	
				Terminals							Catoosa	Rail	162
Enid				Houston	Rail	7590							
Eufaula													
McAlester													
Muskogee				N.Orleans	Barge	3534				Houston	Rail	348	
Poteau													
Shaunee													
Catoosa				N.Orleans	Barge	44051				Houston	Rail	338	
Hogoner				N.Orleans	Barge	5382				Houston	Rail	273	
Paris				Houston	Rail	490				Muskogee	Rail	362	
Amarillo				Houston	Rail	2000				Ft.Worth	Rail	362	
Lubbock													
Michita													
Falls				Houston	Rail	3000				Muskogee	Rail	260	
Ft. Worth				Houston	Rail	3150				No Alternative			
Houston				Export		89954							
N.Orleans				Export		52967							

Table 5.23. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 5B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Houston	Rail	11
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				Processor	Truck	198
Arnett	Enid	Truck	1071	Processor	Truck	906	Houston	Rail	69	Processor	Truck	49
				Houston	Rail	909						
Atoka	Paris	Truck	19	Houston	Rail	1	Muskogee	Truck	33	Muskogee	Truck	130
Beaver	Enid	Truck	3202	Houston	Rail	2534	Anarillo	Truck	39	Processor	Truck	51
	Houston	Rail	82				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Lubbock	Truck	0	Lubbock	Truck	225
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Catoosa	Truck	97	Processor	Truck	148	Muskogee	Truck	29	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Enid	Truck	25	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Catoosa	Truck	238	Houston	Rail	2300	Muskogee	Truck	30	Processor	Truck	3
Guymon	Anarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Nich.Flls	Truck	38	Processor	Truck	62
Hollis	Houston	Rail	1668	Houston	Rail	102	Nich.Flls	Truck	10	Processor	Truck	82
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Processor	Truck	145
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	12	Processor	Truck	221

Table 5.23. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1632	Houston	Rail	4956	Processor	Rail	36	Processor	Truck	15
	Catoosa	Truck	1									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangun	Hich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McFlester				Houston	Rail	126				Catoosa	Truck	79
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	74
Muskogee				Muskogee	Truck	371				Processor	Truck	42
Muskirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Morman	Ft.Worth	Truck	305	Houston	Rail	16	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Oklmulgee	Muskogee	Truck	146	Houston	Rail	52	Wagoner	Truck	37	Muskogee	Truck	10
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Processor	Truck	31	Muskogee	Truck	33	Muskogee	Truck	16
Pawnee				Houston	Rail	316				Muskogee	Truck	106
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Muskogee	Truck	199	Houston	Rail	10	Houston	Rail	14	Processor	Truck	90
Pryor	Muskogee	Truck	333	Processor	Truck	62	Catoosa	Truck	10	Wagoner	Truck	0
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	28
Sallisaw				Processor	Truck	98				Houston	Rail	11
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Muskogee	Truck	40	Catoosa	Truck	23
Sayre	Hich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Houston	Rail	7
	Houston	Rail	1221									
Shaunee				Processor	Truck	344				Houston	Rail	46
Stillwater				Houston	Rail	376				Wagoner	Truck	46
				Processor	Truck	500				Processor	Truck	46
Tahlequah	Muskogee	Truck	22	Processor	Truck	20	Wagoner	Truck	7	Wagoner	Truck	1
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	26
Tishoningo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	45	Muskogee	Truck	173
							Houston	Rail	45			





Table 5.24. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 5C.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	8
Altus				Houston	Rail	5967				Ft.Worth	Truck	70
Alva				Houston	Rail	7179				Catoosa	Truck	3
Anadarko				Houston	Rail	5344				Catoosa	Truck	40
Arapaho				Processor	Truck	614				Catoosa	Truck	2
				Houston	Rail	5114						
Ardmore				Houston	Rail	272				Paris	Truck	87
Arnett				Catoosa	Truck	2886				Enid	Truck	17
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	30
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	16
Boise City				Houston	Rail	4950				Lubbock	Truck	79
										Amarillo	Truck	79
Buffalo	Houston	Rail	707	Enid	Truck	350	Enid	Truck	43	Houston	Rail	17
				Catoosa	Truck	2639						
Chandler				Wagoner	Truck	245				Processor	Truck	54
Cherokee				Catoosa	Truck	6890				Houston	Rail	1
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	27
Chickasha				Houston	Rail	1746				Processor	Truck	16
Claremore				Wagoner	Truck	372				Catoosa	Truck	1
Cordell				Houston	Rail	4850				Processor	Truck	21
Duncan				Houston	Rail	534				Ft.Worth	Truck	65
Durant				Houston	Rail	191				Muskogee	Truck	81
El Reno				Processor	Truck	72				Muskogee	Truck	16
				Catoosa	Truck	5471						
Enid				Catoosa	Truck	9778				Enid	Truck	26
Fairview				Catoosa	Truck	4183				Houston	Rail	30
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	51
Guthrie				Muskogee	Truck	2538				Wagoner	Truck	1
Guymon				Enid	Truck	11150				Lubbock	Truck	0
										Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	46
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	15
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	28
Idabel				Houston	Rail	363				Paris	Truck	114

Table 5.24. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher				Catoosa	Truck	6589				Muskogee	Truck	28
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Hogoner	Truck	28
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Ft.Worth	Truck	41
McAlester				Catoosa	Truck	126				Mich.Flls	Truck	10
Medford				Catoosa	Truck	9720				Paris	Truck	0
Miami				Houston	Rail	890				Houston	Rail	15
Muskogee				Muskogee	Truck	371				Hogoner	Truck	3
Newkirk				Catoosa	Truck	3198				Hogoner	Truck	61
				Processor	Truck	3000				Hogoner	Truck	31
Norman	Houston	Rail	84	Processor	Truck	237	Processor	Truck	0	Catoosa	Truck	6
Oklahoma City				Processor	Truck	571				Catoosa	Truck	50
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Truck	5	Catoosa	Truck	5
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	19
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Muskogee	Truck	28	Catoosa	Truck	46
Paunee				Houston	Rail	316				Muskogee	Truck	6
Perry				Hogoner	Truck	3152				Muskogee	Truck	8
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	97	Paris	Truck	4
Pryor	Hogoner	Truck	113	Hogoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Ft.Worth	Truck	0
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	18
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Hogoner	Truck	30	Hogoner	Truck	30
Sayre	Houston	Rail	235	Processor	Truck	3042	Amarillo	Truck	0	Mich.Flls	Truck	0
							Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Muskogee	Truck	3
Stillwater				Hogoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah				Hogoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Catoosa	Truck	3055	Enid	Truck	0	Processor	Truck	30
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Ft.Worth	Truck	37
Tulsa				Catoosa	Truck	529				Hogoner	Truck	72
Vinita				Hogoner	Truck	644				Muskogee	Truck	19
Hogoner	Hogoner	Truck	126	Hogoner	Truck	357	Houston	Rail	43	Muskogee	Truck	55
Halters				Houston	Rail	4473				Ft.Worth	Truck	75

Table 5.24. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Matonga				Catoosa	Truck	4133				Houston	Rail	6
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.North	Truck	79
				Houston	Rail	2105				Catoosa	Truck	1
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	3771				Houston	Rail	348
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	59653				Houston	Rail	338
Hagoner				N.Orleans	Barge	5834				Houston	Rail	273
Paris												
Anarillo												
Lubbock												
Michita												
Falls												
Ft. North												
Houston				Export		73663						
N.Orleans				Export		69258						

Table 5.25. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 50.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Paris	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	0	
Alva				Houston	Rail	7179			Ft.Worth	Truck	113	
Anadarko				Houston	Rail	5344			Catoosa	Truck	64	
Arapaho				Houston	Rail	5728			Processor	Truck	65	
Ardmore				Houston	Rail	272			Processor	Truck	12	
Arnett				Enid	Truck	2886			Paris	Truck	124	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Houston	Rail	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Muskogee	Truck	91
Boise City				Houston	Rail	4950			Enid	Truck	20	
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Lubbock	Truck	83
Chandler				Wagoner	Truck	245			Amarillo	Truck	83	
Cherokee				Houston	Rail	6890			Houston	Rail	13	
Chayenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	11
Chickasha				Houston	Rail	1746			Catoosa	Truck	60	
Clarenora				Wagoner	Truck	372			Processor	Truck	44	
Cordell				Houston	Rail	4850			Processor	Truck	34	
Duncan				Houston	Rail	534			Catoosa	Truck	1	
Durant				Houston	Rail	191			Houston	Rail	1	
El Reno				Processor	Truck	309			Processor	Truck	33	
				Houston	Rail	5234			Ft.Worth	Truck	108	
Enid				Houston	Rail	9778			Ft.Worth	Truck	124	
Fairview				Houston	Rail	4183			Catoosa	Truck	43	
Fredrick				Houston	Rail	5427			Enid	Truck	1	
Guthrie				Houston	Rail	2538			Processor	Truck	23	
Guymon				Enid	Truck	5625			Ft.Worth	Truck	94	
				Houston	Rail	5525			Processor	Truck	3	
Hobart				Houston	Rail	5873			Lubbock	Truck	0	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Amarillo	Truck	0
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Mich.Flls	Truck	58
Idabel				Houston	Rail	363			Paris	Truck	27	
Kingfisher				Houston	Rail	6589			Paris	Truck	65	
									Processor	Truck	151	
									Processor	Truck	15	

Table 5.25. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flrs	Truck	24	Ft.Worth	Truck	84
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flrs	Truck	0	Mich.Flrs	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	16
Madford				Houston	Rail	9720				Catoosa	Truck	46
Miami				Houston	Rail	890				Wagoner	Truck	64
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	2532				Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	666						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Muskogee	Truck	262	Catoosa	Rail	0	Catoosa	Truck	5
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	63
Panhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Processor	Truck	30
Pawnee				Houston	Rail	316				Muskogee	Truck	67
Perry				Houston	Rail	3152				Wagoner	Truck	25
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Rail	121	Paris	Truck	41
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Muskogee	Truck	9	Muskogee	Truck	9
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	18
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	Houston	Rail	16
							Wagoner	Rail	16			
Sayre	Houston	Rail	235	Processor	Truck	601	Anarillo	Truck	0	Mich.Flrs	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shaunee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	7
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishoningo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	79
Tulsa				Catoosa	Truck	529				Houston	Rail	71
Vinita				Houston	Rail	644				Wagoner	Truck	19
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Wagoner	Truck	18	Houston	Rail	30

Table 5.25. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Halters				Houston	Rail	4173				Ft.Worth	Truck	118
Watonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	122
Woodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1233				Houston	Rail	287
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	3517				Houston	Rail	277
Hagoner				N.Orleans	Barge	1536				Houston	Rail	212
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.26. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 5E.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Processor	Truck	41			Ft.Worth	Truck	0	
				Houston	Rail	36			Paris	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	139	
Alva				Houston	Rail	7179			Processor	Truck	75	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	16	
Ardmore				Houston	Rail	272			Paris	Truck	150	
Arnett				Enid	Truck	2886			Houston	Rail	13	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	130
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950			Lubbock	Truck	83	
									Amarillo	Truck	83	
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Processor	Truck	245			Processor	Truck	11	
Cherokee				Houston	Rail	6890			Processor	Truck	69	
Choyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	48
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Clarenore				Houston	Rail	372			Processor	Truck	24	
Cordell				Houston	Rail	4850			Processor	Truck	37	
Duncan				Houston	Rail	534			Processor	Truck	116	
Durant				Houston	Rail	191			Processor	Truck	147	
El Reno				Processor	Truck	64			Processor	Truck	75	
				Houston	Rail	5479						
Enid				Houston	Rail	9778			Enid	Truck	1	
Fairview				Houston	Rail	4183			Processor	Truck	27	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	120	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guymon				Enid	Truck	5625			Lubbock	Truck	0	
				Houston	Rail	5525			Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	58	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	91
Idabel				Houston	Rail	363			Paris	Truck	177	
Kingfisher				Houston	Rail	6589			Processor	Truck	15	
Lauton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	90

Table 5.26. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flrs	Truck	0	Mich.Flrs	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	42
Madford				Houston	Rail	9720				Processor	Truck	62
Miami				Houston	Rail	890				Processor	Truck	85
Muskogee				Muskogee	Truck	371				Processor	Truck	53
Newkirk				Houston	Rail	3198				Processor	Truck	17
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	12	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Oknulgee	Houston	Rail	61	Houston	Rail	262	Processor	T/R	0	Muskogee	Truck	10
							Catoosa	T/R	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	88
Pawhuska	Houston	Rail	162	Processor	Truck	459	Catoosa	Truck	21	Muskogee	Truck	5
Pawnee				Houston	Rail	316				Muskogee	Truck	106
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	124	Paris	Truck	67
Pryor	Hogoner	Truck	113	Hogoner	Truck	407	Hogoner	Rail	0	Muskogee	Truck	9
							Muskogee	T/R	0			
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Processor	Truck	98				Houston	Rail	0
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	8	Catoosa	Truck	23
Sayre	Houston	Rail	235	Houston	Rail	3042	Amarillo	Truck	0	Mich.Flrs	Truck	0
							Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	35
Stillwater				Houston	Rail	376				Processor	Truck	46
				Processor	Truck	500						
Tahlequah				Hogoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	15
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	105
Tulsa				Catoosa	Truck	529				Houston	Rail	32
Vinita				Houston	Rail	644				Processor	Truck	57
Hogoner	Houston	Rail	126	Houston	Rail	357	Hogoner	Truck	57	Hogoner	Truck	9
Halters				Houston	Rail	4473				Ft.Worth	Truck	144



Table 5.26. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Matonga				Houston	Rail	4133				Processor	Truck	28
Haurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Hich.Flls	Truck	65	Ft.Worth	Truck	148
				Houston	Rail	2105				Processor	Truck	46
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	371				Houston	Rail	348
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	529				Houston	Rail	338
Wagoner				N.Orleans	Barge	562				Houston	Rail	273
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		141459						
N.Orleans				Export		1462						

Table 5.27. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 6A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	8
Altus	Houston	Rail	1229	Houston	Rail	4738	Ft.North	Truck	46	McAlester	Truck	113
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Catoosa	Truck	3
Anadarko	Eufaula	Truck	76	Houston	Rail	4946	Poteau	Truck	39	Eufaula	Truck	15
	McAlester	Truck	322									
Arapaho				Processor	Truck	2527				Catoosa	Truck	2
				Houston	Rail	3201						
Ardmore				Houston	Rail	272				McAlester	Truck	71
Arnett	Enid	Truck	1071	Catoosa	Truck	1815	Houston	Rail	69	Processor	Truck	29
Atoka	Poteau	Truck	19	Houston	Rail	1	McAlester	Truck	10	Muskogee	Truck	30
Beaver	Enid	Truck	1820	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	46
	Houston	Rail	1464				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	125
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Catoosa	Truck	585	Houston	Rail	67	Houston	Rail	17
Chandler	Eufaula	Truck	97	Eufaula	Truck	148	Catoosa	Rail	0	Wagoner	Truck	5
Cherokee	Enid	Truck	1680	Catoosa	Truck	5210	Enid	Rail	45	Houston	Rail	1
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Catoosa	Truck	27
Chickasha	Eufaula	Truck	156	Eufaula	Truck	1590	McAlester	Truck	1	Houston	Rail	2
Clarenore				McAlester	Truck	372				Wagoner	Truck	0
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	21
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	McAlester	Truck	76
Durant				Houston	Rail	191				Eufaula	Truck	58
El Reno				Catoosa	Truck	5234				Eufaula	Truck	1
				Processor	Truck	309						
Enid	Enid	Truck	1954	Catoosa	Truck	7824	Catoosa	Truck	83	Houston	Rail	29
Fairview	Enid	Truck	1406	Catoosa	Truck	2777	Catoosa	Truck	56	Houston	Rail	30
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.North	Truck	13	McAlester	Truck	101
Guthrie	Eufaula	Truck	187	Muskogee	Truck	2300	Wagoner	Truck	7	Wagoner	Truck	1
	McAlester	Truck	51									
Guyton	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Hich.Flls	Truck	38	Processor	Truck	57
							McAlester	Truck	38	Eufaula	Truck	57
							Eufaula	Truck	38			

Table 5.27. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	McAlester	Truck	65
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Poteau	Truck	44
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Poteau	Truck	69
Kingfisher	Enid	Truck	396	Catoosa	Truck	4956	Processor	Rail	0	Wagoner	Truck	28
	Catoosa	Truck	1237							Muskogee	Truck	28
Lauton	Ft.Worth	Truck	1758	Houston	Rail	561	McAlester	Truck	13	McAlester	Truck	61
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	37
										Eufaula	Truck	37
McAlester				McAlester	Truck	126				Eufaula	Truck	66
Madford	Enid	Truck	2000	Catoosa	Truck	5121	Enid	Rail	0	Houston	Rail	15
	Houston	Rail	2599									
Miami				Eufaula	Truck	890				Poteau	Truck	26
Muskogee				Muskogee	Truck	371				Wagoner	Truck	61
Newkirk				Catoosa	Truck	3198				Wagoner	Truck	31
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Eufaula	Truck	16	Poteau	Truck	36	McAlester	Truck	5
Oklahoma City				Processor	Truck	571				Eufaula	Truck	45
Oklmulgee	Poteau	Truck	271	Poteau	Truck	52	Eufaula	Truck	12	McAlester	Truck	12
Pauls												
Valley	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Eufaula	Truck	20
Pawhuska	Muskogee	Truck	590	Muskogee	Truck	31	Catoosa	Truck	11	Eufaula	Truck	24
Pawnee				Houston	Rail	316				Muskogee	Truck	6
Perry				Wagoner	Truck	3152				Muskogee	Truck	8
Poteau	Poteau	Truck	199	Poteau	Truck	10	Poteau	Rail	193	Houston	Rail	95
Pryor	Poteau	Truck	333	McAlester	Truck	62	McAlester	Truck	2	Wagoner	Truck	1
	Wagoner	Truck	125									
Purcell	McAlester	Truck	396	McAlester	Truck	135	Eufaula	Truck	16	Eufaula	Truck	7
Sallisaw				Catoosa	Truck	98				Poteau	Truck	1
Sapulpa	Muskogee	Truck	59	Catoosa	Truck	10	Wagoner	Truck	2	McAlester	Truck	5
	Poteau	Truck	127									
Sayre	Eufaula	Truck	984	Processor	Truck	1129	Processor	Truck	0	Eufaula	Truck	11
	Mich.Flls	Truck	927							Catoosa	Truck	11
	Houston	Rail	237									
Shawnee				Processor	Truck	344				Muskogee	Truck	3

Table 5.27. continued.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Stillwater				Wagoner	Truck	376			Muskogee	Truck	7	
Tahlequah	Poteau	Truck	22	Processor	Truck	500			Muskogee	Truck	2	
Taloga	Enid	Truck	2066	Wagoner	Truck	20	Muskogee	Truck	27	Muskogee	Truck	2
Tishomingo	Poteau	Truck	58	Catoosa	Truck	1182	Catoosa	Truck	28	Processor	Truck	30
Tulsa	Catoosa	Truck	263	Houston	Rail	3	McAlester	Truck	5	Eufaula	Truck	39
Vinita	Wagoner	Truck	116	Catoosa	Truck	266	Wagoner	Truck	40	McAlester	Truck	63
Wagoner	Wagoner	Truck	459	Eufaula	Truck	528	Wagoner	Rail	0	McAlester	Truck	30
Halters	Houston	Rail	2362	Wagoner	Truck	24	Muskogee	Truck	48	Muskogee	Truck	55
Hatonga				Houston	Rail	2111	Ft.Worth	Truck	18	McAlester	Truck	115
Haurika	Houston	Rail	660	Catoosa	Truck	4133				Houston	Rail	6
Woodward				Processor	Truck	2200						
				Houston	Rail	382	Ft.Worth	Truck	12	McAlester	Truck	117
				Houston	Rail	2105				Catoosa	Truck	1
				-----Terminals-----								
Enid				Houston	Rail	4972			Catoosa	Rail	162	
Eufaula				N.Orleans	Barge	4672			Houston	Rail	348	
McAlester				N.Orleans	Barge	2195			Houston	Rail	326	
Muskogee				N.Orleans	Barge	3482			Houston	Rail	348	
Poteau				N.Orleans	Barge	1562			Houston	Rail	277	
Shawnee												
Catoosa				N.Orleans	Barge	43909			Houston	Rail	338	
Wagoner				N.Orleans	Barge	4272			Houston	Rail	273	
Paris												
Anarillo				Houston	Rail	2000			Ft.Worth	Rail	362	
Lubbock												
Michite Falls				Houston	Rail	3000						
Ft. Worth									Eufaula	Rail	242	
Houston				Houston	Rail	1758			No Alternative			
N.Orleans				Export		82829						
				Export		60092						

Table 5.28. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 6B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Houston	Rail	11
Altus	Houston	Rail	1229	Houston	Rail	4738	Hich.Flls	Rail	0	Lubbock	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Eufaula	Truck	76	Houston	Rail	4946	Poteau	Truck	39	Processor	Truck	65
	McAlester	Truck	322									
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				McAlester	Truck	171
Arnett	Enid	Truck	1071	Processor	Truck	968	Houston	Rail	69	Catoosa	Truck	49
				Houston	Rail	847						
Atoka	Poteau	Truck	19	Houston	Rail	1	McAlester	Truck	10	Muskogee	Truck	130
Beaver	Enid	Truck	1820	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	1464				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	225
				Lubbock	Truck	0						
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Eufaula	Truck	97	Processor	Truck	148	McAlester	Truck	12	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Eufaula	Truck	156	Houston	Rail	1590	McAlester	Truck	1	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234				Catoosa	Truck	64
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Eufaula	Truck	187	Houston	Rail	2300	Wagoner	Truck	7	Processor	Truck	3
	Muskogee	Truck	51									
Guynon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Hich.Flls	Truck	38	Processor	Truck	62
							McAlester	Truck	38			
							Eufaula	Truck	38			

Table 5.20. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Poteau	Truck	144
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Poteau	Truck	169
Kingfisher	Enid	Truck	396	Houston	Rail	4956	Processor	Rail	0	Processor	Truck	15
	Catoosa	Truck	1237									
Larion	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				Houston	Rail	126				McAlester	Truck	4
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Eufaula	Truck	50
Muskogee				Muskogee	Truck	371				Processor	Truck	42
Newkirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Houston	Rail	16	Poteau	Truck	36	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
				Poteau	Truck	52	Eufaula	Truck	12	Houston	Rail	2
Okmulgee	Poteau	Truck	271									
Pauls Valley	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Processor	Truck	94
Pawhuska	Muskogee	Truck	590	Processor	Truck	31	Catoosa	Truck	11	Muskogee	Truck	16
Pawnee				Houston	Rail	316				Processor	Truck	130
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Poteau	Truck	199	Houston	Rail	10	Eufaula	Truck	195	Poteau	Truck	5
Pryor	Poteau	Truck	333	McAlester	Truck	62	Muskogee	Truck	2	Wagoner	Truck	1
	Wagoner	Truck	125							Processor	Truck	1
Purcell	McAlester	Truck	396	Houston	Rail	135	Eufaula	Truck	16	Processor	Truck	28
Sallisaw				Processor	Rail	98				Houston	Rail	11
Sapulpa	Muskogee	Truck	59	Houston	Rail	10	Wagoner	Truck	2	Catoosa	Truck	23
	Poteau	Truck	127									
Sayre	Eufaula	Truck	984	Processor	Truck	1129	Processor	Truck	0	Houston	Rail	7
	Mich.Flls	Truck	927									
	Houston	Rail	237									
Shawnee			Processor	Truck	344				Houston	Rail	46	
Stillwater				Houston	Rail	376				Wagoner	Truck	46
				Processor	Truck	500				Processor	Truck	46

Table 5.28. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest			Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price	
Tahlequah	Poteau	Truck	22	Processor	Truck	20	Muskogee	Truck	27	Wagoner	Truck	1	
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	26	
Taloga													
Tishomingo	Poteau	Truck	58	Houston	Rail	3	McAlester	Truck	5	Eufaula	Truck	139	
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Muskogee	Truck	46	Houston	Rail	32	
Vinita	Wagoner	Truck	116	Houston	Rail	528	Eufaula	Truck	9	Eufaula	Truck	22	
Wagoner	Wagoner	Truck	459	Houston	Rail	24	Muskogee	Truck	48	Wagoner	Truck	9	
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	141	
Watonga				Houston	Rail	4133				Processor	Truck	17	
				Processor	Truck	2200							
Haurika	Houston	Rail	660	Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159	
Hoodward				Houston	Rail	2105				Processor	Truck	35	
				Terminals									
Enid				Houston	Rail	1972				Catoosa	Rail	262	
Eufaula				N.Orleans	Barge	1500				Houston	Rail	348	
McAlester				N.Orleans	Barge	1562				Houston	Rail	326	
Muskogee				N.Orleans	Barge	1071				Houston	Rail	348	
Poteau				N.Orleans	Barge	1552				Houston	Rail	277	
Shawnee													
Catoosa				N.Orleans	Barge	1766				Houston	Rail	338	
Wagoner				N.Orleans	Barge	700				Houston	Rail	273	
Paris													
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	462	
Lubbock													
Hichita										Eufaula	Truck	342	
Falls				Houston	Rail	3000							
Ft. North				Houston	Rail	1758				No Alternative			
Houston				Export		134770							
N.Orleans				Export		8151							

Table 5.29. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 6C.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Catoosa	Truck	16	
Altus				Houston	Rail	5967			Ft.Worth	Truck	61	
Alva				Houston	Rail	7179			Catoosa	Truck	3	
Anadarko				Houston	Rail	5344			Catoosa	Truck	15	
Arapaho				Processor	Truck	614			Catoosa	Truck	2	
				Houston	Rail	5114						
Ardmore				Houston	Rail	272			Paris	Truck	63	
Arnett				Catoosa	Truck	2886			Enid	Truck	17	
Atoka	Houston	Rail	5	Houston	Rail	15	McAlester	Truck	0	Muskogee	Truck	30
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	16
Boise City				Houston	Rail	4950			Lubbock	Truck	79	
									Amarillo	Truck	79	
Buffalo	Houston	Rail	707	Enid	Truck	350	Enid	Truck	43	Houston	Rail	17
				Catoosa	Truck	2639						
Chandler				Eufaula	Truck	245			Wagoner	Truck	5	
Cherokee				Catoosa	Truck	6890			Houston	Rail	1	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	27
Chickasha				Eufaula	Truck	1746			Houston	Rail	2	
Clarenore				McAlester	Truck	372			Wagoner	Truck	0	
Cordell				Houston	Rail	4850			Processor	Truck	21	
Duncan				Houston	Rail	534			Ft.Worth	Truck	56	
Durant				Houston	Rail	191			Eufaula	Truck	58	
El Reno				Processor	Truck	309			Eufaula	Truck	1	
				Catoosa	Truck	5234						
Enid				Catoosa	Truck	9778			Enid	Truck	26	
Fairview				Catoosa	Truck	4183			Houston	Rail	30	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	42	
Guthrie				Muskogee	Truck	2538			Wagoner	Truck	1	
Guyton				Enid	Truck	11150			Lubbock	Truck	0	
									Amarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	46	
									Ft.Worth	Truck	46	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Ft.Worth	Truck	14
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	4
Idabel				Houston	Rail	363			Poteau	Truck	69	



Table 5.29. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher				Catoosa	Truck	6589				Muskogee	Truck	28
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Hogoner	Truck	28
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Ft.Worth	Truck	32
McAlester				McAlester	Truck	126				Mich.Flls	Truck	10
Medford				Catoosa	Truck	9720				Ft.Worth	Truck	10
Miami				Eufaula	Truck	890				Paris	Truck	64
Muskogee				Muskogee	Truck	371				Houston	Rail	15
Newkirk				Catoosa	Truck	3198				Poteau	Truck	26
				Processor	Truck	3000				Hogoner	Truck	61
Norman	Houston	Rail	84	Eufaula	Truck	237	Processor	Truck	0	Hogoner	Truck	31
							McAlester	Truck	0	McAlester	Truck	5
Oklahoma				Processor	Truck	571				Eufaula	Truck	45
City				Poteau	Truck	262	Eufaula	Truck	0	Muskogee	Truck	12
Oknulgee	Muskogee	Truck	61									
Pauls				Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	10
Valley	Houston	Rail	58	Muskogee	Truck	459	Muskogee	Truck	28	Eufaula	Truck	24
Pawhuska	Catoosa	Truck	162	Houston	Rail	316				Muskogee	Truck	6
Paunee				Hogoner	Truck	3152				Muskogee	Truck	8
Perry				Poteau	Truck	154	Houston	Rail	47	Paris	Truck	75
Poteau	Poteau	Truck	55	McAlester	Truck	407	Muskogee	Truck	9	Hogoner	Truck	1
Pryor	Hogoner	Truck	113	McAlester	Truck	462	Ft.Worth	Truck	0	Eufaula	Truck	7
Purcell	Houston	Rail	69	Catoosa	Truck	98				Poteau	Truck	1
Sallisaw				Catoosa	Truck	145	Hogoner	Truck	30	McAlester	Truck	5
Sapulpa	Catoosa	Truck	51	Processor	Truck	3042	Anarillo	Truck	0	Mich.Flls	Truck	0
Sayre	Houston	Rail	235				Lubbock	Truck	0	Ft.Worth	Truck	0
Shawnee				Processor	Truck	344				Muskogee	Truck	3
Stillwater				Hogoner	Truck	376				Muskogee	Truck	7
				Processor	Truck	500						
Tahlequah				Hogoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Catoosa	Truck	3055	Enid	Truck	0	Processor	Truck	30
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	18
Tulsa				Catoosa	Truck	529				McAlester	Truck	63
Vinita				Eufaula	Truck	644				McAlester	Truck	30

Table 5.29. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Wagoner	Wagoner	Truck	126	Wagoner	Truck	357	Houston	Rail	43	Muskogee	Truck	55
Halters				Houston	Rail	4473				Ft.Worth	Truck	66
Matonga				Catoosa	Truck	4133				Houston	Rail	6
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	70
Woodward				Houston	Rail	2105				Catoosa	Truck	1
-----Terminals-----												
Enid												
Eufaula				N.Orleans	Barge	3762				Houston	Rail	348
McAlester				N.Orleans	Barge	1367				Houston	Rail	326
Muskogee				N.Orleans	Barge	3509				Houston	Rail	348
Poteau				N.Orleans	Barge	471				Houston	Rail	277
Shawnee												
Catoosa				N.Orleans	Barge	59290				Houston	Rail	338
Wagoner				N.Orleans	Barge	4166				Houston	Rail	273
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		70356						
N.Orleans				Export		72565						

Table 5.30. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 6D.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	0
Alva				Houston	Rail	7179				Ft.Worth	Truck	113
Anadarko				Houston	Rail	5344				Catoosa	Truck	64
Arapaho				Houston	Rail	5728				Processor	Truck	65
Ardmore				Houston	Rail	272				Processor	Truck	12
Arnett				Enid	Truck	2886				Paris	Truck	124
Atoka	Houston	Rail	5	Houston	Rail	15	McAlester	Truck	59	Houston	Rail	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Muskogee	Truck	91
Boise City				Houston	Rail	4950				Enid	Truck	20
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Lubbock	Truck	83
Chandler				Eufaula	Truck	245				Amarillo	Truck	83
Cherokee				Houston	Rail	6890				Houston	Rail	13
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Wagoner	Truck	5
Chickasha				Houston	Rail	1746				Catoosa	Truck	60
Claremore				Houston	Rail	372				Processor	Truck	44
Cordell				Houston	Rail	4850				Processor	Truck	34
Duncan				Houston	Rail	534				Wagoner	Truck	0
Durant				Houston	Rail	191				Processor	Truck	33
El Reno				Processor	Truck	309				Ft.Worth	Truck	108
Enid				Houston	Rail	5234				Eufaula	Truck	119
Fairview				Houston	Rail	9778				Catoosa	Truck	43
Fredrick				Houston	Rail	4183				Enid	Truck	1
Guthrie				Houston	Rail	5427				Processor	Truck	23
Guymon				Houston	Rail	2538				Ft.Worth	Truck	94
Hobart				Enid	Truck	5625				Processor	Truck	3
Hollis	Houston	Rail	453	Houston	Rail	5525				Lubbock	Truck	0
Hugo	Houston	Rail	75	Houston	Rail	5873				Amarillo	Truck	0
Idabel				Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	58
Kingfisher				Houston	Rail	213	Paris	Truck	0	Paris	Truck	27
Lauton	Houston	Rail	319	Houston	Rail	363				Paris	Truck	65
				Houston	Rail	6589				Processor	Truck	151
				Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	15
										Ft.Worth	Truck	84

Table 5.30. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Mangum	Houston	Rail	435	Houston	Rail	2132	Hich.Flls	Truck	0	Hich.Flls	Truck	22
McAlester				McAlester	Truck	126	Houston	Rail		Houston	Rail	35
Madford				Houston	Rail	9720	Catoosa	Truck		Catoosa	Truck	46
Miami				Houston	Rail	890	Eufaula	Truck		Eufaula	Truck	11
Muskogee				Muskogee	Truck	371	Wagoner	Truck		Wagoner	Truck	61
Newkirk				Catoosa	Truck	1608	Processor	Truck		Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	1590						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma												
City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Poteau	Truck	262	Catoosa	Rail	0	Muskogee	Truck	12
							Eufaula	Truck	0			
							McAlester	Truck	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.North	Truck	5	Ft.North	Truck	62
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Eufaula	Truck	24
Paunee				Houston	Rail	316				Muskogee	Truck	67
Perry				Houston	Rail	3152				Wagoner	Truck	25
Poteau	Houston	Rail	55	Poteau	Truck	154	Poteau	Truck	0	Houston	Rail	34
Pryor	Wagoner	Truck	113	McAlester	Truck	407	Muskogee	Truck	9	Wagoner	Truck	1
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.North	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Poteau	Truck	1
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	McAlester	Truck	5
							Wagoner	Rail	16			
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Hich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	7
				Processor	Truck	500						
Tahlequah				Wagoner	Truck	42				Muskogee	Truck	2
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.North	Truck	14	Paris	Truck	79
Tulsa				Catoosa	Truck	529				McAlester	Truck	63
Vinita				Eufaula	Truck	644				Houston	Rail	17

Table 5.30. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Wagoner Walters Watonga	Wagoner	Truck	126	Wagoner	Truck	357	Wagoner	Truck	18	Houston	Rail	30
				Houston	Rail	4473				Ft.Worth	Truck	118
				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika Woodward	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	122
				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid				N.Orleans	Barge	889				Houston	Rail	287
Eufaula				N.Orleans	Barge	905				Houston	Rail	265
McAlester				N.Orleans	Barge	971				Houston	Rail	287
Muskogee				N.Orleans	Barge	416				Houston	Rail	216
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	2593				Houston	Rail	277
Wagoner				N.Orleans	Barge	512				Houston	Rail	212
Paris												
Anarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.31. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 6E.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Processor	Truck	44			Ft.Worth	Truck	0	
				Houston	Rail	36			Paris	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	139	
Alva				Houston	Rail	7179			Processor	Truck	75	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	16	
Ardmore				Houston	Rail	272			Paris	Truck	150	
Arnett				Enid	Truck	2886			Houston	Rail	13	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	130
Beaver	Houston	Rail	78	Houston	Rail	5740	Anarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950			Lubbock	Truck	83	
									Anarillo	Truck	83	
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Processor	Truck	245			Eufaula	Truck	9	
Cherokee				Houston	Rail	6890			Processor	Truck	69	
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	48
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Clarenore				Houston	Rail	372			Processor	Truck	24	
Cordell				Houston	Rail	4850			Processor	Truck	37	
Duncan				Houston	Rail	534			Processor	Truck	116	
Durant				Houston	Rail	191			Eufaula	Truck	144	
El Reno				Processor	Truck	64			Eufaula	Truck	69	
				Houston	Rail	5479						
Enid				Houston	Rail	9778			Enid	Truck	1	
Fairview				Houston	Rail	4183			Processor	Truck	27	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	120	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guymon				Enid	Truck	5625			Lubbock	Truck	0	
				Houston	Rail	5525			Anarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	58	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	91
Idabel				Houston	Rail	363			Poteau	Truck	169	
Kingfisher				Houston	Rail	6589			Processor	Truck	15	
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	90

Table 5.31. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Mangum McAlester Medford Miami Muskogee Newkirk	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	22
				Houston	Rail	126	McAlester	Truck		McAlester	Truck	4
				Houston	Rail	9720	Processor	Truck		Processor	Truck	62
				Houston	Rail	890	Eufaula	Truck		Eufaula	Truck	36
				Muskogee	Truck	371	Processor	Truck		Processor	Truck	53
				Houston	Rail	3198	Processor	Truck		Processor	Truck	17
Norman Oklahoma City Okmulgee	Houston	Rail	84	Processor	Truck	3000	Processor	Truck	12	Processor	Truck	1
				Houston	Rail	237				Houston	Rail	64
	Houston	Rail	61	Poteau	Truck	262	Eufaula	Truck	0	Eufaula	Truck	2
Pauls Valley Pawhuska Paunee Perry Poteau Pryor				Processor	Truck	571	McAlester	T/R	0	Houston	Rail	2
				Poteau	Truck		Poteau	Rail	0	Houston	Rail	2
							Processor	T/R	0			
							Catoosa	T/R	0			
	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	88
	Houston	Rail	162	Processor	Truck	459	Catoosa	Truck	21	Muskogee	Truck	5
				Houston	Rail	316				Muskogee	Truck	106
				Houston	Rail	3152				Processor	Truck	46
	Houston	Rail	55	Houston	Rail	154	Poteau	Truck	0	Poteau	Truck	5
	Wagoner	Truck	113	McAlester	Truck	407	Wagoner	Rail	0	Wagoner	Truck	1
Purcell Sallisaw Sapulpa Sayre  Shawnee Stillwater  Tahlequah Taloga Tishomingo Tulsa							McAlester	T/R	0			
							Eufaula	Rail	0			
							Ft.Worth	Truck	0	Processor	Truck	28
	Houston	Rail	69	Houston	Rail	462				Houston	Rail	0
				Processor	Truck	98	Catoosa	Truck	8	Catoosa	Truck	23
	Houston	Rail	51	Houston	Rail	145	Amarillo	Truck	0	Mich.Flls	Truck	0
	Houston	Rail	235	Houston	Rail	3042	Lubbock	Truck	0			
				Processor	Truck	344				Houston	Rail	35
				Houston	Rail	376				Wagoner	Truck	46
				Processor	Truck	500				Processor	Truck	46
			Wagoner	Truck	42				Muskogee	Truck	2	
Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	15	
Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	105	
			Catoosa	Truck	529				Houston	Rail	32	

Table 5.31. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Houston	Rail	644				Eufaula	Truck	8
Wagoner	Houston	Rail	126	Houston	Rail	357	Wagoner	Truck	57	Wagoner	Truck	9
Walters				Houston	Rail	4473				Ft.Worth	Truck	144
Watonga				Houston	Rail	4133				Processor	Truck	28
				Processor	Truck	2200						
Maurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	148
Woodward				Houston	Rail	2105				Processor	Truck	46
-----Terminals-----												
Enid										Houston	Rail	369
Eufaula										Houston	Rail	343
McAlester				N.Orleans	Barge	407				Houston	Rail	365
Muskogee				N.Orleans	Barge	371				Poteau	Truck	289
Poteau				N.Orleans	Barge	262						
Shawnee												
Catoosa				N.Orleans	Barge	529				Houston	Rail	356
Wagoner				N.Orleans	Barge	155				Houston	Rail	290
Paris												
Amarillo												
Lubbock												
Nichita												
Falls												
Ft. Worth												
Houston				Export		141197						
N.Orleans				Export		1724						



Table 5.32. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 7A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	2
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Catoosa	Truck	60
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				Muskogee	Truck	189
Arnett	Enid	Truck	1071	Processor	Truck	1345	Houston	Rail	69	Catoosa	Truck	23
				Houston	Rail	470						
Atoka	Paris	Truck	19	Houston	Rail	1	Muskogee	Truck	33	Muskogee	Truck	93
Beaver	Enid	Truck	3202	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	82				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	125
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Catoosa	Truck	97	Processor	Truck	148	Catoosa	Rail	0	Processor	Truck	7
										Processor	Truck	7
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Catoosa	Truck	56
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Catoosa	Truck	81
Claremore				Catoosa	Truck	372				Catoosa	Truck	7
Cordell	Houston	Rail	2037	Houston	Rail	2813	Enid	Truck	25	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Houston	Rail	5234				Catoosa	Truck	39
				Processor	Truck	309						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Catoosa	Truck	28
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Catoosa	Truck	238	Houston	Rail	2300	Muskogee	Truck	30	Processor	Truck	3
Guynon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	62
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Muskogee	Truck	145
										Processor	Truck	145

Table 5.32. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	12	Muskogee	Truck	210
Kingfisher	Enid	Truck	1632	Houston	Rail	4956	Processor	Rail	36	Processor	Truck	15
	Catoosa	Truck	1									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangum	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McFlester				Houston	Rail	126				Catoosa	Truck	36
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Catoosa	Truck	42
	Houston	Rail	2599									
Miami				Houston	Rail	890				Wagoner	Truck	68
Muskogee				Muskogee	Truck	371				Wagoner	Truck	63
Newkirk				Houston	Rail	3198				Houston	Rail	4
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Houston	Rail	16	Processor	Truck	0	Processor	Truck	1
Oklahoma City												
Okmulgee				Processor	Truck	571				Houston	Rail	64
	Muskogee	Truck	146	Catoosa	Truck	52	Wagoner	Truck	37	Muskogee	Truck	1
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Muskogee	Truck	31	Muskogee	Truck	33	Processor	Truck	21
Pawnee				Houston	Rail	316				Muskogee	Truck	69
Perry				Houston	Rail	3152				Wagoner	Truck	29
Poteau	Muskogee	Truck	199	Houston	Rail	10	Houston	Rail	14	Catoosa	Truck	69
Pryor	Muskogee	Truck	333	Wagoner	Truck	62	Catoosa	Truck	10	Muskogee	Truck	7
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	24
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10	Muskogee	Truck	40	Houston	Rail	20
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Houston	Rail	7
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Houston	Rail	46
Stillwater				Houston	Rail	376				Wagoner	Truck	11
				Processor	Truck	500						
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Muskogee	Truck	20	Wagoner	Truck	7	Wagoner	Truck	0
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Catoosa	Truck	22

Table 5.32. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	45	Muskogee	Truck	136
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Houston	Rail	45	Houston	Rail	75
Vinita	Hogoner	Truck	116	Houston	Rail	528	Hogoner	Truck	86	Hogoner	Truck	23
Hogoner	Hogoner	Truck	459	Hogoner	Truck	24	Muskogee	Truck	46	Houston	Rail	26
Halters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	141
Matonga				Houston	Rail	4133				Processor	Truck	17
Haurika	Houston	Rail	660	Processor	Truck	2200						
Woodward				Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159
				Houston	Rail	2105				Processor	Truck	35
				-----Terminals-----								
Enid				Houston	Rail	7590				Catoosa	Rail	219
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	1202				Houston	Rail	285
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	5496				Houston	Rail	281
Hogoner				N.Orleans	Barge	934				Houston	Rail	208
Paris				Houston	Rail	490				Muskogee	Rail	425
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	362
Lubbock												
Michita												
Falls				Houston	Rail	3000				Ft.Worth	Rail	314
Ft. Worth				Houston	Rail	3150				No Alternative		
Houston				Export		135289						
N.Orleans				Export		7632						

Table 5.33. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 7B.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Houston	Rail	11
Altus	Houston	Rail	1229	Houston	Rail	4738	Lubbock	Truck	103	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Houston	Rail	398	Houston	Rail	4946	Ft.Worth	Truck	17	Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				Processor	Truck	198
Arnett	Enid	Truck	1071	Processor	Truck	535	Houston	Rail	69	Processor	Truck	49
				Houston	Rail	1280						
Atoka	Paris	Truck	19	Houston	Rail	1	Muskogee	Truck	33	Processor	Truck	184
Beaver	Enid	Truck	3202	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	82				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	225
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Catoosa	Truck	97	Processor	Truck	148	Muskogee	Truck	29	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Ft.Worth	Truck	156	Houston	Rail	1590	Processor	Rail	0	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Enid	Truck	25	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	Ft.Worth	Truck	9	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Catoosa	Truck	238	Houston	Rail	2300	Muskogee	Truck	30	Processor	Truck	3
Guymon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	62
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Paris	Truck	274	Houston	Rail	14	Houston	Rail	98	Processor	Truck	145
Idabel	Paris	Truck	197	Houston	Rail	166	Houston	Rail	12	Processor	Truck	221

Table 5.33. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Kingfisher	Enid	Truck	1632	Houston	Rail	4956	Processor	Rail	36	Processor	Truck	15
	Catoosa	Truck	1									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangum	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				Houston	Rail	126				Processor	Truck	115
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	74
Muskogee				Processor	Truck	371				Muskogee	Truck	21
Newkirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Norman	Ft.Worth	Truck	305	Houston	Rail	16	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Muskogee	Truck	146	Houston	Rail	52	Wagoner	Truck	37	Processor	Truck	25
	Catoosa	Truck	125									
Pauls Valley	Ft.Worth	Truck	477	Houston	Rail	234	Houston	Rail	54	Processor	Truck	94
Pawhuska	Catoosa	Truck	590	Processor	Truck	31	Muskogee	Truck	33	Houston	Rail	26
Pawnee				Houston	Rail	316				Processor	Truck	130
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Muskogee	Truck	199	Houston	Rail	10	Houston	Rail	14	Processor	Truck	90
Pryor	Muskogee	Truck	333	Processor	Truck	62	Catoosa	Truck	10	Houston	Rail	2
	Wagoner	Truck	125									
Purcell	Ft.Worth	Truck	396	Houston	Rail	135	Processor	Rail	44	Processor	Truck	28
Sallisaw				Processor	Truck	98				Houston	Rail	11
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Muskogee	Truck	40	Processor	Truck	70
Sayre	Mich.Flls	Truck	927	Processor	Truck	1129	Enid	Truck	5	Houston	Rail	7
	Houston	Rail	1221									
Shawnee				Processor	Truck	344				Houston	Rail	46
Stillwater				Houston	Rail	376				Processor	Truck	46
				Processor	Truck	500						
Tahlequah	Muskogee	Truck	22	Wagoner	Truck	20	Wagoner	Truck	7	Muskogee	Truck	66
										Wagoner	Truck	66
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Processor	Truck	26

Table 5.33. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tishomingo	Ft.Worth	Truck	58	Houston	Rail	3	Paris	Truck	45	Processor	Truck	183
Tulsa	Catoosa	Truck	263	Houston	Rail	266	Houston	Rail	45	Catoosa	Truck	25
Vinita	Wagoner	Truck	116	Houston	Rail	528	Wagoner	Truck	86	Processor	Truck	46
Wagoner	Wagoner	Truck	459	Houston	Rail	24	Muskogee	Truck	10	Processor	Truck	61
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	46	Processor	Truck	141
Watonga				Houston	Rail	4133			18	Processor	Truck	17
Haurika	Houston	Rail	660	Processor	Truck	2200						
Woodward				Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159
				Houston	Rail	2105				Processor	Truck	35
				Terminals								
Enid				Houston	Rail	7590				Catoosa	Rail	319
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	700				Houston	Rail	285
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	1500				Houston	Rail	281
Wagoner				N.Orleans	Barge	700				Houston	Rail	208
Paris				Houston	Rail	490				Muskogee	Rail	525
Amarillo				Houston	Rail	2000				Ft.Worth	Rail	462
Lubbock												
Michita												
Falls				Houston	Rail	3000				Ft.Worth	Truck	414
Ft. Worth				Houston	Rail	3150				No Alternative		
Houston				Export		140021						
N.Orleans				Export		2900						

Table 5.34. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 7C.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Horth	Truck	0
Alva				Houston	Rail	7179				Ft.Horth	Truck	115
Anadarko				Houston	Rail	5344				Catoosa	Truck	60
Arapaho				Houston	Rail	5728				Catoosa	Truck	65
Ardmore				Houston	Rail	272				Processor	Truck	12
Arnett				Enid	Truck	2886				Paris	Truck	126
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Houston	Rail	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Muskogee	Truck	93
Boise City				Houston	Rail	4950				Enid	Truck	20
										Lubbock	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Amarillo	Truck	83
Chandler				Wagoner	Truck	245				Houston	Rail	13
Cherokee				Houston	Rail	6890				Processor	Truck	7
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Catoosa	Truck	56
Chickasha				Houston	Rail	1746				Processor	Truck	44
Claremore				Catoosa	Truck	372				Processor	Truck	34
Cordell				Houston	Rail	4850				Houston	Rail	1
Duncan				Houston	Rail	534				Processor	Truck	33
Durant				Houston	Rail	191				Ft.Horth	Truck	110
El Reno				Processor	Truck	309				Ft.Horth	Truck	126
				Houston	Rail	5234				Catoosa	Truck	39
Enid				Houston	Rail	9778				Enid	Truck	1
Fairview				Houston	Rail	4183				Processor	Truck	23
Fredrick				Houston	Rail	5427				Ft.Horth	Truck	96
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guymon				Enid	Truck	5625				Lubbock	Truck	0
				Houston	Rail	5525				Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	67
Idabel				Houston	Rail	363				Paris	Truck	153
Kingfisher				Houston	Rail	6589				Processor	Truck	15

Table 5.34. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Ft.Worth	Truck	86
										Processor	Truck	86
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	22
McAllester				Houston	Rail	126				Paris	Truck	18
Medford				Houston	Rail	9720				Catoosa	Truck	42
Miani				Houston	Rail	890				Wagoner	Truck	68
Muskogee				Muskogee	Truck	371				Wagoner	Truck	63
Newkirk				Catoosa	Truck	3198				Houston	Rail	4
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City										Houston	Rail	64
Okmulgee	Catoosa	Truck	61	Catoosa	Truck	262	Muskogee	Truck	0	Muskogee	Truck	1
							Catoosa	Rail	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	64
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	7	Processor	Truck	28
Paunee				Houston	Rail	316				Muskogee	Truck	69
Perry				Houston	Rail	3152				Wagoner	Truck	29
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Rail	121	Paris	Truck	43
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Muskogee	Truck	6	Muskogee	Truck	7
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	24
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Wagoner	Truck	20	Houston	Rail	20
Sayre	Houston	Rail	235	Processor	Truck	601	Anarillo	Truck	0	Mich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	11
				Processor	Truck	500						
Tahlequah				Muskogee	Truck	42				Wagoner	Truck	0
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Catoosa	Truck	15
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	81
Tulsa				Catoosa	Truck	529				Houston	Rail	75
Vinita				Houston	Rail	644				Wagoner	Truck	23
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	22	Houston	Rail	26
Walters				Houston	Rail	4473				Ft.Worth	Truck	120



Table 5.34. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Houston	Rail	4133				Processor	Truck	24
Maurika	Houston	Rail	60	Processor	Truck	2200						
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.North	Truck	124
				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	952				Houston	Rail	285
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	4878				Houston	Rail	281
Wagoner				N.Orleans	Barge	1122				Houston	Rail	208
Paris												
Amarillo												
Lubbock												
Michita												
Falls												
Ft. North												
Houston				Export		135969						
N.Orleans				Export		6952						

Table 5.35. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 70.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Receiver	Mode	Price	Receiver	Mode	Price	
Ada				Muskogee	Truck	80			Paris	Truck	0	
									Ft.Worth	Truck	0	
Altus				Houston	Rail	5967			Ft.Worth	Truck	119	
Alva				Houston	Rail	7179			Catoosa	Truck	64	
Anadarko				Houston	Rail	5344			Processor	Truck	65	
Arapaho				Houston	Rail	5728			Processor	Truck	12	
Ardmore				Houston	Rail	272			Paris	Truck	130	
Arnett				Enid	Truck	2886			Houston	Rail	13	
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Muskogee	Truck	97
Beaver	Houston	Rail	78	Houston	Rail	5740	Anarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950			Lubbock	Truck	83	
									Anarillo	Truck	83	
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Wagoner	Truck	245			Processor	Truck	3	
Cherokee				Houston	Rail	6890			Catoosa	Truck	60	
Chayenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	44
Chickasha				Houston	Rail	1746			Processor	Truck	34	
Clarenore				Houston	Rail	372			Catoosa	Truck	0	
Cordell				Houston	Rail	4850			Processor	Truck	33	
Duncan				Houston	Rail	534			Ft.Worth	Truck	112	
Durant				Houston	Rail	191			Ft.Worth	Truck	130	
El Reno				Processor	Truck	309			Catoosa	Truck	43	
				Houston	Rail	5234						
Enid				Houston	Rail	9778			Enid	Truck	1	
Fairview				Houston	Rail	4183			Processor	Truck	23	
Fredrick				Houston	Rail	5427			Ft.Worth	Truck	100	
Guthrie				Houston	Rail	2538			Processor	Truck	3	
Guymon				Enid	Truck	5625			Lubbock	Truck	0	
				Houston	Rail	5525			Anarillo	Truck	0	
Hobart				Houston	Rail	5873			Mich.Flls	Truck	58	
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	71
Idabel				Houston	Rail	363			Paris	Truck	157	
Kingfisher				Houston	Rail	6589			Processor	Truck	15	

Table 5.35. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	86
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flls	Truck	0	Mich.Flls	Truck	22
McAlester				Houston	Rail	126				Paris	Truck	22
Madford				Houston	Rail	9720				Catoosa	Truck	46
Miami				Houston	Rail	890				Wagoner	Truck	72
Muskogee				Muskogee	Truck	371				Wagoner	Truck	63
Newkirk				Catoosa	Truck	2904				Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	294						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Catoosa	Truck	61	Catoosa	Truck	262	Wagoner	Truck	0	Muskogee	Truck	1
							Catoosa	Rail	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	68
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Processor	Truck	24
Pawnee				Houston	Rail	316				Muskogee	Truck	73
Perry				Houston	Rail	3152				Wagoner	Truck	33
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Rail	121	Paris	Truck	47
Pryor	Wagoner	Truck	113	Wagoner	Truck	407	Wagoner	Rail	3	Muskogee	Truck	7
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Muskogee	Truck	24
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	Houston	Rail	16
							Wagoner	Rail	16			
Sayre	Houston	Rail	235	Processor	Truck	601	Amarillo	Truck	0	Mich.Flls	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	15
				Processor	Truck	500						
Tahlequah				Muskogee	Truck	42				Wagoner	Truck	0
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	85
Tulsa				Catoosa	Truck	529				Houston	Rail	71
Vinita				Houston	Rail	644				Wagoner	Truck	27

Table 5.35. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hagoner	Hagoner	Truck	126	Hagoner	Truck	357	Hagoner	Truck	26	Houston	Rail	22
Walters				Houston	Rail	4473				Ft.Worth	Truck	124
Watonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Hich.Flls	Truck	65	Ft.Worth	Truck	128
Woodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	952				Houston	Rail	281
Poteau												
Shawnee												
Catoosa				N.Orleans	Barge	4212				Houston	Rail	277
Hagoner				N.Orleans	Barge	1122				Houston	Rail	204
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.36. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 7E.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Houston	Rail	80				Ft.Worth	Truck	0
										Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	139
Alva				Houston	Rail	7179				Processor	Truck	85
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	26
Ardmore				Houston	Rail	272				Paris	Truck	150
Arnett				Enid	Truck	2886				Houston	Rail	13
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Ft.Worth	Truck	133
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950				Lubbock	Truck	83
										Amarillo	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Processor	Truck	245				Processor	Truck	21
Cherokee				Houston	Rail	6890				Enid	Truck	78
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	58
Chickasha				Houston	Rail	1746				Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	34
Cordell				Houston	Rail	4850				Processor	Truck	47
Duncan				Houston	Rail	534				Processor	Truck	126
Durant				Houston	Rail	191				Ft.Worth	Truck	150
El Reno				Processor	Truck	64				Mich.Flls	Truck	77
				Houston	Rail	5479						
Enid				Houston	Rail	9778				Enid	Truck	1
Fairview				Houston	Rail	4183				Processor	Truck	37
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	120
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guymon				Enid	Truck	5625				Lubbock	Truck	0
				Houston	Rail	5525				Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	91
Idabel				Houston	Rail	363				Paris	Truck	177
Kingfisher				Houston	Rail	6589				Processor	Truck	15
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	100

Table 5.36. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Mangun	Houston	Rail	435	Houston	Rail	2132	Hich.Flls	Truck	0	Hich.Flls	Truck	22
McAlester				Houston	Rail	126	Paris	Truck		Paris	Truck	42
Madford				Houston	Rail	9720	Processor	Truck		Processor	Truck	72
Miami				Houston	Rail	890	Processor	Truck		Processor	Truck	95
Muskogee				Muskogee	Truck	271	Houston	Rail		Houston	Rail	9
				Processor	Truck	100						
Newkirk				Houston	Rail	3198	Processor	Truck		Processor	Truck	27
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	12	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Houston	Rail	61	Houston	Rail	262	Processor	T/R	0	Paris	Truck	25
							Catoosa	T/R	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	88
Pawhuska	Houston	Rail	162	Processor	Truck	459	Catoosa	Truck	21	Houston	Rail	5
Paunee				Houston	Rail	316				Processor	Truck	130
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Houston	Rail	154	Muskogee	Truck	125	Paris	Truck	67
Pryor	Houston	Rail	113	Houston	Rail	407	Wagoner	T/R	0	Wagoner	Truck	18
							Muskogee	T/R	0			
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Houston	Rail	98				Processor	Truck	10
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	8	Catoosa	Truck	55
Sayre	Houston	Rail	235	Houston	Rail	3042	Amarillo	Truck	0	Hich.Flls	Truck	0
							Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	25
Stillwater				Houston	Rail	376				Processor	Truck	46
				Processor	Truck	500						
Tahlequah				Processor	Truck	42				Wagoner	Truck	0
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	5
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	105
Tulsa				Houston	Rail	529				Catoosa	Truck	0
Vinita				Houston	Rail	644				Processor	Truck	67
Wagoner	Houston	Rail	126	Houston	Rail	357	Wagoner	Truck	59	Wagoner	Truck	29
Walters				Houston	Rail	4473				Ft.Worth	Truck	144

Table 5.36. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Watonga				Houston	Rail	4133				Processor	Truck	38
				Processor	Truck	2200						
Maurika	Houston	Rail	60	Houston	Rail	982	Mich.Falls	Truck	65	Ft.Worth	Truck	148
Woodward				Houston	Rail	2105				Processor	Truck	56
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	271				Houston	Rail	285
Poteau												
Shawnee												
Catoosa												
Wagoner												
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		142650						
N.Orleans				Export		271						

### Model 8

Model 8 combines Models 4 and 7. These models considers the segment-specific user fee as in model 7 with the three additional port sites used in Models 4 and 6. Results are similar to those in Model 7 in that the river systems show a large reduction in volume. In Model 8A, the river systems transport less than 12 million bushels. This is a loss of 84 percent of the Model 4A volume. Tables 5.37 through 5.41 show results of Model 8A through Model 8E.

### Effect of Different Assumptions

Each model was run under five different sets of assumptions. These consider different handling costs, storage capacities, and flow limits through New Orleans. Table 5.42 shows flows through Houston and New Orleans and total costs of flows for all models.

Two different handling costs were considered, a ten cents charge for each movement into and out of an elevator and a fifteen cent charge into and out of an elevator. Increasing handling costs to fifteen cents had a significant effect on the flow of grain through river ports. This reduction is a result of grain movements through a river port requiring an additional handling charge when compared to a movement from a county elevator to Houston. Costs on the river system were low enough to compete with the direct flow when a twenty cent charge was used, but could not compete well with a thirty cent handling charge. The



Table 5.37. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 8A.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Catoosa	Truck	2
Altus	Houston	Rail	1229	Houston	Rail	4738	Mich.Flls	Rail	0	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Catoosa	Truck	60
Anadarko	Eufaula	Truck	153	Houston	Rail	4946	Houston	Rail	45	Ok..City	Truck	60
	McAlester	Truck	245									
Arapaho										Processor	Truck	5
				Houston	Rail	5728						
Ardmore				Houston	Rail	272				McAlester	Truck	136
Arnett	Enid	Truck	1071	Houston	Rail	470	Houston	Rail	69	Catoosa	Truck	23
				Processor	Truck	1345						
Atoka	McAlester	Truck	19	Houston	Rail	1	Poteau	Truck	4	Muskogee	Truck	93
Beaver	Enid	Truck	2335	Houston	Rail	2534	Amarillo	Truck	39	Processor	Truck	51
	Houston	Rail	949				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Amarillo	Truck	0	Lubbock	Truck	51
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Eufaula	Truck	97	Eufaula	Truck	148	Catoosa	Rail	0	Wagoner	Truck	7
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Catoosa	Truck	56
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Eufaula	Truck	156	Houston	Rail	1590	McAlester	Truck	1	Processor	Truck	34
Clarenore				Catoosa	Truck	372				Houston	Rail	4
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	Processor	Truck	105
Durant				Houston	Rail	191				Eufaula	Truck	121
El Reno				Houston	Rail	5234				Catoosa	Truck	39
				Processor	Truck	309						
Enid												
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Eufaula	Truck	238	Houston	Rail	2300	McAlester	Truck	8	Processor	Truck	3
Guynon	Amarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	42
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	62
							McAlester	Truck	38			
							Eufaula	Truck	38			

Table 5.37. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Poteau	Truck	107
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Poteau	Truck	132
Kingfisher	Enid	Truck	689	Houston	Rail	4956	Processor	Rail	0	Processor	Truck	15
	Catoosa	Truck	944									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangum	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				McAlester	Truck	126				Houston	Rail	31
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Catoosa	Truck	42
	Houston	Rail	2599									
Miami				Houston	Rail	890				Eufaula	Truck	13
Muskogee				Muskogee	Truck	371				Wagoner	Truck	63
Newkirk				Catoosa	Truck	3198				Processor	Truck	10
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Houston	Rail	16	Poteau	Truck	50	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee Pauls Valley	Eufaula	Truck	271	Poteau	Truck	52	Poteau	Truck	2	Catoosa	Truck	11
Pawhuska	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Eufaula	Truck	83
	McAlester	Truck	483	Muskogee	Truck	31	Eufaula	Truck	12	Processor	Truck	21
	Catoosa	Truck	107									
Paunea				Houston	Rail	316				Muskogee	Truck	69
Perry				Houston	Rail	3152				Muskogee	Truck	35
Poteau	Poteau	Truck	199	Poteau	Truck	10	Poteau	Truck	179	Houston	Rail	32
Pryor	McAlester	Truck	217	McAlester	Truck	62	Poteau	Truck	1	Wagoner	Truck	1
	Wagoner	Truck	241									
Purcell	McAlester	Truck	396	Houston	Rail	135	Eufaula	Truck	16	McAlester	Truck	40
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Catoosa	Truck	186	Catoosa	Truck	10	Eufaula	Truck	16	McAlester	Truck	13
							Muskogee	Truck	16			
Sayre	Eufaula	Truck	469	Processor	Truck	1129	Processor	Truck	0	Houston	Rail	7
	Mich.Flls	Truck	927									
	Houston	Rail	752									
Shawnee				Processor	Truck	344				Houston	Rail	46

Table 5.37. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Stillwater				Houston	Rail	376				Wagoner	Truck	11
				Processor	Truck	500						
Tahlequah	Poteau	Truck	22	Muskogee	Truck	20	Muskogee	Truck	24	Wagoner	Truck	0
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Catoosa	Truck	22
Tishomingo	McAlester	Truck	58	Houston	Rail	3	Eufaula	Truck	8	Eufaula	Truck	102
Tulsa	Catoosa	Truck	263	Catoosa	Truck	266	Wagoner	Truck	53	McAlester	Truck	71
Vinita	Eufaula	Truck	116	Eufaula	Truck	528	Wagoner	Rail	0	Houston	Rail	15
Wagoner	Wagoner	Truck	459	Wagoner	Truck	24	Muskogee	Truck	46	Houston	Rail	26
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	141
Watonga				Houston	Rail	4133				Processor	Truck	49
				Processor	Truck	2200						
Haurika	Houston	Rail	660	Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159
Woodward				Houston	Rail	2105				Processor	Truck	35
-----Terminals-----												
Enid				Houston	Rail	5780				McAlester	Rail	227
Eufaula				N.Orleans	Barge	2176				Houston	Rail	285
McAlester				N.Orleans	Barge	1688				Houston	Rail	261
Muskogee				N.Orleans	Barge	1202				Houston	Rail	285
Poteau				N.Orleans	Barge	754				Houston	Rail	214
Shaunee												
Catoosa				N.Orleans	Barge	5444				Houston	Rail	281
Wagoner				N.Orleans	Barge	724				Houston	Rail	208
Paris												
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	362
Lubbock												
Wichita Falls				Houston	Rail	3000				Eufaula	Rail	305
Ft. Worth				Houston	Rail	1758				No Alternative		
Houston				Export		130933						
N.Orleans				Export		11988						

Table 5.38. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 88.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Processor	Truck	80				Houston	Rail	11
Altus	Houston	Rail	1229	Houston	Rail	4738	Mich.Flls	Rail	0	Processor	Truck	130
Alva	Enid	Truck	968	Houston	Rail	6211	Enid	Rail	22	Processor	Truck	64
Anadarko	Eufaula	Truck	153	Houston	Rail	4946	Houston	Rail	45	Processor	Truck	65
	McAlester	Truck	245									
Arapaho				Houston	Rail	5728				Processor	Truck	5
Ardmore				Houston	Rail	272				Processor	Truck	198
Arnett	Enid	Truck	1071	Processor	Truck	535	Houston	Rail	69	Processor	Truck	49
				Houston	Rail	1280						
Atoka	McAlester	Truck	19	Houston	Rail	1	Poteau	Truck	4	Processor	Truck	184
Beaver	Enid	Truck	2335	Houston	Rail	2534	Anarillo	Truck	39	Processor	Truck	51
	Houston	Rail	949				Lubbock	Truck	39			
Boise City	Houston	Rail	2565	Houston	Rail	2385	Anarillo	Truck	0	Lubbock	Truck	225
							Lubbock	Truck	0			
Buffalo	Enid	Truck	3111	Houston	Rail	585	Houston	Rail	67	Processor	Truck	18
Chandler	Eufaula	Truck	97	Processor	Truck	148	McAlester	Truck	12	Processor	Truck	0
Cherokee	Enid	Truck	1680	Houston	Rail	5210	Enid	Rail	45	Processor	Truck	58
Cheyenne	Houston	Rail	1018	Houston	Rail	496	Enid	Truck	27	Processor	Truck	37
Chickasha	Eufaula	Truck	156	Houston	Rail	1590	McAlester	Truck	1	Processor	Truck	34
Clarenore				Houston	Rail	372				Processor	Truck	13
Cordell	Houston	Rail	2037	Houston	Rail	2813	Eufaula	Truck	5	Processor	Truck	26
Duncan	Houston	Rail	185	Houston	Rail	349	McAlester	Truck	8	Processor	Truck	105
Durant				Houston	Rail	191				Processor	Truck	136
El Reno				Processor	Truck	309				Processor	Truck	64
				Houston	Rail	5234						
Enid	Enid	Truck	1954	Houston	Rail	7824	Catoosa	Truck	83	Processor	Truck	30
Fairview	Enid	Truck	1406	Houston	Rail	2777	Catoosa	Truck	56	Processor	Truck	16
Fredrick	Houston	Rail	1025	Houston	Rail	4402	Ft.Worth	Truck	13	Processor	Truck	122
Guthrie	Eufaula	Truck	238	Houston	Rail	2300	McAlester	Truck	8	Processor	Truck	3
Guynon	Anarillo	Truck	2000	Houston	Rail	8764	Lubbock	Truck	0	Lubbock	Truck	142
	Houston	Rail	386									
Hobart	Houston	Rail	2565	Houston	Rail	3308	Mich.Flls	Truck	38	Processor	Truck	62
							McAlester	Truck	38			
							Eufaula	Truck	38			
Hollis	Houston	Rail	1668	Houston	Rail	102	Mich.Flls	Truck	10	Processor	Truck	82

Table 5.38. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Hugo	Poteau	Truck	274	Houston	Rail	14	Paris	Truck	0	Processor	Truck	145
Idabel	Poteau	Truck	197	Houston	Rail	166	Paris	Truck	70	Processor	Truck	221
Kingfisher	Enid	Truck	689	Houston	Rail	4956	Processor	Rail	0	Processor	Truck	15
	Catoosa	Truck	944									
Lawton	Ft.Worth	Truck	1758	Houston	Rail	561	Houston	Rail	5	Processor	Truck	79
Mangun	Mich.Flls	Truck	2073	Houston	Rail	494	Houston	Rail	1	Processor	Truck	58
McAlester				Houston	Rail	126				McAlester	Truck	69
Medford	Enid	Truck	2000	Houston	Rail	5121	Enid	Rail	0	Processor	Truck	51
	Houston	Rail	2599									
Miami				Houston	Rail	890				Processor	Truck	74
Muskogee				Processor	Truck	371				Muskogee	Truck	21
Newkirk				Houston	Rail	3198				Processor	Truck	6
				Processor	Truck	3000						
Norman	McAlester	Truck	305	Houston	Rail	16	Poteau	Truck	50	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Eufaula	Truck	271	Houston	Rail	52	Poteau	Truck	2	Processor	Truck	25
Pauls Valley	McAlester	Truck	477	Houston	Rail	234	Eufaula	Truck	17	Processor	Truck	94
Pawhuska	Muskogee	Truck	483	Processor	Truck	31	Eufaula	Truck	12	Houston	Rail	26
	Catoosa	Truck	107									
Pawnee				Houston	Rail	316				Processor	Truck	130
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Poteau	Truck	199	Houston	Rail	10	Eufaula	Truck	181	Poteau	Truck	68
Pryor	Muskogee	Truck	217	Processor	Truck	62	Poteau	Truck	1	Houston	Rail	2
	Wagoner	Truck	241									
Purcell	McAlester	Truck	396	Houston	Rail	135	Eufaula	Truck	16	Processor	Truck	28
Sallisaw				Processor	Rail	98				Houston	Rail	11
Sapulpa	Catoosa	Truck	186	Houston	Rail	10	Eufaula	Truck	7	Processor	Truck	70
							Muskogee	Truck	7			
Sayre	Eufaula	Truck	469	Processor	Truck	1129	Processor	Truck	0	Houston	Rail	7
	Mich.Flls	Truck	927									
	Houston	Rail	752									
Shawnee			Processor	Truck	344				Houston	Rail	46	
Stillwater				Houston	Rail	376				Processor	Truck	46
				Processor	Truck	500						

Table 5.38. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tahlequah	Poteau	Truck	22	Processor	Truck	20	Muskogee	Truck	24	Wagoner	Truck	66
Taloga	Enid	Truck	2066	Processor	Truck	1182	Catoosa	Truck	28	Muskogee	Truck	66
Fishoningo	McAlester	Truck	58	Houston	Rail	3	Eufaula	Truck	8	Processor	Truck	26
Tulsa	Catoosa	Truck	263	Houston	Rail	266	Wagoner	Truck	53	Processor	Truck	183
Vinita	Eufaula	Truck	116	Houston	Rail	528	Wagoner	Truck	4	Catoosa	Truck	25
Wagoner	Wagoner	Truck	459	Houston	Rail	24	Muskogee	Truck	46	Processor	Truck	46
Walters	Houston	Rail	2362	Houston	Rail	2111	Ft.Worth	Truck	18	Processor	Truck	61
Watonga				Houston	Rail	4133				Processor	Truck	141
				Processor	Truck	2200				Processor	Truck	17
Haurika	Houston	Rail	660	Houston	Rail	382	Ft.Worth	Truck	12	Processor	Truck	159
Woodward				Houston	Rail	2105				Processor	Truck	35
-----Terminals-----												
Enid				Houston	Rail	5780				Catoosa	Rail	319
Eufaula				N.Orleans	Barge	1500				Houston	Rail	285
McAlester				N.Orleans	Barge	1500				Houston	Rail	261
Muskogee				N.Orleans	Barge	700				Houston	Rail	285
Poteau				N.Orleans	Barge	692				Houston	Rail	214
Shaunee												
Catoosa				N.Orleans	Barge	1500				Houston	Rail	281
Wagoner				N.Orleans	Barge	700				Houston	Rail	208
Paris												
Anarillo				Houston	Rail	2000				Ft.Worth	Rail	462
Lubbock												
Michita												
Falls				Houston	Rail	3000				Eufaula	Rail	405
Ft. Worth				Houston	Rail	1758				No Alternative		
Houston				Export		136329						
N.Orleans				Export		6592						

Table 5.39. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 8C.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Ft.Worth	Truck	0
										Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	115
Alva				Houston	Rail	7179				Catoosa	Truck	60
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Enid	Truck	39
Ardmore				Houston	Rail	272				Paris	Truck	126
Arnett				Enid	Truck	2886				Houston	Rail	13
Atoka	Houston	Rail	5	Houston	Rail	15	McAlester	Truck	60	Muskogee	Truck	93
Beaver	Houston	Rail	78	Houston	Rail	5740	Anarillo	Truck	20	Enid	Truck	20
Boise City				Houston	Rail	4950				Lubbock	Truck	83
										Anarillo	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Houston	Rail	13
Chandler				Eufaula	Truck	245				Wagoner	Truck	7
Cherokee				Houston	Rail	6890				Catoosa	Truck	56
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Processor	Truck	44
Chickasha				Houston	Rail	1746				Processor	Truck	34
Claremore				Catoosa	Truck	372				Houston	Rail	4
Cordell				Houston	Rail	4850				Processor	Truck	33
Duncan				Houston	Rail	534				Ft.Worth	Truck	110
Durant				Houston	Rail	191				Eufaula	Truck	121
El Reno				Processor	Truck	309				Catoosa	Truck	39
				Houston	Rail	5234						
Enid				Houston	Rail	9778				Enid	Truck	1
Fairview				Houston	Rail	4183				Processor	Truck	23
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	96
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guymon				Enid	Truck	5625				Lubbock	Truck	0
				Houston	Rail	5525				Anarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	67
Idabel				Houston	Rail	363				Poteau	Truck	132
Kingfisher				Houston	Rail	6589				Processor	Truck	15

Table 5.39. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Flts	Truck	24	Processor	Truck	86
										Ft.Worth	Truck	86
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flts	Truck	0	Mich.Flts	Truck	22
McAlester				McAlester	Truck	126				Houston	Rail	31
Medford				Houston	Rail	9220				Processor	Truck	42
Miani				Houston	Rail	890				Eufaula	Truck	13
Muskogee				Muskogee	Truck	371				Wagoner	Truck	63
Newkirk				Catoosa	Truck	3198				Houston	Rail	4
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City												
Okmulgee	Catoosa	Truck	61	Processor	Truck	571				Houston	Rail	64
				Poteau	Truck	262	Eufaula	Truck	0	Catoosa	Truck	11
							McAlester	Truck	0	Houston	Rail	2
							Muskogee	Truck	0			
							Processor	Rail	0			
Pauls												
Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	64
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	7	Eufaula	Truck	24
Pawnee				Houston	Rail	316				Muskogee	Truck	69
Perry				Houston	Rail	3152				Wagoner	Truck	29
Poteau	Houston	Rail	55	Poteau	Truck	154	Poteau	Truck	0	Houston	Rail	32
Pryor	Wagoner	Truck	113	McAlester	Truck	407	Muskogee	Truck	6	Wagoner	Truck	1
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	McAlester	Truck	40
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Wagoner	Rail	20	McAlester	Truck	13
							Houston	Rail	20			
Sayre	Houston	Rail	235	Processor	Truck	601	Anarillo	Truck	0	Mich.Flts	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shawnee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	11
				Processor	Truck	500						
Tahlequah				Muskogee	Truck	42				Wagoner	Truck	0
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Wagoner	Truck	15
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	81
Tulsa				Catoosa	Truck	529				McAlester	Truck	71



Table 5.39. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Vinita				Eufaula	Truck	644				Houston	Rail	15
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	22	Houston	Rail	26
Halters				Houston	Rail	4473				Ft.Worth	Truck	120
Watonga				Houston	Rail	4133				Processor	Truck	24
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	124
Hoodward				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula				N.Orleans	Barge	889				Houston	Rail	285
McAlester				N.Orleans	Barge	533				Houston	Rail	261
Muskogee				N.Orleans	Barge	952				Houston	Rail	285
Poteau				N.Orleans	Barge	416				Poteau	Truck	214
Shawnee												
Catoosa				N.Orleans	Barge	4616				Houston	Rail	281
Wagoner				N.Orleans	Barge	470				Houston	Rail	208
Paris												
Anarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		135045						
N.Orleans				Export		7876						

Table 5.40. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 80.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Muskogee	Truck	80				Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	0
Alva				Houston	Rail	7179				Ft.Worth	Truck	119
Anadarko				Houston	Rail	5344				Catoosa	Truck	64
Arapaho				Houston	Rail	5728				Processor	Truck	65
Ardmore				Houston	Rail	272				Processor	Truck	12
Arnett				Enid	Truck	2686				Paris	Truck	130
Atoka	Houston	Rail	5	Houston	Rail	15	McAlester	Truck	61	Houston	Rail	13
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Muskogee	Truck	97
Boise City				Houston	Rail	4950				Enid	Truck	20
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Lubbock	Truck	83
Chandler				Eufaula	Truck	245				Amarillo	Truck	83
Cherokee				Houston	Rail	6890				Houston	Rail	13
Chayenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Wagoner	Truck	7
Chickasha				Houston	Rail	1746				Catoosa	Truck	60
Clarenore				Houston	Rail	372				Processor	Truck	44
Cordell				Houston	Rail	4850				Processor	Truck	34
Duncan				Houston	Rail	534				Catoosa	Truck	0
Durant				Houston	Rail	191				Processor	Truck	33
El Reno				Processor	Truck	309				Ft.Worth	Truck	114
Enid				Houston	Rail	5234				Eufaula	Truck	125
Fairview				Houston	Rail	9778				Catoosa	Truck	43
Fredrick				Houston	Rail	4183				Enid	Truck	1
Guthrie				Houston	Rail	5427				Processor	Truck	23
Guymon				Houston	Rail	2538				Ft.Worth	Truck	100
Hobart				Enid	Truck	5625				Processor	Truck	3
Hollis	Houston	Rail	453	Houston	Rail	5525				Lubbock	Truck	0
Hugo	Houston	Rail	75	Houston	Rail	5873				Amarillo	Truck	0
Idabel				Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	58
Kingfisher				Houston	Rail	213	Paris	Truck	0	Paris	Truck	27
Lanton	Houston	Rail	319	Houston	Rail	363				Poteau	Truck	71
				Houston	Rail	6589				Processor	Truck	136
				Houston	Rail	2000	Mich.Flls	Truck	24	Processor	Truck	15
										Processor	Truck	86

Table 5.40. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Mangun	Houston	Rail	435	Houston	Rail	2132	Mich.Flts	Truck	0	Mich.Flts	Truck	22
McAlester				McAlester	Truck	126	Houston	Rail		Houston	Rail	27
Madford				Houston	Rail	9720	Catoosa	Truck		Catoosa	Truck	46
Miami				Houston	Rail	890	Eufaula	Truck		Eufaula	Truck	17
Muskogee				Muskogee	Truck	371	Wagoner	Truck		Wagoner	Truck	63
Newkirk				Catoosa	Truck	1980	Processor	Truck		Processor	Truck	13
				Processor	Truck	3000						
				Houston	Rail	1218						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	0	Processor	Truck	1
Oklahoma City										Houston	Rail	64
Okmulgee	Muskogee	Truck	61	Processor	Truck	571	Catoosa	Rail	0	Catoosa	Truck	11
				Poteau	Truck	262	Eufaula	Truck	0			
							Muskogee	Truck	0			
							McAlester	Truck	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	68
Pawhuska	Catoosa	Truck	162	Muskogee	Truck	459	Houston	Rail	3	Eufaula	Truck	24
Pawnee				Houston	Rail	316				Muskogee	Truck	73
Perry				Houston	Rail	3152				Wagoner	Truck	33
Poteau	Houston	Rail	55	Poteau	Truck	154	Poteau	Truck	0	Houston	Rail	28
Pryor	Wagoner	Truck	113	McAlester	Truck	407	Eufaula	Rail	3	Wagoner	Truck	1
Purcell	Houston	Rail	69	Houston	Rail	462	Ft.Worth	Truck	0	Processor	Truck	28
Sallisaw				Catoosa	Truck	98				Poteau	Truck	7
Sapulpa	Catoosa	Truck	51	Catoosa	Truck	145	Houston	Rail	16	McAlester	Truck	13
							Wagoner	Rail	16			
Sayre	Houston	Rail	235	Processor	Truck	601	Anarillo	Truck	0	Mich.Flts	Truck	0
				Houston	Rail	2441	Lubbock	Truck	0			
Shansee				Processor	Truck	344				Houston	Rail	39
Stillwater				Houston	Rail	376				Wagoner	Truck	15
				Processor	Truck	500						
Tahlequah				Muskogee	Truck	42				Wagoner	Truck	0
Taloga	Houston	Rail	193	Processor	Truck	3055	Enid	Truck	0	Processor	Truck	19
										Catoosa	Truck	19
Tishomingo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	85

Table 5.40. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tulsa				Catoosa	Truck	529				McAlester	Truck	71
Vinita				Eufaula	Truck	644				Houston	Rail	71
Wagoner	Houston	Rail	126	Wagoner	Truck	357	Wagoner	Truck	26	Houston	Rail	11
Walters				Houston	Rail	4473				Houston	Rail	22
Watonga				Houston	Rail	4133				Ft.Worth	Truck	124
Maurika	Houston	Rail	60	Processor	Truck	2200				Processor	Truck	24
Woodward				Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	128
				Houston	Rail	2105				Processor	Truck	42
-----Terminals-----												
Enid												
Eufaula				N.Orleans	Barge	889				Houston	Rail	281
McAlester				N.Orleans	Barge	533				Houston	Rail	257
Muskogee				N.Orleans	Barge	952				Houston	Rail	281
Poteau				N.Orleans	Barge	416				Houston	Rail	210
Shawnee												
Catoosa				N.Orleans	Barge	3026				Houston	Rail	277
Wagoner				N.Orleans	Barge	470				Houston	Rail	204
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		136635						
N.Orleans				Export		6286						

Table 5.41. Optimal Receiver, Mode, and Flow for Harvest and Nonharvest Grain With Shadow Price for Alternative With the Lowest Shadow Price by Location for Model 8E.

Shipper	Optimal Flow (in 1000 Bu.)					Shadow Prices (in \$/1000 bu.)						
	Harvest			Nonharvest		Harvest			Nonharvest			
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Ada				Houston	Rail	80				Ft.Worth	Truck	0
										Paris	Truck	0
Altus				Houston	Rail	5967				Ft.Worth	Truck	139
Alva				Houston	Rail	7179				Processor	Truck	85
Anadarko				Houston	Rail	5344				Processor	Truck	65
Arapaho				Houston	Rail	5728				Processor	Truck	26
Ardmore				Houston	Rail	272				Paris	Truck	150
Arnett				Enid	Truck	2886				Houston	Rail	13
Atoka	Houston	Rail	5	Houston	Rail	15	Paris	Truck	61	Ft.Worth	Truck	133
Beaver	Houston	Rail	78	Houston	Rail	5740	Amarillo	Truck	20	Poteau	Truck	133
Boise City				Houston	Rail	4950				Enid	Truck	20
										Lubbock	Truck	83
Buffalo	Houston	Rail	707	Enid	Truck	2989	Enid	Truck	43	Amarillo	Truck	83
Chandler				Processor	Truck	245				Houston	Rail	13
Cherokee				Houston	Rail	6890				Eufaula	Truck	10
Cheyenne	Houston	Rail	125	Houston	Rail	1389	Lubbock	Truck	71	Enid	Truck	78
Chickasha				Houston	Rail	1746				Processor	Truck	58
Clarenore				Houston	Rail	372				Processor	Truck	34
Cordell				Houston	Rail	4850				Processor	Truck	47
Duncan				Houston	Rail	534				Processor	Truck	126
Durant				Houston	Rail	191				Eufaula	Truck	145
El Reno				Processor	Truck	64				Eufaula	Truck	70
				Houston	Rail	5479						
Enid				Houston	Rail	9778				Enid	Truck	1
Fairview				Houston	Rail	4183				Processor	Truck	37
Fredrick				Houston	Rail	5427				Ft.Worth	Truck	120
Guthrie				Houston	Rail	2538				Processor	Truck	3
Guynon				Enid	Truck	5625				Lubbock	Truck	0
				Houston	Rail	5525				Amarillo	Truck	0
Hobart				Houston	Rail	5873				Mich.Flls	Truck	58
Hollis	Houston	Rail	453	Houston	Rail	1317	Mich.Flls	Truck	11	Mich.Flls	Truck	27
Hugo	Houston	Rail	75	Houston	Rail	213	Paris	Truck	0	Paris	Truck	91
Idabel				Houston	Rail	363				Poteau	Truck	171
Kingfisher				Houston	Rail	6589				Processor	Truck	15

Table 5.41. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Lawton	Houston	Rail	319	Houston	Rail	2000	Mich.Fils	Truck	24	Processor	Truck	100
Mangum	Houston	Rail	435	Houston	Rail	2132	Mich.Fils	Truck	0	Mich.Fils	Truck	22
McAlester				Houston	Rail	126				McAlester	Truck	7
Medford				Houston	Rail	9720				Processor	Truck	72
Miami				Houston	Rail	890				Eufaula	Truck	37
Muskogee				Muskogee	Truck	271				Houston	Rail	9
				Processor	Truck	100						
Newkirk				Houston	Rail	3198				Processor	Truck	27
				Processor	Truck	3000						
Norman	Houston	Rail	84	Houston	Rail	237	Processor	Truck	12	Processor	Truck	1
Oklahoma City				Processor	Truck	571				Houston	Rail	64
Okmulgee	Houston	Rail	61	Houston	Rail	262	Eufaula	Truck	0	Poteau	Truck	0
							McAlester	T/R	0			
							Poteau	Rail	0			
							Processor	T/R	0			
							Catoosa	T/R	0			
Pauls Valley	Houston	Rail	58	Houston	Rail	653	Ft.Worth	Truck	5	Ft.Worth	Truck	88
Pawhuska	Houston	Rail	162	Processor	Truck	459	Catoosa	Truck	21	Houston	Rail	5
Paunee				Houston	Rail	316				Eufaula	Truck	116
Perry				Houston	Rail	3152				Processor	Truck	46
Poteau	Houston	Rail	55	Houston	Rail	154	Poteau	Truck	0	Poteau	Truck	7
Pryor	Houston	Rail	113	Houston	Rail	407	Wagoner	T/R	0	McAlester	Truck	0
							Muskogee	T/R	0			
							Eufaula	Rail	0			
							Ft.Worth	Truck	0	Processor	Truck	28
Purcell	Houston	Rail	69	Houston	Rail	462				Poteau	Truck	5
Sallisaw				Houston	Rail	98				McAlester	Truck	31
Sapulpa	Houston	Rail	51	Houston	Rail	145	Catoosa	Truck	8	Mich.Fils	Truck	0
Sayre	Houston	Rail	235	Houston	Rail	3042	Amarillo	Truck	0			
							Lubbock	Truck	0			
				Processor	Truck	344				Houston	Rail	25
Shawnee				Houston	Rail	376				Processor	Truck	46
Stillwater				Processor	Truck	500						
				Processor	Truck	42				Wagoner	Truck	0
Tahlequah				Processor	Truck	3055	Enid	Truck	0	Processor	Truck	5
Taloga	Houston	Rail	193									

Table 5.41. continued.

Shipper	Optimal Flow (in 1000 Bu.)						Shadow Prices (in \$/1000 bu.)					
	Harvest			Nonharvest			Harvest			Nonharvest		
	Receiver	Mode	Bushels	Receiver	Mode	Bushels	Receiver	Mode	Price	Receiver	Mode	Price
Tishoningo	Houston	Rail	16	Houston	Rail	45	Ft.Worth	Truck	14	Paris	Truck	105
Tulsa				Houston	Rail	529				Catoosa	Truck	0
Vinita				Houston	Rail	644				Eufaula	Truck	9
Wagoner	Houston	Rail	126	Houston	Rail	357	Wagoner	Truck	59	Wagoner	Truck	29
Walters				Houston	Rail	4473				Ft.Worth	Truck	144
Watonga				Houston	Rail	4133				Processor	Truck	38
				Processor	Truck	2200						
Haurika	Houston	Rail	60	Houston	Rail	982	Mich.Flls	Truck	65	Ft.Worth	Truck	148
Hoodward				Houston	Rail	2105				Processor	Truck	56
-----Terminals-----												
Enid												
Eufaula												
McAlester												
Muskogee				N.Orleans	Barge	271				Houston	Rail	285
Poteau												
Shawnee												
Catoosa												
Wagoner												
Paris												
Amarillo												
Lubbock												
Wichita												
Falls												
Ft. Worth												
Houston				Export		142650						
N.Orleans				Export		271						

Table 5.42. Summary of Flows Through Houston and New Orleans and Total Costs for all Models Included in the Study.<sup>a</sup>

Assumptions A through E	Model							
	1	2	3	4	5	6	7	8
(A) Commercial Storage with 20 cent Handling Costs.								
Houston	76,793	74,259	67,240	70,996	89,954	80,875	135,289	130,933
New Orleans	66,128	68,662	75,681	71,925	52,967	62,046	7,632	11,988
Total Cost	\$114,167	\$114,823	\$111,474	\$113,364	\$115,309	\$114,588	\$116,762	\$116,392
(B) Commercial Storage with 30 cent Handling Costs.								
Houston	139,097	139,091	138,869	134,461	139,384	134,770	140,021	136,329
New Orleans	3,824	3,830	4,052	8,460	3,537	8,151	2,900	6,592
Total Cost	\$134,986	\$135,706	\$133,704	\$134,282	\$135,051	\$134,412	\$135,250	\$134,893
(C) Commercial and Farm Storage with 20 cent Handling Costs.								
Houston	61,067	61,067	44,099	55,642	73,663	70,356	135,969	135,045
New Orleans	81,854	81,854	98,822	87,279	69,258	72,565	6,952	7,876
Total Cost	\$108,603	\$108,773	\$105,684	\$108,424	\$110,028	\$109,909	\$111,779	\$111,755
(D) Commercial and Farm Storage with 20 cent Handling Costs, With New Orleans Limited to 6,286 thousand bushels.								
Houston	136,635	136,635	136,635	136,635	136,635	136,635	136,635	136,635
New Orleans	6,286	6,286	6,286	6,286	6,286	6,286	6,286	6,286
Total Cost	\$111,296	\$111,474	\$110,166	\$111,277	\$111,407	\$111,381	\$111,782	\$111,762
(E) Commercial and Farm Storage with 30 cent Handling Costs.								
Houston	140,222	140,060	139,897	139,942	141,459	141,197	142,650	142,650
New Orleans	2,699	2,861	3,024	2,979	1,462	1,724	271	271
Total Cost	\$128,357	\$128,539	\$127,278	\$128,352	\$128,393	\$128,392	\$128,434	\$128,434

<sup>a</sup> Flows in Thousands of Bushels, Costs in Thousands of Dollars.

increased handling charge had little effect on harvest flows since these flows often went through terminal locations.

When harvest grain was forced through a terminal other than Houston, the river ports no longer require additional handling costs when compared to the alternative rail route.



When New Orleans was constrained to 6,286 thousand bushels (Set D), the river could not compete beyond that level. Although barge shipments were possible from river ports to Houston for an additional \$120 per thousand bushel above the cost to New Orleans, this option was not utilized by any model. After the New Orleans arc reached its maximum bound, all additional export flow was railed to Houston.

Adding farm storage had a definite affect on river flows. When farm storage was combined with a twenty cent handling charge, river ports handled the highest volume of wheat. When combined with a thirty cent handling charge, river ports handled the lowest volumes. This was because more grain could be stored at the county level. This allowed large volumes to flow through the nonharvest portion of the model which has less constraints and lower trucking costs. Under a twenty cent handling cost, the water transportation was the cheaper alternative over much of the state, so the river system handled a large portion of the grain taken from storage. When the handling cost was increased to thirty cents, rail transportation became the cheaper mode over most of the state, so that most of the wheat in storage was shipped by rail to Houston.

## CHAPTER VI

### SUMMARY AND CONCLUSIONS

This project determines optimal movements of wheat produced in Oklahoma to processors and export markets and Houston and New Orleans. Eight models have been included under five different sets of assumptions. These eight models are:

1. Least cost flow with contract rates between terminal elevators,
2. Model 1 without contract rates for terminal elevators,
3. Model 1 with truck net weights increased from 55,000 pounds to 65,000 pounds,
4. Model 1 plus ports in McAlester, Poteau, and Eufaula on the Poteau-Deep Fork River System,
5. Model 1 plus full recovery fuel tax on existing ports,
6. Model 5 plus Poteau-Deep Fork River ports,
7. Model 5 with the segment-specific tax instead of the fuel tax,
8. Model 6 with segment-specific tax instead of the fuel tax.

Each of these eight models were developed under five different set of assumptions. These five sets are:

- A. Handling costs of ten cents into and ten cents out of an elevator, with farm storage equal to five percent of production,

- B. Handling costs of fifteen cents in and fifteen cents out, with farm storage as specified in Set A,
- C. Handling costs of ten cents in and ten cents out, with farm storage of 130,551 thousand bushels, divided among counties according to county production levels,
- D. Set C plus a constraint on flows through New Orleans such that flow above 6,286 thousand bushels must be shipped on to Houston at an additional cost of \$120 per thousand bushels,
- E. Handling costs of fifteen cents in and fifteen cents out, with farm storage of 130,551 thousand bushels, divided among counties according to county production levels.

Also included in this study are preliminary results of a grain flow survey study for Oklahoma. These models are based on the 1985 grain flow study and can be compared.

In this study, the river systems were highly sensitive to model assumptions. River ports were very competitive with handling cost of ten cents into and ten cents out of each elevator but was much less competitive when handling cost were increased to fifteen cents in and out. The extreme volumes for barges shipment were 98.8 million bushels under Model 3C and 0.3 million bushels in Models 7E and 8E. Model 3C includes truck net weights at 65,000 pounds, commercial and farm storage, and 10 cents handling costs for each loading and unloading. Models 7E and 8E include a segment-specific tax with handling costs of fifteen cents in and fifteen cents out without and with the proposed river system, respectively. barge flows changed little when the fuel tax user fee was included, but the implementation of segment-specific tax reduced flows

greatly. In Model 1A, without a tax, the river system carried 66 million bushels. A segment-specific tax was added in Model 7 and reduced barge flows in Model 7A to 7.6 million bushels. Furthermore, the additional constraint in Set D was enough to limit river movements to 6,286 thousand bushels from movements of over 80 million bushels seen in Set C.

The proposed river sites reduced costs some. However, these locations tend to transport wheat which had been moving down the existing river system. This has limited the effect of these locations on total handling and transportation costs

The removal of contract rates also had little effect on flows. The change in rates were small and grain movements tend to flow by river ports or direct rail to Houston.

Increasing the legal highway weight limit, as in Model 3, showed a definite reduction in costs. In each of the five sets, Model 3 was the least cost model. The main use of trucks in these models was to move grain to river ports as opposed to moving grain to terminals. Therefore, the effect of the increased highway weight limit was greatest in models where the river system handled larger volumes. This change also resulted in increased volumes on the river in all cases except Set D where New Orleans had constrained capacity.

## Limitations

Several important factors are not addressed by this model. These factors include flows from farms to country elevators, flows from other states into terminals included in this study, total capacities of rail and truck systems, differences in commercial and farm storage at the county level, timeliness, and flows of other grains and products. Addition of these factors are needed to build more accurate models.

Many flows were ignored in these models. These include flows from farm level to country elevators, movements of grain into the state, and movements by other states into Houston and New Orleans. Also ignored, were capacities of truck and rail equipment during the busy harvest season. This was handled on an individual bases at the terminals, but the total capacity was not restricted.

In these models, on farm storage was treated as commercial storage. This allowed rail shipments of grain stored on farms to Houston just as grain stored in local commercial storage. In actual practice, this is not correct. Handling costs are needed to move grain from on farm to commercial storage before any farm stored grain can be moved by rail. The result of this change could mean increased movements from on farm storage to river ports or terminals bypassing the local elevator.

Timeliness has also not been addressed. Sometimes, it is important that grain arrive at a certain time. If grain

is received early or late, costs may be associated with this, but cost of this nature do not appear in these models. Trucks provide the most timely transportation service followed by rail.

These models ignore the flow of other grains and products which provide backhaul opportunities. Changing from current flows to optimal flows may cause considerable impacts on the shipment of other grains and goods.

#### Need for Further Study

Work still needs to be done in this area. The section above details several limitations with this study. These limitations need to be resolved. Considerable time and effort is needed to research the effects of the changing transportation industry.

Results from these models are very sensitive to changes in handling costs and can be sensitive to changes in capacity limits, storage availability, and transportation costs. The results from modeling efforts such as this are only as good as the data used. Efforts to develop and maintain good handling costs, capacity, storage, actual grain movement patterns, and transportation cost data is a prerequisite to good modeling efforts in this area.

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