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Contents

Foreword

Hederman's paper deals with the Federal Energy Regulatory Commission (FERC) Order 436 (October 1985) that was intended to create a new natural gas marketplace based on open-access nondiscriminatory transportation, as well as with the issues that emerged as the order was implemented.

Black developed a procedure for sampling county land records to determine the nature of railroad ownership of rights-of-way, both through easement and and fee simple title. Issues of property ownership frequently arise when rail lines are abandoned.

Lane looks at the remarkable efficiency gains and traffic growth of the Advanced Truckload Firms (ATLFs) that have resulted from carefully selecting markets and tailoring services to meet the transportation needs of those markets.

In their report on a disaggregate model of freight transport demand in South Africa, Prins and Schultheis emphasize the compilation and tabulation of a disaggregate data base as well as the predicted impacts of the public policy changes that were demonstrated through application of the model.

Implications of Open Access for Natural Gas Markets

WILLIAM F. HEDERMAN, JR.

In October 1985, the Federal Energy Regulatory Commission issued a new rule that was intended to create a new natural gas marketplace based on open-access nondiscriminatory natural gas transportation. However, that rule, Order 436, failed to resolve all the issues adequately. Because of these unresolved issues, change has been troublesome and the transition to open-access transportation has not been completed. Described in this paper are the changes that have taken place, the key issues that remain unresolved, and the important new issues emerging as Order 436 is implemented.

The following paragraphs provide some background for those not familiar with the natural gas aspect of the energy business. The natural gas industry has been buffeted by federal regulation for decades. Wellhead price controls created the supply shortages of the mid-1970s and Congress responded with the Natural Gas Policy Act of 1978 (NGPA).

The NGPA improved the supply situation but also generated forces unanticipated at its time of passage. These forces put gas suppliers in competition with suppliers of other fuels and then in competition among themselves. When combined with factors such as soft petroleum prices, a serious surplus of deliverability for the interstate natural gas market resulted. This competition has yielded some important benefits to gas users in terms of lower gas prices. Industrial consumers, however, have voiced loud objections because they are dissatisfied with the pace of price decreases.

Pipeline companies traditionally operated as wholesale merchants of gas operating under regulations that set their rates and established service obligations to their sales customers. To meet their service obligations, they signed long-term contracts with their suppliers. Not surprisingly, during severe supply shortages when some pipelines were being sued by customers for failure to meet service obligations, there was great pressure to bid on whatever supplies were available. Federal regulated prices—intended to be ceilings—served as the floor prices producers would accept, and bidding took place through nonprice terms of the contracts. These nonmarket responsive contracts have seriously hindered pipelines in adjusting to the radically new gas marketplace.

Congress, concerned about the market disorders still troubling natural gas markets, has attempted, unsuccessfully, to pass new, comprehensive natural gas legislation. Federal gas regulators at the Federal Energy Regulatory Commission (FERC) have imposed several important new rules that are intended to address these same market distortions. These rules have released pipeline customers from their contractual obligations and have released pipeline suppliers of low-cost gas from their low, regulated prices. The FERC has also attempted to coerce pipelines to open access to their systems. Implementation of open access has proved difficult. The key to unlocking the interstate natural gas transportation system is the establishment of a policy framework that fairly shares the costs and rewards of shifting from a closed to an open-access system; from a sale-for-resale system burdened with long-term contract problems to a transportation system.

Interstate Natural Gas Association of America, 1660 L St., N.W., Washington, D.C. 20036. Current affiliation: ICF, Inc., 9300 Lee Highway, Fairfax, Va. 22031.

ALTERNATIVES FOR PIPELINES

Policymakers concluded that opening pipelines to transport gas owned by parties other than pipelines would help solve the problem of getting market signals from the burner tip to the wellhead. An overview of the various options that have been explored as ways for interstate pipelines to respond to current market conditions is shown in Figure 1. Traditional, full merchant service is indicated in the lower right-hand corner of this matrix; heavy regulation with all services (gas purchase, brokering, transporting, storing, load balancing, etc.) are shown bundled together. In the upper left-hand corner voluntary carriage as an example of a less-regulated, unbundled, one-service option is shown. In between are many alternatives that could vary with the extent of regulation or the extent of services that are bundled together.

Through Order 436, however, the FERC has locked the pipeline into the heavily regulated band of this matrix. As indicated in the figure, unbundling subject to heavy regulation is largely unexplored terrain. Regulated unbundled services, therefore, are a new development. This change could mean new opportunities—and new risks—for pipeline customers, pipeline suppliers, and of course, for pipelines themselves.

KEY ISSUES

As already mentioned, the road to open-access transportation has been a rocky one. Much of this difficulty may be attributed to the failure of federal policymakers to address two crucial issues: *(a)* the contracts problem, and *(b)* gas supply planning. This failure by FERC is creating a leadership void in the natural gas industry, especially in gas supply planning.

Contracts Problems and Transportation

The supply contracts problems that pipelines have with their natural gas suppliers remain the key hindrance to more open-

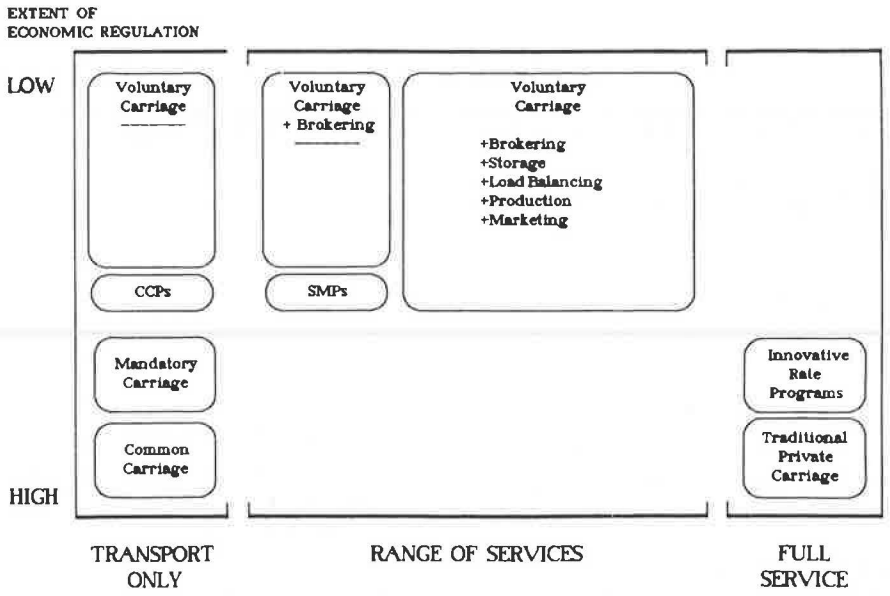
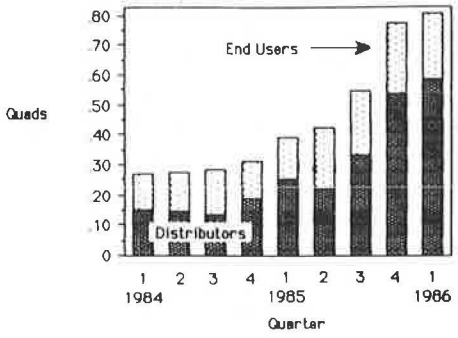


FIGURE 1 Alternative business structures for pipelines.

access transportation. The cumulative impact of FERC's actions has been to lay a take-or-pay burden on the pipelines. Not only has the FERC abrogated pipeline contracts with customers through Order 380, it has also taken away the only lever pipelines had to encourage producers holding problem contracts to renegotiate—the power to control access to their systems.

The member companies of the Interstate Natural Gas Association of America (INGAA) reported more than $9 billion in take-or-pay exposure at the end of 1985. They predict additional exposure of more than $6 billion for 1986 alone. In the context of roughly $25 billion of equity in the interstate pipeline business, the extent of the problem can be appreciated. Pipelines have been troubled by this issue for several years now, but the problem is not diminishing. Even the producers' figures show that post-settlement take-or-pay grew by 75 percent in 1985. Pipeline concern about take-or-pay is, if anything, growing. The House Government Operations Committee has demonstrated sound judgment in its continuing efforts to persuade the FERC to take a realistic approach toward a fair resolution of take-or-pay and related contract problems.

INGAA keeps a close watch on interstate transportation activity, and the evidence demonstrates that pipelines are, in general, seriously committed to transporting gas for others. The latest statistics show transportation for distributors and end users in the first two quarters after Order 436 was implemented was more than double the level for the same period a year earlier (Figure 2). Transportation for distributors and end users is now almost one-quarter of interstate pipeline deliveries to market.



Source: INGAA survey data

FIGURE 2 Carriage for distributors and end users.

Supply Planning

The second crucial area in which federal regulators have fallen short is in gas supply planning. Somebody needs to take responsibility to assure reliable gas supplies. FERC rules are used as a means to persuade pipelines to shed their merchant role and transport gas only. The administration, and to some extent the courts, are encouraging similar changes. In the past, pipelines have served to arrange supplies without receiving any markup on purchased gas prices. Profits have come from transporting gas.

Many at the FERC seem to believe that the market will assure supplies in the future. In the long run, it is expected that the market will balance demand and supply. As a noted economist once said, however, "In the long run, we're all dead." As the events of recent months have shown so dramatically, energy market circumstances can experience radical changes very quickly. The kind of price runup that a seriously cold winter could create in conjunction with supply difficulties resulting from the current depressed exploration and development activity would, most likely, not be viewed as serving the public interest.

Establishing accountability for the gas supply planning function is of immediate and critical importance. When the home owner, hospital, or school authorities turn up the thermostat, the gas must be there. It must be made clear where the responsibility lies.

Federal policy has failed to assign responsibility. Fortunately, some state regulators have realized the dangerous gap in supply planning created by FERC's stance. Some states are

considering including local utility forecasts and long-term supply strategies in their oversight review of distributor operations. Hopefully, pipelines, their local distribution company (LDC) customers, and state regulators can agree on new pipeline service obligations as merchant and transporter. Such agreement, and the establishment of corresponding obligations for customers to their suppliers, should go a long way toward achieving the benefits of a more competitive marketplace and provide a framework for arranging future gas supply availability.

State Regulation

The previous two issues are of longstanding importance in the natural gas industry. One that has emerged recently is that the importance of state level regulation for natural gas is increasing dramatically. State regulation will play an increasingly crucial role in the success or failure of the new natural gas marketplace. State regulators approve the rates most users see; they will determine the extent to which competitive forces extend beyond the city gate, and they will set the supply planning requirements for LDCs.

The executive committee of the National Association of Regulatory Utility Commissioners (NARUC) recently passed a resolution urging the establishment of a joint federal-state board with FERC. This action by NARUC is a welcome sign of leadership on the part of state regulators to fill the void created by FERC's laissez faire policies on natural gas supply planning, take-or-pay, and other crucial issues.

Settlements

Many of INGAA's member companies are now in the process of negotiating with their customers. The object of these negotiations is to develop workable transitions from the traditional full-service world, in which pipelines are merchants, selling wholesale gas, to a world in which pipeline customers—for better or worse—take control of their destinies. In the absence of workable federal guidelines, settlements appear to provide one remaining option for developing a fair sharing of the costs and responsibilities of the transition to open-access transportation. Through these negotiations, pipelines hope to establish mutually acceptable conditions under which they can open their systems to transportation while protecting the interests of their remaining sales customers and their stockholders. If the FERC would approve all pending filings and settlements, INGAA's tally indicates that about 85 percent of the interstate market would be open to nondiscriminatory access.

At the present time, there appears to be some reluctance on the part of LDCs and most state regulatory bodies to encourage the pipelines to shed their merchant role. Many pipeline LDC customers want pipelines to retain the major responsibility for acquiring and managing gas supply, as has been done in the past.

This is the role the pipelines have always played and are willing to continue to play, provided there is a clear definition of where the responsibilities lie.

CONCLUSION

Despite the shortcomings of current natural gas regulations, achieving a fair resolution of remaining transition problems is in everyone's interest. Natural gas now needs open access to remain effectively competitive; but pipelines cannot be left holding the bag for nonmarket responsive contracts from an era of intrusive federal regulation that seriously distorted normal contracting options.

Federal policymakers have not succeeded in developing a framework to promote a smooth transition. Pipelines and their customers are seriously negotiating to find a mutually acceptable way to reach open access. Other parties, including state regulators, pipeline competitors, and industrial end users are actively involved in the struggle. Hopefully, this effort can lead to a resolution of remaining problems on a case-by-case basis. With the leadership of state regulators and a willingness on the part of others to move beyond these current problems, natural gas should be able to retain its role as an important domestic energy source.

Publication of this paper sponsored by Committee on Pipeline Transportation.

An Investigation of the Ownership of Railroad Right-of-Way: The Case of Indiana

WILLIAM R. BLACK

State governments are often asked to supply information on the ownership of operating or abandoned rail lines. Citizens' concerns range from issues of maintenance in the operating case to questions of ownership related to alternative uses in the abandoned case. This research developed a procedure for sampling county land records to determine the original railroad owners of rail right-of-way and the nature of that ownership. The instruments used to hold the land were categorized as either fee simple or easement. Based on the research, the dominant instrument was the right-of-way easement (60 percent), with fee simple holding 30 percent. Ten percent of the lines could not be classified because they were composed of a mixture of these instruments. The procedures developed should be useful in the eastern United States where railroads had to secure their right-of-way.

One of the more difficult research questions regarding abandoned railroad right-of-way land is to determine how the railroad owned the land before abandonment. The question goes beyond idle curiosity for its answer is an integral component of several types of analyses. For example, in assessing the viability of railroad branch lines, it is common to consider land value as a salvageable component of the right-of-way and this helps to determine the opportunity cost of retaining a line. Implicit in this construction is the assumption that the land is owned by the railroad.

It is common for railroad rationalization teams, whether they are transport consultants, rail industry members, or federal planners, to assume that railroads own their rights-of-way. Those opposed to abandonments speak of easements and reversion of rights-of-way to abutting property owners. The impression is given that no one knows what they are talking about in this area; unfortunately, this impression may be correct.

The transportation and land use literature also has not proved useful on this question. The literature that does exist is often oriented toward the western United States where federal land grants were important *(1, 2)*. Such studies are not relevant to the eastern and southern portions of the country where railroads acquired their rights-of-way by using several different types of legal instruments.

The purpose of this paper is to summarize the manner in which the rail right-of-way ownership was examined in a recent study in Indiana *(4)*. It presents a brief history of the process of land acquisition, explains how the research was conducted, identifies some of the problems encountered, notes the sampling procedure finally used, and presents the general findings of the study. It is not known if these findings are applicable to other states (they probably are to nearby Midwestern states), but the general design and approach should be useful for other states that wish to economically examine this issue.

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The Acquisition of Transport Rights-of-Way: A Brief History

During the colonial period of American history it was common for individuals to request permission from local courts to build roads from one point to another. The following is typical of such early records:

> To the Honorable Court of Augusta. Petition of inhabitants and subscribers of the South Fork of the South Branch of the Pattomuck are very much discommoded for want of a road to market and to Court if occation but espetily to market. We have found a very good way for road: Beginning at John Patton's over the mountain to Cap. John Smith's; we begg that you will take this our petition unto your consideration and grant us a briddle road to Court and a road to market where it will suit most convenient, and will ever pray, etc. (*5*, p. 432).

That record is for Augusta County, Virginia, in the year 1749. There is something attractive about the simplicity with which the land was acquired in those days.

Of course, the military was also active in building roads during the 1700s. Examples would be Forbes' Road and Braddock's Road in Pennsylvania.

Moving into the 1800s, the acquisition of rights-of-way was usually done through a charter enacted as a special legislative act by the state. In Indiana there were numerous pieces of legislation enacted by the General Assembly for the building of roads or plank roads. These special pieces of legislation, called "local acts", gave private entrepreneurs permission to acquire the necessary right-of-way for these roads by acquisition or release. Given the choice, most road builders preferred to have landowners simply release the right-of-way. An example of a release form used in 1850 for the Indianapolis and Springfield Plank Road appears as Figure 1. The road builders would arrange for an agent to visit all property owners along the intended right-of-way. It was the responsibility of the agent to get the individuals to sign the document. The compensation to the landowner was defined as the "benefits to be derived from

State of Indiana
Putnam County S.S.

I A _____ B _____ through whose lands the Indianapolis and Springfield Plank Road has been Surveyed, to wit, through the (here describe the land) do hereby in consideration of the benefits to be derived from said road forever relinquish, convey, and quit claim to said Company the right of way, and the right to open, construct, and permanently locate and establish the said road, through, over, and across my said lands on the same route so surveyed and estimated by A. B. Condit, the Engineer of said Company or any other route said Company may see fit to locate or establish said road upon. Hereby relinquishing to said Company all manner of right to sue for or recover any damages I may sustain by reason of said road being located, opened, constructed, or established through, over, or upon my said lands as aforesaid.

Witness my hand and seal here this

A.D. 1850

A. B. seal

State of Indiana, Putnam County, S.S. On this ____ day of _____ 1850, the above named A. B. came personally before me and acknowledged the execution of the above release to be his act and deed for the purpose thereon explained.

Witness my hand and seal

J. P. Estes

FIGURE 1 Release form for the Indianapolis and Springfield Plank Road.

said road"; there was no financial compensation offered as such.

This was the general procedure used during the 1830s, 1840s, and 1850s. However, beginning in the 1840s it was apparent that the railroads offered an even better alternative or mode of transport than wagons moving over roads. As a result, several of the early charters for plank roads in the Midwest were converted to charters for railroads. Even the charters written explicitly for railroads did not differ much from the road charters. It was natural that the railroad builders would also use the same type of release forms, and they did.

No one seems to have viewed such releases of rights-of-way as land transactions. The landowners retained the basic ownership of the land; they were merely granting an easement to the railroad. In many cases the landowners were anxious to see the railroads arrive because they increased the accessibility of the land and the marketability of its crops or minerals. If an area already had a railroad, then another railroad was not always viewed with such enthusiasm; in this case the farmers often objected to the railroad taking their land. During the 1850s and later these conflicts were often settled through condemnation proceedings. One such proceedings took place in Indiana's Lawrence County in the year 1853. The railroad was the Ohio and Mississippi Railway being built between Cincinnati, Ohio, and Vincennes, Indiana. Every landowner in the proceedings lost his case and his land and none received compensation. The railroad paid the court costs of $6 or $7 for each segment of land taken.

An exception to this process in the early years occurred in cities and towns. In these cases the railroads were usually obligated to buy the individual's store or house. Such transactions were usually recorded, but the railroads still felt no compulsion to record releases and in most cases they did not.

By the 1890s it was clear that the railroads did not always bring economic wealth or benefits to all of the lands they passed through. For this reason it became necessary for the railroad companies to begin purchasing the land. These purchases were duly taken to the county court house and recorded. Without doubt there are exceptions to this historical pattern, but this practice was generally employed.

INSTRUMENTS OF CONVEYANCE

There are two basic types of instruments that were used to convey land to the railroads in Indiana. These were fee simple absolute deeds and easements. A brief examination of each of these follows.

Fee Simple Absolute Deed

A fee simple absolute deed is a real property interest of infinite duration and absolute control free of any conditions, limitations, or restrictions. Such a deed is also referred to as a fee simple deed. A railroad company that holds land in this manner has complete control of the land. It is similar to the way in which an individual might own a house and the land on which it is located. As a general rule, acquiring land in fee simple absolute is more expensive than other methods. The deeds under which railroad corridors are conveyed in this manner will

usually refer to the land as "a strip, piece, or parcel of land," not as a right-of-way.

Easements

As it is generally used in the rail literature, an easement involves primarily the privilege of doing a certain act on, or to the detriment of, another's land. In the case of a railroad, the rail right-of-way might be referred to as a public easement.

Although the literature abounds with references to different types of easements (e.g., determinable easements and affirmative easements), and fees other than fee simple absolute (e.g., fee simple conditional, fee simple defeasible, and fee simple determinable), it is sufficient to view all of these as easements because they place constraints on the railroad that would not exist if the land were held in fee simple absolute. In other words, all of the conveyance instruments can be placed in one of two mutually exclusive classes: fee simple absolute title and easements.

A reading of Indiana case law leads to the conclusion that fee simple absolute deeds are easy to identify. Land conveyed in this manner was free of any restrictions on use. As previously noted, it was also referred to generally as "a piece, strip, or parcel of land"; in no case was the land referred to as a right-of-way. As a result although some researchers would view certain deeds in a strict legal sense as "fee simple conditional," the presence of the condition tended to void the interpretation of the instrument as fee simple absolute. It became an easement.

Research reveals far more different types of easements in the deeds or records examined. Among these were the "release of right-of-way" previously referred to, permission to take necessary lands as granted by state charters, deeds subject to constraints on use, lands received through condemnation proceedings, and lands obtained through adverse possession.

The important point regarding right-of-way that is held fee simple absolute and right-of-way that is held through any type of easement, is that on abandonment of the primary use the land held by easement will generally revert to abutting property owners. Land held as fee simple remains with the railroad owners and may be sold by them. This may appear to be an oversimplification of the situation, but it is surprisingly accurate.

RESEARCH AND SURVEY DESIGN

The railroad system examined in this study is presented in Figure 2. This is the rail system of Indiana that existed in 1967. At that time the system consisted of 6,488 route miles of track. Since that time more than 1,689 route miles have been abandoned. These abandoned miles were included in the study universe because they are, at present, the focus of most of the interest in this area. The study also examined operating lines that are part of the current rail system. Although it was desirable to decrease the size of the universe examined, it was recognized that any rail line in Indiana could be abandoned the next day and, therefore, the study included all of the 1967 system.

In order to make a determination of how the land was held, it was necessary to examine records for the initial right-of-way land acquired by the railroads. In its simplest form, this constitutes a title search. When nearly 6,500 miles of rail line are involved, however, it is not practical to search all the titles.

A sampling approach was required that would answer the title questions with a low error level. The best approach appeared to be to sample the counties in Indiana. This approach was tried. It required an examination of all the land records of the counties included in the sample. This was far too labor intensive and time consuming. The data collectors had no way of determining which recorded information was relevant. For example, it was not uncommon to find dozens of miles of right-of-way acquired by a railroad through some county during the 1870s. It was also not uncommon to find that nothing had ever been constructed on the right-of-way so acquired and it had later been sold in pieces. Just recording this information was a waste of time, but there was no clear way to know this at the time the data were collected.

Other approaches were tried, but the procedure finally adopted was based on an observed regularity in the data. It was found that the manner in which a railroad company acquired land in one county tended to be followed in the other counties where it was located. If the railroad company had started acquiring a fee simple absolute interest in their right-of-way in one county, it tended to do this in all counties. As a result, if it were possible to identify the names of the original railroads that acquired land it would be possible to examine a sample of their deeds from any county and generalize this data for their entire line in the state. Similarly, if a railroad had a charter that essentially granted them permission to take land, they would do this in all counties. They would also fail to record such a practice in all counties.

As an illustration of this point, consider the practices of two early railroad companies: the New Albany and Salem Railroad and the Indianapolis Southern Railroad. The New Albany and Salem Railroad had an 1847 charter that permitted them to obtain releases of right-of-way. The railway passed through 14 counties. In no county was it possible to find records of its land acquisitions. Its land acquisition practice could have been inferred from one county. In the case of the Indianapolis Southern, it acquired its lands during the early 1900s through a fee simple absolute mechanism. It did this in all counties and likewise its behavior could have been inferred from any one of the counties.

Before collecting data in the field, therefore, it was necessary to identify the names of the original land-acquiring railroads. Indiana has had more than 250 railroads that have operated within its borders. Of these, it is believed that about 105 acquired the original right-of-way of the system. That is, if a map of all rail lines that have ever been constructed in the state is inspected, it is seen that the land they occupied was acquired by about 105 railroads.

These early railroads were identified by examining annual volumes of Poor's Manual of Railroads for each year of the late 1800s. Use was also made of Moody's manuals for the 1920s; these often contained historical information. So-called railroad histories were occasionally useful, but county histories were often more so.

Besides the names of the early railroads, data on end points and approximate date of land acquisition were recorded. Once

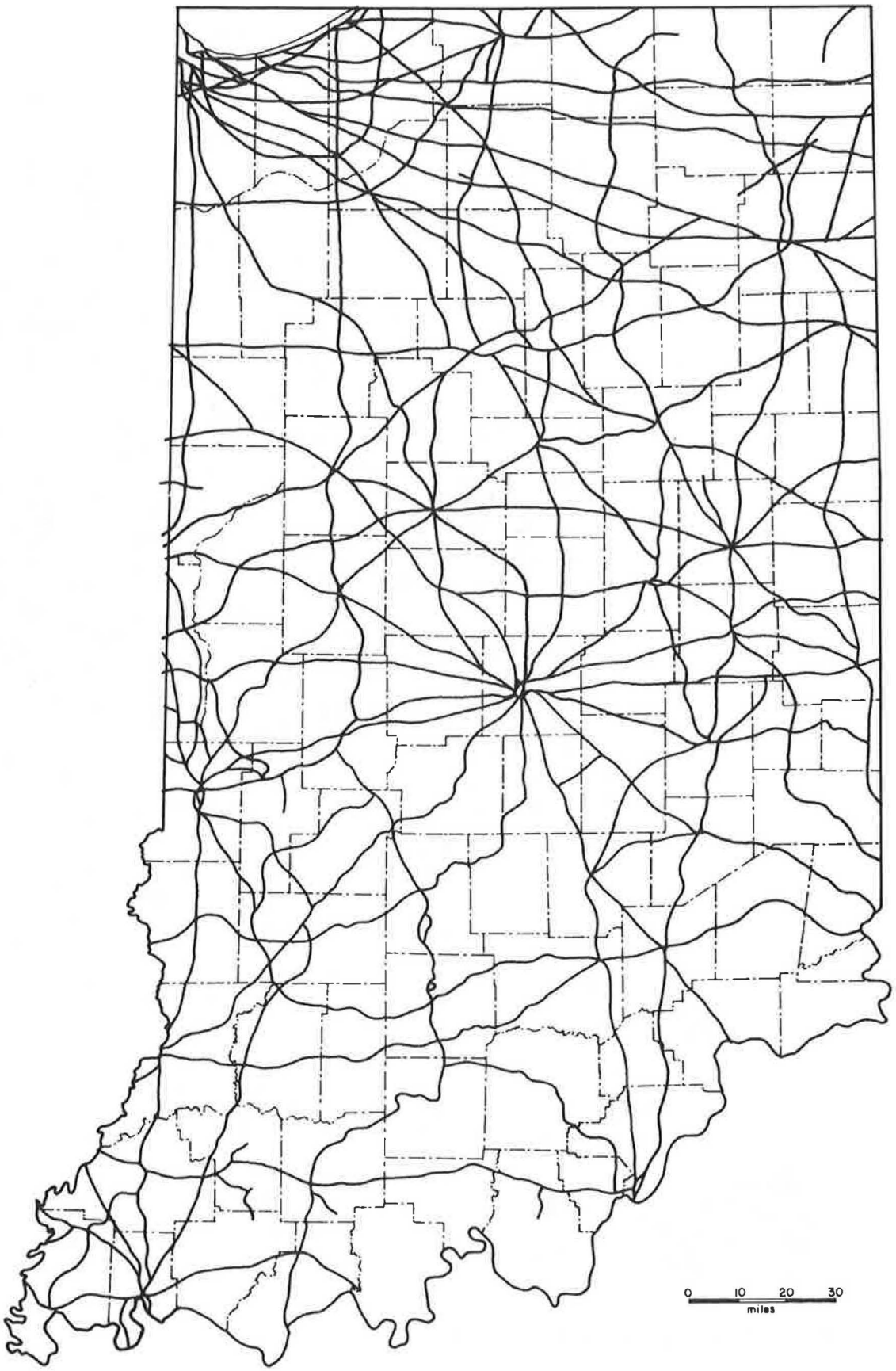

FIGURE 2 Railroad system of Indiana in 1967.

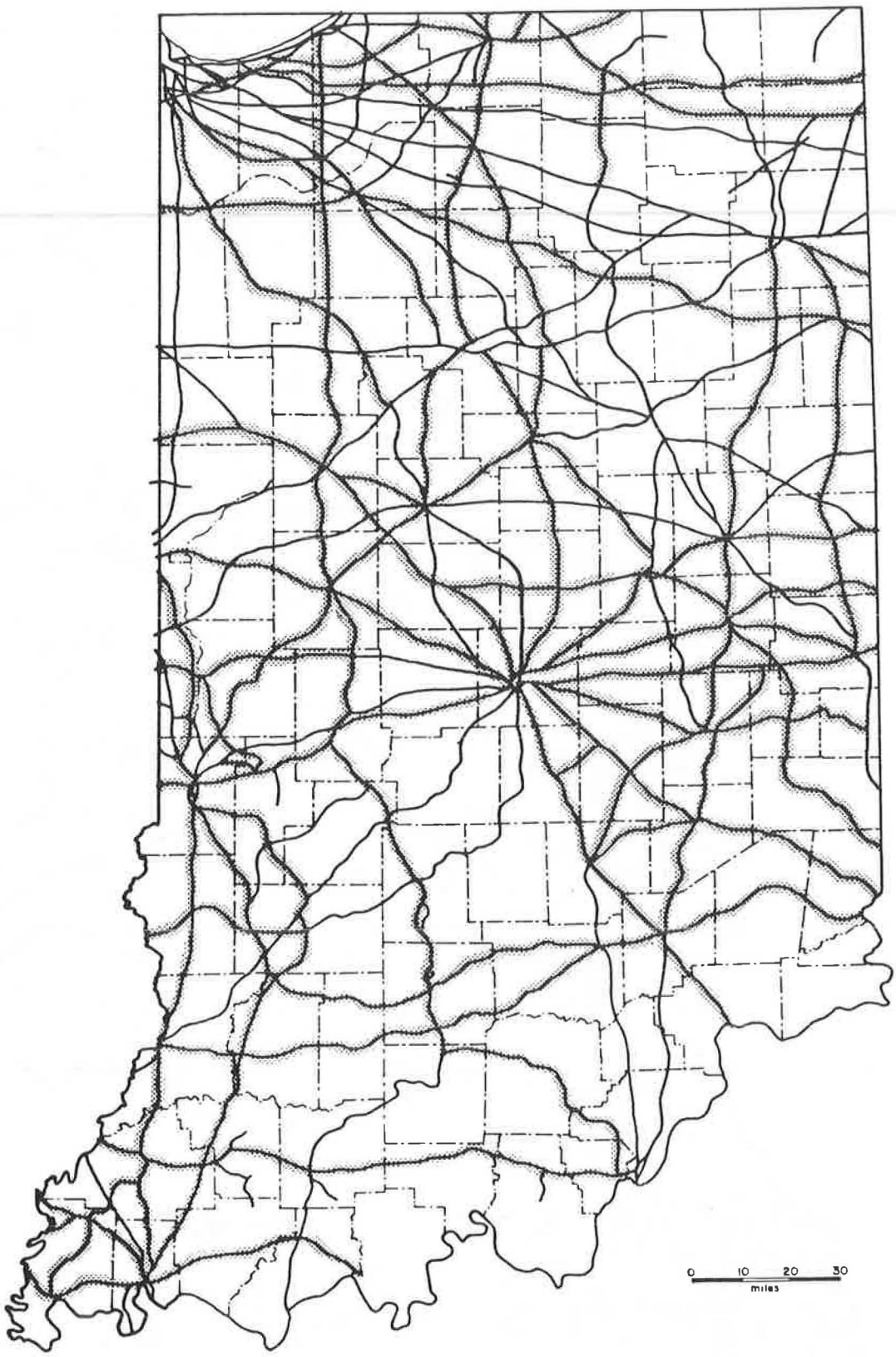

FIGURE 3 Railroad lands held by easements.

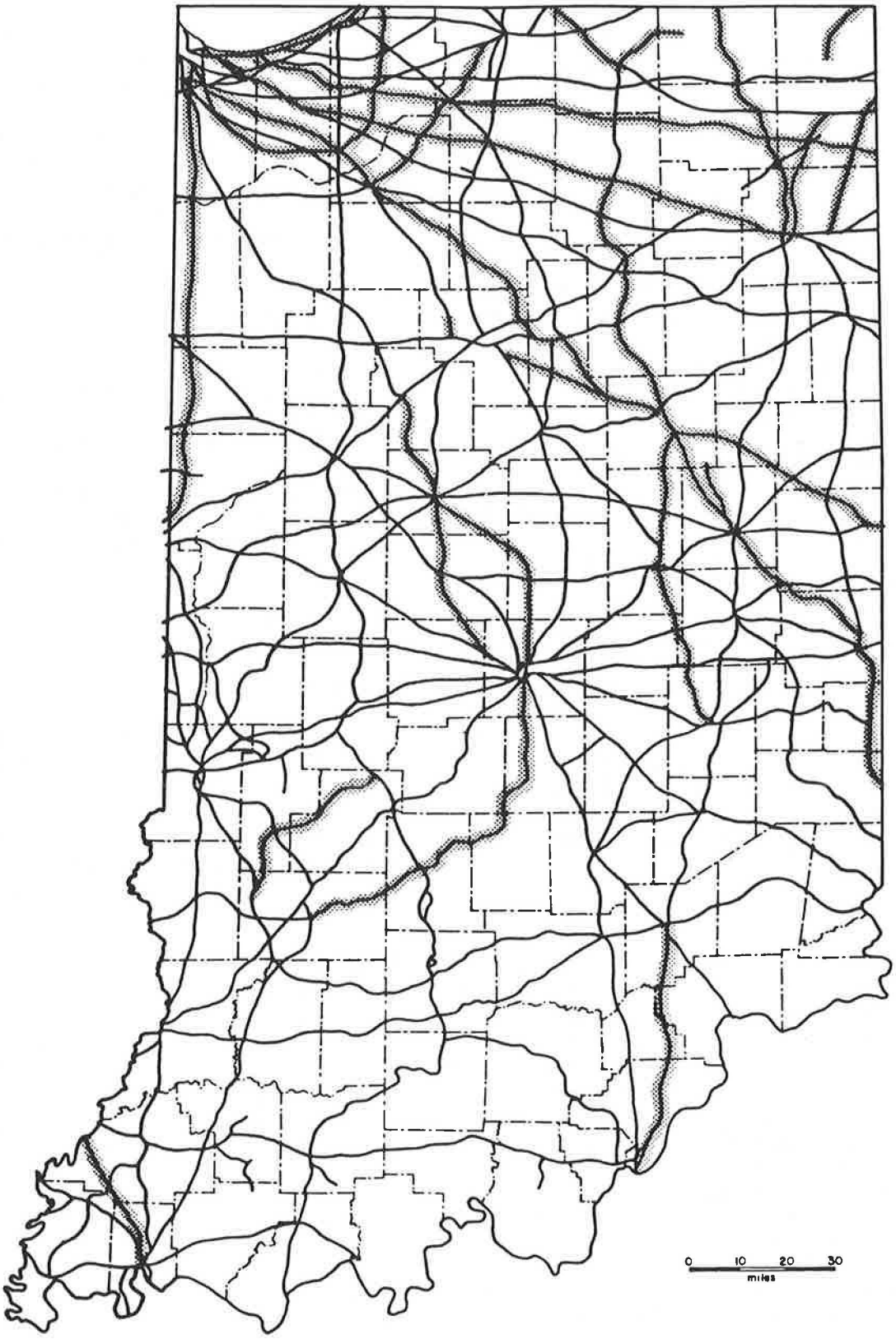

FIGURE 4 Railroad lands held fee simple absolute.

the extent of the line, its name, and year of purchase were known, it was possible to figure out exactly where to look in the county records for deeds, if they existed.

In a few cases it was found that the information collected was wrong (e.g., the land might have been acquired under a completely different name from that of the first operating railroad). Whenever the records were not found as expected, a thorough search was undertaken to make sure the land was not acquired and recorded by a different railroad.

INTERPRETATION OF THE RECORDS

All the charters and land records that exist for this process of railroad land acquisition could therefore be found, but it was still necessary to interpret the records. This required a complete review of Indiana case law covering railroad lands, easements, right-of-way, abandonments, and so forth. Before reaching any conclusions, some working assumptions had to be established; these were based to a large extent on Indiana statutes and court rulings. They are as follows:

1. All right-of-way lands released or relinquished by a charter of the State of Indiana are easements;
2. All right-of-way lands acquired through condemnation proceedings are easements;
3. All right-of-way "deeds" that restrict the use of land or specify how the land is to be used, or the purpose for which it was being conveyed, are easements;
4. All right-of-way cases where individual deeds are missing (as opposed to all deeds) are assumed to be held by the railroads through adverse possession and this creates an easement;
5. Failure to find a series of deeds for a right-of-way led to the conclusion that the land was held as an easement; and
6. A fee simple absolute deed was one that conveyed property (e.g., "a strip, piece, or parcel of land") without any indication that the land was to be used for railroad right-of-way or purposes.

FINDINGS

Given these assumptions, it was possible to categorize numerous lines as predominantly fee simple or easements. For the 105 railroad companies identified as being involved in acquiring rail land in Indiana, it was necessary to drop 13 of these segments because of an absence of data. For the 92 remaining railroad segments, 28 were categorized as fee simple absolute, and 55 were categorized as easements. There were an additional 9 segments that could not be categorized. In terms of percentages, 60 percent were easements, 30 percent were fee simple absolute, and 10 percent could not be classified.

It should be noted that there were exceptions to all of the cases examined. For example, a railroad might set out to acquire a fee simple title to a right-of-way only to find that a few landowners were unwilling to sell regardless of the price offered. In these cases the railroad would be involved in a condemnation suit that, if successful, would result in the railroad getting the land as an easement. Similarly, some landowners had no interest in granting railroads an easement but they were willing to sell their land. As a result, to categorize lines' deeds as fee or easements may be misleading. In interpreting the results, therefore, it may make more sense to view the lines as 90 percent fee and 10 percent easement, or 10 percent fee and 90 percent easement.

The findings of this study occupy more than one hundred maps. The findings are geographically summarized in Figures 3 and 4. The overwhelming dominance of easements is illustrated by Figure 3. Lines held as fee simple absolute are far less common and occur primarily in the northern part of the state. This is consistent with the general development pattern and the process referred to earlier; that is, rail lines constructed late in the development process frequently had to obtain fee title to their rights-of-way. Lines that do not appear on either map are those that could not be classified.

As previously noted, this procedure was not a complete title search and there may have been cases in which a railroad company has tried to perfect its title on some of these lines that may have been missed. It seems likely that it would do this on some 90 percent fee simple lines and some evidence of this was noted. Trying to perfect title on lines that were 90 percent easements would appear difficult and as a result unlikely to have taken place.

CONCLUSIONS

The approach summarized here appears to be a sound method of determining the nature of rail line ownership. This information can be used by state transportation officials to advise individuals of the ownership status of lines that have been abandoned, as well as to identify who has the maintenance responsibilities for abandoned lines. It can also be used by state recreational planners to identify lines for future development of jogging, hiking, and biking trails. It is not a substitute for a complete title search, but it does give the state considerably more information, in an economical way, than it has had heretofore on the question of rail line ownership.

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Innovation in Trucking: Advanced Truckload Firms

L. LEE LANE

Advanced truckload firms are achieving remarkable efficiency gains. These gains threaten to capture important blocks of railroad traffic. The advanced truckload firms are obtaining these results by applying new business strategies, such as the following, to truckload trucking: *(a)* carefully selecting markets and tailoring service to satisfy these markets, *(b)* increasing growth to enhance efficiency in the target markets, *(c)* emphasizing the close integration of operations and marketing, and *(d)* increasing the use of nonunion company drivers to ensure operational flexibility. The application of these business methods is resulting in the kind of success and growth that indicates rapid future transformation of the truckload sector. One measure of this success is the sharp cutting of almost every category of truck costs. The advanced truckload firms have used their cost advantages so far to expand rapidly, but their ability to continue to grow is finite. Still, large growth potential remains. In the immediate future, continuing growth by these firms will result in improved truckload sector productivity and a change in the sector's composition.

Advanced truckload firms (ATLFs) such as J.B. Hunt, P.A.M. Transportation, MNX, M.S. Carriers, Builders' Transport, Werner Enterprises, and BN Transport are using a variety of new business methods (described in the following paragraphs) to enhance efficiency. Their success is encouraging the growth of existing ATLFs and their imitation by other firms.

As a consequence, truckload (TL) sector productivity is growing rapidly. Three to four years ago typical TL costs equaled $1.20 to $1.30 per loaded mile. In mid-1986, the typical TL carrier long-run marginal costs were $1.03 per loaded mile as shown in Table 1. [These costs were evaluated using an ongoing survey, the National Motor Transport Data Base (NMTDB) as well as various trade publications and industry sources.] By mid-1986, the typical ATLF had long-run marginal costs of $0.90 per loaded mile, a 12.4 percent reduction (see Table 2). These cost reductions are independent of any future increases in truck size and weight limits.

As TL rates fall, rail rates must decline to remain competitive and some rail traffic will be diverted to truck. When fully reflected in railroad rates and traffic, a 12.4 percent TL cost reduction will result in a short-run traffic loss of 14 to 16 billion ton-miles. The long-run traffic losses may exceed this first impact, with the eventual total traffic loss representing 36 to 40 billion ton-miles, or 4.5 to 5.0 percent of total railroad traffic. The Association of American Railroads' (AAR) Intermodal Competition Model (ICM) was used to predict the impact of TL industry-wide ATLF costs on the railroad industry. The ICM is described in the report "AAR Intermodal Competition Model," which is available from the AAR.

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NEW APPROACHES TO TRUCKLOAD TRUCKING BY ATLFs

As used here, the term ATLF denotes more than a small group of unusually successful TL carriers. The concept also refers to the way these firms do business. Indeed, although important variations exist among the most productive TL firms, there is an overlapping nexus of business methods. Understanding these business methods is important for predicting the future evolution of truckload trucking.

Selecting Markets and Providing Services

Though legally common carriers, ATLFs are selective in choosing their markets. At the moment, ATLF growth targets center on

- TL freight previously handled by less efficient private or contract carriers;
- Less than truckload (LTL) freight that can be consolidated at regional centers into TL lots or added to already partially filled trailers; and
- TL freight previously handled by rail.

Among these targets, freight carried by private and contract TL carriers and LTL carriers have so far ranked higher than that carried by railroads. To win this service-sensitive truck business, ATLFs have had to provide premium quality service. Over time, ATLFs' service quality combined with their low rates may become more tempting to increasingly service-sensitive rail shippers.

ATLFs employ a number of approaches to providing service quality responsive to shipper needs:

1. Dispatching: conducted 24 hours a day, 7 days a week;
2. Building traffic density in key corridors to ensure equipment availability;
3. Providing extra trailers (two trailers for each tractor instead of one), making loading and unloading more convenient for shippers and avoiding delays associated with waiting for trailers;
4. Making multiple pickups and deliveries to improve overall shipper logistics as well as reducing per ton-mile costs;
5. Owning equipment rather than relying on independent contractors, allowing shorter equipment cycles; employing preventive maintenance to ensure that vehicles are clean and reliable; and

TABLE 1 TYPICAL 1986 RAIL-COMPETITIVE TRUCK COSTS (based on a single 48-ft trailer)

	Total Mile (cents)	Loaded Mile (cents)	Ton-Mile (cents)	Percent
Labor[a]	32.62	36.21	1.91	35.3
Equipment[b]	31.67	35.15	1.85	34.3
Fuel	15.51	17.22	0.91	16.8
Overhead[c]	4.51	5.01	0.26	4.9
Other costs[d]	8.05	8.94	0.47	8.7
Total	92.36	102.53	5.40	100.0

[a]Includes driver wages, paid time off, and fringe benefits.
[b]Includes original purchase price; depreciation; and amortization, vehicle parts, and tires.
[c]A markup, includes salaries, paid time off, and fringes for all employees other than drivers; general supplies and expenses; communications and utilities; expenses for all nontransportation equipment and buildings; and miscellaneous expenses.
[d]Includes federal and state user charges and insurance.

SOURCE: NMTDB, various trade publications, industry sources, and AAR Intermodal Competition Model.

6. Supplying big trailers, permitting faster loading and unloading as well as greater carrying capacity.

The cumulative result is premium service quality, creating a major ATLF competitive advantage.

Selectivity is the key to providing this premium service quality cheaply enough to make it price competitive. The ATLFs actively solicit freight only where and when it contributes to building dense, balanced flows of freight and equipment. Balance is important in time as well as in direction. Marketing seeks to overcome both short-term and seasonal irregularities in demand levels. This selective marketing has produced high loaded ratios and largely eliminated seasonal imbalances. The flexible pricing that is central to these successes is conducted independently of rate bureaus.

Increasing Growth to Enhance Efficiency in ATLFs' Target Markets

In generating dense, balanced freight flows, selective marketing facilitates high equipment availability at low cost. Increasing demand in a traffic lane makes traffic volume more predictable because chance fluctuations are more likely to cancel one another out. With more predictable demand, a smaller percentage of truck capacity is needed as standby to ensure that trucks will be available to meet demand. A larger percentage of truck capacity is, therefore, actually producing revenue at any given time.

Carriers also seek to improve truck use by linking their high traffic density lanes into an efficient route structure. New markets are evaluated according to their potential contribution to efficient equipment utilization. Expansion proceeds by adding new lanes connected with existing markets.

This additional size provides yet further economies. Opening new regional terminals expands access to the limited pool of long-haul drivers. New terminals also produce other advantages:

- Faster response to dispatch,
- Reduced empty or unprofitable mileage required to bring home the long-haul driver,
- More efficient maintenance, and
- Greater efficiency in bulk fuel purchases and refueling.

For all these reasons a more extensive network is more efficient, all other things being equal.

Increased firm size also confers some advantages. Noticeable size combined with ATLF patterns of rapid equipment turnover translates into substantial market power in equipment purchases. The result is often 25 to 35 percent price discounts on new equipment.

Integrating Marketing and Operations

Despite the advantage of firm size, the distribution of growth remains more important. Establishing the right distribution of growth requires close integration of marketing and operations.

TABLE 2 THE COSTS OF AN ADVANCED TRUCKLOAD FIRM (based on a single 48-ft trailer)

	Total Mile (cents)	Loaded Mile (cents)	Ton-Mile (cents)	Percent
Labor[a]	28.16	29.85	1.57	33.2
Equipment[b]	26.43	28.02	1.47	31.2
Fuel	14.79	15.68	0.83	17.5
Overhead[c]	7.86	8.33	0.44	9.3
Other costs[d]	7.46	7.91	0.42	8.8
Total	84.70	89.79	4.73	100.0

[a]Includes driver wages, paid time off, and fringe benefits.
[b]Includes original purchase price; depreciation; and amortization, vehicle parts, and tires.
[c]A markup, includes salaries, paid time off, and fringes for all employees other than drivers; general supplies and expenses; communications and utilities; expenses for all nontransportation equipment and buildings; and miscellaneous expenses.
[d]Includes federal and state user charges and insurance.

SOURCE: NMTDB, various trade publications, industry sources, and AAR Intermodal Competition Model.

ATLFs use a variety of organizational forms to achieve this integration. Some firms integrate these functions quite far down in management hierarchy, creating profit centers with considerable autonomy in day-to-day decisions. Others integrate marketing and operations at higher organizational levels. In any case, ATLFs typically structure individual rewards to stress consistency of operational and marketing activities.

Success requires close coordination on a daily basis of five functions:

1. Soliciting business from a specific set of customer accounts,
2. Troubleshooting customer complaints from those accounts,
3. Matching loads with truck capacity,
4. Scheduling pickup and delivery, and
5. Supervising blocks of 40 to 60 drivers and tractors.

Management creates a framework to guide the integration of these activities. A detailed marketing plan establishes priorities for load solicitation. This plan, which may be revised quarterly, is itself the joint product of marketing and operational considerations. Network models assist coordination of loads and trucks and may assist in scorekeeping.

Using Nonunion Company Drivers To Ensure Operational Flexibility

The fine-tuned integration of marketing and operations would be valueless without the control to implement it. Use of nonunion company drivers ensures this control without the elaborate negotiations entailed by reliance on owner-operators. It also offers some other major advantages:

1. Nonunion company drivers, unlike owner-operators, do not need the capital to buy their own tractors, therefore the pool of available drivers is larger than it would be with owner-operators;
2. Nonunion company drivers are operationally more flexible; thus slipseating, team driving, and relay operations can be used to improve tractor utilization;
3. Nonunion company drivers require only moderate compensation levels: 25 to 29 cents per mile in total compensation compared with about 40 cents in compensation required for a teamster; and
4. Nonunion company drivers are fuel efficient; standardized fuel equipment, driver training, and wage incentives help to control fuel costs.

ATLF BUSINESS METHODS: CURRENT AND FUTURE TRENDS

ATLF Business Methods Are Cutting Truck Costs

ATLF business methods are producing cost reductions in several cost categories simultaneously (see Tables 1 and 2).

Equipment accounts for the most important cost savings between the ATLF and the typical TL firm. In this category, costs fall from 35.2 cents to 28.0 cents per loaded mile, a drop of about 20 percent. Equipment cost falls because of the higher annual mileage (140,000), volume discounts, and improved empty/loaded ratios. For the typical ATLF, equipment now represents 31.2 percent of total costs.

Labor costs for the ATLF carrier drop from 36.2 cents to 29.9 cents per loaded mile, a 17 percent reduction. Almost one third (31 percent) of this cost reduction comes from productivity gains attributable to improved empty/loaded ratios. The rest is because ATLFs are paying their labor less per mile. Labor, in total, represents 33.2 percent of total cost for the ATLF.

Fuel costs for the ATLF are lower, 15.7 cents compared to 17.2 cents for the typical TL firm per loaded mile, a 9 percent reduction. This reduction reflects volume fuel purchases by ATLFs and increased fueling at terminals. Fuel is the third largest component of ATLF costs and makes up 17.5 percent of total cost.

Overhead expenses are the exception to this downward cost trend. These expenses increase from 5.0 cents to 8.3 cents per loaded mile. Marketing and operational efforts necessary to reduce empty/loaded ratios from 0.11 to 0.05 contribute to these higher costs and more than justify them.

Despite Rapid Growth, Future ATLF Expansion May Be Limited

ATLFs have so far used their cost advantages to expand rapidly, as can be seen in the following table showing the selected ATLF percentage growth in total assets and operating revenue (1983, 1984, and 1985). These ATLF firms include J. B. Hunt, MNX, M. S. Carriers, P. A. M. Transportation, and Werner.

	Percent Growth	
	1983–1984	*1984–1985*
Total assets	83.1	42.7
Operating revenue	54.1	37.6

It is not clear, however, that they can grow indefinitely. ATLFs may, for example, exhaust the potential for some kinds of cost savings. Certainly energy costs are unlikely to fall much below current levels. Equipment prices are unlikely to decline by much unless the Japanese enter the heavy tractor market. Current ATLF firm sizes probably generate about as much leverage on new equipment prices as can be generated.

ATLF strategies may in some ways be self-limiting. ATLFs achieve high tractor productivity and have substituted 3- and even 2-yr equipment cycles for the more conventional 5-yr cycle. These strategies contribute to the present tractor glut.

The tractor glut is in turn lowering ATLF equipment resale values. Consequently, somewhat longer equipment cycles may return to fashion. (Elimination of the investment tax credit may reinforce this trend.) Indeed, low used tractor prices may even confer an economic boom on owner-operators and the non-ATLF carriers they drive for, though most used tractors probably shift to various short-haul markets.

ATLFs may also encounter diseconomies of scale at some point. Even the largest ATLF, J. B. Hunt, now only earns slightly more than $100 million in annual gross revenue. Very rapid growth from such a small base can readily produce "growth accidents," in which size outruns the capabilities of the management system in place. Size may also over longer periods erode the entrepreneurial spirit of the current ATLF managements.

ATLFs may also be somewhat more vulnerable to business cycle downturns because they use company-owned equipment rather than owner-operators. Relying on owner-operator contractors' equipment shifted much of the risk of cyclical downturns to the owner-operator contractors. The contractors might go bankrupt, but the carrier would not have its own equipment as demand fell. The ATLF, by acquiring its own equipment, is exposed to greater risk.

Large Growth Potential Still Remains

ATLF concentration of service quality positions these firms for future growth because it is consistent with the increasing emphasis on logistic cost management. Intensified foreign and domestic competition have supplemented high real interest rates as a stimulus to improving inventory cost control. Table 3 illustrates the continuation of high real interest rates that are part of the force behind the drive to lower inventory costs.

TABLE 3 CHANGES IN REAL INTEREST RATES

Year	Prime Rate	Inflation Rate	Real Interest Rate
1960–1964	4.6	1.0	3.6
1965–1969	6.0	2.9	3.1
1970–1974	7.5	4.7	2.8
1975–1979	8.7	6.6	2.1
1980–1984	14.4	6.6	7.8
1985	9.9	3.6	6.3

SOURCE: *Economic Report of the President*, 1986, Tables B-4, B-68.

In addition to service quality advantages, ATLFs may enhance service and lower costs through further improvements in the more efficient rotation of drivers and equipment. Some experts predict future ATLF fleet averages will be as high as 170,000 mi/yr. Such improvements would produce a whole new phase of cost decreases.

ATLFs also enjoy financial postures, positioning them to exploit growth opportunities rapidly or to weather difficulties. ATLF growth has been largely equity financed. Indeed, profits have been high enough to make equity financing relatively easy. The growing equity base of these firms has, in turn, facilitated debt financing.

Effects of Growth on Truckload Sector

At current average TL revenue levels, ATLFs are earning quasi-rents or temporary supra-normal profits. Such profits are predictable when average sector revenues are around $1.05 per loaded truck mile. ATLF costs are $0.90 per loaded truck mile. Obviously, the result is supra-normal profits—profits that are fueling rapid ATLF expansion and inducing other carriers to imitate or even seek to improve on ATLF methods.

Expansion of more efficient carriers either transforms or drives out the less efficient firms. Existing ATLFs are growing and their numbers are increasing. Some current TL sector trends suggest the result of this growth.

Most important, TL sector productivity has been tracking the upward course pioneered by ATLFs. According to the National Motor Transport Data Base (NMTDB), average annual tractor mileage has climbed from 109,214 miles in 1980 to 120,159 miles in 1985. The empty-to-loaded ratio has fallen from 0.14 in 1980 to 0.11 in 1985.

These productivity gains are correlated with changes in the TL sector's composition. Irregular route common carriers are gaining market share at the expense of private fleets. The NMTDB shows that between 1980 and 1985, irregular route common carriers have gone from 64.4 percent to 88.3 percent of truckload long-haul for-hire trucking. During this period, long-haul traffic made up of those private carriers that are also engaged in for-hire business has declined from 10.3 percent to 5.2 percent.

CONCLUSION

ATLFs are using selective marketing, growth-oriented policies, nonunion company drivers, and entrepreneurial management styles to provide cost reductions in several cost categories simultaneously. The truckload sector is changing to increasingly reflect ATLF characteristics. The timing of this process is important, but some aspects of it are difficult to predict. Certainly, most dense, long-haul general commodity TL markets will be heavily influenced by ATLFs during the next 5 years.

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Measuring the Impacts of Freight Transport Regulatory Policies

VICTOR PRINS AND MAUREEN SCHULTHEIS

The purpose of this paper is to report on a disaggregate model of freight transport demand that was developed to forecast the impacts of freight transport regulatory policy options in South Africa. Two aspects of the methodology are emphasized: the compilation and tabulations of a disaggregate data base, and the policy option impacts predicted during application of the model. South Africa is currently undergoing a transition from a highly regulated to a deregulated freight transport industry. During the investigation leading up to this position, the data tabulations were used to illustrate to policymakers how regulation had created major distortions in the freight transport market. The predicted impacts of relaxing regulatory restrictions that were generated by the model helped to persuade these same policymakers to implement a more market-oriented freight transport policy for the country.

The major part of this paper focuses on the evaluation of options for a new freight transport regulatory policy in South Africa. To provide a perspective on that discussion, the background on the current regulatory situation is first summarized.

The freight transport industry in South Africa has historically operated within a strict regulatory environment. First, the central government controls the only railroad operation. The government has used this control to intervene significantly into the business matters of the railroad to promote the country's social and economic goals. This intervention has imposed a substantial cost burden on the railroad and has necessitated an extensive system of internal cross-subsidization, which has in turn led to tariff distortions in all transport modes.

To protect the economic health of the railroad as it performs its overall social and economic functions, the government has further intervened by regulating the other modes of transport in markets where the potential for competition with rail exists. Thus, for example, the road transport industry, composed primarily of private sector operators, is extensively regulated through a system of permits, licenses, and authorities. In particular, there are strict entry controls into the long-distance road transport market on a commodity basis for the private sector road operators.

The continuation of the regulatory system is problematic on two fronts. Over time, the administration of the system has become cumbersome, unwieldy, and difficult to enforce. A more serious problem, however, is that the policy of regulation has led to considerable distortion and inequities in the entire transport market. The lack of competition has led to the inefficient allocation of resources, resulting in an artificially high transport cost to the consumer.

The severity of the inefficiencies and inequities is of such magnitude that within the last several years there has been a move toward more competition in the freight transport market. A National Transport Policy Study (NTPS) was created in part to study the problems with the existing freight transport system and to make recommendations for a new national freight transport policy that would be based on the principle of equitable and effective competition *(1)*.

In the initial stages of the investigation it became clear that although the regulation of freight transport was opposed by many people, the actual relaxation of regulatory restrictions would be greatly facilitated if the frequent claims of regulatory distortions could be substantiated and if the consequences of a move away from the current system of regulation could be predicted. Comprehensive information in this regard had never been documented and the data needed to evaluate such an issue had not been collected.

Thus, as part of the National Transport Policy Study, it was determined that a tool for quantitatively evaluating freight transport regulatory policy options was needed so that the final policy selection would be made based on better researched, more rational decisions. Given this need, data were collected and a behaviorally based stochastic model of user choice was developed for the South African intercity freight transport market *(2, 3)*. This model was also applied to predict and understand the consequences of changing the regulatory framework of freight transport *(4)*.

In the rest of this paper, three salient aspects of the modeling work will be described. First, the basic theory on which the model depends and the methodology employed will be briefly summarized. Second, the data collection and tabulation aspects of the research will then be discussed because they clearly indicated to decision makers the distortions (and potential opportunities) inherent in the current regulatory system. Third, the forecasting package, the model on which it is based, and some of the results obtained from it will be described because they illustrated to policymakers the potential benefits and costs of moving to a less regulated system. Finally, a brief conclusion follows.

DESCRIPTION OF THE METHODOLOGY

A study of the demand for freight transport can be approached from several theoretical viewpoints *(5)*. The method employed

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by the NTPS team was based on the theory of disaggregate travel demand *(6, 7)*.

When this approach is applied to freight transport, it is important to decide on a time scale for the analysis. The approach taken in this study is essentially short term. It assumes that the firm's location is fixed. It also assumes that the firm's sources of raw materials as well as the destinations of its products are fixed. Under these circumstances, the profit-maximizing firm will be minimizing its total logistic costs. As shown by Chiang *(7)*, this implies the optimization by the firm of the decision on the mode choice and shipment size combinations available to the firm. In the model used in this study, the shipment size was accepted as a given and the mode choice decision was modeled conditional on the shipment size.

Following the choice of an appropriate methodology, a full-scale modeling exercise was undertaken: data collection, model specification and estimation of a multinomial logit model of freight demand, and the development of a forecasting package for use in policy analysis.

COMPILATION OF A DISAGGREGATE DATA BASE

The selected methodology requires data on decisions made by individual firms on the freight mode choice decision so that the coefficients of the model that capture the trade-offs between the various attributes of the alternatives as seen by firms in a real-world situation could be empirically determined.

As indicated by Roberts *(8)*, the factors that affect the choice of the firm can be classified into one of the following four categories: *(a)* the transport level of service attributes of the alternatives available to the firm (e.g., travel time, travel cost); *(b)* the attributes of the commodity to be transported (e.g., its value, density); *(c)* user and producer attributes (e.g., use of commodity, type of business); and *(d)* market attributes in general (e.g., modal ownership, interest rates).

These factors concerning the choice of mode of freight transport had not been documented for South African freight transport users. To obtain this information, a data-collection exercise was undertaken. Given that the focus of the study was on trips in which there either existed competition or the potential for competition between modes, the collection of data excluded the urban distribution of freight (road transport is the only major mode of freight transport in urban areas), and the movement of block trains that are used to transport large quantities of raw materials for export (an area dominated by rail transport). A survey form was designed to collect data on a selection of individual trips from selected firms nationwide. The data objectives of the questionnaire are outlined as follows:

- Transport Level of Service Attributes for all Modes in Choice Set
  - Wait and access time
  - Line-haul travel time
  - Reliability (variance in travel time)
  - Loss and damage
  - Tariff rate
  - Handling costs
  - Special charges
- Commodity Attributes
  - Commodity
  - Value per kg
  - Density
  - Base state
  - Consignment size
- Market Attributes
  - Modal availability
  - Ownership
- Receiver/Supplier Attributes
  - Annual use of production rate of commodity
  - Frequency of shipment
    - Seasonality
    - Use of commodity
  - Inventory policy
    - Industry classification
    - Employment size
    - Distance of trip
  - Main reason for selecting mode
  - Location of origin and destination of shipment

In formulating the sample design, a two-pronged approach was selected. First, to ensure a minimum response rate, an interview questionnaire was personally distributed to 84 transport users. These users were selected either because of the likelihood that they would use transport or to ensure coverage of industries not included in the mail questionnaire. Second, a mail questionnaire was distributed to ensure a wide coverage of commodities, trips, and geographic locations of firms. The mail questionnaire followed a stratified random sample design and was distributed to manufacturing firms across the country. For both the interview and the mail questionnaire, respondents were asked to complete information on their input and output trips occurring during the period March 12–23, 1984.

The two-pronged approach resulted in the coverage of a wide variety of trips, as seen in Figure 1. This type of coverage was necessary to ensure that a robust data set would be available for use in the model-estimation phase of the study.

The overall response rate for the interview questionnaire was 61.0 percent, yielding trip-based information for 51 of the larger users of transport.

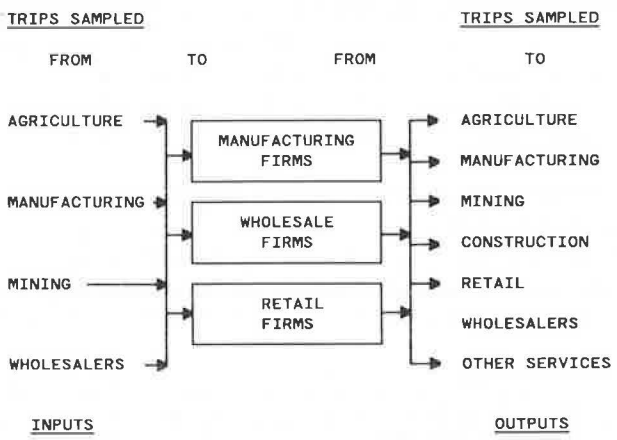

FIGURE 1 Types of trips sampled.

The population of interest from which a sample was drawn in the mail questionnaire numbered 10, from 235 manufacturing firms. The method of systematic sampling used yielded a sample of 5,034 firms, which was 49.1 percent of the population. Of the firms that were sampled, 45.2 percent responded in some way to the questionnaire. Responses can be broken down into two groups: firms that had trips greater than 100 km (and thus were able to complete the questionnaire); and firms indicating that all of their trips were less than 100 km (and thus fell into the intracity category).

Of the firms reporting applicable trips, 40.2 percent actually completed the questionnaire. This response is high when compared with other response rates reported in the literature *(9)*, which indicate that responses for mail questionnaires often range between 5 and 20 percent. Further, considering the extent of trip-based detail requested in the questionnaire, the amount of information received per questionnaire was exceptional. In fact, in many cases, firms provided information on more than the requested number of 60 trips.

The actual number of trip reports collected from the mail questionnaire responses totaled 9,783. However, some firms only completed the questionnaire for a sample of their total trips during the middle 2-week period in March 1984. They then indicated how many trips this sample represented. Taking such additional trips into account, and standardizing to Standard Industrial Classification Code (SICC) and geographic population characteristics, information was collected on 30,114 trips. When these 30,114 trips are factored up to represent the population of trips for the middle 2-week period in March 1984, the data represent a total of 352,334 trips. The relative standard error on this estimate has been calculated to be 10 percent of the true population, using a 95 percent confidence level.

The resulting data base provided a pool of information from which smaller samples could be drawn to calibrate the multinomial logit model. The data base itself is unique in that it contains data on trips in which the firm did not have a choice of mode as well as data on trips in which there was a choice involved. Each type of trip was identified by asking the respondent why, for the given trip, a particular mode was chosen. Respondents could choose between reasons such as regulatory restrictions, faster travel time, lowest cost, only available mode, and so on. During the forecasting phase, the impact of introducing more competition to the freight transport market was measured by taking the trips in which a mode was previously chosen because of regulatory restrictions and allowing firms responsible for these trips to then "choose" another mode.

Although the primary purpose of compiling this data base was to use it for estimation of the disaggregate mode choice model, descriptive statistics and tabulations compiled from survey responses were also used to comment on the current environment. Because data had been collected for all commodities on a nationwide basis, findings arising from the evaluation of the data tabulations proved interesting: not only did they provide a clear description of the status quo to the policymakers but they illustrated that regulatory restrictions do in fact inhibit the exploitation of inherent modal advantages.

UNDERSTANDING COMPETITION: SELECTED TABULATIONS

The status quo modal split between the modes of rail, public road (common carrier), private road (own transport), air, and coastal sea (shipping) is given in the following table, based on ton-kilometers carried by each mode.

Mode	*Percent of Total Ton-Kilometers (excludes block trains)*
Rail	61.46
Public road	21.68
Private road	12.75
Air	0.02
Coastal sea	4.09

Note that this table represents trips in which there is the potential for competition. Rail is the dominant mode of transport in South Africa followed by the road modes. Coastal sea has a small percentage of the ton-kilometer market share in part because it operates only along the coastal routes.

In Figure 2, the modal split within five commodity value categories is shown. As expected, the rail mode is responsible for the major share of low-valued goods. Their market share declines to approximately 19 percent when goods are evaluated with product values of between R2,000 and R10,000/ton (1 Rand = $0.80 in March 1984). However, road and rail have a relatively equal share of the ton-kilometer market for the highest product value category. Most of the sea ton-kilometers occur in the product value range of R100 to R2,000/ton, whereas all of the air ton-kilometers occur in the high-valued product range.

Note, however, that there is no consistent pattern of modal share by mode across the product value categories. If a hypothesis is made that product value has no effect on modal share, then the rail mode would be expected to have a 61 percent share in all product value categories. This is clearly not so, as seen in Figure 2. A more likely hypothesis would be that the lower the product value, the higher the modal share of rail. The converse is expected for the road modal share. This hypothesis is based on the premise that the higher the product value of the commodity the more time-sensitive the commodity becomes to users and the more likely they are to take the road mode. This trend was also previously empirically identified by Roth *(10)*. Consideration of Figure 2, however, indicates no such consistent pattern. Rail is carrying the lower-valued commodities, as expected, but it appears that it is carrying a greater-than-expected portion of the commodities in the highest product value category. This is not surprising, given the current legal restrictions on road haulers.

Although a similar analysis can be undertaken with various other variables such as density, type of commodity, and so on, the distortions are perhaps best illustrated by evaluating the mode split by consignment size and trip length relationship. Only road and rail were selected for this analysis because they are the major movers of freight and are capable of operating in most geographic areas.

This comparison exercise is modeled after a study conducted by the American Trucking Association (ATA) *(10)* in which

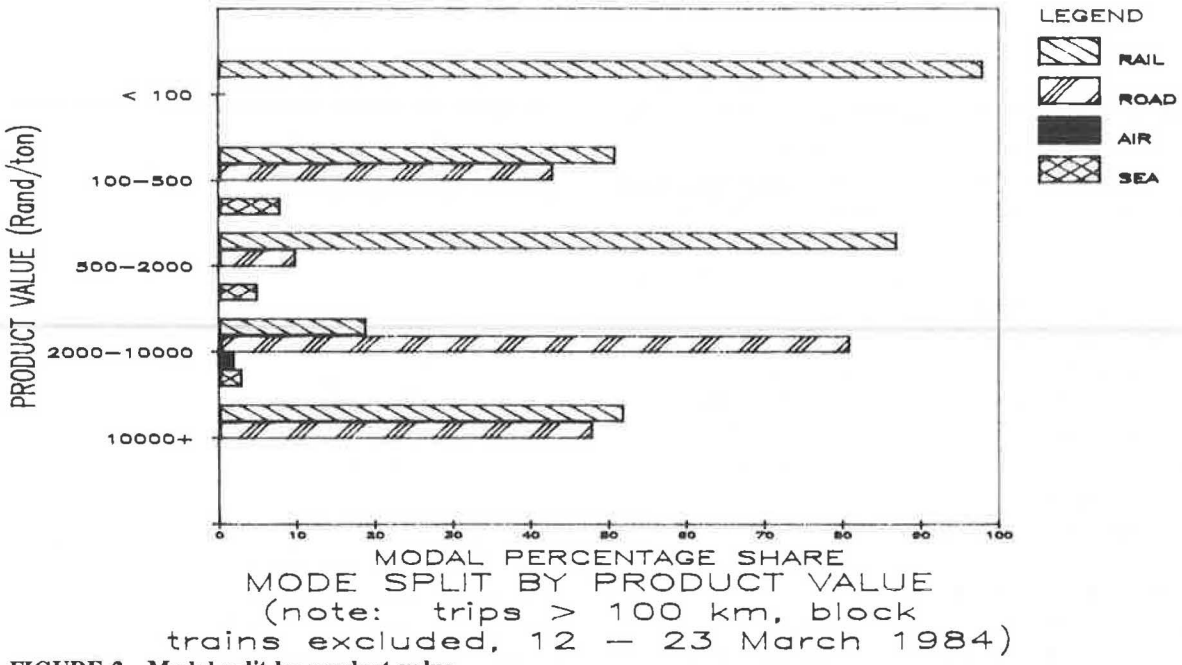

FIGURE 2 Modal split by product value.

data on manufactured commodities were arranged in a matrix table format and analyzed for the extent of road or rail involvement in handling tonnage of various consignment size brackets moving over a series of distance blocks. Figure 3 contains the ATA study results based on 1972 data *(10)*. The results show, as expected, that road dominated the movement of smaller consignment sizes and rail dominated the movement of larger consignment sizes. Competition, or involvement by both modes, was limited to tonnage shipped in medium consignment sizes, which was not an extensive amount. Note that rail-dominated tons represented 28.8 percent of total tons, road-dominated tons represent another 44.6 percent, and competitive tons represent a final 26.6 percent.

The results of a study conducted in South Africa in 1984 are given in Figure 4. Note that cells where the modes compete occur in the small consignment sizes and low-distance categories, even for consignments of less than 5 tons. This finding is interesting because these movements are generally thought to be handled by road and are the movements that tend to be handled better by road rather than by rail. In fact, in the ATA study, road transport was dominant for moving small consignment sizes at all distances. Rail became dominant only for large consignment sizes. The ATA study finding is in contrast to the findings shown in Figure 4, which is not surprising considering the protective measures used to retain the traditional rail market. Thus, rail is a competitor in these unexpected areas.

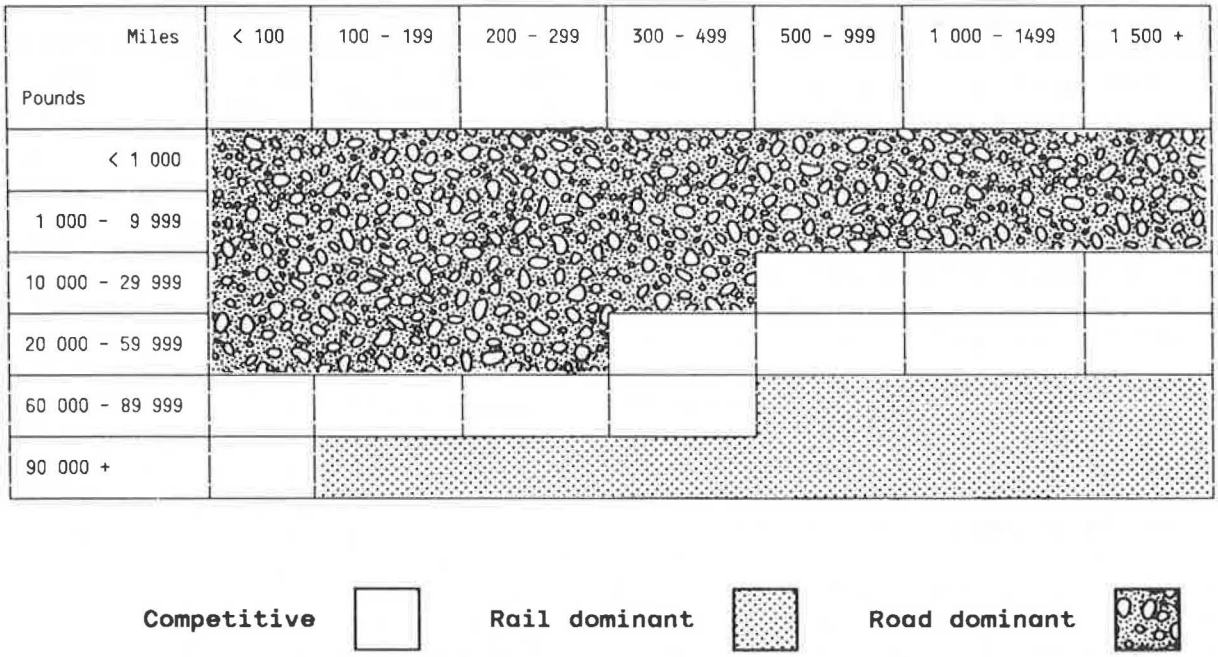

FIGURE 3 Distribution of road and rail mode split in United States for consignment size and distance criteria.

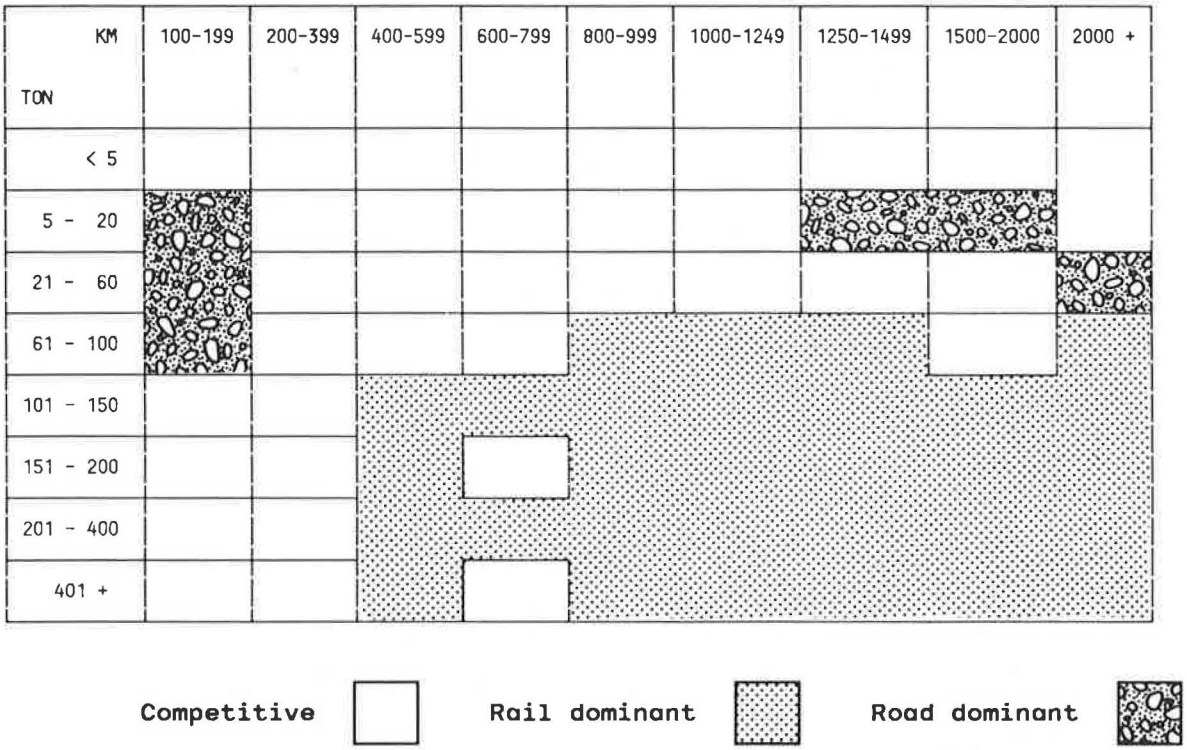

FIGURE 4 Distribution of rail and road mode split in South Africa for consignment size and distance criteria.

Note that road and rail are competitors for 30.7 percent of the tonnage hauled. Road is dominant for another 12.2 percent, with most of this dominance occurring in the shorter distance range. Finally, rail dominates in the larger consignment size and long-distance market, which represents 57.1 percent of total tonnage moved.

Different policy changes would potentially shift the dominance and competitive percentages. It would be expected that in a less regulated environment, road would tend to handle the major portion of the smaller consignment sizes, which constitute about 4.5 percent of the total tonnage market for this sample (where smaller consignment sizes are assumed to be less than 10 tons). Further, it may be expected that the competitive region of traffic would shrink in size as each mode settles into its natural share of the market—where the boundaries are defined more by inherent advantage than by regulatory restrictions.

It should be noted, however, that only two parameters were used in this analysis: consignment size and distance. Thus, before any conclusions on modal advantage can be made, other parameters such as product value, density, or commodity should be tested. So many elements, both observable and unobservable, enter into the mode-selection process that it cannot be conclusively stated that rail (or road) is best in a particular market. Modal advantage is specific to a given situation. The value of the exercise mentioned previously is that it illustrates tendencies or patterns of modal advantage and thus clarifies obvious distortions.

THE MODE CHOICE MODEL OF FREIGHT TRANSPORT DEMAND

On compilation of the disaggregate data base, a multinomial logit mode choice model of freight transport demand was specified and estimated using the BLOGIT maximum likelihood estimation package *(11)* [see *(4)* for a detailed discussion of the model]. Variables included in the model are shown in Table 1. Statistics indicated that the model was significant. It was therefore used as a forecasting tool because many policy-sensitive variables had been included.

One method of prediction using the model is to compare aggregate modal elasticities. Such modal elasticities can be used as an indication of the sensitivity of transport users to changes in the choice of a mode, given changes in a particular level-of-service variable. However, in order to have a more flexible and comprehensive method for evaluating the impacts of proposed changes to the current regulatory system, a forecasting package was developed.

DEVELOPMENT OF THE FORECASTING PACKAGE

The structure of the forecasting package is summarized in Figure 5. Note that the package is centered around the disaggregate mode choice model. As input to the mode choice model, a data set and a level-of-service model are required. The outputs of the model include disaggregate mode choice probabilities and aggregate modal shares.

Given a consignment of a certain commodity from an origin to a destination, the model predicts what the probability will be of choosing a particular mode. The model computes these probabilities for individual trips. Before the mode choice model can compute mode choice probabilities for a given trip, two things are needed: a data base of trips and a level-of-service model.

For the data base of trips, a sample from the same data set used in the model estimation phase was used in the forecasting package.

TABLE 1 DEFINITION OF VARIABLES FOR CONDITIONAL MODE CHOICE MODEL GIVEN CONSIGNMENT SIZE

Variable	Definition
CCNES	Capital carrying cost of the product in transit[a] for nonemergency consignments[b] of size less than 50 kg: value of the product (in rand × 10^3) multiplied by total time (in minutes × 10^3), 0 otherwise.
CCNEL	Capital carrying cost in transit for nonemergency consignments of size 50 kg or more, 0 otherwise.
CCE	Capital carrying cost for emergency[c] consignments, 0 otherwise.
SMLTCOST	Total cost[d] for small consignments, excluding those going by air.
C/TONL	Total cost per ton for large consignments, excluding those going by air.
COSTAIR	Total cost for air consignments, 0 otherwise.
LDCLAIM	The probability of loss and damage multiplied by the number of days to settle a claim.
AT/TTIMEAIR, AT/TTIMESEA	Access time/total time for air and sea, 0 otherwise.
1/DIST	Reciprocal of distance[e] for private road, 0 otherwise.
UR/TTRAIL	Unreliability/travel time for rail, 0 otherwise.
EXEMPT	1 for exempt commodities for public road, 0 otherwise.
SMLRAIL	1 for small consignments for rail, 0 otherwise.
HINTER	1 for hinterland origins for public road, 0 otherwise.
LV*LFD	Log of the vehicle population at the origin multiplied by log of the number of manufacturing and commercial firms at the destination for road, 0 otherwise.

[a] Travel and access time.
[b] Annual usage/consignment size ≤365.
[c] Annual usage/consignment size >365.
[d] Travel and access cost (in rand × 10^3).
[e] In kilometers × 10^2.

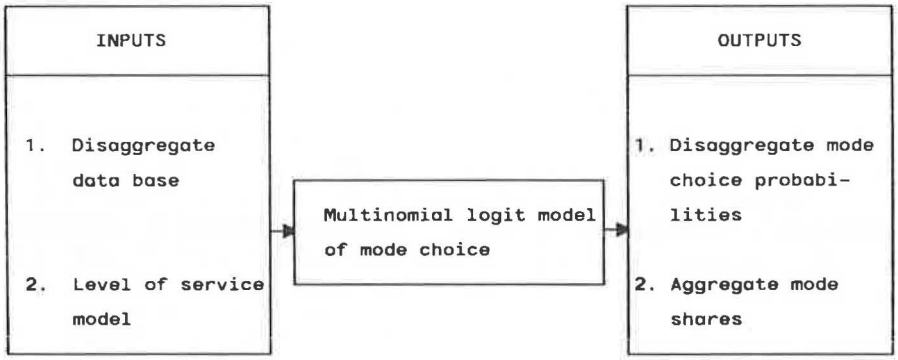

FIGURE 5 Structure of forecasting package.

A level-of-service model was developed to generate level-of-service data for all modes within a transport user's choice set (defined as the modes available to a given user). This model sis necessary because the data base only contains level-of-service information for the chosen mode.

The level-of-service information is computed for five different modes: rail, public road, private road, air, and sea. For each of the modal submodels, there are various models used to compute the level-of-service data. These are: an access cost model, a tariff model, an access time model, a travel time model, a loss and damage model, an unreliability model, and a distance model. In some cases these models are broken down further. For example, the rail tariff model computes different tariffs for rail less-than-carload consignments, rail carload consignments, and rail container consignments. The tariff models for the other modes compute tariffs in a similar manner.

In designing the outputs of the forecasting package, the study team had to keep in mind who would be using it. Although shifts in the modal split at the national level were obviously of general interest, policymakers were also concerned about how deregulation might affect selected commodities or how traffic between major city pairs would be affected. These concerns were taken into account and the resulting forecasting package can accommodate different types and levels of aggregation. For example, modes can be aggregated along a generic level (rail, road, air, sea) or along more specific consignment size dimensions (e.g., rail less-than-carload, road container, air parcels, coastal sea pallet, and so on). For commodity groupings, users can specify a range of classifications (from as coarse as 6 commodity categories to as fine as 38 categories) or they can concentrate on just one commodity sector. Similarly, for the geographic specification, data can be aggregated on a corridor basis or on a nationwide basis.

Policymakers were not only concerned with modal impacts but also with how a policy change would affect the transport users themselves. From a national standpoint, they were also

interested in how effective a particular policy would be regarding government objectives such as energy conservation. Thus, the forecasting package was also designed so that results could be categorized for different population groups: the operators, the users, and the government. Operator impacts are measured by the percent change in revenue, whereas user impacts are given using the measure of percent change in consumer surplus. Government impacts are measured by the percent change in total energy consumption.

UNDERSTANDING COMPETITION: APPLICATION OF THE FORECASTING PACKAGE

During the course of the forecasting phase of the study, policymakers used the model to test out different regulatory policy changes. For example, the government-owned railroad had long been opposed to deregulation. One reason for this opposition was that it was believed that such a move would then place the railroad at a disadvantage compared with road operators (the main competitors). The contention was that road operators could charge artificially low transport prices because they did not pay their full share of road infrastructure costs. Road operators on the other hand strongly opposed paying more in infrastructure costs in part because they feared huge sums would be required and they would lose their fragile market share.

A sensitivity analysis was undertaken using the forecasting package to determine how the implementation of additional road infrastructure costs would affect rail and road operators. Policymakers as well as operators were surprised to learn that implementation of higher road-user infrastructure costs had only a minor effect nationwide. For low-valued commodities, for which fast travel times and minimal loss and damage are as important as cost considerations, it is predicted that road operators will not experience a loss in market share. Because higher-valued products make up the bulk of the road operators' business anyway, the findings helped to quell their concerns.

The model was used to answer many "what if" questions such as those already mentioned. However, probably the most significant use of the model came about when policymakers posed the following question: What would happen if all transport users were given the freedom to select the mode they preferred? As mentioned in the introductory section of this paper, road operators have been constrained by a system of permits to serve a relatively limited number of transport users. This constraint was exemplified in the ton-kilometer market share of the two competing modes: rail had a 61 percent market share of all intercity (excluding block train) ton-kilometers, whereas the road mode's market share was 34 percent. (The remaining market share was taken up by the sea and air modes.)

In Table 2, the impact of implementing a policy option of eliminating regulatory restrictions is quantified.

Note that this option represents the principle of allowing transport users to select the transport mode that best meets their needs. Under the current regulatory system, those transport users who are required to use a particular mode (rail) can be termed "captive." In Table 3 it can be estimated how these captives are affected by a change in the regulatory policy. When this change occurs, the forecasting package predicts a shift of 3.6 percent in ton-kilometers to the road mode and a 0.03 percent shift to the coastal sea mode. This percentage comes from the rail mode, as expected, and the shift measures the captive ton-kilometers (i.e., those ton-kilometers that were legally constrained to use rail before the implementation of the proposed option).

TABLE 2 IMPACTS OF POLICY OPTION IN WHICH USERS ARE FREE TO SELECT MODE OF THEIR CHOICE

Mode	Market Impact (± % in ton-km market share)	Operator Impacts (± % change in revenue)
Rail	−3.66	−2.60
Public road	+2.24	+1.68
Private road	+1.39	+1.02
Air	0.00	0.00
Sea	+0.03	+<0.01

NOTE: User impacts: Percentage change in consumer surplus = +7.82 percent. Government impacts: Percentage change in total energy consumption (MJ/ton-km) = +1.27 percent.

Overall, this result indicates that the current mode split would remain relatively stable if users were free to choose their preferred mode. Some transport users would shift to other modes, as expected, but the ceiling in any one commodity sector appears to be a shift of less than 20 percent of the previous share (not shown).

Most important, however, the consumer surplus has increased significantly by 7.82 percent for implementation of this option. This result shows that transport users are much better off when legal restrictions to the user are lifted—a result that strongly favored deregulation.

In contrast, if regulatory restrictions were indiscriminately tightened (a random selection of 20 percent of users were constrained to use rail), the results given in Table 3 suggest that the transport user would be negatively affected and the consumer surplus would decrease overall by 14.28 percent. Total energy consumption would decrease slightly as consumers switched to rail—the more energy-efficient mode. Note that the market changes indicate an overall increase in rail's share of the total ton-kilometer market of 1.92 percent. Rail's share of the total revenue also increases by 2.69 percent, as expected.

Overall, the major losers are the transport users, indicating that from an efficiency viewpoint, stricter economic regulations should be discouraged.

TABLE 3 IMPACTS OF POLICY OPTION IN WHICH STRICTER ECONOMIC REGULATIONS ARE IMPLEMENTED

Mode	Market Impact (± % in ton-km market share)	Operator Impacts (± % change in revenue)
Rail	+1.92	+2.69
Public road	−1.12	−2.13
Private road	−0.79	−1.26
Air	0.00	0.00
Sea	0.00	0.00

NOTE: User impacts: Percentage change in consumer surplus = −14.28 percent. Government impacts: Percentage change in total energy consumption (MJ/ton-km) = −0.20 percent.

CONCLUSIONS

As part of an investigation into competition in the South African freight transport market, the development of a model capable

of predicting impacts of future policy changes was required. The disaggregate approach to estimating freight travel demand was chosen as the preferred methodology for the study, given that it follows a user-based individual firm oriented approach.

An extensive data base was compiled for use in the calibration of the multinomial logit model. As tabulations generated from this data indicated, the regulatory restrictions imposed on intercity freight transport inhibited the manifestation of inherent modal advantages and in fact distorted traffic patterns within the industry.

Calibration of the disaggregate mode choice model was successful and yielded statistically significant policy variables. This model was then used as the basis for developing a forecasting package. This package is capable of measuring how economic distortions could be minimized by a regulatory policy change.

The model provides a useful link between analysis and policymaking because by using the forecasting package, policymakers were able to evaluate alternative regulatory policies. The impacts predicted by the forecasting package facilitated the formulation of a more market-oriented freight transport policy that will soon be implemented for the country *(12)*.

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