PERFORMANCE OF COORDINATED AND NON-COORDINATED RURAL TRANSIT SYSTEMS IN THE MOUNTAIN-PLAINS REGION

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ABSTRACT

There has been controversy over the relative benefits of coordinating rural transit systems. Initially, it was expected that coordinated systems would experience lower costs and/or offer increased services. Some regional studies have indicated that coordinated systems do not experience decreased costs, but rather increased costs. However, no studies have analyzed the coordinated systems in the Midwest and Mountain-Plains states. The objective of this study was to examine the performance of coordinated and non-coordinated systems in the Midwest and Mountain-Plains states of Colorado, Minnesota, Montana, North Dakota, South Dakota, Utah, and Wyoming. Data were collected from several transit systems in this region to compare select performance measures. Each transit system was categorized into one of the following categories of coordination: cooperation, joint-use arrangement, consolidation, or none. The performance measures selected assessed efficiency and effectiveness of the transit systems surveyed.

Results provide some support for the notion that coordinated transit systems perform with more effectiveness than non-coordinated systems in the Mountain-Plains states.

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CHAPTER 1

INTRODUCTION

Rural passenger transportation is an important part of life for many rural residents. Many of the rural transit riders are elderly, disabled, and/or have low incomes, making them partially or completely dependent on public transportation for access and mobility. The low population density and vast land area create unique challenges for rural transit systems in regions of the Mountain-Plains states. Essentially, low population density translates into a small tax base. The lack of tax revenues means fewer funds are available for subsidizing rural transit operations. Moreover, low population density also translates into low farebox revenues relative to costs, as transit costs per passenger are high due to long distance trips.

Several emerging trends suggest that providing rural transit services will become more challenging in the future. One trend is the continued increases in the age of the rural population. Advances in medicine and a declining birth rate are resulting in an aging United States population. In 1960, only about 13 percent of the population was above age 60. In 2020, it is estimated that nearly 25 percent of the population will be more than 60 years old (Lowy 1986). Another trend is the continued out migration of young rural residents to urban areas, which affects transit in two ways. First, the out migration reduces the tax base. The declining tax base leads to limited funding for transit in rural areas. In addition, the out migration means fewer younger family members will be available to provide transportation to aging family members.

Another trend to watch is the federal government's involvement in rural public transit. The federal government has had a long involvement in public transportation. Changes in administration and

transportation policies influenced transportation in the past and will continue to influence it in the future. The direction of federal policy has been toward coordination of transit systems. Coordination occurs when transit systems work together to meet needs of transit riders in a cost-effective consumer responsive manner. The process may include pooling resources, sharing information, or consolidating systems.

In 1977, the U.S. General Accounting Office estimated that there were 114 federal programs funding transportation services. Many of the programs were state-administered health and human service programs, which provided transportation for clients to and from a point of service or relied on transportation services provided through another federal program (Greene 1987). Congress took the view that too many federal programs funding transportation services existed and acknowledged a need for coordination among the programs. In 1978, Congress amended transit legislation UMTA-64, which created the Section 18 and 16b2 programs. Applicants for Section 18 funding were required to show how their public transportation service would coordinate with other transportation providers (Greene 1987). The Office of Human Development Services of the U.S. Department of Health and Human Services reported that by 1981, more than half the states had "made considerable progress" in taking steps toward coordination.

The federal government became more active in the coordination efforts in 1986. The increased population of elderly and handicapped U.S. citizens and their need for health and human service programs and transportation led to the "Agreement on the Coordination of Transportation Services" between the U.S. Department of Health and Human Services (DHHS) and the U.S. Department of Transportation (DOT). The two agencies agreed to jointly "coordinate related programs at the federal

level wherever possible and to promote maximum feasible coordination at the state and local level" (USDOT 1992). The agreement established a Joint DOT/DHHS Coordinating Council on Human Services Transportation. This agreement exemplified the importance of coordinated transit services.

By 1992, more than one-half of the states had adopted some type of government requirement related to the coordination of transit services. In 1993, Sen. Tom Harkin (D-IA) drafted a bill to establish national guidelines for coordinating all human services and transportation funding. The bill, referred to as the Human Opportunities Transportation Efficiency Act (HOT TEA), was intended to recognize the essential role of transportation in Health and Human Services (HHS) programs and "provide for a coordinated, unified and cost-effective approach to the management of human services transportation activities" (TD Safety 1994). The bill did not pass.

There are several reasons agencies may consider coordinating their services aside from a legislative policy requiring the cooperation. The dominant reasons are to eliminate overlap and duplication of services, improve and expand services, and to save money. Hallock (1991) suggests that the major reason for agencies to coordinate is to get the maximum benefit from every public dollar spent for passenger transportation.

Presently, no federal coordination mandates exists. However, there are federal mandates that have made providing transportation more challenging. For example, the Americans With Disabilities Act (ADA), which was passed in 1990, requires equal opportunities for persons with disabilities in the areas of employment, transportation, housing, and public accommodation. Transit agencies are required to provide special services such as para-transit, wheel-chair lifts, and to transcribe materials

into alternative formats to aid the visually- or hearing-impaired. The special requirements have increased costs of transit service.

The federal budget deficit also is a problem that looms over transit. Transit funding has not decreased; however, the future is always uncertain because administrative turnover and balancing the federal deficit is an issue at least every four years. Funding uncertainties should motivate transit managers to work to increase efficiency and effectiveness of their agencies.

Current and Future Federal Transportation Policy

Future federal transportation policy is uncertain. The current, but soon to be outdated legislation, Intermodal Surface Transportation Efficiency Act (ISTEA) had called for 1) a reduction in transit's dependence on the Federal General Fund and an increased focus on user-based financing; 2) increased attention to the efficiency of transit systems and application of cost-effectiveness standards to transit that receives federal assistance; 3) increased reliance on the states in the funding of transit; 4) increased concentration on enhancing mobility in rural areas; 5) increased flexibility in the use of federal funds; 6) coordination of transit programs between agencies (to eliminate duplication) and with other modes such as airports, highways, and intercity rail services (to improve intermodal connections); and 7) encouragement of private participation in transit and coordinated efforts with private business and community groups. The trends and transportation policy suggests that North Dakota's transit systems will need to provide more services with less resources in the future.

PROBLEM STATEMENT

There has been no consensus on whether coordination of rural transit agencies increase efficiency and effectiveness. Presently, no official study has documented the performance of coordinated systems in the Midwest-Mountain-Plains states. In 1994, the Upper Great Plains Transportation Institute at North Dakota State University developed a performance evaluation guidebook to aid system evaluations in the Mountain-Plains states. The evaluation guidebook illustrated how to place the transit systems into peer groups based on factors that could not be controlled by the transit manager, i.e., population density, land area served, etc. This allows transit systems to compare their performance to transit systems with similar characteristics. However, the evaluation guidebook did not evaluate systems based on their coordination status. This study is an extension of the 1994 performance evaluation guidebook. Similar performance measures are used to determine if coordinated systems perform more efficiently than non-coordinated systems.

RESEARCH OBJECTIVES

The primary purpose of this study is to compare the efficiency and effectiveness of coordinated and non-coordinated rural transit systems in the Midwest and Mountain-Plains states. To achieve this, the specific objectives of the study are:

1. Review select literature on the performance of coordinated and non-coordinated rural transit systems.
2. Select specific performance measures to evaluate the change in efficiency and effectiveness that may occur as a result of coordination.

3. Use primary data from rural transit systems in the Mountain-Plains states to compare the selected performance measures to determine if coordinated transit systems are more efficient or effective than non-coordinated transit systems.
4. Offer recommendations to coordinated and non-coordinated rural transit systems based on statistical findings.

ORGANIZATION

The next chapter consists of a literature review of rural transit coordination studies. In Chapter 3, the survey instrument used to gather the data and the methods used to evaluate the data are discussed. In addition, the efficiency and effectiveness measures used to evaluate the performance of coordinated and non-coordinated transit systems in the Mountain-Plains states of Colorado, Minnesota, Montana, North Dakota, South Dakota, Utah, and Wyoming are identified. The comparison between performance of coordinated and non-coordinated transit systems are documented in Chapter 4. The final chapter offers recommendations to transit systems that are considering coordinating their transit efforts.

CHAPTER 2

SELECT LITERATURE REVIEW

In 1986, the Department of Transportation's and Department of Health and Human Service's Coordination Round table identified the need for a clear definition of coordination. Initially, when Section 18 funding was implemented and applicants described how they would coordinate with other transportation providers, the goal seemed to be elimination of duplicate services. Burkhardt (1981) stated coordination can be viewed as the process in which two or more agencies interact to jointly accomplish their transportation objectives. Walther (1990) viewed coordination as a means for achieving efficiency and effectiveness goals. He explained the goals of coordination relate to service delivery, efficiency, and rider service.

Studies indicate that early expectations of coordination, i.e., cost reductions are not always achieved. In 1977 and 1978, five agencies received funding to participate in coordination demonstration projects. Results indicate each of the agencies showed improvements in the services they provided — but not as great as anticipated. After this two-year study, Burkhardt et al. (1979) found that among the five demonstration projects, "coordination and the number of riders served increased but costs per unit of service also increased, even after adjusting for inflation. Only one of the five projects showed the substantial improvements in efficiency and effectiveness that were expected."

McKnight et al. found in a study of 12 agencies that the increased efficiency of consolidated systems over unconsolidated systems is improved services rather than lower costs (Urban Systems 1988). Likewise, Rosenbloom found in a study of handicapped needs and transportation services in six

Texas cities, that coordinating transportation services will not necessarily result in reduced costs (Urban Systems 1988). In his study, Rosenbloom identified important factors that affect cost, they include:

- restrictions on rider eligibility
- assistance required by different rider groups
- level of service
- amount of administrative control
- management (Urban Systems 1988)

Recommendations for mandating coordination have varied through time (Walther 1990). It was recommended at the First UMTA Administration on Aging (AoA) National Conference on Transportation for the Elderly and Handicapped that the U.S. Congress mandate the coordination of federal funds for transportation and that state coordination be mandated by the various states (Ecosometrics, Inc., 1985). Two years later the participants at the service coordination session of the Seventh National Conference on Rural Public Transportation (1987) recommended that coordination not be mandated at the local level, but should be encouraged. There does not seem to be a consensus on the coordination topic. However, it is still on the forefront of discussion.

States are approaching the coordination topic with the possibilities of forming transit authorities. Regional Transit Authorities (RTA) generally require state legislation, but can be accomplished through aggressive policies by state's department of transportation (CTAA). In this model, an entire state is divided into regions, and agencies are created in each region that are charged with meeting the region's entire public transportation needs. Iowa adopted this approach in the late 1970s. Regional transit authorities often are given the authority to levy taxes or issue bonds; they also have the authority to approve or disapprove all vehicles purchased with state-administered funds in their region. Some RTAs operate all their transportation services directly. Others contract out a portion of their services to

private operators. Still other RTAs provide no service directly, and simply monitor the transportation activities of local governments, private non profit agencies, and private taxi, van and bus operators that provide transportation with public financial assistance.

Although the body of literature for coordination is extensive, no official studies have been conducted to address coordination efforts in the Mountain-Plains states of Colorado, Minnesota, Montana, North Dakota, South Dakota, Utah, and Wyoming. This study focuses on the differences in efficiency and effectiveness measures of coordinated and non-coordinated rural transit systems.

CHAPTER 3

RESEARCH METHOD

This chapter documents the process used to collect data and contains a description of the performance measures selected to compare the performance of coordinated and non-coordinated rural transit systems in the Midwest and Mountain-Plains states.

DATA COLLECTION

Primary data were collected from 62 transit systems in Colorado, Minnesota, Montana, North Dakota, South Dakota, Utah, and Wyoming using a mail survey. The questionnaire was developed and mailed to rural transit managers to gather pertinent service, financial, and human resource information. The information was collected to calculate performance measures for each of the transit systems and compare the measures among specific transit system groups. The groups were categorized according to their level of coordination. The survey instrument and the method used to compare the transit systems are described in more detail in the following pages.

Survey Group Selection

A list of section 18 (now referred to as USC 5311) transit managers was obtained from the section 18 state administrator in Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming, and Minnesota. One hundred sixty-two transit managers were identified and mailed the questionnaire. A total of 69 surveys were returned; however, only 62 could be used for analytical purposes due to

missing data. The response rate of useful surveys was 40.8 percent (Table 3.1). Colorado, Minnesota, Montana, and North Dakota had above a 40 percent response rate (Table 3.1). The response rate among South Dakota, Utah, and Wyoming was between 25 and 30 percent.

TABLE 3.1 Response Rate, Survey of Rural Transit Managers, Mountain-Plains States

States Surveyed	Number Sent	Number Received	Number Useful	Percentage Response (Useful)
Colorado	17	8	7	41.2
Minnesota	56	26	26	46.4
Montana	7	3	3	42.9
North Dakota	32	21	15	46.9
South Dakota	15	4	4	26.7
Utah	4	1	1	25
Wyoming	21	6	6	28.6
Total	152	69	62	40.8

Survey Instrument

The questionnaire focused on gathering financial, ridership, and service area information. Detailed financial data, including expenses and revenues, were collected for the fiscal year 1991-92 to conduct performance evaluations. Additional census data were collected for each transit system that responded to the questionnaire. Census data including population, percent of all persons over 65, and persons per square mile were necessary to compute some of the effectiveness measures. Respondents

also reported the number of vehicles they operate and the annual number of miles and hours the vehicles were in operation.

In a follow-up postcard survey, each of the transit systems were asked if they coordinate efforts with other transit systems. The definitions for the levels of coordination were adapted from *CTAA's Handbook for Coordinating Transportation Services.* Transit managers could select one of four options to describe their coordination status. The options included:

COOPERATION:	You interacted and exchanged information with other transit systems.
JOINT USE ARRANGEMENTS:	Your transit systems shared resources with other transit systems. For example, one transit system agreed to pay a certain rate per vehicle mile for using another transit system's vehicle.
CONSOLIDATION:	You merged transportation resources and either you or another participant or a new entity took on the role of coordinator.
OTHER:	Please describe
NONE:	No Coordination

More than 70 percent of the systems responding to the survey fit in one of the three coordination categories. Forty-eight percent (30 systems) of the systems participate in the most basic form of coordination, which is cooperation (Table 3.2). There are eight systems that participate in a joint use arrangement and six systems that are consolidated. For comparative purposes, the joint use arrangement systems and the consolidation systems were combined because the small sample size of

each group would not allow reliable t-test interpretations. The combined group allows a more accurate interpretation of the statistics.

TABLE 3.2 Type of Rural Transit System Responding, Mountain-Plains States

State	Total	Coop	Joint	Consolidate	None
Colorado	7	4	1	1	1
Minnesota	26	15	2	1	8
Montana	3	2	1	.	0
North Dakota	15	5	2	2	6
South Dakota	4	3	.	.	1
Utah	1	1	.	.	0
Wyoming	6	0	2	2	2
Total	62	30	8	6	18

PERFORMANCE MEASURES SELECTED

There are two basic categories of performance measures — efficiency and effectiveness. Efficiency measures are aimed at providing service in the most productive and least cost manner, whereas effectiveness measures are aimed at maximizing the quality and utilization of service provided. An efficient system will maximize the level of service provided with limited resources, while an effective system will serve the needs of the community for which the service is provided. There are a host of performance measures that can be used to evaluate different aspects of the system, e.g., labor or administrative costs, etc. Performance evaluations should be used by transit managers to examine their transit systems to determine "if" and "where" system improvements are needed. For this study, specific performance measures were selected from the guidebook developed by the Upper Great Plains Transportation Institute to compare the performance of coordinated and non-coordinated rural transit

systems. Measures were selected to represent cost efficiency, service effectiveness, and social effectiveness.

Cost Efficiency Measures

The cost efficiency measures selected reveal the transit system's overall ability to minimize costs while providing adequate service in vehicle miles or hours. Three cost efficiency measures were selected. They include *total expense (cost) per vehicle mile* and *total expense per passenger*.

Total Expense (Cost) Per Vehicle Mile (Hour)

Decreases in this indicator represent improvements in performance. It is useful to examine total expenses on vehicle mile and vehicle hour basis, as each may provide a different illustration of cost efficiency. For example, in some cases the value for total expenses per vehicle mile will be in line with that of similar type transit systems, but the value for total expenses per vehicle hour will not. This may simply reflect more efficient utilization of vehicles, since more miles are covered in a smaller amount of time. However, it also may show a possible area for improvement as total expenses may be reduced.

Total Expense Per Vehicle Mile is calculated as follows[1]:

(Direct Operating Expenses + Administrative Expenses) / Vehicle Miles (total for all vehicles)

Total Expense Per Passenger

[1] To calculate this measure on a vehicle hour basis, substitute the number of vehicle hours for all vehicle in place of vehicle miles.

This is a general measure of cost efficiency, placing expenses on a per passenger basis. Total expense per passenger encompasses service effectiveness and cost efficiency. Decreases in this measure indicate improvements in performance, while increases indicate deterioration in performance.

Total Expense Per Passenger is calculated as follows:

Total Expenses / Total One-Way Passenger Trips

Select Cost, Service, and Social Effectiveness Measures

Cost and service effectiveness measures show how effectively the resources are used to provide service and what level of subsidy is required to maintain the system. The cost and service effectiveness measures evaluated include *Subsidy per passenger* and *passengers per vehicle mile/hour*. Moreover, the social effectiveness measures show how effectively the transit services are being used in the service area. The specific social effectiveness measures identified for evaluation include *vehicle miles/hours per elderly population* and *passengers per capita*.

Subsidy Per Passenger

This is a general measure of cost effectiveness showing the dependence of the transit system on federal, state, and local governments, and other charitable organizations for its total operations. Transit systems that are less reliant on subsidies, are more likely to survive government funding cuts or a loss of charitable contributions. However, some care must be used in interpreting this measure, as some systems may have higher subsidies per passenger because they serve a higher percentage of low income or elderly passengers.

Subsidy Per Passenger is calculated as follows:

Total Subsidy / Total One-Way Passenger Trips

Total Subsidy = *Total Revenues - Farebox Revenues - Contract Revenues - Advertising Revenues - Any Other Project Generated Revenue*

Passengers Per Vehicle Mile

This is a general measure of service effectiveness, showing the use of vehicles in terms of passengers. Increases in this measure indicate improvements in performance, while decreases indicate deterioration in performance.

Passengers Per Vehicle Mile are calculated as follows:

Total One-Way Passenger Trips / Vehicle Miles (total for all vehicles)

Passengers Per Capita

Passengers per capita is a general measure of the social effectiveness of transit systems. It is based on the theory that a system doing well in scheduling, routing, advertising, fare setting, and other areas should provide a large number of trips as a percentage of service area population. This measure gives an indication of the transit system's ability to provide service where it is in demand. Increases in this measure suggest improvements in social effectiveness, while decreases suggest deterioration of social effectiveness.

Passenger Per Capita are calculated as follows:

Total One Way Passenger Trips Provided / Total Service Area Population

Vehicle Miles Per Elderly Population

This detailed measure of social effectiveness, provides an illustration of the service units provided on a per elderly population basis. This is important, due to the transit dependence of the elderly population in rural and small urban areas. However, some caution must be used in interpreting this measure. Although a transit system may provide a lot of miles or hours of service in relation to elderly population, it does not mean that it is doing so effectively. Increases in vehicle miles per elderly population may indicate improvements in performance, while decreases may indicate deterioration of performance.

Vehicle Miles Per Elderly Population are calculated as follows:

Total Vehicle Miles (all vehicles) / elderly population (over 65 years old) in the service area)

DATA ANALYSIS

Responses from the survey were entered into a statistical package SAS. The research methods used to analyze the data were straight-forward. A t-test was used to identify differences in performance between the coordinated transit systems and the non-coordinated systems. The t-test essentially tests if the means of two groups of observations are equal. This test would indicate if the performance measures of the transit systems are similar.

CHAPTER 4

PERFORMANCE OF COORDINATED AND NON-COORDINATED RURAL TRANSIT SYSTEMS

Do coordinated transit systems provide better transit service in a more cost efficient manner? This chapter will address this question by evaluating the efficiency and effectiveness performance measures of coordinated and non-coordinated transit systems. Each transit systems was categorized into one of three levels of coordination. The levels of coordination include: 1) systems that participate in minimal efforts of coordination (cooperation); 2) systems in a joint/consolidated agreement with other transit systems; and 3) systems that do not participate in any coordination or cooperative efforts.[2] The limited sample size did not allow further classification of systems according to demographic or market area characteristics.

RESULTS OF EFFICIENCY MEASURES

Two cost efficiency measures illustrate mixed results with respect to increased efficiency as a result of coordination. First, the measure total expense per vehicle mile (TEVM), indicate that transit systems currently not participating in coordination efforts have lower costs per vehicle mile ($1.75) than the systems participating in cooperation efforts ($1.89) or systems that used joint\consolidated ($2.00) (Table 4.1) coordination. However, the difference was not statistically significant. Moreover, a comparison of the means may not show the actual differences in coordinated and uncoordinated systems, as other factors influencing performance are not controlled. Because the transit systems are

[2] A description of these coordination categories is contained in Chapter 3.

not homogenous, service area characteristics, system size, or other factors besides coordination may be driving these results.

The second cost efficiency measurement, total expense per passenger (TEP) measures the overall resources consumed in providing service per capita. In this case, the transit systems that merely cooperated had lower expenses per passenger ($5.17) than the joint/consolidated ($6.14) or non-coordinated systems ($8.22) (Table 4.1). Neither of these cost efficiency measures show a significant difference in cost between the levels of coordination.

TABLE 4.1 Mean Values for Cost Efficiency Measures for Transit System Classes

Performance Measures	Cooperation	Joint/ Consolidation	No Coordination	T stat. Coop[1]	T stat. Cons[2]
Total Expense per Vehicle Mile	$ 1.89	$ 2.00	$ 1.75	.494	1.269
Total Expense per Passenger	$ 5.17	$ 6.14	$ 8.22	-1.013	-0.476

[1] This is the T value for transit systems with cooperative coordination and no coordination.
[2] This is the T value for transit systems with joint/consolidation and cooperative/no coordination.

RESULTS OF EFFECTIVENESS MEASURES

The four effectiveness measures selected and evaluated to compare the performance of coordinated systems with non-coordinated reveal the coordinated systems perform with a significantly greater effectiveness than non-coordinated systems in the Mountain-Plains states.

The cost effectiveness measure, *subsidies per passenger* (SP), reflects pricing practices and resource efficiency. Subsidies were highest for systems with no coordination ($7.88), and lowest for

consolidated systems ($3.80) (Table 4.2). Consolidated systems probably have a lower subsidy per passenger because the population is more willing to pay for higher service levels.

More specifically, the *passengers per capita* (PC) measure indicates the extent to which the transit agency serves its targeted population. As shown in Table 4.2, joint/consolidation transit systems transport significantly more passengers per capita than systems that only cooperate or do not do anything in terms of coordination. Transit systems that only cooperate, transport significantly more passengers per capita than systems that engage in no coordination whatsoever.

TABLE 4.2 Mean Value of Cost, Social, and Service Effectiveness Measures for Transit System Classes

Performance Measures	Cooperation	Joint/ Consolidated	No Coordination	T stat. Coop[1]	T stat. Cons[2]
Subsidy per Passenger	$ 4.50	$ 3.80	$ 7.88	-1.089	-0.569
Passengers per Capita	3.90	44.27	2.11	1.819*	1.767*
Passengers per Vehicle Mile	0.61	0.78	0.54	.399	.785
Vehicle Miles per Elderly Population	37.00	282.00	25.00	1.257	1.862*

[1] This is the T value for transit systems with cooperative coordination and no coordination.
[2] This is the T value for transit systems with joint/consolidation and cooperative/no coordination.
* Denotes statistical significance at .10 level.

The performance measure, *passengers per vehicle mile*, indicates the effectiveness of scheduling, route operations, bus utilization, and the price level. Transit systems with some level of coordination moved more passengers per vehicle mile than systems that were not coordinated (Table

4.2). This was expected because coordinated systems, due to their size, should have higher service levels and better scheduling.

Vehicle miles per elderly resident reflect the level of service provided to the target population of elderly residents. The joint/consolidated transit systems traveled significantly more vehicle miles per elderly resident (282 miles) than the transit systems that had cooperative agreements (37 miles) and also further than transit systems with no coordination (25 miles) (Table 4.2).

CONCLUSIONS

Coordinated or consolidated systems may have performed better than non-coordinated because of economies of size. Typically, when a firm is small, expansion usually increases efficiency, and average costs per unit of output will fall. When costs fall, it is said that the firm is experiencing economies of size. Costs will decrease to a certain point; however, if a firm expands past a certain level costs will begin to rise again, resulting in diseconomies of size. In relation to transit, providers may experience lower costs as they cover more service area and provide more rides. Larger transit systems are the result of multiple systems pooling resources and covering more area and offering better services to customers. An added benefit is that better services may increase ridership by drawing individuals who previously were not using transit.

This study provides some support for the belief that coordinated rural transit systems in the Mountain-Plains region are able to provide service more efficiently and effectively than systems that are not coordinated. Five out of six efficiency and effectiveness measures showed better average

performance for coordinated systems than for non-coordinated systems. However, not all of the measures were statistically significant.

LIMITATIONS

Extreme caution must be used in interpreting these results, as the comparison does not control for differences in transit systems that are not due to coordination. Ideally, a study that attempts to examine the differing performance between coordinated and non-coordinated services should examine the effects of coordination after controlling for other factors that may potentially influence performance. Multiple regression is one technique that could be used to control other factors. However, regression analysis could not be used in this study because of the limited number of systems that engaged in coordination and because of the difficulty in defining classifications of coordination. Several regression models were formulated, but statistical results were poor.

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