Final Report

Long Term Effects of Rail Abandonment in Arkansas

Project: MBTC 1011

Submitted to:

The Mack-Blackwell Rural Transportation Study Center
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INTRODUCTION

Overview

Railroads are critical to the success of many businesses in the U.S., especially those involved in large-scale production requiring large volumes of bulk raw materials. More than 40 percent of all domestic ton-miles move by rail and railroads move virtually all types of freight (AAR 2007a). They are also a critical component in our participation in a global economy. Railroads are the link between ocean carriers and trucks for shippers moving containers internationally, and intermodal freight is the fastest growing segment of the railroad industry. Recognition of the importance of the rail industry is tied to its development during the late 1800s. In fact, it was considered so important to society and the economy in general that government developed a system of regulations to control its activities. Congress passed the Act to Regulate Commerce in 1887, which created the Interstate Commerce Commission (ICC), and brought railroads under economic regulation of the federal government (Harper 1982). Inherent in this system of regulation is the concept of Common Carrier Obligations, under which rail carriers sometimes have been required to provide unprofitable services that they would otherwise discontinue (Harper 1982).

Although railroads are a vital part of our nation's transportation system and remain subjected to regulation by the federal government, the number of rail carriers has decreased dramatically and operations have evolved radically. Furthermore, the miles of rail line in the network has continually declined so that barely half of the 254,000 miles it had at its peak in 1916 now remains (AAR 2007a). This decline in rail mileage and potential loss of rail service is a major concern of shippers and communities throughout the U.S. (Stewart et al. 1996; Office of

Public Services 1997; AHTD 2002; Babcock et al. 2003a; Babcock et al. 2003b). In response to this concern, government policy makers have attempted to balance the needs of shippers and communities with the financial burden on railroads that are forced to continue operations over unprofitable branch lines.

It is not clear, however, that government intervention to prevent rail abandonment is warranted in today's evolving economy. When railroads were the only reasonable form of transportation, they often had monopoly power and sometimes it was abused (Farris 1969). Under those conditions, there may have been a need for protective regulations, but abandonment of unprofitable branch lines can hardly be classified as monopolistic exploitation. In many instances, rail lines are abandoned because of declining traffic levels resulting from more creative shippers selecting other forms of transportation, especially trucks. Protests are made typically on behalf of firms that are thought to have no alternative means of transport. Unfortunately, their traffic volumes frequently are not sufficient to permit profitable operations of the line. Protective policies of this nature may be simply enabling less creative shippers to continue inefficient and archaic business practices.

Shippers who lose rail service because they are "the last to leave" will find either a new, perhaps more efficient way of meeting their customers' needs, or failing a successful transition, they may become victims of abandonment and cease operations. While the failure of a business should not be taken lightly and may be initially a serious problem for owners and employees, it is difficult to imagine that they could not rebound, since others found preferable means of transport prior to the abandonment (Gittings and Thomchick 1987; Office of Public Services 1997). If firms cannot survive without rail service, and the impact of the abandonment is truly serious, the entire local economy would be affected, not just a single company, and those effects should be

apparent over a long period of time. In fact, federal abandonment policy requires that the STB find "serious, adverse impact on rural and community development" before rejecting an abandonment application (Office of Public Services 1997, p. 10).

This purpose of this study was to examine the long-term economic impact of rail abandonment. To assess these long-term effects, counties in Arkansas that had no rail service prior to 1980 or had experienced rail abandonments prior to 1996 were compared to counties that had not lost rail service during that period. Conditions relating to population, employment, income, banking, manufacturing, wholesaling, and retailing and changes in those measures between 1980 and 2000 were analyzed, using data from the County and City Data Book (U.S. Census Bureau 2007). The next section provides an overview of the railroad industry and its importance. This is followed by a discussion of the decision process in transportation mode selection and organizational response to changes in competitive environments. Provided next is a review of state and federal policy on rail abandonment and then an overview of the literature on the economic impact of rail abandonment. The methodology used in the study is then presented, followed by the results of the analyses. Finally, the conclusions and recommendations are discussed.

Overview of Railroads in the US

Railroads are a vital part of our nation's transportation system and provide essential services to corporate America. As of 2005, there were 560 common carrier freight railroads operating in the U.S. and they earned nearly 50 billion dollars in annual revenue. Railroads employ over 180,000 people and operate over a system of nearly 141,000 miles of roadway. Approximately 40 percent of all domestic ton-miles move by rail and railroads move virtually all types of freight (AAR 2007a). Class I railroads are those that earned approximately $320 million

or more in revenue in 2005. Currently, there are 7 Class I railroads in the U.S., and while they represent just 1 percent of the carriers, they own 68 percent of the rail infrastructure in terms of route mileage, employ 89 percent of the industry's workers, and earn 93 percent of its revenue (AAR 2007a). There were 30 Regional Railroads operating in 2005. These carriers employed about 7,000 people and earned about 1.5 billion in revenue. There were 320 local line haul (short-line Railroads) in operation in 2005, and they employed about 5,700 workers and earned about 1.2 billion in revenue. Switching and terminal (S & T) carriers do not offer line haul, intercity services, focusing instead on local pick up and delivery services or shuttling traffic between line haul carriers within a specified area. In 2005, there were 203 S & L carriers that employed about 6,000 and earned about 800 million dollars in annual revenue (AAR 2007a).

As shown in Table 1, coal is the most important individual commodity moved by railroads. It accounts for approximately 40 percentage of railroads' tonnage and 20 percent of their revenues. Chemicals make up about 9 percent of the tonnage, but account for nearly 12 percent of revenues. Grain and other agricultural products represent about 8 percent of the tonnage and 8 percent of revenue. Non-metallic minerals such as sand, gravel, and crushed stone are also important commodities moved by rail. Other important sources of revenue include food products, steel, forest products such as lumber and paper, motor vehicles and parts, petroleum, and scrap materials. Miscellaneous mixed shipments represent only about 6 percent of the tonnage but nearly 15 percent of revenues. These mixed shipments are primarily intermodal freight movements; the movement of trailers and containers by rail, and is the fastest growing segment of rail traffic (AAR 2007b). In 1980, 3 million trailers and containers moved by rail, more than two-thirds of which were trailers. By 2003, however, the railroads participated in

nearly 12 million intermodal movements, 9.5 million (80 percent) of which were containers (IANA 2007).

Table 1
Type of Freight Carried for Year 2006

	Tons Originated		Gross Revenue**	
Commodity Group	(000)	% of Total	(million)	% of Total
Coal	852,061	43.5 %	$10,821	20.6 %
Chemicals & allied products	168,275	8.6	6,119	11.6
Farm products	149,392	7.6	4,205	8.0
Non-metallic minerals	140,871	7.2	1,462	2.8
Misc. mixed shipments*	125,880	6.4	7,792	14.8
Food & kindred products	105,433	5.4	3,730	7.1
Metals & products	62,256	3.2	2,235	4.2
Metallic ores	60,601	3.1	529	1.0
Petroleum & coke	55,449	2.8	1,651	3.1
Stone, clay & glass products	51,931	2.7	1,664	3.2
Waste & scrap materials	48,280	2.5	1,190	2.3
Lumber & wood products	42,956	2.2	2,335	4.4
Pulp, paper & allied products	37,225	1.9	2,124	4.0
Motor vehicles & equipment	33,668	1.7	4,001	7.6
All other commodities	22,294	1.1	2,782	5.3
Total	1,956,572	100.0 %	$52,639	100.0 %

Source: Association of American Railroads, "Overview of U.S. Freight Railroads," (Washington DC: Association of American Railroads, Policy and Economics Department, January).

The rail system has evolved over the years in response to changes in government policy, changes in the economy, and changes in the competitive environment. In response to these changes the railroad industry adopted a strategy of "downsizing" that has increased the productivity of labor, fuel, and asset utilization while decreasing the number employees, miles of track, and the number of freight cars (Larkin et al. 2005). With the help of the federal government, this downsizing strategy allowed rail carriers to focus on the needs of their most potentially profitable markets. During the 1970s, the rail industry faced such serious financial

problems that the federal government radically changed it philosophy of regulation in an attempt to ensure the rail industry's survival. This is especially pertinent since some of the problems the rail industry faced were due to excessive regulation in the face of promotion of other modes that often put railroads at a competitive disadvantage (Harper 1982; Wood and Johnson 1983).

The services sector of the U.S. economy accounts for over 78 percent of GDP (CIA 2006), and as we evolved toward this service orientation, there were major declines in rail-oriented freight accompanied by the growth of freight that was more suitable for trucks (Harper 1982). Technological improvement in vehicles together with the development of state and federal highways, especially the interstate system, made trucks especially more competitive. The speed, flexibility and convenience of trucks eventually led railroads to eliminate their less-than-carload service (Johnson and Wood 1983).

The elimination of passenger traffic is another example of the rail industry's response to change and its downsizing strategy. Passenger traffic once was an important part of railroad revenue, but development of the automobile and highway construction together with the growth of the airline industry (aided by government) led to serious reductions in passengers, and passenger deficits mounted until the federal government relieved railroads of their common carrier obligations to serve passengers and took over that responsibility with the creation of Amtrak in 1971 (Harper, 1982; Wood and Johnson 1983).

The realization that trucks were better suited for small shipments and pickup and delivery activities led railroads to focus on large customers with high traffic volumes. The movements of coal and grain are excellent examples and together with intermodal freight were critical to the downsizing strategy (Larkin et al. 2004). As noted earlier, coal is one of the most important commodities moved by rail. An individual power plant will use a sufficient volume of coal to

make it economical to load unit trains of 100 cars and move them directly to the power plant and return the empty cars for reloading. Many members of the agricultural community would prefer that rail carriers pickup grain shipments right from their facilities, but railroads would rather let the trucking industry move individual shipments to collection points known as unit train loading facilities. From those facilities, rail carriers can load full unit trains and move them directly to their destination. Changes in government policy on rail abandonment made it easier for railroads to rationalize the rail network and divest itself of unprofitable, light density, branch lines and focus on long distance movements of high volume freight (Office of Public Services 1997).

The development of intermodal traffic, especially Trailer on Flat Car (TOFC) and Container on Flat Car (COFC) was also a product of this response to the evolving environment, but the rail industry believed it should be done on a large scale, not for small, individual shippers, and it became part of their overall strategy of downsizing. During the 1990s, the rail industry closed over 100 intermodal rail yards across the U.S. and began to focus on high volume unit train movements between major cities (Ozment 2001a; Ozment and Spraggins 2001). The role of the trucking industry become intricately intertwined with the rail industry as rail took on the long haul movement of trailers and containers, relying on the trucking industry for pick-up and delivery services between shippers and major intermodal yards.

Larkin et al. (2004) identified intermodal movements (especially containers), coal, and grain as the three major sources of traffic that were critical to the rail industry's continued survival. Clearly, these traffic segments were part of the industry's downsizing strategy, but focusing on high volume long haul freight movements of this nature was accompanied by serious rationalization of the rail network. This generated waves of protests by shippers facing the loss of rail service as carriers abandoned unprofitable, light density branch lines. However, there is

reason to believe that many protests are made by people who are either not aware of better methods of meeting their transportation needs, or who simply resist change and rely on government policies to delay the inevitable. The next section reviews changes in business practices that may help explain why some shippers choose truck over rail, generating declining rail traffic levels that lead to abandonment. The remaining shippers who are unaware of new decision methods might naturally fear (and protest) the loss of rail service when in fact it might be beneficial for them to switch to another mode of transportation. There is also discussion of why some managers simply resist change.

Mode Selection and Organizational Change

Rail lines often are abandoned because of declining traffic levels resulting from some shippers selecting alternative means of transportation, especially trucks. Beginning in the early 1960s, a new and innovative way of making decisions relating to moving goods emerged in the form of business logistics (Bowersox et al. 1961; Boswersox 1965; Smykay et al. 1961; Drucker 1962; Harper 1982; Magee 1960; Neuschel 1967). The logistics concept is based on the total cost of movement, which involves not only the cost of transportation, but also other costs, especially those relating to inventory, that accrue as goods are moved from points of production to points of consumption (Harper 1982; Wood and Johnson 1983; Ballou 2004; Bowersox et al. 2002; Coyle, et al. 2005; Stock and Lambert 2001). As knowledge of this approach spread, many shippers found that shipping smaller volumes by trucks could be less expensive than shipping by rail even though the cost of truck transportation was more than that of rail. Shippers often found that the use of trucks helped them better meet the needs of their customers as markets responded to a changing economy. Those switching to trucks found the higher transportation costs could be off-set by savings in inventory carrying costs due to smaller

shipment sizes, faster and more dependable delivery times, and less damage in transit (Ballou 2004; Bowersox et al. 2002; Coyle, et al. 2005; Gittings and Thomchick 1987; Harper 1982; Stock and Lambert 2001).

Railroads recognized their limitations and began to evolve, eliminating less than carload (LCL) and express traffic, focusing on high volume shippers of bulk commodities and intermodal freight. As small and medium sized shippers switched from rail to truck, railroads sought to abandon unprofitable, light density branch lines. During the 1970s, even though fuel prices made truck transportation proportionately more expensive, escalating interest rates increased the costs associated with inventory, convincing even more shippers to switch from rail to truck for their transportation needs (Gittings and Thomchick 1987; Harper 1982). The Federal Railroad Administration provides a model to assist shippers in selecting between truck and intermodal shipments that incorporates trade-offs between shipment size and inventory (FRA 2005).

Naturally, not all shippers recognize the trade-offs between the costs of inventory and transportation, and some feel threatened by the potential loss of rail service, and many of them look to government for protection from the potential loss of rail service. When faced with a change in its environment, such as a new competitor, new government regulations, or the loss of service (i.e., rail abandonment), an organization may take a long time to realize that it needs to respond or adjust to the change, and it may take even longer to actually make any adjustments. Many notable organizations have gone bankrupt because they failed to adjust to changes in their environment (Staw et al. 1981). However, when an organization reacts to change, it is often in predictable ways. The Crisis-Change model of institutional change suggests that firms will go through four typical phases in dealing with new threats (Fink et al. 1971). First, is the “shock”

phase in which they do nothing, except perhaps contemplate noncompetitive ways of destroying the threat. Second, they enter a phase of "defensive retreat" in which members of the existing system ban together to preserve the status quo, often through legal means. For example, during the emergence of chain stores in the 1920s and 1930s, small independent grocers banned together and lobbied for protective legislation, which resulted in passage of the Robinson-Patman Act (Stern and El-Ansary 1982). During Wal-Mart's rise to its position as a leading retailer, the Association of Retail Druggists and individual communities used legal remedies to block its entrance into various markets (Smith 1989; Kurtz et al. 1995). The next phase is one of "acknowledgement" in which individual member of the system begin a period of self-examination and some begin to doubt the validity of the traditional methods of operation and become open to new alternative ways of doing business. Finally, they enter the phase of "adaptation and change" in which creativity and innovation emerge, permitting those recognizing this need to survive (Fink et al. 1971).

Not all members of threatened systems view changes in the environment the same, and not all firms survive. Some members of a threatened system will indeed alter their organizational structures and operations to cope with potential threats to their environment, but others will remain "rigid" and never emerge from the "defensive retreat" phase (Staw et al. 1981). Evidence from the rail abandonment literature appears to support this theory, as will become evident in a later section. Some firms recognize the need to change their operating methods as the economy evolves and switch from rail to truck to take advantage of the potential savings associated with smaller shipment sizes, less damage, and faster and more dependable delivery times (Gittings and Thomchick 1987; Crane and Leatham 1993). In fact, such actions may contribute to declining traffic levels that lead railroads to file for abandonment. Other shippers remain rigid, not wanting to change, and rely on

government policy to retain their traditional use of rail service. Since very little adverse impact has been shown to be actually associated with rail abandonment, most firms that remain rigid apparently are still able to adjust to their new environments; undoubtedly, some are better off afterwards (Gittings and Thomchick 1987).

Abandonment Activity: 1920-2004

As can be seen from Table 2, over 100,000 miles of rail line have been abandoned since the Interstate Commerce Commission was given control over rail abandonment in 1920. Figure 1 is a plot of that data which shows the steady upward increase in miles of rail abandoned until about 1980. The deep dip in abandoned miles in the 1970s was due to the extensive government activity in reorganizing the bankrupt rail system in the Northeastern U.S. which became Conrail, and the sharp decline in abandonment activity during the 1980s and 1990s was due primarily to a change in federal policy which encouraged Class I railroads to sell light density branch lines to independent operators rather than abandon them. These and other policies affecting rail abandonment are discussed in the next section.

Attempts to prevent rail abandonment have been very costly. In the early 1970s, the Federal Railroad Administration determined that the cost of preparing an abandonment application could be as high as $50,000 (FRA 1973). Moreover, government programs to preserve rail service have cost hundreds of millions of dollars, not counting the direct subsidies to keep the northeast rail system operating during the formation of Conrail under the 3R and 4R Acts. If given a choice, most railroads would abandon light density branch lines and concentrate their efforts on moving high volume, long haul traffic. Thus, government subsidy associated with the branch line assistance program and state rail planning in general actually is not "…a rail subsidy but is in fact a shipper subsidy (Friedlander and Spady 1981)."

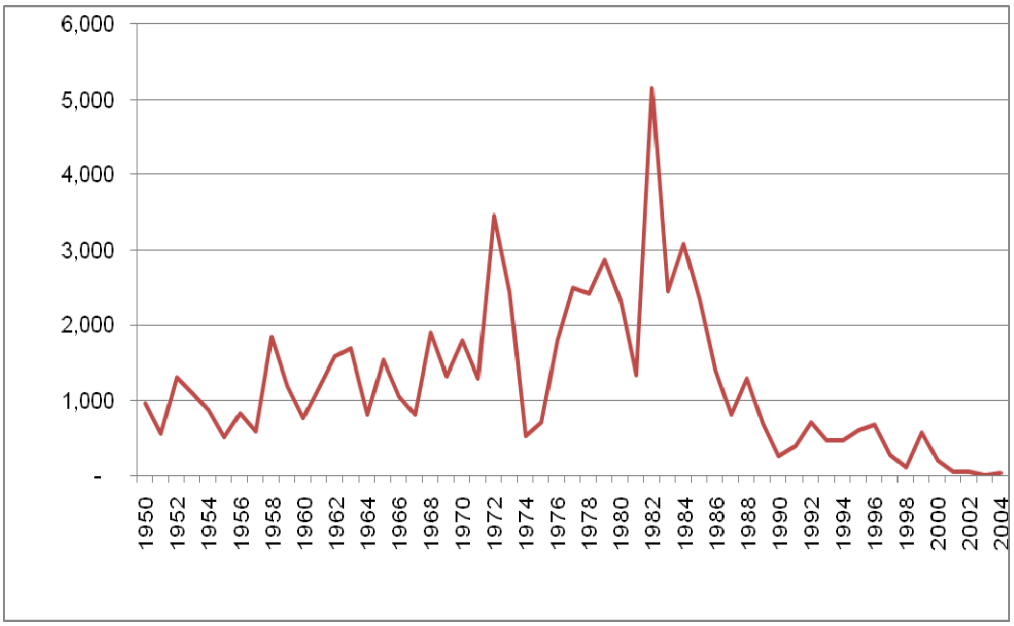
Table 2

Miles of Rail Line Abandoned Since 1920

	Applications				Miles				Granted Since
Year	Filed	Dismissed	Denied	Granted	Filed	Dismissed	Denied	Granted	1920
1950	71	7	8	80	886	93	110	955	35,389
1951	69	5	5	55	815	99	181	564	35,953
1952	91	5	4	84	1,294	41	99	1,306	37,259
1953	72	5	1	77	976	65	6	1,102	38,361
1954	61	6	3	66	498	125	14	873	39,234
1955	80	5	-	62	976	73	-	514	39,748
1956	58	8	1	69	731	71	45	823	40,571
1957	74	8	2	65	1,190	61	89	589	41,159
1958	96	4	2	85	2,062	82	51	1,825	42,985
1959	86	5	4	94	1,203	127	137	1,180	44,165
1960	100	9	3	69	1,682	120	234	772	44,936
1961	98	6	4	101	1,140	376	140	1,167	46,104
1962	122	1	2	95	1,616	8	53	1,582	47,686
1963	127	6	3	110	1,937	77	73	1,688	49,374
1964	109	8	4	83	1,528	248	74	811	50,186
1965	107	13	1	117	2,224	909	121	1,538	51,724
1966	106	8	5	92	920	352	334	1,054	52,778
1967	72	6	7	85	860	195	96	817	53,595
1968	76	3	4	74	2,036	197	76	1,890	55,486
1969	136	5	1	89	2,287	48	12	1,320	56,805
1970	104	19	2	82	762	210	65	1,782	58,587
1971	241	6	3	129	142	21	30	1,287	59,874
1972	273	10	3	268	3,978	263	48	3,458	63,332
1973	266	9	5	198	4,436	114	154	2,428	65,760
1974	139	5	1	24	2,247	58	17	529	66,289
1975	113	169	-	42	3,309	2,774	-	708	66,997
1976	94	15	6	99	1,635	281	78	1,789	68,786
1977	84	24	13	147	1,916	533	422	2,500	71,285
1978	127	9	4	113	3,379	360	111	2,417	73,702
1979	13	3	12	123	4,419	73	799	2,873	76,575
1980	130	33	3	105	4,785	5,259	97	2,322	78,896
1981	161	11	1	81	3,219	25	12	1,342	80,239
1982	382	39	3	381	4,821	696	52	5,151	83,390
1983	178	7	2	123	3,702	91	28	2,454	85,844
1984	472	5	7	419	3,878	69	548	3,083	88,927
1985	138	30	3	148	2,877	657	103	2,343	91,269
1986	141	11	4	117	1,890	275	148	1,417	92,686
1987	60	11	2	60	1,208	268	32	818	93,504
1988	250	9	3	47	1,470	200	33	1,293	94,797
1989	35	12	2	35	809	393	76	699	95,496
1990	18	5	1	15	505	134	28	256	95,752
1991	9	1	-	12	181	10	-	396	96,148
1992	18	1	2	15	700	16	1	701	96,849
1995	12	3	1	13	518	13	123	605	98,381
1996	15	1	2	16	688	201	3	677	99,058
1997	5	1	0	5	306	72	0	264	99,322
1998	9	2	0	6	501	19	0	110	99,432
1999	5	0	1	5	205	0	6	568	100,000
2000	4	2	0	4	205	44	0	198	100,198
2001	8	3	0	1	23	28	0	49	100,247
2002	3	1	1	7	2	2	1	43	100,290
2003	3	0	0	2	39	0	0	1	100,291
2004	4	0	2	2	48	0	47	24	100,315

Source: Interstate Commerce Commission, Annual Report, various years; Surface Transportation Board, Annual Report, 1996-2006.

Figure 1
Miles or Rail Line Abandoned: 1950-2004



Source: Plotted from Table 2.

GOVERNMENT POLICY ON RAIL ABANDONMENT

Early Rail Abandonment Policy

Railroad track abandonment stems from several causes, including overbuilding of the railroad system before l916, local or regional depletion of natural resources, geographic shifting of industry and population, and increasing competition from other modes of transportation. Peak railroad mileage in the United States was reached in l916, at 254,037 miles of intercity railroad route (Harper 1982). Although there was some abandonment of track before that time, almost all of it has occurred since.

From the early days of railroading, some states claimed the right to control abandonment of track by virtue of the railroad company's charter of incorporation. Abandonments were handled by law suits in the courts, or in some states by a railroad or public utility commission. In l907, Minnesota granted to a commission the authority to control abandonments. In l9l9 a Michigan law "provided that the state commission should not consent to an abandonment that was incompatible with the public interest (Cherington, l948)." The general idea was that acceptance of special privileges by a railroad corporation (e.g., eminent domain, monopoly position, public assistance) involve a contractual agreement, express or implied, not to discontinue operation against the will of the state. The legal theory and practical motivation were expounded in an extended dictum in Gates v. Boston and N.Y. Air Line RR Co. (53 Conn. 333, 5 Atl. 695, 1885). A more concise statement came from the Supreme Court of Kansas (Naylor v. Dodge City, Montezuma & Trinidad R.R. Co., 36 Pac. 747, 748, l894):

> The railroad corporation takes its franchises subject to the burden of a duty to the public to carry out the purposes of the charter. The road, when constructed, becomes a permanent instrumentality, and the roadbed, superstructure, and other permanent property of the Corporation all are devoted to public use. From this use neither the corporation itself, nor any person, company or corporation deriving its title by purchase … can divert it without the assent of the state (36 Pac. 747, 748, l894).

The Transportation Act of 1920

Around l916, the number of abandonments began to increase significantly, and interest in controlling them grew in the state legislatures and then in the Congress. Eventually, the Transportation Act of 1920 gave the Interstate Commerce Commission (ICC) virtually complete control over railroad abandonments. The law required the ICC to grant railroads a certificate of public convenience and necessity before a line could be abandoned. The Commission's task

regarding abandonments was to balance the losses of the carriers and the economic impact of abandonment on the shippers and communities involved (Harper 1982).

Balancing these interests was no easy task. There was always the concern that abandonment would be granted too freely, so federal policy typically required railroads to cross subsidize unprofitable operations on socially desirable lines with profits earned elsewhere in the system. Local interests were protected by the view that a rail line may not be abandoned even if it was being operated at a loss as long as the corporation's overall system showed a profit (see State of Iowa v. Old Colony Trust Co., 215 Fed. 307, l914). The railroad's obligation to serve ceased only if the corporation's entire railroad system was operating at a loss. A state requiring continued operation through "internal cross subsidization" would be depriving the corporation of property without due process of law. This doctrine was applied by state courts for some time, and just before passage of the Transportation Act of 1920 it was finally confirmed by the United States Supreme Court in Brooks-Scanlon Company v. Railroad Commission of Louisiana (251 U.S. 396, 40 Sup. Ct. 183, l920). This policy was upheld for many years, as noted by a federal court which said, "… we hold that no confiscation results from an order … denying the abandonment of rail services which are shown to be responsible, as long as there is no net loss to the over-all system (Northwestern Pacific R. Co. v. United States, 228 F. Supp. 690, 694, l964)."

Recent Rail Abandonment Policy

Following the collapse of the Penn Central and several smaller railroads in the northeastern United States during the early 1970s, federal legislation was enacted to reorganize the bankrupt railroads and to plan for the rail transportation needs of the 17 states affected. Congress recognized that the railroads could no longer be expected to cross subsidize the

operation of unprofitable branch lines internally, but they also felt a responsibility to protect the interest of shippers and communities depending on rail service. In their attempt to balance the needs of all parties, government railroad policy began to change dramatically and a new era of government promotion of railroad freight transportation had begun (Harper 1982).

The Regional Rail Reorganization (3R) Act of 1973 was signed into law in early 1974 (Pub. L. 93-236), providing, among other things, a program for subsidizing light density branch rail lines which had been approved for abandonment but which were considered essential by state and local government officials. The seriousness of problems in the rail industry rapidly became more apparent, and additional legislation in the form of the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) (Public Law 94-210), and the Staggers Rail Act of 1980 (Pub. L. 96–448) brought about sweeping changes in both regulation and promotion of railroads in the U.S. By 1995, those changes led to the elimination of the ICC, but the responsibility of balancing the needs of railroads carriers with the concerns of shippers was passed on to the Surface Transportation Board (STB) (Pub. L. 104-88).

The STB is still responsible for balancing the needs of railroads with the concerns of shippers, and the changes that were made with respect to rail abandonment over the years have been preserved and are enforced today by the STB (Office of Public Services 1997). Rail carriers must still obtain permission from the federal government to abandon a rail line, and while legislation eliminated internal cross subsidization as a condition to reject abandonment applications, carriers must still show how continued operation of a line would be a burden. The carrier, however, does not have to show that the line would be operated at a loss, and the "opportunity costs" of tying up assets that could earn a better return elsewhere may be considered. Furthermore, if no traffic has moved over a line for at least two years, and no formal

complaints have been registered, the carrier can petition for an exemption, thus avoiding the traditional regulatory process (Office of Public Services 1997).

Since the level of traffic on an active line may be insufficient to generate adequate profit for the carrier, an application for abandonment may be filed. In these cases, Congress required that sufficient notice be given to those potentially affected by abandonment and that abandonment decisions would be made in a timely manner. Rail carriers are required to maintain a map of all their rail lines, and identify all lines for which abandonment applications might be filed within the next three years (category 1 lines), and identify lines that are considered to be potential candidates for abandonment (category 2 lines). These system maps must be kept up to date and published in newspapers and circulated in counties in which any category1 lines exist. Furthermore, lines must be shown as category 1 for at least 60 days before an application for abandonment can be filed. When an abandonment is not exempt, there are definite limits on the duration of the procedures. Anyone wishing to protest an abandonment must do so with in 45 days after the application is filed. If an application is investigated, the date of the abandonment must be postponed for a reasonable time in order to complete the investigation, but it must be completed within 120 day (Office of Public Services 1997).

The initial purpose of the 3R Act was to protect shippers and communities in the northeast from adverse economic impacts of rail abandonments brought about by the formation of the Consolidated Rail Corporation (Conrail), and through it was created a program for subsidizing light density branch rail lines which had been approved for abandonment. The 4R Act expanded the program nationwide, and further modifications came with the Local Rail Service Assistance Act of 1978 (Public Law 95-607) and the Northeast Rail Service Act of 1981 (Public Law 97-35). Thus, Congress ensured that alternatives would be available to protect

shippers when railroads wanted to abandon light density lines. The legislation required states to develop State Rail Plans in order to qualify for federal funds, and those plans had to be approved by the Federal Railroad Administration (FRA) in the U.S. Department of Transportation (Public Law 94-210). The program evolved from providing operating subsidies for abandoned lines in the northeast to a nationwide program to rehabilitate light density branch lines prior to abandonment and started a wave of state sponsored rail line rehabilitation projects known as the "Feeder Rail Development Program" to help preserve rail services that would otherwise be discontinued (Allen and Vellenga 1983).

The Feeder Railroad Development Program enabled any financially responsible person to force a railroad to sell a line that had been identified as a potential abandonment. This could take place even before an abandonment application was filed. On the other hand, financially responsible parties can prevent an abandonment even though an application has been filed and proceedings are underway. Another important provision in the Staggers Act was that it empowered the Commission, (and later the STB), upon request, to establish the conditions and amount of compensation, or terms of sale, subject to the statutory guidelines. The decision is binding on both parties, except that the person who had offered to subsidize or purchase the line could withdraw his offer within 10 days of the Commission's decision. Offers to subsidize the carrier's service or purchase the line can guarantee continued rail service to the area (Office of Public Services 1997).

The ability of carriers to petition for exemptions made it easier for carriers to abandon unprofitable rail lines, but when coupled with available funding through the "Feeder Rail Development Program," the was also much easier for States and private parties to preserve rail service. In fiscal 1982, the Commission noted a substantial increase in abandonment that was

attributed largely to enactment of the Northeast Rail Service Act of l981 (NERSA) and the consequent increase in Conrail's authority to abandon rail properties (ICC 1982, p. 38). Under NERSA, the Commission had to grant an abandonment application unless an offer of financial assistance was filed within 90 days of the application date. In 1983, there were 17 offers of financial assistance involving 411 miles of track. Sixteen of the offers 16 were to purchase lines and one was an offer of subsidy (ICC 1983, p. 40).

Acting on concerns over this rapid decline of the rail network, Congress amended the National Trails System Act to create the Rail Banking Program to preserve rail corridors for potential future use (Pub. L. No. 98-11). The law was challenged but the U.S. Supreme Court upheld the Trails Act in 1990 (494 U.S. 1). Rail lines proposed for abandonment can be preserved for future rail use through Rail Banking, and in the interim they can be converted to trails for use by the public. Such use can be requested by either a public agency or by private organization once a rail line has been approved for abandonment (Office of Public Services 1997). As of 2006, there were Rail Banked miles 4,628 in 256 corridors in 34 states plus the District of Columbia (Rails to Trails Conservancy 2006).

In balancing the needs of the public with those of the railroad, the potential effects of abandonment on labor also must be considered. Railroad labor has been a major concern for many years, and Congress has dealt with it in many ways, beginning with the Railway Labor Act of 1920. Financial problems of railroads during the 1970s, however, brought a more specific involvement of Congress, including specific Labor Protective Conditions (LPC) under the 3R Act for railroad employees affected by abandonments (45 U.S.C. 701 et seq.) and were extended by Congress when dealing with employees affected by line abandonments arising out of the bankruptcies of the Milwaukee Railroad (Pub. L. 96-101) and the Rock Island Railroad (Pub. L.

96-264). These policies came under severe criticism (Morton 1975), and in the NERSA (Pub. L. 97-35), Congress relieved the Commission of the responsibility of imposing LPCs when deciding the disposition of lines involving Conrail (45 U.S.C. Sec. 1101). However, Conrail was a special case, and labor protection is still required in most abandonments (Office of Public Services 1997).

In general, there are three provisions for labor protection, depending on the situation. In abandonment cases the Oregon Short Line conditions are imposed, in lease transactions the Mendocino Coast conditions are used, and the New York Dock conditions are imposed cases involving line sales to existing carriers. Employees are not covered by any LPC's whenever a line is acquired by a non-carrier or by a Class III railroad, or in cases of forced sales under the "offer of financial assistance" provisions (Office of Public Services 1997).

Clearly, there is great concern for the impact of rail abandonment on shippers, communities, and labor, but the STB must also consider the effects on rail carriers. Before rejecting an abandonment application, the STB must find "serious, adverse impact on rural and community development (Office of Public Services 1997, p. 10)."

REVIEW OF ABANDONMENT IMPACT LITERATURE

Introduction

There has obviously been a great deal of concern over the loss of rail service, and its potential impact. Government has attempted to balance the interests of the railroads with those of shippers, communities, and labor. However, the question remains as to whether those efforts have been effective or whether there are adverse impacts associated with rail abandonment.

The purpose of this section is to review studies that have examined the nature and level of economic impact associated with rail abandonments and to review the methods and techniques

used to measure it. Reviewed first are prospective studies of abandonment. These are studies that have attempted to predict the level of impact before an abandonment is approved. Second, a review of retrospective studies is presented. These studies evaluate the actual impact of rail abandonments that have already taken place. Attention is given to the techniques and models used in the process as well as the level of impact predicted or measured.

Review of Prospective Studies

Tyrchniewicz and Tosterud (1973) developed a modified version of an existing model of plant location based on Stollsteimer (1963) to simulate the effects of various strategies to rationalize the grain handling system of southwest Manitoba. The model expressed total system costs as a function of grain collection costs (from farm to country elevator), handling costs (at the elevator), and distribution costs by rail (from elevator to terminal). Rail rates are legislated in Canada by the federal government and handling rates are established through the Canadian Wheat Board. The simulation was used first to estimate the actual cost to farmers, considering these institutional constraints. Second, it was used to estimate costs based on actual resources used.

The model was run several times to simulate the system taking out 6 light density branch lines, 1 at a time. The order in which the lines were removed was based on an analysis of public hearings. The last simulation was run assuming that all 6 branch lines were abandoned and that all elevators with less than 100,000 bushels capacity on remaining lines were also closed. The lowest cost system in terms of actual costs to farmers was the existing system, but the most efficient system in terms of total resources used was the rationalized system with all six branch lines eliminated.

In June, 1975, the Rail Services Planning Office (RSPO) of the ICC released suggested criteria for state rail planners to use in evaluating the impacts of rail abandonments (RSPO 1975). Section 205 of the 3R Act of 1973 required the RSPO to develop such a criteria to assist state and local agencies in deciding whether to provide operating subsidy on specific rail lines or to permit the rail service to end (Public Law 93 236). The RSPO report suggested that project evaluators should consider the effects of rail abandonments on economic, social, and environmental factors.

According to the report, several economic factors should be considered. These include the effects on employment and income loss in the affected area, the loss of profits to companies affected by the abandonment, government transfer payments to employees and firms, unemployment benefits and/or welfare payments to displaced workers, and loss of tax revenues. Additional economic factors which the report recommended to consider include the impact on shippers' transportation costs, the impact on costs to consumers, the loss of future benefits due to decreased potential for new industrial development and plant expansion, and the decrease in commercial and residential property values which accompany a rail abandonment.

Social factors that the RSPO report suggested should be considered include demographic changes in population distribution, the change in mix of population in rural and urban areas, and changes in lifestyle peculiarities of persons in the affected area. Additional social factors to consider include changes in the diversity of skills among the area's labor force and disruptions in land use plans and zoning regulations. Environmental factors which were suggested to be considered include pollution of air, land, noise, and water.

The RSPO warned that the list of factors was suggested as a guide only, and that no claim was made that it was all-inclusive. In many instances, the factors would need to be used as input

to a complete benefit-cost analysis to determine whether the benefits of preventing line abandonments are greater than the cost of preserving rail service. The RSPO made no attempt to describe the benefit-cost analysis process, but it did suggest that any calculation of costs and revenues attributable to a line under evaluation should be based on the rail service needs of the affected area rather than just upon past or present service levels.

Ladd and Lifferth (1975) also developed a location model based on Stollsteimer's (1963) plant location model, which was similar to that of Tyrchniewicz and Tosterud (1973). However, instead of a simulation, they used a heuristic procedure to maximize net revenue to grain producers. Net revenue was defined as gross receipts from the sale of grain minus the costs of transportation from farm to elevator to final destination, and minus the cost of handling at various points in the channel. The process determined the number, size, and location of new sub-terminals, expansions needed in existing country elevators, and the rail network needed to serve a six and one-half county area in north central Iowa. Grain could move from farm to country elevator and then to sub-terminal, or it could move directly to sub-terminals. From sub-terminals, grain moved to final destination (export markets or local processors) by unit train.

Several solutions were obtained based on different rail abandonment plans, different rate structures, and different prices of grain. The highest net revenue was obtained with 10 sub-terminals shipping 50-car unit trains to final destination. Most of the corn and soybean production was shipped to the Gulf export markets. Country elevators handled 48 percent of the grain. Nine percent was shipped from country elevators to final destination by rail and the other 39 percent was shipped by truck to sub-terminals. Sub-terminals received 52 percent of the grain directly from farmers. The system yielded 5.1 cents net revenue per bushel above that of the traditional system moving the same quantity of grain.

Black and Hunke (1975) studied the potential impact of rail abandonment on communities located along four branch lines in Indiana, Iowa, Maine, and Pennsylvania. The authors concluded that in each of the four cases abandonment would lead to negative economic impacts on communities, counties, and the respective states. Increased transportation costs would occur and would eliminate many firms' ability to compete, forcing some out of business and others to layoff workers. Decreases in employment would lead to loss of area income and loss of taxes paid to state and local governments while unemployment compensation claims would increase. However, in most cases, it was anticipated that the actual impact would not be as severe as shippers predicted.

Baumel, et al. (1976) used benefit-cost analysis to evaluate the economics of rehabilitating 71 branch rail lines in Iowa. A Stollsteimer-type plant location model similar to that of Ladd and Lifferth (1975) was used to optimize the flow of grain, fertilizer, and other products from producers to final destinations. Transportation and handling costs for each of the branch lines were determined under two scenarios. First, it was assumed that the branch line was abandoned. Then, it was assumed that the line was upgraded to 263,000 pound carrying capacity, conforming to FHA Class II safety standards (e.g., 25 mph). The difference between the annual transportation and handling costs of the two alternatives was considered the benefits of upgrading a line rather than abandoning it.

Of the 71 branch line studied, 13 had benefit-cost ratios of 0.75 or more. Eight lines had ratios greater than 1.00 under a multiple-car grain rate structure. Most of the lines (56 percent) had ratios of less than 0.25. The authors explain:

> The reason why so few Iowa rail lines produced a benefit-cost ratio of at least 1.00 is that there are so many rail lines in the state. The additional distance to get to another rail line in Iowa is short, and the incremental cost of moving products to or from another line is small, compared with the incremental cost of upgrading (Baumel et al. (1976).

The key to an efficient system, the authors note, is volume, and upgrading and maintaining many light density branch lines discourages the accumulation of sufficient volume to significantly reduce transportation and handling costs. The implication is that a system characterized by several large sub-terminals receiving grain from country elevators and shipping to major markets in unit trains is more efficient than one in which most country elevators ship small rail quantities direct to major markets.

The authors also examined the effects of rail abandonment on highways. To do so, the incremental cost of construction and maintenance of highways with increased traffic as predicted by the model were compared with the incremental highway revenues from license and fuel tax generated by the increased traffic. The added revenue was generally not enough to pay for the additional construction and maintenance costs associated with the increased truck traffic. However, when the additional highway costs were added to the benefits of upgrading specific rail lines, the ratios changed only slightly. This indicates that the deficit from added truck traffic is only a small percentage of the total benefits of upgrading a rail line. Furthermore, they found the added truck traffic necessary to replace rail shipments was not enough to have a detrimental effect on highway safety.

Anderson, Gaibler, and Berglund 1976) et al., applied Baumel's model basically as described above to a 6 county region in south central Nebraska. As in the application of the model to Iowa, the objective was to maximize net revenue. However, a benefit-cost approach was not used. Net revenue was defined as gross receipts from the sale of grain minus the costs of transportation from farm to elevator to final destination, minus the cost of handling at various

points in the channel, and minus the annualized costs of upgrading and maintaining rail lines in the system.

The optimal system would require 7 sub-terminals in the region collecting grain from farmers and country elevators by truck and shipping to final destination by rail, usually in 50-car unit trains. A total of 668,000 dollars more in annual net revenue was realized under this option than the existing system would generate. Additionally, no existing elevators would be forced out of business by rail abandonment under this option. However, the authors note that in the long-run elevators without rail service may be disadvantaged relative to sub-terminals and country elevators located on main lines.

An analysis of abandonment impact on highways revealed an opposite conclusion from that drawn by Baumel, et al. (1976), using basically the same approach. Although abandonment would lead to increased truck shipments, fuel taxes and licensing fees would far exceed the added cost of highway construction and maintenance.

Berglund and Anderson (1977) reported on an extension of their research in Nebraska which incorporated inbound fertilizer movements into the model along with outbound grain shipments. As in their original study, the objective was to maximize net revenue; however, the cost of handling and transporting fertilizer shipments were now deducted. Additionally, the annualized fixed costs of new fertilizer facilities required under various system configurations were included. Abandonment of about one-fourth of the region's rail line that was in the worst condition, proved to be the most desirable solution. As in the original study, 7 sub-terminals received grain by truck and shipped to final destination in 50-car units. Fertilizer was shipped in 3-10 car lots to an existing warehouse near the study area. From there, it was reshipped by truck to blending plants and dealers. The most costly plan was that of upgrading the existing system.

The authors concluded that fertilizer dealers on abandoned lines will probably not be disadvantaged relative to dealers on existing lines because most existing blending plants in the region were too small to receive multiple-car shipments. Further, they caution that the optimal system may not evolve since neither rail rates nor service characteristics are determined directly through competition.

Boske and Wolfgram (1977) reported on the framework incorporated into Wisconsin's State Rail Plan for analyzing the impact of rail abandonment. Instead of using a traditional benefit-cost methodology, Wisconsin rail planners developed a statistical format which incorporated uncertainty into the analysis. It also converted all measures of impact into indices which permitted analysis of combined effects of variables that are generally reported in unrelated units. For instance, wages lost are reported in dollars, pollutants are reported in terms of emission rates, and energy consumption is reported in BTU's. The indices also permitted a rank ordering of rail lines according to their relative importance to society. Each measure of impact was weighted by its perceived social importance based on the results of a survey of the general public. The methodology includes various measures of economic impact on the local economy and measures of impact on energy, the environment, highways, land use, and public utilities.

Specific values of social, environmental, and economic impact must be estimated, usually based on surveys of rail users and community officials. Through use of the probability distributions for each measure of impact, confidence intervals can be constructed. The confidence intervals are useful in determining a social benefit ranking of rail lines being considered for financial assistance.

This approach does not ensure that the benefits of any specific rail line project will be enough to justify the cost, but the authors suggest that the approach is superior to alternative

techniques for several reasons. One reason, they note, is that more relevant information can be brought to bear on the evaluation of an abandonment. Another reason is that the approach relies on public opinion in determining the relative importance of various impacts. Last, it includes a method of dealing with uncertainty surrounding abandonment decisions.

Tyrchrniewicz, et al. (1978) reported on the results of a study to assess the impact of branch line abandonment and statutory rail grain rates on the economy of Manitoba, Canada. The authors used the Stollsteimer-type simulation model which had been developed earlier by Tyrchniewicz and Tosterud (1975) along with several other models to provide a very detailed analysis of several alternative conditions. Two alternatives in particular were abandonment of uneconomic branch lines and increasing rail grain rates to make the lines profitable; two alternatives open to government to restore earning power to the railroads.

The simulated abandonment of uneconomic branch lines which had been recommended for abandonment by a commission of the Canadian government suggested that major changes in the costs and delivery patterns of grain would occur. It was estimated that the cost to farmers of moving grain to elevators would increase by 248,511 dollars or approximately 2 cents per bushel, on average. However, capacity reductions due to closure of the elevators on the lines would decrease operating costs in the elevator industry by over one million dollars annually. The impact of abandonment on highways was not expected to be significant since the increase in truck traffic was small relative to the existing level on roads in the region.

Eliminating railroad branch line deficits by raising the rates to ship grain would require a 258 percent increase in costs to farmers. This would mean an additional cost of over 17.6 million dollars per year, or 13 cents per bushel. A simulation of the combined effects of line

abandonment and rate increases resulted in an increased cost to farmers of 19.7 million dollars, or 13.2 cents per bushel.

Schuler (1979) used factor analysis to analyze 26 variables in order to develop an aggregate index of rail abandonment impact. The variables used in the study were those suggested by the ICC (RSPO 1975). Five factors emerged from the analysis which were labeled (1) industrial inertia, (2) direct employment loss, (3) local and state economy, (4) social-environment, and (5) cost of movement. The index was formed by the sum of all factor scores. The factor scores provide a set of measures that represent the positive or negative impacts of an abandonment.

The author applied the model to 21 branch lines totaling 500 miles in Indiana. These 21 rail lines had been evaluated previously by state rail planners in Indiana. A comparison of rankings of the lines revealed substantial differences. The author concluded that the differences were due to the omission by state planners of important variables which help explain the economic and social impact of abandonment. The technique does not consider whether the benefits of keeping a line in service would exceed the cost to the public. However, the author suggested that the technique was superior to arbitrarily or subjectively selecting variables to measure the impacts of rail abandonment.

Fleming and Yansouni (1980) evaluated the potential impact of rail abandonments in Canada. They compared the cost associated with abandonment and closure of all elevators on a line (as required under Canadian grain licensing laws) with two alternatives. One of the alternatives was the retention of an off-track elevator to be used as a collection point from which large truck shipments to a nearby rail-based elevator would be made. The other alternative was to retain rail service exclusively to the site of what would otherwise be the off-track elevator.

Under the complete closure situation, grain producers would bear the burden of increased shipping costs to an on-line elevator. However, government would eliminate the cost of railroad operating subsidy as well as the cost of rehabilitating the line. If rail service was retained to one site, producers would still incur increased delivery costs but less than if no elevator was retained. Additionally, government would incur the cost of rehabilitation of the rail line and possible rail subsidy expenditures. Under the off-track option, producers would also experience a minor increase in delivery costs, but government would not incur the cost of subsidy or rehabilitation. Instead, government expenditures would be required to cover the commercial trucking costs and secondary elevation at the off-track site.

The authors concluded that the greatest savings resulted from abandonment and complete closure of all elevators on the line. The least attractive alternative was the off-track elevator. The savings in rail subsidy and rehabilitation costs were not enough to offset the added cost of commercial trucking and secondary elevation.

Nellas (1982) developed a network planning model to analyze the alternative effects of abandonment and rehabilitation on shippers and communities in Iowa. The model used was different from those of previous studies in that it incorporated consumer's surplus into the calculation of public benefits of preventing line abandonment. Consumer's surplus is the maximum sum of money a consumer would be willing to pay for a specific good or service, less the amount actually paid (Mishan 1976). Furthermore, prior studies had typically evaluated rail lines in a predetermined order without considering that the benefits of retaining each rail line are dependent upon the existence or nonexistence of other lines in the system. Consequently, this study attempted to determine the optimal rail system by examining all possible network configurations. For instance, if one rail line is to be eliminated, which line should it be? If two

lines are to be eliminated which two? And so on until all potential combinations have been examined. The results of the network model were compared to those of the Baumel, et al. (1976). Similar results were found in areas where there were a small number of lines to be examined and where rail lines were independent of one another. However, in areas where a large number of interdependent lines exist, the two approaches produced different results, illustrating, according to the author, "the importance of theoretically sound benefit measures in situations for which optimal solutions are not obvious Nellas 1982)."

Bangsund, et al (1996) examined the potential economic impact of abandoning the Carrington to Turtle Lake rail line in North Dakota. They estimated that the combined effects of increased shipping costs, damages to the road system, effects on local employment, reductions in local tax revenues, reduced economic development opportunities, and some secondary impacts would total $1 million annually. The direct increase in transportation costs to shippers on the line was estimated to be 329,000 dollars annually, and the annual secondary impacts were estimated to be 682,000 dollars.

Babcock et al. (2003b) used simulation to assess the potential impact of transportation and handling costs on shipments of wheat resulting from the abandonment of short line railroads in Kansas. The simulation was based on Arc View Geographic Information System (GIS) software and a truck routing algorithm Babcock and Bunch (2002). They simulated the costs of wheat movements through the system first with, and then without the short line rail system in place. The difference in the two scenarios led them to conclude that abandonment of short line railroads would increase the costs of transportation and handling by 20.7 million dollars.

In a second publication from the same study, Babcock et al. (2003b) assessed the impact or rail abandonment on damage to highways in Kansas. In this portion of the study, they

included a Highway Pavement model developed for the Washington State Department of Transportation (Tolliver 2000). The results of the simulated the Kansas wheat system with and without short line railroads suggested that damage costs would be approximately 57.8 million dollars annually. The additional state fuel tax revenue was only estimated to be 0.5 percent of the annual cost of additional damage.

The Wisconsin State Department of Transportation's concern over the potential abandonment of rail service from Saukville to Kiel led to the State's purchase of the line studied the potential effects of abandoning rail service between Saukville and Kiel (Leong et al. 2004).

Review of Retrospective Studies

Theodore and Doody (1976) analyzed the impact of abandonment of the Rutland Railroad on the New England economy. There was no measurable effect on non-railroad employment; however, 365 railroad employees lost their jobs because of the abandonment. A year later, 62 were still unemployed.

Most shippers had access to other railroad transportation or had been relying on trucks prior to the abandonment. Consequently, shipper impact was judged to be minimal. The worst impact was on shippers of low value, bulky commodities such as lumber, coal and feed. Most of these companies were able to pass along the increased costs to their customers, except when they were in competition with companies that still had rail service. A few coal and feed dealers were forced out of business, but most survived. There was very little impact on manufacturing. For all but one of the manufacturers, the additional costs were insignificant and simply absorbed. Fuel oil dealers found that trucks offered a superior level of service, and as a result, these companies experienced a reduction in total operating costs following the abandonment.

Zasada (1968) examined the effects of two rail abandonments on grain elevators in the wheat producing regions of Saskatchewan and Manitoba. To be licensed in Canada, a grain elevator must be located on a rail line. Therefore, all elevators on the two lines closed following the abandonment. However, elevators on nearby lines underwent capacity expansions almost equivalent to the reduction in capacity on the abandoned lines. One of the nearby lines was being considered for abandonment, and the elevating capacity expansion on this line was of a temporary nature, in the form of annexes. Expansion on the nearby line which was not being considered for abandonment was in the form of elevators.

Abandonment did not appear to lead to a reduction in the elevator capacity of the region. However, it led to a more highly concentrated grain handling system. The author concluded that this may not be in the best interest of the industry. The ratio of volume of grain handled to capacity (capacity turnover) is not improved as long as capacity reductions resulting from abandonment is replaced elsewhere in the system. He suggested that careful planning of capacity is needed.

The firm of Simat, Helliesen, and Eichner (1973) prepared a report for the U.S. Department of Transportation (USDOT) on the impact of rail abandonment on shippers and communities along 10 branch lines which had been abandoned in the northeastern U.S. during the mid-1960s. The study compared the allegations and predictions made during protests at public hearings with actual consequences of the abandonments. Most businesses continued to prosper in spite of the loss of rail service. Several firms were forced out of business following the abandonment, but most of these companies were marginal in nature and would probably have eventually failed even had rail service been retained.

Transportation costs increased for most of the former rail users. The types of businesses most adversely affected by abandonment were feed, fertilizer, coal, and lumber dealers. Large firms were generally better able to adjust than were smaller firms. Additionally, many communities could not attract new industry because of the lack of rail service.

Bunker and Hill (1975) studied two abandoned rail lines in Iowa and compared firms that had lost rail service due to abandonment with nearby firms that were still served by a railroad. The first line (Case I) was abandoned in 1971 and ran approximately 95 miles from Oskaloosa, Iowa to Kiethsburg, Illinois. The second line (Case II) was abandoned in 1969. It was 14 miles long and located in central Iowa. The shippers located along the line in Case I had access to water transportation on the Mississippi River while those shippers on the line in Case II were geographically restricted from using water transportation as a substitute for rail service.

The results of the study indicated that the proximity to water transportation was an important element in adjusting to the loss of rail service. The grain elevators studied in Case I experienced virtually no adverse impact due to abandonment; however, elevators in Case II were somewhat adversely affected. The control group of elevators in the study which retained rail service increased grain shipments by over 147 percent from 1968 to 1973, but the Case II elevators were able to expand their grain shipments by only 45 percent during the same period. Fertilizer distributors in both cases experienced increased transportation costs, and in case II the effect was markedly worse; one of the firms was forced out of business due to abandonment. In both cases, however, the remaining fertilizer dealers continued to expand sales in spite of the higher transportation costs.

Due (1975) studied the effects of rail abandonment in Sherman County, Oregon. The line had been used primarily for the movement of export wheat traffic. After the abandonment, most

grain shipments were made by truck to either of two major terminals located near the Columbia River. However, only one of the terminals had access to water transportation. This provided shippers with two basic alternatives for grain shipments destined for Portland. One alternative was to use truck-barge combination and the other was to use truck-rail combination. The truck-barge combination offered shippers a slightly lower transportation cost than had been incurred by making direct rail shipments before abandonment. The cost of the truck-rail alternative was slightly higher than before abandonment.

Other effects of the abandonment were also minimal. The area lost approximately 9,000 dollars per year in property taxes previously paid by the railroad, but this was a very small percentage of total taxes of the county. There was also an additional investment in county roads required. Many of the communities studied had been declining in population, but the loss of the rail line seemed to speed up the process somewhat.

Allen (1975) reported on the impact of rail abandonment on 10 communities in states from New York to Texas. The analysis focused on increases in transportation costs, short-run adjustments to abandonment, and the overall long-run effects. Most of the communities studied had unbalanced traffic patterns with inbound shipments dominating the flow. The worst impact was on receivers of feed, fertilizer, and coal. In almost all of the communities, coal dealers were forced out of business due to increased transportation costs. For other businesses, the major cost was a one-time expense resulting from establishing new procedures for shipping and receiving goods. Most firms using rail service at the time of abandonment were either able to switch to truck transportation at no extra expense or were able to pass along any increase in transportation costs incurred. Even though many employees of coal dealers lost their jobs in almost all of the communities, only 2 of the 10 communities actually experienced a negative impact on aggregate

employment. In many instances, the abandonment led to the creation of new jobs such as truck drivers and extra labor for double handling of goods that had to be transshipped. Little evidence was found to support a belief that two of the counties rail abandonment produced any long lasting adverse effects.

Sloss et al. (1975) evaluated the impact of rail abandonment by comparing nine counties that had lost rail service with nine counties that had lost no rail lines. Two of the counties studied were in Oklahoma, and the remaining were in Arkansas, Georgia, Michigan, Minnesota, Missouri, North Carolina, and Texas. Each of the control counties was in the same state as the county without rail service with which it had been paired.

The authors compared the two sets of counties on the basis of the percentage changes in measures of economic development from before the abandonment until after it. The measures used were: changes in bank deposits; value added to farm products; value added in manufacturing; employees in manufacturing; net capital expenditures; retail sales; and wholesale sales. The percentage changes in measures of economic development in the counties that had lost rail service were not significantly different from those in the control counties. Hence, they concluded that the economic development of a county would not be affected by the loss of rail service.

Miller, et al. (1977) reported on the results of a study to evaluate the impact of rail abandonment on communities and grain shippers in Iowa. The authors compared performance measures of cooperative elevators and incorporated towns that had lost rail service before 1974 with performance measures of cooperatives and towns still served by a railroad. The performance measures of cooperatives included total sales, grain sales (in both dollars and bushels), fertilizer sales, total assets, and return on investment. Community performance

measures included population, retail sales, bank demand deposits, bank loans and discounts, and bank surpluses and undivided profits.

The results indicated that there were no significant differences in communities that have lost rail service and communities that still have rail service. Nor were there any significant differences in cooperatives that have lost rail service and cooperatives that still have rail service. Cooperatives located on abandoned rail lines actually experienced slightly higher rates of return on investment than did elevators with rail service. The authors reported that managers of the cooperatives that lost rail service completely reevaluated their elevators' operations. The loss of rail service appears to have stimulated better management practices and improved efficiency which, in turn, led to higher profitability. The authors noted:

> ...contrary to popular opinion, cooperatives located on abandoned rail lines do not die but rather continue to grow...The results...tend to confirm the conclusions of case studies that suggest minor or negligible impacts of rail abandonment on rural towns and elevators (Miller, et al. 1977).

Spraggins (1978) studied grain elevators in Minnesota that had lost rail service between 1966 and 1975 in order to evaluate the Interstate Commerce Commission's policy on rail abandonment. He compared grain elevators that had lost rail service with nearby elevators that were still receiving rail service. In the majority of cases, elevators that had lost rail service were faced with truck rates that were actually lower than the rail rates faced by nearby elevators. Elevators that had lost rail service were able to expand in terms of grain sales and capacity just as well as rail-based elevators. Elevators located on existing rail lines had slightly higher capacity turnover ratios than elevators on abandoned lines, but the relative changes in turnover from 1969 to 1975 were not substantially different.

The author suggested that abandonment could permit the development of large sub-terminal elevators and take advantage of low cost unit train rates to major export grain markets such as ports along the Gulf of Mexico. The low cost transportation would permit the sub-terminal to offer prices to farmers and country elevators which could offset the cost of trucking grain to the sub-terminal. The net effect, he concluded, "...could be to actually increase returns to the elevator losing rail service as well as to the affected farmers (Spraggins 1978)."

The firm of Ernst and Whinney (1981) prepared a report for the Federal Railroad Administration on shipper responses to the loss of rail service. The report was based on a telephone survey of 135 companies that lost rail service between 1976 and 1980. Some shippers had been on lines that were closed when Conrail was formed in 1976, and the remaining were on Rock Island and Milwaukee Road lines which had been abandoned during 1979 and 1980. Of the 135 cases examined, only 2 firms were forced out of business as a direct result of the loss of rail service. Three firms were forced to relocate. Most firms surveyed (83 percent) experienced an increase in transportation costs, but only 20 respondents (15 percent) indicated that they had experienced a drop in sales as a result of the increase in transportation expenses. Unfortunately, no comparisons were made with companies that still receive rail service, so there is no way of knowing whether the increased transportation costs were simply the result of inflation or if they were actually caused by the abandonment.

Firms most likely to be hurt by rail abandonment were found to be those that simultaneously meet three conditions. First, transportation cost must be a significant portion of the total delivered cost of the firm's major products. Second, there must be little opportunity to differentiate their products from those of competitors. Last, competitors must have rail service.

Maloney (1982) reviewed the effects of two rail abandonments on rural communities in Alberta, Canada. The populations of some of the communities studied had been declining even before abandonment and some have increased since abandonment. The critical task, the author concluded, is to identify communities that are stable economic centers before abandonment but which would decline if rail service were terminated. Characteristics of such communities include: a population between 200 and 1,000; a tax assessment that is more than 30 percent dependent on rail properties; a business environment; a municipal and social infrastructure that serves a rural hinterland; a geographical location close enough to alternative grain elevators so that farmers will not have to haul grain more than 10 additional miles; and good road access.

Communities that fail to meet the minimum level of these criteria would probably decline even if rail service was retained, and those communities that surpass the criteria would probably survive in spite of abandonment. According to the author, the former type of community is not worth attempting to save, and the latter type does not need assistance. However, communities that fit the profile outlined above will probably need public assistance to survive, and failure to provide it may lead to significantly adverse impacts. The author suggested that careful planning could prevent problems which may result due to abandonment.

Gittings and Thomchick (1987) did a longitudinal study of shippers located along six rail lines in Pennsylvania. Shippers were contacted by telephone twice, first during 1983 and again in 1986. The lines on which the shippers were located were not yet abandoned, but were likely candidates, based traffic volume and density. The 1983 survey revealed that the majority of respondents had switched from rail to truck during the early1980s because of lower truck rates and improved service levels following deregulation of the motor carrier industry. Some cited the desirability of shipping smaller lot sizes by motor carriers, especially given the relatively high

interest rates and subsequently higher cost of holding inventory. The researchers pointed out that small shippers would pay substantially more for truck service than rail as long as the shipment size permitted them to hold smaller inventory levels, and that the truck-rail rate differential, or competitiveness of rail rates became more important only for large shippers who necessarily shipped larger volumes. A single shipper on a line accounted for as much as 35 percent of the volume of rail traffic in two instances.

By the end of 1986, six of the shippers who had been surveyed in 1983 were out of business. However, only one shipper had reported that the potential loss of rail service would hurt its business, and the rail line on which that shipper was located was still active, so it was determined that the regional economy was the problem, not the loss of rail service. The remaining respondents were all using motor carrier services as their major transportation mode, and over half of them were using trucks exclusively. The dependence on motor carriers was attributed to the desire to reduce inventory in their own facilities as well as those of their customers. Overall, the effect of changes in rail service on shippers surveyed in 1983 was, "only a low to moderate impact from even the worst-service scenario, namely abandonment of rail service (Gittings and Thomchick 1987, p. 24)." The authors concluded that it was important to consider total logistics costs and the range of logistics alternatives available when evaluating the impact of the loss of rail service on shippers.

Crane and Leatham (1993) performed an economic analysis to examine the relationship between transportation expenditures and economic growth for rural areas in Texas. They found that switching from rail to truck could create jobs in construction, maintenance and other areas, as well as improve access to and from rural areas and had a positive economic impact on both farm and non-farm incomes, and on employment growth.

Sanderson and Babcock (2005) studied the effects of rail abandonment at the county level in Kansas using an econometric approach that had not been used in prior studies. They examined county level data from the U.S. Department of Commerce and the Kansas Department of Transportation. They assessed the effects of abandonment on a wide range of variables including the prices of goods and services, factor payment levels, production decisions, income and related measures, and wealth. They suggested that the effects of abandonment may not be immediate, and therefore lagged variables up to four years to estimate the effects of abandonment on areas in later time periods.

Their results indicated that only a few the coefficients for abandonment-related variables were statistically significant, and in most cases, they were not what were expected. They "any adverse impacts appear to be minimal (Sanderson and Babcock 2005, p. 108)." They found that population growth had the strongest effects on economic measures at the county level, and this was followed by regional product growth. The effects of abandonment were initially followed by net growth, but some of it is possibly temporary. They suggested that adverse effects may not appear for a number of years beyond what they measured with their lagged variables.

Conclusions Regarding Abandonment Impact Literature

In many respects, the studies reviewed offer conflicting conclusions regarding the impact of rail abandonment on shippers and communities. However, a few generalizations can be made. First, prospective studies relying on input from managers and community officials who face the loss of rail service appear to predict much worse effects than do studies that rely on available cost data to model the impacts of rail abandonment. Second, the effects of actual abandonments appear to be less severe than those predicted by most of the prospective studies employing mathematical models, and, according to retrospective studies, the actual level of adverse

economic impact due to rail abandonment has not been serious. Finally, most rail lines approved for abandonment have had major declines in traffic prior to the carrier filing with the ICC/STB, and they have little or no traffic at the time of abandonment. This decline in traffic is a function of shippers, especially small shippers, switching to motor carriers to take advantage of savings associated with smaller shipment sizes, less damage, and faster, more dependable delivery times.

The discrepancies in findings of prospective and retrospective studies may be due to the fact that only a limited set of anticipated responses to abandonment can be analyzed, but shippers have many alternative ways in which to cope with the loss of rail service. Each mode of transportation has its unique advantages. In the past, most shippers that have lost rail service have apparently been able to take advantage of specific benefits offered by alternative modes or combinations of modes and have successfully adjusted to their new environments. Another explanation of these discrepancies may be found in the cost of holding inventory. Very few of the studies reviewed refer to inventory costs at all, and the prospective studies that have attempted to consider the effects of inventory have incorporated them into their measures of unit handling costs (i.e., Baumel, et al. 1976). This necessarily assumes that inventory costs increase with the volume of goods handled, but it is widely acknowledged that inventory costs are an increasing function of the average level of inventory on hand (e.g., inventory turnover), not of the overall annual volume, per se (Lambert and Stock 2003; Coyle, Bardi, and Langley 2006; Ballou 2002).

Many studies have stressed that increased transportation costs are an adverse effect of rail abandonment. However, the smaller shipment sizes associated with truck transportation, vis-a-vis rail transportation, will permit lower average inventory levels. Truck transportation also

offers lower costs of inventory in transit and lower costs associated with safety stock due to faster and more predictable delivery times, respectively. In many cases, the reduction in inventory costs is apparently sufficient to offset the higher cost of premium forms of transportation. This helps explain why so many shippers switch to truck service, adding to declining rail traffic levels. Furthermore, some shippers are undoubtedly able to enjoy a reduction in inventory carrying costs after losing rail service, even when they are forced to change modes (Gittings and Thomchick 1987).

Railroads are for-profit corporations, and they base abandonment decisions on their ability to profitably perform their services. In most instances, railroads attempt to abandon rail lines only after shippers have abandoned them. Thus, one might conclude that when adverse impact occurs due to abandonment, it might well be that the shippers affected have not made good decisions regarding their choice of transport mode. In fact, there is evidence to suggest that very few shippers are aware of how to measure the trades offs between carrier rates and inventory carrying costs associated with shipments size, transit times, and transit time variability (Ozment 2001b). While shippers may be aware of "trade-offs" in general, the actual measurement of relevant costs is not something that is intuitive, and can require collection and computation of complex data. The Federal Railroad Administration (2005) provides a comprehensive model for analyzing supplier choice, shipment size, and mode but it is apparently not widely distributed, and managers in general are not well educated with respect to decisions involving transportation and logistics.

Consequently, attempting to assess the effects of abandonment impact on individual shippers can provide misleading results. This is in line with federal policy requiring the STB to find "serious, adverse impact on rural and community development" before rejecting an

abandonment application (Office of Public Services 1997, p. 10). If the overall economic well being of areas that have lost rail service are not worse off than areas that have not lost rail service, then one would conclude that in the aggregate, shippers have adequately adjusted to the new environment.

METHODOLOGY

Hypotheses

In many instances, rail lines are abandoned because of declining traffic levels resulting from more creative shippers selecting other forms of transportation, especially trucks. Protests are made typically on behalf of firms that are thought to have no alternative means of transport, but remaining traffic volumes may not be sufficient to permit profitable operations of the line. Protective government policies may be simply enabling less creative shippers to continue inefficient and archaic business practices. Shippers who lose rail service because they are "the last to leave" should be able to find new and more efficient methods of transportation. If firms cannot survive without rail service, and the impact of the abandonment is truly serious, the entire local economy should be affected, not just a single company, and those effects should be apparent over a long period of time.

Thus, if the overall changes in economic conditions of areas that have lost rail service do not decline or are not worse than the changes in areas that have not lost rail service, then one would conclude that, in the aggregate, shippers have adequately adjusted to the new environment. If, however, the effects of rail abandonment have been negative, this impact should be manifest in the economic conditions of the area and the rates of change in those conditions over time. Thus, for the purposes of this analysis, the following two general hypotheses regarding the effects of rail abandonment are tested:

H1: The economies of areas that have not lost rail service will be better than those of areas that do not have rail service or that have lost it.

H2: Over time, the change in economic conditions in areas that have not lost rail service will be better than the change in conditions in areas that do not have rail service or that have lost it.

Data and Variables

To test these hypotheses, data from the County and City Data Book and from the U.S. Census Bureau's Website for USA Counties were examined. The variables that were analyzed reflected the economic conditions in those counties in 1980, 1990, and 2000. In some instances, data were not available for those years and other years were used (i.e., 1979, 1989, and 1999 or 1982, 1992, and 2002). Specific years used are identified in the results. The percentage changes shown over the first 10-year period (i.e., between 1980-1990), or the second 10-year period (1990-2000), or the full 20-year period (1980-2000) are divided by 10, 10, or 20, respectively, to provide to annual rates of change.

The variables analyzed in the study shown in Table 3 and reflect a variety of economic conditions relating to population and employment, income, banking, manufacturing, wholesaling, and retailing. Some of the data were not available for all counties, so the number of observation is shown together with the means and p-values, which indicates whether the differences in means of the two groups is statistically significant. P-values of less than 0.05 indicate at least a 95 percent probability that the difference shown is meaningful (Kutner et al. 2005).

The sample studied included 75 counties in Arkansas, which were divided into those that did not have rail service as of 1980 or had experienced abandonment prior to 1996 and counties that had not lost any rail service during that time. Figures 2 and 3 are maps of Arkansas showing

the rail network system as of 1975 and 2002. Many counties have experienced abandonments, and clearly, some of those still have rail service in other areas, but for convenience of discussion, those counties that experienced abandonment during the study period will be referred to as "counties with abandonments" and those that did not lose any rail service during the study period will be referred to as "counties without abandonments." The counties in each category, and their populations as of 2000, are shown Table 4.

The counties marked with an asterisk are the largest in Arkansas. As can be seen, each of these four counties had populations in 2000 of over 115,000; two had populations of over 150,000 and one had a population of over 300,000. Three of these four counties had rail service and had not lost any rail lines since prior to 1980 (if ever). Since no other county had a population of more than 90,000, their presence could introduce a bias into the analysis, so they were omitted from the analysis. However, Appendix A includes an analysis in which these counties are included.

The goal of this analysis was to assess the long-term effects of rail abandonment, and, as noted by Sanderson and Babcock (2005), the effects of abandonment may not be felt for some time, so counties that did not experience their first abandonment until after 1995 were included in the analysis as part of the sample that had not lost rail service. Table 5 shows the abandonments that took place in Arkansas after 1995, according to the Surface Transportation Board dockets (STB 2007). There were 13 counties affected by those abandonments, but some had experienced abandonment prior to 1996.

Figure 2
Arkansas Rail Network: 1975

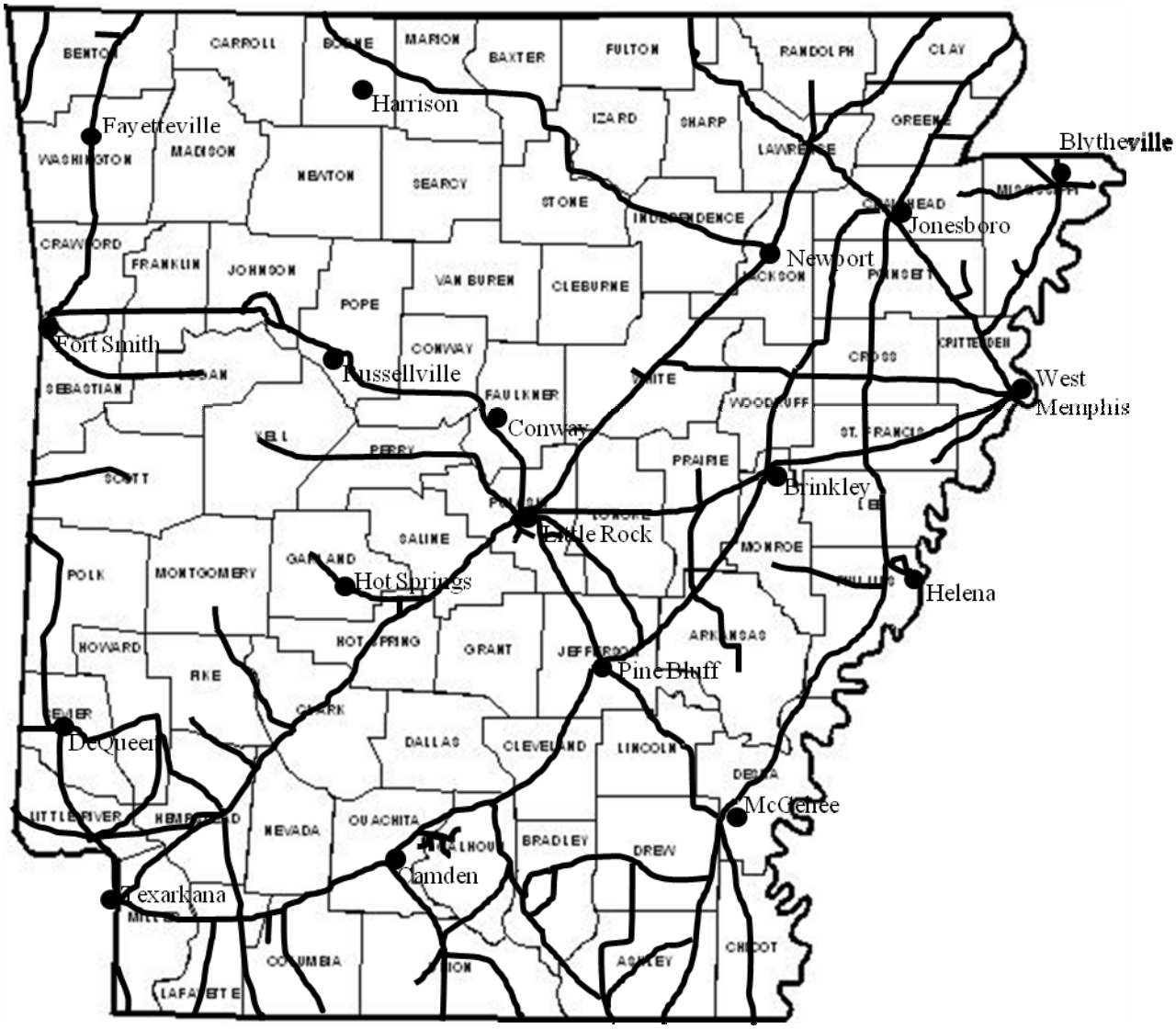
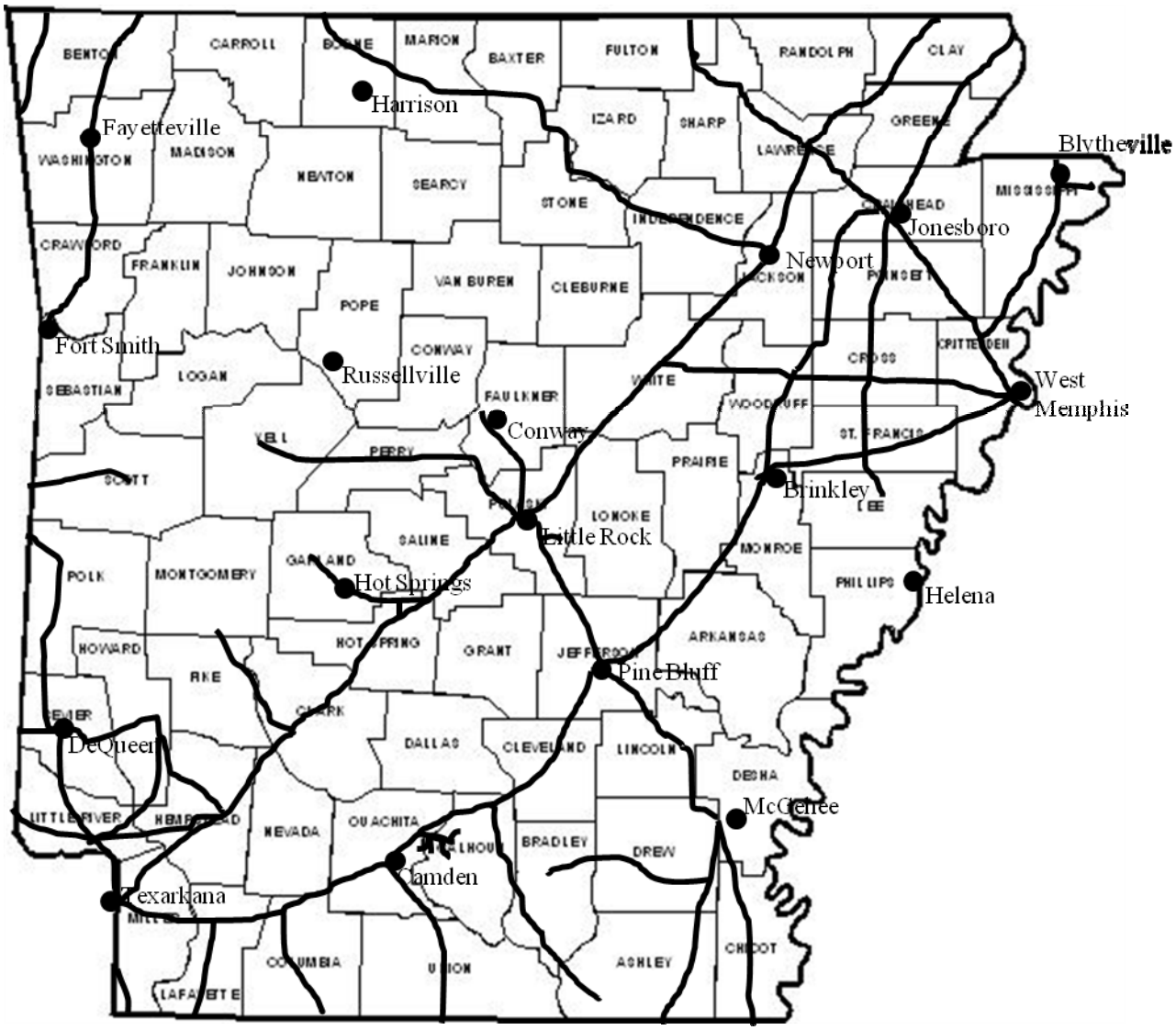


Figure 3
Arkansas Rail Network: 2002



Counties for which abandonments were not previously recorded are marked with an asterisk in Table 5. Of the 13 counties in the Table, there were 5 (Arkansas, Ashley, Hemstead, Lawrence, and Pulaksi) that had already recorded abandonments, so including them with the counties having had abandonments was not an issue. The 8 remaining counties were affected by abandonment for the first time after 1995, but they were included in the group of counties that had not lost rail service. While technically five of these counties (Clark, Drew, Nevada, Ouachita, and White) had lost some rail service by 2000, the goal was to examine the long term effects of abandonment, so these all 8 of the counties were treated as if they had not been affected by abandonment. This follows the suggestion of Sanderson and Babcock (2005) that the effects of abandonment would not be apparent for several years.

However, the analysis provided in Appendix A includes five of those counties (Clark, Drew, Nevada, Ouachita, and White) as part of the sample that had "lost rail service." Columbia, Chicot, and Lafayette were not included as having lost rail service since the majority of the data used was not current enough to have affected them. Chicot County did not experience abandonment until 2007, and Columbia and Lafayette lost service in 2001, just one year prior to the most recent data reported for Manufacturing, Wholesaling, and Retailing.

Table 3
Variables Used in the Analysis

Population and Employment

Mean Population
Percentage Change in Population
Civilian Labor Force
Percentage Change in Civilian Labor Force
Unemployment Rate

Income

Median Income
Percentage Change in Median Income
Income per Capita
Percentage Change in Income per Capita

Housing

Number of New Housing Permits/Capita
Number of New Housing Permits/10,000 Pop
Percentage Change in Permits/10,000 Pop
Value of New Housing per Permit
Percentage Change in Housing Value per Permit

Financial Institutions

Number of Banks and Savings and Loans
Percentage Change in the Number of Banks and S & Ls
Banks and S & L Deposits ($1,000)
Banks and S & L Deposits per Capita
Percentage Change in Deposits per Capita

Manufacturing

Number of Manufacturing Establishments
Percentage Change in Manufacturing Establishments
Manufacturing Value of Shipments ($ millions)
Percentage Change in Value of Shipments
Shipment Value per Manufacturer
Percentage Change in Shipment Value per Mfr
Number of Manufacturing Employees
Percentage Change in Manufacturing Employees
Manufacturing Payroll ($ millions)
Percentage Change in Manufacturing Payroll
Manufacturing Pay per Employee
Percentage Change in Manufacturing Pay/Employee

Wholesaling

Number of Wholesale Establishments
Percentage Change in Wholesale Establishments
Wholesale Revenues ($ millions)
Percentage Change in Wholesale Revenues
Wholesale Revenues per Establishment
Percentage Change in Wholesale Revenue/Establishment
Number of Wholesale Employees
Percentage Change in Wholesale Employees
Wholesale Payroll
Percentage Change in Wholesale Payroll
Wholesale Pay per Employee
Percentage Change in Wholesale Pay per Employee

Retailing

Number of Retail Establishments
Percentage Change in Retail Establishments
Retail Revenues ($ millions)
Percentage Change in Retail Revenues
Retail Revenues per Establishment
Percentage Change in Retail Revenues/Establishment
Number of Retail Employees
Percentage Change in Retail Employees
Retail Payroll
Percentage Change in Retail Payroll
Retail Pay per Employee
Percentage Change in Retail Pay per Employee

Table 4
Arkansas Counties, Populations, and Rail Service

Counties with Abandonments*		
County	2000 Population	
Arkansas	20,749	
Ashley	24,209	
Bradley	12,600	
Calhoun	5,744	
Carroll	25,357	
Cleburne	24,046	
Craighead	82,148	
Crittenden	50,866	
Desha	15,341	
Franklin	17,771	
Grant	16,464	
Greene	37,331	
Hempstead	23,587	
Jefferson	84,278	
Johnson	22,781	
Lawrence	17,774	
Logan	22,486	
Lonoke	52,828	
Madison	14,243	
Mississippi	51,979	
Monroe	10,254	
Montgomery	9,245	
Newton	8,608	
Phillips	26,445	
Pike	11,303	
Poinsett	25,614	
Prairie	9,539	
Randolph	18,195	
Saint Francis	29,329	
Saline	83,529	
Searcy	8,261	
Sebastian	115,071	**
Stone	11,499	
Union	45,629	
Van Buren	16,192	
Average	30,037	
Average w/o ** (i.e., <90,000)	27,536	

Counties without Abandonment		
County	2000 Population	
Baxter	38,386	
Benton	153,406	**
Boone	33,948	
Chicot	14,117	
Clark	23,546	
Clay	17,609	
Cleveland	8,571	
Columbia	25,603	
Conway	20,336	
Crawford	53,247	
Cross	19,526	
Dallas	9,210	
Drew	18,723	
Faulkner	86,014	
Fulton	11,642	
Garland	88,068	
Hot Spring	30,353	
Howard	14,300	
Independence	34,233	
Izard	13,249	
Jackson	18,418	
Lafayette	8,559	
Lee	12,580	
Lincoln	14,492	
Little River	13,628	
Marion	16,140	
Miller	40,443	
Nevada	9,955	
Ouachita	28,790	
Perry	10,209	
Polk	20,229	
Pope	54,469	
Pulaski	361,474	**
Scott	10,996	
Sevier	15,757	
Sharp	17,119	
Washington	157,715	**
White	67,165	
Woodruff	8,741	
Yell	21,139	
Average	40,553	
Average w/o ** (i.e., <90,000)	25,662	

* Counties that had no rail service or had experienced abandonment between 1980 and 1995.
** Counties with populations over 100,000 for the year 2000.
Source: Population data; U.S. Census Bureau, County City Data Book, http://censtats.census.gov/usa/usa.shtml, (various years). Rail service data; Planning and Research Division, State Rail Plan: 2002, (Arkansas Highway and Transportation Department, May, 2002), pp. II-3, Interstate Commerce Commission (ICC) (1987), "Annual Report of the Interstate Commerce Commission," (Washington, DC: U.S. Government Printing Office), and Surface Transportation Board, Surface Transportation Board, "Decisions and Notices," (www.stb.dot.gov/decisions/readingroom.nsf/ByDocketPrefix).

Table 5
Rail Abandonment in Arkansas: 1996-2007

Year	STB Docket	From - To	Mile Post	Total Miles	Miles in AR	County in AR
1996	AB 3-129	Gurdon, AR	428.3			Clark,* Ouachita,*
	Exempt	Camden, AR	457.0	28.7	28.7	and Nevada*
1996	AB 455-0	Monticello, AR	Entire RR	36.3	36.3	Ashley and Drew*
	Exempt	Crossett, AR				
1998	AB 33-121	Ricusky, AR	236.0			Arkansas
	Exempt	Indiana, AR	262.0	26.0	26.0	
1999	AB 558-0	DKS Branch, AR	299.1			White*
	Exempt	Line	300.4	1.3	1.3	
2001	AB 33-185	Jct Bridge, AR	343.6			Pulaski
	Exempt	Line	343.0	0.6		
		Rock Street Lead		2.1	2.7	
2001	AB 103-11	Hope, AR	4.0			Columbia,* Hemstead,
	NITU	AR Border	46.8	42.8	42.8	and Lafayette*
2004	AB 6-411	Hoxie, AR	397.8			Lawrence
	NITU	Walport	402.3	4.5		
		Walnut Ridge Spur		2.2	6.7	
2006	AB 33-222	Gilcrest, AR	457.0			Ouachita*
	Pending	El Dorado Jct	460.6	3.6	3.6	
2007	AB 384-1	Lake Village, AR	433.0			Chicot*
	Pending	AR Border	454.8			
		Shelburn, LA	463.0	30.0	21.8	

* Counties that had not lost rail service prior to 1996.

Source: Surface Transportation Board, Surface Transportation Board, "Decisions and Notices," (www.stb.dot.gov/decisions/readingroom.nsf/ByDocketPrefix).

RESULTS

The following Tables show comparisons of general economic conditions in counties that had no rail service prior to 1980 or had experienced rail abandonments prior to 1996 with counties that had not experienced abandonment (counties with and without abandonment, respectively). Reported in the Tables are the number of counties in each category (N), the mean level of the variable for the category of county (Mean), and the significance level (P-value) of the difference between the two means. The values of N should be 34 for counties that had abandonments and 37 for those that did not; however, in some instances, the data was not available for certain counties. Reasons provided by the Census Bureau include, "data not applicable, not available, suppressed, withheld to avoid disclosure pertaining to a specific organization or individual, or value would amount to less than half the unit of measurement shown (U.S. Census Bureau 2007)." P-values of less than 0.05 suggest that there is less than a 5 percent probability that the difference in the two variables is due to chance. That is, if the p-value is less than 0.05 one could assume with at least 95 percent confidence that the difference was meaningful, or statistically significant (Kutner et al. 2005).

The variables used in the analysis are those shown in Table 3, and reflect levels and changes in measures of population, employment, unemployment, income, financial institutions, manufacturing, wholesaling, and retailing. The percentage changes over the various periods have been adjusted to annual rates of change. The changes from 1980 to 1990 are for comparison to more recent changes (i.e., from 1990 to 2000), but average changes over the entire 20-year period also are provided.

Table 6

Impact of Rail Abandonment on Population, Growth, and Employment: 1980-2000[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Mean Population					
1980	34	25,382	37	21,866	0.382
1990	34	25,214	37	22,521	0.527
2000	34	27,536	37	25,662	0.709
Percentage Change in Population[3]					
1980-1990	34	(0.1)	37	0.0	0.438
1990-2000	34	1.0	37	1.0	0.872
1980-2000	34	0.5	37	0.6	0.660
Civilian Labor Force					
1980	34	9,982	37	8,607	0.418
1990	34	11,625	37	10,332	0.535
2000	34	12,592	37	11,678	0.710
Percentage Change in Civilian Labor Force[3]					
1980-1990	34	1.6	37	1.8	0.681
1990-2000	34	0.9	37	0.9	0.821
1980-2000	34	1.4	37	1.5	0.780
Unemployment Rate (percent)					
1980	34	8.5	37	7.5	0.058
1990	34	7.9	37	7.8	0.744
2000	34	4.8	37	4.9	0.792
Change in Unemployment Rate (annual)					
1980-1990	34	(0.1)	37	0.0	0.163
1990-2000	34	(0.3)	37	(0.3)	0.543
1980-2000	34	(0.8)	37	(0.8)	0.608

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as "counties with abandonments."

[3] Percentage changes are annual.

Effects on General Economic Conditions

The average populations of counties that experienced abandonment as shown in Table 6 were slightly larger than those that had not lost rail service over the years examined, but none of the differences were statistically significant, and there were virtually no differences in population growth rates over the periods examined. Similarly, the size of the civilian labor force was slightly larger in counties with abandonments, but neither those differences nor differences in growth rates were significant over the years studied. The average unemployment rate in counties that lost rail service was slightly higher in 1980 and 1990 than for counties without abandonments but it was slightly lower during 2000; however, none of the differences were statistically significant. Similarly, none of the changes in the unemployment rate over time were significantly different for either group of counties.

None of these measures would support the hypotheses that counties that have lost rail will be economically disadvantaged, either when compared directly or when compared to changes over time.

As shown in Table 7, the median income and income per capita in counties that have no rail service or have experienced abandonment were virtually no different from those in counties that have not lost rail service, and none of the differences are statistically significant. Similarly, there are virtually no differences in changes over time.

Table 7

Impact of Rail Abandonment on Income: 1979-1999[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Median Income (dollars)					
1979	34	10,921	37	10,973	0.899
1989	34	18,536	37	18,466	0.923
1999	34	28,774	37	28,487	0.771
Percentage Change in Median Income[3]					
1979-1989	34	7.0	37	6.8	0.546
1989-1999	34	5.6	37	5.5	0.694
1979-1999	34	8.2	37	8.0	0.349
Income per Capita (dollars)					
1979	34	4,916	37	5,048	0.359
1989	34	9,014	37	9,177	0.547
1999	34	15,033	37	15,080	0.899
Percentage Change in Income per Capita[3]					
1979-1989	34	8.4	37	8.2	0.594
1989-1999	34	6.8	37	6.5	0.264
1979-1999	34	10.4	37	10.0	0.203

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

Table 8 shows the differences with respect to permits for new housing construction for counties that lost rail service and those that did not. As can be seen, there are no significant differences in any of these measures.

There is an anomaly with respect to the percentage changes in new housing permits per 10,000-population for counties with rail service that should be mentioned. The number of new housing permits per 10,000 that were issued in both types of counties actually declined from 1980 to 1990, but the percentage change in new housing permits for the counties with rail service is a positive number, 1.1 percent. This raises the question, "How can the percentage change be positive when the average decreased?"

The explanation lies in the nature of percentage changes and the effects of a large standard deviation. As numbers fall, the percentage changes are constrained between 0 and 100 percent, but as they increase, there is no upper bound. A very large county could decline to half of its previous value, which may be more than many small counties combined, but the decrease would be only 50 percent. A small increase of say 4 units by a small county with a base of 2 would be a 200 percent increase. For example, Boone County registered 254 building permits in 1980 and only 109 in 1990. On a basis of permits per 10,000-population, this was 97 and 39, respectively. The decline of 58 permits per 10,000 is approximately 60 percent, or 6 percent per year.

Izard County registered 2 building permits in 1980 and 18 in 1990. On a basis of permits per 10,000-population, this was 2 and 16, respectively. The increase of 14 permits per 10,000 represents a 700 percent increase, or 70 percent per year. When coupled with a large standard deviation, the net effect of counties with a small base gives rise to what might be questionable results; however, the important point is that both types of counties experienced similar effects

and there were no significant differences between them. Thus, it would be difficult to argue that counties that lost rail service were at a disadvantage.

In general, the number and value of building permits and their changes over time are no different for counties that have lost rail service than those that have not. In fact, counties in both situations have experienced healthy growth rates in the value of building permits as well as the value per permit. The only significant difference was the value per permit in 1980. Counties with rail service had an average value of $36,220, which was $5,174 (17%) more than counties without rail service, but by 1990, the difference was less than $4,000 (8%), and by 2000, the average value of a new housing permit was over $1,500 more in counties without rail service than in those with it. While the difference in the average annual percentage change in value per permit was not statistically significant, it is not possible to support the hypotheses that counties that lost rail service are at a disadvantage compared to those that have not.

Table 9 shows the impact of rail abandonment on financial institutions. There were no significant differences in the number or percentage changes in banks and savings and loans for either type of county. Similarly, there were no significant differences in the deposits or the deposits per capita or the average annual percentage change in deposits per capita for either type of county. The number and growth of financial institutions as well as the size and growth of deposits per capita suggest a healthy economy in both areas.

Table 8

Impact of Rail Abandonment on Permits for New Housing Construction: 1980-2000[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of New Housing Permits					
1980	23	89	30	77	0.657
1990	32	55	37	44	0.575
2000	32	75	37	57	0.504
New Housing Permits per 10,000 Pop					
1980	21	28	28	30	0.712
1990	27	18	33	17	0.709
2000	31	19	34	19	0.930
Percentage Change in Permits per 10,000 Pop[3]					
1980-1990	19	(1.5)	28	1.1	0.466
1990-2000	27	5.0	32	10.7	0.466
1980-2000	21	(0.2)	27	0.3	0.782
Value of New Housing Permits ($1,000)					
1980	23	2,534.9	30	2,757.3	0.752
1990	32	2,662.1	37	2,417.7	0.820
2000	32	6,343.3	37	4,755.4	0.567
Value of New Housing per Permit ($1,000)					
1980	21	31,047	28	36,220	0.022
1990	27	45,835	33	49,573	0.364
2000	31	79,413	34	77,887	0.849
Percentage Change in Value of Housing per Permit[3]					
1980-1990	19	4.4	28	4.6	0.859
1990-2000	27	8.2	32	8.1	0.959
1980-2000	21	8.0	27	6.2	0.158

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

Table 9

Impact of Rail Abandonment on Financial Institutions: 1980-2000[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Banks and Savings and Loans					
1980	34	7	37	7	0.558
1990	34	8	37	8	0.604
2000	34	13	37	12	0.771
Percentage Change in the Number of Banks and S & Ls[3]					
1980-1990	34	2.1	37	1.7	0.673
1990-2000	34	6.7	37	5.3	0.331
1980-2000	34	5.1	37	4.0	0.330
Banks and S & L Deposits ($1,000)					
1980	34	92,946	37	80,025	0.444
1990	34	174,251	37	165,182	0.779
2000	34	303,850	37	314,162	0.859
Banks and S & L Deposits per Capita (dollars)					
1980	34	3,533	37	3,551	0.949
1990	34	7,011	37	7,186	0.767
2000	34	11,231	37	12,018	0.336
Percentage Change in Deposits per Capita[3]					
1980-1990	34	9.8	37	10.6	0.348
1990-2000	34	6.6	37	7.3	0.355
1980-2000	34	11.3	37	12.5	0.119

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as "counties with abandonments."

[3] Percentage changes are annual.

Effects on Manufacturing

Table 10 shows the differences in counties that lost rail service and those that had not, with respect to the number of manufacturing facilities, the value of manufacturing shipments, and the percentage changes in those variables between 1982 and 2002. An anomaly similar to that discussed with respect to housing permits is present in the percentage change in manufacturing establishments between 1982 and 2002 but the effect is minor, and there were no significant differences in either the number of manufacturing establishments or the average annual percentage change in establishments in counties with rail service compared to those that had lost rail service.

Although the average value of manufacturing shipments and the average value of shipments per manufacturer were consistently higher for counties that lost rail service than those that had not, the differences were not statistically significant. Nor were there any significant differences in the growth rates in the average value of manufacturing shipments or the average value of shipments per manufacturer.

Similarly, as shown in Table 11, the number of people employed in manufacturing, and manufacturers' payroll were not significantly different for counties that lost rail service compared to counties that had not. While the number of people employed in manufacturing increased substantially between 1982 and 1992 in counties with rail service, the percentage change was not significantly higher than the moderate increase in counties that had lost rail service. Moreover, by different by 2002 the number of employees in counties with rail service had dropped below that of counties without rail service. Again, however, those differences and the average annual percentage changes in those differences were not statistically significant.

Table 10

Impact of Rail Abandonment on Manufacturing and Value of Mfg Shipments: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Manufacturing Establishments					
1982	34	34	37	34	0.925
1992	34	40	37	40	0.997
2002	27	37	28	38	0.848
Percentage Change in Manufacturing Establishments[3]					
1982-1992	34	1.9	37	2.1	0.738
1992-2002	27	(1.5)	28	(2.0)	0.512
1982-2002	27	0.1	28	(0.1)	0.622
Value of Manufacturing Shipments ($1,000)					
1982	31	250,697	31	156,268	0.206
1992	29	366,955	29	330,679	0.702
2002	21	569,876	24	504,104	0.692
Percentage Change in Value of Shipments[3]					
1982-1992	29	14.7	27	14.0	0.914
1992-2002	19	3.0	21	3.1	0.871
1982-2002	19	6.6	21	8.5	0.291
Shipment Value per Manufacturer (dollars)					
1982	31	5,446,195	31	4,005,299	0.180
1992	29	7,712,569	29	7,098,317	0.689
2002	21	14,631,153	24	13,073,473	0.610
Percentage Change in Shipment Value per Manufacturer[3]					
1982-1992	29	12.7	27	9.5	0.614
1992-2002	19	7.2	21	8.2	0.741
1982-2002	19	6.9	21	9.8	0.170

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

Table 11

Impact of Rail Abandonment on Manufacturing Employment and Pay: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Manufacturing Employees					
1982	30	2,100	30	1,877	0.591
1992	29	2,272	29	2,431	0.754
2002	27	2,658	28	2,529	0.785
Percentage Change in Manufacturing Employees[3]					
1982-1992	28	3.6	26	2.7	0.623
1992-2002	22	(1.0)	22	(1.0)	0.888
1982-2002	24	0.9	23	1.0	0.824
Manufacturing Payroll ($1,000)					
1982	31	29,935	31	25,206	0.494
1992	29	47,255	29	50,452	0.787
2002	21	69,125	24	74,953	0.729
Percentage Change in Manufacturing Payroll[3]					
1982-1992	29	11.0	27	12.6	0.718
1992-2002	19	3.1	21	2.7	0.660
1982-2002	19	6.8	21	7.5	0.697
Manufacturing Pay per Employee (dollars)					
1982	30	13,129	30	12,887	0.778
1992	29	18,594	29	19,441	0.503
2002	21	29,132	24	27,719	0.451
Percentage Change in Manufacturing Pay per Employee[3]					
1982-1992	28	4.6	26	5.2	0.394
1992-2002	19	5.4	21	3.9	0.010
1982-2002	19	6.5	21	5.3	0.072

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

Only 2 variables in Table 11 had differences that were statistically significant. There were no statistical differences in pay per employee in any of the three years examined, but the average annual rate of change from 1992 to 2002 was significantly higher for counties with abandonments than for those that had not lost rail service, as was the average annual change over the 20 year period.

In 1992, the average pay per employee in counties with abandonments was $18,594 compared to $19,441 in counties with rail service, a difference of $847 or about 4.6 percent. By 2002, however, the average pay per employee in counties with abandonments had increased to $29,132 compared to $27,719 in counties that had not lost rail service. The average annual rate of increase was 5.4 percent for counties with abandonments compared to 3.9 percent in other counties, and that difference was statistically significant at $p = 0.01$. Additionally, the rate of increase in pay per employee over the 20-year period from 1982 to 2002 was significantly higher ($p = 0.072$) for employees working in counties that had lost rail service.

As with the previous measures, there is no support for the hypotheses that counties that have lost rail will be economically disadvantaged, either when compared directly or when compared to changes over time. If anything, one might argue that counties that have lost rail service are improving at a better rate than those that have not.

Effects on Wholesaling

Tables 12 and 13 show the differences in counties that lost rail service and those that had not, with respect to wholesaling. While there were more wholesalers and more revenue per wholesaler in counties that lost rail service, the differences were not statistically significant.

Table 12

Impact of Rail Abandonment on Wholesaling and Wholesale Revenue: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Wholesale Establishments					
1982	34	36	37	29	0.308
1992	34	37	37	33	0.580
2002	34	28	37	25	0.637
Percentage Change in Wholesale Establishments[3]					
1982-1992	34	0.1	37	1.3	0.074
1992-2002	34	(1.3)	37	(3.0)	0.161
1982-2002	34	(0.8)	37	(1.0)	0.809
Wholesale Revenues ($1,000)					
1982	33	70,598	36	63,617	0.707
1992	33	91,884	36	101,158	0.761
2002	24	182,841	19	110,451	0.176
Percentage Change in Wholesale Revenues[3]					
1982-1992	33	4.8	35	6.5	0.432
1992-2002	24	4.3	19	3.0	0.706
1982-2002	24	7.7	19	5.1	0.432
Wholesale Revenues per Establishment (dollars)					
1982	33	1,652,995	36	1,776,852	0.587
1992	33	2,211,618	36	2,437,130	0.522
2002	24	4,959,852	19	3,820,240	0.266
Percentage Change in Wholesale Revenues per Establishment[3]					
1982-1992	33	4.5	35	4.9	0.823
1992-2002	24	9.4	19	8.1	0.790
1982-2002	24	10.5	19	7.6	0.364

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

However, between 1982 and 1992, the average number of wholesale establishments in counties with rail service increased from 29 to 33, an average annual increase of 1.3 percent over the 10-year period. Counties that lost rail service only added one firm on average. The average annual increase of only one-tenth of one percent, was significantly less than for counties with rail service, but the absolute numbers were not substantial in either instance.

More importantly, by 2002 the number of wholesale establishments had declined substantially in all counties, and the difference in the percentage drop was not statistically different for the two groups of counties. Furthermore, the number of firms was declining, but the average size of firm as measured by revenue did not decline over any of the periods in question. Although the average wholesale revenue per establishment in both 1982 and 1992 was slightly less in counties that had lost rail service than in counties with rail service, by 2002, the situation was reversed. The average revenue per wholesaler in counties that had lost rail service was $4.9 million compared to $3.8 million in counties with rail service.

While neither the difference in average size of wholesaler nor the average growth rate in size of wholesalers in counties with or without rail service, was statistically significant, the average growth rates themselves were substantial. The average size of wholesalers in all counties increased substantially over the 20-year period, and this is consistent with nation-wide trends in consolidation. For example, over the 10-year period between 1992 and 2002, the number of wholesalers in the U.S. declined by approximately 12 percent, but the average size of wholesalers increased by over 40 percent during the same period. Moreover, between 1982 and 2002 the number of wholesalers increased by only 4.7 percent, but the average revenue per wholesaler increased by over 130 percent during that period (U.S. Census Bureau 2007).

There were no significant differences in the number of wholesale employees for either type of county, nor the percentage change in employees over any of the years examined. Since the average size of wholesalers in counties that had experienced abandonment was larger than for counties that still had rail service, it would follow that the average payroll of wholesalers in those counties would be larger. In fact, the average payroll of wholesalers in counties with abandonments was larger than that of wholesalers in counties with rail service in 1982 and 2002, albeit, none of the differences were statistically significant. Still, the 2002 payroll in counties with abandonments was over 10 million dollars compared to just under 7 million for rail-served counties. There appears to be an anomaly with respect to the percentage change in wholesaler payroll for counties with rail service similar to that noted in the discussion of building permits for housing. The average payroll in 1992 was over $7 million, but by 2002 it had dropped to $6.9 million. Yet the average annual growth was a positive 1.7 percent. Again, the explanation lies in the rather large standard deviation and the effects of computing percentage changes from different base levels. Some counties had large rates of change on small payrolls while those with declining payrolls were larger on average. Thus, the average size of payroll in those counties declined, but the average growth rate was positive. As in the discussion of housing, the important point is that neither type of county appears to have an advantage over the other.

Table 13 also shows the average pay per employee, which was virtually the same for both types of county, but the average percentage increase in pay per employee was somewhat higher in counties with abandonments than those of other counties, and the increase was statistically significant at the 0.10 level (.061) between 1992 and 2002, and almost significant (.11) for the 20 year period from 1982 to 2002. Again, the results do not support the hypotheses that counties that have lost rail service are at an economic disadvantage.

Table 13

Impact of Rail Abandonment on Wholesale Employees and Pay: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Wholesale Employees					
1982	33	294	36	284	0.916
1992	34	296	37	344	0.655
2002	34	279	37	264	0.850
Percentage Change in Wholesale Employees[3]					
1982-1992	33	1.7	35	3.4	0.204
1992-2002	33	(1.3)	36	(1.6)	0.799
1982-2002	33	0.0	36	0.3	0.716
Wholesale Payroll ($1,000)					
1982	33	4,024	36	3,834	0.892
1992	33	5,991	36	7,027	0.664
2002	24	10,532	19	6,906	0.212
Percentage Change in Wholesale Payroll[3]					
1982-1992	33	7.1	35	9.5	0.289
1992-2002	24	4.6	19	1.7	0.159
1982-2002	24	7.3	19	5.7	0.522
Wholesale Pay per Employee (dollars)					
1982	33	12,102	36	12,329	0.732
1992	33	17,335	36	17,774	0.712
2002	24	27,773	19	25,439	0.211
Percentage Change in Wholesale Pay per Employee[3]					
1982-1992	33	5.3	35	4.9	0.844
1992-2002	24	5.7	19	3.8	0.061
1982-2002	24	6.2	19	5.1	0.108

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as "counties with abandonments."

[3] Percentage changes are annual.

Effects on Retailing

The changes in the number of retail establishments and retail sales followed very closely the changes in wholesaling. As shown in Table 14, the number of retailers increased in both categories of county from 1982 to 1992, but only slightly, and there were no significant differences in either the number of establishment or the rates of change given the presence of rail abandonment. By 2002, the average number of retail establishments had declined substantially in both types of county. Average retail sales and retail sales per establishment increased over all three years examined, but none of the absolute or changes levels were significantly different for either group of counties.

The declining number of establishments and the increasing revenues per establishment follows the same nation-wide trend discussed with respect to wholesaling, only more dramatic. For example, between 1992 and 2002 the number of retailers in the U.S. declined by over 58 percent, but the average size of retailers increased by 276 percent during the same period. Over the entire 20-year period, the average number of retailers declined by 42 percent, but the average size of retailers increased by nearly 400 percent (U.S. Census Bureau 2007).

Finally, there are virtually no differences in the pay per employee or the average annual increase in pay for either type of county as shown in Table 15. As with the previous measures, these results do not suggest that counties without rail service or that have lost rail service are any different than counties that have had rail service for many years and have not experienced abandonments.

Table 14

Impact of Rail Abandonment on Retailing and Retail Revenue: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Retail Establishments					
1982	34	147	37	129	0.507
1992	34	151	37	137	0.632
2002	34	122	37	115	0.770
Percentage Change in Retail Establishments[3]					
1982-1992	34	0.5	37	0.5	0.977
1992-2002	34	(1.9)	37	(1.9)	0.954
1982-2002	34	(0.7)	37	(0.7)	0.896
Retail Revenues ($1,000)					
1982	34	83,946	37	71,737	0.515
1992	34	142,483	37	128,203	0.677
2002	34	224,277	37	206,043	0.758
Percentage Change in Retail Revenues[3]					
1982-1992	34	7.3	37	7.2	0.953
1992-2002	34	5.3	37	5.9	0.521
1982-2002	34	8.6	37	8.7	0.906
Retail Revenues per Establishment (dollars)					
1982	34	502,202	37	497,951	0.893
1992	34	822,618	37	814,694	0.892
2002	34	1,538,159	37	1,562,192	0.840
Percentage Change in Retail Revenues per Establishment[3]					
1982-1992	34	6.4	37	6.4	0.994
1992-2002	34	8.8	37	9.6	0.344
1982-2002	34	10.3	37	10.8	0.539

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as “counties with abandonments.”

[3] Percentage changes are annual.

Table 15

Impact of Rail Abandonment on Retail Employees and Pay: 1982-2002[1]

	Counties with Abandonments[2]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Retail Employees					
1982	34	1,062	37	952	0.672
1992	34	1,342	37	1,240	0.760
2002	34	1,208	37	1,147	0.840
Percentage Change in Retail Employees[3]					
1982-1992	34	2.8	37	3.0	0.725
1992-2002	34	(0.6)	37	(0.7)	0.843
1982-2002	34	1.1	37	1.2	0.854
Retail Payroll ($1,000)					
1982	34	8,588	37	7,409	0.568
1992	34	13,795	37	12,884	0.795
2002	34	20,186	37	18,965	0.820
Percentage Change in Retail Payroll[3]					
1982-1992	34	6.8	37	7.0	0.799
1992-2002	34	4.6	37	4.4	0.815
1982-2002	34	7.4	37	7.5	0.961
Retail Pay per Employee (dollars)					
1982	34	7,802	37	7,686	0.501
1992	34	10,125	37	10,036	0.683
2002	34	15,685	37	15,446	0.571
Percentage Change in Retail Pay per Employee[3]					
1982-1992	34	3.1	37	3.1	0.920
1992-2002	34	5.5	37	5.5	0.957
1982-2002	34	5.1	37	5.1	0.989

[1] The four largest counties were not included, and counties that had not experienced abandonment until after 1995 were included in the sample of counties with rail service.

[2] Counties that did not have rail service as of 1980 or that lost service prior to 1995 may still have rail service in other areas, but for convenience they are referred to as "counties with abandonments."

[3] Percentage changes are annual.

CONCLUSIONS

Clearly, rail transportation is important to our economy. Over 40 percent of the total ton-miles moved in this country move by rail, and many industries are heavily dependent on rail services. However, railroads are for-profit enterprises and when a shipper is truly dependent on rail transportation, its volume is typically sufficient for the rail carrier to make a reasonable return on its investment. Economic changes in the U.S. and throughout the World together with a better understanding of transportation choice decision-making have changed the competitive environment in which railroads compete. Changes in government policy have paralleled these changes permitting the railroad industry to evolve into its current role of focusing on what it does best through a strategy of downsizing. What the rail industry does best is move large volumes long distances with minimal switching or interchange. Unless very large volumes are involved, most pickup and delivery of freight to individual shippers is more economically performed by truck than by rail.

Some shippers have accepted the changes in the economy and their transportation alternatives and have recognize the need to consider the cost of inventory and other costs beyond just that of transportation when making mode choice decisions. These shippers have even contributed to rail downsizing by choosing truck over rail, reducing rail traffic levels that have led to abandonment. Remaining shippers who may be unaware of new decision methods might naturally fear (and protest) the loss of rail service when in fact they may benefit by switching to another mode of transportation. If these shippers cannot survive without rail service and the impact of the abandonment is truly serious, the entire local economy would be affected, not just a single company, and those effects should be apparent over a long period of time.

The analysis provided here compared counties in Arkansas that have lost rail service to counties that have not and found no meaningful differences between them. Consequently, there appears to be no evidence of any long-term adverse economic impacts due to rail abandonment. While there is no way of determining from this analysis whether individual firms may have experienced adverse economic effects, including bankruptcy, due to the loss of rail service, it seems clear that the local economies in general are not affected. This is consistent with the findings of other post abandonment impact studies, and is consistent with Congressional goals requiring the STB to the find "serious, adverse impact on rural and community development" before rejecting an abandonment application (Office of Public Services 1997, p. 10).

The Crisis-Change Model is very useful in explaining why some shippers, when threatened with the loss of rail service, will remain rigid, seeking legal protection rather than facing the new challenge, while others adapt to changes in the environment (Fink 1971, Staw 1981). Beyond the behavioral characteristics of individuals, there is a potentially a serious lack of understanding of how decisions should be made in the area of mode selection. While some managers may recognize the trade-offs between transportation and inventory carrying costs associated with shipments size, transit times, and transit time variability, few are aware of the need for data collection and the complex computations necessary to take full advantage of the benefits they can bring (Ozment 2001b).

Government intervention to protect firms from rail abandonment may not be in their best interest or in the best interest of the local economies in which they operate. It is certainly not in the best interest of the rail carriers. If government is to intervene, perhaps it would best be in the form of education. The FRA's development of the Intermodal Transportation and Inventory Cost Model (2005) is an excellent start, but it is not widely distributed and should be broadened

to include analyses of all modes. Moreover, it is not clear how many managers could understand the process well enough to use it without further education. Before spending tax dollars to preserve rail service, mangers facing rail abandonment could be provided with government sponsored instructional sessions to help them evaluate the total cost of alternatives available to them.

Perhaps more important is the need for logistics education on a much broader scale. Business education in colleges and universities throughout the U.S. has developed for the most part without the inclusion of transportation and logistics. There are currently more than 450 universities accredited by the Association to Advance Collegiate Schools of Business (AACSB 2007), and students can major in the basic core disciplines such as accounting, finance, management, and marketing at virtually all of them, but there are very few universities that offer degrees in the field of transportation and logistics. It is in these programs where students can learn the methods required to fully understand the decision processes involved in analyzing trade-offs between the costs of transportation and inventory at a level sufficient to allow firms to compete globally in the 21st Century. Perhaps government intervention to help create programs in this discipline would be beneficial to our economy.

REFERENCES

Allen, Benjamin J. (1975), "The Economic Effects of Rail Abandonment on Communities: A Case Study," Transportation Journal, Vol. 15, No. 1 (Fall), pp. 52-61.

Allen, Benjamin J. and David B. Vellenga (1983), "Public Financing of Railroads Under the New Federalism: The Progress and Problems of Selected State Programs," Transportation Journal, Vol. 23, No. 2 (Winter), pp. 52-61.

Allen, W. Bruce (1974), "ICC Behavior on Rail Abandonments," ICC Practitioners' Journal, Vol. XXXXI, No. 5 (July-August), pp. 553-571.

Anderson, Dale G., Floyd D. Gaibler, and Mary Berglund (1976), Economic Impacts of Branch-Line Abandonments: Results of a South Central Nebraska Case Study, Agricultural Experiment Station Bulletin SB541, (Lincoln, NE: University of Nebraska).

Arkansas Highway and Transportation Department (AHTD) (2002), Arkansas State Rail Plan Year 2002, (Little Rock, AR: Arkansas Highway and Transportation Department, Planning and Research Division, May).

Association for the Advancement of Collegiate Schools of Business (AASSCB) (2007),

Association of American Railroads (2007a), "Class I Railroad Statistics," (Washington DC: Association of American Railroads, Policy and Economics Department, May 14).

Association of American Railroads (2007b), "Overview of U.S. Freight Railroads," (Washington DC: Association of American Railroads, Policy and Economics Department, January).

Association of American Railroads (2006), "U.S. Freight Railroad Statistics," (Washington DC: Association of American Railroads, Policy and Economics Department, November 20).

Babcock, Michael W., James L. Bunch, James Sanderson, and Jay Witt (2003a), "Impact of Short Line Railroad Abandonment on Highway Damage Costs: A Kansas Case Study," Transportation Quarterly, Vol. 57, No. 4 (Fall), pp. 105-121.

Babcock, Michael W., James L. Bunch, James Sanderson, and Jay Witt (2003b), "Impact of Short Line Railroad Abandonment on Wheat Transportation and Handling Costs: A Kansas Case Study," Transportation Quarterly, Vol. 57, No. 4 (Fall), pp. 87-103.

Ballou, Ronald H. (2004), Business Logistics Management, 5th edition (Upper Saddle River, NJ: Prentice-Hall).

Bard, Robert L. (1967), "The Challenge of Rail Passenger Service: Free Enterprise, Regulation, and Subsidy," The University of Chicago Law Review, Vol. 34, No. 2 (Winter, 1967), pp. 301-340.

Barnett, Carole K. and Michael G. Pratt (2000), “From Threat-Rigidity to Flexibility - Toward a Learning Model of Autogenic Crisis in Organizations,” Journal of Organizational Change Management, Vol. 13, No. 1, pp. 74-88.

Baum, Joel A.C. and Jitendra V. Singh (1996), “Dynamics of Organizational Responses to Competition,” Social Forces, Vol. 74, No. 4 (June), pp. 1261-1297.

Baumel, C. Phillip, John J. Miller, and Thomas P. Drinka (1976), Economic Analysis of Upgrading Branch Lines: A Study of 71 Lines in Iowa, Report Number, FRA-OPPD-76-3, (Washington, DC: Department of Transportation, Federal Railroad Administration, March).

Berglund, Mary and Dale G. Anderson (1977), "Impact of Branch-Line Rail Abandonment on Costs and Structure of Fertilizer Distribution," Proceedings of the Transportation Research Forum, (Oxford, Indiana: Richard B. Cross) pp. 463-468.

Black, William R. and James F. Runke (1975), The States and Rural Rail Preservation, (Lexington, KY: The Council of State Governments, October) Chapter 3, pp. 22-34.

Boske, Leigh B. and Mark J. Wolfgram (1977), "A Social Decision-Making Framework for Analyzing Rail Service Abandonment Impacts," Transportation Journal, Vol. 16, No. 4 (Summer), pp. 78-85.

Bowersox, Donald J. (1966), "Physical Distribution in Semi-Maturity," Air Transportation, January, pp. 9-11.

Bowersox, Donald J. (1969), "Physical Distribution Development, Current Status, and Potential," Journal of Marketing, Vol. 33, No. 1 (January).

Bowersox, Donald J., David J. Closs, and M. Bixby Cooper (2002), Supply Chain Logistics Management, (New York, NY: The McGraw-Hill Companies).

Brown, Dennis M. (1998), “Rail Freight Consolidation and Rural America,” Rural Development Perspectives, Vol. 13, No. 2, pp. 19-23.

Bunker, A.R. and L.D. Hill (1975), "Impact of Rail Abandonment on Agricultural Production and Associated Grain Marketing and Fertilizer Supply Firms," Illinois Agricultural Economics, (January), pp. 12-20.

Census Bureau (2007), “USA Counties,” (U.S. Department of Commerce, U.S. Census Bureau), (http://censtats.census.gov/usa/usa.shtml).

Cherington, Charles Richards (1948), The Regulation of Railroad Abandonments, (Cambridge: Harvard University Press).

Coyle, John J. and Edward J. Bardi (1980), The Management of Business Logistics, second edition, (St. Paul, MN: West Publishing Company) Chapters 3 and 4.

Coyle, John J., Edward J. Bardi, and C. John Langley (2002), Management of Business Logistics: A Supply Chain Perspective, 7th edition, (St. Paul, MN: West Publishing Company).

Crane, L. and D. Leatham (1993), "Distributed Lag Effects on Transportation Expenditures on Rural Income and Employment," Review of Regional Studies, Vol. 23, No. 2, pp. 163-181.

Drucker, Peter F. (1962), "The Economy's Dark Continent," Fortune, April, pp. 102, 265-270.

Due, John F. (1975), "The Effects of Railroad Abandonment on Agricultural Areas: A Case Study," Illinois Agricultural Economics, (July), pp. 14-22.

Due, John F., Benjamin J. Allen, Mary R. Kihl, and Michael R. Crum (1990), Transportation Service to Small Rural Communities: Effects of Deregulation, Ames: Iowa State University Press, 1990.

Ernst and Whinney (1981), Shipper Response to Service Loss: An Assessment of Case Studies, (Washington, DC: Federal Railroad Administration, April).

Farris, Martin T. (1969), "Transportation Regulation and Economic Efficiency," American Economic Review, Vol. 59, No. 2 (May), p. 244-250.

Federal Railroad Administration (FRA) (1973), Development and Evaluation of Economic Abstraction of Light Density Rail Line Operations, (Washington, D.C.: U.S. Department of Transportation).

Federal Railroad Administration (FRA) (1980), Benefit-Cost Guidelines: Rail Branch Line Continuation Assistance Program, (Washington, D.C.: U.S. Department of Transportation, January 11).

Federal Railroad Administration (FRA) (2005), Intermodal Transportation and Inventory Cost Model: Highway-to-Rail Intermodal User's Manual, (Washington, DC: U.S. Department of Transportation, March).

Fleming, M.S. and P.A. Yansouni (1980), "Economic Feasibility of Off-Track Elevators," Proceedings of the Transportation Research Forum, (Oxford, Indiana: Richard B. Cross), pp. 616-623.

Foster Wheeler Environmental Corporation (1999), "Lower Snake River Juvenile Salmon Migration Feasibility Study: Draft Social Analysis Report," (Walla Walla, WA: US Army Corps of Engineers, June), http://www.nww.usace.army.mil/lsr/REPORTS/social/social.htm (Annex B: The Effects

of Socioeconomic Changes on Rural Agricultural Communities: A Review of the Literature).

Fruin, Jerry E. (1992), "A Summary of Research Studies on the Impacts of Rail Abandonment in the Midwest," (Minneapolis, MN: University of Minnesota, Department of Agricultural and Applied Economics, Staff Paper Series, Staff Paper No. P92-16, July).

Gittings, Gary and Evelyn Thomchick (1987), "Some Logistics Implications of Rail Line Abandonment," Transportation Journal, Vol. 26, No. 4 (Summer), pp. 16-25.

Gervais, Jean-Philippe and C. Phillip Baumel (1996), "The Iowa Grain Flow Survey: Where and How Iowa Grain Producers Ship Corn and Soybeans," Semisequicentennial Transportation Conference Proceedings, (Iowa State University, Ames, Iowa, May).

Harper, Donald V. (1969), "Transportation Regulation and Economic Efficiency," American Economic Review, Vol. 59, No. 2 (May), pp. 270-271.

Harper, Donald V. (1982), Transportation in America: Users, Carriers, Government, 2nd edition, (Englewood Cliffs, NJ: Prentice-Hall).

Honeyman, Joel S., Dean A. Bangsund, and F. Larry Leistritz (1996), "Economic Impact of Railroad Abandonment: Carrington-to-Turtle Lake Rail Line," Agricultural Economics Miscellaneous Report No. 179-S (Fargo, ND: Department of Agricultural Economics, and the Upper Great Plains Transportation Institute, North Dakota State University).

Intermodal Association of North America (2007), "Intermodal Industry Statistics," (Calverton, MD: Intermodal Association of North America), various years; updated, June 2007.

Interstate Commerce Commission (ICC) (1974), "Annual Report of the Interstate Commerce Commission," (Washington, DC: US Government Printing Office).

Interstate Commerce Commission (ICC) (1976), "Abandonment Rules Pursuant to the 4 R Act of 1976," Ex Parte No. 274 (Sub-No. 2), (November 1).

Interstate Commerce Commission (ICC) (1980a), "Abandonment of Railroad Lines - Use of Opportunity Costs," (Washington, DC: US Government Printing Office), 360 ICC 571.

Interstate Commerce Commission (ICC) (1980b), "Annual Report of the Interstate Commerce Commission," (Washington, DC: US Government Printing Office).

Interstate Commerce Commission (ICC) (1982), "Annual Report of the Interstate Commerce Commission," (Washington, DC: US Government Printing Office).

Interstate Commerce Commission (ICC) (1983), "Annual Report of the Interstate Commerce Commission," (Washington, DC: US Government Printing Office).

Interstate Commerce Commission (ICC) (1985), “Annual Report of the Interstate Commerce Commission,” (Washington, DC: US Government Printing Office).

Interstate Commerce Commission (ICC) (1987), “Annual Report of the Interstate Commerce Commission,” (Washington, DC: US Government Printing Office).

Iowa and Minnesota Departments of Transportation (IMDT) (1977), Trends in Transportation Regulation: Rails, Buses, Trucks, (Des Moines, IA and St. Paul, MN: Iowa and Minnesota Departments of Transportation, September, 1977).

Kelly, Dawn and Terry L. Amburgey (1991), “Organizational Inertia and Momentum: A Dynamic Model of Strategic Change,” The Academy of Management Journal, Vol. 34, No. 3 (September), pp. 591-612.

Kurtz, David L., Scott B. Keller, Mike J. Landry, and Daniel F. Lynch (1995), “Wal-Mart Fights the Battle of Conway,” Business Horizons, Vol. 38 (September-October), pp. 46-50.

Kutner, Michael H., Christopher J. Nachtsheim, John Neter, William Li (2005), Applied Linear Statistical Models, 5th edition, (Homewood, IL: McGraw-Hill).

Larkin, John, David Ross, and Matthew Grady (2005), “The Budding Railroad Renaissance,” (Baltimore, MD: Legg Mason Wood Walker, Inc., November 18).

Ladd, George W. and Dennis R. Lifferth (1975), "An Analysis of Alternative Grain Distribution Systems," American Journal of Agricultural Economics, Vol. 57, No. 3 (August), pp. 420-430.

Leong, Dennis, Liat Lichtman, and Robert Russell (2004) “Economic Impact Analysis: Saukville to Kiel Railroad Abandonment,” (Madison WI: Wisconsin Department of Transportation).

Magee, John F. (1960), "The Logistics of Distribution," Harvard Business Review, July-August, pp. 89-101.

Maloney, Patricia A. (1982), "Impacts of Rail Abandonment on Rural Communities: an Alberta Example," Proceedings of the Canadian Transportation Research Forum, (Oxford, Indiana: Richard B. Cross), pp. 90-101.

Maynard, Micheline and Nick Bunkley (2007), “Obama Scolds and Soothes Automakers,” New York Times, May 8, p. A-18.

Miller, John J., C. Phillip Baumel, and Thomas P. Drinka (1977), "Impact of Rail Abandonment Upon Grain Elevator and Rural Community Performance Measure," American Journal of Agricultural Economics, Vol. 59, No. 4 (November), pp. 745-749.

Mishan, E.J. (1976), Cost-Benefit Analysis, (New York, New York: Praeger Publishers), Chapter 7.

Morton, Alexander Lyall (1975), “Northeast Railroads: Restructured or Nationalized?” The American Economic Review, Vol. 65, No. 2, (May, 1975), pp. 284-288.

Nellas, George J. (1982), "Network Analysis of Rail Branch Line Abandonment," Proceedings of the Transportation Research Forum, (Oxford, Indiana: Richard B. Cross), pp. 480-489.

Neuschel, Robert P. (1967), "Physical Distribution: The Forgotten Frontier," Harvard Business Review, March-April.

Online, The Journal of Commerce (2003), “STB to Review Small Roads' Abandonment Rules,” The Journal of Commerce Online,” (August 3), http://www.joc.com/.

Office of Public Services (1997), “Abandonments and Alternatives to Abandonments,” (Washington, DC: Surface Transportation Board, April).

Ozment, John (2001a), “Demand for Intermodal Transportation in Arkansas,” Report No. 1018, (Fayetteville, AR: Mack-Blackwell National Rural Transportation Study Center).

Ozment, John (2001b), “Effects of Motor Carrier Deregulation on Small Rural Communities,” Report No. 1019, (Fayetteville, AR: Mack-Blackwell National Rural Transportation Study Center).

Ozment, John and H. Barry Spraggins (2001), “Assessing the Potential for Intermodal Traffic Using Total Logistics Cost,” Proceedings of the 2001 Conference on Emerging Issues in Business and Technology, Myrtle Beach, SC, November 8-10, pp. 156-165.

Pub. L. 90-543, “The National Trails System Act,” 16 U.S.C. 1247(d), (October 2, 1968).

Pub. L. 93-236, “The Regional Rail Reorganization Act of 1973,” 87 Stat. 985; (January 2, 1974).

Pub. L. 94-210, “Railroad Revitalization and Regulatory Reform Act of 1976,” 90 Stat. 31; (February 5, 1976).

Pub. L. 95-607, Local Rail Service Assistance Act of 1978,” 92 Stat. 3059, (November 8, 1978).

Pub. L. 96-101, “Milwaukee Railroad Restructuring Act,” 93 Stat. 736, (November 4, 1979).

Pub. L. 96-254, “Rock Island Railroad Transition and Employee Assistance Act,” 94 Stat. 400, (May 30, 1980).

Pub. L. 96–448, “The Staggers Rail Act of l980,” 94 Stat. 1895, (October 14, 1980).

Pub. L. 97-35, “Northeast Rail Service Act of 1981,” 95 Stat. 644, (August 13, 1981).

Pub. L. 97-468, “Bankrupt Railroad Service Preservation and Employee Protection Act of 1982,” 96 Stat. 2543, (January 14, 1982).

Pub. L. No. 98-11, “Rails-to-Trails Act of 1983,” 97 Stat. 48, (March 28, 1983).

Pub. L. 104-88, “ICC Termination Act of 1995,” 109 Stat. 803 (December 29, 1995).

Rail Services Planning Office (1975), “Rail Service Continuation Subsidy Decisions," Interstate Commerce Commission - Federal Register, Vol. 40 (June 9), pp. 24686-24689.

Rail Services Planning Office (1982), “Guidelines for Evaluating the Feasibility of Short Line Operations,” (Washington, DC: Interstate Commerce Commission, Rail Services Planning Office, August).

Rails to Trails Conservancy (2006), “Rail Banking and Rails to Trails: A Legacy for the Future,” Washington DC: Rails to Trail Conservancy, July).

Russell, Eugene R., Sr., Michael W. Babcock, and Curtis Mauler (1996), “Methodology for Determining Road Damage Due to Railroad Branchline Abandonment,” Semisequicentennial Transportation Conference Proceedings, (Iowa State University, Ames, Iowa, May).

Sanderson, James and Michael W. Babcock (2005) “County-Level Impacts of Rail Line Abandonments: A Kansas Case Study,” Journal of the Transportation Research Forum, Vol. 44, No. 3 (Fall), pp. 93-112.

Schuler, Harry J. (1979), "A Decision Model for Subsidizing Unprofitable Rail Properties: A Case Study and Comparison," Logistics and Transportation Review, Vol. 15, No. 5, pp. 643-657.

Sheys, Kevin M. (1994), “Strategies to Facilitate Acquisition and Use of Railroad Right of Way by Transit Providers,” Legal Research Digest, (September), No. 1.

Simat, Helliesen, and Eichner (1973), Retrospective Abandonment Study: Final Report, (Washington, DC: U.S. Department of Transportation).

Smith, Denise L. (1989), “Ready to Fight Goliath,” The Detroit News, (June 12), pp. D-1, D-3.

Sloss, J., T.J. Humphrey, and F.N. Krutter (1975), An Analysis and Evaluation of Past Experience in Rationalizing Railroad Networks, M.I.T. Report R74-54 (Cambridge, MA: Massachusetts Institute of Technology, Department of Civil Engineering).

Smykay, Edward W., Donald J. Bowersox, and Frank H. Mossman (1961), Physical Distribution Management, (New York: The Macmillan Company).

Spraggins, H. Barry (1978), "Rationalization of Rail Line Abandonment Policy in the Midwest Under the Railroad Revitalization and Regulatory Reform Act of 1976," Transportation Journal, Vol. 18, No. 1 (Fall), pp. 5-18.

Staw, Barry M., Lance E. Sandelands, and Jane E. Dutton (1981) "Threat-Rigidity Effects in Organizational Behavior: A Multilevel Analysis," Administrative Science Quarterly, Vol. 26, No. 4 (December), pp. 501-524.

Stern, Louis W. and Adel I. El-Ansary (1982), Marketing Channels, 2nd edition (Englewood Cliffs, NJ: Prentice-Hall).

Stewart, Richard D., Xiubin Wang, William Sproule, William Bajjali, Pasi Lautala and Libby Ogard (1996), "Evaluation of Shipper Requirements and Rail Service for Northern Wisconsin and the Upper Peninsula of Michigan," (Superior, WI: Transportation and Logistics Research Center, University of Wisconsin – Superior, August 1).

Stock, James R. and Douglas M. Lambert, Strategic Logistics Management, 4th ed, (Boston, MA: McGraw-Hill Irwin, 2001).

Stollsteimer, John F. (1963), "A Working Model for Plant Numbers and Locations," Journal of Farm Economics, Vol. 45, No. 3 (August), pp. 631-645.

Surface Transportation Board (STB) (1998), 1996/1997Annual Report, (Washington, DC: Surface Transportation Board, Office of Congressional and Public Services, March 16).

Surface Transportation Board (STB) (2002), 1998/1999/2000/2001 Report, (Washington, DC: Surface Transportation Board, Office of Congressional and Public Services, September 20).

Surface Transportation Board (STB) (2005), FY 2002-2004 Report, (Washington, DC: Surface Transportation Board, Office of Congressional and Public Services, December).

Surface Transportation Board (STB) (2007), "Decisions and Notices," (www.stb.dot.gov/decisions/readingroom.nsf/ByDocketPrefix).

Theodore, C.A. and F.S. Doody (1966), "The Economic Impact of the Discontinuance of the Rutland Railway," (Boston, MA: Boston University, Bureau of Business Research).

Tolliver, Denver, and HDR Engineering Inc. (2000), Benefits of Rail Freight Transportation in Washington: A Multimodal Analysis, (Olympia, WA: Washington State Department of Transportation), Appendix D.

Tyrchniewicz, E.W., C.F. Framingham, J.A. MacMillan, and J.W. Craven (1978), "The Abandonment of Uneconomic Branch Lines and Unremunerative Grain Rates: Effects on Agriculture and Regional Development," Logistics and Transportation Review, Vol. 14, No. 4, pp. 411-431.

Tyrchniewicz, Edward W. and Robert J. Tosterud (1973), "A Model for Rationalizing the Canadian Grain Transportation and Handling System on a Regional Basis," American Journal of Agricultural Economics, Vol. 55, No. 5 (December), pp. 805-813.

Weinblatt, H.B. and D.E. Matzzie (1977), Effects of Railroad Abandonment on the Modal Distribution of Traffic and on Related Costs, (Washington, DC: Department of Transportation, Office of the Secretary, Office of Transportation Systems Analysis and Information).

Wood, Donald F. and James C. Johnson (1983), Contemporary Transportation, (Tulsa, OK: PennWell Publishing, Co.).

Zasada, D. (1968), "The Probable Effects of the Application for Railway Branch Line Abandonment on the Grain Elevator Industry," Canadian Farm Economics, Vol. 3, No. 2 (April), pp. 20-23.

Appendix

Analysis of data including largest four counties and counties that lost rail service after 1995 in sample of counties "without rail service"

The sample used in the primary analysis omitted the four largest counties (Benton, Pulaski, Sebastian, and Washington). The Tables shown below were based on the full sample of counties as shown in Table A-4. Additionally, counties that had lost rail service for the first time after 1995 were included in the primary analysis as part of the sample that had not lost rail service. The rationale was based on the suggestion made by Sanderson and Babcock (2005) that it would take several years for the effects of abandonment to become manifest. The counties that had lost rail service for the first time after 1995 were Clark (1996), Columbia (2001), Chicot (2007), Drew (1996), Lafayette (2001), Ouachita (1996), Nevada (1996, and White (1999).

This analysis includes five of those counties (Clark, Drew, Nevada, Ouachita, and White) as part of the sample that had "lost rail service." Columbia, Chicot, and Lafayette were not included as having lost rail service since the majority of the data used was not current enough to have affected them. Chicot County did not experience abandonment until 2007, and Columbia and Lafayette lost service in 2001, just one year prior to the most recent data reported for Manufacturing, Wholesaling, and Retailing.

Comparison of the results of the primary analysis and this one are not substantially different. The additional variables that are significant in this Appendix that are not in the Primary analysis are marked with an asterisk. There are 7 additional variables that are significant in this analysis. Three of them are related to unemployment and changes in unemployment, one is related to the change in Manufacturers' pay per employee, one is related to the growth in Wholesalers' revenue, and two are related to the change in Wholesalers' pay per employee. Except for the differences in unemployment, all of the additional significant variables suggest that counties that lost rail service are better off than those that have not.

Table A-4

Arkansas Counties, Populations, and Rail Service: All Counties (1980-2000)

Counties with Abandonments*			Counties without Abandonment		
County	2000 Population		County	2000 Population	
Arkansas	20,749		Baxter	38,386	
Ashley	24,209		Benton	153,406	**
Bradley	12,600		Boone	33,948	
Calhoun	5,744		Chicot	14,117	
Carroll	25,357		Clay	17,609	
Clark	23,546		Cleveland	8,571	
Cleburne	24,046		Columbia	25,603	
Craighead	82,148		Conway	20,336	
Crittenden	50,866		Crawford	53,247	
Desha	15,341		Cross	19,526	
Drew	18,723		Dallas	9,210	
Franklin	17,771		Faulkner	86,014	
Grant	16,464		Fulton	11,642	
Greene	37,331		Garland	88,068	
Hempstead	23,587		Hot Spring	30,353	
Jefferson	84,278		Howard	14,300	
Johnson	22,781		Independence	34,233	
Lawrence	17,774		Izard	13,249	
Logan	22,486		Jackson	18,418	
Lonoke	52,828		Lafayette	8,559	
Madison	14,243		Lee	12,580	
Mississippi	51,979		Lincoln	14,492	
Monroe	10,254		Little River	13,628	
Montgomery	9,245		Marion	16,140	
Nevada	9,955		Miller	40,443	
Newton	8,608		Perry	10,209	
Ouachita	28,790		Polk	20,229	
Phillips	26,445		Pope	54,469	
Pike	11,303		Scott	10,996	
Poinsett	25,614		Sevier	15,757	
Prairie	9,539		Sharp	17,119	
Pulaski	361,474	**	Washington	157,715	**
Randolph	18,195		Woodruff	8,741	
Saint Francis	29,329		Yell	21,139	
Saline	83,529		Average	32,719	
Searcy	8,261				
Sebastian	115,071	**			
Stone	11,499				
Union	45,629				
Van Buren	16,192				
White	67,165				
Average	38,072				

* Counties that had no rail service or had lost rail service between 1980 and 1995.

** Counties with populations over 100,000 for the year 2000.

Source: Population data; Bureau of the Census, County City Data Book, http://censtats.census.gov/usa/usa.shtml, (various years). Rail service data; Planning and Research Division, State Rail Plan: 2002, (Arkansas Highway and Transportation Department, May, 2002), pp. II-3, Interstate Commerce Commission (ICC) (1987), "Annual Report of the Interstate Commerce Commission," (Washington, DC: US Government Printing Office), and Surface Transportation Board, Surface Transportation Board, "Decisions and Notices," (www.stb.dot.gov/decisions/readingroom.nsf/ByDocketPrefix).

Table A-6
Impact of Rail Abandonment on Population, Growth, and Employment: 1980-2000

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Mean Population					
1980	41	34,939	34	25,116	0.284
1990	41	35,139	34	26,766	0.387
2000	41	38,072	34	32,719	0.627
Percentage Change in Population[2]					
1980-1990	41	(0.1)	34	0.2	0.173
1990-2000	41	0.9	34	1.3	0.279
1980-2000	41	0.4	34	0.8	0.196
Civilian Labor Force					
1980	41	14,537	34	10,143	0.304
1990	41	17,025	34	12,589	0.388
2000	41	17,976	34	15,390	0.647
Percentage Change in Civilian Labor Force[2]					
1980-1990	41	1.6	34	1.9	0.455
1990-2000	41	0.8	34	1.2	0.193
1980-2000	41	1.3	34	1.8	0.248
Unemployment Rate (percent)					
1980	41	8.2	34	7.3	0.075
1990	41	8.1	34	7.2	0.060 *
2000	41	4.8	34	4.7	0.887
Change in Unemployment Rate (annual)					
1980-1990	41	(0.0)	34	(0.0)	0.915
1990-2000	41	(0.3)	34	(0.2)	0.014 *
1980-2000	41	(0.8)	34	(0.7)	0.048 *

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-7
Impact of Rail Abandonment on Income: 1979-1999

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Median Income (dollars)					
1979	41	11,147	34	11,071	0.855
1989	41	18,971	34	18,698	0.718
1999	41	29,178	34	28,912	0.795
Percentage Change in Median Income[2]					
1979-1989	41	7.1	34	6.9	0.521
1989-1999	41	5.5	34	5.6	0.792
1979-1999	41	8.2	34	8.1	0.777
Income per Capita (dollars)					
1979	41	5,052	34	5,080	0.856
1989	41	9,275	34	9,288	0.967
1999	41	15,293	34	15,256	0.928
Percentage Change in Income per Capita[2]					
1979-1989	41	8.4	34	8.3	0.740
1989-1999	41	6.6	34	6.5	0.663
1979-1999	41	10.2	34	10.1	0.540

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-8
Impact of Rail Abandonment on Permits for New Housing Construction: 1980-2000

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of New Housing Permits					
1980	28	138	28	116	0.724
1990	39	81	34	81	0.989
2000	39	115	34	139	0.738
New Housing Permits per 10,000-Pop					
1980	24	30.2	25	33.7	0.582
1990	24	20.2	25	20.8	0.904
2000	24	23.2	25	27.4	0.583
Percentage Change in Permits per 10,000-Pop[2]					
1980-1990	24	(2.5)	25	0.9	0.357
1990-2000	24	3.2	25	5.0	0.601
1980-2000	24	(6.5)	25	(4.9)	0.467
Value of New Housing Permits ($1,000)					
1980	28	5,018.2	28	3,455.3	0.528
1990	39	4,712.1	34	4,379.8	0.889
2000	39	11,443.1	34	12,127.6	0.926
Value of New Housing per Permit (dollars)					
1980	24	34	25	34	0.875
1990	24	51	25	49	0.821
2000	24	81	25	81	0.947
Percentage Change in Value of Housing per Permit[2]					
1980-1990	24	5.2	25	5.1	0.908
1990-2000	24	7.6	25	8.7	0.754
1980-2000	24	(4.5)	25	(4.5)	0.936

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-9
Impact of Rail Abandonment on Financial Institutions: 1980-2000

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Banks and Savings and Loans					
1980	41	10	34	7	0.238
1990	41	12	34	9	0.295
2000	41	18	34	15	0.534
Percentage Change in the Number of Banks and S & Ls[2]					
1980-1990	41	1.8	34	1.9	0.813
1990-2000	41	6.4	34	6.1	0.828
1980-2000	41	4.7	34	4.6	0.916
Banks and S & L Deposits ($1,000)					
1980	41	138,949.5	34	94,645.9	0.300
1990	41	259,992.2	34	205,206.5	0.503
2000	41	463,798.8	34	403,785.3	0.688
Banks and S & L Deposits per Capita (dollars)					
1980	41	3,608	34	3,569	0.883
1990	41	7,052	34	7,330	0.616
2000	41	11,558	34	11,989	0.584
Percentage Change in Deposits per Capita[2]					
1980-1990	41	9.6	34	10.8	0.140
1990-2000	41	6.9	34	6.9	0.962
1980-2000	41	11.5	34	12.3	0.257

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as “counties with abandonments.”

[2] Percentage changes are annual.

Table A-10

Impact of Rail Abandonment on Manufacturing and Value of Mfg Shipments: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Manufacturing Establishments					
1982	41	50	34	37	0.284
1992	41	58	34	46	0.395
2002	34	53	25	51	0.897
Percentage Change in Manufacturing Establishments[2]					
1982-1992	41	1.9	34	2.2	0.638
1992-2002	34	(2.0)	25	(1.4)	0.446
1982-2002	34	(0.1)	25	0.3	0.420
Value of Manufacturing Shipments ($1,000)					
1982	38	339,608	28	194,414	0.142
1992	35	553,334	27	417,152	0.414
2002	26	901,352	23	702,718	0.522
Percentage Change in Value of Shipments[2]					
1982-1992	35	13.5	25	14.8	0.800
1992-2002	24	3.2	20	3.3	0.868
1982-2002	24	6.6	20	9.2	0.139
Shipment Value per Manufacturer (dollars)					
1982	38	5,325,052	28	4,155,767	0.223
1992	35	7,738,939	27	7,377,813	0.801
2002	26	14,365,101	23	13,631,830	0.782
Percentage Change in Shipment Value per Manufacturer[2]					
1982-1992	35	11.4	25	10.0	0.800
1992-2002	24	8.0	20	7.1	0.737
1982-2002	24	7.5	20	9.4	0.331

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as “counties with abandonments.”

[2] Percentage changes are annual.

Table A-11
Impact of Rail Abandonment on Manufacturing Employment and Pay: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Manufacturing Employees					
1982	37	3,103	27	2,337	0.386
1992	35	3,451	27	3,137	0.766
2002	34	3,579	25	3,476	0.920
Percentage Change in Manufacturing Employees[2]					
1982-1992	34	3.3	24	2.9	0.778
1992-2002	28	(1.2)	20	(0.6)	0.426
1982-2002	31	0.7	20	1.4	0.399
Manufacturing Payroll ($1,000)					
1982	38	46,134	28	30,700	0.267
1992	35	75,920	27	65,333	0.667
2002	26	113,149	23	102,486	0.784
Percentage Change in Manufacturing Payroll[2]					
1982-1992	35	10.4	25	13.4	0.510
1992-2002	24	3.0	20	2.8	0.804
1982-2002	24	6.7	20	7.9	0.456
Manufacturing Pay per Employee (dollars)					
1982	37	13,437	27	12,689	0.350
1992	35	19,150	27	19,395	0.846
2002	26	29,237	23	27,867	0.441
Percentage Change in Manufacturing Pay per Employee[2]					
1982-1992	34	4.6	24	5.4	0.224
1992-2002	24	5.1	20	3.8	0.010
1982-2002	24	6.2	20	5.4	0.135 *

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-12
Impact of Rail Abandonment on Wholesaling and Wholesale Revenue: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Wholesale Establishments					
1982	41	63	34	35	0.235
1992	41	69	34	43	0.356
2002	41	54	34	38	0.491
Percentage Change in Wholesale Establishments[2]					
1982-1992	41	0.3	34	1.6	0.051
1992-2002	41	(1.5)	34	(2.7)	0.242
1982-2002	41	(0.8)	34	(0.6)	0.739
Wholesale Revenues ($1,000)					
1982	40	197,224	33	84,113	0.348
1992	40	272,419	33	217,114	0.779
2002	29	567,949	16	101,844	0.195
Percentage Change in Wholesale Revenues[2]					
1982-1992	40	5.1	32	8.2	0.225
1992-2002	29	4.8	16	2.4	0.509
1982-2002	29	8.2	16	3.6	0.106
Wholesale Revenues per Establishment (dollars)					
1982	40	1,724,770	33	1,873,505	0.552
1992	40	2,317,855	33	2,801,078	0.321
2002	29	5,337,720	16	3,413,117	0.036
Percentage Change in Wholesale Revenues per Establishment[2]					
1982-1992	40	4.4	32	5.6	0.541
1992-2002	29	9.9	16	7.4	0.611
1982-2002	29	10.7	16	6.2	0.096 *

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-13
Impact of Rail Abandonment on Wholesale Employees and Pay: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Wholesale Employees					
1982	40	657	33	373	0.394
1992	41	679	34	471	0.569
2002	41	680	34	467	0.587
Percentage Change in Wholesale Employees[2]					
1982-1992	40	1.5	32	3.8	0.089
1992-2002	40	(0.9)	33	(1.3)	0.787
1982-2002	40	0.1	33	0.6	0.525
Wholesale Payroll ($1,000)					
1982	40	10,282	33	4,986	0.356
1992	40	16,250	33	10,263	0.540
2002	29	30,899	16	6,618	0.201
Percentage Change in Wholesale Payroll[2]					
1982-1992	40	6.9	32	10.3	0.122
1992-2002	29	4.7	16	0.9	0.050 *
1982-2002	29	7.3	16	5.2	0.320
Wholesale Pay per Employee (dollars)					
1982	40	12,521	33	12,134	0.543
1992	40	18,156	33	17,674	0.683
2002	29	28,230	16	25,100	0.084
Percentage Change in Wholesale Pay per Employee[2]					
1982-1992	40	5.3	32	5.2	0.951
1992-2002	29	5.5	16	3.7	0.082
1982-2002	29	6.1	16	5.0	0.071 *

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.

Table A-14
Impact of Rail Abandonment on Retailing and Retail Revenue: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Retail Establishments					
1982	41	214	34	148	0.280
1992	41	226	34	165	0.386
2002	41	176	34	145	0.568
Percentage Change in Retail Establishments[2]					
1982-1992	41	0.5	34	0.7	0.693
1992-2002	41	(2.0)	34	(1.7)	0.486
1982-2002	41	(0.7)	34	(0.5)	0.439
Retail Revenues ($1,000)					
1982	41	140,426	34	86,357	0.281
1992	41	248,501	34	168,729	0.412
2002	41	380,249	34	294,748	0.579
Percentage Change in Retail Revenues[2]					
1982-1992	41	7.2	34	7.7	0.658
1992-2002	41	5.3	34	6.2	0.260
1982-2002	41	8.5	34	9.4	0.458
Retail Revenues per Establishment (dollars)					
1982	41	523,680	34	498,724	0.438
1992	41	859,531	34	825,345	0.573
2002	41	1,623,387	34	1,595,118	0.820
Percentage Change in Retail Revenues per Establishment[2]					
1982-1992	41	6.4	34	6.5	0.832
1992-2002	41	9.0	34	9.8	0.330
1982-2002	41	10.5	34	11.0	0.433

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as “counties with abandonments.”

[2] Percentage changes are annual.

Table A-15
Impact of Rail Abandonment on Retail Employees and Pay: 1982-2002

	Counties with Abandonments[1]		Counties without Abandonments		
	N	Mean	N	Mean	P-Value
Number of Retail Employees					
1982	41	1,803	34	1,180	0.347
1992	41	2,367	34	1,617	0.425
2002	41	1,947	34	1,600	0.639
Percentage Change in Retail Employees[2]					
1982-1992	41	2.7	34	3.4	0.406
1992-2002	41	(0.7)	34	(0.4)	0.533
1982-2002	41	0.9	34	1.5	0.355
Retail Payroll ($1,000)					
1982	41	15,091	34	9,242	0.314
1992	41	25,441	34	17,343	0.444
2002	41	34,550	34	27,388	0.614
Percentage Change in Retail Payroll[2]					
1982-1992	41	6.8	34	7.4	0.592
1992-2002	41	4.3	34	4.8	0.509
1982-2002	41	7.2	34	8.1	0.470
Retail Pay per Employee (dollars)					
1982	41	7,807	34	7,732	0.654
1992	41	10,242	34	10,048	0.405
2002	41	15,870	34	15,545	0.441
Percentage Change in Retail Pay per Employee[2]					
1982-1992	41	3.2	34	3.0	0.612
1992-2002	41	5.5	34	5.6	0.866
1982-2002	41	5.2	34	5.1	0.689

[1] Counties that did not have rail service as of 1980 or that lost service prior to 2000 are referred to as "counties with abandonments."

[2] Percentage changes are annual.