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TITLE: Effectiveness of Competitive Forces in Limit Rail Rate Increases on Export Wheat Traffic in South Plains

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ABSTRACT: The paper relates results of research conducted to determine the effectiveness of competition to limit increases in rail rate levels under conditions of rail deregulation. The study focuses on the ability of intramodal and intermodal competition to constrain rail rate increases on South Plains export wheat movement.

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Abstract

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EFFECTIVENESS OF COMPETITIVE FORCES TO LIMIT RAIL RATE INCREASES ON EXPORT WHEAT TRAFFIC IN SOUTH PLAINS

This paper attempts to measure the ability of competing modes to constrain rail rates under deregulation. The Staggers Rail Act of 1980 permits greater reliance on the marketplace for purposes of rate determination (U.S. House of Representatives). Accordingly, many producers and agricultural shippers believe regional or geographic discrimination will occur because of ineffective competition from competing modes. This study was designed to determine the effectiveness of competitive forces in limiting rail rate increases in the South Plains hard winter wheat producing region. Since the study area has historically exported over three-fourths of its production, the analysis centers on this movement. The research focuses on the ability of intra-and intermodal competition to constrain rail rate increases.

In the intramodal analysis, it is assumed that the dominant railroad alters its rates without corresponding changes from other transportation firms in the region. In which case, rate competition is provided by competing railroads, trucks, and the truck-barge combination. This analysis measures the ability of a single carrier to improve its profitability without collaborative action from competing railroads.

The intermodal competitive analysis centers on the ability of competing modes to constrain rail rate increases. In this analysis it is assumed that no rate competition exists between railroads, in which case, the dominant railroad becomes a successful price leader. Competing railroads follow the price leadership of the dominant firm and adopt similar rate increases.

The intramodal analysis is carried out in a short-run time frame while the intermodal analysis is examined in the short-run and long-run. Historically, about 95 percent of the study region's wheat exports have been handled by Texas ports. Port elevators on the lower Mississippi River are operating at full capacity with Midwest corn and soybean exports and would be unable to accommodate any substantial increase in wheat exports from the study region. Therefore, in the short-run analysis, each port area is assumed to handle the same level of study region production as has historically occurred. To more fully analyze the effect of intermodal competition, the analysis was extended to allow for new capital in river and port elevator facilities. Because the barge rate from the study region to the lower Mississippi River port is substantially less than to Texas ports, an incentive to invest in additional Arkansas River elevator and Mississippi River port facilities may develop if railroads adjust rates upward. For this reason, the intermodal analysis includes a long-run perspective.

Three specific scenarios are examined in this study. These include 1) effectiveness of intramodal competition to limit rail rates in the short-run, referred to as <u>intramodal analysis</u>: 2) effectiveness of intermodal competition to limit rail rates in the short-run, referred to as <u>short-run intermodal analysis</u>, and 3) effectiveness of intermodal competition to limit rail rates in the long-run, referred to as <u>long-run intermodal analysis</u>.

The study region is a contiguous 27-county area in portions of Kansas, Oklahoma, and Texas (Fig. 1). The region is approximately 288 miles in length, 144 miles at its widest location, and is located an average of 625 miles from the principal Texas Gulf ports. The region has historically had annual wheat production of approximately 160 million bushels, approximately 75 percent of which has been exported. Within this region there are 347 country elevators which operate at 244 locations. In addition, there are 34 inland terminals (secondary holders), which operate at five locations and receive wheat from study region country elevators. Historically, about 90 percent of the study region's export-destined wheat has moved to North Texas ports. North Texas ports include the eight export elevators located at Houston, Galveston, Beaumont, and Port Arthur, Texas. The remainder of the export-destined wheat has exited through South Texas and Mississippi River ports (Fig. 1).

Railroads operate 2,200 miles of track within the region and are the dominant transporters of the region's wheat production (Fig. 2). Four railroad companies operate in the study area. The dominant carrier, Santa Fe, operates about 54 percent of the region's track and annually handles about one-half of the region's rail wheat movement. All four railroad firms operate in the eastern one-third of the region, while only the Santa Fe and Rock Island traverse the western two-thirds of the region.

Although railroads currently transport nearly all the study region's wheat exports, several alternative mode or mode combinations are available for the export movement. One alternative includes direct truck shipment from study region origins to port elevators. An alternative routing involves the truck-barge combination, where trucks deliver wheat to an Arkansas River elevator for subsequent haulage by barge to Gulf port elevators. At present, the nearest river elevator is located at the terminus of the navigable portion of the Arkansas River (Catoosa, Oklahoma) and lies approximatley 100 miles east of the study region's eastern boundary.

Analytical Procedure

The analysis was accomplished with a network flow model that minimized total annual costs and rates associated with the export wheat handling, storage, and transportation system. It was assumed that grain shippers would seek to minimize those costs associated with moving export wheat to port areas and, accordingly, maximize study region site price. Consequently, the cost-minimizing framework was adopted.

The model is structured to include grain movement from production origins (farms) through country elevators and secondary holders (inland terminals, river elevators) to port terminal destinations. The model is structured so that the harvest-time supply of wheat may be stored at production origins or shipped directly by farm truck to nearby country elevators for storage and/or subsequent shipments. Country elevators may ship to inland terminals, Gulf port terminals, or the river elevator on the Arkansas River. Truck and rail modes are available for all country elevator shipments except for those to the river elevator, in which case only truck carriage is available. Export rail rates connect country elevators, inland terminals, and Gulf port areas. The river elevator is linked to the lower Mississippi River, North Texas and South Texas ports via barge transportation rates.

To accomplish the intramodal analysis with the cost-minimizing model, two steps were followed. First, the model was solved with current rates. This solution related least-cost distribution patterns for each country elevator location and the revenues generated by the dominant and competing railroads. Second, the export rail rates for those country elevator locations served by the dominant carrier were adjusted. Again, the model was solved and the revenue generated by the dominant carrier at each served location recorded. If the dominant carrier's revenue increased above the initial or previous solution, then rates were again adjusted at that location and the model again solved. Rates at each country elevator location were adjusted until the dominant carriers revenue commenced to decrease. To gain insight into the effect of rate manipulation on profitability, the variable cost of various rail movements were estimated for each country elevator location. Subtracting the appropriate variable cost from revenue yielded an estimate of railroads' revenue above variable cost for each served location. Because unit variable cost was not effected by volume, maximizing railroad revenue at a location was analogous to maximizing revenue above variable cost.

The procedure to accomplish the intermodal analysis was similar to that employed to accomplish the intramodal analysis. The principal modification in procedure was a result of the assumed change in railroad's pricing behavior. Since all railroads were assumed to follow a price leader in the intermodal analysis, railroad rates at all locations were adjusted simultaneously. Because of the short-run time frame of the intramodal and short-run intermodal scenarios, the model was constrained so that study region flows to the various port areas could not exceed historic levels. In contrast, the long-run intermodal analysis allows for new capital to be invested in order to expand river elevator and Mississippi River port terminal capacity. In which case, the historic flow to a port area was not an upper bound. The long-run time frame was accomplished in the model by allowing historic flows to continue at the current elevator (variable costs) cost levels but necessitates that any flows in excess of historic levels can only be accomplished at costs which include new investment in land and capital.

Results

Intramodal Competition

The intramodal analysis is based on the assumption that competing rail, truck and barge firms do not alter their rates in response to rate manipulation by the dominant rail carrier. Because Santa Fe operates 1,200 miles of track (54 percent of region's total trackage), it was designated the study region's dominant carrier.

At current (1978) rate levels, the model shows the dominant carrier to generate revenues of $30.65 million and transport 62.95 million bushels of the study region's wheat exports. All other railroads generated revenues of $24.96 million and transported 51.55 million bushels. The study region's remaining 3.7 million bushels of export wheat was barged.[1]

Analysis indicated that upward rate adjustments by the dominant carrier would decrease its revenue, revenue above variable cost and volume at all served locations, except for those in the southwest portion of the study region (Fig. 3). In this area, the dominant carrier could profitably increase rail rates an average of 5 percent. This upward rate adjustment would yield additional rail revenue of $.027 per transported bushel and increase the dominant carrier's revenue from the current $30.65 million to $30.87 million.

In an effort to learn more about the demand characteristics for the dominant carrier's transportation service, rates at all served locations were simultaneously adjusted. Analysis showed that if the dominant carrier's rates were adjusted upward by 5 percent, its revenue would decrease from $30.65 to $17.19 million while transported volume would decrease form 62.95 to 33.47 million bushels. Similarly, revenue above variable cost would decrease from $9.63 to $5.99 million. Approximately 95 percent of the dominant carrier's lost volume would be carried by competing railroads. The remaining portion would be carried via the truck-barge combination. Conversely, if Santa Fe were to adjust rates downward by 5 percent and competing carriers left their rates unaltered, Santa Fe's revenue, revenue above variable cost and volume would increase. In this case, revenue would increase from $30.65 to $42.92 million and volume from 62.95 to 93.04 million bushels. Revenue above variable cost would increase from $9.63 million to $11.92 million. The increase in dominant carrier's market share would be at the expense of competing rail lines.

The assumption that competing railroads will not alter their rates as the dominant carrier adjusts rate levels downward is probably unrealistic. It is doubtful that competing railroads would allow Santa Fe to increase its market share via rate reductions. Rate decreases by Santa Fe would likely result in corresponding decreases by competing railroads, in which case, rate reductions by Santa Fe would bring about a decrease in revenue for their firm and competing railroads. For example, if both the dominant carrier and competing railroads adjust rates downward by 5 percent, the combined revenue of the railroads decrease from $55.61 to $53.39 million.

Based on the assumptions of the intramodal analysis, the dominant carrier has limited ability to increase revenue and revenue above variable cost through upward rate adjustments. The assumption that competing railroads will not follow the upward rate adjustment of the dominant carrier is debatable. Friedlaender argues that intramodal price competition is an unlikely course of action with deregulation, even if deregulatory action abolished rate bureaus. The following intermodal analysis addresses the situation where railroads are assumed to coordinate rate adjustments.

Short-run Intermodal Competition

The intermodal analysis is designed to determine the effectiveness of truck and truck-barge competition in restraining rail rate increases. The short-run analysis does not include the opportunity for capital investment for purposes of altering port or river elevator capacities; accordingly, flows to the various port areas are constrained to historical levels.

At current rate levels, the railroads are earning revenues of $55.61 million while transporting 114.5 million bushels. The study region's remaining 3.7 million bushels are transported via barge to the lower Mississippi River port area.

Analysis indicated railroads have greater ability to increase revenue and revenue above variable cost if they collaborate in upward rate adjustments. Figure 4 suggests the extent that cooperating railroads can profitably increase rates in various portions of the study region. In general, railroads have the greatest ability to increase rates in the Texas and Oklahoma portion of the study region. In the western portion of the region, railroads have the ability to increase rates 15 to 30 percent. Railroads operating in the Panhandle counties of Texas and Oklahoma could increase rates an average of $.09 per bushel. Clearly, the increased distance of these locations from the river elevator decreases the effectiveness of intermodal competition, in particular, the truck-barge combination. In spite of the proximity of the river elevator to the eastern Oklahoma portion of the study region, railroads have ability to adjust rates upward. This seems to be best explained by the relatively low rail rates charged by railroads operating in this area. Because of the railroads' relatively low current rates when compared to competing modes, there is ability to adjust rail rates upward 10 to 20 percent without losing significant quantities of traffic. Upward rate adjustments would increase rates an average of $.024 per transported bushel. The rate structure in the eastern part of the study region may have evolved because of its proximity to the river elevator and railroads' concern about losing grain traffic to the truck-barge combination.

Through selective rate increases, railroads have the ability to increase annual revenue from $55.61 to $58.10 million while transported volume decreases from 114.5 to 109.50 million bushels. Increased revenue coupled with reduced haulage and the associated lower costs would increase railroad's revenue above variable cost from $19.3 to $22.5

million. The five million bushel loss in volume results from upward rail rate adjustments: the truck-barge combination gains the loss in railroad volume.

Historically, most of the study region's export wheat has flowed to North Texas ports. Because of the assumption accompaning the short-run analysis, flows to each port were constrained to historic levels. Therefore, as rail rates were adjusted upward, barge traffic was forced to bypass the lower Mississippi River port to be delivered to North Texas ports. Barge movements from the Arkansas River elevator to North Texas ports is at an additional rate of $.099 per bushel over movements to the lower Mississippi River port. Accordingly, the possible incentive to invest in additional river and port elevator capacity.

<u>Long-Run Intermodal Competition</u>

The long-run intermodal analysis determines the effectiveness of truck and truck-barge competition in restraining rail rate increases when the time period is extended to allow for new capital investment. This scenario determines whether incentive exists for additional river and port elevator capacity so as to capture the lower barge rates associated with movement to the lower Mississippi River port area.

The long-run analysis indicated greater quantities of study region wheat flowing to the lower Mississippi River port area via the truck-barge combination than occurred at 1978 rate levels. That is, based on analysis conducted at the 1978 rate level, incentive exists to add additional elevator capacity for purposes of increasing flow to the lower Mississippi River port. Although wheat flow has increased substantially since completion of the Arkansas River project in 1971, the 1980 export flow was about 30 percent of the 51.49 million bushels projected by the model. Sufficient time has elapsed to invest in necessary elevator facilities to accommodate flows which approximate that of the long-run solution. A plausible explanation of the divergence between the predicted and actual flow may be due to risk associated with river elevator investment. Because a large portion of railroad costs are fixed and nontraceable, railroads have capability to operate at relatively low rates in those areas where competitive threats exist. It follows that a firm contemplating an investment in a river elevator, with a 25 to 30 year life, could be reluctant to invest because of railroads ability to keep rates low in the region. For this reason, it is difficult to precisely determine how effective truck-barge competition would be in the long-run.

Network flow model analysis indicates increased effectiveness of the truck-barge combination in restraining rail rates in the long-run. Investment in river and port elevator facilities bring about redirection of wheat flows to the lower Mississippi River port area and restricts railroad's rate increasing ability to the western portion of the study region (Fig. 5). Railroads have almost no ability to increase rates in the eastern one-half of the study region, only at country elevator locations in excess of 260 miles of the river elevator could railroads successfully adjust rates upward. In the extreme western portion of the study region, (at a distance of about 400 miles), collaborating railroads could increase rates up to 20 percent before truck-barge competition became an effective restraint.

Conclusion

Intramodal competition, if made to function, would appear to provide an effective means of restricting rail rate increases. However, it should be noted that the trend toward rail company merger tends to spatially concentrate ownership and reduce the effectiveness of intramodal competition.

The intermodal analysis indicates collaborative rate-setting would allow railroads to increase rate levels in the short-run. The truck-barge combination would be the most effective form of competition. Analysis indicates that in the long-run an economic incentive exists to invest in additional river facilities to allow an increase in barge movement. This action substantially improves the competitiveness of the truck-barge combination and restricts the ability of the railroads to increase rate levels in all but the most western portion of the study region. It is difficult to know how effective the truck-barge competition would be in the long-run. Railroad's cost structure allows them substantial rate-setting freedom, thus creating some risk for river elevator investment.

Footnotes

[1]In an effort to validate the model, the models predicted flows were compared with data on actual flows. In general, the models' predicted flow patterns correlated closely with actual haulage by each mode. The principal exception was truck transportation to port areas. The model showed no grain moving by truck from study region origins to the North Texas port area, when in actuality wheat is trucked to this port from the southern portion of the study region. Only when the lower costs associated with overloaded trucks were entered into the model did truck haulage commence. The models' predicted movement by barge approximated export flows occurring in the mid-1970's but slightly underestimated 1977-1978 flows. In 1980, the river elevator handled about 21 million bushels of wheat, only a portion of this wheat was destined for the export market. About one-fourth of this flow moved to domestic markets.

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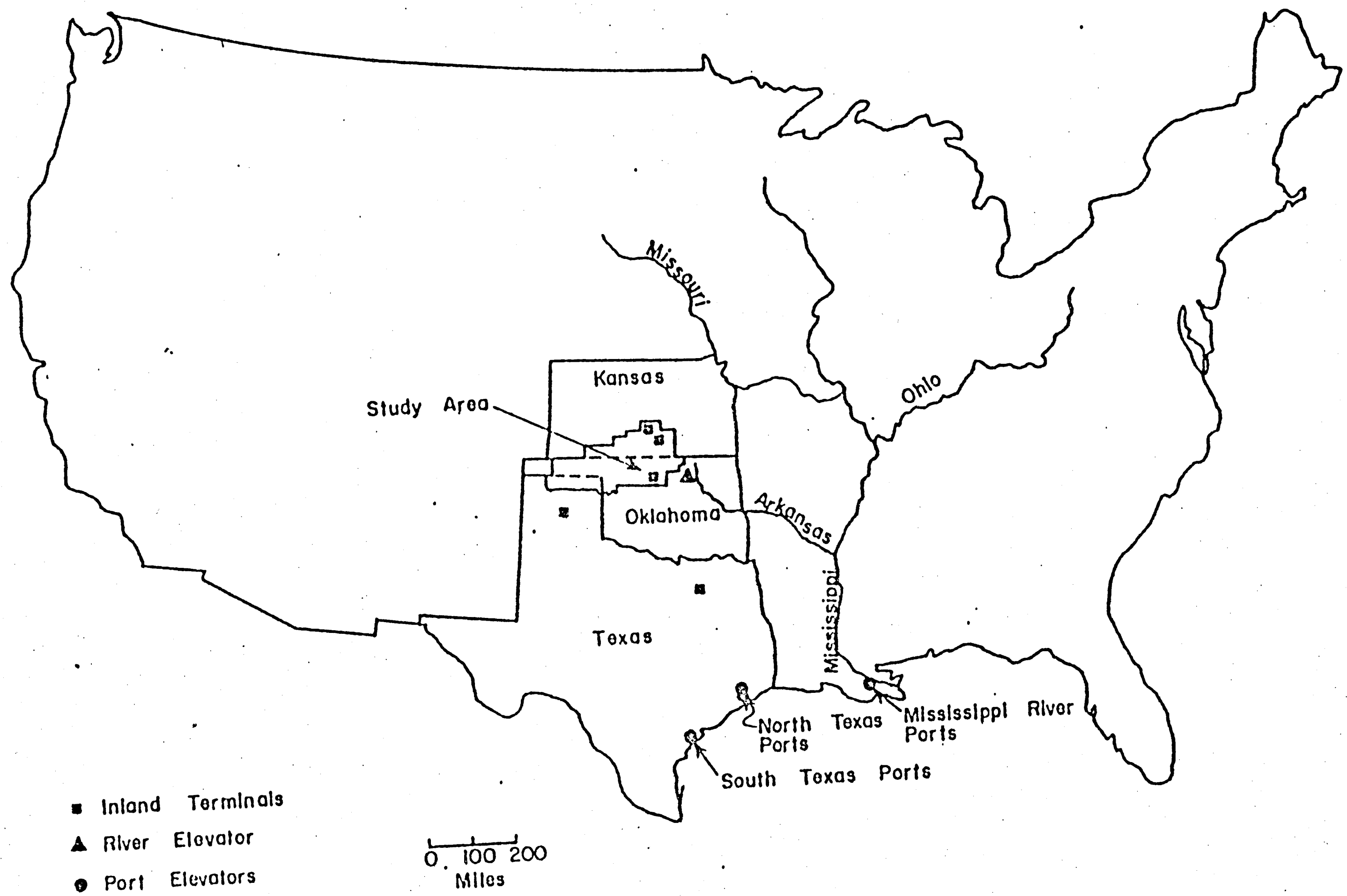

Figure 1. U.S. Outline Map of Study Area

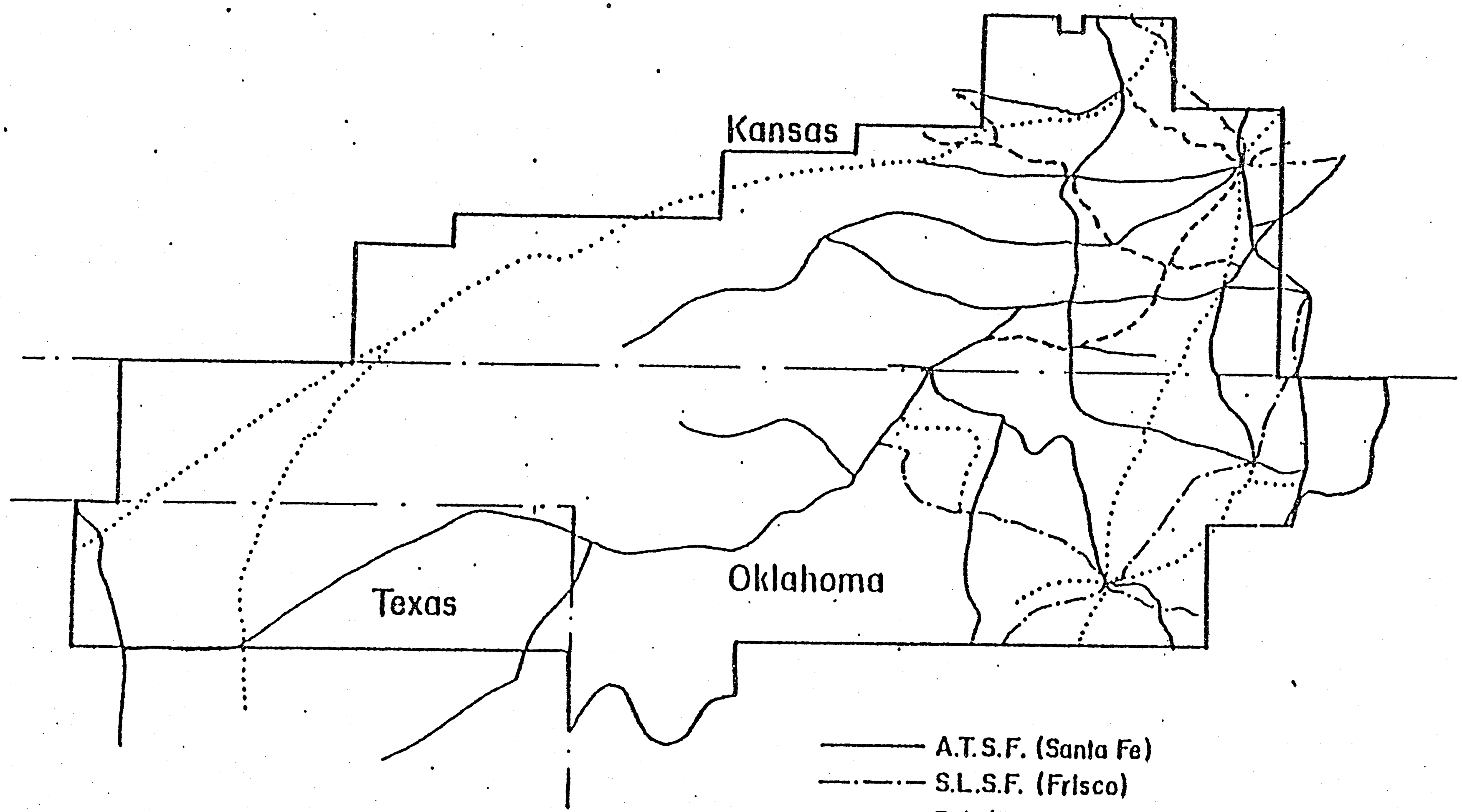

Figure 2. Study Region Rail System.

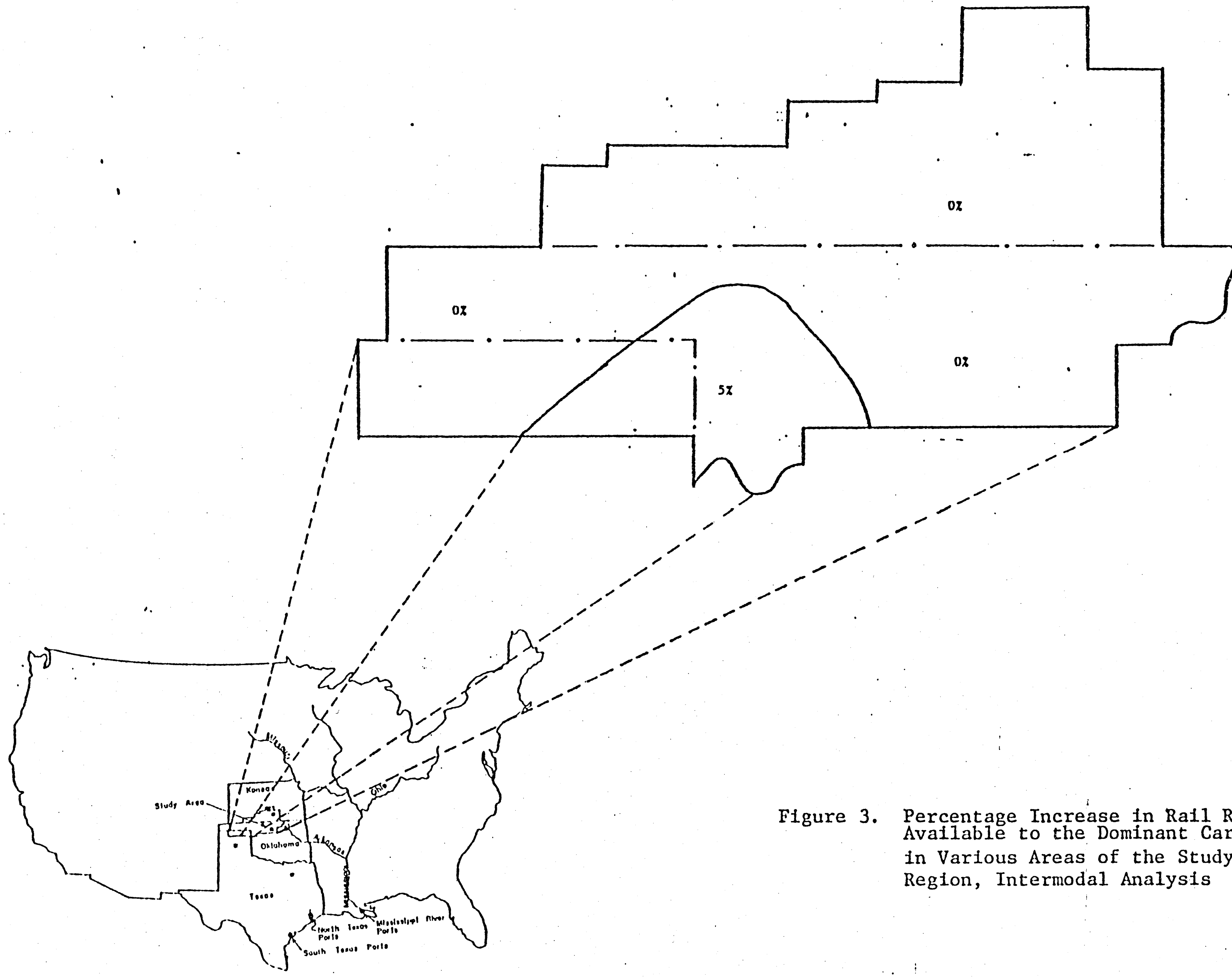

Figure 3. Percentage Increase in Rail Rates Available to the Dominant Carrier in Various Areas of the Study Region, Intermodal Analysis

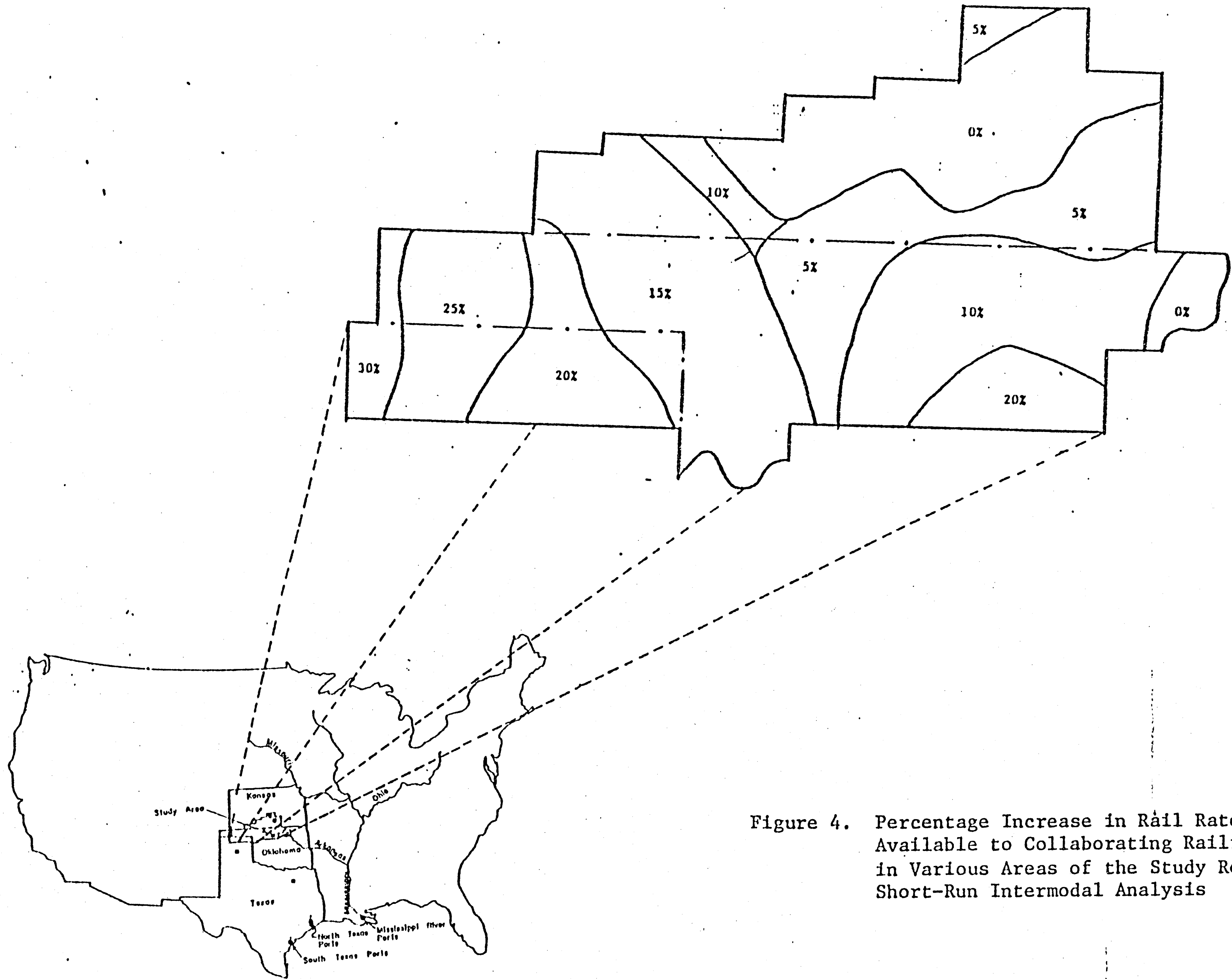

Figure 4. Percentage Increase in Rail Rates Available to Collaborating Railroads in Various Areas of the Study Region, Short-Run Intermodal Analysis

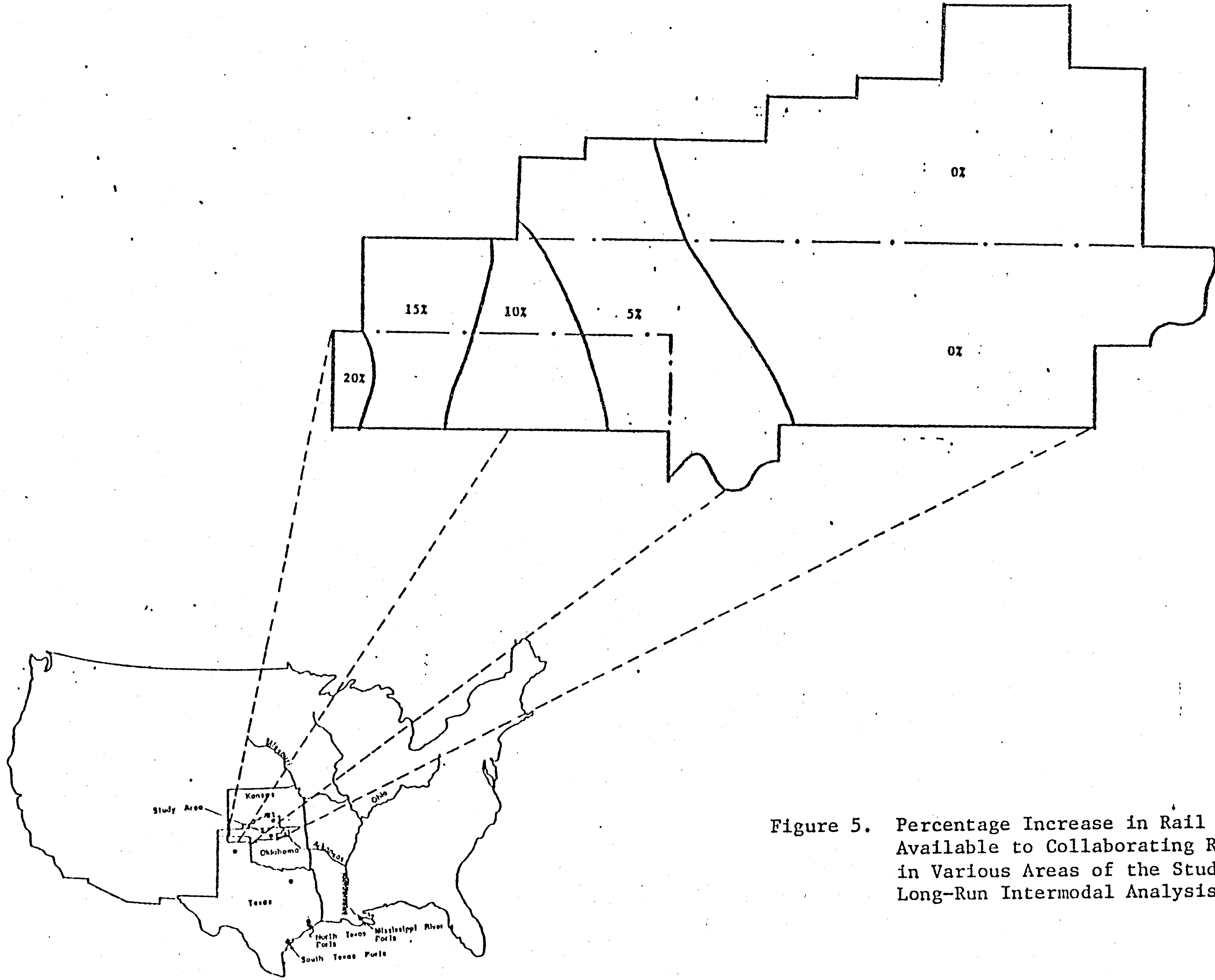

Figure 5. Percentage Increase in Rail Rates Available to Collaborating Railroads in Various Areas of the Study Region, Long-Run Intermodal Analysis