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Railroad Deregulation and Rail Rates: A Disaggregated Analysis

Mark L. Burton
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To the Graduate Council:

I am submitting herewith a dissertation written by Mark L. Burton entitled "Railroad Deregulation and Rail Rates: A Disaggregated Analysis." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

John W. Mayo, Major Professor

We have read this dissertation and recommend its acceptance:

David Mandy, Sidney Carroll, Pete Patton, Henry Herzog

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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RAILROAD DEREGULATION AND RAIL RATES:

A DISAGGREGATED ANALYSIS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Mark L. Burton

May 1991

This dissertation is dedicated to my father, H. P. Burton, my mother, Sally D. Burton, my brother, Dr. Newt Burton, and to the thousands of men and women who for over a hundred years made the St. Louis - San Francisco Railroad the finest railroad in America.

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ABSTRACT

This investigation first provides a highly disaggregated study of deregulated railroad rates for seventeen commodities. The results indicate that the Staggers Rail Act fundamentally altered the way in which rail carriers price their services. Rates now adhere more closely to incurred costs and exhibit a heightened sensitivity to the presence of both intermodal and intramodal competition. The model is then extended to accommodate the possibility of shipper responses to changed carrier behavior. The results of this extension suggest that shippers have responded eagerly to altered railroad behavior by changing the characteristics of their shipments. Together, the changes in railroad behavior and shipper responses to these changes have produced lower railroad rates for the movement of many commodities. At the same time, there is no evidence that rates for even a single commodity have been made higher by deregulation.

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CHAPTER I

INTRODUCTION AND MOTIVATION

It has been suggested that two focuses within economics contributed to the wave of federal deregulation evident in the 1970's and 1980's. Stigler's "Economic Theory of Regulation" (1971) caused a general reconsideration of the economic motivations and effects of regulation. At the same time, Baumol, Panzar, and Willig (1982) and a collection of other economists directed renewed attention to what Joe Bain has termed the "conditions of entry". Together, these advancements provided the academic motivation and the means for a re-examination of the presence of federal regulation in a number of industries.[1]

Within the broadly defined arena of transportation, there was movement toward the deregulation of all prevalent modes of both passenger and freight carriage in the 1970's. The first measure to afford any industry significant relief from rate regulation came in 1978 when the Civil Aeronautics Board was abolished and domestic airlines were allowed to freely select routes and fare structures. The reasoning which has emerged in defense of this deregulation has rested heavily on the belief that in the absence of sunk costs or other barriers to

[1]This is not to say that academics were the sole or even principal force behind the deregulation wave. Indeed, the Economic Theory of Regulation would suggest that shifting "political economy" determinants underlying varying interested groups were central to the deregulation movement. See Peltzman (1989).

entry, the simple threat of intramodal competition was sufficient to insure an economically efficient outcome.

The same reasoning has supported the decision to deregulate motor carriage. Sunk costs are viewed as negligible, so that the only barrier to the sort of hit and run entry prescribed by contestability was Interstate Commerce Commission regulation. Further, there was tangible evidence which suggested that both organized labor and the trucking industry opposed deregulation because of an awareness of its potentially competitive effects. Indeed, Stigler's work helped to motivate the Motor Carrier Act of 1980 just as Baumol's efforts have since served to justify it. This act brought nearly complete deregulation to the trucking industry.

Empirical investigations to determine the effects of these deregulation measures have been plentiful and, while there have been disappointments and surprises in both industries, deregulation has generally had its intended effect. There has been massive entry and exit in both industries.[2] At the same time, prices have fallen substantially without any evidence that either the availability or quality of service has been harmed.[3]

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[2]The president of the Sante Fe Railroad was quoted as saying, "Deregulated trucking means that anyone with a rebuilt Kenworth, a packet of road maps and a thermos of coffee can enter the industry."

[3]For a full discussion of the impacts of motor carrier deregulation see Winston, Corsi, Grim and Evans (1990).

The railroad industry, however, exhibits a structure which sharply contrasts those of the airline and trucking industries. The federal government neither owns nor directly maintains the infrastructure necessary to provide rail service. Rather, the tremendously large physical plant central to railroad operations remains in the hands of private firms who are responsible for its upkeep and who, for the most part, determine its use. The costs of constructing new rail lines are both large and largely unrecoverable, so that they constitute a formidable sunk cost. Hit and run entry by other railroads in response to economic profits is virtually impossible for this reason. If markets for rail transport are defined to exclude other possible modes of transport and if railroad trackage and facilities are not open to all potential users, there is no way these markets may be considered contestable.[4]

Accordingly, advocates of railroad deregulation did not rely on such arguments in their attempts to have rate making freedoms returned to rail carriers. Instead, proponents suggest that deregulation would affect the industry in three ways. First, it was hoped that a loosening of operational controls (particularly with respect to mergers and abandonments) would allow railroads to reduce costs and, at the same time, offer more attractive services. Secondly, new rate making freedoms would give the railroads the ability to adjust more quickly to new traffic opportunities. Lastly, it was argued that intermodal competition - competition from trucking and barge - would be sufficient to generate further cost

[4]For a full discussion of railroads and contestability, see Baumol and Baily (1984).

reducing measures and to insure that deregulated carriers would be unable to capture economic rents.[5]

At the time of these discussions, the rail industry was ailing so that concerns about the continued availability and adequacy of rail service, combined with an inherent suspicion of nationalization greatly enhanced the attractiveness of the deregulation perspective. The 1970's witnessed a number of legislative attempts to reform and reduce railroad regulation. These efforts were capped in 1980 by the Staggers Rail Act which effectively eliminated the regulation of railroad rates and significantly reduced all other rail regulation.

The impacts of deregulation on railroad operations and costs have been wide ranging and often pronounced, but most often these effects have been readily recognized and agreed upon. However, the manner in which deregulation may or may not have influenced rail rates, though central to all questions of future policy, has not been appropriately treated. The research presented here seeks to correct this inadequacy by employing the Interstate Commerce Commission's annual Carload Waybill Sample in a highly disaggregated analysis of railroad rates. It is only through such a comprehensive analysis that the full impact of Staggers on the consumers of rail services can be seen.

In those transport industries where sunk costs are low and rapid entry is often possible, deregulation has produced the predicted results, but can this

[5]It was widely believed that the railroad industry was a virtual paragon of X-inefficiency.

favorable conclusion be extended to include an industry where intermodal competition is the primary enforcement device? Has deregulation, as the railroads would contend, simply leveled the field, so that they may now compete effectively or does the improved financial health of America's railroads owe to an increased capacity to capture monopoly profits? If rates have fallen, have they fallen proportionately for all customers, or may some shippers have benefitted more than others? Do railroad rates more accurately reflect the costs of providing service or are more captive shippers now forced to pay a disproportionate share of common costs? These are the questions which must be addressed if policy makers are to reasonably treat the continued calls for re-regulation of some rail rates. This research approaches these question in the following way. Chapter II presents a regulatory history of the railroad industry and an analysis of the Staggers Rail Act. Chapter III summarizes the existing research describing the impacts of deregulation with particular emphasis on rate effects. Chapter IV provides a model of railroad pricing behavior which is refined for empirical estimation, so that any effects of deregulation or railroad rates may be detected. Empirical results are explained and discussed in Chapter V. In Chapter VI, the model is further refined to allow changes in shipper behavior as a response to carrier changes. Finally, Chapter VII integrates the results with findings from past studies in a discussion of future rail policy.

CHAPTER II

THE INSTITUTIONAL SETTING

The Interstate Commerce Act and Revisions

There is no consensus regarding the precise course of events which lead to the passage of the Interstate Commerce Act in 1887 or the formation of the Interstate Commerce Commission in 1889. There are, however, a number of prominent factors which somehow worked together to produce these measures. First, the agricultural community, feeling that unfair railroad pricing practices had contributed to declining real farm incomes, lobbied hard for both state and federal regulation of rail rates.[1] There is also the common view that rail carriers favored federal regulation as a means of curbing destructive competition.[2] However, Chandler (1977) suggests that, while there was a desire on the part of the carriers for federal intervention, the sort of regulation embodied in the Interstate Commerce Act was not at all what the carriers sought a decade earlier.

Prudent analysis suggests that there are elements of truth in each approach. In any case, the act to regulate commerce and to establish the Interstate Commerce Commission was passed into law in 1887. Table 2-1 summarizes the regulated activities and enforcement devices attributed to this legislation.

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[1]See Robertson (1964).

[2]See Gilligan, Marshall and Weingast (1989) for a discussion of this view point.

However, as noted by Fair and Guandolo (1979), the law was found lacking in early legal tests. While the original legislation made unfair rates illegal, a series of court decisions made it clear that the ICC did not have the power to impose either maximum or minimum rates. The Hepburn Act (1906) first gave the Commission explicit power to establish maximum "fair" rates. The power to establish minimum rates was conferred by the Transportation Act of 1920. The 1920 act marked a watershed in transportation policy. Prior to World War I, railroad regulation had been designed simply to constrain anti-competitive practices. The ICC only possessed power to fix maximum rates. Amendments to the ICA prior to 1920 garrisoned this power, but did not state or imply any broader concern for a stable transportation network. However, by the war's end motor carriage was coming to be seen as a truly viable alternative means of transport and it was reasonably clear that railroad expansion had peaked. The war had also made it clear that an extensive and stable national transportation network was central to the public interest. More and more transportation policy began to reflect this realization. While the 1920 act did place additional constraints on rail carriers, many of these constraints were designed to enhance stability within the industry.[3]

[3]Specifically, the law recognized that rates should guarantee a fair rate of return. Also, the act contained the sorts of provisions aimed at reducing destructive competition which had been desired by the carriers forty years earlier.

TABLE 2.1

THE INTERSTATE COMMERCE ACT REGULATION AND INFORCEMENT

Regulated Activity	*Enforcement Mechanisms*
Rates	Penalties, Liability, Fines
Discrimination	Inquiry Power
Prejudice	Complaints and Investigations
Long and Short Haul	Annual Report
Pooling	Published Tariffs
Tariffs	Uniform Accounts
Interchange, through rates	Cease and Desist Orders
	Subpoena Witnesses

Source: Fair and Guandolo, p. 26

Appendix I outlines the more prominent pieces of transportation legislation enacted between 1887 and 1970. The amendments to the original Interstate Commerce Act and other legislative measures largely reflect the intent to maintain a stable and adequate surface transportation network in the face of a rapidly changing transportation environment. However, it is unarguable that these additions had taken both the depth and scope of railroad regulation far beyond that envisioned by its original proponents.

The Regulatory Environment in 1970

By the end of the second world war, nearly every facet of railroad operation was strictly regulated. The ICC maintained full rate making power, the

power to approve or disapprove mergers, abandonments, and service discontinuance, the power to control car flows, prescribe safe operating procedures, and equipment standards. The Commission was able to confer trackage rights, control the use of joint facilities, and prescribe the rules of interchange. With the exception of a few measures designed to reduce the burdens imposed by passenger operations, these regulations remained unchanged until the decade of the '70's. The following paragraphs outline the scope of these regulations in each of the areas mentioned above.[4] Together, these regulations summed to form the institutional environment which existed in the ten years immediately prior to the passage of Staggers.[5]

Combinations and Control

In approving railroad acquisition, merger, or control of another railroad, the ICC was called upon to consider, (1) the effect upon adequate service to the public, (2) the effect upon the public interest of the inclusion, or failure to include other railroads in the territory, (3) the total fixed charges resulting unless the ICC

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[4]This list of regulated functions is by no means exclusive and is limited only to the ICC, the ICA, and its amendments. Other statutes and regulatory bodies maintained control of various aspects of railroad operation. For example, unlike any other industry (regulated or otherwise) the Federal Employers Liability Act (FELA) dictates carriers' responsibilities toward injured employees. Repeal of the FELA is the number three legislative objective of industry lobbyist, preceded only by the maintenance of Staggers and newly passed legislation providing for mandatory, random drug testing.

[5]This review of railroad regulation is substantially that of Fair and Guandolo pp. 49-59, edited and revised for readability.

finds that such increase would not be contrary to public interest, and (4) the interest of the carrier employees affected so that for a period of four years from the effective date of the authorization, the employees of the railroads involved will not be in a worse position with respect to their employment.

The regulatory attitude exuded by the ICC in the years prior to Staggers was as important as these statutory constraints in dissuading large scale consolidation. The Commission subscribed to a particularly broad definition of "public interest", so that any potentially detrimental effects to even the most peripherally affected party received Commission consideration. Therefore, prospective merger partners were forced to quell the concerns of innumerable groups as a part of the application process or face its almost certain refusal. A case in point is the Penn Central disaster. The research and formulation of merger plans of the New York Central and Pennsylvania Railroads took place in the middle 1960's. From that point forward, the proposed partners negotiated fervently with affected communities, shippers, competitors, and labor unions to gain the support necessary to secure Commission approval. This process produced a myriad of concessions to these parties and took years to accomplish. The prolonged nature of the approval process coupled with the forced concessions is routinely mentioned as a factor which contributed to the resulting Penn Central disaster.[6]

The Railroad Revitalization and Regulatory Reform (4R) Act amended

[6]For a full discussion of the Penn Central bankruptcy see Daughen (1971).

Section 5 and 5(2), giving the Secretary of Transportation broad authority regarding plans and proposals for railroad unification and coordination projects. The 1976 act called on the Secretary to make a comprehensive study of the possible restructuring of the railway system, to respond to and pass upon request of carriers regarding mergers or joint use of facilities and to conduct informal hearings on such and to report these to the ICC. The Commission still retains final authority for approval of all proposals and agreements, but prior to a recommended decision, the ICC must request the views of the Secretary of Transportation, the Secretary of Labor and the Attorney General. The same act prescribed detailed procedural and time requirements for disposing of railroad applications. The Regional Rail Reorganization (3R) Act grants authority to the ICC to direct a carrier to operate under certain conditions over the lines of another carrier and to adjust the compensation involved.

Section 5(15) of the Interstate Commerce Act (hereafter ICA) prohibited railroad control of any common carrier by water operating through the Panama Canal or of a water carrier elsewhere with which the railroad applicant might compete for traffic. Railroad acquisition or control of motor carriers under Part II of the ICA, according to Section 5(2) (b), was not permitted unless the ICC found that the result would be: (1) consistent with the public interest and will enable such carrier to use service by motor vehicle to public advantage and (2) the resulting operations would not unduly restrain competition. The ICC interpreted these conditions to mean that the motor freight operations of railroads

ordinarily should be auxiliary to and supplemental of rail operations. However, the Supreme Court ruled that the ICC might authorize operations not so restricted if warranted by facts showing public need.

Discontinuance and Abandonment

Among the four modes of regulated transport (air, water, rail, and motor carriage) only railroads own facilities other than terminals. Railroads could not abandon all or any portion of the way facilities operated, or discontinue service on any or all way facilities except after 60 days notice to the ICC and the Governor of each state involved, and after obtaining a certificate from the ICC to do so. As in the case of consolidations, the regulatory burden was strengthened by a perennial hesitancy on the part of the Commission to grant the certificates which allowed abandonments.

Exempt Traffic

All revenue traffic of railroads was subject to regulation until 1976 when Congress passed the 4R Act, providing in Section 207 that the ICC, after notice and hearing and for a specified period could exempt transactions and services that meet certain conditions. These conditions were that transactions be limited in scope, and that the regulation of these transctions placed an undue burden on persons or classes of persons or on interstate or foreign commerce and were not necessary to effectuate the nation's transportation policy. By the time the 4R Act

was passed, the disposition of the ICC had changed sufficiently to allow wide spread use of the rule for exemption.

Interchange of Traffic

Railroads were (and are) required to afford all reasonable, proper and equal facilities for interchange with other railroads and with water carriers subject to Part III of the ICA.

Joint Use of Terminals

The ICC could order a railroad to permit a second railroad to share in the use of terminal facilities including main line track for a reasonable distance outside of such terminal if it is found, (1) to be in the public interest, (2) to be practicable, (3) and not to substantially impair the ability of the owning railroad to handle its own business.

If the carriers cannot agree on terms of the necessary agreement, the ICC could prescribe reasonable terms.

Rate Regulation

Prior to deregulation in 1980, the basic elements of rate regulation were common to all regulated transportation. These included requirements that rates be just and reasonable, not be discriminatory or give undue preference or advantage to any shipper. Lawful rates were to be published in tariffs and approved by the appropriate administrative agency. Joint rates between two or more carriers were also to be approved.

The 4R Act of 1976 prescribed criteria for the ICC to use in passing upon rail rates as distinct from other carriers. These applied to calculations of costs and valuation factors and to consideration of competitive conditions. Specifics were given in regard to charges in single and joint rates and the bases and terms for suspension of proposed rates. Time limits and procedures were included. These specifics were not applicable by law to other transport modes.

There were a number of other features which pertained only to railroad regulation, and not to the other modes under the ICC, CAB or FMC.

1. *Aggregate of Intermediates*. Railroads and water carriers were not allowed to charge a through rate which was greater than the aggregate of intermediate rates. Motor carriers were never subject to this restriction.

2. *Intrastate Rates*. With respect to intrastate railroad rates, the ICC could, after full hearing, find that a rate, fare, charge or classification caused undue or unreasonable advantage preference or prejudice with respect to competitive interstate traffic or that such rates or practices place an undue burden on interstate commerce or discriminated against foreign commerce. If such a finding was made, the ICC could forbid use of such rates or practices and could prescribe the rate or the maximum and minimum rates to be charged.

3. *Long and Short Haul Rates*. The Fourth Section of the ICA prohibited railroads under Part I and water carriers under Part III from charging more for a shorter than for a longer distance on a given route and in the same direction.

Under certain conditions, the ICC could give "Fourth Section Relief" if the

charge to the more distant point was compensatory. But such relief to railroads was restricted. Water competition in the more distant movement used to support application for relief must have actually existed and not have been just potential. Furthermore, rate reduction to meet such water competition could not be subsequently set aside and rates raised without specific permission of the ICC.

4. *Through Rates and Joint Rates.* Railroads were required as a duty to establish through routes and joint rates and charges with other common carriers by water and rail. Where one of the parties to a through route was a water carrier, the ICC prescribed such reasonable differentials with respect to such rates, and the all rail rate for the route, as it found justified. A railroad could not be required, in establishing a through route, to embrace in such a route substantially less than its entire line, including lines it controlled or managed, unless it was unreasonably long compared to another practical through route, or the ICC found that the proposed through route was needed to provide adequate, more efficient and more economic transportation. But subject to public interest, the ICC was required to give reasonable preference to the originating carrier and no through route could be established to help meet financial needs of a given carrier.

The authority of the ICC to prescribe the division of joint rates incident to the establishment of through routes and rates was complete and comparable in all three parts of the Act except that in respect to rail and water common carriers, the ICC in deterring the division among rail carriers in a rail route or water carriers in a water route could consider, (1) efficiency, (2) revenue required to pay

respective operating expenses including taxes, (3) a fair rate of return and (4) relative importance of the services of the respective carriers in the public.

Routing by Shipper

If two or more through routes were available, railroads under Part I were required to strictly observe the choice of route made by a shipper if given in writing at time of delivery to the carrier. All railroads in the route were equally bound to observe this choice.

The Staggers Act

President Jimmy Carter signed the 1980 Staggers Rail into law on October 14, 1980. As pointed out in an early release by the Association of American Railroads, the Act did not provide "wholesale deregulation," but it did substantially reduce the amount of rate regulation in particular. *Railway Age* provides the following summary of the rate provisions.[7]

Rate Regulation

Nearly two-thirds of rail rates (based on 1980 traffic levels) were freed from any form of ICC regulation. Under Staggers, the ICC can prescribe maximum rates where railroads have market dominance, but it is the burden of the shipper to demonstrate that this is the case. Further, market dominance is not

[7]See Railway Age, January 26, 1981, pp. 56-73.

defined by market share or other like measure. Rather, a carrier may be judged to be dominant only if the rates it charges are deemed excessive. Initially, the ICC could investigate rates only if the shipper could demonstrate that the rates exceed variable costs by at least 160%. This threshold was increased to 180% in 1984.

For the first four years, all rate increases attributable to increases in the rail cost index (up to 6% per year, but not to exceeded a total of 18%) were automatically exempt from ICC control. After 1985, such increase have been limited to 4% per year and are reserved primarily for carriers with financial problems.

Any rate reduction by which the resulting rate exceeds average variable costs is automatically exempt from ICC control. As noted by Boyer (1987), the exemption of rate reductions had been the trend since the middle seventies. However, this provision once and for all removed rate decreases from bureaucratic control.

General rate increases were limited to joint rates until 1984, then eliminated entirely. Even for the years 1981 - 1984, general increases could not exceed the level of inflation.

Rate bureaus were no longer allowed to discuss or vote on single line rates and discussion or voting on joint rates was limited to carriers which could reasonably participate in the haul. Beginning in 1984, this provision was made even stronger. Now, discussion of joint rates must be limited to the carriers

forming a particular route. This provision clearly reduced carriers' ability to legally collude in the fixing of rates.

Contract rates, which the ICC had gradually come to embrace, were made, in all cases, legal.

The time frame for the suspension and investigation of a rate was reduced. In order to get a suspension, a shipper must demonstrate likelihood that it will win on the merits of its case, that it will suffer substantial injury though application of the rate, and that a refund would not be adequate protection.

These provisions confer tremendous latitude to carriers in the setting of rates. However, the restrictions on rate bureau activities, the abandonment of general rate increases, and the full freedom to confidentially contract all serve to encourage adherence to costs and heighten competition among carriers.

Car Service

On matters related to car service, ICC orders are restricted to emergency situations with national or regional importance. At the same time, the commission's powers to require joint use of terminals during emergencies were increased. The legislation also provides that premium charges may be levied for special services to improve car utilization. It eliminates incentive per diem and it authorizes shippers to try to reach agreement among themselves on private-car compensation and then to negotiate with the carriers. The ICC serves only as a court of last resort.

Additional Provisions

In addition to these provisions, the law contained measures which substantially expedited merger and abandonment procedures. It also gave added support to efforts to spin off to smaller carriers (either public or private) lines which were previously targeted for abandonment. Staggers extended the support to Conrail which was originated by the 3R and 4R Acts and finally, in what *Railway Age* calls the most controversial provisions, the 1980 act made provision for the entrance of the Union Pacific and Chicago & Northwestern into the Powder River Basin of Wyoming by authorizing the construction of new rail line and by ordering trackage rights over the Burlington Northern.

A comparison of the regulatory changes under Staggers to the regulatory framework already in place in 1980 reveals that the railroad industry is still under substantial statutory control. However, as mentioned above, the legislation signaled a marked change in Congressional mandate. It is important to realize that the 1980 Rail Act not only loosened the degree of specific control, it also profoundly affected the way in which the Interstate Commerce Commission interprets and enforces remaining regulation.

CHAPTER III

LITERATURE REVIEW

Railroad Pricing Under Deregulation

To date, there have been five efforts to forward any sort of comprehensive evaluation of the effects of deregulation on all rail rates. These include the works of Grimm and Smith (1986), Boyer (1987), Barnekov and Kleit (1988), McFarland (1989), and Winston, Corsi, Grim, and Evans (1990). The earliest of these works summarizes a shipper survey conducted in the years immediately following deregulation. Boyer, Barnekov and Kleit, and McFarland each present an aggregate econometric analysis of post-Staggers rates. Only the newly published work of Winston et al offers the sort of broad ranging, more highly disaggregated analysis of deregulated rail rates which is necessary to answer the questions of policy alluded to in the introduction of this work.

The results of Grimm and Smith's Shipper survey were interesting and shipper satisfaction should not be ignored, but the fact that a majority of shippers feel that rail rates and rail service has improved does not provide the sort of conclusive evidence needed to underpin future transportation policy. Further their survey was biased in that they only contacted large volume shippers, so that the results of this research are even more limited than they appear.

The three aggregated studies offer much greater precision and do begin to answer some policy questions. Unfortunately, there is no consensus among these

authors as to the impact of deregulation on rail rates. More importantly, the high level of aggregation obscures much of the information needed to treat the perennial cries for reregulation of selected rail rates. In each case, *average annual* rail rates are the dependent variable, so that no distinction is made between commodities or regions.

Boyer concludes that the decline evident in rates in the years since Staggers is the result of improved technology and that deregulation has been largely innocuous in its effects. Because this study was the first to offer an econometric analysis of the effects of deregulation on rates, it has received considerable attention. Subsequent works (aggregate and disaggregate alike) have confirmed the important contribution of improved factor productivity to lower rail rates. However, the conclusion that Staggers has not affected rates certainly has found no consensus and is openly disputed by many of the later studies cited above. Again, the aggregated nature of the Boyer study may account for this controversy. While improved utilization of technology may predict lower rates for some commodities, the results offered below suggest that carrier response to deregulation has been the driving force behind lowered rates for the movement of other goods. This sort of intercommodity variation disappears when millions of individual movements are averaged into seventeen observations.

McFarland's efforts and those of Barnekov and Kleit closely parallel that of Boyer, but the results are substantially different. Barnekov and Kleit determined that rates are lower as a result of deregulation. McFarland's conclusion is that rail

rates are unchanged, but that there have been significant service improvements attributable to Staggers, so that in a hedonic sense shippers have benefitted by getting more product for the same price.

Winston et al use data from the deregulated era to construct counter-factual rate deflators for a wide range of commodities. The authors conclude that rates for some commodities have declined due to deregulation, while other rates have been increased.[1] When the dollar values of these changes are aggregated, the conclusion is that the total expenditure on rail shipment has been made slightly higher than it would have been in the absence of deregulation. The authors admit however that this final conclusion is the conservative case estimate and that their conclusion is violated if assumptions regarding shipper response to rate changes are relaxed.

In addition to the broad based studies outlined above, there have been some works which thoroughly analyze the impact of Staggers on rates for a few particular commodities. Robert J. Hauser (1987) uses data from 1978-1983 to look at the impact of deregulation on rail rates for export grain across seven regions of the U.S. Hauser finds that deregulation has significantly reduced these rates, but that the degree of both intramodal and intermodal competition is still important in determining rate levels. There are two weaknesses in this work.

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[1]Because the authors do not report the results, it is not possible to determine estimated rate changes for the full range of commodities. However, it is noted that rates for grain appear to have been lowered by Staggers while rates for the movement of coal appear to be higher.

First, the six year period of investigation is regrettably short, particularly given the volatility of export grain markets during this period. More importantly, Hauser based his analysis on "rates collected from public rate tariffs, rate books of region grain cooperatives and rate books of grain exchanges." There is strong evidence to suggest that the majority of shipments do not move under published rates.

James MacDonald (1987, 1989) also has analyzed the impact of deregulation on railroad rates for export grains. He does not conduct an explicit regional analysis, but because he distinguish between corn, soybeans, and wheat, some region conclusions may be drawn. MacDonald, like Huaser, finds that competition from other railroads and from water transport significantly affects rail rates. The 1987 study utilizes data from 1983 only and, thereby, shares the first weakness cited in the Hauser work. However, in both studies, MacDonald uses data from the ICC's annual Carload Waybill Sample, so that his results more accurately reflect the actual rates under which shipments moved.[2]

In their analysis of coal transport rates, Garrod and Miklius (1987) use a method quite different from that of MacDonald or Hauser. They use mine mouth rates and delivered rates as reported to the federal government to reconstruct the actual rates for coal shipments to public utilities. By this method, they avoid many of the problems which contract rates pose for users of other data sources. They

[2]Given the prominence of grain as a fraction of total rail traffic the findings of MacDonald represent an important contribution to overall efforts to analyze the behavior of deregulated rates. Further, MacDonald (1987) demonstrates and Winston (1990) confirms that the data contained in the carload waybill sample are not significantly biased by the existence of contract rates.

use the methodology of Zimmerman (1979) to determine whether or not carriers of western, low sulfur coal are attempting to capture the maximum available economic rents. Garrod and Miklius conclude that railroads were not constrained by the potential use of alternative fuels, but were limited in their pricing by the availability of coal from other geographic locations, so that they apparently captured less than twenty percent of available profits. The chief weakness in this effort is that it employs rates from one point in time only. Furthermore, the date selected was July 1, 1983. This date falls within a period when electricity usages had undergone a record decline, so that there is, at least, the possibility that the railroads' unwillingness to try to capture rents may have only reflected the softness in the market for coal.

Quality of Service

Two of the studies outlined above give considerable attention to the improvements in rail service. As mentioned, McFarland concludes that shipper welfare has improved under Staggers even though he detected no statistically significant decline in aggregates. The basis of this conclusion is improved quality of service. Winston, Corsi, Grim and Evans further substantiate this conclusion by offering an estimation of the welfare gain to shippers which has resulted from faster, more predictable service. The authors conclude that rail transit times have improved by over thirty percent in the years since Staggers and that the improvements in the variability of these times is even greater. They estimate that

this has resulted in a $4.69 billion gain in welfare for shippers. It is worth noting, however, that the authors conclude this gain and the increased profits of carriers merely represent a transfer of welfare from rail labor and do not, therefore, represent any real economic gain.

Regulation During Transition

There have been two works which address the difficult regulatory issues which remain in Staggers' wake. Both of these focus on the position of "captive shippers". Staggers provides regulatory support for such shippers if they can demonstrate that railroads are charging excessive rates. In a 1986 working paper Ann Friedlaender uses simulation analysis to investigate whether the "cost-ceiling" approach for residual regulation is more or less efficient than some form of Ramsey pricing. She concludes that in nearly all cases, the cost-ceiling approach as implemented is allowing railroads to extract rents from captive shippers which are in excess of what might be necessary for the carriers to earn a normal profit. Further, by examining the movement of average rail rates for the movement of manufactured commodities, she asserts that the railroads are using profits from captive shippers to compensate for losses from pricing below costs in "competitive" markets.

Merrill Roberts (1987) evaluated the ICC method of rail costing as it applies to the 180 percent rule. This discussion centers on the technical aspects of this costing model, but the paper does provide a solid overview of the pitfalls

inherent in any rail costing model. One of his more interesting assertions is that railroad capital was significantly over-valued under regulation, causing railroad returns to appear lower than they really were.

Non-Price Behavior

Two very interesting efforts have been published discussing the problem of vertical foreclosure in the regulation of railroads. Henry McFarland (1987) provides a compelling theoretical argument. He concludes that carrier aversion to interchange evidenced since deregulation is generally not anti-competitive and, more often than not, represents attempts to avoid unnecessary costs. However, Grimm and Harris (1988) contend that unwillingness to interchange traffic is not the only form of vertical foreclosure practiced by railroad who have some degree of monopoly power over shippers. They contend that such railroads may compel the shippers to short-haul rival railroads with threats of poorer service over the portion of the route which the monopoly carrier controls. Grimm and Harris use a route choice model to provide empirical evidence for their case. Their estimations employ pre-Staggers data to determine the frequency in which shippers choose a single line routing when a multi-line would offer better (non-price) service. They indeed find that some shippers tend to behave less than optimally by choosing less desirable routings to maintain single line service. Further, they find this propensity increases as the monopoly share of the routing increases. Finally they assert that if this sort of vertical foreclosure was present

prior to deregulation, it must be even more pronounced in its wake. There are several characteristics of this work which may be troubling to some, not the least of which is their exclusion of differential rates from the analysis. Also, evidence suggests that the shippers for whom quality of service is most important are exactly the same shippers who could most easily be lost to alternative modes of transportation, so that one must wonder why these shippers would endure this manipulation.

Abandonments and Regional Railroads

John Due (1987) offers a thoroughly detailed chronology of the resurgence of regional and local railroads as an alternative to branch-line abandonments. However, this work contains very little analysis. In particular, Due does not mention the strong regional patterns evident in the characteristics of newer carriers nor does he consider the implications of these variations for the survival of these lines.

Survey Literature

Nancy Rose (1987) has assembled a well crafted survey of current literature describing the effects of surface freight deregulation. It is valuable not only because of its literature summaries, but also because of its concise description of the current regulatory debate.

Finally, Clifford Winston (1985) provides a thorough evaluative survey of transportation economics. This work does not explicitly treat railroad deregulation, but it does provide a comprehensive view of the techniques and issues evident in all transportation research.

CHAPTER IV

MODEL, DATA, AND ESTIMATION

This chapter develops a model of railroad pricing behavior which borrows heavily from existing models of railroad costs and the demand for railroad services. These elements are then combined and refined to produce a reduced form equation suitable for statistical estimation. Next, there is a full description of the data available from the ICC's annual Carload Waybill Sample and a delineation of the means by which this data was assembled with other available information to form the final data set. Finally, this chapter outlines the econometric technique which combined the theoretical with the observed to estimate the impacts of deregulation on railroad rates.

The Theoretical Model

First, it is assumed that rail carriers acted to maximize firm profits throughout the period of this research. Because the Interstate Commerce Commission had the ability to alter, delay or fully reject any application for rate changes, some have found this assumption to be unacceptable (see MacDonald, 1989a). However, there are four precepts which justify its use here. First, as Boyer (1987) notes, most applications for rate decreases were exempt from ICC ruling, so that rates were substantially free to move downward throughout the period under investigation. Secondly, applications for rate increases were

routinely granted without alteration, albeit in a sometimes less that timely manner. It is important to realize that rate regulation was originally instituted to insure that rates were representative of incurred costs and that rail carriers did not earn excessive profits. Railroad earnings had been chronically low for two decades prior to the passage of Staggers, so there was no need to suppress rates. Next, there is no a priori reason to assume that even the most constrained firm will not *attempt* to earn the most money possible. Indeed, the regulation literature is replete with scenarios which depict rate of return regulated firms engaging in various practices intended to maximize profits. Finally, the empirical specification to be presented at the end of this chapter allows for the confirmation or refutation of this assumption. The variables emerging from the profit maximizing model are substantially the same as those generated by other models of firm behavior. Therefore, the parameter estimates provide a means to test the assumption.

Considering first individual firm demand for freight transportation, it is likely that such demand functions are largely discontinuous, particularly in the short run. It is improbable that a potential shipper will vary either the quantity to be shipped or the distance of the movement in response to a change in rail price. Instead, the shipper will continue to purchase the same amount of rail transportation (measured in ton-miles) until price has climbed to some reservation rate sufficiently high to induce the shipper to switch to a different rail carrier, a different transport mode, or to abandon the shipment altogether.

Given this situation, the profit maximizing rail carrier, *if it possessed perfect information*, would engage in first degree price discrimination, setting the rate for each shipment marginally below that rate which would cause the shipper to abandon the railroad's services. However, in reality railroads do not possess the degree of information necessary to engage in such practices. Rather, carriers distinguish between the demands of different groups of shippers by observing important characteristics. These various groups of customers are defined by two primary considerations - the availability of rail and non-rail transport substitutes as defined by geographic characteristics and the characteristics of the shipped commodity. Finally, while individual demands for transportation services may be discontinuous, collections of shippers grouped by discernably different demand elasticities exhibit demand functions which are largely continuous.

Ann Friedlaender and Richard Spady (1981) observe:

> In analyzing the demand for freight transportation it is important to realize that it is used as a factor of production. Consequently the specified demand function should be able to be related to the underlying cost and production functions...

Therefore, the characteristics of a down stream production process and the characteristics of the commodity shipped to facilitate this process work together to determine of the demand for the transport of that particular commodity. The demand for the transport of commodities which are bulky or which are less essential to down stream production will be more responsive to price changes than will the transport demand for a highly valued non-bulk commodity. And again, these are characteristics which are easily observed by rail carriers.

While the commodity characteristics are the primary determinant of the appropriateness of transport alternatives, geographic considerations often dictate the availability and pricing of rail and non-rail transportation alternatives. With regard to possible water transport, certain regions of the country are favored with an abundance of navigable water ways, while other regions have none. Motor carriage is ubiquitous, but, the fact that trucking costs (and the resulting prices) escalate sharply with increased distances makes this mode of transport prohibitively expensive for origin destination pairs which are remote.

Friedlaender and Spady's work, as well as that of Richard Levin (1981) spans only a short time period, so that cyclical variations in transportation demand were given only passing consideration. However, this study spans a significantly longer period of time so tha it must be assumed that changes in the level of aggregate economic activity might also affect the demand for transportation by affecting the demand for final goods. This possibility is given consideration here.

Based on the above discussion, the demand for transportation services is specified as:

$$(4.1) \qquad Q = f(P, \mathbf{M}, \mathbf{K}, A)$$

where Q is the quantity of railroad services (measured in ton-miles) that is demanded by some catagory of shipper in a given time period. P represents the own price of rail service. **M** is a vector of variables describing the availability and relative prices of rail and non-rail transportation alternatives. **K** is a set of

commodity characteristics such as weight to value, perishability, etc. And A is some aggregate measure of overall economic activity. There is no theoretical reason to assume a specific functional form for this demand equation. It is simply assumed for the purposes of further analysis that this function is well behaved and exhibits those properties typically associated with market demand functions.

The cost of providing railroad services to the various groups of customers is given by:

$$C = g[f(P, \mathbf{M}, \mathbf{K}, A), \mathbf{S}, \mathbf{R}, \mathbf{F}] \qquad (2)$$

Here, C represents the total cost (in dollars) of producing some quantity of rail services for a specific catagory of shipper. P, **M**, **K**, and A retain their above definitions. **S** is a vector of shipment characteristics including weight, distance, number of loads, special equipment requirements, etc. **R** represents a set of route characteristics such as the number of line interchanges and the overall density of traffic along the route. Finally, **F** denotes factor prices and productivity.

The consideration of traffic density introduces a confounding situation in the analysis of individual or grouped rail costs. Railroads provide a number of distinct products represented by the transportation of different commodities between various origins and destinations. However, most fixed facilities (including right of way) are important to the provision of many if not all of these services

and, therefore, present large common costs which are not easily apportioned among the different products (shipments) which the railroad sells.

The initially high average fixed costs associated with railroad trackage and terminal facilities decline rapidly as the number of trains using them increases. This is typically referred to as "Economies of Density". These economies cause the average cost of providing one product to decline as the carrier sells more of that product, but these costs also decline if the carrier sells different products which require use of the same trackage or facilities. If rail prices were set simultaneously, the quantity of each product sold would affect the costs of all shipments and their consequent prices by affecting the overall traffic density. This renders all rail pricing decisions interdependent so that the optimal vector of prices can be obtained only by solving a simultaneous system, containing an equation for each of the services which the railroad provides.

Fortunately, the verities associated with actual rail pricing suggest that simultaneity, far from being a necessary component of any model, is inappropriate. Available anecdotal information suggest that traffic density is important in rail pricing decisions, but that this density is considered as exogenous when individual rate decisions are made. Theoretically, each pricing decision in period "t" has the capacity of affecting the costs and prices of all other services provided in this period. However, the tremendous variety of shipments over tens of thousands of potential routes which converge and diverge over various route segments makes explicit consideration of these interdependencies by the carriers as they set prices

impossible. Therefore, this research mirrors actual carrier behavior by assuming that traffic density is exogenously determined by the level of traffic in period "t-l". Further, the impact of pricing in period "t" on future traffic density is ignored. That is to say that carriers attempt no sort of intertemporal optimization.

Factor prices and productivity are present as an argument in equation (4.2). However, the reader will note that the empirical model considered below includes only those variables which determine the quantity of factor use. It does not take explicit account of factor prices or factor productivity. From a cross-sectional vantage, this is immediately defendable. Neither factor prices nor their productivity vary substantially across commodities or regions in any given time period. There are several reasons this is true. Throughout the period of this investigation labor represented the largest of all variable costs. Also during this period, carriers continued to band together and negotiate all labor contracts on a national basis, so that union wages and labor requirements are invariant across carriers.[1] The second largest expenditure was on diesel fuel. While there may have been cross sectional variations in fuel prices, there is little reason to believe that these variations were pronounced or in any way systemic across regions. Further, the very prominence of diesel makes it less likely that fuel sellers could successfully engage in any form of price discrimination.[2] Finally, any examination

[1]For example in 1982, labor costs represented over sixty percent of all operating expenditures on the Burlington Northern.

[2]Bradburd (1982) demonstrates that all else being equal, it is more difficult for a seller to extract monopoly profits when the commodity represents a significant

of locomotive fleet records will reveal that there are only marginal cross sectional variations in the level of fuel efficiency for any time period.

The intertemporal aspects of factor prices and productivity are a bit more troublesome. Both Boyer (1987) and McFarland (1989) attribute continually falling rail prices to improvements in technology and factor productivity. Virtually all information indicates that the capital in place on Class I railroads in 1987 was significantly more fuel efficient and less labor intensive than was the physical plant of 1973. Boyer makes no explicit notice of factor prices in his analysis of aggregate rail rates. He does, however, use average train length as a proxy for technological improvement. McFarland, on the other hand, accounts for factor prices by use of a factor price index. However, his work does not directly include a measure of technological progress. Both of these studies include a trend measure as a general means of considering changes in factor productivity and factor pricing. This is the approach which is adopted here. The empirical estimation includes a trend variable to reflect intertemporal changes in factor productivity and prices

Combining equations (4.1) and (4.2) generates the profit function:

$$(4.3) \quad \pi = f(P, \mathbf{M}, \mathbf{K}, A)^{*}P - g[f(P, \mathbf{M}, \mathbf{K}, A), \mathbf{S}, \mathbf{R}, \mathbf{F}]$$

This function represents the profits obtainable by the sale of transportation services to distinct groups of customers which are again defined by the commodity

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portion of the buyers input expenditures.

characteristics and by the origin and destination of the shipment. The revenues generated from sales to each group are obviously independent and, because the impact of current sales on traffic density must be ignored, carriers behave as if the costs associated with each class of movement are also independent. Thus to maximize total firm profits, the carrier need only maximize equation (4.3) for each group of customers.

Again, there is nothing to suggest that equation (4.3) might exhibit any perverse qualities, so it is assumed to be at least twice and continuously differentiable and strictly concave. These assumptions combined with the implicit function theorem allow for differentiation and solution for an own price, P, which by concavity is guaranteed to represent the profit maximizing price, P^*, where:

$$P^* = h(\mathbf{M}, \mathbf{K}, A, \mathbf{S}, \mathbf{R}, \mathbf{F}) \qquad (4.4)$$

It is this equation which forms the basis for the empirical estimation designed to evaluate the rate impact of the Staggers Rail Act.

The Data

The principal data source for the estimation of equation (4.4) was the Interstate Commerce Commissions annual Carload Waybill Sample (CWS) for the years 1973 through 1987 excluding 1975.[3] The CWS is a one percent stratified

[3]ALK Associates, the firm which handles the distribution of the Carload Waybill sample is unable to produce a public use tape for 1975.

sample of all rail movements within the United States. Full documentation for this sample is available in Appendix II. As noted earlier, rail carriers are assumed to set prices for like sets of customers based on commodity characteristics and origin - destination pair. The expanded records were, therefore, aggregated by commodity, quarter, and origin - destination to accommodate this assumption. This formulation yields a pooled cross section and time series data set where the shipments of a particular commodity are represented cross sectionally by a variety of origin - destination pairs which are then pooled to form the quarterly time series.

The origin and destination information on the public use sample is given by state to preserve carrier and shipper confidentiality, so that for each commodity in each quarter, there are a possible 2,304 observations. Note this construction allows shipments from origin "i" to destination "j" to be considered separately from shipments originating in "j" and terminating in "i". Still, the geographic aggregation of this portion of the data mandates only very general analysis of the regional impact of deregulation.

Confidentiality also restricts the level of commodity disaggregation. The sample contains commodity descriptions for all shipments at the two digit Standard Transportation Commodity Code (STCC) level. STCC definitions are given in Table 4.1. Many of the records contain much more specific commodity information (up to a five digit level), but confidentiality concerns prohibit this additional information from being made available for all shipments. This loss of

information appears inconsequential for some commodity groups, but for others it is much more troublesome. For example STCC number 10 indicates non-metallic ores, a commodity for which more specific information would be of only limited use. However STCC number 37 indicates transportation equipment and contains records for the movement of everything from bicycles to space shuttle components. The reader is, therefore, advised to be mindful of these definitions when examining the empirical results.

TABLE 4.1

STANDARD TRANSPORTATION COMMODITY CODES

STCC	*Commodity*
10	Metallic Ores
11	Coal
14	Non-Metallic Ores
20	Food and Kindred Products
24	Lumber
25	Furniture and Fixtures
26	Pulp, Paper and Paper Products
28	Chemicals
29	Petroleum and Coal Products
30	Rubber and Plastic Products
32	Clay, Concrete, Glass and Stone (CCGS)
33	Primary Metal Products
34	Fabricated Metal Products
35	Machinery
36	Electrical Equipment
37	Transportation Equipment
40	Waste or Scrap Material

Again, the CWS data are aggregated by commodity, origin - destination, and quarter, so that the value of a particular variable in an observation represents a mean figure. For example in a sample observation, the variable MNINT might represent the mean number of line interchanges for the shipment of some commodity, perhaps lumber, between some origin and destination pair, say Alabama and Oklahoma, in some quarter and in some year such as the fourth quarter of 1978.

The format of the origin - destination information in the CWS was changed in 1986. For 1986 and 1987 this information is given by BEA area of which there are approximately two hundred. Unfortunately, confidentiality and the more specific nature of this information necessitated the elimination of origin - destination information altogether for some records. For some STCC's all records were complete, for others as many as forty percent contained deficient information. Even for those commodities where a significant portion of the records did not contain the necessary origin - destination information, an attempt was made to salvage and use those records which did contain this information. For each commodity where a problem existed the mean values of both the dependent and all independent variables were calculated for the group of records which did contain the origin - destination information. Next, similar means were calculated for those observations with the missing data. If these two means were statistically different for even one of the variables, the 1986 and 1987 data was eliminated entirely for that commodity. If, however, the group means for each

variable were not statistically different at a ninety-five percent level, the observations which contained the origin - destination information were retained. Appendix III indicates the method by which BEA areas were converted to state to state data.

Finally, there has been some controversy regarding the validity of the revenues reported in the CWS for the years 1981 through present. The discussion focusses on the existence of contract rates which are allowed under Staggers. In the scheme of railroad tariffs three echelons of reporting must be considered. First, there are published tariffs. Few if any movements occur under these rates. Next, there are the billed rates. These are the rates which are reported on the waybills which accompany the shipment. Prior to 1981, the billed rates represented the actual charges associated with a shipment. Since 1981, railroads have been able to establish contract rates with shippers and it is the reporting of these rates which sits at the center of the controversy over the CWS. Carriers are not required to report contract rates on the waybills. Rather, they may report the rate at which the movement would occur if there was no contract in force. Further, there is nothing on the bill (and consequently, nothing in the CWS) which identifies the shipment as a contract move, so that it is impossible to separate those records for which the rate information may be misleading.

Some, such as Professor Boyer, have argued that the possible corruption of the line haul revenue field of the CWS makes this sample unusable. Others, including MacDonald (1987 and 1989a) and Winston (1990) have demonstrated

that prudent use of the sample is still quite possible. MacDonald (1987), by direct comparison, first establishes that way-bill rates are not simply tariff rates as some have argued. Next, he compares total grain revenues as reported by the Association of American Railroads with grain revenues derrived by expanding the CWS. These figures were not statistically different, indicating that the way-bill rates, in the aggregate, closely reflect the rates at which shipments actually moved.

In his later (1989a) research, MacDonald adopts a methodology similar to the "mine mouth" strategy of Garrod and Miklius. He compares mean way-bill rates to mean price spreads between for grain at distant origin/destination pairs. MacDonald argues that these price spreads should encompass the true rates. As in his 1987 research, the 1989 results indicate that way-bill figures closely track the price spreads.

Winston, Corsi, Grim, and Evans performed a similar test for coal rates and found that the billed 1985 rates for movements of coal were not significantly different than actual coal rates.[4] An overwhelming majority of contract movements are shipments of grain or coal.

The implication, then, is that even though railroads are not required to report contract rates, they are doing so in most cases. An explanation of this behavior may lie in the structure of the contracts. In most cases the rates charged to contract shippers are not substantially less than those charged to non-contract

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[4]This test (similar to MacDonald (1987)) consisted of comparing the total coal revenues as reported by the Association of American Railroads with the total coal revenues generated by an expansion of the Carload Waybill Sample.

customers. However, the contracts specify rebates to be paid to (or penalties to be paid by) the shippers if the volume of traffic meets (or fails to meet) required levels specified by the contracts. MacDonald (1989b) contends that, in the case of penalties, carriers report for billing purposes the rate they expect to receive. This would not include the amount of any penalty. Further, it seems the value of any payable rebates is not substantial enough to statistically differentiate contract rates from billed rates.[5]

There are three commodities for which contracts are in wide use. The first of these is grain. MacDonald's work is sufficiently complete so that this commodity is not considered here. The second commodity is coal, which leads all other goods in terms of the percentage of shipments moving under contract. Coal contracts are typically structured in the same manner as grain contracts, so that the billed rates are assumed to be equally valid. The final commodity for which contracting is prominent is lumber. Approximately nineteen percent of all lumber shipped by rail moves under contract. The reader should be mindful of the possible impact of contracts when considering this commodity.[6]

Data describing the number of rail carriers operating between each origin and destination pair were compiled by use of the Interstate Commerce

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[5]Again, a word of personal thanks is owed to Jim MacDonald for his explanation of the operation of railroad contract rates and his clarification of the tests which he performed to compare contract and way-bill pricing.

[6]Because most contract rates offer rebates for volume shipping, it is possible that the waybill rates for lumber are actually higher than the effective contract rates.

Commission's Annual Report, the Association of American Railroads' *Yearbook of Railroad Facts*, and *The Official Railway Guide*. These data are annual. A rail carrier was defined as offering service between two states in a particular year if it operated in both states. In a few isolated cases this method is misleading. For example, the Burlington Northern operates in both North and South Dakota, but provides no direct rail link between these states. Still, such examples are rare. In the period between 1973 and 1987 the number of Class I railroads was reduced from thirty-five to sixteen through a series of failures and consolidations. Effort was made to account for this activity even to the point where supplementary information was used to distinguish between the year of approval and actual merger consummation.[7]

Data describing the availability of inland water transport was assembled in a similar manner. Where two states were connected by a single inland watery system, water transport was identified as possible. As in the case of rail service, the physical possibility of water transport may be misleading in that no such movements may ever be undertaken. Still, in the vast majority of instances, this proved a reliable method. Coastal water transportation was not considered as an alternative.

The implementation of deregulation was initially indicated by a zero-one dummy variable, STAGG. Though the Staggers Rail Act was passed in October

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[7]It should also be noted that the computation method allowing this construct made it necessary to exclude all intrastate movements from the data set.

of 1980, it was assumed to have no impact on rail pricing until 1981. The original specification implied that the full impact of deregulation was felt immediately. This hypothesis was tested by interacting the dummy variable for deregulation with time. This interaction term was statistically significant in five of seventeen estimations. Therefore, STAGG was redefiend as the product of the original zero/one dummy variable and a time trend term (Year minus 1980).

Because the data set retains a high level of disaggregation the summary statistics describing the data for each commodity in each year are presented in Appendix IV rather than in the text.[8]

Econometric Technique

Equation (4.4) is estimated separately for each of the seventeen two digit STCC's defined in Table 4.1. This method of analysis eliminates the necessity of including commodity characteristics in the estimation. Instead, inter-commodity comparisons may be made by comparing the values of the other coefficients for each of the STCC's. Variables to proxy **M**, A, **S**, and **R**, as well as the variables designed to detect the impact of deregulation, are defined in the following way:

(**M**) *The availability and pricing of other Transport Modes*

Three primary variables are used to represent **M**. First, the zero-one dummy variable WATER described earlier, is used to indicate the possibility of

[8]Summary statistics were calculated by year even though the actual data are quarterly.

water transport between the particular origin and destination, with a value of one indicating that water transport is viable. If carriers possess any degree of monopoly power, profit maximization implies rate differentials based on varying price elasticities. In such cases, one would expect a negative correlation between the availability of water transport and railroad rates for the movement of bulk commodities.

Similarly, motor carriage is assumed to be everywhere available. However, because trucking costs escalate rapidly with distance, and because motor carrier rates are commonly assumed to be highly reflective of costs (See Levin (1981), trucking is often inappropriate for long distance movements. To measure the effect of this phenomena on rail rates, the variable MMILES is included. Rail rates which are positively related to this variable indicate that carriers respond to the fact that trucking is less appropriate for long distance shipments by charging higher prices for such shipments, all else being equal. However, it is typically assumed that average transport costs decline with distance, so that if rates adhere to costs the coefficient estimates for this parameter should be negative rather than positive. In this way MMILES captures two opposing effects. It is regrettable that these effects can not be isolated. However, it is at least possible to determine which is dominant.

The actual estimation also includes MMILES2 which is the square of the mean distance of shipments between "i" and "j" in period "t". If terminal costs are positive and the marginal cost of providing transport is constant in distance, then

average cost of service (per ton-mile) will fall asymptoticly toward the level of marginal cost as distance increases. Thus, there is reason to suspect that costs do not vary linearly with distance. The quadratic term is included to accommodate this suspicion

Finally, the variable DIRSRV is included as a measure of intramodal competition. It is defined as the number of carriers offering service between the origin, "i", and destination, "j", in period "t". In a perfectly competitive environment, this variable should have no impact on rates. However, in an oligopoly setting, one would expect rates to decline as the number of firms increases.[9] The ideal measure of intramodal competition would not only take into account the number of direct (meaning non-interchange) routes between origins and destinations, but would also account for possible interline routings *and* the additions in shipping times, distances, and variability associated with such routings. This sort of measure was contemplated in this research as an index which included the number of direct routes and the weighted number of indirect routes between the origin and destination. The weight would have lied between zero and one depending on the additional distance associated with the route. However, the computational problems stemming from the (literally) millions of

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[9]In a non-cooperative setting, the Cournot model of oligopoly behavior predicts precisely this result. In a more cooperative framework, attempts to collude are commonly believed to be more successful when the number of firms is small. See Blair and Kaserman (1985).

possible routings between each possible origin and destination lead to the abandonment of a search for a preferable measure.

(A) *Aggregate Economic Activity*

Because the level of aggregate economic activity affects final demands, it is assumed to affect the level of transportation demand as well, and thereby has the potential to influence rates. However, it is possible that this occurs with a lag. The variable AVPROD is included to reflect this possibility. AVPROD is defined as the simple mean of the quarterly index of manufacturing production for periods "t" and "t-1". Ignoring the possibility of mode switching, it is hypothesized that transport demand becomes less elastic during periods of accelerated economic activity and more elastic as the economy cools.[10] Accordingly, it is expected that this variable will be positively correlated with rail rates.

(S) *Shipment Characteristics*

At least two of the shipment characteristics overlap other variable categories. As noted above, the distance variable, MMILES, determines the appropriateness of motor carriage, but it also is a key determinant of average rail costs. Another shipment characteristic - the need for specialized equipment - is assumed to be commodity specific, so that its presence may be viewed as a partial explanation for the disparity of coefficient values for the different STCC's. The

[10]If shippers switch transport modes as a result of changing inventory needs, the impact of shifting aggregate demand may be dampened.

primary shipment characteristic included in the estimation is MLOADS which is defined as the mean number of loads for shipments of the particular commodity between "i" and "j" in period "t". As noted by Patton (1988), any given shipment may require as many as four switch moves by the carrier. The costs of these moves are fairly constant with respect to the number of loads, so that average pick up and delivery costs per load decline as the number of loads increases. Therefore, a negative coefficient estimate for this parameter indicates that rates more accurately reflect costs. On the other hand, larger volume shippers face considerably higher costs if they wish to adapt receiving and loading facilities to accommodate another mode. Presumably, this results in more inelastic demand. Thus, a positive correlation between MLOADS and rates may indicate a carrier's attempt to capture additional profits.

(**R**) *Route Characteristics*

Two primary variables were included as a reflection of route characteristics. The first of these, MNINT, denotes the mean number of line interchanges for the movement of some commodity between origin and destination in period "t". This variable is directly related to the level of total costs because of the terminal activities associated with interchange. Therefore, rail rates will be positively correlated with the number of interchanges if rates adhere to costs. However, the variable MNINT may take on a negative sign as well. Carriers forming a joint route (as suggested by interchange) must also agree on how rates are to be apportioned. Further, there may be a number of joint routes serving a single

origin destination pair. This suggests a high level of strategic interaction between carriers in the creation and division of joint rates. A negative sign for MNINT would indicate that this interaction is dampening carriers' attempts to secure the maximum available profit.

The second route characteristic, DENSITY, is defined by the overall volume of rail traffic between "i" and "j" in period "t". For a number of reasons, this is an inferior proxy for the route density. However, the state to state origin-destination information makes the development of a more appropriate measure impossible. Braeutigam et al (1984) suggests that any real economies in rail shipping are the result of density not scale. Accordingly, rail costs should decline as DENSITY increases until some minimum efficient density is attained. Beyond this optimal level, DENSITY may have no impact or may even indicate increasing costs if the rail infrastructure is be pressed beyond capacity. Most would argue that, ignoring seasonal car shortages, rail capacity is seldom taxed, so that the parameter estimates for density should be negative if rates reflect costs.

(F) *Factor Costs*

As noted earlier, there is no reason to suspect any cross-sectional variation in factor costs, either with respect to commodity or origin - destination pair. The intertemporal improvements in factor productivity are captured by the variable TIME which is a period measure ranging between one (the first quarter of 1973) and fifty-six (the final quarter of 1987).

(P*) *Profit Maximizing Price*

The dependent variable in each estimation is defined as the revenue per ton-mile, RTM. The value of this variable is calculated directly from the line haul revenue, net tons, and milage fields of the CWS. The values are then placed in real terms by use of the quarterly Producer Price Index.

The above may be combined to obtain:

$$(4.5a) \qquad RTM_{ijt} = \beta_0 + \beta_1(MNINT_{ijt}) + \beta_2(MLOADS_{ijt}) + \beta_3(MMILES_{ijt}) + \beta_4(MMILES2_{ijt}) + \beta_5(DIRSRV_{ijt}) + \beta_6(DENSITY_{ijt}) + \beta_7(WATER_{ijt}) + \beta_8(AVPROD_{ijt}) + \beta_9(TIME) + \epsilon_{ijt}$$

which explains rail rates in the absence of any regulatory change.

To capture the effects of deregulation, the estimation contains the previously defined variable (STAGG) and a set of interaction variables defined as the product of STAGG with the right-hand-side variables in equation (4.5a). With the exception of DENSITY for which SDENS is the corresponding interaction term, these secondary terms are simply represented by the original variable name preceded by the letter "S" to indicate the effect of Staggers. The final model to be fitted for each commodity is then:

$$(4.5b) \qquad RTM_{ijt} = \beta_0 + \beta_1(MNINT_{ijt}) + \beta_2(MLOADS_{ijt}) +$$
$$\beta_3(MMILES_{ijt}) + \beta_4(MMILES2_{ijt}) +$$
$$\beta_5(DIRSRV_{ijt}) + \beta_6(DENSITY_{ijt}) + \beta_7(WATER_{ijt}) +$$
$$\beta_8(AVPROD_{ijt}) + \beta_9(STAGG_{ijt}) + \beta_{10}(SMNINT_{ijt}) +$$
$$\beta_1(SMLOADS_{ijt}) + \beta_{12}(SMMILES_{ijt}) +$$
$$\beta_{13}(SMMILES2_{ijt}) + \beta_{14}(SDIRSRV_{ijt}) +$$
$$\beta_{15}(SDENS_{ijt}) + \beta_{16}(SWATER_{ijt}) +$$
$$\beta_{17}(SAVPROD_{ijt}) + \beta_{18}(TIME) + \epsilon_{ijt}$$

where the combination "ij" represents a particular origin - destination pair for some time period "t".

This interaction specification allows three forms of analysis. First, by examining the coefficient estimates for β_0 through β_8, it is possible to determine the effects of the various parameters on rail rates *during the regulated era*. That is, where STAGG equals zero, the value of the interaction variables equal zero, leaving equation (4.5a). Secondly, the value for STAGG when combined with the slope interaction variables depicts the way in which deregulation *changed* carriers' responses to the independent variables. Finally, by setting, the value of STAGG to zero, one can predict what rates might have been charged in the absence of Staggers and compare these predictions to the actual observed rates for the various commodities. Figure 4.1 and an example will illustrate this technique. Assume that the number of interchanges alone is responsible for the observed rail rate. Rates could then be modeled as:

$$(4.6a) \qquad RTM_i = \beta_0 + \beta_1(MNINT)_i + \epsilon_i$$

Hypothetically, estimation might yield the regression line plotted in Figure 4.1. Next, assume that for some set of additional observations *after deregulation*, the relation between $MNINT_i$ and RTM_i is fundamentally different than it was for the original set of observations. These additional observations are denoted by a value of one for a zero/one dummy variable, STAGG. For all other variables STAGG has a value of zero. This structural difference is depicted in the following model:

$$(4.6b) \quad RTM_i = \beta_0 + \beta_1 STAGG_i + \beta_2 MNINT_i + \beta_3(STAGG_i{*}MNINT_i) + \epsilon_i$$

When STAGG has value of zero the fitted regression will have the same parameter values as in (4.6a). However, when STAGG takes on a value of one, the intercept for the regression becomes $\beta_0+\beta_1$ and the slope becomes $\beta_2+\beta_3$. The difference between the effect of MNINT on RTM in the deregulated era is simply β_3. Further, given the observed values of MNINT in the years since deregulation, it is possible to predict what RTM would have been by setting the value of STAGG to zero.

There is no theoretical indication for support of any particular functional form with the exception of the quadratic relation between the optimal price and shipment distance, so that a linear form was initially assumed. Other functional forms were tested with no substantial improvement in fit. Therefore, the linear form is retained for its simplicity.

INTERACTION SPECIFICATION EXAMPLE

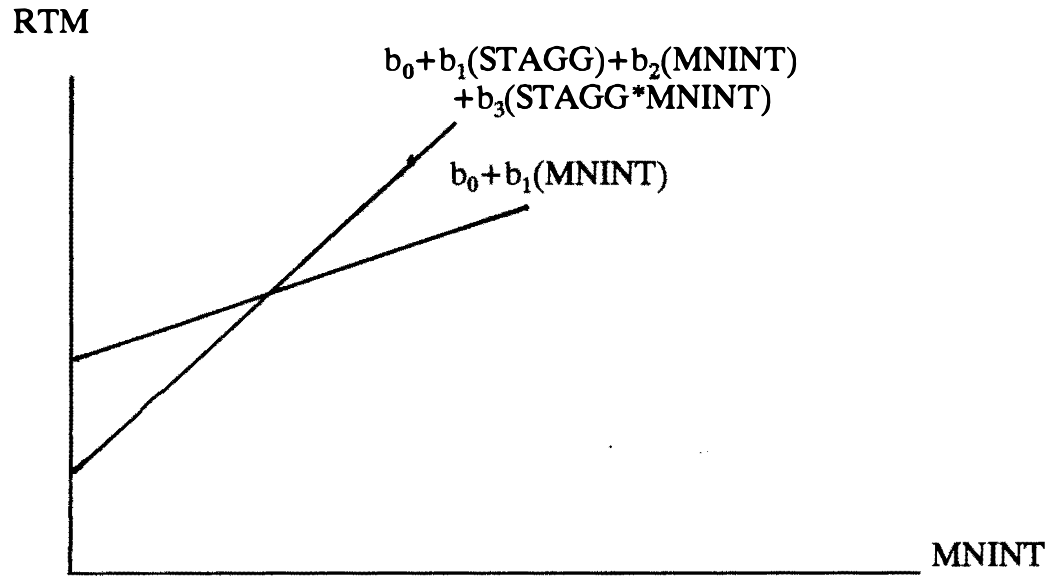

FIGURE 4.1

Consistent with accepted econometric practices,[11] the estimation technique corrects for autocorrelation and heteroskedasticity. It is assumed that the disturbance for each origin - destination pair, ϵ_{ijt} is serially correlated with the disturbance for the same routing in period "t-1". The model also recognizes that the disturbance for different origin - destination pairs within any particular period may exhibit different variences. The error structure may be written as:

(4.7) $E(\epsilon^2_{ijt}) = \sigma^2_{ij}$ (heteroskedasticity)

(4.8) $E(\epsilon_{ijt}\epsilon_{ikt}) = 0 \quad (j \neq k)$ (cross sectional independence)

(4.9) $\epsilon_{ijt} = p_{ij}\epsilon_{ij,t-1} + u_{ijt}$ (autocorrelation)

where:

(4.10) $u_{ijt} \sim N(0,\sigma^2_{uij})$

(4.11) $\epsilon_{ij1} \sim N(0, \sigma^2_{uij}/(1-p^2_{ij}))$

(4.12) $E(\epsilon_{ij,t-1}u_{ik}) = 0$, for all j,k

Kmenta (1986) fully outlines the development of this error specification.[12]

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[11]See Kmenta (1986) and Hsing and Chang (1980).

[12]There are really two cross-sectional elements within the data set, the commodity and the origin-destination pair. Cross-sectional independence was assumed with regard to both. The latter is explicit in the above specification, while the former implies that estimation of each commodity separately is appropriate, rather than some simultaneous estimation technique.

CHAPTER V

ANALYSIS OF RESULTS

Appendix V presents a full reporting of regression results from the estimation of equation (4.5b) for the seventeen STCC's. Actual coefficients and significance levels appear in the text only as they are necessary to support the inferences offered. The results are revealing; first because they provide a reasonable explanation of rail rates during the regulated era, as well as some measure of regulatory efficacy. Second, these findings provide solid evidence of enhanced competition which is directly attributable to deregulation. Finally, in direct contrast to some of the early findings, the results suggest that nearly two thirds of all rail traffic moves under rates which are lower than they might have been in the absence of deregulation.

Rail Rates Prior to Deregulation

The picture of railroad pricing prior to Staggers is one of sluggish (and possibly joint) profit maximization. Regulators were unsuccessful in forcing rail rates to reflect even those costs which are identifiable and easily associated with particular services. At the same time, the regulatory environment constrained carriers from responding fully to the presence or lack of intermodal competition.

Finally, it appears that rate regulation may have dampened any tendency toward intramodal rivalry by facilitating tacit collusion.

An examination of the coefficient estimates in Table 5.1 shows a muted sensitivity to both intermodal and intramodal competition in the years prior to Staggers. The variable DIRSRV appears negative and statistically significant for only four of the seventeen STCC's, indicating that prior to deregulation, the presence of alternative rail carriage did not routinely act to lower rail rates. This result may be explained two ways. If rail rates were highly competitive, one would expect similar rates regardless of the number of operating firms. However, since the results to be discussed below suggest that rates did not closely reflect costs, this scenario is unlikely. An alternative explanation of the result is that the regulatory setting facilitated some form of tacit collusion. The parameter estimates for WATER, also in Table 5.1, show that rail rates for several commodities were lower in those areas where water transport was available. However, the broad range of commodities for which this is true suggests that this is more likely the result of a regulatory bias in favor of southern states than any attempted discrimination on the part of rail carriers.[1] Finally, the coefficient estimates for MMILES and MMILES2 in no case indicate a pricing response to the more appropriate nature of truck transport over shorter distances. The remaining demand-side variable in equation (4.5b) is AVPROD, the measure of cyclical activity.

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[1]Water transport is more available in southern and mid-western states. Friedlaender and Spady (1981) also found evidence of this same bias.

TABLE 5.1

PRE-STAGGERS IMPACT OF DEMAND-SIDE VARIABLES

This table contains parameter estimates derived from the estimation of equation (5b). As with all hypothesis tests conducted in this work the level of confidence is 95%.

Commodity	*Coefficient*	*"t"*	*Prob.*
Parameter Estimates for DIRSRV			
Metallic Ores	-0.000121145	-0.527	0.5984
Coal	0.001834229	8.034	0.0001
Non-Metallic Ores	0.000100565	0.791	0.4289
Food & Kindred Products	-0.000046327	-0.417	0.6768
Lumber & Wood Products	0.000357368	2.059	0.0395
Furniture and Fixtures	0.006098659	3.596	0.0003
Paper & Paper Products	0.002194680	14.364	0.0001
Chemicals	-0.001241855	-11.277	0.0001
Petroleum & Coal Products	-0.000173305	-1.009	0.3132
Rubber and Plastic Products	0.002743614	2.821	0.0048
Clay, Concrete, Glass & Stone	-0.000498739	-2.911	0.0036
Primary Metal Products	-0.000151063	-1.072	0.2837
Fabricated Metal Products	-0.003879347	-2.361	0.0184
Machinery	0.003006133	2.444	0.0147
Electrical Equipment	0.002889945	2.931	0.0034
Transportation Equipment	0.000492168	1.839	0.0660
Scrap Materials	-0.000333292	-2.238	0.0252
Parameter Estimates for WATER			
Metallic Ores	-0.001831963	-1.841	0.0658
Coal	0.000153658	0.148	0.8822
Non-Metallic Ores	-0.002824328	-4.101	0.0001
Food & Kindred Products	-0.001532388	-3.820	0.0001
Lumber & Wood Products	-0.003476791	-4.342	0.0001
Furniture and Fixtures	0.01408010	2.906	0.0037
Paper & Paper Products	-0.003685998	-9.965	0.0001
Chemicals	-0.000814811	-1.997	0.0458
Petroleum & Coal Products	-0.003287302	-4.797	0.0001
Rubber and Plastic Products	0.009622153	2.222	0.0263
Clay, Concrete Glass & Stone	0.000982920	1.167	0.2432
Primary Metal Products	-0.002281563	-4.819	0.0001
Fabricated Metal Products	-0.09381917	-2.786	0.0054
Machinery	0.01628423	0.877	0.3808
Electrical Equipment	0.007595082	1.783	0.0747
Transportation Equipment	-0.001365834	-1.326	0.1850
Scrap Materials	-0.000047721	-0.067	0.9462

TABLE 5.1 (CONTINUED)

Parameter Estimates for **MMILES**

Metallic Ores	-0.000028044	-12.834	0.0001
Coal	-0.000077974	-37.582	0.0001
Non-Metallic Ores	-0.000034854	-38.502	0.0001
Food & Kindred Products	-0.000034252	-55.118	0.0001
Lumber & Wood Products	-0.000015389	-24.477	0.0001
Furniture and Fixtures	-0.000058482	-8.244	0.0001
Paper & Paper Products	-0.000049912	-67.233	0.0001
Chemicals	-0.000043578	-56.805	0.0001
Petroleum & Coal Products	-0.000061164	-48.636	0.0001
Rubber and Plastic Products	-0.000077752	-18.064	0.0001
Clay, Concrete, Glass & Stone	-0.000034904	-33.946	0.0001
Primary Metal Products	-0.000045817	-47.567	0.0001
Fabricated Metal Products	-0.000110126	-7.698	0.0001
Machinery	-0.000097391	-9.383	0.0001
Electrical Equipment	-0.000094060	-12.629	0.0001
Transportation Equipment	-0.000046610	-20.448	0.0001
Scrap Materials	-0.000057203	-39.794	0.0001

Parameter Estimates for **MMILES2**

Metallic Ores	5.74915E-09	7.048	0.0001
Ccoal	2.87630E-08	23.994	0.0001
Non-Metallic Ores	7.65288E-09	26.857	0.0001
Food & Kindred Products	6.46088E-09	39.251	0.0001
Lumber & Wood Products	1.74037E-09	13.234	0.0001
Furniture and Fixtures	8.78553E-09	5.459	0.0001
Paper & Paper Products	1.09319E-08	48.332	0.0001
Chemicals	9.37787E-09	40.529	0.0001
Petroleum & Coal Products	1.56127E-08	32.129	0.0001
Rubber and Plastic Products	1.57706E-08	12.657	0.0001
Clay, Concrete, Glass & Stone	7.08498E-09	22.821	0.0001
Primary Metal Products	9.76228E-09	33.435	0.0001
Fabricated Metal Products	2.23543E-08	6.032	0.0001
Machinery	2.05793E-08	6.298	0.0001
Electrical Equipment	1.93454E-08	9.020	0.0001
Transportation Equipment	1.06667E-08	16.123	0.0001
Scrap Materials	1.52129E-08	28.614	0.0001

TABLE 5.1 (CONTINUED)

Parameter Estimates for **AVPROD**

Metallic Ores	0.000487166	24.688	0.0001
Coal	0.000578374	42.957	0.0001
Non-Metallic Ores	0.000551339	48.405	0.0001
Food & Kindred Products	0.000781839	79.664	0.0001
Lumber & Wood Products	0.000612965	47.724	0.0001
Furniture and Fixtures	0.001810893	15.249	0.0001
Paper & Paper Products	0.000731257	69.585	0.0001
Chemicals	0.000855976	81.339	0.0001
Petroleum & Coal Products	0.000850110	60.687	0.0001
Rubber and Plastic Products	0.001514713	27.472	0.0001
Clay, Concrete, Glass & Stone	0.000790956	52.886	0.0001
Primary Metal Products	0.000925471	68.873	0.0001
Fabricated Metal Products	0.001583022	7.306	0.0001
Machinery	0.001948882	16.023	0.0001
Electrical Equipment	0.001998169	23.606	0.0001
Transportation Equipment	0.001340106	46.088	0.0001
Scrap Materials	0.000758043	43.660	0.0001

As expected, rail rates for each of the commodity groups were pro-cyclical.

The means by which incurred costs were reflected in rail rates prior to Staggers is often curious, but seldom indicative of strong competition or effective regulation. See Table 5.2. For example, the number of interchanges would be expected to increase rates because of the associated terminal costs. However, prior to deregulation, this was true for only one third of the commodities,[2] and for five commodities more interchange appears to have lowered rates. The former of these results simply reflects the inability of regulators to establish rates that reflected incremental costs. The negative correlation between interchange and rates may indicate the difficulty for carriers of negotiating the level and division of joint rates. In contrast to interchange, an increased number of loads within each shipment would be expected to lower average costs. However, ten of the seventeen commodity estimates yielded coefficients for MLOADS which were positive and statistically significant. Again, if rates were being accurately determined by the Interstate Commerce Commission or if a significant degree of competition existed, one would not predict this result. Instead, the positive relation between the number of loads and the per ton-mile rate in the years prior to Staggers probably reflects attempts to exploit the captive nature of larger

[2]Interestingly, it was primarily bulk commodities for which rates reflected the increased costs of interchange.

TABLE 5.2

PRE-STAGGERS IMPACT OF COST SIDE VARIABLES

This table contains parameter estimates derived from the estimation of equation (5b). As with all hypothesis tests contained in this work the level of confidence is 95%.

Commodity	*Coefficient*	*"t"*	*Prob.*
Parameter Estimates for MNINT			
Metallic Ores	0.001485265	3.766	0.0002
Coal	0.000907169	4.173	0.0001
Non-Metallic Ores	0.000612108	3.587	0.0003
Food & Kindred Products	-0.000071159	-0.643	0.5203
lumber & Wood Products	-0.000046997	-0.487	0.6265
Furniture and Fixtures	-0.002576292	-1.879	0.0604
Paper & Paper Products	-0.000613675	-6.747	0.0001
Chemicals	0.000283283	2.112	0.0347
Petroleum & Coal Products	-0.000343465	-1.370	0.1706
Rubber and Plastic Products	0.001806097	2.511	0.0121
Clay, Concrete, Glass & Stone	-0.000096359	-0.547	0.5841
Primary Metal Products	0.000076513	0.445	0.6565
Fabricated Metal Products	-0.003091922	-1.459	0.1449
Machinery	0.002709573	2.057	0.0400
Electrical Equipment	0.006624035	6.056	0.0001
Transportation Equipment	-0.002467788	-5.990	0.0001
Scrap Materials	-0.000409380	-1.444	0.1489
Parameter Estimates for MLOADS			
Metallic Ores	-.000002087	-1.075	0.2827
Coal	-.000001667	-3.378	0.0007
Non-Metallic Ores	0.000008143	2.778	0.0055
Food & Kindred Products	0.000029527	6.625	0.0001
Lumber & Wood Products	0.000035045	6.012	0.0001
Furniture and Fixtures	0.000225924	3.459	0.0006
Paper & Paper Products	0.000154943	26.355	0.0001
Chemicals	0.000017962	4.469	0.0001
petroleum & Coal Products	0.000024066	5.514	0.0001
Rubber and Plastic Products	0.000036441	1.766	0.0775
Clay, Concrete, Glass & Stone	-0.000014251	-3.131	0.0017
Primary Metal Products	0.000011932	3.097	0.0020
Fabricated Metal Products	0.000128351	1.612	0.1073
Machinery	0.000015912	0.510	0.6099
Electrical Equipment	0.000014200	0.539	0.5900
Transportation Equipment	0.000117745	7.685	0.0001
Scrap Materials	0.000077312	8.693	0.0001

TABLE 5.2 (CONTINUED)

Parameter Estimates for DENSITY

Metallic Ores	4.45116E-08	3.614	0.0003
Coal	-5.66940E-08	-6.600	0.0001
Non-Metallic Ores	3.08928E-08	3.152	0.0016
Food & Kindred Products	-1.72370E-08	-2.499	0.0125
Lumber & Wood Products	1.93960E-08	1.540	0.1235
Furniture and Fixtures	-3.98134E-07	-3.915	0.0001
Paper & Paper Products	3.68299E-08	3.247	0.0012
Chemicals	5.85567E-08	7.281	0.0001
Petroleum & Coal Products	3.50917E-08	2.546	0.0109
Rubber and Plastic Products	1.07719E-07	2.096	0.0362
Clay, Concrete, Glass & Stone	4.08697E-08	4.260	0.0001
Primary Metal Products	4.88012E-08	4.387	0.0001
Fabricated Metal Products	-2.61265E-08	-0.319	0.7500
Machinery	-1.95058E-07	-6.348	0.0001
Electrical Equipment	-1.53666E-07	-3.639	0.0003
Transportation Equipment	-3.62348E-08	-2.159	0.0308
Scrap Materials	5.49320E-08	5.076	0.0001

Parameter Estimates for TIME

Metallic Ores	-0.000031365	-0.634	0.5264
Coal	-0.000040245	-1.199	0.2307
Non-Metallic Ores	-0.000120092	-4.071	0.0001
Food & Kindred Products	-0.000507270	-24.861	0.0001
Lumber & Wood Products	-0.000360914	-15.373	0.0001
Furniture and Fixtures	-0.000523365	-2.363	0.0182
Paper & Paper Products	-0.000385457	-17.899	0.0001
Chemicals	-0.000597271	-28.132	0.0001
Petroleum & Coal Products	-0.000330176	-8.640	0.0001
Rubber and Plastic Products	-0.000831135	-7.003	0.0001
Clay, Concrete, Glass & Stone	-0.000445947	-11.722	0.0001
Primary Metal Products	-0.000796990	-25.604	0.0001
Fabricated Metal Products	0.000019640	0.042	0.9666
Machinery	-0.000990415	-4.244	0.0001
Electrical Equipment	-0.001455123	-7.796	0.0001
Transportation Equipment	-0.000560098	-9.670	0.0001
Scrap Materials	-0.000405966	-9.873	0.0001

shippers who were (and are) less able to switch transport modes because of the higher costs of retro-fitting receiving and loading facilities.[3]

One of the most often noted determinants of rail costs is the traffic density of the selected route. Because of the dispersement of fixed costs over more and more shipments, it is expected that average costs will become lower as density increases until the capacity of the rail infrastructure comes into question. Yet, an examination of the coefficients for the variable DENSITY suggests that these economies of density were only reflected in the rates for movement of four of seventeen commodities prior to deregulation. Further, for a number of primarily bulk commodities, the sign for DENSITY is positive and significant.

Only two cost-side variables routinely displayed signs consistent with any sort of cost influenced pricing. It has long been assumed that average transport costs decline as the distance between origin and destination increases (See Chapter IV). The parameter estimates for MMILES and MMILES2, as reported in Table 5.1, suggest these cost savings were evident in rail rates even in the years prior to deregulation. The reader will recall that MMILES and MMILES2 also reflect the way in which rail rates are influenced by the appropriateness of motor carriage. It was hypothesized that, for shipments of longer distance where trucking might be less appropriate, rail rates might be higher. However, the

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[3]For example, shippers who ship or receive large numbers of carloads at one time usually have extensive on-site switching facilities. The costs of replacing these facilities with those which are appropriate for another transport mode would be extensive.

results indicate that it is the impact on costs of longer shipment distances which influences rates. Finally, the estimates for TIME indicate that the technological improvements alluded to by other authors did play a role in lowering rail rates for the movement of all seventeen commodities throughout the years between 1973 and 1980.

Pricing Under Deregulation

The results indicate that deregulation substantially altered carriers' responses to the profit determining variables as described above. In nearly every case, rates tended to better reflect the level of incurred cost and the presence of transport alternatives.

The interaction specification permits a detailed analysis of deregulation's effects on carrier responses to values of the independent variables in the years since Staggers. The coefficients for the interaction variables provide a measure of the *change* in response attributable to deregulation. The sum of the interaction coefficient and the original coefficient represent the total carrier response to particular variables in the post-deregulation era.

Table 5.3 provides the coefficient estimates for the interaction variables SDIRSRV and SWATER, the sum of these coefficients with their corresponding independent variable coefficients, and the results of joint tests for significance. First, it is apparent that rail carriers are now much more sensitive to the presence of other rail carriers than they were prior to Staggers. The sum of the coefficients

TABLE 5.3

DEREGULATION AND CARRIER SENSITIVITY TO THE AVAILABILITY OF ALTERNATIVE TRANSPORTATION

The "F" statistic tests h_0: VAR + SVAR = 0 at a 95% level of confidence.

Commodity	*VAR*	*SVAR*	*"t"*	*Sum*	"F"	Prob.
Parameter Estimates: VAR = DIRSRV, SVAR = SDIRSRV						
Metallic Ore	-0.000121145	-0.00009308	-0.753	-0.000214225	1.0463	0.3065
Coal	0.001834229	-0.000587687	-4.841	0.001246542	35.4375	0.0001
Non-Metallic Ore	0.000100565	-0.000301489	-4.789	-0.000200924	3.3624	0.0667
Food	-0.000046327	-0.000148507	-3.566	-0.000194834	4.3773	0.0364
Lumber	0.000357368	-0.000123809	-1.764	0.000233559	2.7925	0.0947
Furniture	0.006098659	0.0000085348	0.013	0.0061071938	20.1943	0.0001
Paper Prd.	0.00219468	-0.000473447	-9.11	0.001721233	175.434	0.0001
Chemicals	-0.001241855	-0.000144632	-2.742	-0.00138648	31.4583	0.0001
Petroleum Prd.	-0.000173305	-0.000448831	-4.872	-0.000622136	17.9739	0.0001
Rubber Prd.	0.002743614	-0.000998172	-2.501	0.001745442	4.6594	0.031
CCG&S	-0.000498739	-0.000118779	-1.399	-0.000617518	17.8245	0.0001
Primary Metal Prd.	-0.000151063	-0.000411998	-6.361	-0.000563061	23.6232	0.0001
Fabricated Metal	-0.003879347	0.001334132	1.358	-0.002545215	2.9205	0.0878
Machinery	0.003006133	-0.000855807	-1.287	0.002150326	3.8924	0.0488
Electriacl	0.002889945	-0.00085012	-1.959	0.002039825	6.0631	0.0139
Transportation	0.000492168	-0.000819563	-7.969	-0.000327395	2.1839	0.1395
Scrap Materials	-0.000333292	-0.000186448	-3.096	-0.00051974	16.7949	0.0001
Parameter Estimates: VAR = WATER, SVAR = SWATER						
Metallic Ore	-0.001831963	0.000617421	1.557	-0.001214542	2.1099	0.1465
Coal	0.000153658	-0.000198021	-0.572	-0.000044363	0.0025	0.9602
Non-Metallic Ore	-0.002824328	-0.000461148	-1.655	-0.003285476	32.7355	0.0001
Food	-0.001532388	0.000260985	1.914	-0.001271403	14.5702	0.0001
Lumber	-0.003476791	0.000265456	0.897	-0.003211335	23.3986	0.0001
Furniture	0.0140801	-0.001406269	-0.577	0.012673831	9.6056	0.002
Paper Prd.	-0.003685998	0.000133207	1.131	-0.003552791	129.693	0.0001
Chemicals	-0.000814811	0.000221163	1.3	-0.000593648	3.2449	0.0717
Petroleum Prd.	-0.003287302	-0.000250302	-0.921	-0.003537604	40.6435	0.0001
Rubber Prd.	0.009622153	-0.001776035	-1.206	0.007846118	4.4656	0.0347
CCG&S	0.00098292	0.000315726	0.957	0.001298646	3.4291	0.0641
Primary Metal Prd.	-0.002281563	0.000432387	2.231	-0.001849176	22.7903	0.0001
Fabricated Metal	-0.09381917	0.01449884	1.197	-0.07932033	7.66	0.0057
Machinery	0.01628423	-0.01053247	-1.365	0.00575176	0.1416	0.7068
Electriacl	0.007595082	-0.002317329	-1.317	0.005277753	2.2205	0.1363
Transportation	-0.001365834	0.000788113	2.155	-0.000577721	0.4591	0.498
Scrap Materials	-0.000047721	-0.000332676	-1.451	-0.000380397	0.4184	0.5178

for DIRSRV and SDIRSRV is negative for ten of the thirteen commodities where this sum is statistically different from zero. In three cases, the negative value of SDIRSRV serves to reenforce an already existing relationship between rail rates and the number of carriers offering direct service. For two of the remaining seven commodities, the values for SDIRSRV reverse a positive relation. Finally, there are five commodities for which rates are now negatively affected by the presence of rail alternatives where there was no previous relationship.

The parameter estimates for SWATER confirm two hypotheses. First, they suggest that rail carriers are more responsive to transportation alternatives in setting rates since Staggers. Secondly, the results support the suggested regulatory bias which favored southern states. Again, prior to deregulation, a number of commodities moved under rates which were lower when water transport was available. However, the diversity in the nature of these commodities suggests that the rates were really lower because of a regulatory bias which only coincidentally favored states where water transport was available. If this hypothesis is true, one would have expected rates to return to "normal" levels when regulatory control of rates was abandoned. An examination of Table 5.3 (together with Table 5.1) indicates that this is precisely what happened. Rates for commodities which are not appropriately moved by water lost their sensitivity to the availability of water transport when Staggers was put into place. On the other hand, commodities for which water transport presents a reasonable alternative continued to move under lower rates when barge transport was available. For these commodities, demand

considerations replaced the regulatory bias as the impetus for lower rates.

The extreme adherence of rates to the cost savings associated with longer shipment distances has been maintained in the years since Staggers, so that any difference in the way rail carriers react to possible motor carriage is somewhat obscured. If such differences exist, they may be uncovered in the commodity by commodity analysis which is to be presented later.

Railroad deregulation has dampened, but certainly not eliminated carrier responses to the level of cyclical activity. Table 5.4 contains coefficient estimates for SAVPROD, the sum of these coefficients and those for AVPROD, and the test statistic to determine whether this sum is different than zero. It is clear that the impact of deregulation was to reduce the influence of cyclical activity on rates for most commodities. Given that sensitivity to other demand side factors has been made greater by deregulation, this result may seem a little curious. It is, however, explained by the change in the mix of commodities which are shipped by rail. Recall that prior to deregulation the rates for all commodities tended to be pro-cyclical. Further, this tendency was more pronounced for manufactured goods than for raw materials. An examination of total car loadings reveals that raw materials (predominantly bulk commodities) have increasingly dominated the mix of commodities traveling by rail. These are precisely the commodities for which transport demand has always been less cyclical. Next, as manufactured commodities represent a continually smaller fraction of total rail traffic, the rewards to carriers from adjusting rates to reflect cyclical change becomes smaller

TABLE 5.4

DEREGULATION AND THE CYCLICAL NATURE OF RAIL RATES

The "F" statistic tests h_0: AVPROD + SAVPROD = 0 at a 95% level of confidence.

Commodity	*AVPROD*	*SAVPROD*	*"t"*	*Sum*	"F"	Prob.
Parameter Estimates for AVPROD, SAVPROD						
Metallic Ore	0.000487166	-0.000123325	-10.004	0.000363841	0.0001	0.0001
Coal	0.000578374	-0.000158803	-19.701	0.000419571	999.2539	0.0001
Non-Metallic Ore	0.000551339	-0.000144906	-20.54	0.000406433	282.5395	0.0001
Food	0.000781839	-0.000174573	-40.263	0.000607266	4017.656	0.0001
Lumber	0.000612965	-0.000186474	-32.894	0.000426491	1268.2037	0.0001
Furniture	0.001810893	-0.000492438	-10.11	0.001318455	126.9856	0.0001
Paper Prd.	0.000731257	-0.00017898	-40.41	0.000552277	2768.5657	0.0001
Chemicals	0.000855976	-0.00019952	-38.103	0.000656456	4387.8973	0.0001
Petroleum Prd.	0.00085011	-0.000224472	-23.885	0.000625638	1888.1246	0.0001
Rubber Prd.	0.001514713	-0.000383759	-12.393	0.001130954	424.9195	0.0001
CCG&S	0.000790956	-0.000200394	-21.921	0.000590562	1507.6924	0.0001
Primary Metal Prd.	0.000925471	-0.000219667	-29.092	0.000705804	3003.3308	0.0001
Fabricated Metal	0.001583022	-0.000448835	-4.074	0.001134187	30.3636	0.0001
Machinery	0.001948882	-0.000571963	-9.76	0.001376919	150.7817	0.0001
Electriacl	0.001998169	-0.000384607	-9.061	0.001613562	399.8201	0.0001
Transportation	0.001340106	-0.000269722	-21.032	0.001070384	1401.4371	0.0001
Scrap Materials	0.000758043	-0.000156307	-18.335	0.000601736	1163.2096	0.0001

too. Cyclical variations in commodity demands simply no longer hold a potential for gains sufficient to warrant variations in rates.

From the standpoint of economic efficiency, the changes in carrier response to demand side variables may be interpreted two ways. First, the ability of railroads to charge differential rates based on demand characteristics implies that these carriers possess some degree of market power. If rate regulation had been effective in inhibiting this power, and if prescribed rates had accurately reflected costs, then one could associate a loss of efficiency with the implementation of Staggers. There is, however, an alternative perspective. The discussion in Chapter IV suggests that carriers had substantial rate making freedoms prior to deregulation, yet the evidence presented in this chapter indicates that the rates which they set were not particularly sensitive to the presence of other rail carriers. Taken together, these results suggest that regulated rail carriers depended heavily on the Interstate Commerce Commission to protect them from intramodal rivalry. Neither contract rates nor any other confidential devices were allowed under ICC regulation. Therefore, each firm was constantly aware of the rates being charged by its rivals. At the same time, it would have been difficult for the Commission to sanction differential rates which were not the product of differing costs. Railroads were, therefore, assured that their competitors would not be offering substantially lower rates or, at very least, that any such behavior would be immediately detectable. Stigler (1971) makes it clear that regulation may confer economic benefits to its targets. In the case of American railroads, it appears that

regulation facilitated cartel-like behavior. That rail carriers are now more sensitive to the presence of other carriers, indicates that this tacit collusion has been replaced with a new sense of rivalry.[4]

Presuming that deregulation did heighten intramodal rivalry and recognizing the constant pressures imposed by motor carriage, one would expect that deregulated rail rates would better reflect the ever falling costs of providing rail service. This is, in fact, what the evidence obtained here suggests.

First with regard to shipment characteristics, it was noted earlier that there are significant switching costs associated with pulling and delivering shipments. These costs are largely invariant to changes in the number of loads, so that shipments containing more loads are switched at a lower per ton cost. The number of loads which shippers routinely ship or receive is also assumed to give some indication of the importance of the commodity to the shipper and the potential cost of switching to an alternative form of transportation. Presumably shippers transmitting or receiving larger shipments are more captive.[5] Prior to

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[4]The reader may ask why an industry which was dependent on rate regulation to enforce cartel behavior would actively support the removal of that regulation. The answer would seem to be that most railroads realized the true threat to their welfare did not come from other railroads, but from the motor carrier industry. With prolonged regulation, each carrier could be assured of the behavior of its rival, but such regulation was simply too costly because of the way it inhibited any response to intermodal competition.

[5]While it is the absolute size of the shipment which determines the cost and appropriateness of switching to another transport mode, the degree to which the shipper is "captive' is also a function of how important the shipment is to the shippers

the implementation of Staggers, rail rates for larger shipments were higher than those for shipments containing fewer loads. Perhaps this too represents some form of regulatory bias in favor of small shippers. Possibly this result is an indication of carrier attempts to discriminate against more captive shippers. In any case, it is clear that under regulation rail rates responded perversely to the number of loads within the shipment. Deregulation reversed this pattern, so that now rail rates for twelve of seventeen commodities are negatively influenced by increasing the number of shipment loads. Table 5.5 provides the coefficient estimates for SMLOADS. It also contains the sum of this variable and MLOADS. Further examination of Tables 5.1 and 5.5 reveals that it is bulk commodities for which the negative relationship is the most prominent. This is consistent with railroad operations in which unit trains containing bulk commodities are often roaded and delivered directly with no switching costs.

Just as an increased number of loads lowers average costs, an increase in the number of interchanges should raise them because of more terminal activity. Recall that, prior to deregulation, only one third of the commodities moved under rates which were positively affected by the number of interchanges, so that cost savings associated with fewer interchanges were not being incorporated into rates. Table 5.5 presents the parameter estimates for SMNINT and the sum of SMNINT and MNINT. Clearly deregulation has produced rail rates which better indicate the costs of interchange. In the wake of Staggers, nine of seventeen commodities

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over-all business.

TABLE 5.5

DEREGULATION AND COST SIDE VARIABLES

"F" statistics test h_0: VAR + SVAR = 0 at a 95% level of confidence

Commodity	*VAR*	*SVAR*	*"t"*	*Sum*	*"F"*	*Prob.*
Parameter Estimates: VAR = MLOADS, SVAR = SMLOADS						
Metallic Ore	-0.00000208	-0.000006074	-4.547	-0.000008161	79.969	0.0001
Coal	-0.00000167	-0.0000039853	-6.48	-0.000005653	66.852	0.0001
Non-Metallic Ore	0.00000814	-0.0000067239	-4.27	0.000001419	0.360	0.5483
Food	0.00002952	-0.0000089168	-4.81	0.000020610	34.66	0.0001
Lumber	0.00003504	-0.0000071281	-2.96	0.000027916	39.974	0.00\01
Furniture	0.00022592	-0.000104221	-3.91	0.000121703	6.014	0.0143
Paper Prd.	0.00015494	-0.000037054	-19.54	0.000117889	652.34	0.0001
Chemicals	0.00001796	-0.000011743	-7.71	0.000006219	4.20	0.0402
Petroleum Prd.	0.000024066	-0.000014645	-5.48	0.000009421	6.28	0.0122
Rubber Prd.	0.000036441	-0.000005473	-0.52	0.000030968	3.67	0.0554
CCG&S	-0.000014251	0.000000300	0.11	-0.000013950	12.72	0.0004
Primary Metal Prd.	0.000011932	-0.000005923	-2.50	0.000006008	3.28	0.0702
Fabricated Metal	0.000128351	-0.000022959	-0.65	0.000105392	3.28	0.0703
Machinery	0.000015912	-0.000007781	-0.38	0.000008131	0.09	0.761
Electriacl	0.0000142	-0.000017439	-1.14	-0.000003239	0.02	0.885
Transportation	0.000117745	-0.000050099	-8.79	0.000067646	32.67	0.0001
Scrap Materials	0.000077312	-0.00002079	-5.88	0.000056522	61.97	0.0001
Parameter Estimates: VAR = MNINT, SVAR = SMNINT						
Metallic Ore	0.001485265	-0.000206617	-1.07	0.001278648	14.485	0.0001
Coal	0.000907169	0.000022844	0.23	0.000930013	27.3188	0.0001
Non-Metallic Ore	0.000612108	0.000243421	2.88	0.000855529	36.6577	0.0001
Food	-0.000071159	0.000231063	5.45	0.000159904	3.0273	0.0819
Lumber	-0.000046997	0.000143731	3.172	0.000096734	1.5248	0.2169
Furniture	-0.002576292	0.002283261	3.68	-0.000293031	0.0645	0.7996
Paper Prd.	-0.000613675	0.000147634	4.361	-0.000466041	37.950	0.0001
Chemicals	0.000283283	0.000061103	0.948	0.000344386	10.1368	0.0015
Petroleum Prd.	-0.000343465	0.000135839	1.174	-0.000207626	1.0579	0.3037
Rubber Prd.	0.001806097	0.000523081	1.278	0.002329178	15.1047	0.0001
CCG&S	-0.000096359	-0.000106919	-1.296	-0.000203278	1.9638	0.1611
Primary Metal Prd.	0.000076513	0.000062645	0.765	0.000139158	0.9636	0.3263
Fabricated Metal	-0.003091922	0.002658519	1.953	-0.000433403	0.0483	0.8262
Machinery	0.002709573	0.000807304	1.265	0.003516877	10.396	0.0013
Electriacl	0.006624035	0.00016635	0.302	0.006790385	53.1683	0.0001
Transportation	-0.002467788	0.000373698	2.425	-0.00209409	37.1666	0.0001
Scrap Materials	-0.00040938	0.000353444	3.546	-0.000055936	0.0568	0.8116

display rates which are positively correlated with the number of interchanges. It is also worth noting that prior to deregulation four STCC's actually displayed a negative correlation between rates and the number of interchanges. This number was reduced to three by Staggers.

Table 5.6 contains the coefficient estimates for SMMILES and SMMILES2. Prior to deregulation, rates for the movement of all seventeen commodities reflected the hypothesized reduction in average costs which is associated with longer shipment distance. Deregulation tended to dampen this relation in some cases and enhance it in others, but in no case does the relationship disappear or is it reversed.

Model Predictions

The general conclusion at this point in the analysis must be that deregulation has lead to more intramodal rivalry, more real attention to intermodal challenges and rates which better reflect the costs of providing services. While it is evident that rail carriers still possess some market power, the net effect of the Staggers Rail Act on the degree of efficiency in railroad transportation seems to be positive. Theoretically this positive outcome stands independent of the effects of deregulation on the actual levels of rail rates. However in the arena of public policy, this more efficient pricing behavior pales to concerns over how the level of deregulated rail rates compares to those rates which might have been in evidence if regulation had persisted.

TABLE 5.6

DEREGULATION AND SHIPMENT DISTANCE

The "F" statistics test h_0: VAR + SVAR = 0 at a 95% level of confidence.

Commodity	*VAR*	*SVAR*	*"t"*	*Sum*	*"F"*	*Prob.*
Parameter Estimates: VAR = MMILES, SVAR = SMMILES						
Metallic Ore	-0.000028044	-0.0000032486	-3.231	-0.0000312926	268.55	0.0001
Coal	-0.000077974	0.0000073964	9.984	-0.0000705776	1673.72	0.0001
Non-Metallic Ore	-0.000034854	0.0000010231	2.676	-0.0000338309	045.30	0.0001
Food	-0.000034252	0.0000019736	8.575	-0.0000322784	3666.19	0.0001
Lumber	-0.000015389	-0.0000000011	-0.004	-0.0000153901	796.51	0.0001
Furniture	-0.000058482	-0.0000045915	-1.523	-0.0000630735	104.93	0.0001
Paper Prd.	-0.000049912	0.0000041637	19.733	-0.0000457483	5303.05	0.0001
Chemicals	-0.000043578	0.0000014029	4.04	-0.0000421751	4158.61	0.0001
Petroleum Prd.	-0.000061164	0.0000011378	2.03	-0.0000600262	3497.03	0.0001
Rubber Prd.	-0.000077752	0.0000011119	0.557	-0.0000766401	465.03	0.0001
CCG&S	-0.000034904	0.0000024876	5.15	-0.0000324164	1361.74	0.0001
Primary Metal Prd.	-0.000045817	0.0000018634	4.209	-0.0000439537	2906.48	0.0001
Fabricated Metal	-0.000110126	0.000017728	2.088	-0.000092398	48.40	0.0001
Machinery	-0.000097391	0.000011674	2.325	-0.000085717	101.29	0.0001
Electriacl	-0.00009406	0.0000042396	1.176	-0.0000898204	195.21	0.0001
Transportation	-0.00004661	-0.000004783	-5.359	-0.000051393	716.79	0.0001
Scrap Materials	-0.000057203	0.0000003665	0.752	-0.0000568365	2262.22	0.0001
Parameter Estimates: VAR = MMILES2, SVAR = SMMILES2						
Metallic Ore	0.0000000057	0.000000001	2.58	0.0000000068	89.52	0.0001
Coal	0.0000000288	-0.0000000034	-9.728	0.0000000253	668.00	0.0001
Non-Metallic Ore	0.0000000077	-0.0000000003	-2.124	0.0000000074	1014.60	0.0001
Food	0.0000000065	-0.0000000004	-6.417	0.0000000061	1862.53	0.0001
Lumber	0.0000000017	1.0209700E-10	1.623	0.0000000018	269.88	0.0001
Furniture	0.0000000088	0.0000000008	0.163	0.0000000096	46.82	0.0001
Paper Prd.	0.0000000109	-0.0000000012	-20.807	0.0000000097	2604.46	0.0001
Chemicals	0.0000000094	-0.0000000003	-2.76	0.0000000091	2158.17	0.0001
Petroleum Prd.	0.0000000156	-0.0000000005	-2.455	0.0000000151	1501.91	0.0001
Rubber Prd.	0.0000000158	-0.0000000005	-0.852	0.0000000153	230.98	0.0001
CCG&S	0.0000000071	-0.0000000004	-2.884	0.0000000067	615.78	0.0001
Primary Metal Prd.	0.0000000098	-0.0000000003	-1.914	0.0000000095	1477.66	0.0001
Fabricated Metal	0.0000000224	-0.0000000042	-1.93	0.0000000181	29.00	0.0001
Machinery	0.0000000206	-0.0000000036	-2.292	0.000000017	40.98	0.0001
Electriacl	0.0000000193	-0.0000000012	-1.11	0.0000000181	94.81	0.0001
Transportation	0.0000000107	0.0000000015	5.515	0.0000000121	474.12	0.0001
Scrap Materials	0.0000000152	-1.1251800E-10	-0.63	0.0000000151	1191.31	0.0001

The interaction specification allows the prediction of rates under the scenario of continued regulation. However, as with any out of sample prediction, the confidence attached to these predictions diminishes greatly as the predictions move through time away from the regulated era. Further, it was necessary to aggregate the predicted values across origin destination pairs in order to obtain a workably small set of predictions for analysis. Finally, the predictions offered are based on the transformed values of the independent variables which were generated through the Generalized Least Squares estimation technique. Therefore, they may only be appropriately compared with the transformed values of rates which were actually observed. Thus all inference regarding the changes brought by deregulation appear in percentage terms rather than absolute terms.

For the purpose of this analysis a rate was considered to be higher or lower than the predicted rate if it was above or below the bounds of the 95% prediction interval surrounding the predicted rate.[6] Inspection of Table 5.7 below reveals

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[6]The Generalized Least Squares approach allows the variance-covariance matrix to deviate from the form assumed in an Ordinary Least Squares estimation. Specifically, in the research presented here, both the diagonal and off-diagonal elements may take on values representative of the cross-sectionally heteroskedastic and time-wise autoregressive error structure assumed in Chapter Four. When the true parameters of the error structure are known, data may be transformed, so that the variance-covariance matrix conforms to the OLS assumptions. Thus, the OLS estimators retain all desirable properties as do any predictions based on estimated values. When the true parameters of the error structure <u>are not</u> known, values for the transformation matrix may be estimated. In such a case, the OLS estimators retain all desirable properties. However, an examination of prevailing econometric theory provides little insight into the way in which prediction intervals are established for small samples in this latter case. For the purpose of this research, the values for the transformation matrix were estimated. However, given the absence of applicable econometric theory, predictions were conducted as if the values of the elements

that railroad deregulation has produced rates which are lower than they might have been for some commodities in some years. Further, this table suggests that rail rates have in no case been made higher by the implementation of Staggers. Examination of table 5.7 in conjunction with the coefficient estimates and summary information (See Appendix IV) for each commodity yields very interesting results.

First, we see that there was notably less movement away from predicted rates in 1982 and 1983 than in other years. This result owes primarily to the reduced cyclical nature of rates and the sharp decline in aggregate business activity during those years. Rates were falling at this time which certainly corresponds to their prior cyclical nature. However, when business conditions improved, the decline in rail rates did not reverse itself as it might have in the past.

Next, while the level of intramodal competition was largely invariant across commodities, changes in the degree of sensitivity to this sort of competition often contributed to the proportion of movements traveling under lower rates. Eight of the nine commodities for which over ten percent of rates appear lower display negative coefficients for the variable SDIRSRV. Moreover, when these coefficients were ranked by magnitude, seven of the ten most negative were associated with commodities which had a significant number of shipments moving at lower rates after deregulation. The obvious implication is that when Staggers

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within this matrix were known.

TABLE 5.7

PROPORTION OF RATES ALTERED BY STAGGERS

This table indicates the proportion of traffic which moved under rates which were significantly different than those predicted had regulation continued.

Year	Lower	Higher	Year	Lower	Higher
	Metallic Ore			Coal	
1981	0.0025974	0.00519481	1981	0.0141509	0.00471698
1982	0.0032897	0.00000000	1982	0.00322061	0.00322061
1983	0.0000000	0.00000000	1983	0.00653595	0.00490196
1984	0.0076726	0.00255754	1984	0.0136157	0.0075643
1985	0.0000000	0.0026455	1985	0.0367279	0.0033389
	Non-Metallic Ore			Food and Kindred Products	
1981	0.158038	0.00181653	1981	0.0066793	0.0187659
1982	0.103267	0.00316122	1982	0.0100908	0.0141271
1983	0.11066	0.00000000	1983	0.0127148	0.0109966
1984	0.192646	0.00239808	1984	0.0837812	0.00347771
1985	0.241117	0.00084602	1985	0.224701	0.00188561
1986	0.488467	0.0027137			
1987	0.580231	0.00641849			
	Lumber & Wood Products			Furniture & Fixtures	
1981	0.10628	0.00241546	1981	0.0160966	0.0181087
1982	0.0922659	0.0101764	1982	0.0153846	0.0128205
1983	0.0595745	0.00668693	1983	0.0225564	0.0075188
1984	0.12528	0.00402685	1984	0.0120968	0.00403226
1985	0.191518	0.00182399	1985	0.0158416	0.0019802
1986	0.010989	0.0000000			
1987	0.0232558	0.0000000			

TABLE 5.7 (CONTINUED)

Pulp Paper and Paper Products

1981	0.0102437	0.0296715
1982	0.0125046	0.0279515
1983	0.0165041	0.0217554
1984	0.0398099	0.0103981
1985	0.10692	0.00683101
1986	0.306667	0.0115556
1987	0.434254	0.00552486

Chemicals

1981	0.153764	0.00568182
1982	0.0649686	0.00516796
1983	0.0497495	0.00465283
1984	0.130595	0.00113314
1985	0.18043	0.00226244

Petroleum and Coal Products

1981	0.283665	0.00239044
1982	0.211084	0.00488998
1983	0.226711	0.00247321
1984	0.288395	0.000694927
1985	0.314661	0.00345781

Rubber and Plastic Products

1981	0.096206	0.00542005
1982	0.0522152	0.0000000
1983	0.0595238	0.0119048
1984	0.122392	0.00834492
1985	0.1378	0.00884956

Clay, Concrete, Glass and sStone

1981	0.0332769	0.00958827
1982	0.01341	0.0127714
1983	0.010113	0.0130874
1984	0.0428571	0.00561224
1985	0.0543423	0.00812595

Primary Metals

1981	0.0974504	0.00283286
1982	0.0375	0.00394737
1983	0.02685	0.00327439
1984	0.102128	0.00159574
1985	0.164871	0.000538793

Fabricated Metal Products

1981	0.00240385	0.0120192
1982	0.010101	0.013468
1983	0.0000000	0.013289
1984	0.00779221	0.0155844
1985	0.0227273	0.00568182

Machinery

1981	0.00241546	0.02657
1982	0.00671141	0.0234899
1983	0.013289	0.0265781
1984	0.00465116	0.0162791
1985	0.0126263	0.0126263

TABLE 5.7 (CONTINUED)

Electrical Equipment

1981	0.0105932	0.00847458
1982	0.014218	0.007109
1983	0.0135659	0.0000000
1984	0.0711974	0.0000000
1985	0.119008	0.0000000
1986	0.526316	0.0000000
1987	0.391304	0.0000000

Transportation Equipment

1981	0.0153602	0.0217161
1982	0.0254881	0.0146421
1983	0.0246533	0.00410889
1984	0.0702635	0.00501882
1985	0.151889	0.00198807
1986	0.342799	0.010142
1987	0.445783	0.00803213

Scrap Materials

1981	0.00445104	0.00890208
1982	0.00528701	0.0135952
1983	0.00581818	0.0116364
1984	0.0208071	0.00315259
1985	0.0956464	0.00461741
1986	0.198618	0.00345423
1987	0.277539	0.00143062

enhanced sensitivity to intramodal competition the result was that a substantial amount of traffic moved under lower rates.

Interestingly, there seems to be little real correlation between the proportion of rail rates which declined based on the bulk/non-bulk nature of the commodity. By 1987, rates for nearly thirty percent of all shipments of scrap were lower than the prediction had regulation continued. Similarly, over twenty-four percent of the movements of nonmetallic ores were moving at significantly lower rates by 1985. However, rates for metallic ores, coal, and CCGS appear virtually unchanged. Conversely, the proportion of rail rates for machinery, for rubber and plastic products, and for fabricated metal products which appear to be lowered by Staggers is moderate to none. Yet the proportion of transportation equipment, electrical equipment, food products, and lumber traveling at lower than predicted rates is substantial.

Rather than conforming to any specific inter-commodity pattern, the percentage of rates for each commodity which are lower under deregulation seems to be a function of that commodity's own demand and cost characteristics. For example, rates for the movement of scrap material appear particularly sensitive to the availability of water transport in the years since Staggers. It may also be noted from the summary statistics in Appendix IV that the percentage of such shipments in regions where water transport is readily available is particularly high. Thus, the rates for a large number of such shipments have fallen significantly. On the other hand, the observed rates for the movement of machinery do not

appear to have been significantly lowered by deregulation. In this case, whatever rate reducing forces may exist are offset by a strong new sensitivity to the number of interchanges.

Any attempt to examine the welfare implications of deregulated rail rates must consider the magnitude of individual rate changes as well as the overall quantity of those changes. Again, the estimation technique dictates that rate changes be calculated in relative rather than absolute terms. It is also desirable that the impact of the individual rate changes reflect the size of the shipment for which they applied. Therefore, the following method was used to calculate the average difference in rate for each observation on each commodity.

$$\text{CHANGE} = \frac{\text{RTM - PREDICTED}}{\text{PREDICTED}} \times \frac{\text{MLOADS}}{\text{LDSBAR}}$$

Where RTM is the rate predicted by the model when STAGG equals one, PREDICTED is the rate predicted when STAGG was set to zero, MLOADS is as defined above and LDSBAR is the mean number of loads in for all shipments of the particular commodity. Further, in analyzing the magnitude of the rate changes, it is imperative that the reader be constantly mindful that many observed rates were not statistically different from the rate predicted in the absence of Staggers. The margin for error in the predicted rates is extremely high. Still, the data in Table 5.8 provides some measure of magnitude *for those rates which have changed*.

TABLE 5.8

MAGNITUDE OF RATE CHANGES

The following table presents aggregated estimates of the magnitude of change in rail rates for the seventeen commodities. WChange represents a weighted change. This measure was constructed by weighting the predicted change in rate by the number of car loads in the shipment.

ear	Change	WChange	Year	Change	WChange
Metal Ores			Coal		
1981	-0.32799	-0.53075	1981	-0.32482	-0.72489
1982	-0.24840	-0.24547	1982	0.21376	0.85432
1983	-0.06467	-0.34784	1983	2.80153	5.54650
1984	-0.36923	-0.33943	1984	-0.41579	-0.36246
1985	-0.36735	-0.27150	1985	-0.38008	-0.48154
Non-Metallic Ore			Food and Kindred Products		
1981	-0.46529	-0.37070	1981	-0.04594	-0.03581
1982	-0.39017	-0.36869	1982	-0.07433	-0.07461
1983	-0.39301	-0.34355	1983	-0.16499	-0.13081
1984	-0.50853	-0.28808	1984	-0.33320	-0.17072
1985	-0.53998	-0.34449	1985	-0.48048	-0.27043
			1986	-0.60679	-0.38380
			1987	-0.70752	-0.44458
Lumber and Wood Products			Furniture and Fixtures		
1981	-0.35137	-0.27496	1981	0.02280	0.00283
1982	-0.31536	-0.24639	1982	-0.03958	-0.07945
1983	-0.25741	-0.26295	1983	-0.11698	-0.14728
1984	-0.45022	-0.23173	1984	-0.21139	-0.14108
1985	-0.51496	-0.28009	1985	-0.38043	-0.18426
			1986	-0.56239	-0.30696
			1987	-0.64109	-0.43301

TABLE 5.8 (CONTINUED)

Paper and Paper Products

1981	-0.38175	0.28111
1982	0.03983	-0.03228
1983	0.00116	-0.09089
1984	-0.25395	-0.15010
1985	-0.39735	-0.24843
1986	-0.54859	-0.32051
1987	-0.62246	-0.42355

Chemicals

1981	-0.41989	-0.31593
1982	-0.32979	-0.31360
1983	-0.41207	-0.32130
1984	-0.43840	-0.25184
1985	-0.48883	-0.27855

Petroleum and Coal Products

1981	-0.66919	-0.31570
1982	-0.48981	-0.41912
1983	-0.51138	-0.43476
1984	-0.58424	-0.30024
1985	-0.42819	-0.30689

Rubber and Plastic Products

1981	-0.50342	-0.45396
1982	-0.10593	-0.29030
1983	-0.40426	-0.41200
1984	-0.55501	-0.23279
1985	-0.59928	-0.31986

Clay, Concrete, Glass and Stone

1981	-0.33776	-0.24534
1982	-0.32562	-0.29072
1983	-0.29227	-0.18705
1984	-0.43798	-0.19953
1985	-0.50546	-0.25366

Primary Metal Products

1981	-0.36937	-0.28339
1982	-0.29194	-0.27621
1983	-0.33595	-0.28650
1984	-0.45198	-0.23921
1985	-0.51159	-0.29289

Fabricated Metal Products

1981	-0.05535	-0.05200
1982	-0.05360	-0.10986
1983	-0.02406	-0.02575
1984	-0.28546	-0.04591
1985	-0.43833	-0.26755

Machinery

1981	0.15347	0.12192
1982	1.31620	0.48899
1983	1.67222	8.30505
1984	0.36561	0.25549
1985	-0.17621	-0.04510

TABLE 5.8 (CONTINUED)

Electrical Equipment

1981	-0.15938	-0.03349
1982	-0.22042	-0.16316
1983	-0.29513	-0.22793
1984	-0.43193	-0.20946
1985	-0.55320	-0.27923
1986	-0.68267	-0.54884
1987	-0.79066	-0.61012

Transportation Equipment

1981	-0.04687	-0.06139
1982	-0.08663	-0.09115
1983	-0.13317	-0.12240
1984	-0.25517	-0.15821
1985	-0.36541	-0.20435
1986	-0.43911	-0.29507
1987	-0.55061	-0.33048

Scrap Materials

1981	-0.06990	-0.04066
1982	-0.11266	-0.09113
1983	-0.10275	-0.09952
1984	-0.26767	-0.15603
1985	-0.37772	-0.23077
1986	-0.49340	-0.26751
1987	-0.58491	-0.32880

It is clear from the outset that the magnitude of change is, in general, higher for bulkier commodities. This pattern weakens during the 1982-1983 recession, but re-emerges even stronger in the period between 1984 and 1987. A notable exception to the pattern described above is coal. Coal rates appear as high or higher than predicted through 1983. However, they fall substantially below predicted levels for the years 1984 and 1985. In fact, the percentage deviation from the predicted rates for coal is greatest for both these years. Unfortunately, coal is one of the commodities for which the 1986 and 1987 data is unusable.

As with the percentage of movements for which rates were significantly lower, the magnitude of changes are sharply correlated with cyclical activity. The magnitude of rate reductions for virtually all commodities is reduced during the 1982 - 1983 recession, Again, this owes to the fact that rates did not obey the cyclical pattern which they displayed prior to deregulation. Figure 5-1 illustrates what may be considered a typical pattern for the deviation of observed rates from the rates which might have been evidenced in the absence of Staggers.

Table 5.8 provides estimates for the magnitude of rate changes. However, this table does not provide the results of statistical tests aimed at establishing a confidence region for these changes. Such intervals are not established because the predicted rates are based on values for the independent variables which would

have been *predicted* in the absence of the act of deregulation.[7] In the place of such tests, Table 5.9 contains the results of "F" tests which conclusively refute the hypothesis that the coefficients for the interaction variables and the deregulation term STAGG are simultaneously zero. These test suggest that those rate predicted under Staggers are statistically different from those predicted in its absence for fifteen of the seventeen commodities.[8]

In summarizing the results from the estimation of the empirical model for the seventeen commodities, there are three conclusions which stand most clearly. First, rail rates in the years since Staggers better reflect the costs of service than they did during the regulated era. Next, Rail carriers are much more sensitive to the availability of intramodal and intermodal competition than they were prior to deregulation. Finally, as much as thirty percent of movements of some commodities occur at rates which are measurably lower than they might have been had regulation persisted. The importance of this result is amplified by the knowledge that no single commodity appears to move under rates which are

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[7]A considerable effort was made to determine an appropriate method for establishing appropriate prediction intervals. However, none was discovered. This gap in econometric methodology seems both unfortunate and somewhat unbelievable. Efforts to determine an appropriate technique will continue, so that subsequent research may contain these prediction intervals.

[8]The SAS procedure for testing such hypothesis failed for "Lumber" and for "Furniture and Fixtures". This does not mean that the null hypothesis could not be rejected. Instead it means that the statistical package was unable to carry out the specified test for these two commodities. An examination of the appropriate coefficient estimates and associated standard errors provides no insight as to why this failure may have occurred.

higher as the result of Staggers. The policy implications of these results will be discussed in the following chapter. However, it seems clear that the results obtained here move economists much closer to a definitive opinion regarding the effectiveness of railroad deregulation.

TYPICAL CHANGES IN RAIL RATES

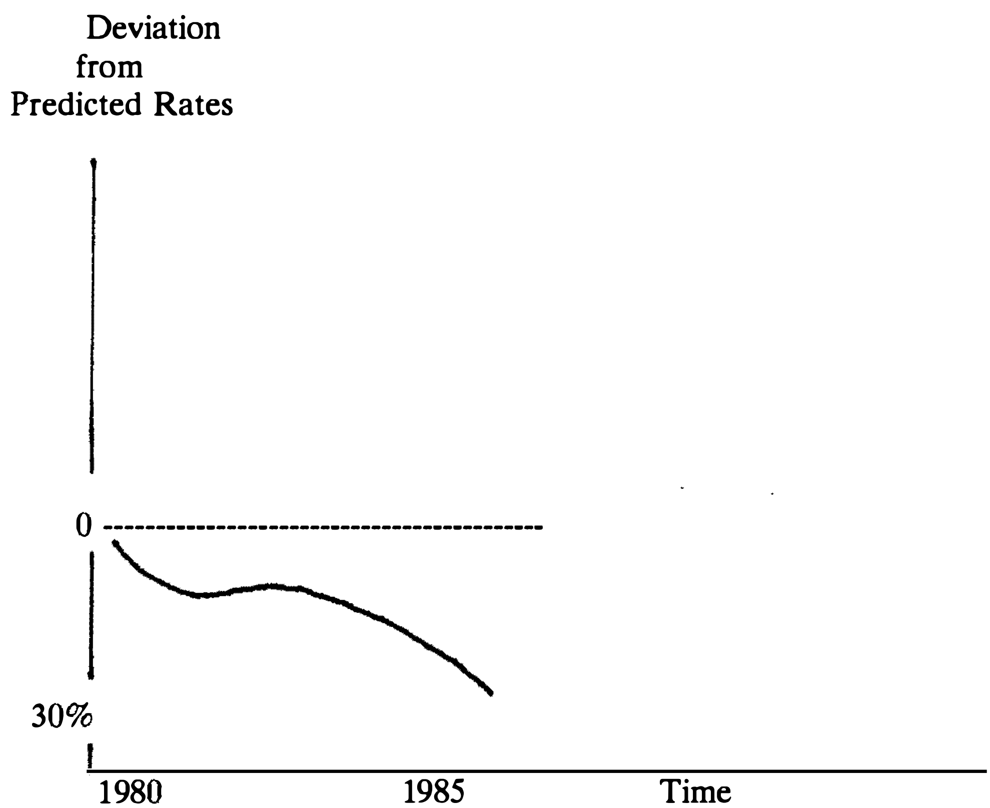

FIGURE 5.1

TABLE 5.9

JOINT STATISTICAL SIGNIFICANCE OF
INTERACTION AND DEREGULATION VARIABLES

"F" tests were conducted to determine whether or not the *set* of variables designed to capture the effects of deregulation was statistically different than zero. Specifically, the null hypothesis was:

$$h_0\text{: STAGG = SMNINT = SMLOADS = SMMILES = SMMILES2}$$

$$\text{= SDIRSRV = SDENS = SAVPROD = 0.}$$

Commodity	F	Probability
Metallic Ore	17.1887	0.0001
Coal	64.1226	0.0001
Non-Metallic Ore	69.7536	0.0001
Food and Kindred Products	272.0758	0.0001
Lumber and Wood Products	-------	-------
Furniture and Fixtures	-------	-------
Pulp, Paper and Paper Products	270.8230	0.0001
Chemicals	205.6254	0.0001
Petroleum and Coal Products	78.9971	0.0001
Rubber and Plastic Products	26.4452	0.0001
Clay, Concrete, Glass and Stone	69.7536	0.0001
Primary Metal Products	136.3291	0.0001
Fabricated Metal Products	4.0560	0.0001
Machinery	14.9640	0.0001
Electrical Equipment	12.4632	0.0001
Transportation Equipment	78.4943	0.0001
Scrap Materials	59.1199	0.0001

CHAPTER VI

SHIPPER RESPONSE

Motivation and Model Refinements

There is some indication in the preceding chapter that deregulation not only changed the manner in which railroads operate, but that these changes in turn led to changes in the composition and characteristics of the traffic which has moved by rail in the years since Staggers. The consideration of this possibility holds the potential for a set of even richer results.[1] This chapter first describes the reasons why deregulation and the changes it brought to carrier behavior might have also altered the characteristics of rail traffic. Next, a simultaneous, recursive model is proposed to represent the relationship between Staggers, carriers, and shippers. This is followed by a description of the estimation results and an analysis of their importance to the overall evaluation of railroad deregulation.

An exhaustive description of the ways in which the Staggers Rail Act affected railroad behavior is beyond the scope of this work. However, as mentioned in the introduction, nearly every facet of railroad operation, marketing, finance, and organization changed radically and rapidly in the wake of deregulation. In the first two years following Staggers' passage, the number of mergers, branch-line sales and line abandonments was so extreme that any

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[1]I am particularly grateful to Jim MacDonald for recognizing this avenue of additional analysis and for his suggestions as to how it would best be pursued.

maintenance of an accurate national rail map was impossible. Even during the recession years of the early 1980's capital spending by the nation's railroads reached all-time record levels. The product of these investments was a vastly improved quality of transportation service. Not only were railroad right-of-ways improved, but carriers invested in a new generation of locomotives and rolling stock. Together, these changes allowed for the introduction of many new services which were aggressively marketed to existing and potential customers. Innumerable changes were made in operations, so that the costs of providing these new services declined. Further, as evidenced here, the structure of railroad rates changed significantly as the structure of the industry changed.

To this point, it has been assumed that none of these changes affected the levels of the independent variables in equation (4.5b). In some cases this assumption is palatable. For example, the changes to the railroad industry had no capacity to change the availability of water transport as it is measured here.[2] It is even more unlikely that the changes within the railroad industry have measurably affected the aggregate level of business activity within the national economy, so that the variables AVPROD and WATER are appropriately treated as entirely exogenous. However, the exogeniety of the other right-hand-side variables from equation (4.5b) may be more of an issue.

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[2]It is, however, possible that a more precise measure of the availability of water transport might eventually reflect some change attributable to rail deregulation. That is to say that those who make decisions with regard to maintaining and improving navigation facilities certainly consider projected barge traffic and these projections are highly dependent on projected rail rates.

Consider first the average number of loads in the shipment of a particular commodity. The intramodal rivalry attributable to Staggers caused an acceleration in the introduction of larger, more dependable freight cars and many shippers moved quickly to the use of this new rolling stock.[3] At the same time, the railroads certainly did not discourage the increased use of shipper-owned and maintained equipment.[4] Together, these deregulation related changes brought about an increase in the average capacity of freight cars. Given that the average tonnage per shipment did not change radically, one would expect use of larger equipment to result in fewer loads per shipment. Examination of the summary information for the variable MLOADS indicates that this was in fact the case, so that operating changes caused by Staggers in turn caused a change in shipper selection of equipment.

Evidence from Chapter V indicates that deregulated rail rates favor shipments where there are fewer interchanges. The potential impact on shipper behavior owing to this deregulation induced change in rate structures is obvious. However, the rate effect is only one component of the way in which Staggers may have changed shippers' selections of rail routes. Since 1981, carriers have introduced an array of new services designed to enhance the quality of rail service. When the number of carriers involved in a route is small, it makes it much easier

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[3]Larger equipment means fewer loads and less expense in loading and unloading. The newer equipment was significantly more dependable, so that it also reduced the variability of transit times attributable to equipment failure.

[4]This was particularly true in the case of coal movements.

for shippers to take full advantage of these new services.[5] Therefore, a decline in the number of interchanges is not unlikely.

The quality of railroad service which shippers have received may also be related to the traffic density along the selected route. The Chapter V results provided no strong association between Staggers, the variable DENSITY, and the rates for the movement of most commodities. However, this does not mean that Staggers did not induce changes in the values of this variable. Grim and Smith (1986), McFarland (1989), and Winston et al (1990) point to significant improvements in railroad service. Much of this improvement is related to reduced variability in shipping times. This advancement is, in part, due to improvements to way and structures. Since, 1980, Class I carriers have invested billions of dollars toward the rehabilitation and improvement of trackage and related facilities. However, these efforts have not been uniform across the entire national rail system. Instead, carriers have focussed on core main lines. Many carriers have sold secondary mains to regional carriers or, at least, have not worked to improve the condition of these lines. Further, very few railroads have acted to slow the decay of branch lines. This pattern of simultaneous rehabilitation and neglect is a direct result of deregulation. Prior to Staggers, carriers did not have nearly the freedom that they now possess to focus on those operations where traffic

[5]Railroads may cooperate in offering improved service for the shipment of commodities which might be moved by truck. Thus, there have been a number of newly introduced joint piggy-back operations. However, when the perceived competition is primarily intramodal, intramodal rivalry emerges.

potentials are greatest. Also, prior to deregulation, the level of intramodal rivalry was not sufficient to motivate improved service on primary routes. Given the improved quality of service on densely used lines and the continued abandonment of more peripheral operations, one would expect that since Staggers, shippers would be even more inclined to use high density routes where possible.

The potential for shippers to have responded to Staggers induced changes by altering the distance over which they ship by rail is a bit more limited. As noted in Chapter V, there has been a long standing propensity for rail rates to favor shipments of longer distance. This was evident before deregulation and remains the case today. Staggers increased this tendency for the movement of some commodities and dampened it for the shipment of others. All in all, deregulation did not greatly alter the role that distance plays in the formulation of rates. Therefore, there was less of a Staggers provoked change to which shippers might have reacted. Further, individual shipment distances are seldom changeable.[6] This means that any observed change in average shipment distances would necessarily be the result of some shippers either abandoning or converting to rail service. One could only expect that this sort of change would come more slowly.[7]

[6]Recall the Chapter Four discussion in which it was asserted that individual demands for railroad services are largely discontinuous.

[7]To the extent that switching modes may involve significant costs related to facility conversion, a considerable time might pass before an individual firm would opt to abandon rail service.

Much as with the case of shipment distance, individual shippers have little capacity to affect the number of rail carriers offering direct rail service between a particular origin and destination. However, unlike the case of distance, the way in which the variable DIRSRV impacts rail rates was changed significantly by Staggers. It is hard to envision how shippers may have reacted to this change, but there was certainly a sufficiently significant change in carrier behavior to warrant some reaction.

Taken together, the possibilities for shipper reaction to Staggers induced changes in railroad operations and pricing behavior demand consideration if the analysis of railroad deregulation is to be complete. The next task then is to modify the Chapter IV model to accommodate such possibilities.

Equation (4.5b) is reproduced here as equation (6.1)

$$
\begin{aligned}
(6.1)\quad RTM_{ijt} = {} & \beta_0 + \beta_1(MNINT_{ijt}) + \beta_2(MLOADS_{ijt}) + \\
& \beta_3(MMILES_{ijt}) + \beta_4(MMILES2_{ijt}) + \beta_5(DIRSRV_{ijt}) + \\
& \beta_6(DENSITY_{ijt}) + \beta_7(WATER_{ijt}) + \beta_8(AVPROD_{ijt}) + \\
& \beta_9(STAGG_{ijt}) + \beta_{10}(SMNINT_{ijt}) + \beta_{11}(SMLOADS_{ijt}) + \\
& \beta_{12}(SMMILES_{ijt}) + \beta_{13}(SMMILES2_{ijt}) + \\
& \beta_{14}(SDIRSRV_{ijt}) + \beta_{15}(SDENS_{ijt}) + \\
& \beta_{16}(SWATER_{ijt}) + \beta_{17}(SAVPROD_{ijt}) + \beta_{18}(TIME) + \epsilon_{1ijt}
\end{aligned}
$$

This model continues to adequately represent the way in which railroad deregulation affected the structure of railroad rates. Hover, allowing for the

possibility of shipper reaction to changes in operations and pricing requires the model must be expanded to include a set of structural equations which describe this shipper response. Finally the resulting *system* of equations must be appropriately estimated.

The first question to be resolved is whether the exogenous variables in equation (6.1) are better expressed as a function of rail rates or as a more general function of deregulation. This issue has already been addressed above. Necessarily, any shipper response to deregulation encompassed a reaction to the rate structure which was demonstratively altered by Staggers. However, Staggers did much to the nature of rail service which is not reflected in the changes to rates. These non-price Staggers-induced modifications in the character of railroad service must be captured as well. Therefore, the structural equations representing shipper response are modeled as a function of STAGG rather than RTM.

Given that several of the exogenous variables in equation (6.1) are hypothesized to be a function of STAGG, we must next determine whether or not their are other explanatory variables which should be included to explain *variations* in the observed levels of MLOADS, MNINT, MMILES, DENSITY, and DIRSRV. Using MNINT as an example, the structural variable explaining the number of interchanges evidenced in shipments of a particular commodity between a specific origin destination pair is presently specified as:

$$(6.2)\quad MNINT_{ijt} = \beta_0 + \beta_1 STAGG + \epsilon_{ijt}$$

which assumes that the number of interchanges would have remained constant at a level of β_0 had it not been for the implementation of Staggers. This is not an entirely untenable assumption for this particular variable. However, for at least two of the other variables which require structural equations, this assumption is less acceptable.

In the case of MLOADS, two opposing forces worked both prior to and after deregulation to change the average number of loads in a particular shipment. First, the size of most classes of rail cars has continually increased, so that, all else being equal, we might expect fewer loads in the shipments of some commodities.[8] At the same time the increased use of unit trains for the movements of coal, grain, automobiles, and intermodal movements was growing steadily well in advance of deregulation. This latter phenomena would indicate an increasing trend in the number of loads for the shipment of those commodities. Similarly, railroads had long been engaged in programs to abandon low density lines. Therefore, independent of any regulatory response, we would expect values for DENSITY to have been declining over time. Quite simply, the only services which remained available to shippers were increasingly over lines with greater traffic density.

Similar arguments might suggest intertemporal changes in the values of the remaining two exogenous variables for which structural equations are indicated (MMILES and DIRSRV). Each of which would be linked primarily to continual

[8]This is precisely the argument of Jim MacDonald in his July, 1990 correspondence.

changes in the available technology. Though perhaps a more precise measure is desirable, this analysis will proceed under the hypothesis that these technological changes are adequately captured by the trend variable TIME, so that the resulting structural equations to be estimated in conjunction with equation (6.1) are:

(6.3a) $MLOADS_{ijt} = \beta_0 + \beta_1(STAGG) + \beta_2(TIME) + \epsilon_{a,ijt}$

(6.3b) $MNINT_{ijt} = \beta_0 + \beta_1(STAGG) + \beta_2(TIME) + \epsilon_{b,ijt}$

(6.3c) $MMILES_{ijt} = \beta_0 + \beta_1(STAGG) + \beta_2(TIME) + \epsilon_{c,ijt}$

(6.3d) $DENSITY_{ijt} = \beta_0 + \beta_1(STAGG) + \beta_2(TIME) + \epsilon_{d,ijt}$

(6.3e) $DIRSRV_{ijt} = \beta_0 + \beta_1(STAGG) + \beta_2(TIME) + \epsilon_{e,ijt}$

Before equations (6.1) and (6.3a) - (6.3e) can be estimated, some assumptions must be made regarding the relationship which may exist between the six individual error terms and these and between these error terms and the explanatory variables in the structural equations. To expedite the estimation process and because there is no a priori reason to assume otherwise, it is assumed that the error terms in the structural equation are independent of each other and also independent of the error term in equation (6.1). According to Kmenta (1985), violation of this assumption would not lead to biassed estimators for the

various model coefficients. It would, however, result in a loss of efficiency.[9] Independence was *not* assumed between the individual error terms and the independent variables or between the error term in period t and period $t-1$.

Empirical Results and Implications

Full regression results for equations (6.3a) - (6.3e) are not reported here. However, these results are summarized in Table 6.1. The hypothesis that shippers responded to Staggers-induced changes in the structure of rail rates is clearly supported by these results. In every case where shippers could adjust shipment characteristics to take advantage of this new structure they did so. In fact, shipper response in the wake of deregulation was just as important as the change in price structure in providing the lower average rates which were previously outlined.[10]

Chapter V results indicate that rail rates now reflect the costs attributable to shipment interchange. This was not the case prior to Staggers. At the same time, Table 6.1 indicates that the number of interchanges for the shipment of fourteen commodities declined. Detractors from deregulation might argue that

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[9]It is likely that any subsequent re-estimation of this system will utilize a more complex estimation technique which is capable of accommodating a relationship between the error terms.

[10]With regard to the specification of the structural equations, "Regression Specification Errors (RESET) Tests" were performed at the time of estimation. The results of these tests indicate that the simple specification of equations 6.3a - 6.3e may suffer from omitted variables bias. Accordingly, future research should include attempts to more fully specify these equations.

TABLE 6.1

SHIPPER RESPONSE TO CARRIER CHANGES

Dependent Variable	Independent Variable	Parameter Estimate	"t"	Prob > |t|
Commodity: Metallic Ores				
MNINT	INTERCEP	0.88628170	20.278	0.0001
	STAGG	-0.01845103	-1.239	0.2153
	TIME	0.005446838	2.792	0.0053
MLOADS	INTERCEP	118.83380	8.467	0.0001
	STAGG	-21.0337977	-4.399	0.0001
	TIME	1.04469103	1.668	0.0955
MMILES	INTERCEP	734.86204	22.800	0.0001
	STAGG	-21.20890431	-1.932	0.0535
	TIME	4.42921209	3.079	0.0021
DIRSRV	INTERCEP	2.12239303	25.451	0.0001
	STAGG	0.04217333	1.485	0.1377
	TIME	0.000192643	0.052	0.9587
DENSITY	INTERCEP	23955.77478	13.177	0.0001
	STAGG	-288.87792	-0.466	0.6409
	TIME	-49.30421849	-0.608	0.5435
Commodity: Coal:				
MNINT	INTERCEP	0.80078639	24.453	0.0001
	STAGG	-0.000733547	-0.066	0.9471
	TIME	0.000193110	0.133	0.8941
MLOADS	INTERCEP	120.88814	11.899	0.0001
	STAGG	-0.46766359	0.136	0.8915
	TIME	0.91565884	2.035	0.0419

TABLE 6.1 (CONTINUED)

Commodity Coal:

MMILES	INTERCEP	600.88963	31.371	0.0001
	STAGG	4.21273217	0.652	0.5146
	TIME	1.71415716	2.020	0.0434
DIRSRV	INTERCEP	2.04371910	34.156	0.0001
	STAGG	0.08848576	4.383	0.0001
	TIME	-0.002627337	-0.991	0.3216
DENSITY	INTERCEP	6791.82535	15.683	0.0001
	STAGG	120.24754	0.209	0.8348
	TIME	213.81653	2.826	0.0047

Commodity: Non-Metallic Ores

MNINT	INTERCEP	0.81754800	30.512	0.0001
	STAGG	-0.05221310	-5.799	0.0001
	TIME	0.007442300	6.249	0.0001
MLOADS	INTERCEP	109.12197	89.613	0.0001
	STAGG	-9.52934605	-23.289	0.0001
	TIME	-0.27898263	-5.155	0.0001
MMILES	INTERCEP	735.82035	29.997	0.0001
	STAGG	-8.00766429	-0.971	0.3313
	TIME	6.94207576	6.367	0.0001
DIRSRV	INTERCEP	2.27866962	45.755	0.0001
	STAGG	0.07353396	4.394	0.0001
	TIME	-0.008528849	-3.853	0.0001
DENSITY	INTERCEP	22337.66444	23.431	0.0001
	STAGG	647.49165	2.021	0.0433
	TIME	-93.51195992	-2.207	0.0273

TABLE 6.1 (CONTINUED)

Commodity: Food & Kindred Products

MNINT	NTERCEP	1.05028563	64.455	0.0001
	STAGG	-0.06936179	-14.055	0.0001
	TIME	0.00319417	4.505	0.0001
MLOADS	INTERCEP	107.29741	256.117	0.0001
	STAGG	-8.0939621	-63.792	0.0001
	TIME	-0.4120271	-22.604	0.0001
MMILES	INTERCEP	1044.33671	70.415	0.0001
	STAGG	-2.653596	-0.591	0.5547
	TIME	3.068795	4.756	0.0001
DIRSRV	INTERCEP	1.85886442	67.121	0.0001
	STAGG	0.06680616	7.965	0.0001
	TIME	-0.00240741	-1.998	0.0457
DENSITY	INTERCEP	14400.20754	29.968	0.0001
	STAGG	1487.43521	10.221	0.0001
	TIME	-82.68003	-3.955	0.0001

Commodity: Lumber and Wood Products

MNINT	INTERCEP	1.05028563	64.455	0.0001
	STAGG	-0.06936179	-14.055	0.0001
	TIME	0.0031941	4.505	0.0001
MLOADS	INTERCEP	107.29741	256.117	0.0001
	STAGG	-8.093962	-63.792	0.0001
	TIME	-0.412027	-22.604	0.0001
MMILES	INTERCEP	1044.33671	70.415	0.0001
	STAGG	-2.653596	-0.591	0.5547
	TIME	3.068795	4.756	0.0001
DIRSRV	INTERCEP	1.858864	67.121	0.0001
	STAGG	0.066806	7.965	0.0001
	TIME	-0.002407	-1.998	0.0457
DENSITY	INTERCEP	14400.20754	29.968	0.0001
	STAGG	1487.43521	10.221	0.0001
	TIME	-82.68003	-3.955	0.0001

TABLE 6.1 (CONTINUED)

Commodity: Furniture and Fixtures

MNINT	INTERCEP	1.13256964	35.909	0.0001
	STAGG	-0.08073443	-7.083	0.0001
	TIME	0.0023718	1.601	0.1095
MLOADS	INTERCEP	104.92703	174.742	0.0001
	STAGG	9.326921	-42.979	0.0001
	TIME	-0.327714	-11.616	0.0001
MMILES	INTERCEP	974.29116	34.503	0.0001
	STAGG	22.32772522	2.188	0.0287
	TIME	6.76612913	5.100	0.0001
DIRSRV	INTERCEP	1.77163282	32.444	0.0001
	STAGG	0.14947404	7.574	0.0001
	TIME	-0.01642995	-6.404	0.0001
DENSITY	INTERCEP	18702.76055	18.444	0.0001
	STAGG	3310.28888	9.033	0.0001
	TIME	-206.63655	-4.337	0.0001

Commodity: Pulp, Paper and Paper Products

MNINT	INTERCEP	1.30232482	65.081	0.0001
	STAGG	-0.06549791	-11.346	0.0001
	TIME	0.00708762	8.238	0.0001
MLOADS	INTERCEP	108.59561	279.013	0.0001
	STAGG	-7.480354	-66.623	0.0001
	TIME	-0.4693490	-28.047	0.0001
MMILES	INTERCEP	1069.78743	73.309	0.0001
	STAGG	-13.210444	-3.138	0.0017
	TIME	2.875591	4.583	0.0001
DIRSRV	INTERCEP	1.5649044	52.870	0.0001
	STAGG	0.07708982	9.028	0.0001
	TIME	-0.00389703	0.002	
DENSITY	INTERCEP	14699.75171	28.821	0.0001
	STAGG	1017.27739	6.914	0.0001
	TIME	-103.95470	-4.740	0.0001

TABLE 6.1 (CONTINUED)

Commodity: Chemicals

MNINT	INTERCEP	1.077719	66.414	0.0001
	STAGG	-0.056761	-10.711	0.0001
	TIME	0.004570	6.386	0.0001
MLOADS	INTERCEP	106.93534	184.243	0.0001
	STAGG	-9.068676	-47.845	0.0001
	TIME	-0.355890	-13.901	0.0001
MMILES	INTERCEP	989.25707	67.256	0.0001
	STAGG	-8.610660	-1.793	0.0730
	TIME	2.574884	3.969	0.0001
DIRSRV	INTERCEP	1.810539	59.371	0.0001
	STAGG	0.068113	6.840	0.0001
	TIME	-0.004042	-3.005	0.0027
DENSITY	INTERCEP	14906.85651	27.335	0.0001
	STAGG	-131.09664	-0:736	0.4617
	TIME	17.82710	0.741	0.4586

Commodity: Petroleum and Coal Products

MNINT	INTERCEP	0.943133	43.847	0.0001
	STAGG	-0.025918	-3.515	0.0004
	TIME	0.001859	1.924	0.0543
MLOADS	INTERCEP	106.30023	96.386	0.0001
	STAGG	-9.54724	-25.251	0.0001
	TIME	-0.24845	-5.015	0.0001
MMILES	INTERCEP	784.34721	42.016	0.0001
	STAGG	-14.76939	-2.308	0.0210
	TIME	4.590026	5.473	0.0001
DIRSRV	INTERCEP	2.307195	51.814	0.0001
	STAGG	0.049349	3.233	0.0012
	TIME	-0.006847	-3.423	0.0006
DENSITY	INTERCEP	19977.289	22.371	0.0001
	STAGG	-305.866	-0.999	0.3178
	TIME	39.2673	0.979	0.3277

TABLE 6.1 (CONTINUED)

Commodity: Rubber and Plastic Products

MNINT	INTERCEP	1.0777143	37.589	0.0001
	STAGG	-0.0840444	-8.396	0.0001
	TIME	0.0017867	1.382	0.1670
MLOADS	INTERCEP	107.16231	144.747	0.0001
	STAGG	-10.85997	-42.012	0.0001
	TIME	-0.27300	-8.178	0.0001
MMILES	INTERCEP	991.23977	38.995	0.0001
	STAGG	10.398488	1.172	0.2414
	TIME	1.659857	1.448	0.1476
DIRSRV	INTERCEP	2.00795	34.197	0.0001
	STAGG	0.12546	6.120	0.0001
	TIME	-0.01045	-3.950	0.0001
DENSITY	INTERCEP	18976.40048	18.623	0.0001
	STAGG	731.93841	2.057	0.0397
	TIME	-6.22993	-0.136	0.8922

Commodity: Clay, Concrete, Glass, and Stone

MNINT	INTERCEP	1.0706812	52.202	0.0001
	STAGG	-0.041221	-5.923	0.0001
	TIME	0.0034406	3.754	0.0002
MLOADS	INTERCEP	106.52925	158.621	0.0001
	STAGG	-10.53530	-46.227	0.0001
	TIME	-0.23915	-7.969	0.0001
MMILES	INTERCEP	863.36048	52.899	0.0001
	STAGG	-23.128039	4.176	0.0001
	TIME	4.595595	6.301	0.0001
DIRSRV	INTERCEP	1.957267	50.378	0.0001
	STAGG	0.092957	7.051	0.0001
	TIME	-0.0073719	-4.246	0.0001
DENSITY	INTERCEP	16732.46505	25.461	0.0001
	STAGG	248.84385	1.116	0.2645
	TIME	10.951658	0.373	0.7092

TABLE 6.1 (CONTINUED)

Commodity: Primary Metal Products

MNINT	INTERCEP	1.048691	51.571	0.0001
	STAGG	-0.063669	-9.485	0.0001
	TIME	0.003844	4.304	0.0001
MLOADS	INTERCEP	108.61338	147.907	0.0001
	STAGG	-9.71989	-40.099	0.0001
	TIME	-0.37401	-11.595	0.0001
MMILES	INTERCEP	1042.18193	53.94	0.0001
	STAGG	-6.17460	-0.968	0.3329
	TIME	0.62346	0.735	0.4625
DIRSRV	INTERCEP	2.00802	50.035	0.0001
	STAGG	0.13779	10.402	0.0001
	TIME	-0.00920	-5.219	0.0001
DENSITY	INTERCEP	18200.57853	25.043	0.0001
	STAGG	302.90308	1.263	0.2067
	TIME	-27.19510	-0.852	0.3943

Commodity: Fabricated Metal Products

MNINT	INTERCEP	1.11480	36.3210	0.0001
	STAGG	-0.05302	-4.014	0.0001
	TIME	-0.00403	-2.658	0.0079
MLOADS	INTERCEP	105.51633	106.895	0.0001
	STAGG	-11.44655	-26.944	0.0001
	TIME	-0.17858	-3.655	0.0003
MMILES	INTERCEP	868.33458	32.879	0.0001
	STAGG	3.93161	0.346	0.7294
	TIME	5.62667	4.304	0.0001
DIRSRV	INTERCEP	2.46653	38.205	0.0001
	STAGG	0.08963	3.226	0.0013
	TIME	-0.01134	-3.551	0.0004
DENSITY	INTERCEP	21086.68986	18.110	0.0001
	STAGG	2483.74208	4.956	0.0001
	TIME	-1.73394	-0.030	0.9760

TABLE 6.1 (CONTINUED)

Commodity: Machinery

MNINT	INTERCEP	1.10894	34.004	0.0001
	STAGG	-0.08093	-6.244	0.0001
	TIME	0.00001	0.009	0.9926
MLOADS	INTERCEP	106.97623	86.189	0.0001
	STAGG	-11.66736	-23.649	0.0001
	TIME	-0.22399	-3.752	0.0002
MMILES	INTERCEP	1048.41392	34.990	0.0001
	STAGG	-20.0080	-1.680	0.0930
	TIME	6.6790	4.634	0.0001
DIRSRV	INTERCEP	2.31609	36.378	0.0001
	STAGG	0.12835	5.072	0.0001
	TIME	-0.01222	-3.992	0.0001
DENSITY	INTERCEP	19327.80974	14.928	0.0001
	STAGG	2208.52753	4.291	0.0001
	TIME	-28.72119	-0.461	0.6447

Commodity: Electrical Equipment

MNINT	INTERCEP	0.997070	33.440	0.0001
	STAGG	-0.084994	-7.663	0.0001
	TIME	0.001792	1.273	0.2030
MLOADS	INTERCEP	107.03185	124.215	0.0001
	STAGG	-10.94421	-34.145	0.0001
	TIME	-0.29318	-7.207	0.0001
MMILES	INTERCEP	951.61305	36.261	0.0001
	STAGG	-5.89859	-0.604	0.5457
	TIME	6.15401	4.967	0.0001
DIRSRV	INTERCEP	2.27943	39.507	0.0001
	STAGG	0.16282	7.587	0.0001
	TIME	-0.017841	-6.550	0.0001
DENSITY	INTERCEP	20294.59107	16.895	0.0001
	STAGG	2209.44198	4.945	0.0001
	TIME	-58.35827	-1.029	0.3035

TABLE 6.1 (CONTINUED)

Commodity: Transportation Equipment

MNINT	INTERCEP	1.005559	53.402	0.0001
	STAGG	-0.014552	-2.660	0.0078
	TIME	0.001439	1.782	0.0748
MLOADS	INTERCEP	105.79746	183.742	0.0001
	STAGG	-8.29874	-49.610	0.0001
	TIME	-0.32307	-13.075	0.0001
MMILES	INTERCEP	982.29869	53.308	0.0001
	STAGG	4.61684	0.862	0.3885
	TIME	3.90912	4.944	0.0001
DIRSRV	INTERCEP	2.06510	52.086	0.0001
	STAGG	0.11175	9.702	0.0001
	TIME	-0.01266	-7.445	0.0001
DENSITY	INTERCEP	19111.70706	26.610	0.0001
	STAGG	1846.58186	8.850	0.0001
	TIME	-165.15620	-5.359	0.0001

Commodity: Scrap Materials

MNINT	INTERCEP	0.833574	37.987	0.0001
	STAGG	-0.079130	-13.054	0.0001
	TIME	0.007496	8.085	0.0001
MLOADS	INTERCEP	107.89562	172.559	0.0001
	STAGG	-7.91984	-45.850	0.0001
	TIME	-0.38310	-14.501	0.0001
MMILES	INTERCEP	677.24208	40.080	0.0001
	STAGG	-51.40767	-11.013	0.0001
	TIME	6.51284	9.122	0.0001
DIRSRV	INTERCEP	2.17340	49.803	0.0001
	STAGG	0.12355	10.248	0.0001
	TIME	-0.00968	-5.250	0.0001
DENSITY	INTERCEP	23586.96379	25.075	0.0001
	STAGG	2665.98823	10.259	0.0001
	TIME	-229.49376	-5.774	0.0001

this behavior could indicate increased vertical foreclosure, that higher rates for interchanged traffic and the associated shipper response, simply reflect new carrier power to oppress captive shippers. However, the evidence in Table 6.1 refutes such claims. The three commodities for which the variable STAGG was not statistically significant were Coal, Chemicals and Metallic Ores. Certainly two if not all three of these commodities are transported for shippers who are extremely captive in terms of rail/non-rail alternatives.

Table 6.1 also indicates that STAGG was a significant and positive predictor of DENSITY for ten of seventeen commodities. The reader will recall that the variable DENSITY did not perform particularly well in the estimation of equation (4.5b). However, there is other evidence that this variable is tremendously important in determining rail costs.[11] Chapter V contains some speculation seventeen commodities dropped significantly with the implementation of the act to deregulate. No doubt, part of this change is attributable to the number of post-Staggers mergers, but it is unlikely that mergers are responsible for the full amount of change.[12] The indication is that shippers, recognizing the change in about why this variable failed in the earlier model. This centered on

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[11]See Brautigam, Daugherty and Turnquist (1984).

[12]As indicated earlier, there were a number of large mergers in the two or three years after Staggers. To the extent that these mergers were parallel mergers, the number of direct serve routes would be reduced. For example, the Frisco-Burlington Northern merger reduced the number of direct rail routes between Missouri and Kansas. However, to the extent that the mergers were end to end the number of direct serve alternatives was increased. For example, the same Frisco-BN merger created a new direct rail alternative between Nebraska and Florida.

the means by which it was constructed. However, this construction does not inhibit the ability of the model in equations (6e) to detect the change in density attributable to Staggers. Ten of seventeen commodities moved in corridors (if not on specific routes) where traffic was more dense than it had been prior to deregulation.[13] As in the case of interchange, carrier behavior may have contributed somewhat to this result. Consistent with the provisions of Staggers, branch-line abandonments have increased in the years since deregulation. However, many of the Class I carriers have chosen to sell the larger of their unprofitable lines to regional carriers rather than abandon them, so that service on many low density lines is still available. The implication is that shippers have either re-routed shipments over routes with greater volumes of traffic or, when this is not possible, chosen an alternate mode of transport.

Sixteen of seventeen commodities moved over routes in which the implementation of deregulation was associated with a positive and statistically significant increase in the number of carriers providing direct service. The results from Chapter V have indicated that post-deregulation rail rates strongly favor shippers who have larger numbers of rail alternative. Just as movements now travel over routes which are denser, shipments are also moving over routes where there are a larger number of railroads offering direct service. In the above discussion of interchange, it was noted that the merger activity in the early 1980's

[13]The reader will recall that the origin - destination information is state to state. Thus, the density measure is state to state rather than route specific.

affected the number of direct routes between many origin and destination pairs. However, it is clear that since deregulation shippers are either routing shipments in corridors where there is more rail competition or they are shipping by another mode. In this way both the post-Staggers rate structure and shipper response to this new structure are producing lower observed rail rates.

Of the variables over which shippers have control, the observed levels for MMILES seemed the least responsive to the implementation of Staggers. Average shipment distances changed for only seven of the seventeen commodity groups and where a Staggers related change was observed, it was typically small and negative.[14] At the same time the time trend coefficient estimates were positive and significant for fifteen of the seventeen commodities. Little explanation can be offered for the six cases in which STAGG was negative. However, it appears that, overall, shipment distances for most commodities are continuing to slowly increase.[15]

The coefficient estimates for the impact of deregulation on MLOADS are the only results in table 6.1 which are immediately inconsistent with the hypothesis that shippers reacted to the changed price structure. In Chapter V it was noted that rail rates now reflect the lower car load costs which are associated with multiple car load shipments. One would, therefore, expect to see shippers move

[14]The shift in shipment distances was usually in the neighborhood of one to two percent.

[15]The discussion in Chapter Four suggested that individual shippers were reluctant or at least slow to change either the volume which they shipped or the distance over which it traveled. The results here seem very consistent with this assertion.

toward fewer shipments with more cars. This is not at all what table 6.1 indicates. The imposition of Staggers was associated with <u>fewer</u> loads per shipment for sixteen of the seventeen commodity groups.[16] Kenneth Boyer (1987) and James MacDonald[17] both have offered discussions which explain this seemingly perverse result. The number of loads in typical shipments has declined sharply because of the use of larger equipment. There are tremendous cost savings associated with the use of such equipment. These cost reductions have resulted in lower rates and, therefore shippers are inclined to distribute a constant tonnage over a smaller number of the larger freight cars.

Chapter V established that railroad deregulation changed the way that carriers set rates. Aggregate (average) rates have fallen and rate characteristics now more accurately reflect underlying cost characteristics. In this chapter, we have seen that changes in railroads' rate setting and operational behavior have led to significant responses by shippers which. These responses have led to a noticeable alteration of rail shipment characteristics in the post-Staggers period. As a consequence, the total welfare gain to consumers resulting from deregulation is the result of (1) lower average rail rates and (2) savings due to reconfigure shipment characteristics.

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[16]The one commodity which is not included is Coal. The extensive use of unit trains in the movement of this commodity certainly explains this result.

[17]In a written commentary on this work, James MacDonald suggested that the variable MLOADS might be reconsidered for this very reason. He suggested that the number of tons in the shipment might be a more appropriate measure.

CHAPTER VII

CONCLUDING REMARKS

Economic theory suggests as appropriate the regulation of industries when the production technology and the configuration of firms within and contiguous to the industry are such that a stable and efficient equilibrium is impossible. Somewhere, imbedded in the thrust for such regulation is the belief that unconstrained firms will be capable of earning positive economic profits, or that destructive competition may ensue. However, when the scenario is devoid of the potential for normal, much less excessive, returns, the problem facing policy makers becomes entirely convoluted. This latter situation was epitomized by the circumstance of the U.S. railroad industry as it entered the final quarter of the twentieth century.

Certainly, when market demand is insufficient to sustain the regulated, as well as the ungoverned, firm the first and most obvious option is to simply allow the industry to disappear. Indeed, American railroads could have been allowed their continued decay until the mode was extinct. However, to have done so would have drastically increased factor costs for a host of other industries, imposing considerable hardship on those industries which are most efficiently served by rail. From a policy perspective, the abandonment of railroad freight service was simply unacceptable.

Given that railroad freight transportation was deemed essential to the national interest and yet apparently incapable of self-preservation under regulation, the second option was that of nationalization. If costs exceeded potential revenues, some form of subsidization could have been combined with extant governance to produce a viable national rail system. The 3R Act aptly demonstrated the federal government's willingness to commit large sums toward the preservation of rail transport. However, the magnitude of the problem when taken at a national rather than regional level, combined with an inherent and long standing distrust of nationalized enterprise, made this option unattractive.

From an economic vantage, the problem was two-fold. Railroad costs might be reduced or demand for the mode's services might be increased so that potential revenues would be adequate. However, history dictated that any steps toward either of these ends must be accompanied by the assurance that solvent carriers would be incapable of capturing excessive profits. Deregulation might work, but it would only be an acceptable solution if policy makers, shippers and the public were convinced that it did not imply renewed monopoly power. Winston Churchill once vowed that, "The Hun is at our feet or he is at our throat." Even as the U.S. railroads entered their third decade of pronounced decay, those who would have revived them found it difficult to escape the effects of their tainted (and once well earned) reputation.

The Staggers Rail Act of 1980 offered nearly total relief from rate regulation. If rates for the shipment of higher valued commodities had been held

artificially high by regulation, they might be lowered. Traffic levels could thereby be restored and the industry spared extinction. Proponents of railroad deregulation argued (probably without need) that operational and rate making freedoms would foster viable intermodal competition while enhancing intramodal rivalry. The concerns of more captive shippers, though loudly voiced, were muted by the distress of the railroad industry.

It will be decades before any final evaluation of Staggers is agreed upon. Still, transport policy makers are faced daily with demands to refine, overhaul, or overturn the act of deregulation. If the status quo is to be preserved or if new policies are to be adopted in its stead, those charged with the decisions must have the benefit of whatever amount of knowledge the academic community can offer. It is in this spirit that this research was undertaken.

The paramount ambition of the act to deregulate was to guarantee the well-being of the railroad industry. It was reasoned that rate making freedom would restore rail's share of intercity traffic and, thereby, accomplish this end. Rail's share has not increased. Still, there is every evidence that the industry is much more sound than it was even a decade ago. After a wave of consolidation in the early 1980's, the configuration of Class I carriers has remained largely constant. The remaining firms have offered financial returns which at least approach the levels that the ICC judges as adequate.

Operating costs have been substantially reduced. Carriers have eliminated the use of cabooses from most trains, negotiated smaller crew sizes and more

flexible work rules. Carrier owned service facilities have often been replaced by contract service agreements. More fuel efficient locomotives have replaced aging second and third generation diesels. Low density branch-line operations have either been abandoned or sold to short-line operators.[1] The cost of producing one ton-mile of railroad service is by all means less in the wake of Staggers. Still, very little in what is described above seems directly attributable to rate deregulation. Further, there is nothing in this to guarantee that lowered costs have not been combined with pricing freedoms to generate economic profits.

Since the act to deregulate, most railroad returns have increased so that they are of a level considered adequate by the Interstate Commerce Commission, but none have exceeded this standing. The link between railroad deregulation, cost reductions, and continually falling rail rates is the intramodal rivalry which has been spawned by Staggers. Evidence presented above clearly supports the contention that rail carriers are much more sensitive to the presence of intramodal competition than they were prior to 1981. Individual carriers have pushed to lower costs and to effectively market rates which reflect these reductions. This owes to the pervasive belief that all railroads must now compete with each other if they wish to maintain their own share of even the traffic for which they need not compete with other modes. This sort of expectation has been reenforced by the activities of the Interstate Commerce Commission. The reader will recall that one

[1]As an example of the degree of force reductions, employment on the Burlington Northern dropped from approximately 65,000 in 1980 to 30,000 in 1987 during a period where coal traffic in particular increased substantially.

of the original provisions of Staggers granted trackage rights to two other carriers over the Burlington Northern's route into the Powder River region of Wyoming. Additionally, the ICC has been particularly aggressive in imposing other trackage rights agreements in conjunction with merger approvals.[2]

Prior to 1981, rate regulation effectively eliminated intramodal rivalry. Railroads collectively competed against other modes of transport, but within the industry there was very little competition. Rates were set at levels which were largely independent of costs and which were vulnerable to the biases of the regulators. In the wake of deregulation, rail carriers are fiercely aware of intramodal alternatives. Rates better reflect costs and the biases, once evident, have been eliminated. Actual rate levels have not moved dramatically. Still, significant portions of numerous commodities move at rates which are lower than they would have been had regulation persisted. At the same time, there is no evidence that rail rates for even a single commodity have been made higher by Staggers.

The evidence suggests that railroads set rates which are different for various classes of customers without respect to existing cost differentials. Therefore, one may assume they retain some amount of market power. This does not necessarily mean that rail carriers are earning economic profits. McFarland (1989) maintains that declining average costs for the provision of some services

[2]For example, the Commission granted extensive trackage rights to the Denver, Rio Grand & Western when it approved the merger of the Union Pacific, Western Pacific, and Missouri Pacific railroads.

may make it necessary for some rates to exceed marginal costs. Winston, Corsi, Grim and Evans estimate the additions to welfare which would result if all rail rates were set at marginal cost, but in their policy conclusions suggest that railroad profits are mow only adequate. Therefore, they do not advocate any change in the present regulatory setting. The results presented here suggest that the structure and formulation of rail rates is more efficient than it was prior to deregulation. At the same time, both the physical and fiscal state of the railroad industry is better than it has been for decades.

That carrier expectations about rivals' behavior may change, that railroads will learn to undertake tacit collusion is possible. Even in the least concentrated rail markets, the number of available carriers is not sufficiently large to preclude that possibility. Neither is intermodal competition always adequate to guarantee that colluding rail carriers could not extract significant economic profits. However, from a policy perspective, the first decade of deregulated rail service has demonstrated that ungoverned intramodal and intermodal forces can provide a satisfactory outcome. If it becomes necessary for the federal government to refine existing transport policy, those refinements should be aimed at strengthening the forces of competition rather than reimposing direct rate regulation.

REFERENCES

REFERENCES

Atkson, S. E. and J. Kerkvliet, 1986, "Measuring the Multilateral Allocation of Rents: Wyoming Low-Sulfer Coal," Rand Journal of Economics, 1986.

Association of American Railroads, CS-45 Records, 1975-1984, Washington, D.C.

------------, Yearbook of Railroad Facts, 1974-1987, Washington, D.C.

Bailey, Elizabeth E. and William J. Baumol, "Deregulation and the Theory of Contestable Markets," Yale Journal of Regulation, 1984.

Barnekov, C.C. and A. N. Kleit, "The Costs of Railroad Regulation: A Further Analysis," Bureau of Economics, Federal Trade Commission, Working Paper #167, 1988.

Baumol, William, John Panzar and Robert Willig, Contestable Markets and the Theory of Industry Structure. New York: Harcourt, Brace, Jovanovich, 1982.

Boyer, Kenneth, "The Costs of Price Regulation: Lessons from Railroad Deregulation," Bell Journal of Economics and Management Science, Fall 1987.

Blair, Roger D. and David L. Kaserman, Antitrust Economics, Irwin Inc., Homewood, Illinois, 1985.

Bradburd, Ralph M., "Price-Cost Margins in Producer Goods and 'The Importance of Being Unimportant,'" Review of Economics and Statistics, 1982.

Braeutigam, Ronald R., Andrew F. Daugherty, and Mark A. Turnquist, "A Firm-Specific Analysis of Economies of Density in the U.S. Railroad Industry," Journal of Industrial Economics, September 1984, pp 408-416.

Chandler, Alfred D., The Visible hand: The Managerial Revolution in American Business, Belknap Press, Cambridge, Mass., 1977.

Daughen, Joseph R., The Wreck of the Penn Central, Little rown, Boston, 1971.

"Deregulation Helps Ease the Pains of Recession," Railway Age, January 26, 1981, 57-70.

Dougan, William R., "Railway Abandonments, Cross-Subsidization and the Theory of Deregulation," Rand Journal of Economics, Autum 1987, 18, 408-416.

Due, John F., "Abandonments of Rail Lines and the Smaller Railroad Alternative," Logistics and Transportation Review, November 1987, 23, 110-134.

Fair, Marvin L. and John Guandolo, Transportation Regulation, Wiilliam C. Brown Company, Dubuque, Iowa, 1979.

Friedlaender, Ann F. and Richard Spady, Freight Transportation Regulation, MIT Press, Cambridge, Massachusetts, 1981.

Friedlaender, Ann F. "Efficient Rail Rates and Deregulation," Working Paper, MIT, October 1986.

Garrod, P. V., and W. Mikius, "Capttive Shippers' and the Success of Railroads in Capturing Monopoly Rent," Journal of Law and Economics, Summer 1987.

Gilligan, T. W., W. J. Marshall, and B. B. Weingast, "Regulation and the Theory of Legislative Choice: The Interstate Commerce Act of 1887," The Journal of Law and Economics, April 1989, pp. 35-62.

Grimm, Curtis M. and Robert G. Harris, "A Qualitative Choice Analysis of Rail Routings: Implications for Vertical Foreclosure and Competition Policy," Logistics and Transportation Review, 1988, 24:1, 49-67.

---------------- and Kenneth G. Smith, "The Impact of Rail Regulatory Reform on Rates, Service Quality and Management Performance: A Shipper Perspective," Logistics and Transportation Review, 1986, 22:3.

Guandolo, John, Transportation Law, William Brown Company, Dubuque, Iowa, 1983.

Hauser, Robert J., "Competitive Forces in the U.S. Inland Grain Transport Industry: A Regional Perspective," Logistics and Transportation Review, 1986, 22:2, 158-173.

Hsing, Yu and Hui Chang, "Demand for Faculty of Public Higher Education in the Southeast: A Cross-Sectionally Correlated and Time-Wise Autoregressive Model," Procedings of the American Statistical Association, Business and Economics Statistics Section, 1980

Interstate Commerce Commission, Office of Transportation Analysis, Section on Rail Services Planning, Report on Rail Contract Rates,March 1984.

------------, Contract Rate Competitive Impact Report - Grain Shippers, February 1987.

Keeler, Theodore, "Theories of Regulation and the Deregulation Movement," Public Choice, 1984, 44, 103-145.

Kmenta, Jan, Elements of Econometrics, Second Ed., New York: McMillan Publishing Co., 1986, pp. 618-622.

Levin, Richard, "Railroad Rates, Profitability and Welfare Under Deregulation." Bell Journal of Economics and Management Science, Spring 1981.

-------------, "Railroad Regulation, Deregulation and Workable Competition," American Economic Review, May 1981.

McDonald, James, "Competition and Railr Rates for the Shipment of Corn, Soybeans, and Wheat," Rand Journal of Economics, Spring, 1987.

-------------, "Railroad Deregulation, Inovation, and Competitive Effects of the Staggers Act on Grain Transportation," Journal of Law and Economics, 1989.

--------------, Effects of Railroad Deregulation on Grain Transportation, U.S. Department of Agriculture, Technical Bulletin No. 1759, 1990.

McFarland, Henry, "The Economics of Vertical Restraints and Relationships Between Conecting Railroads," Logistics and Transportation Review, 1987, 23:2, 207-221.

-------------, "Did Railroad Deregulation Lead to Monopoly Pricing? An Application of 'q'," Journal of Business, July 1987.

-------------, "The Effects of United States Railroad Deregulation on Shippers, Labor, and Capital," Journal of Regulatory Economics, Fall 1989.

MacAvoy Paul W. and John W. Snow, Railroad Revitalization and Regulatory Reform, Ford Administration Papers on Regulatory Reform, American Enterprise Institute for Public Policy Research, Washington, D.C., 1977.

Peltzman, Sam, "The Economic Theory of Regulation After a Decade of Deregulation," Economic Activity, Ed. Martin Neil Baily and Clifford Winston, Brookings Institute, Washington, D.C., pp. 1-60.

Roberts, Merrill J., "Residual Railroad Rate Control: The Unmet Challenges of Deregulation," Logistics and Transportation Review, 1987, 23:1, 83-121.

Robertson, Ross M., History of the American Economy, Harcourt, Brace, World, New York, 1964, pp. 289-290.

Rose, Nancy L., "An Economic Assesment of Surface Freight Transportation Deregulation," Working Paper, MIT, Sloan School of Management, 1987.

Stigler, George, "The Theory of Economic Regulation," Bell Journal of Economics and Management Science, 2 (1971),

Winston, Clifford, "A Disaggregated Qualitative Mode Choice Model for Intercity Freight Transportation," Working Paper No. SL-7904, Department of Economics, University of California - Berkley, 1979.

------------, "Conceptual Developments in the Economics of Transportation: An Interpretive Survey," Journal of Economic Literature, March 1985, 57-94.

-------------. Thomas M. Corsi, Curtis M. Grim and Carol A. Evans, The Economic Effects of Surface Freight Deregulation, Brookings Institute, Washington, D.C., 1990.

Zimmerman, Martin M., "Rent and Regulation in Unit Train Rate Determination," Bell Journal of Economics, Spring 1979, 271-281.

APPENDICES

APPENDIX I

RAILROAD REGULATORY LEGISLATION

The following is an abridged list and explanation of railroad regulatory legislation through 1976 based on the more expansive treatment of Fair and Guandolo (1979). The list is confined to regulatory acts which explicitly govern railroad behavior and does not include more general antitrust legislation even though such laws are often applicable to rail carriage.

1887 The Interstate Commerce Act (ICA) was the initial act to regulate commerce. It applied to common carriage by rail, as well as transport which included partial use of either mode. The purpose wasto regulate individual rates and through rates, pooling arrangements etc. The bill sought to prevent rate discrimination and to eliminate long and short haul practices. The act was to be administered by the Interstate Commerce Commission (ICC).

1889 This amendment to ICA clarified original provisions relating to tariffs. More importantly, it gave the ICC the power to enforce the provisions of the ICA.

1903 The Elkins Act provided that published tariffs must be observed. It strengthened the provisions against rebates by making carriers liable for the receipt thereof. It also dealt more forcefully with the practice of rate discrimination.

1906 The Hepburn Act gave the ICC explicit power to impose maximum and minimum rates. This act also included pipe line operators under ICC jurisdiction. The act allowed the Commission to impose a system of accounting and reports and it was given the power to administer oaths, examine witnesses, and receive evidence, so that hearings might be held.

1906 The Amnesty of Witnesses Act provided that amnesty stemming from compulsory could only be extended to individuals, not to corporations.

1910 The Mann - Elkins Act gave the ICC the power to suspend and investigate rates on its own behalf. It also added the "aggregate of intermediates" clause. Finally the legislation brought telephone, telegraph, and cable companies under the ICA.

1912 The Panama Canal Act prohibited the ownership of water carriage by railroads when this might be injurious to competition. It also authorized the ICC to establish through rates for rail - water combinations.

1917 The Esch Car Service Act expanded the ICC's ability to investigate and, if necessary, modify car service agreements. It also gave the Commission express power to suspend car service agreements and directly control car supply during times of nation emergency.

1918 By Presidential Order the United States government began to directly operate the nation's railroads. This continued until 1920.

1920 The Transportation Act of 1920 returned railroads to private ownership. The act also defined "fair" rate of return, gave the Commission authority to direct operation of one carrier by another, and directed the ICC to develop a plan for merging the nation's railroads into a smaller number of systems. The act also gave the ICC explicit control of intrastate rates which discriminated against interstate commerce and the commission was also given control of railroad securities. Additionally, the ICC gained the power to enforce the division of joint rates and to force the installation of safety equipment.

1933 The Emergency Transportation Act established new rules for the making of rates, directed and encouraged carriers to examine ways to eliminate the duplication of services and expenses, and directed the Federal Trade Commission to develop a plan for improving all modes of transport.

1940 The Transportation Act of 1940 further broadened the Commission's powers regarding car usage agreements. This act also made it expressly illegal to discriminate against or in favor of regions and territories. The act expanded demands on carriers for acceptance of interchange and also defined motor carriage incidental to rail carriage.

1942 The Freight Forwarder Act brought freight forwarders under ICC control.

1948 The Mahaffie Act made it possible for rail carriers to reorganize without the necessity of bankruptcy.

1964 The Urban Mass Transportation Act made grant money available for planning of mass transit. The act also provided low interest loans for undertaking improvements.

1966 The Department of Transportation Act established the Department of Transportation (DOT) and transferred safety matters to this agency.

1970 The Rail Passenger Act mandated the creation of a nation rail passenger network (AMTRAK).

1973 The Regional Railroad Reorganization Act provided financing for U.S. Railway Association to create a final plan for the operation of freight service in the northeast.

1976 The Railroad Revitalization and Regulatory Reform Act began to reduce the degree of rate regulation. This act also imposed strict time limits on the length of certain regulatory processes.

APPENDIX II

DATA DOCUMENTATION

Below, is the documentation for the Interstate Commerce Commission's public use tapes derived from the annual Carload Waybill Sample. As this documentation indicates, the format of the public use tapes was changed in 1986.

1973 through 1985

Position	Description
1	Waybill Quarter
2	Waybill Year
4	Number of car loads in shipment
8	AAR mechanical car type
12	TOFC Plan
13	Number of TOFC/COFC loads in shipment
17	Standard Transportation Commodity Code
22	Net tons in shipment
29	Line haul revenue
38	Interstate/Intrastate flag
39	Transit Code
40	All rail/Intermodal flag
41	Actual shipment distance
45	Strata
46	Subsample
47	Origin State
50	States of interchange (up to nine)
68	Termination State
70	Origin ICC rate territory
71	Termination ICC rate territory
72	Expansion factor
75	Expanded number of car loads
81	Expanded number of tons
90	Expanded revenue
101	Expanded number of TOFC/COFC units

1986 and 1987

Position	Description
1	Waybill date
7	Accounting period
11	Number of car loads in shipment
15	Car ownership (rail or private)
16	AAR car type
20	AAR mechanical designation
24	ICC car type
26	TOFC/COFC plan
29	Number of TOFC/COFC units
33	TOFC/COFC unit ownership
34	TOFC/COFC type
35	Hazardous or bulk material in boxcar flag
36	Standard Transportation Commodity Code
41	Billed weight
48	Actual weight
55	Line haul revenue
64	Transit revenue
73	Miscellaneous revenue
82	Interstate/Intrastate flag
83	Import/Export flag
84	All rail/intermodal flag
85	Type of move via water
86	Outbound transit code
87	Substituted truck for rail service
88	Rebill code
89	Estimated miles
93	Stratum identification
94	Subsample number
95	Strata count
100	Theoretical expansion factor
103	Number of interchanges
104	Origin BEA area
107	Origin ICC rate territory
108	Interchange state
126	Termination BEA area
129	Termination rate territory
130	Waybill reporting period length
131	Car capacity

136	Nominal car capacity
139	Tare weight of car
143	Outside length of car
148	Outside width of car
152	Outside height of car
156	Extreme outside height
160	Type of wheel bearings and brakes
161	Number of axles
162	Draft gear
164	Number of articulated units
165	AAR error codes
215	ALK bad routing code
216	Expanded number of car loads
222	Expanded number of tons
231	Expanded revenue
242	Expanded number of TOFC/COFC units

APPENDIX III

B.E.A. TO STATE CONVERSIONS

Below is a listing of BEA areas, their description and the state with which they were associated for the purpose of matching 1986 and 1987 with that from earlier years.

Origin/Destination State	BEA's	Origin/Destination State	BEA's
Maine	1-2	Vermont	3
Massachusetts	4	Rhode Island	5
Connecticut	6	New York	7-12
Pennsylvania	13-18	Maryland	19
District of Columbia	20	Virginia	21-23
North Carolina	24-30	South Carolina	31-34
Georgia	35-40	Florida	41-46
Alabama	47-50	Tennessee	51-55
Kentucky	56-58	Vest Virginia	59-60
Ohio	64-70	Michigan	71-74
Indiana	75-82	Illinois	83-88
Wisconsin	89-94	Minnesota	95-97
Iowa	98-104	Missouri	105-108
Arkansas	109-111	Mississippi	112
Louisiana	113-118	Texas	119-135
Oklahoma	136-138	Kansas	139-141
Nebraska	142-145	South Dakota	146-148
South Dakota	149-152	Montana	153-155
Wyoming	156	Colorado	157-159
New Mexico	160	Arizona	161-162
Nevada	163-164	Utah	166-167
Washington	168-171	Oregon	172
California	174-181		

APPENDIX FOUR

SUMMARY STATISTICS

This appendix contains a set of summary statistics describing eight variables and seventeen commodities. Even though the data are quarterly, these summary figures were computed annually

Metallic Ore

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=74 ------------------------------					
RTM	408	0.031163	0.018438	0.00157352	0.1833
MNINT	423	0.955083	0.879124	0.00000000	4.0000
MLOADS	423	144.416076	267.876522	100.00000000	3667.0000
MMILES	423	792.962175	578.979437	0.00000000	3698.0000
DENSITY	423	23478.959811	39030.446335	100.00000000	244200.0000
AVINDX	423	100.920485	10.596618	91.28500000	127.0800
WATER	423	0.250591	0.433867	0.00000000	1.0000
DIRSRV	413	2.251816	1.776199	0.00000000	10.0000
------------------------------ MYEAR=76 ------------------------------					
RTM	307	0.047712	0.070783	0.00496134	0.9684
MNINT	433	0.942263	0.854667	0.00000000	4.0000
MLOADS	433	125.949192	179.317320	100.00000000	2300.0000
MMILES	433	682.348730	696.555574	0.00000000	3236.0000
DENSITY	433	22201.847575	33389.113694	100.00000000	231700.0000
AVINDX	433	97.370173	10.094583	89.73500000	127.0800
WATER	433	0.260970	0.439672	0.00000000	1.0000
DIRSRV	432	2.187500	1.660104	0.00000000	10.0000
------------------------------ MYEAR=77 ------------------------------					
RTM	389	0.039488	0.038219	0.01228951	0.3842
MNINT	389	0.910026	0.773016	0.00000000	4.0000
MLOADS	389	140.701799	357.510498	100.00000000	6300.0000
MMILES	389	849.462725	592.438510	38.00000000	3809.0000
DENSITY	389	22393.830334	35790.341135	200.00000000	209500.0000
AVINDX	389	97.244087	8.565928	89.73500000	127.0800
WATER	389	0.280206	0.449678	0.00000000	1.0000
DIRSRV	389	1.917738	1.598459	0.00000000	10.0000
------------------------------ MYEAR=78 ------------------------------					
RTM	394	0.033027	0.016169	0.00751536	0.1230
MNINT	394	0.992386	0.805479	0.00000000	4.0000
MLOADS	394	126.687817	209.096363	100.00000000	2633.0000
MMILES	394	863.644670	631.064423	62.00000000	5537.0000
DENSITY	394	24418.020305	41142.311265	300.00000000	250800.0000
AVINDX	393	101.337061	6.982128	89.73500000	127.0800
WATER	394	0.251269	0.434294	0.00000000	1.0000
DIRSRV	394	2.022843	1.785433	0.00000000	10.0000
------------------------------ MYEAR=79 ------------------------------					
RTM	422	0.037489	0.047059	0.00569577	0.6669
MNINT	422	0.990521	0.797803	0.00000000	3.0000
MLOADS	422	150.194313	377.338460	100.00000000	3882.0000
MMILES	422	890.182464	637.909619	9.00000000	3617.0000
DENSITY	422	23936.255924	40672.606155	200.00000000	267300.0000
AVINDX	421	106.976734	6.630074	90.33500000	127.0800
WATER	422	0.232227	0.422755	0.00000000	1.0000
DIRSRV	422	1.893365	1.716347	0.00000000	10.0000
------------------------------ MYEAR=80 ------------------------------					
RTM	357	0.040056	0.051357	0.00609639	0.6529
MNINT	357	1.028011	0.857420	0.00000000	4.0000
MLOADS	357	177.260504	574.061659	100.00000000	6700.0000
MMILES	357	857.649860	644.550761	9.00000000	3880.0000
DENSITY	357	21658.543417	33233.942073	100.00000000	225200.0000
AVINDX	357	109.402241	5.525120	91.75000000	127.0800
WATER	357	0.226891	0.419409	0.00000000	1.0000
DIRSRV	357	2.128852	1.780097	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------ MYEAR=81 ------					
RTM	383	0.038060	0.016819	0.00772288	0.1128
MNINT	383	1.185379	0.917882	0.00000000	4.0000
MLOADS	383	122.921671	195.207687	40.00000000	3400.0000
MMILES	383	893.182768	658.061327	93.00000000	3584.0000
DENSITY	383	22137.373368	40044.708957	80.00000000	292775.0000
AVINDX	383	109.213838	5.642455	90.47000000	127.0800
WATER	383	0.198433	0.399342	0.00000000	1.0000
DIRSRV	383	2.420366	1.581405	0.00000000	10.0000
------ MYEAR=82 ------					
RTM	304	0.039408	0.016432	0.00451522	0.1224
MNINT	304	1.128289	0.929879	0.00000000	5.0000
MLOADS	304	104.006579	93.083943	40.00000000	665.0000
MMILES	304	817.595395	571.961437	97.00000000	3035.0000
DENSITY	304	19704.802632	28853.825056	100.00000000	315480.0000
AVINDX	304	108.698454	5.266524	90.47000000	127.0800
WATER	304	0.213816	0.410674	0.00000000	1.0000
DIRSRV	303	2.504950	1.543779	0.00000000	10.0000
------ MYEAR=83 ------					
RTM	306	0.037685	0.014987	0.01162346	0.1104
MNINT	306	1.029412	0.850719	0.00000000	4.0000
MLOADS	306	100.267974	89.634193	36.00000000	600.0000
MMILES	306	802.349673	569.744417	72.00000000	4148.0000
DENSITY	306	19383.441176	25312.150581	120.00000000	122996.0000
AVINDX	306	105.404918	5.730011	91.28500000	127.0800
WATER	306	0.261438	0.440138	0.00000000	1.0000
DIRSRV	306	2.385621	1.403154	0.00000000	9.0000
------ MYEAR=84 ------					
RTM	390	0.037922	0.017294	0.01280911	0.1679
MNINT	390	1.069231	0.847089	0.00000000	5.0000
MLOADS	390	77.261538	95.491279	36.00000000	1215.0000
MMILES	390	907.107692	607.394405	79.00000000	3227.0000
DENSITY	390	21515.992308	31037.696332	80.00000000	171352.0000
AVINDX	390	111.610449	7.206146	91.75000000	127.0800
WATER	390	0.210256	0.408014	0.00000000	1.0000
DIRSRV	369	2.211382	1.257059	0.00000000	8.0000
------ MYEAR=85 ------					
RTM	377	0.040128	0.023311	0.01248686	0.3361
MNINT	377	1.108753	0.829222	0.00000000	4.0000
MLOADS	377	74.572944	78.404913	36.00000000	688.0000
MMILES	377	894.347480	623.842340	74.00000000	3149.0000
DENSITY	377	18734.771883	26257.143462	40.00000000	149340.0000
AVINDX	377	119.964589	7.876861	91.08500000	127.0800
WATER	377	0.217507	0.413098	0.00000000	1.0000
DIRSRV	355	2.197183	1.264685	0.00000000	8.0000

Coal

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------ MYEAR=74 ------					
RTM	677	0.027836	0.019877	0.00226256	0.2585
MNINT	719	0.830320	0.820438	0.00000000	4.0000
MLOADS	719	118.753825	149.588141	100.00000000	2100.0000
MMILES	719	628.086231	476.133898	0.00000000	3279.0000
DENSITY	719	28339.499305	40673.931654	200.00000000	244200.0000
AVINDX	719	98.553790	9.604749	89.87000000	127.0800
WATER	719	0.204451	0.403580	0.00000000	1.0000
DIRSRV	665	2.138346	1.675152	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=76 ------------------------------					
RTM	498	0.079373	0.132690	0.00326841	0.9621
MNINT	677	0.751846	0.775275	0.00000000	4.0000
MLOADS	677	152.262925	537.048899	100.00000000	12600.0000
MMILES	677	479.217134	588.111612	0.00000000	3380.0000
DENSITY	677	27432.791728	32935.043926	100.00000000	231700.0000
AVINDX	677	95.606677	9.188051	89.60000000	127.0800
WATER	677	0.202363	0.402059	0.00000000	1.0000
DIRSRV	667	2.151424	1.696891	0.00000000	10.0000
------------------------------ MYEAR=77 ------------------------------					
RTM	618	0.028051	0.012411	0.00000000	0.1404
MNINT	618	0.734628	0.793489	0.00000000	5.0000
MLOADS	618	147.993528	320.654881	100.00000000	4600.0000
MMILES	618	657.160194	460.874423	50.00000000	3425.0000
DENSITY	618	28880.906149	33208.154343	100.00000000	209500.0000
AVINDX	618	95.946998	6.382543	89.73500000	127.0800
WATER	618	0.182848	0.386855	0.00000000	1.0000
DIRSRV	614	1.726384	1.475207	0.00000000	9.0000
------------------------------ MYEAR=78 ------------------------------					
RTM	670	0.029950	0.027777	0.00349956	0.4043
MNINT	670	0.747761	0.750059	0.00000000	5.0000
MLOADS	670	116.920896	124.405797	100.00000000	2356.0000
MMILES	670	685.600000	451.506097	34.00000000	3196.0000
DENSITY	670	30243.880597	38663.588930	100.00000000	250800.0000
AVINDX	670	102.459627	6.172722	89.60000000	127.0800
WATER	670	0.200000	0.400299	0.00000000	1.0000
DIRSRV	665	1.812030	1.560769	0.00000000	10.0000
------------------------------ MYEAR=79 ------------------------------					
RTM	632	0.029091	0.014458	0.00244317	0.1913
MNINT	632	0.751582	0.757423	0.00000000	5.0000
MLOADS	632	135.234177	297.447816	100.00000000	5100.0000
MMILES	632	658.469937	420.734765	33.00000000	3173.0000
DENSITY	632	34616.930380	44359.280325	400.00000000	267300.0000
AVINDX	632	108.527033	4.767240	89.60000000	127.0800
WATER	632	0.208861	0.406817	0.00000000	1.0000
DIRSRV	627	1.821372	1.546920	0.00000000	9.0000
------------------------------ MYEAR=80 ------------------------------					
RTM	600	0.027907	0.013521	0.00027368	0.1910
MNINT	600	0.891667	0.802707	0.00000000	5.0000
MLOADS	600	136.608333	246.304577	100.00000000	3950.0000
MMILES	600	675.995000	653.990646	71.00000000	9999.0000
DENSITY	600	35467.666667	45494.423749	100.00000000	283800.0000
AVINDX	600	109.708325	4.766689	89.60000000	127.0800
WATER	600	0.195000	0.396531	0.00000000	1.0000
DIRSRV	595	1.794958	1.545595	0.00000000	9.0000
------------------------------ MYEAR=81 ------------------------------					
RTM	633	0.030508	0.022025	0.00800250	0.3152
MNINT	633	0.873618	0.795447	0.00000000	5.0000
MLOADS	633	157.017378	127.443875	36.00000000	1424.0000
MMILES	633	671.309637	422.286047	9.00000000	2994.0000
DENSITY	633	33294.573460	42914.772317	80.00000000	292775.0000
AVINDX	633	108.464455	4.271237	90.33500000	127.0800
WATER	633	0.199052	0.399603	0.00000000	1.0000
DIRSRV	629	2.408585	1.386923	0.00000000	9.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=82					
RTM	619	0.031855	0.019800	0.01225756	0.3022
MNINT	619	0.817447	0.812893	0.00000000	5.0000
MLOADS	619	181.310178	141.234963	36.00000000	553.0000
MMILES	619	671.812601	440.086021	11.00000000	2774.0000
DENSITY	619	33940.883683	44684.296559	160.00000000	315480.0000
AVINDX	619	108.002262	4.130859	89.60000000	127.0800
WATER	619	0.174475	0.379824	0.00000000	1.0000
DIRSRV	614	2.423453	1.387372	0.00000000	9.0000
MYEAR=83					
RTM	609	0.031793	0.026191	0.00537045	0.5304
MNINT	609	0.766831	0.830038	0.00000000	4.0000
MLOADS	609	178.566502	148.710508	36.00000000	814.0000
MMILES	609	666.454844	452.469025	11.00000000	3088.0000
DENSITY	609	33453.871921	40201.389226	100.00000000	229824.0000
AVINDX	609	103.440608	3.512213	92.03500000	127.0800
WATER	609	0.174056	0.379469	0.00000000	1.0000
DIRSRV	602	2.300664	1.222760	0.00000000	8.0000
MYEAR=84					
RTM	656	0.031389	0.023238	0.01217864	0.3946
MNINT	656	0.820122	0.840551	0.00000000	5.0000
MLOADS	656	146.467988	117.976769	36.00000000	556.0000
MMILES	656	704.312500	500.891850	45.00000000	3421.0000
DENSITY	656	37317.865854	47528.361673	240.00000000	236517.0000
AVINDX	656	114.416959	6.021472	91.08500000	127.0800
WATER	656	0.185976	0.389384	0.00000000	1.0000
DIRSRV	645	2.144186	1.155322	0.00000000	7.0000
MYEAR=85					
RTM	597	0.029295	0.015886	0.00818474	0.2115
MNINT	597	0.812395	0.856272	0.00000000	5.0000
MLOADS	597	149.405360	112.875963	36.00000000	560.0000
MMILES	597	705.815745	518.160550	35.00000000	3057.0000
DENSITY	597	39164.556114	47006.786433	40.00000000	263783.0000
AVINDX	597	123.034238	5.494768	91.08500000	127.0800
WATER	597	0.175879	0.381037	0.00000000	1.0000
DIRSRV	589	2.200340	1.203990	0.00000000	8.0000

Non-Metallic Ore

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	1132	0.033074	0.020977	0.00126236	0.3455
MNINT	1182	0.939932	0.871379	0.00000000	6.0000
MLOADS	1182	109.214044	92.133324	100.00000000	3000.0000
MMILES	1182	816.159898	760.054764	0.00000000	4179.0000
DENSITY	1182	20936.209814	29796.428848	100.00000000	244200.0000
AVINDX	1181	100.249996	10.502279	91.08500000	127.0800
WATER	1182	0.199662	0.399915	0.00000000	1.0000
DIRSRV	1153	2.300954	1.785009	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------- MYEAR=76 -------------------------------					
RTM	837	0.047474	0.053243	0.00168376	0.8278
MNINT	1139	0.880597	0.829890	0.00000000	5.0000
MLOADS	1139	104.031607	28.719216	100.00000000	500.0000
MMILES	1139	697.821773	836.754432	0.00000000	3967.0000
DENSITY	1139	20945.215101	28386.989294	100.00000000	231700.0000
AVINDX	1139	96.880904	10.117129	89.73500000	127.0800
WATER	1139	0.179982	0.384342	0.00000000	1.0000
DIRSRV	1138	2.275923	1.779231	0.00000000	10.0000
------------------------------- MYEAR=77 -------------------------------					
RTM	1083	0.034932	0.023877	0.00225288	0.4757
MNINT	1083	0.902124	0.822301	0.00000000	4.0000
MLOADS	1083	105.037858	48.657385	100.00000000	1400.0000
MMILES	1083	914.607572	778.339525	7.00000000	4234.0000
DENSITY	1083	20151.800554	26555.501534	100.00000000	209500.0000
AVINDX	1083	96.952835	8.598744	89.73500000	127.0800
WATER	1083	0.163435	0.369933	0.00000000	1.0000
DIRSRV	1081	1.959297	1.728896	0.00000000	10.0000
------------------------------- MYEAR=78 -------------------------------					
RTM	1086	0.035068	0.026453	0.00279241	0.5015
MNINT	1086	0.865562	0.789547	0.00000000	5.0000
MLOADS	1086	106.290976	48.479404	100.00000000	900.0000
MMILES	1086	898.489871	759.180443	7.00000000	3889.0000
DENSITY	1086	21388.121547	30116.925700	100.00000000	250800.0000
AVINDX	1086	101.406354	6.623486	89.73500000	127.0800
WATER	1086	0.172192	0.377721	0.00000000	1.0000
DIRSRV	1085	1.963134	1.704813	0.00000000	10.0000
------------------------------- MYEAR=79 -------------------------------					
RTM	1087	0.036546	0.033626	0.00182754	0.5672
MNINT	1087	0.914443	0.810295	0.00000000	4.0000
MLOADS	1087	105.894204	44.001662	100.00000000	1200.0000
MMILES	1087	920.825207	774.170504	7.00000000	4342.0000
DENSITY	1087	21710.487580	32702.305611	100.00000000	267300.0000
AVINDX	1087	107.014379	6.651830	89.73500000	127.0800
WATER	1087	0.172953	0.378381	0.00000000	1.0000
DIRSRV	1087	1.839926	1.668732	0.00000000	10.0000
------------------------------- MYEAR=80 -------------------------------					
RTM	997	0.038053	0.038176	0.00163036	0.4701
MNINT	997	1.102307	0.915926	0.00000000	5.0000
MLOADS	997	105.578736	32.539211	100.00000000	500.0000
MMILES	997	937.969910	770.928927	28.00000000	4218.0000
DENSITY	997	19683.650953	29799.922568	100.00000000	283800.0000
AVINDX	997	109.648746	5.266012	90.47000000	127.0800
WATER	997	0.147442	0.354724	0.00000000	1.0000
DIRSRV	997	1.898696	1.695366	0.00000000	10.0000
------------------------------- MYEAR=81 -------------------------------					
RTM	1099	0.037841	0.041025	0.00153753	0.9588
MNINT	1099	1.160146	0.937877	0.00000000	5.0000
MLOADS	1099	82.473157	41.644628	36.00000000	400.0000
MMILES	1099	1007.690628	797.976304	7.00000000	3950.0000
DENSITY	1099	17885.520473	26821.607249	40.00000000	212165.0000
AVINDX	1099	108.384777	4.772015	89.73500000	127.0800
WATER	1099	0.154686	0.361770	0.00000000	1.0000
DIRSRV	1097	2.379216	1.595570	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=82					
RTM	946	0.037584	0.021621	0.00066046	0.3902
MNINT	946	1.102537	0.927564	0.00000000	5.0000
MLOADS	946	72.805497	40.661491	36.00000000	400.0000
MMILES	946	981.633192	801.592936	33.00000000	3996.0000
DENSITY	946	18400.357294	30012.988212	100.00000000	315480.0000
AVINDX	946	108.599894	4.691726	90.33500000	127.0800
WATER	946	0.140592	0.347784	0.00000000	1.0000
DIRSRV	946	2.360465	1.510486	0.00000000	10.0000
MYEAR=83					
RTM	985	0.034766	0.017737	0.00101501	0.2868
MNINT	985	0.962437	0.863446	0.00000000	5.0000
MLOADS	985	67.358376	44.381963	36.00000000	500.0000
MMILES	985	1019.543147	798.973010	12.00000000	4919.0000
DENSITY	985	20004.955330	31319.241589	40.00000000	229824.0000
AVINDX	985	104.866756	5.053927	91.08500000	127.0800
WATER	985	0.137056	0.344081	0.00000000	1.0000
DIRSRV	985	2.201015	1.316020	0.00000000	9.0000
MYEAR=84					
RTM	1248	0.035604	0.029534	0.00263672	0.8127
MNINT	1248	1.005609	0.899506	0.00000000	5.0000
MLOADS	1248	54.750000	29.915224	36.00000000	300.0000
MMILES	1248	1098.312500	821.296920	11.00000000	3518.0000
DENSITY	1248	19463.534455	34141.380512	40.00000000	236517.0000
AVINDX	1248	113.085741	7.256776	91.08500000	127.0800
WATER	1248	0.136218	0.343157	0.00000000	1.0000
DIRSRV	1152	2.080729	1.316702	0.00000000	8.0000
MYEAR=85					
RTM	1181	0.033532	0.014543	0.00000000	0.2098
MNINT	1181	0.928027	0.864989	0.00000000	4.0000
MLOADS	1181	53.526672	29.994158	36.00000000	300.0000
MMILES	1181	1065.121084	811.752860	34.00000000	3850.0000
DENSITY	1177	20466.926933	34014.319921	36.00000000	263783.0000
AVINDX	1179	120.416408	7.400895	91.75000000	127.0800
WATER	1181	0.127858	0.334073	0.00000000	1.0000
DIRSRV	1096	2.106752	1.292942	0.00000000	8.0000

Food and Kindred Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	3098	0.044200	0.030357	0.00000000	0.9589
MNINT	3152	1.115165	0.869672	0.00000000	6.0000
MLOADS	3152	101.578997	16.993515	100.00000000	550.0000
MMILES	3152	1122.469543	794.485140	0.00000000	4660.0000
DENSITY	3152	13301.586294	22801.706524	100.00000000	244200.0000
AVINDX	3152	98.674180	10.179431	89.73500000	135.6150
WATER	3152	0.176396	0.381217	0.00000000	1.0000
DIRSRV	3107	1.922755	1.588904	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=76					
RTM	2628	0.066381	0.068329	0.00207096	0.9730
MNINT	3063	1.062357	0.843597	0.00000000	6.0000
MLOADS	3063	101.276853	13.812607	100.00000000	550.0000
MMILES	3063	938.386223	880.660351	0.00000000	4103.0000
DENSITY	3063	12752.693438	20583.492616	100.00000000	231700.0000
AVINDX	3063	94.607746	8.360070	89.73500000	135.6150
WATER	3063	0.174992	0.380022	0.00000000	1.0000
DIRSRV	3036	1.935771	1.599266	0.00000000	10.0000
MYEAR=77					
RTM	3039	0.044865	0.024302	0.00000000	0.3890
MNINT	3040	1.063487	0.822669	0.00000000	5.0000
MLOADS	3040	101.533882	16.411604	100.00000000	550.0000
MMILES	3039	1145.335637	786.854325	51.00000000	4492.0000
DENSITY	3040	12891.250000	20580.245492	100.00000000	209500.0000
AVINDX	3039	95.322014	6.192927	89.73500000	135.6150
WATER	3040	0.174671	0.379748	0.00000000	1.0000
DIRSRV	3022	1.665122	1.543489	0.00000000	10.0000
MYEAR=78					
RTM	3043	0.044723	0.025298	0.00000000	0.4505
MNINT	3043	1.071311	0.840213	0.00000000	6.0000
MLOADS	3043	101.208676	15.796833	100.00000000	800.0000
MMILES	3043	1130.084456	762.301641	39.00000000	4787.0000
DENSITY	3043	13578.935261	22551.050565	100.00000000	250800.0000
AVINDX	3043	101.096098	5.033984	89.73500000	135.6150
WATER	3043	0.172856	0.378185	0.00000000	1.0000
DIRSRV	3032	1.666227	1.539561	0.00000000	10.0000
MYEAR=79					
RTM	3059	0.044635	0.027186	0.00000000	0.6901
MNINT	3059	1.115397	0.891473	0.00000000	6.0000
MLOADS	3059	102.236025	22.285513	100.00000000	800.0000
MMILES	3059	1139.645963	768.550218	42.00000000	4877.0000
DENSITY	3059	14080.679961	24937.478054	100.00000000	267300.0000
AVINDX	3059	107.975660	5.266169	89.73500000	135.6150
WATER	3059	0.171952	0.377400	0.00000000	1.0000
DIRSRV	3042	1.657462	1.535406	0.00000000	10.0000
MYEAR=80					
RTM	2953	0.045399	0.023650	0.00000000	0.3166
MNINT	2953	1.214358	0.944122	0.00000000	6.0000
MLOADS	2953	101.332205	14.066710	100.00000000	500.0000
MMILES	2953	1153.449712	782.482815	36.00000000	4638.0000
DENSITY	2953	13390.890620	24054.274005	100.00000000	283800.0000
AVINDX	2953	109.902843	3.846229	90.33500000	135.6150
WATER	2953	0.168303	0.374199	0.00000000	1.0000
DIRSRV	2945	1.686587	1.552929	0.00000000	10.0000
MYEAR=81					
RTM	3085	0.048361	0.028511	0.00243144	0.5446
MNINT	3085	1.149433	0.919262	0.00000000	7.0000
MLOADS	3085	76.871961	30.910672	38.00000000	467.0000
MMILES	3085	1166.945219	785.832859	50.00000000	4333.0000
DENSITY	3085	12616.008752	24236.729333	40.00000000	292775.0000
AVINDX	3085	108.588301	3.630212	90.33500000	135.6150
WATER	3085	0.164992	0.371233	0.00000000	1.0000
DIRSRV	3073	2.098601	1.473411	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=82					
RTM	2931	0.047745	0.031748	0.00171989	0.7518
MNINT	2931	1.049471	0.905393	0.00000000	6.0000
MLOADS	2931	69.484817	31.697483	20.00000000	500.0000
MMILES	2931	1154.556124	797.904937	23.00000000	4971.0000
DENSITY	2931	12735.694643	24349.796317	40.00000000	315480.0000
AVINDX	2931	108.250781	3.772719	90.33500000	132.3850
WATER	2931	0.168202	0.374109	0.00000000	1.0000
DIRSRV	2922	2.149897	1.462336	0.00000000	10.0000
MYEAR=83					
RTM	2878	0.044315	0.026292	0.00001150	0.5361
MNINT	2878	0.927033	0.861786	0.00000000	6.0000
MLOADS	2878	64.848853	32.081769	38.00000000	500.0000
MMILES	2878	1138.480542	778.848724	66.00000000	4512.0000
DENSITY	2878	13548.050730	23891.198282	40.00000000	229824.0000
AVINDX	2878	103.514639	3.291571	91.42000000	135.6150
WATER	2878	0.171647	0.377139	0.00000000	1.0000
DIRSRV	2872	2.036560	1.322732	0.00000000	9.0000
MYEAR=84					
RTM	3152	0.042943	0.024323	0.00000000	0.4036
MNINT	3152	0.920051	0.840851	0.00000000	5.0000
MLOADS	3152	48.688135	18.472280	36.00000000	200.0000
MMILES	3152	1160.667830	780.021668	38.00000000	3872.0000
DENSITY	3152	14275.223033	26335.235293	40.00000000	236517.0000
AVINDX	3151	113.821347	6.423412	91.05000000	135.6150
WATER	3152	0.164975	0.371217	0.00000000	1.0000
DIRSRV	3050	1.872131	1.267208	0.00000000	8.0000
MYEAR=85					
RTM	3176	0.039959	0.023561	0.00414543	0.7788
MNINT	3176	0.897040	0.825448	0.00000000	6.0000
MLOADS	3176	47.212217	18.133859	36.00000000	207.0000
MMILES	3176	1175.031171	777.795644	21.00000000	3821.0000
DENSITY	3176	13331.363980	24406.824607	36.00000000	252720.0000
AVINDX	3175	122.362083	5.795570	91.08500000	135.6150
WATER	3176	0.165302	0.371512	0.00000000	1.0000
DIRSRV	3063	1.883774	1.277426	0.00000000	8.0000
MYEAR=86					
RTM	735	0.035244	0.017296	0.00233007	0.2167
MNINT	735	0.771429	0.903822	0.00000000	5.0000
MLOADS	735	45.529252	17.525580	36.00000000	200.0000
MMILES	735	1233.863946	824.122807	110.00000000	3918.0000
DENSITY	735	29597.814966	50657.525763	80.00000000	330014.0000
AVINDX	735	126.124816	3.580578	101.11500000	129.4350
WATER	735	0.198639	0.399248	0.00000000	1.0000
DIRSRV	731	2.310534	1.495431	0.00000000	8.0000
MYEAR=87					
RTM	774	0.033999	0.022041	0.00346658	0.3327
MNINT	774	0.762274	0.910097	0.00000000	4.0000
MLOADS	774	45.348837	15.227886	36.00000000	161.0000
MMILES	774	1252.487080	853.235046	110.00000000	3780.0000
DENSITY	774	31241.844961	53211.898265	80.00000000	348068.0000
AVINDX	774	128.277106	3.580344	92.02000000	130.9700
WATER	774	0.183463	0.387296	0.00000000	1.0000
DIRSRV	766	2.349869	1.449920	0.00000000	8.0000

Lumber and Wood Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	1862	0.043397	0.036387	0.00000000	0.5738
MNINT	1891	1.289265	1.037593	0.00000000	7.0000
MLOADS	1891	102.178741	35.490066	100.00000000	1100.0000
MMILES	1891	1344.901639	1004.410436	0.00000000	4701.0000
DENSITY	1891	14443.521946	25241.905278	100.00000000	244200.0000
AVINDX	1891	99.453289	9.854325	90.91500000	127.0800
WATER	1891	0.187203	0.390177	0.00000000	1.0000
DIRSRV	1865	1.704021	1.516119	0.00000000	10.0000
MYEAR=76					
RTM	1646	0.057497	0.067834	0.00000000	0.9206
MNINT	1907	1.245412	0.946399	0.00000000	6.0000
MLOADS	1907	102.209229	28.798751	100.00000000	1100.0000
MMILES	1907	1258.143681	1071.158759	0.00000000	4428.0000
DENSITY	1907	13215.626639	20164.933178	100.00000000	231700.0000
AVINDX	1907	95.639389	8.612838	89.73500000	127.0800
WATER	1907	0.192449	0.394327	0.00000000	1.0000
DIRSRV	1902	1.655626	1.507030	0.00000000	10.0000
MYEAR=77					
RTM	1872	0.043256	0.039249	0.00000000	0.8665
MNINT	1872	1.251068	0.937376	0.00000000	6.0000
MLOADS	1872	101.067308	11.914301	100.00000000	400.0000
MMILES	1872	1441.988782	997.581648	52.00000000	4733.0000
DENSITY	1872	12463.728632	19886.978182	100.00000000	209500.0000
AVINDX	1872	96.312821	7.564825	89.73500000	127.0800
WATER	1872	0.178419	0.382967	0.00000000	1.0000
DIRSRV	1867	1.492769	1.386787	0.00000000	10.0000
MYEAR=78					
RTM	1851	0.041330	0.029791	0.00000000	0.4739
MNINT	1851	1.290654	0.967479	0.00000000	6.0000
MLOADS	1851	100.484063	5.732896	100.00000000	250.0000
MMILES	1851	1429.057266	984.658734	47.00000000	4339.0000
DENSITY	1851	13379.362507	23263.420673	100.00000000	250800.0000
AVINDX	1851	101.063320	6.023252	89.73500000	127.4300
WATER	1851	0.179903	0.384210	0.00000000	1.0000
DIRSRV	1851	1.491086	1.392762	0.00000000	10.0000
MYEAR=79					
RTM	1807	0.041440	0.028946	0.00000000	0.5298
MNINT	1807	1.310459	0.977270	0.00000000	8.0000
MLOADS	1807	101.415053	18.457828	100.00000000	660.0000
MMILES	1807	1427.555064	1000.794511	22.00000000	4950.0000
DENSITY	1807	13854.178196	25712.180087	100.00000000	267300.0000
AVINDX	1807	107.118857	6.036255	89.73500000	127.4300
WATER	1807	0.176536	0.381381	0.00000000	1.0000
DIRSRV	1807	1.477034	1.405336	0.00000000	10.0000
MYEAR=80					
RTM	1601	0.041961	0.029428	0.00000000	0.3420
MNINT	1601	1.502186	1.158189	0.00000000	8.0000
MLOADS	1601	100.831355	8.351664	100.00000000	233.0000
MMILES	1601	1455.276077	1025.378601	37.00000000	4781.0000
DENSITY	1601	13597.064335	25097.156664	100.00000000	283800.0000
AVINDX	1601	109.332517	5.158791	89.73500000	127.0800
WATER	1601	0.181761	0.385768	0.00000000	1.0000
DIRSRV	1599	1.493433	1.398122	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------ MYEAR=81 ------------					
RTM	1652	0.043684	0.035738	0.00000000	0.7108
MNINT	1652	1.381356	1.100010	0.00000000	6.0000
MLOADS	1652	77.250605	31.691103	36.00000000	508.0000
MMILES	1652	1417.544189	1002.084857	43.00000000	4617.0000
DENSITY	1652	13209.211259	26567.699763	40.00000000	292775.0000
AVINDX	1652	108.383590	4.691870	90.47000000	127.4300
WATER	1652	0.164649	0.370976	0.00000000	1.0000
DIRSRV	1647	1.956284	1.353824	0.00000000	10.0000
------------ MYEAR=82 ------------					
RTM	1459	0.042220	0.026445	0.00000000	0.3765
MNINT	1459	1.370117	1.130733	0.00000000	7.0000
MLOADS	1459	67.198081	28.710677	36.00000000	210.0000
MMILES	1459	1481.971213	1051.848600	44.00000000	4883.0000
DENSITY	1459	13288.408499	26339.379809	40.00000000	315480.0000
AVINDX	1459	108.392474	4.065659	90.33500000	127.0800
WATER	1459	0.161069	0.367721	0.00000000	1.0000
DIRSRV	1457	1.943720	1.336148	0.00000000	10.0000
------------ MYEAR=83 ------------					
RTM	1634	0.040085	0.024658	0.00000000	0.3328
MNINT	1634	1.259486	1.094992	0.00000000	7.0000
MLOADS	1634	62.408813	28.865960	36.00000000	400.0000
MMILES	1634	1430.809670	988.760273	45.00000000	4781.0000
DENSITY	1634	13253.898409	24515.417771	40.00000000	229824.0000
AVINDX	1634	104.332215	4.063278	90.33500000	127.0800
WATER	1634	0.175031	0.380110	0.00000000	1.0000
DIRSRV	1628	1.859951	1.153299	0.00000000	9.0000
------------ MYEAR=84 ------------					
RTM	2226	0.039758	0.024779	0.00001949	0.5386
MNINT	2226	1.367475	1.161054	0.00000000	7.0000
MLOADS	2226	48.836927	19.642808	36.00000000	223.0000
MMILES	2226	1500.404762	988.351570	15.00000000	4087.0000
DENSITY	2226	13109.021563	26202.769724	40.00000000	236517.0000
AVINDX	2223	114.389604	7.471922	89.73500000	127.0800
WATER	2226	0.144205	0.351376	0.00000000	1.0000
DIRSRV	1886	1.696713	1.165034	0.00000000	8.0000
------------ MYEAR=85 ------------					
RTM	2189	0.037134	0.030768	0.00000000	0.6972
MNINT	2189	1.294198	1.107672	0.00000000	6.0000
MLOADS	2189	46.728643	17.464129	36.00000000	200.0000
MMILES	2189	1499.492005	983.867582	23.00000000	4498.0000
DENSITY	2189	12422.911832	23869.683963	40.00000000	252720.0000
AVINDX	2189	121.580288	6.608991	89.73500000	127.0800
WATER	2189	0.132481	0.339090	0.00000000	1.0000
DIRSRV	1847	1.690850	1.180024	0.00000000	8.0000

Furniture and Fixtures

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------ MYEAR=74 ------					
RTM	944	0.150331	0.073277	0.01248845	0.9180
MNINT	949	1.186512	0.905904	0.00000000	6.0000
MLOADS	949	100.456270	6.567680	100.00000000	200.0000
MMILES	949	1090.094837	719.831611	0.00000000	4444.0000
DENSITY	949	17169.125395	26402.518048	100.00000000	244200.0000
AVINDX	949	100.345411	9.324248	90.47000000	135.6150
WATER	949	0.214963	0.411013	0.00000000	1.0000
DIRSRV	943	1.757158	1.709033	0.00000000	10.0000
------ MYEAR=76 ------					
RTM	656	0.166357	0.104929	0.01028037	0.9915
MNINT	806	1.153846	0.890895	0.00000000	6.0000
MLOADS	806	100.599256	7.334049	100.00000000	200.0000
MMILES	806	939.779156	783.987201	0.00000000	4079.0000
DENSITY	806	15206.947891	23705.279468	100.00000000	231700.0000
AVINDX	805	96.600888	8.411360	89.73500000	135.6150
WATER	806	0.197270	0.398185	0.00000000	1.0000
DIRSRV	802	1.577307	1.663933	0.00000000	10.0000
------ MYEAR=77 ------					
RTM	761	0.156589	0.064734	0.01818678	0.4613
MNINT	761	1.097240	0.800332	0.00000000	5.0000
MLOADS	761	101.094612	16.629760	100.00000000	500.0000
MMILES	761	1064.950066	679.581613	91.00000000	4198.0000
DENSITY	761	15194.086728	22482.879550	100.00000000	209500.0000
AVINDX	760	96.251599	7.383150	89.73500000	135.6150
WATER	761	0.211564	0.408686	0.00000000	1.0000
DIRSRV	754	1.362069	1.586026	0.00000000	10.0000
------ MYEAR=78 ------					
RTM	713	0.149954	0.059383	0.00898392	0.4371
MNINT	713	1.166900	0.816903	0.00000000	5.0000
MLOADS	713	100.326788	5.432535	100.00000000	200.0000
MMILES	713	1155.893408	752.610022	149.00000000	5031.0000
DENSITY	713	14258.064516	22054.672749	100.00000000	250800.0000
AVINDX	713	99.772048	6.923746	89.73500000	134.2000
WATER	713	0.183731	0.387536	0.00000000	1.0000
DIRSRV	710	1.198592	1.389563	0.00000000	10.0000
------ MYEAR=79 ------					
RTM	688	0.152257	0.071849	0.01095835	0.6800
MNINT	688	1.178779	0.860766	0.00000000	5.0000
MLOADS	688	100.944767	9.491121	100.00000000	200.0000
MMILES	688	1196.802326	746.839851	144.00000000	3747.0000
DENSITY	688	15394.912791	23826.188062	100.00000000	218400.0000
AVINDX	687	104.647300	7.275464	89.73500000	134.8000
WATER	688	0.171512	0.377230	0.00000000	1.0000
DIRSRV	686	1.166181	1.426064	0.00000000	10.0000
------ MYEAR=80 ------					
RTM	506	0.159329	0.085805	0.00204117	0.9189
MNINT	506	1.274704	0.912852	0.00000000	6.0000
MLOADS	506	100.294466	3.366440	100.00000000	150.0000
MMILES	506	1218.537549	792.358262	94.00000000	4775.0000
DENSITY	506	14885.968379	23946.106584	100.00000000	225200.0000
AVINDX	506	107.165296	6.594885	89.73500000	127.9650
WATER	506	0.164032	0.370671	0.00000000	1.0000
DIRSRV	505	1.283168	1.453312	0.00000000	9.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=81 ------------------------------					
RTM	488	0.168233	0.088269	0.00344537	0.7714
MNINT	488	1.174180	0.840693	0.00000000	5.0000
MLOADS	488	73.204918	28.335316	40.00000000	100.0000
MMILES	488	1245.008197	786.010267	109.00000000	3987.0000
DENSITY	488	12153.008197	18489.451898	40.00000000	116789.0000
AVINDX	488	107.662449	6.148673	89.73500000	133.2650
WATER	488	0.163934	0.370596	0.00000000	1.0000
DIRSRV	488	1.698770	1.541166	0.00000000	9.0000
------------------------------ MYEAR=82 ------------------------------					
RTM	385	0.162709	0.077310	0.01442930	0.5354
MNINT	385	1.142857	0.840298	0.00000000	5.0000
MLOADS	385	65.262338	28.659936	40.00000000	133.0000
MMILES	385	1283.906494	826.588034	220.00000000	3562.0000
DENSITY	385	14826.651948	23406.983006	40.00000000	141058.0000
AVINDX	385	107.830247	5.412043	91.22000000	135.6150
WATER	385	0.140260	0.347708	0.00000000	1.0000
DIRSRV	384	1.645833	1.432405	0.00000000	9.0000
------------------------------ MYEAR=83 ------------------------------					
RTM	396	0.156941	0.086789	0.01348978	0.7812
MNINT	396	0.904040	0.848459	0.00000000	5.0000
MLOADS	396	64.108586	28.594340	40.00000000	120.0000
MMILES	396	1231.166667	819.321731	162.00000000	4169.0000
DENSITY	396	15591.007576	24247.492466	40.00000000	138516.0000
AVINDX	396	105.092967	4.647648	90.33500000	125.2000
WATER	396	0.154040	0.361444	0.00000000	1.0000
DIRSRV	395	1.640506	1.320429	0.00000000	5.0000
------------------------------ MYEAR=84 ------------------------------					
RTM	494	0.139378	0.078072	0.00808106	0.5685
MNINT	494	0.983806	1.010965	0.00000000	6.0000
MLOADS	494	46.042510	17.780845	40.00000000	200.0000
MMILES	494	1402.846154	858.870196	170.00000000	4659.0000
DENSITY	494	21575.601215	37224.585909	40.00000000	236517.0000
AVINDX	494	110.036164	8.058117	90.33500000	132.3850
WATER	494	0.109312	0.312346	0.00000000	1.0000
DIRSRV	467	1.582441	1.327795	0.00000000	6.0000
------------------------------ MYEAR=85 ------------------------------					
RTM	504	0.139263	0.089892	0.00773703	0.7970
MNINT	504	0.839286	0.920262	0.00000000	5.0000
MLOADS	504	44.023810	14.542302	36.00000000	100.0000
MMILES	504	1327.906746	854.447740	180.00000000	3709.0000
DENSITY	504	22025.480159	33443.716708	40.00000000	196415.0000
AVINDX	504	117.130417	9.219816	91.65000000	127.0800
WATER	504	0.099206	0.299236	0.00000000	1.0000
DIRSRV	474	1.710970	1.336907	0.00000000	6.0000
------------------------------ MYEAR=86 ------------------------------					
RTM	91	0.121510	0.071423	0.03054652	0.3823
MNINT	91	0.967033	0.862175	0.00000000	3.0000
MLOADS	91	40.967033	6.628978	40.00000000	100.0000
MMILES	91	1640.912088	929.081609	290.00000000	3520.0000
DENSITY	91	44178.065934	75005.661637	160.00000000	330014.0000
AVINDX	91	121.864835	8.845643	93.25000000	127.9300
WATER	91	0.032967	0.179540	0.00000000	1.0000
DIRSRV	84	1.428571	1.263822	0.00000000	4.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=87		
RTM	86	0.108524	0.055695	0.01678202	0.2934
MNINT	86	0.744186	0.769814	0.00000000	3.0000
MLOADS	86	41.453488	7.626050	40.00000000	100.0000
MMILES	86	1727.546512	946.539489	280.00000000	3290.0000
DENSITY	86	32685.930233	70198.032582	80.00000000	344928.0000
AVINDX	86	126.884709	5.898147	91.75000000	130.9700
WATER	86	0.093023	0.292169	0.00000000	1.0000
DIRSRV	80	1.337500	1.321140	0.00000000	5.0000

Pulp, Paper and Paper Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=74		
RTM	2518	0.049782	0.039461	0.00167036	0.8331
MNINT	2541	1.397088	0.990971	0.00000000	7.0000
MLOADS	2541	102.073593	13.615433	100.00000000	400.0000
MMILES	2541	1113.616686	723.546123	0.00000000	4794.0000
DENSITY	2541	13552.262889	22592.897981	100.00000000	244200.0000
AVINDX	2541	99.328223	10.856524	91.05000000	135.6150
WATER	2541	0.224321	0.417217	0.00000000	1.0000
DIRSRV	2518	1.664019	1.620998	0.00000000	10.0000
			MYEAR=76		
RTM	2375	0.059810	0.060024	0.00529569	0.9514
MNINT	2614	1.392502	0.981905	0.00000000	6.0000
MLOADS	2614	102.064269	12.660711	100.00000000	500.0000
MMILES	2614	1021.594874	799.474092	0.00000000	4722.0000
DENSITY	2614	12941.928080	21430.536999	100.00000000	231700.0000
AVINDX	2614	95.723147	9.841367	89.73500000	135.6150
WATER	2614	0.216144	0.411692	0.00000000	1.0000
DIRSRV	2595	1.600771	1.578137	0.00000000	10.0000
			MYEAR=77		
RTM	2635	0.047671	0.030861	0.00000000	0.6306
MNINT	2635	1.376471	0.926809	0.00000000	6.0000
MLOADS	2635	102.110436	11.671615	100.00000000	200.0000
MMILES	2635	1153.792410	726.823683	48.00000000	4983.0000
DENSITY	2635	12780.493359	20987.374602	100.00000000	209500.0000
AVINDX	2635	95.745142	7.299421	89.73500000	135.6150
WATER	2635	0.215939	0.411550	0.00000000	1.0000
DIRSRV	2624	1.335366	1.526095	0.00000000	10.0000
			MYEAR=78		
RTM	2689	0.046938	0.033187	0.00000000	0.7218
MNINT	2689	1.412421	0.927752	0.00000000	5.0000
MLOADS	2689	101.071774	8.847147	100.00000000	300.0000
MMILES	2689	1153.795091	707.909403	20.00000000	4607.0000
DENSITY	2689	13044.886575	22969.482959	100.00000000	250800.0000
AVINDX	2689	101.349649	6.087365	89.73500000	135.6150
WATER	2689	0.212347	0.409045	0.00000000	1.0000
DIRSRV	2678	1.300971	1.504745	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
---------- MYEAR=79 ----------					
RTM	2752	0.047152	0.033869	0.00282777	0.6776
MNINT	2752	1.438590	0.948630	0.00000000	7.0000
MLOADS	2752	101.336846	9.803870	100.00000000	300.0000
MMILES	2752	1159.033794	709.493885	36.00000000	5084.0000
DENSITY	2752	13723.909884	24710.317955	100.00000000	267300.0000
AVINDX	2752	107.923839	5.799353	89.73500000	135.6150
WATER	2752	0.211483	0.408434	0.00000000	1.0000
DIRSRV	2743	1.278527	1.484322	0.00000000	10.0000
---------- MYEAR=80 ----------					
RTM	2635	0.048541	0.034322	0.00000000	0.5069
MNINT	2635	1.536622	0.989930	0.00000000	8.0000
MLOADS	2635	100.826186	7.595617	100.00000000	250.0000
MMILES	2635	1147.492220	690.973692	31.00000000	4041.0000
DENSITY	2635	12377.343454	21869.477152	100.00000000	225200.0000
AVINDX	2635	110.164742	4.293486	89.73500000	135.6150
WATER	2635	0.216319	0.411812	0.00000000	1.0000
DIRSRV	2624	1.323933	1.535035	0.00000000	10.0000
---------- MYEAR=81 ----------					
RTM	2747	0.050719	0.042421	0.00331300	0.9254
MNINT	2747	1.528941	1.010587	0.00000000	7.0000
MLOADS	2747	78.069894	28.220019	36.00000000	400.0000
MMILES	2747	1159.710957	695.225148	13.00000000	4449.0000
DENSITY	2747	11377.807790	22509.725845	40.00000000	292775.0000
AVINDX	2747	108.755526	3.605723	90.33500000	135.6150
WATER	2747	0.204223	0.403206	0.00000000	1.0000
DIRSRV	2735	1.799634	1.478720	0.00000000	10.0000
---------- MYEAR=82 ----------					
RTM	2643	0.049891	0.032593	0.00000000	0.4482
MNINT	2643	1.515323	1.011316	0.00000000	6.0000
MLOADS	2643	70.368521	27.946195	36.00000000	300.0000
MMILES	2643	1138.950813	683.814049	27.00000000	4384.0000
DENSITY	2643	11129.293984	20697.048403	40.00000000	185054.0000
AVINDX	2643	108.364461	4.011122	89.73500000	135.6150
WATER	2643	0.214529	0.410573	0.00000000	1.0000
DIRSRV	2633	1.818078	1.451058	0.00000000	10.0000
---------- MYEAR=83 ----------					
RTM	2608	0.048055	0.032876	0.00000000	0.5828
MNINT	2608	1.417561	0.993318	0.00000000	6.0000
MLOADS	2608	64.708589	27.616841	36.00000000	300.0000
MMILES	2608	1133.396089	683.692547	27.00000000	4517.0000
DENSITY	2608	12089.732362	21751.991178	40.00000000	214627.0000
AVINDX	2608	103.764599	3.619569	90.33500000	135.6150
WATER	2608	0.223926	0.416953	0.00000000	1.0000
DIRSRV	2600	1.736538	1.316502	0.00000000	9.0000
---------- MYEAR=84 ----------					
RTM	3331	0.047323	0.030667	0.00000000	0.5688
MNINT	3331	1.505254	1.046754	0.00000000	6.0000
MLOADS	3331	49.885320	19.665676	38.00000000	200.0000
MMILES	3331	1223.084959	733.952397	22.00000000	4470.0000
DENSITY	3331	11596.892525	23657.945133	40.00000000	236517.0000
AVINDX	3328	115.146208	7.045276	91.08500000	135.6150
WATER	3331	0.173822	0.379013	0.00000000	1.0000
DIRSRV	2828	1.637907	1.247738	0.00000000	8.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=85		
RTM	3344	0.047063	0.034441	0.00000000	0.8578
MNINT	3344	1.418062	1.020219	0.00000000	6.0000
MLOADS	3344	47.763158	18.733776	38.00000000	300.0000
MMILES	3344	1228.345096	729.059750	21.00000000	4055.0000
DENSITY	3344	10950.906699	21462.164218	40.00000000	196415.0000
AVINDX	3344	122.345760	5.741750	91.22000000	135.6150
WATER	3344	0.175837	0.380739	0.00000000	1.0000
DIRSRV	2831	1.651007	1.237117	0.00000000	8.0000
			MYEAR=86		
RTM	1112	0.043140	0.021218	0.00693622	0.3166
MNINT	1112	1.260791	0.981545	0.00000000	6.0000
MLOADS	1112	45.358813	15.297407	39.00000000	100.0000
MMILES	1112	1110.477518	742.066817	125.00000000	9990.0000
DENSITY	1112	21590.845324	49674.985988	80.00000000	510660.0000
AVINDX	1112	126.248723	3.001230	100.91500000	130.9700
WATER	1112	0.252698	0.434755	0.00000000	1.0000
DIRSRV	1098	1.791439	1.214933	0.00000000	8.0000
			MYEAR=87		
RTM	900	0.040518	0.016804	0.01312716	0.2042
MNINT	900	1.230000	0.977722	0.00000000	6.0000
MLOADS	900	45.910000	16.007358	40.00000000	100.0000
MMILES	900	1132.170000	719.597821	50.00000000	3685.0000
DENSITY	900	18254.526667	43771.466214	80.00000000	348068.0000
AVINDX	900	128.465706	3.432871	96.05000000	132.3850
WATER	900	0.222222	0.415971	0.00000000	1.0000
DIRSRV	889	1.763780	1.235909	0.00000000	8.0000

Chemicals

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=74		
RTM	2621	0.045693	0.026663	0.00157121	0.4631
MNINT	2647	1.179448	0.788658	0.00000000	7.0000
MLOADS	2647	102.184737	16.776246	100.00000000	500.0000
MMILES	2647	1052.344163	708.264018	0.00000000	4194.0000
DENSITY	2647	15211.635814	24842.759793	100.00000000	244200.0000
AVINDX	2647	99.198999	10.277520	90.33500000	127.0800
WATER	2647	0.188138	0.390896	0.00000000	1.0000
DIRSRV	2641	1.875426	1.603502	0.00000000	10.0000
			MYEAR=76		
RTM	2299	0.060302	0.058419	0.00120106	0.9322
MNINT	2602	1.119908	0.762084	0.00000000	6.0000
MLOADS	2602	101.677940	13.493275	100.00000000	450.0000
MMILES	2602	926.697925	794.502170	0.00000000	5472.0000
DENSITY	2602	14358.531899	22097.490429	100.00000000	231700.0000
AVINDX	2602	95.254710	9.107895	89.73500000	127.0800
WATER	2602	0.187932	0.390733	0.00000000	1.0000
DIRSRV	2598	1.852964	1.620507	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=77		
RTM	2062	0.045244	0.023651	0.00000000	0.4246
MNINT	2062	1.083899	0.765107	0.00000000	6.0000
MLOADS	2062	101.337051	10.840799	100.00000000	300.0000
MMILES	2062	1060.057711	695.645446	33.00000000	3983.0000
DENSITY	2062	15887.293889	22842.238163	100.00000000	209500.0000
AVINDX	2062	94.925335	6.150749	89.60000000	127.0800
WATER	2062	0.177013	0.381772	0.00000000	1.0000
DIRSRV	2061	1.570597	1.572978	0.00000000	10.0000
			MYEAR=78		
RTM	2601	0.045685	0.027496	0.00132215	0.4639
MNINT	2601	1.114956	0.746950	0.00000000	6.0000
MLOADS	2601	102.693195	45.485734	100.00000000	2300.0000
MMILES	2601	1066.142637	706.542505	28.00000000	4672.0000
DENSITY	2601	15550.557478	24975.887924	100.00000000	250800.0000
AVINDX	2601	100.736571	6.463181	89.73500000	127.0800
WATER	2601	0.191080	0.393228	0.00000000	1.0000
DIRSRV	2599	1.556753	1.561342	0.00000000	10.0000
			MYEAR=79		
RTM	2656	0.045300	0.028155	0.00000000	0.5238
MNINT	2656	1.097139	0.739761	0.00000000	5.0000
MLOADS	2656	101.496988	15.265509	100.00000000	600.0000
MMILES	2656	1052.073042	700.329267	21.00000000	4777.0000
DENSITY	2656	16179.028614	27488.403731	100.00000000	267300.0000
AVINDX	2656	107.466517	5.961785	89.73500000	127.0800
WATER	2656	0.186747	0.389782	0.00000000	1.0000
DIRSRV	2656	1.513931	1.543284	0.00000000	10.0000
			MYEAR=80		
RTM	2037	0.042976	0.035425	0.00000000	0.8580
MNINT	2037	1.305351	0.864627	0.00000000	6.0000
MLOADS	2037	101.732941	25.792724	100.00000000	900.0000
MMILES	2037	1097.908198	722.293728	28.00000000	4346.0000
DENSITY	2037	15811.438390	26711.070156	100.00000000	283800.0000
AVINDX	2037	110.051004	4.403628	89.73500000	127.0800
WATER	2037	0.181149	0.385236	0.00000000	1.0000
DIRSRV	2037	1.551301	1.572712	0.00000000	10.0000
			MYEAR=81		
RTM	2800	0.046433	0.031278	0.00107756	0.8724
MNINT	2800	1.268571	0.832107	0.00000000	7.0000
MLOADS	2800	77.418929	31.225520	36.00000000	575.0000
MMILES	2800	1079.497143	704.957711	30.00000000	4466.0000
DENSITY	2800	14273.409643	26388.767052	36.00000000	292775.0000
AVINDX	2800	109.156661	4.246620	89.73500000	127.0800
WATER	2800	0.177143	0.381858	0.00000000	1.0000
DIRSRV	2796	1.998927	1.479858	0.00000000	10.0000
			MYEAR=82		
RTM	2695	0.046456	0.027303	0.00000000	0.7434
MNINT	2695	1.216698	0.835250	0.00000000	7.0000
MLOADS	2695	70.358442	33.605708	36.00000000	520.0000
MMILES	2695	1067.958071	706.498781	25.00000000	3978.0000
DENSITY	2695	14400.022635	27380.627720	40.00000000	315480.0000
AVINDX	2695	108.807347	4.209871	90.33500000	127.0800
WATER	2695	0.178479	0.382986	0.00000000	1.0000
DIRSRV	2676	2.040359	1.474473	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=83					
RTM	2781	0.045240	0.024095	0.00000000	0.4214
MNINT	2781	1.078029	0.779704	0.00000000	7.0000
MLOADS	2781	65.254585	34.280864	36.00000000	500.0000
MMILES	2781	1038.157497	680.554115	35.00000000	3843.0000
DENSITY	2781	15217.899317	27194.013120	40.00000000	229824.0000
AVINDX	2781	104.021721	3.929910	89.73500000	127.0800
WATER	2781	0.185904	0.389099	0.00000000	1.0000
DIRSRV	2778	1.941685	1.319987	0.00000000	9.0000
MYEAR=84					
RTM	3526	0.045429	0.025596	0.00000000	0.5832
MNINT	3526	1.118264	0.803835	0.00000000	6.0000
MLOADS	3526	51.135848	26.802932	36.00000000	400.0000
MMILES	3526	1104.374929	712.450765	52.00000000	4035.0000
DENSITY	3526	14411.590187	28467.758432	40.00000000	236517.0000
AVINDX	3525	114.519233	6.966242	90.47000000	127.4300
WATER	3526	0.153715	0.360727	0.00000000	1.0000
DIRSRV	3116	1.820924	1.253448	0.00000000	8.0000
MYEAR=85					
RTM	3527	0.045767	0.028507	0.00000000	0.7681
MNINT	3528	1.097789	0.830600	0.00000000	6.0000
MLOADS	3528	49.272676	27.490863	36.00000000	675.0000
MMILES	3528	1111.013039	716.338294	12.00000000	3822.0000
DENSITY	3528	13819.928288	27004.891939	40.00000000	263783.0000
AVINDX	3526	122.290808	5.731784	89.73500000	127.0800
WATER	3528	0.154762	0.361729	0.00000000	1.0000
DIRSRV	3126	1.822137	1.256931	0.00000000	8.0000

Petroleum and Coal Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	1380	0.042439	0.032184	0.00191569	0.8259
MNINT	1423	1.014758	0.771636	0.00000000	4.0000
MLOADS	1423	103.606465	43.751469	100.00000000	1489.0000
MMILES	1423	858.541813	617.924082	0.00000000	3591.0000
DENSITY	1423	20042.234715	29956.149759	100.00000000	244200.0000
AVINDX	1423	100.268303	10.499626	89.73500000	127.0800
WATER	1423	0.225580	0.418110	0.00000000	1.0000
DIRSRV	1403	2.312188	1.696952	0.00000000	10.0000
MYEAR=76					
RTM	1027	0.062041	0.066636	0.00280032	0.6702
MNINT	1276	0.936520	0.732366	0.00000000	4.0000
MLOADS	1276	102.656740	22.763191	100.00000000	500.0000
MMILES	1276	713.481975	702.003079	0.00000000	3686.0000
DENSITY	1276	20244.043887	28086.585518	100.00000000	231700.0000
AVINDX	1276	95.760357	9.031130	89.73500000	127.0800
WATER	1276	0.231975	0.422259	0.00000000	1.0000
DIRSRV	1276	2.380094	1.671598	0.00000000	10.0000

------------------------------ MYEAR=77 ------------------------------

RTM	1046	0.043935	0.024197	0.01199345	0.4682
MNINT	1046	0.881453	0.655708	0.00000000	3.0000
MLOADS	1046	103.164436	23.479437	100.00000000	500.0000
MMILES	1046	908.465583	635.627641	47.00000000	3686.0000
DENSITY	1046	20557.456979	27445.334912	100.00000000	209500.0000
AVINDX	1046	95.695167	7.094154	89.73500000	127.0800
WATER	1046	0.239006	0.426680	0.00000000	1.0000
DIRSRV	1046	2.015296	1.694843	0.00000000	10.0000

------------------------------ MYEAR=78 ------------------------------

RTM	1309	0.044123	0.028851	0.00000000	0.6315
MNINT	1309	0.939649	0.713689	0.00000000	4.0000
MLOADS	1309	102.083270	18.178143	100.00000000	500.0000
MMILES	1309	908.711994	644.747884	28.00000000	3960.0000
DENSITY	1309	21162.184874	30834.070553	100.00000000	250800.0000
AVINDX	1309	100.524049	6.764241	89.73500000	127.0800
WATER	1309	0.223835	0.416972	0.00000000	1.0000
DIRSRV	1309	1.966387	1.641054	0.00000000	10.0000

------------------------------ MYEAR=79 ------------------------------

RTM	1282	0.045229	0.031483	0.00269659	0.5916
MNINT	1282	0.952418	0.678715	0.00000000	4.0000
MLOADS	1282	103.904056	69.869742	100.00000000	2500.0000
MMILES	1282	917.367395	627.627488	20.00000000	3534.0000
DENSITY	1282	21853.900156	32792.289862	100.00000000	267300.0000
AVINDX	1282	107.070967	6.522171	89.73500000	127.0800
WATER	1282	0.230109	0.421067	0.00000000	1.0000
DIRSRV	1282	1.940718	1.683250	0.00000000	10.0000

------------------------------ MYEAR=80 ------------------------------

RTM	910	0.046165	0.030363	0.01598580	0.4870
MNINT	910	1.020879	0.839484	0.00000000	5.0000
MLOADS	910	104.593407	39.218235	100.00000000	800.0000
MMILES	910	925.278022	654.018827	20.00000000	4208.0000
DENSITY	910	22871.098901	32132.653915	200.00000000	225200.0000
AVINDX	910	109.863203	4.948068	89.73500000	127.0800
WATER	910	0.238462	0.426377	0.00000000	1.0000
DIRSRV	910	1.976923	1.649254	0.00000000	10.0000

------------------------------ MYEAR=81 ------------------------------

RTM	1252	0.049070	0.026673	0.01143972	0.4390
MNINT	1252	1.080671	0.818868	0.00000000	5.0000
MLOADS	1252	80.016773	39.392800	36.00000000	500.0000
MMILES	1252	946.559105	650.221137	37.00000000	3811.0000
DENSITY	1252	20408.623003	33387.446084	40.00000000	292775.0000
AVINDX	1252	108.581625	5.324964	89.73500000	127.0800
WATER	1252	0.201278	0.401116	0.00000000	1.0000
DIRSRV	1251	2.416467	1.531018	0.00000000	10.0000

------------------------------ MYEAR=82 ------------------------------

RTM	1221	0.051139	0.031603	0.00464419	0.4532
MNINT	1221	1.016380	0.784936	0.00000000	5.0000
MLOADS	1221	72.722359	36.850083	36.00000000	323.0000
MMILES	1221	930.528256	637.836031	16.00000000	3831.0000
DENSITY	1221	18516.642916	28927.971883	40.00000000	315480.0000
AVINDX	1221	108.352772	4.746740	89.73500000	127.4300
WATER	1221	0.181818	0.385853	0.00000000	1.0000
DIRSRV	1218	2.362890	1.426248	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=83		
RTM	1210	0.048556	0.025410	0.00790931	0.4577
MNINT	1210	0.934711	0.733147	0.00000000	4.0000
MLOADS	1210	68.976860	42.487845	36.00000000	500.0000
MMILES	1210	917.047934	625.524421	38.00000000	3421.0000
DENSITY	1210	19461.727273	28951.591644	40.00000000	229824.0000
AVINDX	1210	104.490529	4.419023	90.33500000	127.4300
WATER	1210	0.201653	0.401400	0.00000000	1.0000
DIRSRV	1210	2.238017	1.332129	0.00000000	9.0000
			MYEAR=84		
RTM	1437	0.048334	0.021030	0.01551789	0.2648
MNINT	1438	0.998609	0.801876	0.00000000	5.0000
MLOADS	1438	53.177330	27.963738	36.00000000	500.0000
MMILES	1438	948.827538	648.911802	34.00000000	3577.0000
DENSITY	1438	20119.155772	31855.988432	40.00000000	236517.0000
AVINDX	1435	113.206446	7.339924	91.42000000	127.0800
WATER	1438	0.186370	0.389540	0.00000000	1.0000
DIRSRV	1298	2.134052	1.232644	0.00000000	8.0000
			MYEAR=85		
RTM	1441	0.051583	0.036981	0.00709260	0.5044
MNINT	1441	0.966690	0.791623	0.00000000	4.0000
MLOADS	1441	51.589868	26.955604	36.00000000	300.0000
MMILES	1441	956.073560	663.446860	13.00000000	3439.0000
DENSITY	1441	19334.809160	32012.550103	40.00000000	252720.0000
AVINDX	1441	120.981447	7.026189	90.47000000	127.4300
WATER	1441	0.171409	0.376997	0.00000000	1.0000
DIRSRV	1282	2.067863	1.244848	0.00000000	8.0000

Rubber and Plastic Products

VARIABLE DEVIATION	N	MEAN	STANDARD VALUE	MINIMUM VALUE	MAXIMUM
			MYEAR=74		
RTM	899	0.113956	0.083622	0.00000000	0.7980
MNINT	914	1.167396	0.866429	0.00000000	6.0000
MLOADS	914	101.811816	11.383566	100.00000000	200.0000
MMILES	914	1050.975930	730.167038	0.00000000	4552.0000
DENSITY	914	18665.864333	28256.882091	100.00000000	244200.0000
AVINDX	914	101.775935	10.548459	89.60000000	127.0800
WATER	914	0.251641	0.434194	0.00000000	1.0000
DIRSRV	914	2.014223	1.789226	0.00000000	10.0000
			MYEAR=76		
RTM	652	0.117408	0.099773	0.00000000	0.6905
MNINT	832	1.060096	0.868624	0.00000000	6.0000
MLOADS	832	104.590144	19.550091	100.00000000	200.0000
MMILES	832	864.310096	787.632236	0.00000000	4328.0000
DENSITY	832	19150.721154	25600.786869	100.00000000	231700.0000
AVINDX	832	97.683810	9.394593	89.73500000	127.0800
WATER	832	0.227163	0.419251	0.00000000	1.0000
DIRSRV	832	2.042067	1.807701	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=77					
RTM	815	0.103780	0.090123	0.00061806	0.8384
MNINT	815	1.038037	0.791401	0.00000000	6.0000
MLOADS	815	105.474847	21.767739	100.00000000	300.0000
MMILES	815	1083.386503	737.362846	42.00000000	4526.0000
DENSITY	815	18634.233129	26270.530637	100.00000000	209500.0000
AVINDX	815	96.977319	8.694806	89.73500000	127.0800
WATER	815	0.245399	0.430588	0.00000000	1.0000
DIRSRV	815	1.593865	1.683337	0.00000000	9.0000
MYEAR=78					
RTM	829	0.102737	0.091009	0.01450096	0.9559
MNINT	831	1.067389	0.814201	0.00000000	6.0000
MLOADS	831	103.488568	17.571940	100.00000000	300.0000
MMILES	831	1065.054152	727.169545	58.00000000	4781.0000
DENSITY	831	19529.362214	25781.471435	100.00000000	250800.0000
AVINDX	831	99.750379	6.603290	89.73500000	127.0800
WATER	831	0.231047	0.421756	0.00000000	1.0000
DIRSRV	831	1.612515	1.682378	0.00000000	9.0000
MYEAR=79					
RTM	851	0.106070	0.078646	0.01065894	0.4943
MNINT	851	1.056404	0.786124	0.00000000	5.0000
MLOADS	851	102.901293	15.275190	100.00000000	200.0000
MMILES	851	1049.009401	690.141384	54.00000000	3985.0000
DENSITY	851	20171.092832	29833.807292	100.00000000	267300.0000
AVINDX	851	104.605059	7.131910	89.73500000	127.0800
WATER	851	0.226792	0.419003	0.00000000	1.0000
DIRSRV	851	1.565217	1.673014	0.00000000	9.0000
MYEAR=80					
RTM	704	0.109017	0.086573	0.00722895	0.6475
MNINT	704	1.213068	0.843383	0.00000000	5.0000
MLOADS	704	101.349432	11.391022	100.00000000	200.0000
MMILES	704	1033.714489	668.591341	51.00000000	3985.0000
DENSITY	704	17640.198864	26230.771251	100.00000000	225200.0000
AVINDX	704	108.222166	6.322173	90.33500000	127.0800
WATER	704	0.223011	0.416562	0.00000000	1.0000
DIRSRV	704	1.629261	1.789903	0.00000000	10.0000
MYEAR=81					
RTM	734	0.108115	0.091313	0.01451491	0.9645
MNINT	734	1.126703	0.801786	0.00000000	4.0000
MLOADS	734	77.664850	29.412704	36.00000000	200.0000
MMILES	734	1081.113079	715.885721	54.00000000	3834.0000
DENSITY	734	17927.433243	26608.648647	40.00000000	212165.0000
AVINDX	734	107.733297	5.110677	89.73500000	127.0800
WATER	734	0.198910	0.399452	0.00000000	1.0000
DIRSRV	734	2.099455	1.583398	0.00000000	9.0000
MYEAR=82					
RTM	632	0.100466	0.084424	0.01079800	0.9806
MNINT	632	1.107595	0.839481	0.00000000	5.0000
MLOADS	632	71.381329	31.509994	36.00000000	300.0000
MMILES	632	1054.145570	664.343751	97.00000000	3796.0000
DENSITY	632	19819.324367	29394.963353	140.00000000	185054.0000
AVINDX	632	108.539581	5.063106	90.33500000	127.0800
WATER	632	0.178797	0.383486	0.00000000	1.0000
DIRSRV	631	2.082409	1.625059	0.00000000	9.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=83		
RTM	581	0.093970	0.081885	0.01340694	0.8062
MNINT	581	0.783133	0.768647	0.00000000	4.0000
MLOADS	581	64.993115	29.173026	36.00000000	150.0000
MMILES	581	1017.802065	666.286283	82.00000000	5398.0000
DENSITY	581	21346.354561	33006.940068	80.00000000	214627.0000
AVINDX	581	105.088391	4.779870	91.66500000	127.0800
WATER	581	0.163511	0.370150	0.00000000	1.0000
DIRSRV	581	2.012048	1.467414	0.00000000	8.0000
			MYEAR=84		
RTM	713	0.088920	0.080803	0.01065020	0.9153
MNINT	713	0.887798	0.770801	0.00000000	4.0000
MLOADS	713	46.997195	18.501063	36.00000000	150.0000
MMILES	713	1159.387097	725.197673	66.00000000	4039.0000
DENSITY	713	22134.922861	34114.687716	40.00000000	236517.0000
AVINDX	710	111.510507	7.324403	90.33500000	127.0800
WATER	713	0.133240	0.340072	0.00000000	1.0000
DIRSRV	663	1.917044	1.442994	0.00000000	7.0000
			MYEAR=85		
RTM	784	0.091916	0.095000	0.01569998	0.9129
MNINT	784	0.770408	0.732979	0.00000000	3.0000
MLOADS	784	44.126276	14.031824	36.00000000	100.0000
MMILES	784	1155.386480	737.275262	53.00000000	3997.0000
DENSITY	784	20157.781888	30827.909790	40.00000000	196415.0000
AVINDX	784	118.379337	8.819087	90.33500000	127.0800
WATER	784	0.146684	0.354016	0.00000000	1.0000
DIRSRV	732	2.008197	1.438170	0.00000000	7.0000

Concrete, Clay, Glass, and Stone

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=74		
RTM	1985	0.045809	0.031864	0.00263704	0.3398
MNINT	2001	1.181909	0.872865	0.00000000	6.0000
MLOADS	2001	102.878061	20.472668	100.00000000	400.0000
MMILES	2001	932.845577	676.358483	0.00000000	4223.0000
DENSITY	2001	17101.149425	27081.580524	100.00000000	244200.0000
AVINDX	2001	99.099220	9.719752	90.91500000	127.0800
WATER	2001	0.208396	0.406263	0.00000000	1.0000
DIRSRV	1980	2.000000	1.744406	0.00000000	10.0000
			MYEAR=76		
RTM	1629	0.061319	0.063978	0.00428616	0.9476
MNINT	1948	1.069815	0.836539	0.00000000	8.0000
MLOADS	1948	103.103696	23.618947	100.00000000	700.0000
MMILES	1948	812.712012	768.036447	0.00000000	8671.0000
DENSITY	1948	16256.006160	23851.214031	100.00000000	231700.0000
AVINDX	1948	95.647010	9.037822	89.60000000	127.0800
WATER	1948	0.209446	0.407017	0.00000000	1.0000
DIRSRV	1941	1.994848	1.730257	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=77		
RTM	1962	0.049375	0.043793	0.00111239	0.8572
MNINT	1962	1.024975	0.774325	0.00000000	5.0000
MLOADS	1962	103.598369	25.707704	100.00000000	700.0000
MMILES	1962	950.845566	660.070397	38.00000000	4254.0000
DENSITY	1962	16486.901121	23628.430759	100.00000000	209500.0000
AVINDX	1962	95.846929	7.166094	89.73500000	127.0800
WATER	1962	0.208970	0.406677	0.00000000	1.0000
DIRSRV	1953	1.654378	1.696142	0.00000000	10.0000
			MYEAR=78		
RTM	1981	0.047697	0.038162	0.00209960	0.5613
MNINT	1981	1.104493	0.822466	0.00000000	6.0000
MLOADS	1981	103.000000	24.167701	100.00000000	700.0000
MMILES	1981	1003.173650	688.640391	42.00000000	4434.0000
DENSITY	1981	16987.884907	26021.007531	100.00000000	250800.0000
AVINDX	1981	101.184735	6.299034	89.73500000	127.0800
WATER	1981	0.207976	0.405962	0.00000000	1.0000
DIRSRV	1972	1.595842	1.679386	0.00000000	10.0000
			MYEAR=79		
RTM	1899	0.047076	0.037437	0.00759677	0.6294
MNINT	1899	1.087414	0.829351	0.00000000	6.0000
MLOADS	1899	103.872565	25.795797	100.00000000	500.0000
MMILES	1899	999.161664	680.682967	63.00000000	4718.0000
DENSITY	1899	17913.533439	28116.574862	100.00000000	267300.0000
AVINDX	1899	107.188810	5.907544	89.73500000	127.0800
WATER	1899	0.199579	0.399789	0.00000000	1.0000
DIRSRV	1895	1.607916	1.706204	0.00000000	10.0000
			MYEAR=80		
RTM	1700	0.049356	0.048965	0.00476042	0.8989
MNINT	1700	1.244118	0.900491	0.00000000	6.0000
MLOADS	1700	104.871765	39.639280	100.00000000	1100.0000
MMILES	1700	994.492353	693.675019	9.00000000	4744.0000
DENSITY	1700	17235.000000	27070.365523	100.00000000	225200.0000
AVINDX	1700	109.619924	4.763108	89.73500000	127.0800
WATER	1700	0.207059	0.405317	0.00000000	1.0000
DIRSRV	1694	1.621606	1.675798	0.00000000	10.0000
			MYEAR=81		
RTM	1756	0.049201	0.036196	0.00255625	0.5001
MNINT	1756	1.248292	0.921953	0.00000000	6.0000
MLOADS	1756	78.739180	32.333065	36.00000000	333.0000
MMILES	1756	1032.342255	704.982895	63.00000000	4056.0000
DENSITY	1756	16531.180524	26965.220996	40.00000000	212165.0000
AVINDX	1756	108.427372	4.434558	90.91500000	127.0800
WATER	1756	0.187927	0.390765	0.00000000	1.0000
DIRSRV	1750	2.121714	1.638424	0.00000000	10.0000
			MYEAR=82		
RTM	1546	0.049653	0.040940	0.00203084	0.7287
MNINT	1546	1.206986	0.940896	0.00000000	6.0000
MLOADS	1546	70.600906	35.258351	36.00000000	500.0000
MMILES	1546	996.491591	695.701552	9.00000000	4020.0000
DENSITY	1546	17375.847995	29305.554401	40.00000000	315480.0000
AVINDX	1546	108.442629	4.134314	90.33500000	127.0800
WATER	1546	0.184347	0.387892	0.00000000	1.0000
DIRSRV	1538	2.116385	1.628904	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=83					
RTM	1659	0.046593	0.035976	0.00463415	0.4014
MNINT	1659	1.040386	0.843014	0.00000000	6.0000
MLOADS	1659	65.791441	36.725253	36.00000000	500.0000
MMILES	1659	932.510549	615.858817	74.00000000	4231.0000
DENSITY	1659	17128.389994	27567.940948	40.00000000	214627.0000
AVINDX	1659	104.566190	4.309041	91.70000000	127.0800
WATER	1659	0.203134	0.402453	0.00000000	1.0000
DIRSRV	1655	2.035045	1.483478	0.00000000	9.0000
MYEAR=84					
RTM	1949	0.046033	0.038586	0.00752007	0.5147
MNINT	1949	1.121601	0.945697	0.00000000	6.0000
MLOADS	1949	49.880452	20.710099	36.00000000	220.0000
MMILES	1949	1005.767060	681.758830	83.00000000	4010.0000
DENSITY	1949	18442.264751	32296.568250	40.00000000	236517.0000
AVINDX	1947	113.368716	6.830541	91.28500000	127.0800
WATER	1949	0.178040	0.382645	0.00000000	1.0000
DIRSRV	1813	1.898511	1.403898	0.00000000	8.0000
MYEAR=85					
RTM	1953	0.046328	0.042064	0.00506092	0.6332
MNINT	1953	1.055812	0.874536	0.00000000	6.0000
MLOADS	1953	47.623656	18.514731	36.00000000	183.0000
MMILES	1953	1013.033794	707.534551	95.00000000	4927.0000
DENSITY	1953	17200.381976	29828.117405	40.00000000	263783.0000
AVINDX	1952	120.969736	6.886053	91.08500000	127.0800
WATER	1953	0.169483	0.375274	0.00000000	1.0000
DIRSRV	1814	1.909041	1.421991	0.00000000	8.0000

Primary Metal Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	1733	0.050083	0.033099	0.00000000	0.4952
MNINT	1753	1.158015	0.804961	0.00000000	5.0000
MLOADS	1753	103.941814	48.251730	100.00000000	1800.0000
MMILES	1753	1121.330291	796.479200	0.00000000	4490.0000
DENSITY	1753	17459.783229	28253.119344	100.00000000	244200.0000
AVINDX	1753	100.705217	10.922455	90.91500000	127.0800
WATER	1753	0.232744	0.422701	0.00000000	1.0000
DIRSRV	1746	2.034937	1.691182	0.00000000	10.0000
MYEAR=76					
RTM	1213	0.063391	0.063109	0.00000000	0.7403
MNINT	1504	1.045213	0.807041	0.00000000	5.0000
MLOADS	1504	103.507314	22.512507	100.00000000	500.0000
MMILES	1504	889.786569	854.553036	0.00000000	4058.0000
DENSITY	1504	18005.784574	26487.449164	100.00000000	231700.0000
AVINDX	1504	96.053434	9.331309	89.73500000	127.0800
WATER	1504	0.232713	0.422701	0.00000000	1.0000
DIRSRV	1502	2.069241	1.707997	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=77					
RTM	1502	0.050385	0.033978	0.00000000	0.7025
MNINT	1502	1.030626	0.730323	0.00000000	4.0000
MLOADS	1502	103.741678	28.836553	100.00000000	720.0000
MMILES	1502	1040.246338	743.057039	7.00000000	3553.0000
DENSITY	1502	18064.181092	26128.359838	100.00000000	209500.0000
AVINDX	1502	96.074910	7.445353	89.73500000	127.0800
WATER	1502	0.239015	0.426624	0.00000000	1.0000
DIRSRV	1500	1.619333	1.616220	0.00000000	10.0000
MYEAR=78					
RTM	1616	0.047190	0.030054	0.00051007	0.5874
MNINT	1616	1.086634	0.801651	0.00000000	5.0000
MLOADS	1616	101.903465	14.942095	100.00000000	400.0000
MMILES	1616	1091.752475	785.868447	14.00000000	4348.0000
DENSITY	1616	18260.829208	28079.241812	100.00000000	250800.0000
AVINDX	1616	100.968298	6.317078	89.73500000	127.0800
WATER	1616	0.224010	0.417058	0.00000000	1.0000
DIRSRV	1614	1.568154	1.571997	0.00000000	10.0000
MYEAR=79					
RTM	1737	0.046552	0.028009	0.00148274	0.4651
MNINT	1737	1.093840	0.789368	0.00000000	5.0000
MLOADS	1737	102.396085	17.687565	100.00000000	400.0000
MMILES	1737	1065.234888	739.826432	14.00000000	4239.0000
DENSITY	1737	18644.329303	30614.228818	100.00000000	267300.0000
AVINDX	1737	107.185904	6.295237	89.73500000	127.0800
WATER	1737	0.229706	0.420765	0.00000000	1.0000
DIRSRV	1733	1.624351	1.596484	0.00000000	10.0000
MYEAR=80					
RTM	1545	0.044931	0.023281	0.00000000	0.4790
MNINT	1545	1.217476	0.828933	0.00000000	5.0000
MLOADS	1545	102.887379	21.365624	100.00000000	500.0000
MMILES	1545	1078.391586	749.069458	14.00000000	4458.0000
DENSITY	1545	17966.084142	29274.453075	100.00000000	283800.0000
AVINDX	1545	109.474634	5.097513	89.73500000	127.0800
WATER	1545	0.231715	0.422065	0.00000000	1.0000
DIRSRV	1543	1.583927	1.593372	0.00000000	10.0000
MYEAR=81					
RTM	1760	0.047491	0.027816	0.00223129	0.5090
MNINT	1760	1.223864	0.836149	0.00000000	5.0000
MLOADS	1760	77.207386	30.624366	36.00000000	285.0000
MMILES	1760	1084.767614	724.588809	29.00000000	3894.0000
DENSITY	1760	15511.006818	27730.305884	40.00000000	292775.0000
AVINDX	1760	108.504818	4.668923	89.73500000	127.0800
WATER	1760	0.232955	0.422834	0.00000000	1.0000
DIRSRV	1757	2.119522	1.569372	0.00000000	10.0000
MYEAR=82					
RTM	1514	0.047150	0.023077	0.00436655	0.2734
MNINT	1514	1.123514	0.792356	0.00000000	5.0000
MLOADS	1514	70.135403	36.588738	36.00000000	500.0000
MMILES	1514	1046.462351	730.647505	52.00000000	3871.0000
DENSITY	1514	16172.804491	26246.424403	40.00000000	185054.0000
AVINDX	1514	108.346734	4.089083	89.73500000	127.0800
WATER	1514	0.237781	0.425865	0.00000000	1.0000
DIRSRV	1509	2.238569	1.567685	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=83					
RTM	1522	0.044263	0.027801	0.00524885	0.6183
MNINT	1522	0.954008	0.761836	0.00000000	4.0000
MLOADS	1522	64.295664	32.706361	36.00000000	500.0000
MMILES	1522	1024.310118	710.812716	21.00000000	3563.0000
DENSITY	1522	17558.408016	28022.249590	40.00000000	214627.0000
AVINDX	1522	104.405627	4.471506	89.73500000	127.0800
WATER	1522	0.233246	0.423036	0.00000000	1.0000
DIRSRV	1520	2.158553	1.432894	0.00000000	9.0000
MYEAR=84					
RTM	1877	0.043037	0.019754	0.00095329	0.2652
MNINT	1877	1.014385	0.822333	0.00000000	5.0000
MLOADS	1877	49.599361	22.248604	36.00000000	400.0000
MMILES	1877	1056.448055	735.958656	46.00000000	3957.0000
DENSITY	1877	17584.365477	29602.186062	40.00000000	236517.0000
AVINDX	1877	113.388636	7.427908	90.47000000	127.4300
WATER	1877	0.190197	0.392561	0.00000000	1.0000
DIRSRV	1692	2.021868	1.371370	0.00000000	8.0000
MYEAR=85					
RTM	1855	0.041777	0.022691	0.00000000	0.4938
MNINT	1855	1.045283	0.874608	0.00000000	5.0000
MLOADS	1855	46.812938	17.916595	36.00000000	300.0000
MMILES	1855	1081.977898	736.081484	8.00000000	4626.0000
DENSITY	1855	17330.426415	28252.650080	40.00000000	252720.0000
AVINDX	1853	120.933637	7.008294	91.61500000	127.4300
WATER	1855	0.193531	0.395172	0.00000000	1.0000
DIRSRV	1654	2.078597	1.372926	0.00000000	8.0000

Fabricated Metal Products

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	1013	0.085525	0.065043	0.00000000	0.8235
MNINT	1033	1.129719	0.877484	0.00000000	5.0000
MLOADS	1033	102.674734	20.964133	100.00000000	500.0000
MMILES	1033	962.964182	718.989852	0.00000000	5041.0000
DENSITY	1033	20930.590513	30175.084911	100.00000000	244200.0000
AVINDX	1033	99.140644	8.196909	90.33500000	128.5500
WATER	1033	0.249758	0.433083	0.00000000	1.0000
DIRSRV	1026	2.453216	1.793281	0.00000000	10.0000
MYEAR=76					
RTM	636	0.098377	0.086012	0.00000000	0.6691
MNINT	812	1.068966	0.835508	0.00000000	5.0000
MLOADS	812	104.211823	28.051423	100.00000000	500.0000
MMILES	812	799.415025	784.220525	0.00000000	4816.0000
DENSITY	812	21040.024631	30263.141650	100.00000000	231700.0000
AVINDX	812	96.590511	8.099717	89.73500000	127.0800
WATER	812	0.219212	0.413967	0.00000000	1.0000
DIRSRV	810	2.435802	1.879945	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=77 ------------------------------					
RTM	635	0.104162	0.081614	0.00000000	0.6740
MNINT	635	0.938583	0.768674	0.00000000	4.0000
MLOADS	635	103.228346	23.319205	100.00000000	500.0000
MMILES	635	1008.763780	689.200001	14.00000000	3769.0000
DENSITY	635	20091.968504	27828.570783	100.00000000	209500.0000
AVINDX	635	96.559866	7.976174	89.73500000	127.4300
WATER	635	0.204724	0.403818	0.00000000	1.0000
DIRSRV	635	1.951181	1.906938	0.00000000	10.0000
------------------------------ MYEAR=78 ------------------------------					
RTM	532	0.106362	0.079826	0.00000000	0.5510
MNINT	532	0.943609	0.863912	0.00000000	7.0000
MLOADS	532	104.853383	29.250672	100.00000000	500.0000
MMILES	532	1005.265038	672.959019	33.00000000	3158.0000
DENSITY	532	22691.165414	33982.254383	100.00000000	250800.0000
AVINDX	532	98.560132	6.446663	89.73500000	127.0800
WATER	532	0.208647	0.406724	0.00000000	1.0000
DIRSRV	532	2.084586	1.874195	0.00000000	10.0000
------------------------------ MYEAR=79 ------------------------------					
RTM	492	0.103854	0.090523	0.00951035	0.7963
MNINT	492	0.951220	0.869053	0.00000000	5.0000
MLOADS	492	103.997967	24.185426	100.00000000	400.0000
MMILES	492	1037.945122	716.092354	33.00000000	4098.0000
DENSITY	492	23072.560976	29615.102507	100.00000000	267300.0000
AVINDX	492	102.498780	7.077842	89.73500000	127.0800
WATER	492	0.184959	0.388660	0.00000000	1.0000
DIRSRV	492	2.063008	1.947920	0.00000000	10.0000
------------------------------ MYEAR=80 ------------------------------					
RTM	422	0.107252	0.092988	0.00412548	0.9653
MNINT	422	1.056872	0.899505	0.00000000	6.0000
MLOADS	422	105.488152	30.768751	100.00000000	400.0000
MMILES	422	1056.699052	744.513772	33.00000000	4857.0000
DENSITY	422	21442.417062	28354.112620	100.00000000	225200.0000
AVINDX	422	105.111374	7.306394	89.73500000	126.7650
WATER	422	0.196682	0.397962	0.00000000	1.0000
DIRSRV	422	2.099526	1.850608	0.00000000	9.0000
------------------------------ MYEAR=81 ------------------------------					
RTM	411	0.101119	0.090316	0.00638563	0.5862
MNINT	411	1.055961	0.907574	0.00000000	4.0000
MLOADS	411	74.425791	34.910844	36.00000000	300.0000
MMILES	411	1116.875912	731.146738	22.00000000	4577.0000
DENSITY	411	21072.963504	33549.357772	40.00000000	292775.0000
AVINDX	411	105.588601	6.955658	89.73500000	127.0800
WATER	411	0.158151	0.365327	0.00000000	1.0000
DIRSRV	410	2.448780	1.785177	0.00000000	10.0000
------------------------------ MYEAR=82 ------------------------------					
RTM	293	0.103157	0.090036	0.00607752	0.6580
MNINT	293	0.972696	0.883218	0.00000000	5.0000
MLOADS	293	69.928328	37.463567	36.00000000	300.0000
MMILES	293	1065.030717	720.315187	35.00000000	4041.0000
DENSITY	293	21772.754266	30385.400799	40.00000000	185054.0000
AVINDX	293	106.958055	5.563557	89.73500000	127.0800
WATER	293	0.174061	0.379811	0.00000000	1.0000
DIRSRV	292	2.530822	1.786473	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=83 ------------------------------					
RTM	297	0.097277	0.089965	0.00903925	0.6237
MNINT	297	0.693603	0.777900	0.00000000	5.0000
MLOADS	297	67.727273	36.739905	36.00000000	300.0000
MMILES	297	1089.515152	732.583692	115.00000000	3774.0000
DENSITY	297	26657.575758	33062.672494	316.00000000	184255.0000
AVINDX	297	105.036818	5.551814	89.73500000	125.9000
WATER	297	0.164983	0.371792	0.00000000	1.0000
DIRSRV	297	2.397306	1.567316	0.00000000	8.0000
------------------------------ MYEAR=84 ------------------------------					
RTM	379	0.095932	0.096099	0.00373078	0.6812
MNINT	379	0.744063	0.882178	0.00000000	5.0000
MLOADS	379	48.651715	26.835676	36.00000000	300.0000
MMILES	379	1169.366755	763.746100	43.00000000	3495.0000
DENSITY	379	33875.366755	44130.047261	40.00000000	236517.0000
AVINDX	377	108.159496	7.837690	90.33500000	127.0800
WATER	379	0.110818	0.314322	0.00000000	1.0000
DIRSRV	362	2.157459	1.366420	0.00000000	7.0000
------------------------------ MYEAR=85 ------------------------------					
RTM	350	0.080928	0.067385	0.00370917	0.4447
MNINT	350	0.645714	0.757141	0.00000000	4.0000
MLOADS	350	44.857143	16.445173	36.00000000	200.0000
MMILES	350	1162.857143	749.079911	63.00000000	3352.0000
DENSITY	350	31512.820000	38126.744254	40.00000000	196415.0000
AVINDX	349	115.094499	10.111049	91.61500000	126.7300
WATER	350	0.140000	0.347484	0.00000000	1.0000
DIRSRV	333	2.210210	1.300238	0.00000000	7.0000

Machinery

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=74 ------------------------------					
RTM	777	0.101267	0.051810	0.00587458	0.5786
MNINT	788	1.166244	0.785205	0.00000000	4.0000
MLOADS	788	103.128173	24.989707	100.00000000	500.0000
MMILES	788	1170.420051	715.910515	0.00000000	4012.0000
DENSITY	788	18888.832487	30052.631970	100.00000000	244200.0000
AVINDX	788	101.425457	9.817289	90.47000000	127.0800
WATER	788	0.210660	0.408036	0.00000000	1.0000
DIRSRV	786	2.312977	1.704624	0.00000000	10.0000
------------------------------ MYEAR=76 ------------------------------					
RTM	456	0.109492	0.064312	0.00714022	0.5026
MNINT	576	1.067708	0.776121	0.00000000	4.0000
MLOADS	576	106.687500	40.611580	100.00000000	700.0000
MMILES	576	960.302083	789.778192	0.00000000	3761.0000
DENSITY	576	18130.902778	27605.520240	100.00000000	231700.0000
AVINDX	576	98.318715	9.289705	89.73500000	127.0800
WATER	576	0.223958	0.417257	0.00000000	1.0000
DIRSRV	574	2.317073	1.719558	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=77 ------------------------------					
RTM	553	0.107922	0.072769	0.00000000	0.6571
MNINT	553	1.019892	0.740619	0.00000000	4.0000
MLOADS	553	103.311031	17.589548	100.00000000	300.0000
MMILES	553	1200.030741	732.259129	51.00000000	3992.0000
DENSITY	553	18103.616637	25735.039018	100.00000000	209500.0000
AVINDX	553	97.782658	8.868336	89.73500000	127.0800
WATER	553	0.207957	0.406213	0.00000000	1.0000
DIRSRV	553	1.844485	1.638876	0.00000000	10.0000
------------------------------ MYEAR=78 ------------------------------					
RTM	493	0.104606	0.067212	0.00773448	0.7469
MNINT	493	1.062880	0.777021	0.00000000	4.0000
MLOADS	493	105.363083	31.137970	100.00000000	450.0000
MMILES	493	1179.531440	745.968477	82.00000000	3791.0000
DENSITY	493	22037.119675	34611.981299	100.00000000	250800.0000
AVINDX	493	100.021694	7.110929	89.73500000	127.0800
WATER	493	0.210953	0.408400	0.00000000	1.0000
DIRSRV	493	1.738337	1.521690	0.00000000	9.0000
------------------------------ MYEAR=79 ------------------------------					
RTM	470	0.093235	0.056152	0.00000000	0.5749
MNINT	470	1.114894	0.812739	0.00000000	7.0000
MLOADS	470	104.202128	25.609075	100.00000000	500.0000
MMILES	470	1258.729787	713.731787	82.00000000	3558.0000
DENSITY	470	21210.851064	32705.909127	100.00000000	267300.0000
AVINDX	470	102.756053	7.147843	89.73500000	126.4150
WATER	470	0.187234	0.390515	0.00000000	1.0000
DIRSRV	470	1.906383	1.529999	0.00000000	9.0000
------------------------------ MYEAR=80 ------------------------------					
RTM	347	0.098093	0.063178	0.00419069	0.6097
MNINT	347	1.227666	0.917105	0.00000000	5.0000
MLOADS	347	103.587896	25.447331	100.00000000	400.0000
MMILES	347	1283.832853	775.744480	105.00000000	4710.0000
DENSITY	347	19297.118156	27796.471120	100.00000000	225200.0000
AVINDX	347	105.638890	7.394828	89.73500000	126.4150
WATER	347	0.152738	0.360254	0.00000000	1.0000
DIRSRV	347	1.913545	1.596063	0.00000000	9.0000
------------------------------ MYEAR=81 ------------------------------					
RTM	403	0.105119	0.074490	0.00000000	0.6413
MNINT	403	1.079404	0.784583	0.00000000	4.0000
MLOADS	403	76.925558	47.574811	36.00000000	500.0000
MMILES	403	1326.997519	709.210350	59.00000000	3873.0000
DENSITY	403	16667.607940	28751.560998	100.00000000	212165.0000
AVINDX	403	106.149032	6.342398	89.73500000	127.0800
WATER	403	0.124069	0.330071	0.00000000	1.0000
DIRSRV	403	2.369727	1.592825	0.00000000	9.0000
------------------------------ MYEAR=82 ------------------------------					
RTM	291	0.096866	0.063785	0.01216913	0.4303
MNINT	291	0.972509	0.878439	0.00000000	4.0000
MLOADS	291	70.529210	40.028029	36.00000000	300.0000
MMILES	291	1268.075601	729.643305	73.00000000	3503.0000
DENSITY	291	18831.096220	29961.586818	40.00000000	185054.0000
AVINDX	291	107.279777	6.151487	91.28500000	127.0800
WATER	291	0.123711	0.329819	0.00000000	1.0000
DIRSRV	289	2.425606	1.470368	0.00000000	7.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=83					
RTM	293	0.088257	0.054309	0.02002250	0.3586
MNINT	293	0.747440	0.724594	0.00000000	4.0000
MLOADS	293	65.075085	33.865485	36.00000000	300.0000
MMILES	293	1108.569966	604.867839	151.00000000	3535.0000
DENSITY	293	21800.368601	30741.009031	40.00000000	214627.0000
AVINDX	293	105.057850	6.052439	91.05000000	127.0800
WATER	293	0.146758	0.354470	0.00000000	1.0000
DIRSRV	293	2.378840	1.317621	0.00000000	6.0000
MYEAR=84					
RTM	422	0.083821	0.060907	0.00611280	0.4766
MNINT	423	0.827423	0.843714	0.00000000	4.0000
MLOADS	423	46.241135	17.796067	36.00000000	132.0000
MMILES	423	1283.056738	724.751921	59.00000000	3592.0000
DENSITY	423	28108.893617	39213.193264	40.00000000	236517.0000
AVINDX	421	109.251188	8.423963	89.73500000	127.4300
WATER	423	0.115839	0.320411	0.00000000	1.0000
DIRSRV	388	2.146907	1.280571	0.00000000	8.0000
MYEAR=85					
RTM	391	0.079930	0.068757	0.00672621	0.6235
MNINT	391	0.790281	0.875307	0.00000000	5.0000
MLOADS	391	44.872123	17.681339	36.00000000	200.0000
MMILES	391	1342.872123	755.799037	68.00000000	3669.0000
DENSITY	391	26686.066496	36363.577074	80.00000000	196415.0000
AVINDX	390	115.450744	9.829230	91.05000000	127.0800
WATER	391	0.097187	0.296591	0.00000000	1.0000
DIRSRV	367	2.166213	1.298234	0.00000000	8.0000
MYEAR=87					
RTM	2	0.04896	0.00396575	0.04616	0.0518
MNINT	2	0.00000	0.00000000	0.00000	0.0000
MLOADS	2	40.00000	0.00000000	40.00000	40.0000
MMILES	2	884.00000	1.41421356	883.00000	885.0000
DENSITY	2	297540.00000	0.00000000	297540.00000	297540.0000
AVINDX	2	126.74750	0.47022601	126.41500	127.0800
WATER	2	0.00000	0.00000000	0.00000	0.0000
DIRSRV	2	3.00000	0.00000000	3.00000	3.0000

Electrical Equipment

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=74					
RTM	938	0.119773	0.068054	0.00222630	0.6024
MNINT	953	1.049318	0.838091	0.00000000	6.0000
MLOADS	953	102.391396	17.892860	100.00000000	400.0000
MMILES	953	1033.695698	689.645687	0.00000000	4693.0000
DENSITY	953	19553.410283	29279.614603	100.00000000	244200.0000
AVINDX	953	100.366149	10.090226	89.60000000	135.6150
WATER	953	0.277020	0.447761	0.00000000	1.0000
DIRSRV	947	2.192186	1.679066	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
MYEAR=76					
RTM	555	0.135094	0.095738	0.00022704	0.6569
MNINT	740	1.014865	0.833043	0.00000000	4.0000
MLOADS	740	103.908108	22.578378	100.00000000	300.0000
MMILES	740	881.509459	820.666181	0.00000000	4392.0000
DENSITY	740	18546.756757	27537.643622	100.00000000	231700.0000
AVINDX	740	96.317764	8.547934	89.73500000	135.6150
WATER	740	0.258108	0.437890	0.00000000	1.0000
DIRSRV	734	2.260218	1.717933	0.00000000	10.0000
MYEAR=77					
RTM	685	0.119949	0.072208	0.00000000	0.6103
MNINT	685	0.938686	0.775563	0.00000000	4.0000
MLOADS	685	104.678832	23.923408	100.00000000	300.0000
MMILES	685	1126.116788	722.179997	52.00000000	3610.0000
DENSITY	685	19593.284672	27571.881311	100.00000000	209500.0000
AVINDX	685	96.010927	7.538790	89.73500000	135.6150
WATER	685	0.261314	0.439672	0.00000000	1.0000
DIRSRV	683	1.751098	1.615398	0.00000000	10.0000
MYEAR=78					
RTM	632	0.122267	0.074182	0.00000000	0.6250
MNINT	632	0.990506	0.771874	0.00000000	4.0000
MLOADS	632	103.235759	18.002107	100.00000000	300.0000
MMILES	632	1133.359177	697.632225	60.00000000	3279.0000
DENSITY	632	20992.563291	31723.873912	100.00000000	250800.0000
AVINDX	631	99.772005	6.415677	89.73500000	127.0800
WATER	632	0.237342	0.425790	0.00000000	1.0000
DIRSRV	631	1.643423	1.607902	0.00000000	9.0000
MYEAR=79					
RTM	622	0.118957	0.069992	0.00873605	0.4747
MNINT	622	1.020900	0.821146	0.00000000	5.0000
MLOADS	622	103.321543	19.798245	100.00000000	300.0000
MMILES	622	1149.398714	686.703823	54.00000000	3293.0000
DENSITY	622	19408.520900	29287.498359	100.00000000	267300.0000
AVINDX	621	104.708108	6.838386	89.73500000	127.0800
WATER	622	0.245981	0.431014	0.00000000	1.0000
DIRSRV	620	1.617742	1.501967	0.00000000	9.0000
MYEAR=80					
RTM	481	0.122408	0.074194	0.00000000	0.6311
MNINT	481	1.114345	0.822485	0.00000000	3.0000
MLOADS	481	103.164241	17.331211	100.00000000	250.0000
MMILES	481	1153.954262	700.319042	26.00000000	4043.0000
DENSITY	481	19782.328482	30718.619482	100.00000000	225200.0000
AVINDX	481	107.513420	6.355420	89.73500000	126.4150
WATER	481	0.241164	0.428235	0.00000000	1.0000
DIRSRV	479	1.693111	1.538819	0.00000000	8.0000
MYEAR=81					
RTM	467	0.121438	0.071006	0.01745445	0.5307
MNINT	468	1.128205	0.902421	0.00000000	5.0000
MLOADS	468	76.865385	35.865336	36.00000000	500.0000
MMILES	468	1163.438034	710.679165	90.00000000	3425.0000
DENSITY	468	18105.534188	28022.771340	40.00000000	212165.0000
AVINDX	468	107.392703	5.822732	89.73500000	127.0800
WATER	468	0.232906	0.423135	0.00000000	1.0000
DIRSRV	468	2.070513	1.508486	0.00000000	9.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------ MYEAR=82 ------					
RTM	419	0.110567	0.061483	0.01347440	0.4497
MNINT	419	0.887828	0.815120	0.00000000	3.0000
MLOADS	419	61.336516	28.333690	36.00000000	150.0000
MMILES	419	1160.083532	684.370049	67.00000000	3364.0000
DENSITY	419	21729.856802	33692.885343	40.00000000	185054.0000
AVINDX	419	107.341253	5.953101	89.60000000	132.3850
WATER	419	0.212411	0.409503	0.00000000	1.0000
DIRSRV	418	2.296651	1.688738	0.00000000	10.0000
------ MYEAR=83 ------					
RTM	516	0.104247	0.060162	0.01171899	0.7272
MNINT	516	0.730620	0.811993	0.00000000	4.0000
MLOADS	516	62.693798	34.602531	36.00000000	300.0000
MMILES	516	1090.273256	637.394923	96.00000000	3194.0000
DENSITY	516	24003.585271	35184.310767	40.00000000	214627.0000
AVINDX	516	104.604399	5.359148	90.47000000	127.0800
WATER	516	0.199612	0.400097	0.00000000	1.0000
DIRSRV	515	2.205825	1.508847	0.00000000	8.0000
------ MYEAR=84 ------					
RTM	618	0.098712	0.062496	0.00689221	0.5311
MNINT	618	0.729773	0.801004	0.00000000	4.0000
MLOADS	618	47.008091	21.564759	36.00000000	300.0000
MMILES	618	1213.762136	721.577129	109.00000000	3379.0000
DENSITY	618	26054.736246	39069.771402	40.00000000	236517.0000
AVINDX	618	111.304434	7.724032	89.73500000	127.4300
WATER	618	0.169903	0.375852	0.00000000	1.0000
DIRSRV	607	2.031301	1.395659	0.00000000	8.0000
------ MYEAR=85 ------					
RTM	605	0.098582	0.073678	0.00468662	0.7057
MNINT	605	0.690909	0.779710	0.00000000	4.0000
MLOADS	605	42.171901	10.970620	36.00000000	125.0000
MMILES	605	1245.016529	742.745192	87.00000000	3557.0000
DENSITY	605	23386.074380	33169.671547	40.00000000	196415.0000
AVINDX	605	119.183165	8.320913	89.73500000	127.0800
WATER	605	0.163636	0.370251	0.00000000	1.0000
DIRSRV	595	2.048739	1.369206	0.00000000	8.0000
------ MYEAR=86 ------					
RTM	19	0.092790	0.03213	0.0461712	0.1812
MNINT	19	0.894737	0.87526	0.0000000	2.0000
MLOADS	19	40.000000	0.00000	40.0000000	40.0000
MMILES	19	1677.105263	766.95646	746.0000000	2483.0000
DENSITY	19	93098.315789	115236.81272	1680.0000000	330014.0000
AVINDX	19	126.905526	0.82492	125.0000000	127.9300
WATER	19	0.000000	0.00000	0.0000000	0.0000
DIRSRV	19	1.894737	1.19697	0.0000000	4.0000
------ MYEAR=87 ------					
RTM	23	0.071411	0.01489	0.0307128	0.1004
MNINT	23	0.782609	0.90235	0.0000000	2.0000
MLOADS	23	40.000000	0.00000	40.0000000	40.0000
MMILES	23	1858.217391	699.96240	720.0000000	2560.0000
DENSITY	23	88165.739130	116783.57446	1440.0000000	344928.0000
AVINDX	23	126.560217	5.18193	108.9000000	130.9700
WATER	23	0.000000	0.00000	0.0000000	0.0000
DIRSRV	23	1.826087	1.52709	0.0000000	6.0000

Transportation Equipment

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=74		
RTM	1670	0.103112	0.055203	0.00307435	0.7906
MNINT	1698	1.054181	0.756436	0.00000000	4.0000
MLOADS	1698	101.169022	13.281204	100.00000000	400.0000
MMILES	1698	1051.748528	721.814642	0.00000000	4403.0000
DENSITY	1698	16923.262662	26087.941018	100.00000000	244200.0000
AVINDX	1698	100.246867	11.414448	90.91500000	135.6150
WATER	1698	0.232627	0.422631	0.00000000	1.0000
DIRSRV	1688	2.131517	1.718618	0.00000000	10.0000
			MYEAR=76		
RTM	1354	0.131776	0.099401	0.00385128	0.8727
MNINT	1639	1.014033	0.730747	0.00000000	4.0000
MLOADS	1639	101.146431	12.489821	100.00000000	400.0000
MMILES	1639	902.534472	799.780638	0.00000000	3638.0000
DENSITY	1639	16608.297743	23936.337868	100.00000000	231700.0000
AVINDX	1639	96.071876	10.214727	89.73500000	135.6150
WATER	1639	0.216595	0.412050	0.00000000	1.0000
DIRSRV	1634	2.064871	1.684395	0.00000000	10.0000
			MYEAR=77		
RTM	1735	0.105938	0.047991	0.00000000	0.5061
MNINT	1736	0.997696	0.711369	0.00000000	4.0000
MLOADS	1736	101.260945	11.998242	100.00000000	400.0000
MMILES	1736	1090.539747	715.515323	21.00000000	5259.0000
DENSITY	1736	16381.451613	23927.708640	100.00000000	209500.0000
AVINDX	1736	96.535003	8.111838	89.73500000	138.0300
WATER	1736	0.214862	0.410845	0.00000000	1.0000
DIRSRV	1735	1.562536	1.633870	0.00000000	10.0000
			MYEAR=78		
RTM	1825	0.104126	0.052474	0.00499445	0.5735
MNINT	1825	0.987397	0.738475	0.00000000	4.0000
MLOADS	1825	101.073973	10.729607	100.00000000	300.0000
MMILES	1825	1114.229041	731.688084	15.00000000	4354.0000
DENSITY	1825	16798.027397	25772.462874	100.00000000	250800.0000
AVINDX	1824	101.855957	6.819903	89.73500000	135.6150
WATER	1825	0.213151	0.409645	0.00000000	1.0000
DIRSRV	1822	1.562020	1.635764	0.00000000	10.0000
			MYEAR=79		
RTM	1801	0.101403	0.054248	0.00000000	0.7986
MNINT	1801	1.016102	0.748529	0.00000000	4.0000
MLOADS	1801	101.657968	17.513983	100.00000000	500.0000
MMILES	1801	1096.341477	715.869954	12.00000000	4636.0000
DENSITY	1801	17424.319822	28104.292424	100.00000000	267300.0000
AVINDX	1801	108.212002	6.026196	89.73500000	135.6150
WATER	1801	0.207107	0.405346	0.00000000	1.0000
DIRSRV	1801	1.536924	1.633639	0.00000000	10.0000
			MYEAR=80		
RTM	1773	0.099944	0.052681	0.00084634	0.6910
MNINT	1773	1.104343	0.787063	0.00000000	5.0000
MLOADS	1773	100.804851	8.325641	100.00000000	300.0000
MMILES	1773	1108.518331	728.552638	10.00000000	3802.0000
DENSITY	1773	15174.450085	25016.309269	100.00000000	225200.0000
AVINDX	1772	109.977652	4.837369	90.33500000	135.6150
WATER	1773	0.198534	0.399008	0.00000000	1.0000
DIRSRV	1773	1.536379	1.613100	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=81 ------------------------------					
RTM	1846	0.110249	0.064059	0.00320699	0.9621
MNINT	1847	1.090417	0.790621	0.00000000	5.0000
MLOADS	1847	79.742285	30.227571	36.00000000	299.0000
MMILES	1847	1144.995669	744.341475	16.00000000	4247.0000
DENSITY	1847	15177.373579	25619.220040	40.00000000	239857.0000
AVINDX	1847	108.921670	4.241783	90.33500000	135.6150
WATER	1847	0.190579	0.392864	0.00000000	1.0000
DIRSRV	1845	2.081843	1.583990	0.00000000	10.0000
------------------------------ MYEAR=82 ------------------------------					
RTM	1816	0.111047	0.060485	0.00311433	0.6451
MNINT	1817	1.052834	0.774358	0.00000000	5.0000
MLOADS	1817	73.352229	32.274775	13.00000000	400.0000
MMILES	1817	1118.047331	728.666696	36.00000000	3841.0000
DENSITY	1817	14896.423775	25659.027574	40.00000000	185054.0000
AVINDX	1817	108.760605	4.782388	89.73500000	135.6150
WATER	1817	0.209136	0.406804	0.00000000	1.0000
DIRSRV	1780	2.090449	1.579171	0.00000000	10.0000
------------------------------ MYEAR=83 ------------------------------					
RTM	1939	0.110782	0.058478	0.00099882	0.5887
MNINT	1939	0.983497	0.715259	0.00000000	4.0000
MLOADS	1939	67.939144	41.170032	36.00000000	1326.0000
MMILES	1939	1118.840640	701.638033	18.00000000	4490.0000
DENSITY	1939	15539.643115	26136.409701	40.00000000	214627.0000
AVINDX	1939	104.194567	4.128767	91.66500000	135.6150
WATER	1939	0.206292	0.404747	0.00000000	1.0000
DIRSRV	1939	2.012378	1.453742	0.00000000	9.0000
------------------------------ MYEAR=84 ------------------------------					
RTM	2370	0.114303	0.066221	0.00000000	0.7752
MNINT	2379	1.031526	0.764717	0.00000000	4.0000
MLOADS	2379	50.878520	23.459124	36.00000000	500.0000
MMILES	2379	1161.824716	710.629547	28.00000000	3762.0000
DENSITY	2379	15744.897856	28006.998993	40.00000000	236517.0000
AVINDX	2379	114.576280	6.737435	89.73500000	135.6150
WATER	2379	0.176965	0.381719	0.00000000	1.0000
DIRSRV	2148	1.872905	1.383633	0.00000000	8.0000
------------------------------ MYEAR=85 ------------------------------					
RTM	2510	0.113963	0.061193	0.00000000	0.7872
MNINT	2510	1.056574	0.735689	0.00000000	4.0000
MLOADS	2510	46.852988	18.830713	36.00000000	210.0000
MMILES	2510	1202.193625	731.362723	29.00000000	3597.0000
DENSITY	2510	13981.936255	24883.476185	40.00000000	252720.0000
AVINDX	2510	122.332926	5.861662	89.73500000	135.6150
WATER	2510	0.177689	0.382327	0.00000000	1.0000
DIRSRV	2270	1.806167	1.390440	0.00000000	8.0000
------------------------------ MYEAR=86 ------------------------------					
RTM	488	0.125216	0.059445	0.00000000	0.5593
MNINT	488	1.096311	0.865104	0.00000000	4.0000
MLOADS	488	46.618852	17.593231	36.00000000	135.0000
MMILES	488	1269.793033	811.880467	140.00000000	3310.0000
DENSITY	488	33137.090164	54874.873635	80.00000000	330014.0000
AVINDX	488	126.234641	3.760335	98.21500000	127.9300
WATER	488	0.266393	0.442526	0.00000000	1.0000
DIRSRV	488	2.065574	1.631254	0.00000000	8.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=87		
RTM	493	0.114906	0.063704	0.00760830	0.5428
MNINT	494	0.987854	0.823005	0.00000000	4.0000
MLOADS	494	46.872470	18.066980	36.00000000	144.0000
MMILES	494	1302.016194	820.144604	70.00000000	3317.0000
DENSITY	494	37966.291498	62536.429620	80.00000000	348068.0000
AVINDX	494	128.067146	4.088726	100.66500000	135.6150
WATER	494	0.244939	0.430487	0.00000000	1.0000
DIRSRV	492	2.069106	1.539467	0.00000000	8.0000

Scrap Material

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=74		
RTM	1325	0.049176	0.036628	0.00000000	0.6303
MNINT	1364	0.956745	0.851587	0.00000000	6.0000
MLOADS	1364	103.491935	33.059418	100.00000000	900.0000
MMILES	1364	739.459677	605.252876	0.00000000	3734.0000
DENSITY	1364	21870.454545	31748.030358	100.00000000	244200.0000
AVINDX	1364	102.915883	12.518077	91.05000000	135.6150
WATER	1364	0.239736	0.427079	0.00000000	1.0000
DIRSRV	1329	2.270128	1.799436	0.00000000	10.0000
			MYEAR=76		
RTM	969	0.077570	0.095131	0.00000000	0.8622
MNINT	1269	0.918046	0.822340	0.00000000	6.0000
MLOADS	1269	100.778566	8.584557	100.00000000	300.0000
MMILES	1269	620.982664	682.384781	0.00000000	3883.0000
DENSITY	1269	21023.010244	27982.969811	100.00000000	231700.0000
AVINDX	1269	97.479665	10.635174	89.73500000	135.6150
WATER	1269	0.237195	0.425530	0.00000000	1.0000
DIRSRV	1253	2.230646	1.795082	0.00000000	10.0000
			MYEAR=77		
RTM	2255	0.051011	0.028073	0.00284939	0.4169
MNINT	2255	0.923282	0.675903	0.00000000	4.0000
MLOADS	2255	102.764967	19.522169	100.00000000	500.0000
MMILES	2255	904.392461	645.906514	23.00000000	4432.0000
DENSITY	2255	16248.514412	23406.893210	100.00000000	209500.0000
AVINDX	2255	100.545929	11.581763	89.73500000	135.6150
WATER	2255	0.199557	0.399756	0.00000000	1.0000
DIRSRV	2239	1.717285	1.624219	0.00000000	10.0000
			MYEAR=78		
RTM	1260	0.050667	0.031300	0.00585099	0.4386
MNINT	1260	0.923016	0.815620	0.00000000	6.0000
MLOADS	1260	100.818254	8.748420	100.00000000	300.0000
MMILES	1260	756.456349	603.272577	38.00000000	3770.0000
DENSITY	1260	21348.095238	30887.058931	100.00000000	250800.0000
AVINDX	1260	101.758988	6.742246	89.73500000	135.6150
WATER	1260	0.245238	0.430399	0.00000000	1.0000
DIRSRV	1252	1.869010	1.762591	0.00000000	10.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
			MYEAR=79		
RTM	1363	0.045716	0.025400	0.00000000	0.3955
MNINT	1363	0.926632	0.781891	0.00000000	5.0000
MLOADS	1363	101.148936	10.459795	100.00000000	300.0000
MMILES	1363	762.202494	601.407422	21.00000000	4060.0000
DENSITY	1363	22766.471020	34648.906318	100.00000000	267300.0000
AVINDX	1363	106.896665	6.958778	89.73500000	135.6150
WATER	1363	0.238445	0.426289	0.00000000	1.0000
DIRSRV	1352	1.839497	1.735716	0.00000000	10.0000
			MYEAR=80		
RTM	2350	0.047215	0.027024	0.00000000	0.4875
MNINT	2350	1.112766	0.814178	0.00000000	5.0000
MLOADS	2350	102.225106	18.079126	100.00000000	500.0000
MMILES	2350	939.793191	662.283975	23.00000000	3620.0000
DENSITY	2350	16086.978723	27186.148133	100.00000000	283800.0000
AVINDX	2350	108.785660	6.565391	89.73500000	135.6150
WATER	2350	0.198723	0.399124	0.00000000	1.0000
DIRSRV	2339	1.704575	1.609273	0.00000000	10.0000
			MYEAR=81		
RTM	1336	0.047061	0.024287	0.00000000	0.2952
MNINT	1336	1.035928	0.850765	0.00000000	4.0000
MLOADS	1336	81.651946	27.600971	36.00000000	350.0000
MMILES	1336	794.337575	587.998222	34.00000000	3979.0000
DENSITY	1336	18912.321108	32061.818178	40.00000000	292775.0000
AVINDX	1336	108.457964	4.686204	90.33500000	135.6150
WATER	1336	0.230539	0.421336	0.00000000	1.0000
DIRSRV	1324	2.389728	1.585769	0.00000000	10.0000
			MYEAR=82		
RTM	1306	0.050289	0.044258	0.00249517	0.9345
MNINT	1306	1.059724	0.898420	0.00000000	6.0000
MLOADS	1306	70.261103	30.851243	36.00000000	400.0000
MMILES	1306	806.705207	613.891984	10.00000000	3779.0000
DENSITY	1306	19010.212864	31219.188904	40.00000000	315480.0000
AVINDX	1306	108.670168	4.551677	89.73500000	135.6150
WATER	1306	0.226646	0.418822	0.00000000	1.0000
DIRSRV	1294	2.394127	1.583215	0.00000000	10.0000
			MYEAR=83		
RTM	1359	0.048450	0.040386	0.00000000	0.8818
MNINT	1359	0.925681	0.836173	0.00000000	5.0000
MLOADS	1359	64.688742	32.576876	36.00000000	500.0000
MMILES	1359	791.011773	600.646725	3.00000000	4030.0000
DENSITY	1359	18735.286976	29594.118740	40.00000000	229824.0000
AVINDX	1359	104.821670	4.635728	91.70000000	135.6150
WATER	1359	0.233260	0.423062	0.00000000	1.0000
DIRSRV	1348	2.243323	1.444389	0.00000000	9.0000

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
------------------------------ MYEAR=84 ------------------------------					
RTM	1580	0.050735	0.047289	0.00000000	0.9751
MNINT	1581	0.869703	0.799192	0.00000000	5.0000
MLOADS	1581	49.753321	20.258735	36.00000000	124.0000
MMILES	1581	784.253004	609.722560	8.00000000	3765.0000
DENSITY	1581	20639.769133	32883.949152	40.00000000	236517.0000
AVINDX	1580	112.152313	6.661005	91.75000000	135.6150
WATER	1581	0.215054	0.410990	0.00000000	1.0000
DIRSRV	1526	2.148755	1.363032	0.00000000	8.0000
------------------------------ MYEAR=85 ------------------------------					
RTM	1509	0.051170	0.055648	0.00000000	0.8771
MNINT	1509	0.857522	0.785464	0.00000000	4.0000
MLOADS	1509	47.786614	20.326958	36.00000000	300.0000
MMILES	1509	784.043075	593.372361	4.00000000	3431.0000
DENSITY	1509	19973.522863	30278.094762	40.00000000	252720.0000
AVINDX	1507	120.699472	6.894503	90.33500000	135.6150
WATER	1509	0.214049	0.410297	0.00000000	1.0000
DIRSRV	1442	2.149792	1.344701	0.00000000	8.0000
------------------------------ MYEAR=86 ------------------------------					
RTM	577	0.046722	0.027042	0.00000000	0.4530
MNINT	577	0.712305	0.779782	0.00000000	4.0000
MLOADS	577	45.403813	15.568002	38.00000000	119.0000
MMILES	577	667.100520	496.381913	55.00000000	3410.0000
DENSITY	577	33526.318891	68183.793443	80.00000000	592844.0000
AVINDX	577	123.650113	6.748057	92.17000000	127.9300
WATER	577	0.251300	0.434137	0.00000000	1.0000
DIRSRV	560	2.414286	1.307667	0.00000000	8.0000
------------------------------ MYEAR=87 ------------------------------					
RTM	698	0.047228	0.024481	0.00663690	0.2913
MNINT	698	0.628940	0.832358	0.00000000	5.0000
MLOADS	698	46.310888	24.472382	36.00000000	500.0000
MMILES	698	672.339542	527.198536	54.00000000	3430.0000
DENSITY	698	35986.974212	71248.290050	80.00000000	556494.0000
AVINDX	698	125.269491	7.532696	91.82000000	133.2650
WATER	698	0.260745	0.439356	0.00000000	1.0000
DIRSRV	683	2.376281	1.348561	0.00000000	8.0000

APPENDIX V

CHAPTER V REGRESSION RESULTS

The tables which follow report the full regression output from the Generalized Least Squares estimation technique outlined in Chapter V.

The second portion of the reporting process for each commodity contains the "F" statistics and hypothesis tests for the null hypothesis that the sum of the pre-Staggers independent variable and the corresponding interaction term is equal to zero.

METALLIC ORE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	1213.23176	67.40176425	232.393	0.0001
ERROR	1979	573.97760	0.29003416		
C TOTAL	1997	1787.20936			

ROOT MSE	0.5385482	R-SQUARE	0.6788
DEP MEAN	1.009812	ADJ R-SQ	0.6759
C.V.	53.33153		

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.01743491	0.02025360	0.861	0.3894
MLOADS	1	-.0000020877	.00000194274	-1.075	0.2827
SMLOADS	1	-0.000006074	0.0000013358	-4.547	0.0001
MNINT	1	0.001485265	0.000394421	3.766	0.0002
SMNINT	1	-0.000206617	0.000193091	-1.070	0.2847
MMILES	1	-0.000028044	.00000218514	-12.834	0.0001
SMMILES	1	-.0000032486	.00000100532	-3.231	0.0013
MMILES2	1	5.74915E-09	8.15681E-10	7.048	0.0001
SMMILES2	1	1.04714E-09	4.05935E-10	2.580	0.0100
DIRSRV	1	-0.000121145	0.000229968	-0.527	0.5984
SDIRSRV	1	-0.000093080	0.000123581	-0.753	0.4514
DENSITY	1	4.45116E-08	1.23173E-08	3.614	0.0003
SDENS	1	-2.27654E-08	7.09638E-09	-3.208	0.0014
STAGG	1	0.01732914	0.001566342	11.063	0.0001
WATER	1	-0.001831963	0.000995074	-1.841	0.0658
SWATER	1	0.000617421	0.000396505	1.557	0.1196
AVPROD	1	0.000487166	0.000019733	24.688	0.0001
SAVPROD	1	-0.000123325	0.000012328	-10.004	0.0001
TIME	1	-0.000031365	0.000049503	-0.634	0.5264

TEST: MLOADS	NUMERATOR:	5.79169	DF:	1	F VALUE:	19.9690
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	4.20114	DF:	1	F VALUE:	14.4850
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	77.8904	DF:	1	F VALUE:	268.5558
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	25.9667	DF:	1	F VALUE:	89.5297
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	0.303456	DF:	1	F VALUE:	1.0463
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.3065
TEST: DENSITY	NUMERATOR:	1.03627	DF:	1	F VALUE:	3.5729
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0589
TEST: WATER	NUMERATOR:	0.611939	DF:	1	F VALUE:	2.1099
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.1465
TEST: AVPROD	NUMERATOR:	96.8122	DF:	1	F VALUE:	333.7960
	DENOMINATOR:	0.290034	DF:	1979	PROB >F :	0.0001

COAL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	2333.59024	129.64390	348.640	0.0001
ERROR	5128	1906.87738	0.37185596		
C TOTAL	5146	4240.46762			

ROOT MSE	0.6097999	R-SQUARE	0.5503
DEP MEAN	0.7156804	ADJ R-SQ	0.5487
C.V.	85.20562		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.05222915	0.01364562	3.828	0.0001
MLOADS	1	-.0000016677	4.93719E-07	-3.378	0.0007
SMLOADS	1	-.0000039853	6.14248E-07	-6.488	0.0001
MNINT	1	0.000907169	0.000217409	4.173	0.0001
SMNINT	1	0.000022844	0.000099271	0.230	0.8180
MMILES	1	-0.000077974	.00000207479	-37.582	0.0001
SMMILES	1	.00000739641	7.40831E-07	9.984	0.0001
MMILES2	1	2.87630E-08	1.19878E-09	23.994	0.0001
SMMILES2	1	-3.42663E-09	3.52242E-10	-9.728	0.0001
DIRSRV	1	0.001834229	0.000228318	8.034	0.0001
SDIRSRV	1	-0.000587687	0.000121399	-4.841	0.0001
DENSITY	1	-5.66940E-08	8.59027E-09	-6.600	0.0001
SDENS	1	4.80866E-09	2.77589E-09	1.732	0.0833
STAGG	1	0.01642555	0.001019804	16.107	0.0001
WATER	1	0.000153658	0.001037152	0.148	0.8822
SWATER	1	-0.000198021	0.000345959	-0.572	0.5671
AVPROD	1	0.000578374	0.000013464	42.957	0.0001
SAVPROD	1	-0.000158803	.00000806072	-19.701	0.0001
TIME	1	-0.000040245	0.000033575	-1.199	0.2307

TEST: MLOADS	NUMERATOR:	24.8596	DF:	1	F VALUE:	66.8527
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	10.1587	DF:	1	F VALUE:	27.3188
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	622.386	DF:	1	F VALUE:	1673.7287
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	248.402	DF:	1	F VALUE:	668.0067
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	13.1776	DF:	1	F VALUE:	35.4375
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	20.5718	DF:	1	F VALUE:	55.3218
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	9.3E-04	DF:	1	F VALUE:	0.0025
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.9602
TEST: AVPROD	NUMERATOR:	371.579	DF:	1	F VALUE:	999.2539
	DENOMINATOR:	0.371856	DF:	5128	PROB >F :	0.0001

NON-METALLIC ORE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	4963.58145	275.75453	803.220	0.0001
ERROR	6906	2370.90904	0.34331147		
C TOTAL	6924	7334.49049			

ROOT MSE	0.5859279	R-SQUARE	0.6767
DEP MEAN	1.10224	ADJ R-SQ	0.6759
C.V.	53.15792		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	-0.02581816	0.01201188	-2.149	0.0316
MLOADS	1	0.0000081436	.00000293103	2.778	0.0055
SMLOADS	1	-.0000067239	.00000157392	-4.272	0.0001
MNINT	1	0.000612108	0.000170663	3.587	0.0003
SMNINT	1	0.000243421	0.000084325	2.887	0.0039
MMILES	1	-0.000034854	9.05244E-07	-38.502	0.0001
SMMILES	1	.00000102308	3.82358E-07	2.676	0.0075
MMILES2	1	7.65288E-09	2.84954E-10	26.857	0.0001
SMMILES2	1	-2.56546E-10	1.20795E-10	-2.124	0.0337
DIRSRV	1	0.000100565	0.000127109	0.791	0.4289
SDIRSRV	1	-0.000301489	0.000062949	-4.789	0.0001
DENSITY	1	3.08928E-08	9.80100E-09	3.152	0.0016
SDENS	1	-3.21840E-09	3.19060E-09	-1.009	0.3131
STAGG	1	0.01690744	0.000898051	18.827	0.0001
WATER	1	-0.002824328	0.000688678	-4.101	0.0001
SWATER	1	-0.000461148	0.000278691	-1.655	0.0980
AVPROD	1	0.000551339	0.000011390	48.405	0.0001
SAVPROD	1	-0.000144906	.00000705495	-20.540	0.0001
TIME	1	-0.000120092	0.000029500	-4.071	0.0001

TEST: MLOADS	NUMERATOR:	0.12373	DF:	1	F VALUE:	0.3604
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.5483
TEST: MNINT	NUMERATOR:	12.585	DF:	1	F VALUE:	36.6577
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	702.176	DF:	1	F VALUE:	2045.3041
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	348.34	DF:	1	F VALUE:	1014.6480
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.15434	DF:	1	F VALUE:	3.3624
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0667
TEST: DENSITY	NUMERATOR:	4.37985	DF:	1	F VALUE:	12.7576
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0004
TEST: WATER	NUMERATOR:	11.2385	DF:	1	F VALUE:	32.7355
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	440.311	DF:	1	F VALUE:	1282.5395
	DENOMINATOR:	0.343311	DF:	6906	PROB >F :	0.0001

FOOD AND KINDRED PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	18434.02663	1024.11259	2266.719	0.0001
ERROR	26992	12195.09058	0.45180389		
C TOTAL	27010	30629.11721			

ROOT MSE	0.6721636	R-SQUARE	0.6018
DEP MEAN	1.297868	ADJ R-SQ	0.6016
C.V.	51.78981		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.04080169	0.007653504	5.331	0.0001
MLOADS	1	0.000029527	.00000445694	6.625	0.0001
SMLOADS	1	-.0000089168	.00000185092	-4.818	0.0001
MNINT	1	-0.000071159	0.000110687	-0.643	0.5203
SMNINT	1	0.000231063	0.000042331	5.458	0.0001
MMILES	1	-0.000034252	6.21434E-07	-55.118	0.0001
SMMILES	1	.00000197364	2.30168E-07	8.575	0.0001
MMILES2	1	6.46088E-09	1.64604E-10	39.251	0.0001
SMMILES2	1	-3.92006E-10	6.10928E-11	-6.417	0.0001
DIRSRV	1	-0.000046327	0.000111137	-0.417	0.6768
SDIRSRV	1	-0.000148507	0.000041649	-3.566	0.0004
DENSITY	1	-1.72370E-08	6.89796E-09	-2.499	0.0125
SDENS	1	2.49498E-09	1.39884E-09	1.784	0.0745
STAGG	1	0.01933563	0.000596869	32.395	0.0001
WATER	1	-0.001532388	0.000401105	-3.820	0.0001
SWATER	1	0.000260985	0.000136322	1.914	0.0556
AVPROD	1	0.000781839	.00000981415	79.664	0.0001
SAVPROD	1	-0.000174573	0.0000043358	-40.263	0.0001
TIME	1	-0.000507270	0.000020404	-24.861	0.0001

TEST						
TEST: MLOADS	NUMERATOR:	15.6638	DF: 1	F VALUE:	34.6696
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	1.36773	DF: 1	F VALUE:	3.0273
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0819
TEST: MMILES	NUMERATOR:	1656.4	DF: 1	F VALUE:	3666.1973
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	841.502	DF: 1	F VALUE:	1862.5379
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.97766	DF: 1	F VALUE:	4.3773
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0364
TEST: DENSITY	NUMERATOR:	2.91106	DF: 1	F VALUE:	6.4432
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0111
TEST: WATER	NUMERATOR:	6.58289	DF: 1	F VALUE:	14.5702
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	1815.19	DF: 1	F VALUE:	4017.6560
	DENOMINATOR:	0.451804	DF:26992	PROB >F :	0.0001

LUMBER AND WOOD PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	8940.18539	496.67697	1308.170	0.0001
ERROR	12695	4819.95101	0.37967318		
C TOTAL	12713	13760.13641			

ROOT MSE	0.6161763	R-SQUARE	0.6497
DEP MEAN	1.195439	ADJ R-SQ	0.6492
C.V.	51.54392		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	-0.01553774	0.01079124	-1.440	0.1499
MLOADS	1	0.000035045	.00000582881	6.012	0.0001
SMLOADS	1	-.0000071281	.00000240533	-2.963	0.0030
MNINT	1	-0.000046997	0.000096571	-0.487	0.6265
SMNINT	1	0.000143731	0.000045318	3.172	0.0015
MMILES	1	-0.000015389	6.28723E-07	-24.477	0.0001
SMMILES	1	-1.10265E-09	2.75750E-07	-0.004	0.9968
MMILES2	1	1.74037E-09	1.31510E-10	13.234	0.0001
SMMILES2	1	1.02097E-10	6.28872E-11	1.623	0.1045
DIRSRV	1	0.000357368	0.000173529	2.059	0.0395
SDIRSRV	1	-0.000123809	0.000070178	-1.764	0.0777
DENSITY	1	1.93960E-08	1.25923E-08	1.540	0.1235
SDENS	1	-4.05721E-09	3.91089E-09	-1.037	0.2996
STAGG	1	0.02141745	0.000750081	28.553	0.0001
WATER	1	-0.003476791	0.000800716	-4.342	0.0001
SWATER	1	0.000265456	0.000295871	0.897	0.3696
AVPROD	1	0.000612965	0.000012844	47.724	0.0001
SAVPROD	1	-0.000186474	.00000566894	-32.894	0.0001
TIME	1	-0.000360914	0.000023477	-15.373	0.0001

TEST: MLOADS	NUMERATOR:	15.177	DF: 1	F VALUE:	39.9740
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	0.578944	DF: 1	F VALUE:	1.5248
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.2169
TEST: MMILES	NUMERATOR:	302.415	DF: 1	F VALUE:	796.5136
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	102.467	DF: 1	F VALUE:	269.8819
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.06025	DF: 1	F VALUE:	2.7925
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0947
TEST: DENSITY	NUMERATOR:	0.933895	DF: 1	F VALUE:	2.4597
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.1168
TEST: WATER	NUMERATOR:	8.88381	DF: 1	F VALUE:	23.3986
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	481.503	DF: 1	F VALUE:	1268.2037
	DENOMINATOR:	0.379673	DF:12695	PROB >F :	0.0001

FURNITURE AND FIXTURES

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	1296.55026	72.03057009	240.476	0.0001
ERROR	2445	732.35910	0.29953338		
C TOTAL	2463	2028.90936			

ROOT MSE	0.5472964	R-SQUARE	0.6390
DEP MEAN	1.281954	ADJ R-SQ	0.6364
C.V.	42.69237		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.02048023	0.02324078	0.881	0.3783
MLOADS	1	0.000225924	0.000065313	3.459	0.0006
SMLOADS	1	-0.000104221	0.000026604	-3.918	0.0001
MNINT	1	-0.002576292	0.001371274	-1.879	0.0604
SMNINT	1	0.002283261	0.000620371	3.680	0.0002
MMILES	1	-0.000058482	.00000709368	-8.244	0.0001
SMMILES	1	-.0000045915	.00000301486	-1.523	0.1279
MMILES2	1	8.78553E-09	1.60928E-09	5.459	0.0001
SMMILES2	1	8.24450E-10	7.08733E-10	1.163	0.2448
DIRSRV	1	0.006098659	0.001695985	3.596	0.0003
SDIRSRV	1	.00000853481	0.000634109	0.013	0.9893
DENSITY	1	-3.98134E-07	1.01691E-07	-3.915	0.0001
SDENS	1	-5.90341E-09	2.61357E-08	-0.226	0.8213
STAGG	1	0.06563651	0.006846950	9.586	0.0001
WATER	1	0.01408010	0.004845808	2.906	0.0037
SWATER	1	-0.001406269	0.002435775	-0.577	0.5638
AVPROD	1	0.001810893	0.000118759	15.249	0.0001
SAVPROD	1	-0.000492438	0.000048707	-10.110	0.0001
TIME	1	-0.000523365	0.000221482	-2.363	0.0182

TEST						
TEST: MLOADS	NUMERATOR:	1.80148	DF: 1	F VALUE:	6.0143
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0143
TEST: MNINT	NUMERATOR:	.0193161	DF: 1	F VALUE:	0.0645
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.7996
TEST: MMILES	NUMERATOR:	31.4321	DF: 1	F VALUE:	104.9367
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	14.0245	DF: 1	F VALUE:	46.8210
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	6.04887	DF: 1	F VALUE:	20.1943
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	6.89357	DF: 1	F VALUE:	23.0144
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	2.87721	DF: 1	F VALUE:	9.6056
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0020
TEST: AVPROD	NUMERATOR:	38.0364	DF: 1	F VALUE:	126.9856
	DENOMINATOR:	0.299533	DF: 2445	PROB >F :	0.0001

PULP, PAPER AND PAPER PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	17069.63088	948.31283	2206.247	0.0001
ERROR	24335	10459.93326	0.42983083		
C TOTAL	24353	27529.56415			

ROOT MSE	0.6556148	R-SQUARE	0.6200
DEP MEAN	1.14698	ADJ R-SQ	0.6198
C.V.	57.16009		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.02728633	0.007533171	3.622	0.0003
MLOADS	1	0.000154943	.00000587899	26.355	0.0001
SMLOADS	1	-0.000037054	.00000189608	-19.543	0.0001
MNINT	1	-0.000613675	0.000090959	-6.747	0.0001
SMNINT	1	0.000147634	0.000033853	4.361	0.0001
MMILES	1	-0.000049912	7.42382E-07	-67.233	0.0001
SMMILES	1	.00000416371	2.10999E-07	19.733	0.0001
MMILES2	1	1.09319E-08	2.26183E-10	48.332	0.0001
SMMILES2	1	-1.22662E-09	5.89517E-11	-20.807	0.0001
DIRSRV	1	0.002194680	0.000152790	14.364	0.0001
SDIRSRV	1	-0.000473447	0.000051972	-9.110	0.0001
DENSITY	1	3.68299E-08	1.13414E-08	3.247	0.0012
SDENS	1	-1.78344E-09	2.44923E-09	-0.728	0.4665
STAGG	1	0.02200955	0.000607663	36.220	0.0001
WATER	1	-0.003685998	0.000369908	-9.965	0.0001
SWATER	1	0.000133207	0.000117807	1.131	0.2582
AVPROD	1	0.000731257	0.000010509	69.585	0.0001
SAVPROD	1	-0.000178980	.00000442906	-40.410	0.0001
TIME	1	-0.000385457	0.000021535	-17.899	0.0001

TEST: MLOADS	NUMERATOR:	280.397	DF: 1	F VALUE:	652.3422
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	16.3124	DF: 1	F VALUE:	37.9508
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	2279.4	DF: 1	F VALUE:	5303.0209
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	1119.48	DF: 1	F VALUE:	2604.4637
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	75.4084	DF: 1	F VALUE:	175.4374
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	5.80633	DF: 1	F VALUE:	13.5084
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0002
TEST: WATER	NUMERATOR:	55.7187	DF: 1	F VALUE:	129.6293
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	1190.01	DF: 1	F VALUE:	2768.5657
	DENOMINATOR:	0.429831	DF:24335	PROB >F :	0.0001

CHEMICALS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	15343.72596	852.42922	2072.628	0.0001
ERROR	21246	8738.04191	0.41127939		
C TOTAL	21264	24081.76786			

ROOT MSE	0.6413107	R-SQUARE	0.6372
DEP MEAN	1.322174	ADJ R-SQ	0.6368
C.V.	48.50427		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > ¦T¦
INTERCEP	1	0.04766801	0.008124040	5.868	0.0001
MLOADS	1	0.000017962	.00000401965	4.469	0.0001
SMLOADS	1	-0.000011743	.00000152287	-7.711	0.0001
MNINT	1	0.000283283	0.000134146	2.112	0.0347
SMNINT	1	0.000061103	0.000064445	0.948	0.3431
MMILES	1	-0.000043578	7.67150E-07	-56.805	0.0001
SMMILES	1	.00000140292	3.47257E-07	4.040	0.0001
MMILES2	1	9.37787E-09	2.31389E-10	40.529	0.0001
SMMILES2	1	-2.97898E-10	1.07934E-10	-2.760	0.0058
DIRSRV	1	-0.001241855	0.000110126	-11.277	0.0001
SDIRSRV	1	-0.000144632	0.000052746	-2.742	0.0061
DENSITY	1	5.85567E-08	8.04187E-09	7.281	0.0001
SDENS	1	-1.64349E-08	2.50684E-09	-6.556	0.0001
STAGG	1	0.02423235	0.000689134	35.163	0.0001
WATER	1	-0.000814811	0.000408031	-1.997	0.0458
SWATER	1	0.000221163	0.000170071	1.300	0.1935
AVPROD	1	0.000855976	0.000010524	81.339	0.0001
SAVPROD	1	-0.000199520	.00000523639	-38.103	0.0001
TIME	1	-0.000597271	0.000021231	-28.132	0.0001

TEST: MLOADS	NUMERATOR:	1.73115	DF: 1	F VALUE:	4.2092
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0402
TEST: MNINT	NUMERATOR:	4.16905	DF: 1	F VALUE:	10.1368
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0015
TEST: MMILES	NUMERATOR:	1710.35	DF: 1	F VALUE:	4158.6187
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	887.612	DF: 1	F VALUE:	2158.1719
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	95.194	DF: 1	F VALUE:	231.4583
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	17.5782	DF: 1	F VALUE:	42.7404
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	1.33456	DF: 1	F VALUE:	3.2449
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0717
TEST: AVPROD	NUMERATOR:	1804.65	DF: 1	F VALUE:	4387.8973
	DENOMINATOR:	0.411279	DF:21246	PROB >F :	0.0001

PETROLEUM AND COAL PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	7451.50024	413.97224	1207.307	0.0001
ERROR	7861	2695.44996	0.34288894		
C TOTAL	7879	10146.95020			

ROOT MSE	0.5855672	R-SQUARE	0.7344
DEP MEAN	1.168167	ADJ R-SQ	0.7338
C.V.	50.12701		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.01177168	0.01149251	1.024	0.3057
MLOADS	1	0.000024066	.00000436468	5.514	0.0001
SMLOADS	1	-0.000014645	.00000267178	-5.481	0.0001
MNINT	1	-0.000343465	0.000250660	-1.370	0.1706
SMNINT	1	0.000135839	0.000115712	1.174	0.2405
MMILES	1	-0.000061164	.00000125758	-48.636	0.0001
SMMILES	1	.00000113776	5.60383E-07	2.030	0.0424
MMILES2	1	1.56127E-08	4.85942E-10	32.129	0.0001
SMMILES2	1	-5.12042E-10	2.08600E-10	-2.455	0.0141
DIRSRV	1	-0.000173305	0.000171838	-1.009	0.3132
SDIRSRV	1	-0.000448831	0.000092124	-4.872	0.0001
DENSITY	1	3.50917E-08	1.37827E-08	2.546	0.0109
SDENS	1	-9.53435E-09	4.95311E-09	-1.925	0.0543
STAGG	1	0.02801738	0.001230510	22.769	0.0001
WATER	1	-0.003287302	0.000685324	-4.797	0.0001
SWATER	1	-0.000250302	0.000271740	-0.921	0.3570
AVPROD	1	0.000850110	0.000014008	60.687	0.0001
SAVPROD	1	-0.000224472	.00000939812	-23.885	0.0001
TIME	1	-0.000330176	0.000038216	-8.640	0.0001

TEST: MLOADS	NUMERATOR:	2.15664	DF: 1	F VALUE:	6.2896
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0122
TEST: MNINT	NUMERATOR:	0.36275	DF: 1	F VALUE:	1.0579
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.3037
TEST: MMILES	NUMERATOR:	1199.09	DF: 1	F VALUE:	3497.0345
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	514.989	DF: 1	F VALUE:	1501.9124
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	6.16306	DF: 1	F VALUE:	17.9739
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	1.79246	DF: 1	F VALUE:	5.2275
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0223
TEST: WATER	NUMERATOR:	13.9362	DF: 1	F VALUE:	40.6435
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	647.417	OF: 1	F VALUE:	1888.1246
	DENOMINATOR:	0.342889	DF: 7861	PROB >F :	0.0001

RUBBER AND PLASTIC PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	1133.54035	62.97446370	225.490	0.0001
ERROR	3353	936.42024	0.27927833		
C TOTAL	3371	2069.96058			

ROOT MSE	0.5284679	R-SQUARE	0.5476
DEP MEAN	0.65615	ADJ R-SQ	0.5452
C.V.	80.54072		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.000065401	0.01482751	0.004	0.9965
MLOADS	1	0.000036441	0.000020635	1.766	0.0775
SMLOADS	1	-0.000005473	0.000010388	-0.527	0.5983
MNINT	1	0.001806097	0.000719216	2.511	0.0121
SMNINT	1	0.000523081	0.000409157	1.278	0.2012
MMILES	1	-0.000077752	.00000430422	-18.064	0.0001
SMMILES	1	.00000111187	0.000001996	0.557	0.5775
MMILES2	1	1.57706E-08	1.24603E-09	12.657	0.0001
SMMILES2	1	-4.78431E-10	5.61368E-10	-0.852	0.3941
DIRSRV	1	0.002743614	0.000972712	2.821	0.0048
SDIRSRV	1	-0.000998172	0.000399165	-2.501	0.0124
DENSITY	1	1.07719E-07	5.13981E-08	2.096	0.0362
SDENS	1	-1.34019E-08	1.68527E-08	-0.795	0.4265
STAGG	1	0.04520309	0.004101845	11.020	0.0001
WATER	1	0.009622153	0.004330148	2.222	0.0263
SWATER	1	-0.001776035	0.001472220	-1.206	0.2278
AVPROD	1	0.001514713	0.000055136	27.472	0.0001
SAVPROD	1	-0.000383759	0.000030966	-12.393	0.0001
TIME	1	-0.000831135	0.000118680	-7.003	0.0001

TEST: MLOADS	NUMERATOR:	1.02527	DF:	1	F VALUE:	3.6712
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0554
TEST: MNINT	NUMERATOR:	4.21842	DF:	1	F VALUE:	15.1047
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	129.873	DF:	1	F VALUE:	465.0307
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	64.5082	DF:	1	F VALUE:	230.9817
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.30126	DF:	1	F VALUE:	4.6594
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0310
TEST: DENSITY	NUMERATOR:	1.50974	DF:	1	F VALUE:	5.4059
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0201
TEST: WATER	NUMERATOR:	1.24716	DF:	1	F VALUE:	4.4656
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0347
TEST: AVPROD	NUMERATOR:	118.671	DF:	1	F VALUE:	424.9195
	DENOMINATOR:	0.279278	DF:	3353	PROB >F :	0.0001

CONCRETE, CLAY, GLASS, AND CEMENT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	4447.78231	247.09902	703.267	0.0001
ERROR	12891	4529.36536	0.35135873		
C TOTAL	12909	8977.14767			

ROOT MSE	0.5927552	R-SQUARE	0.4955
DEP MEAN	0.7558266	ADJ R-SQ	0.4948
C.V.	78.42476		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > |T|
INTERCEP	1	-0.01466527	0.008887353	-1.650	0.0989
MLOADS	1	-0.000014251	.00000455199	-3.131	0.0017
SMLOADS	1	3.00078E-07	.00000264884	0.113	0.9098
MNINT	1	-0.000096359	0.000176028	-0.547	0.5841
SMNINT	1	-0.000106919	0.000082507	-1.296	0.1950
MMILES	1	-0.000034904	.00000102823	-33.946	0.0001
SMMILES	1	.00000248764	4.83051E-07	5.150	0.0001
MMILES2	1	7.08498E-09	3.10456E-10	22.821	0.0001
SMMILES2	1	-4.29458E-10	1.48899E-10	-2.884	0.0039
DIRSRV	1	-0.000498739	0.000171330	-2.911	0.0036
SDIRSRV	1	-0.000118779	0.000084891	-1.399	0.1618
DENSITY	1	4.08697E-08	9.59290E-09	4.260	0.0001
SDENS	1	-9.92931E-09	3.10402E-09	-3.199	0.0014
STAGG	1	0.02190142	0.001186235	18.463	0.0001
WATER	1	0.000982920	0.000842284	1.167	0.2432
SWATER	1	0.000315726	0.000329836	0.957	0.3385
AVPROD	1	0.000790956	0.000014956	52.886	0.0001
SAVPROD	1	-0.000200394	0.0000091417	-21.921	0.0001
TIME	1	-0.000445947	0.000038042	-11.722	0.0001

TEST						
TEST: MLOADS	NUMERATOR:	4.47153	DF: 1	F VALUE:	12.7264
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0004
TEST: MNINT	NUMERATOR:	0.690014	DF: 1	F VALUE:	1.9638
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.1611
TEST: MMILES	NUMERATOR:	478.462	DF: 1	F VALUE:	1361.7470
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	216.36	DF: 1	F VALUE:	615.7808
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	6.26279	DF: 1	F VALUE:	17.8245
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	5.54252	DF: 1	F VALUE:	15.7745
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	1.20486	DF: 1	F VALUE:	3.4291
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0641
TEST: AVPROD	NUMERATOR:	529.741	DF: 1	F VALUE:	1507.6924
	DENOMINATOR:	0.351359	DF:12891	PROB >F :	0.0001

PRIMARY METAL PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	8688.97204	482.72067	1212.472	0.0001
ERROR	11076	4409.68001	0.39812929		
C TOTAL	11094	13098.65204			

ROOT MSE	0.6309749	R-SQUARE	0.6633
DEP MEAN	1.271859	ADJ R-SQ	0.6628
C.V.	49.61043		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.02320171	0.01102500	2.104	0.0354
MLOADS	1	0.000011932	.00000385347	3.097	0.0020
SMLOADS	1	-.0000059236	.00000236661	-2.503	0.0123
MNINT	1	0.000076513	0.000172042	0.445	0.6565
SMNINT	1	0.000062645	0.000081922	0.765	0.4445
MMILES	1	-0.000045817	9.63221E-07	-47.567	0.0001
SMMILES	1	.00000186335	4.42747E-07	4.209	0.0001
MMILES2	1	9.76228E-09	2.91977E-10	33.435	0.0001
SMMILES2	1	-2.66164E-10	1.39064E-10	-1.914	0.0556
DIRSRV	1	-0.000151063	0.000140894	-1.072	0.2837
SDIRSRV	1	-0.000411998	0.000064772	-6.361	0.0001
DENSITY	1	4.88012E-08	1.11229E-08	4.387	0.0001
SDENS	1	-1.51388E-08	4.13232E-09	-3.663	0.0002
STAGG	1	0.02625204	0.000984784	26.658	0.0001
WATER	1	-0.002281563	0.000473459	-4.819	0.0001
SWATER	1	0.000432387	0.000193812	2.231	0.0257
AVPROD	1	0.000925471	0.000013437	68.873	0.0001
SAVPROD	1	-0.000219667	.00000755074	-29.092	0.0001
TIME	1	-0.000796990	0.000031128	-25.604	0.0001

TEST: MLOADS	NUMERATOR:	1.3059	DF: 1	F VALUE:	3.2801
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0702
TEST: MNINT	NUMERATOR:	0.383635	DF: 1	F VALUE:	0.9636
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.3263
TEST: MMILES	NUMERATOR:	1157.16	DF: 1	F VALUE:	2906.4834
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	588.3	DF: 1	F VALUE:	1477.6617
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	9.40511	DF: 1	F VALUE:	23.6232
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	5.57096	DF: 1	F VALUE:	13.9928
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0002
TEST: WATER	NUMERATOR:	9.0735	DF: 1	F VALUE:	22.7903
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0001
TEST: AVPROD	NUMERATOR:	1195.71	DF: 1	F VALUE:	3003.3308
	DENOMINATOR:	0.398129	DF:11076	PROB >F :	0.0001

FABRICATED METAL PRODUCTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	63.53821102	3.52990061	13.646	0.0001
ERROR	1004	259.71736	0.25868263		
C TOTAL	1022	323.25557			

ROOT MSE	0.5086085	R-SQUARE	0.1966
DEP MEAN	0.5252507	ADJ R-SQ	0.1822
C.V.	96.83158		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.13311624	0.03502076	3.801	0.0002
MLOADS	1	0.000128351	0.000079632	1.612	0.1073
SMLOADS	1	-0.000022959	0.000035394	-0.649	0.5167
MNINT	1	-0.003091922	0.002119124	-1.459	0.1449
SMNINT	1	0.002658519	0.001361092	1.953	0.0511
MMILES	1	-0.000110126	0.000014305	-7.698	0.0001
SMMILES	1	0.000017728	0.0000084898	2.088	0.0370
MMILES2	1	2.23543E-08	3.70594E-09	6.032	0.0001
SMMILES2	1	-4.23084E-09	2.19237E-09	-1.930	0.0539
DIRSRV	1	-0.003879347	0.001643361	-2.361	0.0184
SDIRSRV	1	0.001334132	0.000982472	1.358	0.1748
DENSITY	1	-2.61265E-08	8.19585E-08	-0.319	0.7500
SDENS	1	-1.93767E-08	2.69406E-08	-0.719	0.4722
STAGG	1	0.02919379	0.01442906	2.023	0.0433
WATER	1	-0.09381917	0.03367573	-2.786	0.0054
SWATER	1	0.01449884	0.01210899	1.197	0.2314
AVPROD	1	0.001583022	0.000216660	7.306	0.0001
SAVPROD	1	-0.000448835	0.000110164	-4.074	0.0001
TIME	1	0.000019640	0.000469274	0.042	0.9666

TEST: MLOADS	NUMERATOR:	0.848979	DF:	1	F VALUE:	3.2819
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0703
TEST: MNINT	NUMERATOR:	0.012483	DF:	1	F VALUE:	0.0483
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.8262
TEST: MMILES	NUMERATOR:	12.5227	DF:	1	F VALUE:	48.4096
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	7.50214	DF:	1	F VALUE:	29.0013
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	0.755488	DF:	1	F VALUE:	2.9205
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0878
TEST: DENSITY	NUMERATOR:	0.12021	DF:	1	F VALUE:	0.4647
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.4956
TEST: WATER	NUMERATOR:	1.9815	DF:	1	F VALUE:	7.6600
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0057
TEST: AVPROD	NUMERATOR:	7.85452	DF:	1	F VALUE:	30.3636
	DENOMINATOR:	0.258683	DF:	1004	PROB >F :	0.0001

MACHINERY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	476.15567	26.45309264	95.364	0.0001
ERROR	1111	308.18050	0.27739019		
C TOTAL	1129	784.33617			

ROOT MSE	0.5266784	R-SQUARE	0.6071
DEP MEAN	0.8644214	ADJ R-SQ	0.6007
C.V.	60.92844		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	-0.07499597	0.03085247	-2.431	0.0152
MLOADS	1	0.000015912	0.000031176	0.510	0.6099
SMLOADS	1	-.0000077807	0.000020052	-0.388	0.6981
MNINT	1	0.002709573	0.001317517	2.057	0.0400
SMNINT	1	0.000807304	0.000638002	1.265	0.2060
MMILES	1	-0.000097391	0.000010379	-9.383	0.0001
SMMILES	1	0.000011674	.00000502056	2.325	0.0202
MMILES2	1	2.05793E-08	3.26771E-09	6.298	0.0001
SMMILES2	1	-3.55194E-09	1.55004E-09	-2.292	0.0221
DIRSRV	1	0.003006133	0.001230218	2.444	0.0147
SDIRSRV	1	-0.000855807	0.000665066	-1.287	0.1984
DENSITY	1	-1.95058E-07	3.07264E-08	-6.348	0.0001
SDENS	1	3.22770E-08	9.51368E-09	3.393	0.0007
STAGG	1	0.05801082	0.007935414	7.310	0.0001
WATER	1	0.01628423	0.01857472	0.877	0.3808
SWATER	1	-0.01053247	0.007715460	-1.365	0.1725
AVPROD	1	0.001948882	0.000121633	16.023	0.0001
SAVPROD	1	-0.000571963	0.000058604	-9.760	0.0001
TIME	1	-0.000990415	0.000233378	-4.244	0.0001

TEST: MLOADS	NUMERATOR:	.0256709	DF:	1	F VALUE:	0.0925
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.7610
TEST: MNINT	NUMERATOR:	2.88375	DF:	1	F VALUE:	10.3960
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0013
TEST: MMILES	NUMERATOR:	28.0983	DF:	1	F VALUE:	101.2951
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	11.3696	DF:	1	F VALUE:	40.9876
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.07971	DF:	1	F VALUE:	3.8924
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0488
TEST: DENSITY	NUMERATOR:	12.3605	DF:	1	F VALUE:	44.5601
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	.0392693	DF:	1	F VALUE:	0.1416
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.7068
TEST: AVPROD	NUMERATOR:	41.8254	DF:	1	F VALUE:	150.7817
	DENOMINATOR:	0.27739	DF:	1111	PROB >F :	0.0001

ELECTRICAL EQUIPMENT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	933.04446	51.83580306	181.169	0.0001
ERROR	2605	745.33785	0.28611818		
C TOTAL	2623	1678.38230			

ROOT MSE	0.5349002	R-SQUARE	0.5559
DEP MEAN	0.9318294	ADJ R-SQ	0.5529
C.V.	57.40323		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.08023637	0.01996037	4.020	0.0001
MLOADS	1	0.000014200	0.000026352	0.539	0.5900
SMLOADS	1	-0.000017439	0.000015221	-1.146	0.2520
MNINT	1	0.006624035	0.001093838	6.056	0.0001
SMNINT	1	0.000166350	0.000550601	0.302	0.7626
MMILES	1	-0.000094060	.00000744783	-12.629	0.0001
SMMILES	1	.00000423964	.00000360638	1.176	0.2399
MMILES2	1	1.93454E-08	2.14484E-09	9.020	0.0001
SMMILES2	1	-1.20644E-09	1.08733E-09	-1.110	0.2673
DIRSRV	1	0.002889945	0.000986160	2.931	0.0034
SDIRSRV	1	-0.000850120	0.000433873	-1.959	0.0502
DENSITY	1	-1.53666E-07	4.22268E-08	-3.639	0.0003
SDENS	1	9.80359E-09	1.03168E-08	0.950	0.3421
STAGG	1	0.04424329	0.006044035	7.320	0.0001
WATER	1	0.007595082	0.004259455	1.783	0.0747
SWATER	1	-0.002317329	0.001760007	-1.317	0.1881
AVPROD	1	0.001998169	0.000084645	23.606	0.0001
SAVPROD	1	-0.000384607	0.000042448	-9.061	0.0001
TIME	1	-0.001455123	0.000186652	-7.796	0.0001

TEST: MLOADS	NUMERATOR:	.0059871	DF: 1	F VALUE:	0.0209
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.8850
TEST: MNINT	NUMERATOR:	15.2124	DF: 1	F VALUE:	53.1683
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	55.8546	DF: 1	F VALUE:	195.2151
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	27.1278	DF: 1	F VALUE:	94.8132
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	1.73477	DF: 1	F VALUE:	6.0631
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0139
TEST: DENSITY	NUMERATOR:	4.83081	DF: 1	F VALUE:	16.8840
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	0.635327	DF: 1	F VALUE:	2.2205
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.1363
TEST: AVPROD	NUMERATOR:	114.396	DF: 1	F VALUE:	399.8201
	DENOMINATOR:	0.286118	DF: 2605	PROB >F :	0.0001

TRANSPORTATION EQUIPMENT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	18124.46521	1006.91473	2202.104	0.0001
ERROR	15576	7122.14605	0.45725129		
C TOTAL	15594	25246.61126			

ROOT MSE	0.6762036	R-SQUARE	0.7179
DEP MEAN	1.533469	ADJ R-SQ	0.7176
C.V.	44.09633		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.05899046	0.009279862	6.357	0.0001
MLOADS	1	0.000117745	0.000015321	7.685	0.0001
SMLOADS	1	-0.000050099	.00000569826	-8.792	0.0001
MNINT	1	-0.002467788	0.000412005	-5.990	0.0001
SMNINT	1	0.000373698	0.000154082	2.425	0.0153
MMILES	1	-0.000046610	0.0000022795	-20.448	0.0001
SMMILES	1	-0.000004783	8.92575E-07	-5.359	0.0001
MMILES2	1	1.06667E-08	6.61570E-10	16.123	0.0001
SMMILES2	1	1.46174E-09	2.65040E-10	5.515	0.0001
DIRSRV	1	0.000492168	0.000267695	1.839	0.0660
SDIRSRV	1	-0.000819563	0.000102848	-7.969	0.0001
DENSITY	1	-3.62348E-08	1.67800E-08	-2.159	0.0308
SDENS	1	4.13411E-09	3.58352E-09	1.154	0.2487
STAGG	1	0.04084479	0.001794577	22.760	0.0001
WATER	1	-0.001365834	0.001030273	-1.326	0.1850
SWATER	1	0.000788113	0.000365636	2.155	0.0311
AVPROD	1	0.001340106	0.000029077	46.088	0.0001
SAVPROD	1	-0.000269722	0.000012824	-21.032	0.0001
TIME	1	-0.000560098	0.000057920	-9.670	0.0001

TEST						
TEST: MLOADS	NUMERATOR:	14.9382	DF: 1	F VALUE:	32.6695
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	16.9945	DF: 1	F VALUE:	37.1666
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0001
TEST: MMILES	NUMERATOR:	327.756	DF: 1	F VALUE:	716.7969
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	216.793	DF: 1	F VALUE:	474.1223
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	0.998576	DF: 1	F VALUE:	2.1839
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.1395
TEST: DENSITY	NUMERATOR:	2.39522	DF: 1	F VALUE:	5.2383
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0221
TEST: WATER	NUMERATOR:	0.209943	DF: 1	F VALUE:	0.4591
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.4980
TEST: AVPROD	NUMERATOR:	640.809	DF: 1	F VALUE:	1401.4371
	DENOMINATOR:	0.457251	DF:15576	PROB >F :	0.0001

SCRAP MATERIALS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	18	4999.91920	277.77329	700.894	0.0001
ERROR	10568	4188.23501	0.39631293		
C TOTAL	10586	9188.15421			

ROOT MSE	0.6295339	R-SQUARE	0.5442
DEP MEAN	1.15897	ADJ R-SQ	0.5434
C.V.	54.31841		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.04354584	0.01201893	3.623	0.0003
MLOADS	1	0.000077312	.00000889374	8.693	0.0001
SMLOADS	1	-0.000020790	.00000353018	-5.889	0.0001
MNINT	1	-0.000409380	0.000283578	-1.444	0.1489
SMNINT	1	0.000353444	0.000099675	3.546	0.0004
MMILES	1	-0.000057203	.00000143746	-39.794	0.0001
SMMILES	1	3.66496E-07	4.87379E-07	0.752	0.4521
MMILES2	1	1.52129E-08	5.31667E-10	28.614	0.0001
SMMILES2	1	-1.12518E-10	1.78657E-10	-0.630	0.5288
DIRSRV	1	-0.000333292	0.000148892	-2.238	0.0252
SDIRSRV	1	-0.000186448	0.000060228	-3.096	0.0020
DENSITY	1	5.49320E-08	1.08225E-08	5.076	0.0001
SDENS	1	-8.54584E-09	2.20678E-09	-3.873	0.0001
STAGG	1	0.02029422	0.001209562	16.778	0.0001
WATER	1	-0.000047721	0.000707735	-0.067	0.9462
SWATER	1	-0.000332676	0.000229290	-1.451	0.1468
AVPROD	1	0.000758043	0.000017363	43.660	0.0001
SAVPROD	1	-0.000156307	.00000852514	-18.335	0.0001
TIME	1	-0.000405966	0.000041118	-9.873	0.0001

TEST: MLOADS	NUMERATOR:	24.5585	DF:	1	F VALUE:	61.9675
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001
TEST: MNINT	NUMERATOR:	.0225101	DF:	1	F VALUE:	0.0568
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.8116
TEST: MMILES	NUMERATOR:	896.549	DF:	1	F VALUE:	2262.2256
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001
TEST: MMILES2	NUMERATOR:	472.133	DF:	1	F VALUE:	1191.3142
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001
TEST: DIRSRV	NUMERATOR:	6.65605	DF:	1	F VALUE:	16.7949
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001
TEST: DENSITY	NUMERATOR:	10.3286	DF:	1	F VALUE:	26.0616
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001
TEST: WATER	NUMERATOR:	0.165807	DF:	1	F VALUE:	0.4184
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.5178
TEST: AVPROD	NUMERATOR:	460.995	DF:	1	F VALUE:	1163.2096
	DENOMINATOR:	0.396313	DF:	10568	PROB >F :	0.0001

VITA

Mark Burton was born in Tulsa, Oklahoma in 1959, but moved to Springfield, Missouri in that same year. He was graduated from Springfield's Kickapoo High School in 1977. The following fall he entered the University of Missouri at Columbia, earning the Bachelor of Arts degree in Economics in 1981.

After his undergraduate work, Mark accepted employment in the Law Department of the Burlington Northern Railroad. where he worked for three years.

In 1985, he returned to Columbia, Missouri to begin graduate study. Two years later he transferred his work to the University of Tennessee at Knoxville where he earned the degree of Doctor of Philosophy in Economics in 1990. Upon completing his degree, Mark accepted the position of Assistant Professor of Economics at Lafayette College in Easton, Pennsylvania.